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Future Military Force Possibilities Study, 2001-2021: Korea, Australia, Japan: a Strategic Decision of National Security Evolution.

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Monterey, California: Naval Postgraduate School.

FUTURE MILITARY FORCE POSSIBILITIES STUDY

2001–2021

Korea – Australia – Japan

A Strategic Discussion of National Security Evolution

by

Naval Postgraduate School

Systems Engineering & Integration Study Group

March 2001

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ABSTRACT *(maximum 200 words)* This study describes the evolution of a possible future for Asia 2001-2021. It envisions the realization of two longstanding US goals: peaceful political unification of Taiwan and the People's Republic of China, and, peaceful Korean unification. Nothing dramatic occurs on the global front, no major wars break out, and both economic and technological change are evolutionary rather than revolutionary. In short, we develop an example of what Herman Kahn called a "surprise free" scenario.

The officer-students in the first class of the Systems Engineering and Integration (SEI-1) curriculum developed the above scenario in detail for Korea, Australia and Japan. They are responsible for Chapters 3, 4 and 5, which describe the evolution of Korean unification; Australian efforts to cement protective relations with the United States and others with interests in a peaceful, free Asia; and the "coming out of the penalty box" by Japan as she rides her reinvigorated economy and takes increasing responsibility for her own defense.

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Preface

This study describes the evolution of a possible future for Asia 2001-2021. It envisions the realization of two longstanding US goals: peaceful political unification of Taiwan and the People's Republic of China, and peaceful Korean unification. Nothing dramatic occurs on the global front, no major wars break out, and both economic and technological change are evolutionary rather than revolutionary. In short, we develop an example of what Herman Kahn called a "surprise free" scenario.

Our world of 2021, however, is not a world entirely congenial to the U.S. For example, there is a stasis in Northeast Asia with China, Korea, Japan and Russia all equipped with sizable arsenals of cruise and ballistic missiles, some of which carry nuclear weapons. Korea, upon the final exit of US forces in 2018, has found growing alignment with China the preferred course. China, for various internal economic and political reasons, feels increasingly surrounded and frustrated in exercising its hegemonic rights. The manner of U.S. withdrawal from Korea and its impending withdrawal from Okinawa and all Japanese bases except Yokosuka has reduced Japanese confidence in the U.S. The result has been incremental reinterpretation of Article 9 of its constitution and development of a non-imperial defense force, which includes a "deterrent" capability resting on its missile forces. The integration of Taiwan has given China an opportunity to re-deploy forces to positions along the inner island chain Sea Lines of Communication (SLOC) from Sakhalin to Malaysia. This southeastward move has been resisted or accommodated by the countries in the area, and Darwin, Australia, has been developed to receive some of the US forces leaving Northeast Asia.

Thus, although the “war tinder” of Korea and Taiwan are gone, global economic prosperity has brought with it a much heavier reliance on trade much of which travels by ship. The diminished size of the U.S. presence, particularly the U.S. fleet, which had been the backbone for protection of the Asian SLOCs, has become a central national security concern for the ASEAN nations and, indeed, all nations in the area.

Three teams of officer-students in the first class of the Systems Engineering and Integration (SEI-1) curriculum developed the above scenario in detail for Korea, Australia and Japan. Chapters 3, 4 and 5 are their work. They describe the evolution of Korean unification; Australian efforts to cement protective relations with the United States and others with similar interests; and the “coming out of the penalty box” by Japan as she rides her reinvigorated economy and takes increasing responsibility for her own defense. The context for their work, described in Chapters 1 and 2, was provided by a supporting group of NPS faculty and outside experts and utilized forces evolved in previous Naval Postgraduate School 1997-99 scenario development studies of China, U.S., Iran and India military forces for the 2000-2020 period. This Preface, the Study Director’s Forward, the Study Executive Summary and the three Country Executive Summaries provide a good introduction to this report. In the Annexes to Chapters 3, 4 and 5 there are tables which summarize the scenarios, and provide a short overview of events described in the body of the report.

The study had two purposes: first, to offer one possible and plausible picture of an Asian security future. While no one can know its likelihood, this picture is factually based and follows logically from a wealth of detailed analysis which includes geopolitical, economic, demographic and technological considerations; second, to provide a vehicle to integrate the educational and professional experiences of the officer-students. Each of the country teams had four officers self-selected for a particular country from the pool of 7 Singapore and 5 US officers.

Throughout the period covered by this study, the U.S. is at the center of a “uni-polar world”, making the dangerous presumption that she will continue to be “number one”. We believe that this work, although it develops just a single trajectory from today to 2021, contributes to the ongoing debate about our future security. The uncongenial consequences of “more of the same” points up the need for action and change. Large dominant organizations often tend to preserve existing ways of doing business and lose their position because they fail to seize the opportunities and face the challenges of a changing and highly competitive environment.

Norm Augustine’s Law X, The Law of Surrealistic Planning, states “If today were half as good as tomorrow, it would still be twice as good as yesterday”, arose from his examination of forecasts of the number of ships expected to exist in the future Navy. It is our view that the work presented here avoids such “rose-colored glasses” projections by insisting upon explicit assumptions across geopolitical, economic and technological dimensions. By making assumptions explicit, we have exposed the properties of one trajectory of events through time. In combination with, other diverse trajectories it forms a better basis for strategic planning than simple extrapolation of previous trends. It provide a basis for asking “what if” questions essential to the formation of sound robust plans.

For example, if our story’s 2021 missile based standoff in military power in Northeast Asia, seems incredible, then a decision maker can back up the scenario to that point and explore alternative paths. Max Frisch in his play, "Biography", permits his characters to stop the play, chose a point in the past where they would like to have done something different, return to that point and then start the action again. This should work out well for the actor who chooses to return and start again; however, because the rules permit every other character to change their previous decisions, it frequently turns into a world that the first character finds no better than that he originally faced – just different.

One consequence of conducting this and previous studies is that we have gained some insight into how to do them and what value that they provide.

First: We believe our study is broader, deeper and more explicitly dynamic than those normally devoted to creating scenarios.

> Broader – because we have used teams composed of both US and Singapore officers to allow us to "see ourselves as others see us"; and also because the questions that inform our deliberations can't be answered without cutting across the usual boundaries of government departments, non-governmental actors, and across the academic disciplines
>
> Deeper – because economic and technological constraints cause "pet rocks" to be surfaced and rejected; because the competitive and dynamic assessments we use preclude both 10 foot tall or "stupid" enemies; because the 20 year horizon allows technology to mature and support innovation. Finally, because our team at the Naval Postgraduate School brings together an unusual combination of military officer students with recent field experience from the US Army and Navy and the Singapore Army, Navy and Air Force; departmental faculty with deep knowledge of

their disciplines; and a host of accessible experienced scholars, government officials, and military commanders resident within the family of the Naval Postgraduate School.

Second: We observed that two successive teams of students and faculty prior to this SEI-1 study struggled with the problem of projecting US military development over the next 20 years. “Steaming as before” with only modest improvement at the margin was the best they could produce despite admonition to think “out of the box” and explicit guidance to exploit emerging technological opportunities. They were being “realistic”. It is possible, of course, that today’s US defense planning system has found the best possible mix of forces for now and for any future. That seems unlikely. However it was the U.S. policy, strategy, and military capability that was used in the SEI-1 study reported here. In effect, the world the SEI-1 study finds in 2021 results because the U.S. was pictured as overconfident in its enduring military advantage and loyal political allies, and its actions were so conventional.

Therefore, a basic finding is the need for deep and sustained study of ourselves as others see us, as reflected in the “six questions” which form the basis of the students’ task. This must be done: (1) by a rolling appraisal well into the future, long enough for others to reshape their strategic and technological doctrines; and, (2) by a careful appraisal of our international friends’ vision of self-interest, not just an examination of likely enemies.

In addition to insights that we have gained from conducting this study there are six issues that should concern US policy makers about the world of 2021, which we have constructed:

1. Japan, Korea, Russia and China are already nuclear weapons states or are on the verge of becoming nuclear.

2. Sea Lines of Communication

a. The peaceful resolution of the Taiwan/PRC separation and the Korean unification has changed the points of friction. In particular, new jeopardy to Asian trade routes has developed while trade has become increasingly vital.

b. With a quiet, but tense, Northeast Asia, focus shifts toward the South China Sea. What does this imply for the positioning of US forces, particularly naval forces, in the western Pacific? Is home-porting in Darwin part of the answer?

4. The proliferation of increasingly cheap cruise and ballistic missiles with precision targeting and selected use of nuclear and non-nuclear warheads has dramatically changed the nature of warfare.

5. Missile defense is a possible response, but can it be made to work, is it affordable, and is it better than a pure deterrence strategy?

6. Is there any real difference in a missile world between a homeland defense and a forward deployed engaged US military? Is the depth of the battlespace such that all points of the globe represent a potential threat to the U.S? Homeland defense of the United States historically reflected our geographical isolation from the rest of the world. In the face of many actors with a global reach, where is the "boundary" of our homeland? Do you want to fight "over there" or "over here"? Do you have a choice?

These questions are suggested by this work. While we do not answer them, we do describe a world where they must be taken seriously by future national security policy makers.

Study Director's Forward

Why should a Systems Engineering and Integration curriculum work on and produce a study whose purpose is to define military capability offered by a twenty year evolution of force structure? What possible relevance does this have to "systems engineering and integration" and officer education? There are two different definitions of "systems engineering and integration" useful in answering these questions. To highlight the differences let us describe the two types of system engineers and integrators through the work that each undertakes. The first we'll call the "institution system engineer", who takes a large-scale innovation at the level of his institution's fundamental mission from "idea" to capability. Seldom are these found outside of the largest organizations in a society and they frequently address the fundamental survival needs of those societies. The second is the "customer-driven system engineer": who presupposes the existence of an institutional customer (public or private); who assumes that there exists a customer's "requirement"; and, for whom fulfilling the requirement within the constraints of time and budget constitutes success. The failure of the customer system engineer does not result in the demise of the society, just the demise of his enterprise. We will use both definitions to help answer the "why" of SEI.

When you examine this study you will find that "missile warfare" has become the heart of the Japanese, Korean, Chinese, and Russian military capability. These missiles - cruise, ballistic, interceptor – can be equipped with a variety of warheads. Nuclear, biological, chemical, explosive, and hit-to-kill lethality mechanisms can be attached to any and or all of the missile types. The missiles may be used for "offense/strike" or "defense". Further, you will find that low observability – stealth - has become a standard feature of vehicle design.

Before World War II missile warfare meant guns firing projectiles, stealth meant camouflage, and missile defense meant dig your foxhole deeper. The technological innovations of WWII provided the foundation, however immature, for missile warfare and stealth vehicles. Inventing, developing and producing the naval systems which we take for granted, and which are the "gold standard" for the arsenals assembled by the three country teams reported in this study, can largely be laid at the feet of three of the USN's greatest institution system engineers. Levering Smith, husbander of the fleet ballistic missile (FBM) – Polaris, Poseidon and Trident; Hyman Rickover, steward of the nuclear reactor which made possible the first stealthy, long endurance submarine - Nautilus; Wayne E. Meyer, creator of the first effective defense against anti-ship guided missiles – and, the "Father of Aegis". Not one of these men is free of controversy or critics or acolytes. All had or have extraordinary stamina, depth of technical experience, breadth of education gained through a lifelong habit of intense study of topics far afield from their "current" assignments. They all were tenacious in the protection of their prerogatives to guide their programs. They represented themselves as engineers of systems, but the system that each built was the system that built the FBM's, the nuclear ships, and the Aegis fleet. They built the home for the second type of system engineer - the customer system engineer.

Smith, Rickover and Meyer dreamed of a world which was different and set out to exploit technological opportunity to realize it. However, they realized that it was not enough to produce a good work plan. <u>They needed to understand what problem deserved</u>

to be solved. They realized that if Clausewitz is right, that war is an extension of national policy by other means, then knowing and shaping national policy could be an outgrowth of the form of war machine that they could create. Mutual Assured Destruction could not exist without the assured destruction provided by nuclear weapons. But more assured (than bombers or silo based ICBMs) delivery of nuclear weapons was offered by the FBM solution, made possible by Teller's small thermonuclear weapons, which fitted a "small" nuclear warhead atop solid fueled rockets carried by a stealthy vehicle – the ballistic missile nuclear submarine. Coming full circle, technology is creeping up on a defense against ballistic missiles and the foundation of the USNs ballistic missile defense offering is the cruise missile killer "Aegis".

Technology doesn't become systems and fleet capability overnight. The FBM submarine with nuclear warhead was born of a confluence of people and ideas in the mid-1950's and given highest development priority that put a capability in place in less than seven years. Rickover through Nautilus proved nuclear powered submarines could be built. Smith through Polaris (A-1) proved a solid fueled rocket could be built with sufficient range to be effective when launched from a submarine. Aegis, was born of the failure in 1963-64 Typhon, the advanced analog, naval air defense system of its day. Aegis struggled 17 years to the first deployment of *Ticonderoga*, CG-47, in 1981 and ameliorated the modern "Kamikaze" problem. Smith, Rickover and Meyer provided the leadership that gives us these capabilities today.

What did their leadership consist of? Where did they learn it? Who were they leading? Smith was weapons officer of Indianapolis, CA-35, during WWII, before she was lost to submarine attack in the Philippine Sea in 1945. He was a graduate educated member of the “cannon cocker” or ordnance club of the Navy. He had both battle experience and a fine sense of the advantages of solid rockets for the naval environment. When the Jupiter liquid fueled rocket was proposed in the mid-1950s for the FBM it was Smith who understood its complexity for shipboard operations and safety hazard. He thus pursued development of improved fuel that allowed a different class of solid fueled rocket. As he took over the FBM program office from its founding director, Admiral Raborn, he learned to articulate with great clarity the role that the FBM played. He could talk comfortably with Congress, ship engineers and designers, fleet operators, Defense Department strategists, and the public. Quiet competence was how he was characterized. He was in office for nearly 25 years. On 6 May 1962 he brought of the only full operational launch of a nuclear-armed long-range ballistic missile from its operational submarine to the successful explosion of its nuclear warhead at full range - a feat never accomplished by any land-based system because of safety concerns. He fully appreciated the international political consequences of showing that “it worked”.

Rickover had no natural allies in the Navy. In today’s argot he “had an attitude”, was politically astute enough to neuter the Chief of Naval Personnel by having final approval of selection for service in the nuclear navy, and could “plant a kiss” on those Senators and Congressman who kept him in office year-after-year long after normal retirement age. In his later years, he was effectively used by generations of his “nuclear” officers to foil their opponents in the struggle for the direction of the USN. He demonstrated awe inspiring, intimidating competence, which he freely used to achieve his objectives. Was he a balanced thinker about the Navy? He never felt limited, for example, by the concept of submariners whose experience was with the limited non-nuclear submarines, frequently characterized as surface ships that could submerge more than once. Is the USN better off because of him? Would the Cold War have been different if its long-range ballistic missiles had ended up deployed on the two cruisers, Chicago and Albany, that lived their last days with never completed mid-ship missile launching spaces? Would the USN and country benefit from having more like him in an era where technological opportunity has never been greater?

Smith and Rickover had first call for support in a country desperate for a strategic nuclear deterrent. Brickbat priorities, the countries highest, moved them to the head of the line in any industrial establishment in the United States. Rickover's ownership of the selection and development of the "nuclear officers and men" who operated his "nuclear fleet" were features never available to Wayne Meyer. Yet, when looking back, it is clear that Meyer showed that it was possible, without Brickbat priority, to buy an air defense capability of such quality that it gave the aircraft carrier, the twentieth century USN's capital ship, a new lease on life. The carrier faced a determined Soviet efforts in anti-carrier warfare based on space surveillance, long range bombers, submarines all striking with a plethora of cruise missiles. Meyer, with the leadership habits of a Bible belt preacher of his native Missouri, can bring the threat of hell-fire and damnation realistically to his audiences and then with an eloquence, drama, and clear technological mastery of his subject show that there is salvation. His personal experiences as a seaman recruit at the end of WWII, his move to the officer corps and a series of tours to get a university education and then superb graduate education in "fire control", his operational assignment to make the mission critical radar on a small radar picket destroyer on the US defense line work against the Soviet bomber threat, his tour as technical director of the

Navy's engineering station established to "fix" its highly unreliable surface to air missile air defense systems were the foundation of his understanding and skill at articulating for all audiences why Aegis was needed. His Navy, as late as ten years after starting the Aegis development, wasn't sure that Aegis was worth the money. Many believed that Aegis would bankrupt the Navy. Many believed it couldn't work. Few believed that it would change the way the world and the Navy thought about air defense. Few saw that it made the risk for carrier operations manageable. Today he is vindicated. Yet, he, in a case study on Aegis in 1990, noted that Aegis is "twenty-five years old", and nothing is coming along to replace it.

Where does the USN develop such leaders? Is it possible to give them a head start through education? Does the USN need such broad gauged leaders today? It was the hypothesis of SEI 1 that you could take a line officer and give him an educational experience that would seed his ability to be the system engineer of a world of systems that do not yet exist. The systems that will take today's immature technology and drive it into innovative ways of achieving the most important missions. The second type of system engineer is crucial for success by the first type, but innovation – the creation of new capabilities, not reform, which is the improvement of existing capabilities – demands the first type.

The Navy has historically depended upon its officers to lead the evolution of its mission capability. It has always assumed that the "commanding officer" can organize his command to efficiently and effectively accomplish his assigned mission. It is our view that he cannot organize his mission without the qualities seen in the institutional system engineer. A modern command is a billion dollars worth of equipment, hundreds to thousands of people, and incomplete system engineering - since no designer can know all of the environments where the nation will put his creation. The Commanding Officer is the final system engineer before the battle. Will he play his instrument like a country fiddler or Jascha Heifetz? It is to this end that we at the Naval Postgraduate School have dedicated our efforts in creating and offering the Systems Engineering and Integration curriculum. The "problem" reported in the following pages we believe calls for both breadth and depth and prepares our students to begin the long process of leading institutional change and innovation needed by our countries if they are to remain competitive.

Executive Summary

Introduction:

This report covers group projects undertaken by the first class in a new 18 month System Engineering and Integration curriculum initiated at the Naval Postgraduate School in September 1999. The curriculum emphasizes science and quantitative methods and weaves together the elements and considerations that must underlie successful new defense system development and acquisition. One unique aspect of the curriculum is that each student works as a member of a team on a large problem that draws on all aspects of his NPS education. This team project serves in place of a master's thesis and has as its principal purpose to provide the student with a deep, demanding, and relevant educational experience. However, the problems are also chosen with a view to adding to the body of knowledge useful to decision makers in the defense establishment.

In the broadest sense any new system must fill a national security need; it must also be affordable and technologically feasible. Therefore, national objectives, threats, economic constraints and costs, technology, and operational art all play important parts in System Engineering. Because major defense systems are capital intensive and have long lives, defense system developers and designers must do their best to peer into the future and deal with the inherent uncertainties that this entails. One of the most useful tools is the construction of a range of technically informed and economically realistic forward-looking scenarios. While no one can predict the future, the range of future possibilities can be limited and explored with a view to building systems that are robust over a variety of possible potential futures. In this regard the student projects draw heavily on Peter

Schwartz' seminal work on long-range planning and scenario development, The Art of the Long View.

In the last four years students from a variety of curricula participated in a two-course seminar in which they developed twenty-year projections of possible future forces for China (two cases), Iran, India, and the US. In each case plans were developed in three sequential epochs. At the end of each epoch each student team was given updates on the world situation and feedback on the actions of other teams. The same procedure was followed in the work covered in this report. The class was divided into three regional teams: Japan, Korea, and Australia. Each team was given the task of developing the forces for its country in four sequential steps, with feedback on the world situation and the actions of other teams provided at the outset and at the end of each planning period. Initially, the teams developed a current picture of each country, with special attention to national security objectives and threats, the economy and prospects for growth, the percentage of GDP devoted to defense, demographics, and geography. The end result was a picture of one possible set of forces for each country in 2020, and a coherent story describing how and why that posture resulted.

It must be emphasized that these projections are not predictions. Our work is in the spirit of the old maxim, "If you can't predict the future, then I can't change it." We saw instances in which each team reacted to the plans of the other two and to the actions at each epoch described below. More to the point for US defense planning, the actions of the participants suggest that we might want to take actions so that some of the projections do not become predictions. Still what we have achieved is only a first step toward building the array of scenarios that could form a useful backdrop for defense planning.

Background:

The world beyond the direct control of the countries studied was largely free of surprises viewed from the perspective of 2021.

The United States experienced modest (3%) economic growth with pressure on the defense budget deriving from imperial overreach and domestic entitlements. Nonetheless the defense program continued to grow at 3% and contained no dramatic departures. Growing tension between the competing priorities of power projection and home defense (National Missile Defense, anti-terrorism, and anti-drug) became more pronounced. Despite some success in modernization and recapitalization, there was a slow but definite switch in the correlation of forces toward the regional powers. Homeland defense programs included a serious effort to develop BMD and anti-cruise technology with a view to earliest practical deployment of NMD.

Elsewhere in the world a number of potential trouble spots were resolved. Taiwan and the PRC were peacefully reunified in 2008. The reunification process proceeded steadily on the Korean Peninsula. Japan and Russia reached a mutually satisfactory resolution of all outstanding issues and ratified a peace treaty in 2009. Closer economic ties developed between the two countries with joint efforts to develop Siberian energy initiated in 2006.

After the reunification of Korea, US military forces in these Korea were completely withdrawn by 2018 and plans were well along to remove from Japan everything but the CVBG and fleet support at Yokosuka. With fewer forces in the Western Pacific, The US reemphasized its ties with Australia and Japan with the growing expectation that those countries would play a more proactive role in insuring military stability.

Russia was clearly recovering from the post-Soviet malaise by 2010, with a foreign policy beginning to match her reduced capabilities. National security strategy emphasized defense of the Russian Federation and influence in the surrounding area. Chinese growth and military vigor was a primary concern and called forth a dual response: in the absence of conventional force parity, Russia relied on its continuing nuclear superiority to deter the Chinese. In addition, closer ties with Japan, particularly for the joint development of Siberian natural resources, gave Japan a stake in stability in the area.

China's impressive economic growth continued, albeit stabilizing at a reduced rate of about 5%, deemed disappointing to much of the Chinese population. The country continued to "devolve," as political power increasingly shifted from Beijing to the regions and provinces. Economically, much of the vigor stemmed from the private sector with the State Owned Enterprises continuing to impose heavy burdens. The economic slow-down engendered questioning of the legitimacy of the regime, which responded by expanding its role in East Asia and appealing to Chinese nationalism. The PRC's agreement with Taiwan included gradual merger of the military forces between 2008 and 2018, resulting in a shift of air and naval presence to the South China Sea, and expanded bases on Hainan, the Paracels, and Mischief Reef (near the Philippines). Taking advantage of her expanded presence China made clear that it was considering expanded security arrangements (including basing) with Vietnam, the Philippines and Indonesia. Friendly relations were sought with a unifying Korea and Thailand. Overall, the government of the PRC felt lessening of control at home and increasing encirclement from abroad despite a satisfactory solution to the Taiwan problem. Hence China's strategy looked to ways to break out and secure her rightful role of East Asian Primacy.

India's economy experienced a renaissance in the new millennium - achieving a growth rate of 5.5%. Principally driven by concerns about China, India gradually increased defense spending to 4% of GDP.

The work of the regional SEI teams was based on this background:

Korea:

Korea is unified by 2020. The combined military forces of the formerly DPRK and ROK are capable of substantial regional air, land and sea operations in defense of the Peninsula and the sea-lines of communication vital to the Korean economy. Although the DPRK gave up its fissile material as part of the unification process, the unified Korea feels the need for a credible deterrent and can field nuclear weapons on short notice.

As unification progressed, a strategic alignment with China seemed to address many day-to-day economic, geopolitical and military security concerns. After the complete withdrawal of United States Forces Korea in 2018, the US called upon Japan to take a leadership role in the region. This was perceived as a threat to Korean sovereignty.

The <u>process</u> of reunification of North and South Korea was pivotal. In 2004, reunification planning began in earnest when the DPRK and the ROK formally agreed to pursue unification options. Within two years, however, the DPRK's economic situation worsened to the point of imminent collapse. Statesmen from both nations established the preconditions for unification and the ROK provided a $10B(US) average annual aid package – or roughly 2% of the South's GDP to help the DPRK save face and national sovereignty. In exchange, the DPRK agreed to launch a comprehensive biological and chemical clean-up program and began to re-channel excess manpower from demobilizing forces to infrastructure improvements. In accordance with the preconditions for unification, the United States was invited to begin withdrawing troops from the Peninsula.

The DPRK's first priority was to rid the Peninsula of US military presence while the ROK demanded democracy and a move towards a market economy in the north. The North had little choice. An aid-based foreign policy strategy was essential to the DPRK's prospects for survival, especially with respect to energy supplies and foodstuffs. It was to the advantage of both the ROK and the DPRK to entertain an incremental transition allowing the northern regime to avoid extinction and ultimately permit a meaningful, longer-term process of reconciliation with the south.

Epoch three's dramatic beginning was marked by the signing of the Pamunjon Treaty which formalized the reunification of North and South. In 2018, Korea held its first prefectural elections and the United States Army held closing ceremonies at the US Army Base in Yeongsan. Tensions between Korea and Japan grew, and raised concerns about the United State's commitment to regional stability. This triggered Korea's unilateral strategic and economic alignment with the PRC. Korea's historic and ethnic ties to China proved a powerful additional lure.

By the end of 2020, Korea's national security strategy focused more on protection of national sovereignty and commerce activities. The alignment with China ensured increased security, especially in the areas where Korea was most vulnerable and it translated to a significantly more focused and lethal national military strategy that sought to deter any adversary's use of cruise or ballistic missiles, protection from sea invasion, and a directed defense against SLOC blockages or disruption.

With increased capital flows to the region, the South's economy grew steadily at 4 percent through 2005 and then at 5.9 percent through 2020. They contributed 2 percent of their GDP to the North for infrastructure improvements. This economic aid package allowed the North to sustain double-digit growth throughout the 2010-2015 period, and wane to a nominal 7.2 percent in 2020. Defense expenditures in the South were 3.5 percent of GDP. The North, with its smaller national economy, spent nearly 30 percent of the GDP on defense.

With the prefectural elections in 2018, Korea saw a shift in military capabilities and the role of the unified defense force. Korea sits on the doorstep to a maritime environment and its desire for sea power is linked to a growing Korean reliance on a coastal economy. With the imminent rise of the maritime powers of Japan and China, a high priority was given to Korea's maritime forces with emphasis placed on the navy and the air force. The principal army mission has become the maintenance of social order. The force improvement program priorities were established to accomplish the national military strategy and included Intelligence / Early Warning; Cruise / Ballistic Missile Defense; Precision Engagement; and Agile Combat Support.

The Air Force gradually acquired advanced tactical aircraft suitable for a future operational environment, with considerable effort focused on improving the agile combat support for better response and flexibility. New AEW / ESM, air refueling assets were also procured, as well as long-range UAVs for both intelligence and combat. Modern, air-to-air and air-to-surface missiles were procured for extended-range precision strikes on ground and sea surface targets. The Air Force's main challenge, however, lay with the search for the best, combined force mix, comprising manned and unmanned air platforms and conventional long-range standoff strike missiles.

The Navy was modernized for regional sea control in the blue water. With a constantly expanding naval budget, Korea procured advanced ocean-going Aegis-class destroyers, equipped with anti-air guided missiles as well as extended range cruise missiles. Korea's navy also procured new patrol submarines utilizing Air Independent Propulsion and the Russian Kilo-class diesel submarines.

The Army was rapidly downsized from a combined force of 1.5 million in year 2000 to about 860,000 in 2020. New weapons and equipment (including a much expanded combat helicopter fleet) improved combat effectiveness. At 2020 the Army is reluctant to relinquish dominance in Korean military affairs, but a further shift to a marine outlook seems likely.

Given the absence of declared programs for nuclear, chemical and biological weapons, Korea's cruise and ballistic missile development programs received top developmental priority. Korea's ballistic force of approximately 1000 missiles was primarily dedicated to deterrence. Long-range missiles were preferred, accuracy was improved, and short-range stockpiles were reduced.

The alignment with China resulted in Korea's loss of access to US military technology. This caused some slowdown of Korea's military modernization efforts and reduced logistics support for its US legacy systems.

Australia:

During the first two decades of the 21^{st} century, Australia grew to be a respected leader in Southeast Asian affairs. She participated in the general prosperity in the region during the first two decades of the 21^{st} century with a GDP growth rate between 3 and 4.5%, facilitated by trade, knowledge sharing, emerging technologies and effective government. This provided the opportunity to develop a defense force matched to the country's goals. Defense of the homeland continued to be the top priority, but Australia also sought to aid in non-proliferation of WMD, and also to maintain freedom of the seas in the area. Military force developments for Coalition Operations and Military Operations Other than War (MOOTW) were consistent with the Defense White Paper of 2000.

To accomplish the goals established in the White Paper, the percent of GDP devoted to defense was increased from 1.9% to about 2.5% by 2010 and remained at that level through 2020. Initially the allocation of funds was changed to emphasize R&D and new systems procurement over current operations. As the newly modernized force emerged, the demands on it grew, and by 2020 the allocation to current operations returned to former levels.

The Howard Doctrine articulated in the Defense White Paper of 2000 aligned Australia to the interests and objectives of the United States. However, slowing US economic growth and lack of public support resulted in reduced defense spending and US military retrenchment in the region. In an effort to sustain a respectable military presence in Southeast Asia, Australia made a considerable investment to enlarge and enhance Darwin as a port, military complex, and north-south railroad terminal.

China appeared ready to fill the power vacuum. Increased presence in the South China Sea, basing overtures to the Philippines, and overtures to the unstable government of Indonesia caused great concern in Australia. This combined with Australia's perception of the US resulted in an increasingly independent Australian security policy.

Continued Indonesian instability threatened the archipelago waterways, which took on increased significance as Australia's exports of energy and iron ore to Japan increased. While counting less on the US for political/military support, Australia continued close links for procurement of modern military systems, thereby saving money and gaining interoperability. Advanced maritime assets like the Howard-class Aegis destroyers and the F/A-18 E/F Hornet fighters were among steps to enhance Australia's authority as a regional maritime power. However, Australia chose to develop specific technology niches in energy storage and supply technology as well as space launching capabilities.

At the beginning of the century, Australia's ability to project forces beyond 1000 miles was limited to frigate-sized surface vessels and Collins-class submarines. In addition to enhanced capabilities at sea, growing problems in Indonesia required the ability to project military forces to regional hotspots. As a result, Australia modernized the land forces, and developed an amphibious assault force, initially comprising two Marine brigades and their associated amphibious vehicles and tilt-rotor aircraft. By 2020, Australia raised two additional infantry brigades.

R&D into a variety of energy related technologies paid off for the Australians. Solar, coal, storage, and much improved offshore oil exploration played an important role for the Australians by 2020. In the final epoch, Australia fielded a HEL missile defense system for Darwin, developed the technology for a Theater Ballistic Missile defense system using airborne lasers and/or ground Free Electron Lasers, and deployed diode pumped solid-state laser anti-ship missile defense system for naval ships.

The resulting ADF in 2020 supports the nation's military strategy. It is able to operate autonomously or with allies. With the developments undertaken in the port of Darwin, Australia offers attractive basing options for the United States in the Pacific.

Japan:

Diplomatic relations in East Asia during the first two decades of the 21st century evolved from individual hedging strategies for an uncertain future to a triangular balance of power involving China, Japan, and the United States. The relative influence of the three powers shifted during the period. By 2020 the declining role of US and the gradual ascension of both China and Japan is generating pressures for realignment.

In Japan the economic reforms instituted by the new Progressive Political Party in 2001 resulted in drastic restructuring that produced a trade and financial resurgence. The rejection of a permanent UN Security Council seat for Japan in 2006 changed domestic opinion in support of a greater international role for Japan. Additionally, the draw down of US forces in Korea caused Japan to question the firmness of the US commitment to Japanese defense. China's more assertive role in the East and South China Seas presented increased threats to Japanese security. Korean reunification in 2016 and subsequent removal of US troops there and the planned start in Japan beginning in 2020 caused Japanese planners to initiate efforts toward military autonomy.

Domestically, economic reforms resulted in significant short-term pain but long-term gain as Japan’s GDP returned to positive growth after 2006. Japanese producers increased automation and advanced, less labor-intensive means of production. Concurrently the government encouraged more women to join the labor force and prolonged the participation of older workers. Government promotion of spending on education, training, and R&D also contributed to the positive economic climate. Japan continued to diversify its sources of energy during the twenty-year period. Dependence on oil imports decreased by 20% between 2000 and 2020. Domestic generation and cooperative endeavors with Russia and Australia lessened oil dependence to 1/3 of Japan’s total. While not fully self-reliant for energy production, Japan has limited vulnerabilities by both diversifying fossil fuel suppliers and promoting means of internal power generation.

Japan’s defense strategy, throughout the scenario, increasingly rested upon self-reliance. Japan’s strategic vision became the twin pillars of defense and deterrence. Under the pillar of defense, Japan sought a force capable of responding to the full spectrum of warfare. The JSDF also implemented a long-term plan to manufacture and field large numbers of long-range missiles for deterrence. Nevertheless, Japan continued to adhere to the US-Japan Security Arrangements. These agreements were continuously re-evaluated due to realignments in the regional power structure but remained integral to Japan’s defense strategy.

By 2020 the Japanese military had achieved self-sufficiency for homeland defense, including advanced and comprehensive C4ISR, and has state-of-the-art, domestically produced weapons (including a large conventional missile force). The

JSDF at 2020 also has weaknesses: the lack of a nuclear deterrent, comprehensive missile defense, and robust ASW. To limit its strategic vulnerabilities, Japan must address these deficiencies, further diversify energy sources and strive for continued self-sufficiency in all three components of national power: economic, military, and political.

Insights and Trends:

Seeing ourselves as others see us. The "flash points" of Northeast Asia, North/South Korea and Taiwan/PRC, once removed, changed the kind of military forces required in Northeast Asia. In particular, the quick reaction enforcements provided by USAF and USN units were no longer needed to rescue South Korea. How the US and its allies understand the transition from having this ready US reserve to something else may play heavily in the planning calculus of Japan and Korea. Our previous studies of potential force structures of possible competitors were innovative and informative, but the concurrent work on US force structure evolution was uninspired despite our best efforts. The present work - the study of our allies' force evolution - has forced us to see US foreign and military policy through our allies' eyes. The sight is disquieting, but revealing. This leads to an important insight: we need to study US policy, in a deep, sustained and systematic way as reflected in the structure provided by the "six questions" – to see ourselves as others see us. This must be done: (1) by a rolling appraisal – epoch by epoch - well into the future, long enough for others to reshape their strategic and technological doctrines; and, (2) by a careful appraisal of our international friends' vision of self-interest, not just an examination of likely enemies.

PRC attention can move elsewhere. With the resolution of the Taiwan issue and the reunification of Korea the PRC is free to move its attention southeastward or northward or westward. In this study the look was southeastward with the result that major ocean trade routes from Sakhalin to Indonesia are exposed to pressure. The reaction of the area's states is collaborative defense efforts to ensure freedom of the seas.

Japan becoming a full capability world power. Although the Japan team did not choose to finish their development of nuclear weapons, the possibility looms much larger in 2020 than is the case today. Should they develop them they are fully capable of delivering them with their large inventory of cruise missiles and few ballistic missiles. While Japan's growing military power and independence is seen as threatening by Korea, a unified Korea's alliance with China clearly is perceived as threatening by Japan. As a result tensions are growing and the possibility of conflict beyond 2020 is also increased. . The growing ties between Japan and Russia also suggest that local armed conflict between Japan and Korea could draw in China and Russia as well.

Missile inventories provide the basis for stasis between Korea, Japan, Russia and the PRC. Long range cruise missiles launched from air, sea and land coupled to ballistic missiles give all neighbors a "deterrent" capability. Invasions of Japan or by Japan would be highly destructive and drawn out affairs. The 150,000 man Japanese Army is not a capable invasion force. The missiles coupled to the air and space based surveillance systems make strategic surprise by invasion nearly impossible. The missiles enable wounding your attacker, but as with all mutual assured destruction strategies it is difficult to envision events once the missiles have all been fired. The net assessments Japan suggest that the major cities of China would be destroyed and a great loss born by Japan.

Emergence of a greater sense of regional identity in East and Southeast Asia. The states of the region gave increasing consideration to organizational processes that first became prominent in the last decade of the 20th century, raising the possibility that an effective Asian grouping might become a peer competitor of Europe and the Americas.

This trend was underscored by the ambiguous quest for a regional leadership role by China, Japan, and a cluster of smaller states.

Distracted elephants. Disengagement of Chinese and US military spheres opened much greater freedom of maneuver within the region – especially for advanced, wealthy nations such as Australia, Japan and Korea. They found themselves with greatly expanded latitude to formulate independent national security strategies, and to make a difference within the region. As a result, the "elephants" were obliged to take serious account of the policies of smaller powers. Thus, the individual country scenarios (described in detail later in this report), and the common scenario (outlined in this chapter) evolved together.

We could have done better. As the second decade of the 21st century came to an end in 2020 many observers in Japan, Korea, and Australia -- as well as their counterparts in the major and smaller states throughout the Pacific Rim region -- recognized that events which transpired from 2000-2020 demonstrated a lack of foresight at the start of the new century. A need was recognized for better ways to cope with regional multilateralism and realize the long-term prospects for developing regional structures for governance.

Issues for the US:

Is the nuclearization of NE Asian countries missile forces preferable to the previously provided US nuclear umbrella? With the pending withdrawal of most US forces from Japan, what replaces the “blood sacrifice” that assures the Japanese that the US would react to an attack and defend them?

Reduced US naval presence impact on SLOC protection. The Japanese, Koreans and Australians all realized that the USN was the mainstay of protection of their ocean going trade. The US fleet provides the certitude that egregious abuse of freedom of the seas cannot persist. With fewer forces in NE Asia and the potential pressure along the inner island chain from Sakhalin to Malaysia, does alternative positioning of USN forces become attractive? In particular, homeporting forces in Darwin provide for coverage northward as well as westward to the Indian Ocean. What forces? What relationship to facilities at Subic Bay, Guam, Singapore, and Vietnam?

Are cheap, domestically produced cruise and ballistic missiles a problem? The technology to design and manufacture accurate, affordable cruise and ballistic missiles will be available in Korea, Japan, Russia, PRC, and their clients. Controlling the proliferation of such missiles through technology control regimes will be increasingly difficult as electronic, computational, and materials skills proliferate in support of the basic needs of business to compete globally.

Why buy missile defenses? Defense of military capabilities, such as ships, is justified to avoid being disarmed and rendered defenseless. City and nation protection, with the large areas needing protection, argues for an alternative defense to that used to protect discreet military units and forces. The orbiting of ballistic missile interceptors is technically more attractive than the heroic geometries of ground based systems which are much more expensive per unit area defended. A US system with ballistic missile defense coverage of allies may offer an interesting alternative to the US provided MAD umbrella of the past 50 years. Interceptors on orbit vs nuclear cruise missiles in the Japanese inventory? Which is preferable?

Homeland Defense, where are the borders? Is there any real difference in a missile world between a homeland defense and a forward deployed engaged US military? Is the depth of the battlespace such that all points of the globe represent a potential threat to the US? Homeland defense of the United States historically expressed our geographical isolation from the rest of the world. In the face of many actors with a global reach, where is the "boundary" of our homeland? Do you want to fight "over there" or "over here" or do you have a choice? This raises the age-old issue of where the first line of defense of the US really lies. Is it forward with vigorous engagement in Japan, Korea, and Australia (as well as in NATO)? Or in 2020 and beyond is it closer to home? In either case is gradual evolution of the present forces and service shares appropriate, or are radical departures called for to deal with the new political realities as well as the rapid pace of technological change? The presumptions made about the US and the references to *imperial overstretch* imply that the current review ongoing in the DOD will fail to bring about the sharply focused restructuring without which the scenarios outlined here are, though not predictable, possible, and credible.

CHAPTER 1 — INTRODUCTION

A. Purposes of this Study.

1. To offer a possible and plausible story whose probability no one can know. To offer it as a thoughtful provocation for anyone concerned with avoiding strategic surprise. To identify national security issues worthy of extending our investigation to one of your own. (Note: All events prior to March 2001 occurred, all events after March 2001 are synthetic, created by the study teams.)

2. To provide a vehicle to integrate the educational and professional experiences of the officer-students in the NPS Systems Engineering and Integration curriculum.

B. SEI Program Description and "The Problem"

1. The Problem and this Report.

This study was conducted by the first class of the newly established NPS Systems Engineering & Integration (SEI-1) curriculum during the Fall and Winter quarters of FY2001, October 2000 – March 2001. Preparation for this work began in October 1999. The students were told that they would conduct a study that called upon them to apply and integrate what they learned in the curriculum and knew as military professionals. "The Problem" became the vehicle for this integration.

Development of a geopolitically, economically, and technologically feasible evolution of the military forces of Korea, Australia, and Japan over the period January 2001 to December 2020 was "the problem" chosen. The state of the world external to these countries was provided by the Study Management and Consulting Board (SMCB) composed of faculty and outside experts. For example, it was stipulated that North and

South Korea would reunite at some time during the 2001–2021 period, but precisely when and how was left to Team Korea. Study assumptions about political, economic and military developments for the People's Republic of China (PRC), the Republic of China (ROC), the Russia Federation, the United States of America (USA), the Republic of Indonesia, the Republic of India, and general world conditions are described in Chapter 2.

2. Study Participants and Authors.

The authors of this report are the twelve students in SEI-1 and faculty associated with the curriculum. The seven Singapore and five US military officers self-selected themselves into country teams of four officers per country. They have been responsible for Chapters 3, 4 and 5 of this report. The biographies for each officer are incorporated in the appropriate chapter. The study's Executive Summary was written by Prof. Emeritus Patrick Parker, economist, strategic thinker, business executive, and former OSD official now with the NPS Institute for Joint Warfare Analysis (IJWA). The Preface, Forward, conclusion portions of the Executive Summary and Chapter 1 were written by the study director, Prof. Michael Melich, a physicist and system engineer also of the Institute for Joint Warfare Analysis and Physics Department of NPS. Chapter 2 was written by Prof. Raymond Franck, an economist and USAF Brigadier General (Ret) of the NPS Graduate School of Business and Public Policy. Selected SMCB members drafted contributions to Chapters 1, 2, 6, and 7 and worked closely with the country teams.

Members of the Executive Board of the SMCB were: Prof Edward Olsen, Asian Area Studies specialist with extensive knowledge of Korea and Japan from the National Security Affairs Department; retired Prof Michael Sovereign, economist, former head of the Operations Research Department and the Command, Control and Communications Academic Group at NPS, and former OSD Special Projects Director in OSD (Comptroller) now with IJWA and Editor-in-Chief for this report; Prof Wayne Hughes tactician, analyst and USN Captain (Ret) of the Operations Research Department; Prof. Robert Harney, a physicist, veteran of Livermore and Lincoln Laboratories, combat system engineering Professor in the Total Ships Systems Engineering program and resident in the NPS Physics Department; Dr. Edward Smith, international relations strategist, USN Captain (Ret) and intelligence officer, now with Boeing Corporation's think-tank in Washington, DC; plus messieurs Parker, Melich, and Franck previously mentioned.

Other members of the SMCB who brought their particular expertise to the deliberations of the teams and reviewed their work and provided advice were: Professor Glen Browder, retired Member of Congress and NPS Distinguished Visiting Professor of National Security Affairs; Prof Phil DePoy, former President of the Center for Naval Analyses, former President of the National Opinion Research Center and now NPS Chair Professor of Expeditionary Warfare in the IJWA; retired Admiral Ace Lyons, former Commander-in-Chief of the Pacific Fleet; Prof Orin Marvel, system engineer with the NPS Command and Control Academic Group; Prof Paul McCarthy, USN Admiral (Ret), former Commander of Seventh Fleet, former executive with McDonald Douglas, and now NPS Conrad Chair Professor of Financial Management in the Graduate School of Business and Public Policy; USN Admiral (Ret) Tom Mercer, former Battle Group Commander in the Western Pacific, former Superintendent of NPS, now Executive Director of the NPS Foundation; Prof Hos-ub Park, Research Director, Department of

Maritime Strategy and Policy, Korean Naval War College, retired Captain (Republic of Korea Navy) and visiting scholar in the NPS National Security Affairs Department; Ms. Cathy Spencer, formerly Director of Threat and Lethality, in the OSD Ballistic Missile Defense Organization and now a member of the staff of IJWA; Dr. Walter LaBerge, former OSD R&D official, former Lockheed-Martin executive, former Director of the Naval Laboratory at China Lake, now of the IJWA; Dr. Lowell Wood, Senior Staff Member, Lawrence Livermore Laboratory; Dr. Charles Wolf, international economist, former head of the Rand Graduate School, senior economic advisor and corporate fellow in international economics at Rand, now senior research fellow at the Hoover Institution; and S. Enders Wimbush, director of summer studies for the OSD Office of Net Assessment, VP, International Strategy & Policy, Hicks & Associates, Inc.

3. SEI Origins and Operation.

The Systems Engineering and Integration Curriculum is a new, inter-disciplinary offering designed specifically to create a modern military “officer of the line”, able to understand and grapple with the scientific, technological, system, economic, military, and geopolitical complexity of our modern world. Approximately 75% of the curriculum is devoted to the study of discipline-based topics, such as, physics, engineering, program management, traditional systems engineering, and military operational planning as provided through the Joint Professional Military Education program specified by the Joint Chiefs of Staff. The remaining 25% of the course is devoted to a topical study whose purpose is to exercise these disciplines in the solution of “a problem”.

The “problem” portion of the curriculum began with a broad ranging discussion of the way that military planners have tried with greater and lesser success to prepare for an unknown future. Case studies were offered ranging from the impact of the longbow on armored knights, then to the development of modern management information systems for the US Department of Defense by Robert McNamara, next, to the consequences of the technological revolutions in sensors, information handling, nanotechnology, and biotechnology, and finally to current efforts to innovate within the DOD and US armed services under the banner of the "revolution in military affairs". Texts for this portion included Peter Schwartz's "The Art of the Long View: Planning for the Future in an Uncertain World" and Stephen Rosen's "Winning the Next War: Innovation and the Modern Military".

In the first quarter field trips were taken to, among other places, the Raytheon Missile factory in Tucson, the Litton Shipyard in Pascagoula, MS, the Naval Center for Space Technology at the Naval Research Laboratory, the Warfare Analysis Laboratory at the Applied Physics Laboratory/Johns Hopkins University. A series of guest lectures were received on topics as diverse as Dr. Charles Wolf's Rand projections of economic developments in Asia, to the energy and demographic sub-studies incorporated in the "Summer Studies" carried out for Andy Marshall's DOD Office of Net Assessment and presented by S. Enders Wimbush. The students also met weekly during the second six months of the curriculum in seminars where they presented results of self-selected pertinent topics of research, ranging from how current fighter/attack aircraft operate to the arguments raging about the technical feasibility of ballistic missile defense. In October 2000, one year after the first class started, we began a three month "dress rehearsal". This "dress rehearsal" gave a chance to conduct the entire study of the 20-year evolution and to scope the major features of our work. This was but one of four classes that the SEI students were taking at the time. From January 10 , 2001 to graduation on March 29th, the students have devoted full time to research and preparation of this report.

The Asian context for this study was developed in a series of similar “dress rehearsal” studies carried out in 1998 and 1999. In particular, this “Area Denial” work covered the 2000–2020 evolution of the military forces of the Peoples Republic of China (twice), the USA (twice), Iran (once) and India (once). . These studies had their origin in 1994 CNO-chartered task force of the CNO Executive Panel (CEP), called the Innovation Task Force. Actions spurred by the recommendations of this panel include: a new charter for the CNO's Strategic Studies Group; elevation of the President of the Naval War College to three-star rank; creation of the Navy Warfare Development Command; and a series of studies carried out at NPS under the sponsorship of the CEP and the Office of Naval Research. Capt Edward Smith was the project officer for the CEP for this work. Mr. Andrew Marshall, chartered in February 2001 to conduct a strategic review of the US Defense Department by Secretary Rumsfeld, has been a member of the CEP and its Innovation Task Force. He has made the case that there is a pressing need for innovation by the US national defense establishment, not just reform—which simply improves the performance of what is already in place.

4. Methodology: How we did the study and the “six questions”!

Studies of this sort are not predictions nor are they so intended, but instead develop an explicit, internally consistent description of possible linked events. They are scenarios developed in the spirit of Peter Schwartz's support of a “strategic conversation” as described in his aforementioned book. The goal is to explore and make explicit the assumptions that underlie current and planned investments and actions. These explorations prompt a search for alternatives that may disrupt current efforts and point to alternative policies and, in our studies, made explicit in changed investments in military forces and their capabilities.

This study is modeled on the 1997–1999 “Innovation in Naval Warfare Systems—Area Denial Systems—Red Teams” studies conducted for the CNO Executive Panel and the Office of Naval Research. A fuller description of this work can be found in the June 2000 issue of the NPS Research Newsletter, entitled “THE PLANNER'S DILEMMA: INNOVATION, TECHNOLOGICAL CHANGE, AND LONG-RANGE PLANNING”, available at www.nps.navy.mil under research/publications. There are two main features of these studies, which are carried forward in the SEI-1 work:

a. Epochs - Living life as it comes.

The twenty years under consideration are examined in four 5 year epochs, Jan2001–Dec2005, Jan2006–Dec2010, Jan2011–Dec2015, and Jan2016–Dec2020. At the end of each epoch the three officer-student country teams make decisions, driven in part by “net assessments”, which can alter the assumed strategic context which governed the previous five years evolution. For the initial epoch the national security strategy and defense plans of each country as stated in 2000 are assumed. This direct tie to current forces and conditions responds directly to the criticism of many futurist studies - “How can you get there from here?” Our study team offers a plausible and possible route that will take you from today to a point 20 years in the future.

b. The Six Questions – Spanning from the neighborhood, to goals, to possibilities, to actions, to estimates of consequences five years at a time. **INSERT FIGURE**?

For each epoch the teams addressed these questions:

Q1. What is the expected threat to your territory and national interests, and what strategies, e.g., territorial or other ambitions, might you pursue that could generate a conflict or confrontation during this epoch or in the periods to come?

Q2. What economic, foreign and military policies and programs do you choose to pursue for this epoch?

Q3. What is the projected size of your national economy for the years of this epoch?

Q4. How much of the national economy do you intend to spend on national defense during this epoch? And, what fraction will go for the creation of the "Area Denial Force" or other military capability not currently found in your nations force structure

Q5. How much of the national defense expenditure will you allocate to each of the following resource allocation categories?

A. Current operations

B. Combat System Procurement

C. Intelligence

D. Counterintelligence

E. Research & Development

1. Basic Research

2. Specific capability development, e.g., high energy lasers

3. Combat System Development to provide a change in:

a. Area Coverage of the Combat System (Detection, Engagement, Control, Command subsystems)

b. Fire Power, number of simultaneously engaged targets

c. Responsiveness, time delay

d. Countermeasure susceptibility reduction

e. Availability of combat system, e.g., logistics, base structure.

Q6. What is your resulting force structure anticipated for the end of the epoch, and what is your general operational concept for utilizing these forces in a conflict or confrontation? And, what are their projected combat capabilities characterized in terms of the five categories listed in the fifth question (E3), Combat System Development?

C. Organization and Execution of the Study

1. Teams.

The 12 SEI-1 officer-students were assigned, four each to the Korea, Australia and Japan teams. Within each group responsibility for a particular aspect of the research and reporting was made. Generally, within a team a responsible person was identified for the following work:

a. Integration of the team's country report.

b. Characterization of the external environment.

c. Characterization of national combat systems and capabilities, including net assessments.

d. Characterization of national investment plans with detailed description of investments in military capabilities.

e. Technology and system forecasting, design and investment.

There was no permanently assigned faculty member to work with each team, a significant change from the 1997–99 “Area Denial” studies. However, the study director met nearly every morning in each team's “war room” for 15–45 minutes, during the January–March 2001 period. Minutes of these meetings were generated by the team and emailed to the study director and used to track the daily decisions/debates as the study evolved. Although there was a division of responsibility the four man teams worked on multiple topics and interacted with each other and to some extent with the members of the other country teams. For example, the order of battle used by the Korean and Japanese Teams were based upon information exchanged.

2. War Rooms.

Each country team was assigned a “war room” within which to document research, deliberate with each other and external people, and prepare the reports, briefings and other final documentation. The walls in three windowless rooms (120–140 square feet) were festooned with 8.5x11 inch sheets of paper that captured the current state of research. These rooms were also equipped with internet connections, computers, tables, chairs, filing cabinet or bookcases and a flip chart or white board.

3. Study Management and Consultative Board (SMCB).

Professors Olsen and Franck spent considerable time with each of the teams helping them define answers to Questions 1 through 4. Other members of the board were consulted as required. During the October –December 2000 “dress rehearsal” as the teams completed their study of epochs 1, 2 and 3, members of the SMCB emulating the national deliberative and decision bodies of the country, would meet in the war rooms for an informal briefing/seminar. A similar, but more structured review with stand-up briefings were presented at the end of each Epoch during the January–February 2001 work. The results of these interactions helped clarify issues, provide guidance and formed the foundation for the work on the epoch.

4. Fall Quarter: 2 October – 15 December 2000.

This was a workshop or laboratory (0-12 in NPS class and laboratory notation) class. The Fall course was a complete run-through of the study, a "dress rehearsal" for the Winter "fulltime" study.

a. First, there was no attempt to coordinate the scenarios used by the country teams during the Fall quarter. During the winter quarter a common world scenario was evolved (see Chapter 2). In the Fall for example, everyone assumed (as stipulated for the study) that North and South Korea were to be unified in the period 2001–2021, but the Japanese team selected a reunification date of 2018 while the Korean team selected a phased integration starting in 2006. In the winter quarter, the time table developed by Korea in the Fall was used for the common scenario. This meant that the Japan team had to adjust, or slow, their scenario development.

b. Second, Australia, Japan, and South Korea all have produced official "defense white papers" and some auxiliary supporting documentation. The North Koreans do not produce such public documentation. The final report of the country teams imitated the format of their respective "defense white paper" and supporting documentation to the extent practicable. However, it became clear as we worked through the study that the scope of the defense white papers did not necessarily capture all pertinent considerations. Thus this report deviates at times from the form of those official documents. This is particularly true of the development of investment plans in the level of detail and the “net assessments” exploited to address question 6.

c. The Fall final briefing was given in a public presentation before an audience of about 40 interested people. Approximately 3 hours was devoted to the briefing and discussion.

5. Winter Quarter: 10 January – 29 March 2001.

The entire working week of the class was devoted to the conduct, writing, and presentation of the study. The following is the schedule followed:

a. 10 January – 15 February 2001: Work through each of the epochs with “decision days” at the end of each epoch conducted with SMCB and outside consultants in a briefing theater. The time devoted to Epoch 1 was about four days, while Epoch 4 took about 10 work days. The fall quarter spent more time developing the current factual state of the world, thus the fall Epoch 1 took more time than did the winter Epoch 1. Later Epochs require more invention and less research on the factual state of the country studied. All this was done within the context of a common global scenario. Each epoch is written up by the teams and delivered after the briefing to the SMCB. Note that details of the common scenario responded to decisions being made by the three country teams sequentially, interactively and competitively. Thus, there was no direct extrapolation to a desired end state, which was in sharp contrast to the 1997–99 studies which tended to decide on a desired end state and then resist any attempts to alter plans in response to changed circumstances. Rather, the teams had to adjust their plans in accordance with changing circumstances. They could not go back and change earlier epoch's decisions.

b. 16 February – 5 March 2001: Write up studies and prepare “one-hour” briefing.

c. 5–15 March 2001: Briefings were given to Prof. P.C. Lui, Singapore's Chief Defense Scientist and subsequently to the Superintendent of the NPS, Rear Admiral David Ellison. A video tape of the briefing was recorded to accompany this report.

d. 16–28 March 2001: Refine and publish the final report.

e. 29 March 2001: Graduation.

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CHAPTER 2: THE GLOBAL SCENARIO, 2001-2021

The following retrospective view of the situation in East Asia from 2001 through 2020 provided the background against which the strategic, defense and budgetary debates in Korea, Australia, and Japan were played out. It defines their evolving security environment and, hence, many of the forces driving the military force structure decisions that each country made over the period. Although this much abbreviated background scenario is presented as a continuous retrospective, the retrospective was actually presented to the defense planning teams in terms of four sequential epochs with teams reacting only to what would have been known in that epoch.

The first two decades of the 21st century evolved from a century marked by two world wars, numerous local wars, and fears of a third, and worse, world war. In particular, the early phase of the 21st century was preceded by a decade of political, economic, and strategic experimentation in a "post-Cold War era" (to use the label applied retrospectively) that shaped the transition to a new century. While expectations for the new century and a new millennium were high, they were mixed with apprehensions about the legacy of past tensions, as well as constraints imposed by nature, geopolitics, and societal inertia. In the Asia-Western Pacific region the Japanese, Koreans, and Australians faced distinct but inter-related circumstances that are summarized here.

A. Global Developments

The world beyond the direct control of the countries studied (Australia, Japan and Korea) experiences what would have been termed a largely surprise-free scenario, viewed from the perspective of 2001.

1. Political Restraint

Athough history had clearly not ended, the more apocalyptic visions of post-Cold War world affairs likewise did not materialize. Great power rivalries continued. NATO-EU and Russia frequently found themselves at odds over security issues in the former Warsaw Pact, especially in the Balkans. The Taiwan Question was a continual source of tension in US-PRC relations until the Taiwan-PRC reunification of 2008. The traditional distrust and rivalry between India and China deepened as both countries steadily increased their economic and military power.

However, a number of great-power rivalries were avoided or defused. The reunification agreements of 2006 in Korea and 2008 in China permitted a significant disengagement of the military perimeters of the US and China. Japan and Russia reached a mutually satisfactory settlement of all outstanding border issues which, stated in a treaty ratified by both countries in 2009.

Various regional instabilities continued, especially in sub-Saharan Africa, the Balkans, the coca regions of Latin America, and parts of South Asia. However, a rough consensus developed among the great powers about dealing with such matters. The United States sought a role of reinsurer of regional stability – with countries within the various regions putting most of the troops on the ground. This effort was most successful in Europe, with the EU assuming an ever-larger role on that continent. Elsewhere, results were decidedly mixed; U.S. forces continued a constant cycle of small-scale contingency operations – mostly of peacemaking, peacekeeping or humanitarian assistance in nature.

2. Technology, Globalization And Material Prosperity

Called by many a golden age, the early decades of the 21st century were a period of unprecedented improvements in material welfare. Obituaries for the business cycle proved premature. However, it had clearly moderated, with only mild recessions occasionally interrupting an overall record of growth, prosperity and stability in all the advanced and in many of the developing nations.

The progressive application of information technologies to all areas of economic activity caused growth in total factor productivity that was remarkable for both rate and length in which it had been sustained. Continued expansion of international trade, and global economic opportunity, was also a major factor in the economic expansion.

3. Energy

Throughout this period, energy was expensive, and a worrisome problem. But, it proved manageable and not a significant drag on any of the advanced economies. Extensive and increasing use of control devices and advanced materials lessened energy use (a major benefit of Information Age technologies).

Saudi Sweet Light Crude was generally priced in the low- to mid-thirties (2000 US$). Ready availability of carbon-based energy sources at higher prices served to moderate OPEC policies. Moreover, all countries with the wherewithal to do so took strong and effective steps to diversify energy sources. These measures included the following:

(1) exploiting new sources of carbon-based fuels, to include new fuel types, as well as oil and natural gas at inconvenient locations; (2) increased emphasis on dirty fuels such as coal (with new pollution controls); (3) major emphasis on nuclear power, to include breeder reactors; and (4) development of "renewable" energy sources.

B. Regional Powers: Elephants And Others

1. RUSSIA: elephant on the mend

By 2010, Russia was clearly recovering from its post-Soviet malaise and Putin-era "grandeur" – one of the manifestations being a more pronounced regional focus, vice global. National security strategy aimed for control and defense of the Russian Federation and attaining primacy in the "near abroad." Russian policy held firm to the ingrained belief that an empire is a god-given right, but with ambitions scaled back to more closely reflect means (which were nonetheless clearly increasing).

Expansionist efforts focused south to the former Central Asian Soviet Republics. Russian strategists saw opportunities in the form of natural resources and strategic position to be regained, as well as threats from militant Islamic movements.

Security of eastern frontiers was a continuing worry, with Chinese growth and clearly increasing interest in expansion. The Russian response emphasized a Japanese connection. Agreements for development of Siberian energy sources (2006), and a "final settlement" of all territorial issues, including the Kurile Islands (2009). Russan aims were to improve hard currency position, and to create a Japanese interest in opposing Chinese expansion into Siberia.

Overall, Russia supported development of energy sources in its central and eastern regions for both economic and security reasons. Sales of energy were intended to raise hard currency, which improved economic welfare, but also provided the wherewithal to better resist any Chinese expansion to its north. Russia aggressively developed energy resources and the pipelines for transport – energetically courting investors from Europe, North America and Japan – but not from China.

Russia did, however, develop energy pipelines from its own territory to China and sold petroleum and natural gas to the PRC. It also collaborated with Korea and China to join the Trans-Siberian railroad to the Korea-Manchuria railway. Once again, Russia avoided Chinese or Korean investment in this project.

Throughout these two decades, there was an uneasy military stalemate with China. Russia was continually worried about its ability to deal with any serious Chinese incursion, while the Chinese appeared to be worried about the sheer size of the Siberian land mass. In any event, however, China appeared to be drawn more to its southeast than to its north, and this particular correlation of forces was not tested.

Despite frequent and well-publicized disagreements, the Russian Federation maintained peaceful and civil relations with NATO and the EU to the west. Direct relations with the US were built on the legacy of the Cold War, reflecting the geopolitical distance between the two countries. Several rounds of negotiations with the US resulted in slow, grudging, gradual loosening of ABM Treaty restrictions.

Despite its economy recovery, Russia's role in the world economy remained centered on its raw materials and defense industries. The military-industrial sector continued to possess significant technical capabilities, but was perennially short of the orders (and the cash) needed to transform some world-class designs into weapons produced in quantity. A growing economy and increasing government revenues meant the Russian Ministry of Defense was able to embark on a significant, but not fully adequate, recapitalization program.

Propelled by government encouragement and clear self-interest, the military-industrial enterprises aggressively sought foreign sales. Major customers included China and India. Russian defense industries themselves slowly and painfully adjusted to post-Soviet realities. Accepted as the least of evils, mergers proceeded apace, the most prominent being the combined Mikoyan-Sukhoi design bureau agreed in 2007. Joint ventures with foreign firms were regarded as an indirect path to hard currency, and accordingly pursued with determination. Partners included firms in France, South Africa, and Israel for a wide variety of platforms and munitions, and also with the United States for space launch vehicles.

2. China: regional elephant and frustrated hegemon.

The Mao-Deng dynasty remained in place without serious challengers in 2020. The decades preceding saw continuing economic growth. There were problems however. While economic growth was substantial, 5% per year, it was not enough to fully meet the regime's political needs. After a long period of substantially higher growth, the majority of Chinese citizens considered 5% disappointing.

The country continued to "devolve," as political activity increasingly shifted toward the regions and provinces, an outgrowth of the "one country, many systems" announced in Beijing in 2006 (part of the negotiations over reunification with Taiwan). The main sources of economic growth were the small-scale Town and Village Enterprises (TVEs).

The State-Owned Enterprises (SOEs), as a group, proved remarkably resistant to both commercial viability and being closed down. Faced with a form of political and economic fragmentation, serious long-term problems like the SOEs and reduced ability to deliver economic growth, the regime faced a chronic and continuing crisis of legitimacy.

The regime's response emphasized domestic control – as exemplified by strong reactions to Falun Gong, Tibet autonomy movements and similar groups. The regime also emphasized appeals to Chinese nationalism. Official sources increasingly referred to China's rightful role of primacy in East Asia.

Although it never fully solved the problem of translating increased GDP into increased government revenues, government expenditures nonetheless continued their substantial grow. This enabled a significant military buildup with defense getting a consistent 2% of GDP and a growing share of government expenditures.

Given its increased means, and continuing political difficulties, the regime decided to solve its legitimacy problems by appealing to Chinese nationalism and expanding the Middle Kingdom's role in East Asia. The PRC's agreement with Taiwan for a 10-year, phased unification process (2008-2018) included gradual merger of the Taiwan Defense Forces with the PLA. Although forces on Taiwan were not fully available to PLA operational control until 2018, forces previously earmarked against Taiwan became available for other regional missions.

One visible change in the Chinese order of battle was a shift in basing from the Formosa Straits to the south, clearly visible by 2010 with special focus on Hainan Island. The PRC used the new forces in that region to expand air and naval presence in the South China Sea -- establishing larger bases in the Paracels and Mischief Reef (near the

Philippines). A PLA White Paper published in 2011 referred to China's "Fourfold Celestial Burden" in East Asian affairs – consisting of typhoon prediction and warning; humanitarian response to natural disasters; ridding Asian waters of pirates; and safeguarding the welfare of ethnic Chinese regardless of citizenship.

Taking advantage of that expanded presence, China made clear it was considering security options vis-a-vis Vietnam, Indonesia and the Philippines. Regarding Vietnam, China exerted pressure for access to basing rights (such as Cam Ranh Bay) by extending economic cooperation and encouraging Hanoi to learn from the China-friendly policies of Thailand and a unifying Korea.

Regarding the Philippines, China sought basing rights at Subic Bay and on Palawan Island in exchange for PRC economic and military aid to the Philippines, and for PRC assistance in coping with ongoing Muslim insurgencies. A number of foreign observers interpreted this as part of China's larger campaign to deal with Islamic pressures in the East Asian region and along the Pacific Rim.

Regarding Indonesia, China sought an open invitation from Jakarta to provide humanitarian assistance whenever needed. In that context, China emphasized its role as protector of ethnic Chinese throughout the region. Hanoi, Manila and Jakarta responded cautiously to Beijing's overtures, and seriously explored their options within ASEAN, with the US, and with Japan.

One general result of Chinese expansionism was a reluctance by near neighbors such as VietNam, Thailand and Myanmar to either fully join or actively resist the Chinese band wagon. While many countries were hedging their bets, a number of security arrangements in the Western Pacific were clearly focused on the PRC. Outward manifestations included military staff talks and joint exercises, all with clear focus on the PLA. Sea control exercises were regular feature, with varying national participation, but with regular interest by Russia, Japan, India and various ASEAN navies.

China's view: the government of the PRC felt a lessening of control at home and increasing encirclement from abroad, despite a satisfactory solution to the Taiwan Question. Hence, national security strategy aimed at ways to break out from perceived confinements to secure China's rightful role of East Asian primacy.

The Views of China's Neighbors: The neighboring countries' response to Chinese expansionism reflected three classic modes of response to any powerful, expanding and nearby state: (1) resistance, (2) accommodation, or (3) diversion of the threat to another direction. Korea originally thought in terms of resistance but eventually decided on accommodation. Australia, Japan and India chose resistance. Russia decided on a mixture of accommodation (through energy and arms sales), diversion of the threat (encouragement of Chinese ambitions elsewhere in East Asia) and resistance (by emphasizing close ties with Japan). The smaller states in Southeast Asia hoped to preserve their flexibility – by generally trying to remain on good terms both with the PRC and its rivals.

3. Other Regional Actors

a. India: Emerging Elephant.

After decades of underachievement, the Indian economy experienced a renaissance in the new millennium – achieving growth rates of approximately 5.5% per year. This economic growth resulted directly in increases in government revenues. Given concern over Chinese expansionism, India gradually increased defense share of GDP to 4%, with modernization emphasis on territorial defense of the northern border; quick, decisive offensive operations against Pakistan; and maritime power projection in cooperation with ASEAN, Australia, as well other powers such Japan and the United States should circumstances be favorable.

b. Indonesia

Indonesia had recovered a degree of political stability by 2005, which led to a reasonably robust economic recovery (3% growth per year). However, this uneasy political stability was bought by loosening the bonds of the Indonesian central government and the dominance of the Javanese. A military-supported palace coup in 2015 resulted in a change of regimes but no significant change in national policies or the weakening position of the central government. The result was the emergence of a de facto confederation of still quarreling regions, continued widespread unrest, and, in the case of Irian Jaya, an open rebellion that necessitated UN intervention. The Indonesian military remained for the most part poorly equipped relatively weak, and badly underfunded. It also found itself mostly concerned with maintenance of domestic order and Jakarta’s authority – and increasingly unable to defend Indonesian territory from other armed forces in the region.

c. United States: The Elephant from Abroad:

1. The Double Overstretch

Following the surprisingly rapid economic growth of the 1990s, the U.S. transitioned to a soft landing early in the new century. Growth settled into a relatively steady and uneventful 3% per year. However, this was not enough to avoid the squeeze caused by the double overstretch of international commitments and domestic entitlements. US policymakers faced a number of hard policy choices.

Imperial Overstretch: the military remained committed to multiple peacemaking, peacekeeping, humanitarian and other short-of-combat operations. National policies intended to reduce the number and size of such commitments were only partially successful. While the Pentagon became increasingly adept at working around small-scale contingencies in its budgeting process, such near-term turbulence continued to hamper long-term military planning and cause some underfunding of investment programs.

Entitlements Overstretch: Social security and medicare grew rapidly (and about as previously expected), greatly restricting resource allocations in the non-defense "discretionary" categories. Among other things, this meant tough sledding for policy initiatives that entailed significant resource commitments.

2. Economic Developments

Despite general prosperity, it was fashionable to be pessimistic in the first decade of the new century. However, optimism became fashionable once again after 2010, due to maturing of bio- and nano-technologies. After 2010, the US government and business enterprises became more interested in linking economic development, trade and international events. This resulted in an increased willingness to respond to regional crises, had there been any serious crises identified and agreed upon.

3. Military Affairs

The defense budget, driven by the size of international commitments and the need to recapitalize the forces, grew at a fairly steady rate of 3% (real) per year. Relative shares among services and defense agencies did not change much. Despite successes in modernization, there was nonetheless a slow, but definite switch in correlation of forces in favor of the regional powers (to include relative capabilities for high-intensity conventional combat).

There was a continuing (sometimes acrimonious) competition for defense resources between global force projection and homeland defense (to include NMD, cruise missile defense, anti-terrorism, and anti-drug missions). Homeland defense programs included a serious effort to develop BMD technology with a view to earliest practical deployment of a National Missile Defense. There were significant expenditures and significant progress, but it was a problem still not completely solved in 2020.

Recognizing that the Western Pacific presence in Japan and Korea was both less needed and more unpopular, the US scaled back its regional presence accordingly. There was an almost complete withdrawal of troops from Korea by 2018 and Japan by 2020 is expecting removal of all US forces with the notable exception of a carrier battle group at Yokosuka.

With impending withdrawal of forces from the Western Pacific, the United States reemphasized its ties with Australia and Japan – with those countries asked to be first on the ground in any small-scale military operations in their respective areas of operation. One unintended consequence of this policy change was a widespread interpretation that the United States had asked Japan to take over its leadership role in the Western Pacific.

The forces "released" from the Western Pacific were planned for basing elsewhere in the region (e.g., Darwin), return to the US for "expeditionary" missions, or were deactivated in keeping with a slow decline in Order of Battle units and personnel.

4. The American Policy Debate That Never Happened

For a number of reasons, the United States never seriously rethought its national security and military strategies in this period. The imperial overstretch ensured that many near-term crises consumed policy makers' (and policy analysts') time and attention. Also, the "unipolar moment" (as it was called after the demise of the USSR) seemed to be indefinitely extended, and extendable. There was no observable sea change that was sufficient to provoke a serious national-level review of overall national policy and strategy. That same climate produced a high degree of satisfaction with longstanding policy; this mood was perhaps best captured in Henry Kissinger's retrospective on Asian policy (*Foreign Affairs*, Jan-Feb 2010), which concluded that the ongoing Chinese and Korean reunifications were clear triumphs of US policy initiatives begun in the early 1970s.

While a number of people, both within and outside the government, warned of the need for change, they were generally prophets not accorded much honor. There was no attention-getting event to provoke a serious reexamination of foreign and national security policies. Thus, US policies, strategies and military programs were notable mainly for a surprising lack of change.

In 2021, the United States found itself confronting an East Asia which featured a Korean-Chinese alignment, Japan actively considering nuclear armaments, as well as a powerful, resentful, expansionist China. All in all, the situation in Northeast Asia was not regarded with great comfort or satisfaction in Washington. Foreign policy commentators began seriously asking why we hadn't taken more effective steps to prevent these developments.

d. Overall Trends For The Western Pacific Rim

In the course of the first two decades of the 21st century several trends became evident and are elaborated in this report in the chapters on Korea, Japan, and Australia that follow. Foremost was the revival of nationalist sentiments throughout Asia after the region's countries experienced a lessening of Cold War era constraints. Assertive nationalism was most dramatic in China -- which persisted in its quest for consolidating a "Greater China" and extending its influence throughout the region by persuasion and intimidation. The successful and peaceful integration of Taiwan within the PRC greatly facilitated pursuit of these ends. However, it also was evident in Russia which made serious efforts to rebuild past national security institutions and to reach out to the region as a major player. This nationalist trend was also demonstrated in Korea's peaceful reunification, which had significant results for its ties with China and the United States, and by resurgent efforts in Japan to pursue greater strategic self-reliance and regional connections. The following chapters provide details on these Northeast Asian developments and Australian responses to their impact on Australasia.

A second, and related, trend was the emergence of a greater sense of regional identity in East and Southeast Asia. The states of the region gave increasing consideration to organizational processes that first became prominent in the last decade of the 20th century, raising the possibility that an effective Asian grouping might become a peer competitor of Europe and the Americas. This trend was underscored by the ambiguous quest for a regional leadership role by China, Japan, and a cluster of smaller states.

Third, the disengagement of Chinese and US military spheres opened much greater freedom of maneuver within the region – especially for advanced, wealthy nations such as Australia, Japan and Korea. They found themselves with greatly expanded latitude to formulate independent national security strategies, and to make a difference within the region. As a result, the "elephants" were obliged to take serious account of the policies of smaller powers. Thus, the individual country scenarios (described in detail later in this report), and the common scenario (outlined in this chapter) evolved together.

Finally, a passive trend was evident in the ways the United States' engagement roles in the Western Pacific evolved, causing the Smith administration inaugurated in January 2021 to order a review of past U.S. policies to determine what might have been done more effectively over the past two decades.

As the second decade of the 21st century came to an end in 2020 many observers in Japan, Korea, and Australia -- as well as their counterparts in the major and smaller states throughout the Pacific Rim region -- recognized that events which transpired from 2000-2020 demonstrated a lack of foresight at the start of the new century. They resolved to learn from these experiences in the hope that their track records would improve by the middle of the 21st century -- better positioning the countries of Asia to cope with regional multilateralism and realize the long-term prospects for developing regional structures for governance.

CHAPTER 3 – KOREA

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Executive Summary

In the year 2020, Korea is unified. The combined military forces of the former DPRK and ROK are capable of substantial regional air, land and sea operations in defense of the peninsula and the sea-lanes of communication that have supported sustained positive economic growth of the economy. Although the DPRK gave up its fissile material in an act of good faith, the unified Korea feels the need to possess a credible deterrent and has the capability to field nuclear weaponry. Korea decided that a strategic alignment with China is mutually beneficial toward solving many day-to-day economic, geopolitical and military security concerns. The USFK (United States Forces Korea) have completely withdrawn. Following the USFK withdrawal from the peninsula, the US called upon Japan to take a leadership role in the region. This appeared as a threat to Korean sovereignty as Japan now has a substantial military strike capability.

The process of reunification of North and South Korea was pivotal in geopolitical and military events of the last 20 years. This study began with the following reunification assumptions: there would be no Korean Peninsular conflict throughout the study period; US troops would be withdrawn from Korea; the region would see a marked rise in Japanese militarism; relations between Korea and China would warm in later epochs.

In 2004, reunification planning began in earnest when the DPRK and the ROK formally agreed to pursue unification options. Within two years, however, the DPRK's economic situation worsened to the point of imminent collapse. Statesmen from both nations established the preconditions for unification and the ROK provided a $10B(US) average annual aid package, or roughly two percent of the South's GDP to help the DPRK save face and national sovereignty. In exchange, the DPRK agreed to launch a comprehensive biological and chemical clean-up program and began to re-channel excess manpower from demobilized forces into infrastructure improvements. In accordance with the preconditions for unification, the United States was invited to begin withdrawing troops from the peninsula.

The DPRK's first priority was to rid the peninsula of US military presence while the ROK demanded democracy and a move towards a market economy in the North. The bottom line for the North was that it had little choice. An aid-based foreign policy strategy was essential to the DPRK's prospects for near- to mid-term survival, especially with respect to provisions of energy supplies and foodstuffs. It was to the advantage of both the ROK and the DPRK to entertain an incremental transition allowing the Northern regime to avoid extinction and ultimately permit a meaningful, longer-term process of reconciliation with the South.

Epoch three's dramatic beginning was marked by the signing of the Pamunjon Treaty which formalized the reunification of North and South Korea and ended the longest armistice in modern history. And although the US presence shrunk to 50 percent of its 2005 size, it continued to provide a stabilizing element to the peninsula. The North offered up its fissile materials in a show of good faith and for the first time in history, the two Koreas fielded a single team in the 2012 Olympics under a unified flag. The unified co federal council removed the political boundaries to allow the merging of the two economies and focused on state-supported family reunions and tourism to reconnect long separated families. Informal talks and discussions centered primarily around foreign policy arrangements with the four powers as well as long-range defense planning by way of a joint military council.

In 2018, Korea held its first prefectural elections and the United States Army held closing ceremonies at the US Army Base in Yeongsan. But in an unsettling foreign policy maneuver, the US called upon Japan to take the lead in ensuring regional stability. This and several additional events helped to precipitate tensions between Korea and Japan and raised concerns about the United State's commitment to regional stability. Ultimately, it triggered Korea's unilateral strategic and economic alignment with the PRC.

Korea's historic and ethnic ties to China proved a powerful lure. Adding the substantial Sino-Korean trade and growing concerns over Japanese militarism without the stabilizing force of the United States, Korean leaders welcomed China's invitation to political alignment.

Clearly, the North was no longer viewed as the primary threat to the former South Korea and the nation took on a more global defensive posture. By the end of 2020, Korea's national security strategy focused more on protection of national sovereignty and all commercial activities. The alignment with China ensured increased security, especially in the areas where Korea was most vulnerable. This translated to a significantly more focused and lethal national military strategy that sought to deter any adversary's use of cruise or ballistic missiles, protection from sea invasion, and a directed defense against Sea Lines of Communication (SLOC) blockages or disruption.

With increased capital flows to the region, the South's economy grew steadily at four percent through 2005 and 5.9 percent per annum through 2020 as they contributed two percent of the GDP to the North for infrastructure improvements. This economic aid package, allowed the North to sustain double-digit growth throughout the 2010-2015 period, and a nominal 7.2 percent in 2020. Defense expenditures in the South were 3.5 percent of GDP with current operations allocated 70 percent and force improvement program spending at 30 percent. The North with its smaller national economy spent nearly 30 percent of the GDP on defense, 70 percent of that on current operations and 30 percent on force improvement programs.

With the prefectural elections in 2018, Korea saw a shift in military capabilities and the role of the unified defense force. Korea sits on the doorstep to a maritime environment and its desire for sea power is linked to a growing Korean reliance on a coastal economy. With the imminent rise of the maritime power of Japan and China, a high priority was given to Korea's maritime forces buildup with emphasis placed on the navy and the air force. The Korean Army's mission had also changed to include that of assisting the authorities in maintaining social order in a unified Korea.

The force improvement programs were established to accomplish the national military strategy and included Intelligence / Early Warning; Cruise / Ballistic Missile Defense; Precision Engagement; and Agile Combat Support. The air force gradually acquired advanced tactical aircraft suitable for a future operational environment, with considerable effort focused on improving the agile combat support for better response and flexibility. New AEW / ESM, air refueling assets were also procured in view of departing US forces. An area that has received emphasis in the air force and other arms has been the development and purchase of long-range UAVs for intelligence and even combat missions. In addition, air-to-air and air-to-surface missiles were procured for extended-range attacks and for strategic and precision strikes on ground and sea surface targets respectively. The new resulting force structure was thus a qualitatively superior force with the ability to render prompt fire support to the ground and naval forces. The air force's main challenge, however, remains the search for the best force mix, comprising manned and unmanned air platforms and conventional long-range standoff strike missiles.

The navy was modernized to adjust to three-dimensional warfare, signaling a departure from littoral protection to projection of power in the blue water. With a constantly expanding naval budget, Korea procured advanced ocean-going Aegis-class destroyers, like the new Korean-designed KDX destroyers armed with state-of-the-art weapon systems in the SM-2 and SM-3 variants of anti-air guided missiles as well as extended range anti-ship cruise missiles. Korea's navy also procured submarines that included new patrol submarines like the German Type 214 utilizing AIP (Air Independent Propulsion) and the Russian Kilo-class diesel submarines.

The army was rapidly downsized from a combined force of 1.5 million in year 2000 to about 860,000 in 2020. This was accomplished through the reorganization of its front-line corps, infantry divisions and brigades, into mechanized ones. Korea also increased the army's combat effectiveness by supplementing units with new weapons and equipment Emphasis was placed too on the army's combat helicopters, whose importance in influencing a battle was clearly demonstrated in the Persian Gulf War. Korea's policy thus expanded the combat helicopter fleet and fully integrated its employment in land battles. Major issues concerning integration of doctrine and equipment were pivotal to the success of a unified Korean Army.

Given the absence of nuclear, chemical and biological weapons, Korea's cruise and ballistic missile development program received top developmental priority. Korea's ballistic force of approximately 1000 was primarily dedicated to a strategy of minimum deterrence, which meant that no potential enemy would launch a strike against Korea without suffering retaliation. Consequently, long-range ballistic missiles were preferred over short-range ones in a unified Korea, resulting in the reduction of its short-range stockpiles with the funds channeled to the development of more accurate longer-range ones.

Korean military planners (this study team) used the static net assessment to analyze the correct size of the military and the balance of capabilities within each service. A number of scenarios were considered for their ability to provide meaningful insights. During the first 15 years, a DPRK Invasion was considered as the South looked with cautious optimism towards unification and their ability to defend ROK soil. Issues included the DPRK sustainment capabilities and no intervening influence other than USFK. Looking *outward* in the region and *forward* to unification, a limited war with China as a *unified* Korean force was used. Finally, a Japanese naval blockade and concurrent SLOC interdiction scenario was used in the final epoch to evaluate the capability of existing forces to protect maritime trade routes and sea lines of communication. A deficiency identified during the early epochs was the inability to protect the vital sea lines of communication with a blue water naval force even with an accompanying supportive air force. Korea remains vulnerable to cruise and ballistic attacks and lacks a robust offensive cruise missile capability. With these deficiencies Korea realizes the need for a realignment of the threat-based capabilities by decreasing the army, increasing the navy and stabilizing the air force funding levels in the subsequent epoch.

As stated in its 1999 White Paper, South Korea's technological goals of achieving an indigenous production capability of major weaponry, modernizing the military into a technology-centered force, and a "Use Domestic Weapons First" policy, encapsulate Korea's philosophy. Self-reliance permeated Korea's technological acquisitions throughout the epochs. From an analysis of its industrial capabilities in 2000, Korea concluded that MEMS and biotechnology would be the enabling technologies for attainment of Korea's technological goals.

Indigenously, Korea was now capable of building its own combat and support ships like the KDX-class destroyers and major ground combat systems such as armored and artillery systems. Its unification has given Korea a nuclear-capable BM program. Through joint production efforts, Korea has gained access to new technological weapons. To build its indigenous capabilities, Korea license produced the FX fighter and T-214 submarine in order to acquire the required technology, infrastructure and knowledge base. Due to economic reasons, however, Korea continues to import conventional missile technology for direct combat engagements.

Korea's two key technical partners continue to be Israel and Russia. Its cooperation with Israel was to acquire miniaturization and tactical HEL (High-Energy Laser) technology, while its alliance with Russia focused on acquiring their missile and HPM (High Power Microwave) weapons technology. With France, Korea has secured its rocket and missile propulsion and guidance technology. In the fourth epoch, Korea's cooperation with China in its HPM program was a means of fostering closer military ties. In earlier epochs, however, Korea had exploited the US-ROK alliance to gain access to high technology weapons. This access ended with Korea's alignment to China.

Korea's technology development has been characterized by an increased use of unmanned platforms and dependence on digitization, as well as leaning towards the use of directed energy weapons as an affordable military solution. Its technological development had identified that its transformation into a high-technology military force would exploit the revolutionary advances of MEMS technology. The reunification process forced Korea to align itself with China resulting in Korea's loss of access to US MEMS and related military technology. The implications are thus a slowdown of Korea's military modernization efforts and a reduced logistics supportability of its US legacy systems for post 2021 epochs as a compromise for Korea's need for national self-preservation.

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A. Epoch One (2001 – 2005)

1. Strategy

a. Introduction

The following section is written from the South Korean strategic military planning perspective. It is written retrospectively from December 2005 and the table below captures the significant events of the epoch.

Epoch One Events 2001 – 2005
North and South Peaceful Coexistence. Sunshine Policy in effect
North Korea's impending economic collapse
United States and North Korea nuclear non-proliferation talks
North and South "Muddle along" policy
Formal agreements to pursue unification options
Establishment of Intra-Korean currency

Table 3-1. Epoch One Significant Events

b. Geopolitical/Military Situation – Cooperation and Conflict

Although tensions in the region remained high, the military powers of China, Russia, Japan, and the United States continued to work for peaceful resolution of long-standing disputes. As cooperation outweighed conflict in this tenuous period, the region trended towards neutralizing or stabilizing factors. Each of the four major powers sought to maximize their security advantages while the US maintained the power advantage in the region. China, as the second largest power in the region, viewed the strengthening ties between Japan and the United States as a threat. Furthermore, several events of the previous decade have kept relations between the Chinese and the Americans cool.

1) 1999 NATO air strikes against Serbia

2) Chinese embassy bombing in Belgrade

3) Chinese defense workers installing fiber optic lines in Iraq

More importantly, political ties between Japan and China were unstable. On the surface, Beijing and Moscow relations contributed significantly to regional stability while arms transfers from Russia to China threatened to trigger a regional arms race. Finally, relations between Japan and Russia were characterized as *quid pro quo*.

c. Four Major Power's Policies

While the tide of relation's ebb and flow, each of the four major powers maintains specific policies with respect to the Korean Peninsula. The United States maintained its long-standing policy of war deterrence and denuclearization. During the last decade, the US became more vocal in its support of reunification efforts based on free trade and democracy. Japan continued on diplomatic neutral ground notwithstanding its bilateral security policies with the United States. Japan furthermore maintained credibility through unobtrusive and quiet diplomacy with Korea, China, and Russia. China carried the brunt of North Korea's economic crisis while its policies strongly favored regional stability conducive to economic development. To that end, China and North Korea enjoyed warm relations based on common interests and ethnic ties. Russia sought to create a stable environment but with Russian influences. Not unlike the US, Russia also supported reunification, denuclearization, and an arms reduction.

d. Four Major Power's Posture

The US maintained a general security posture that attempted to balance ground force posture with naval presence and included three main missions: Stabilizing force; defense of Japan and South Korea; security of SLOCs in the Pacific.

Japan continued to cite North Korea's 1998 Daepo-dong missile launch as the rationale for its enhanced posture and some Japan watchers predicted a reemergence of Japanese militarism to pre-World War II levels. Several new strategic assets were fielded including several intelligence satellites, new frigates, a two thousand ton submarine, and two new E-3x AWACS.

Although not bound by treaties, China maintained a defense-only policy. However, the PRC continued to vigorously modernize outdated equipment and revamp her military force structure. China also continued to voice strong concerns over the joint TMD project between Japan and the US and is increasing its weapons development capabilities.

Russia continues to rebuild her military in the image of a leaner, more rapid, mobile force. Russia maintained multilateral military policies and strongly opposes the US -Japan TMD project.

e. What Changed?

Formal agreements between Pyongyang and Seoul to investigate and pursue unification options served to boost optimism and warm relations between the two nations. This was followed shortly by the announcement of an intra-Korean currency designed to streamline merging economies, increase trade, and build overall confidence. Otherwise, little else changed between North and South Korea from the previous decade. The 2001 to 2005 epoch is therefore characterized as the "Muddle Along" epoch. Economic, social, and political suffering remained widespread in the North.

The "Sunshine Policy" is President Kim Dae Jung's philosophy or proposed formula for unification, which envisions this process as occurring in three stages. Stage one is described as a confederation characterized as one nation, two states, and two independent governments that seeks to institutionalize inter-Korean cooperation. Integral to stage one are regularly scheduled North-South summit conferences and the activation of a co federal council. The "would be" co federal council will be tasked ultimately with unification planning and will include the following sub-councils:

4) Joint Economic Council (JEC) responsible for economic merging and viability.

5) Joint Social Council (JSC) responsible for state supported family reunion planning, tourism, etc.

6) Joint Foreign Policy Council (JFPC) responsible for scheduling and directing informal talks and discussions that will ultimately result in foreign policy decisions.

7) Joint Military Council (JMC) responsible for developing and making defense policy recommendations to include demobilization, modernization. The JMC is additionally responsible for close coordination with the JSC on issues involving the social impacts of large-scale demobilization.

The "Sunshine Policy's" second stage involved creating a federation characterized as one nation, one state, and two autonomous regional governments. Under this system, the central government would handle issues of a national or strategic focus such as foreign policy and diplomacy while the regional governments would be responsible for the lesser, clearly internal matters. The subsequent third stage would then be a fully unified, single nation.

f. Reunification

Scholars worldwide are watching for several indicators of change that will drive reunification. Key indicators include: major political-military change in the North; growing economic and political vulnerabilities in the North; regime or state collapse in the North; and waning alliances between North Korea and China and Russia. We have already seen clearly the extreme vulnerability of the North's economic situation, which many North Korea watchers believe will trigger a collapse of the current regime. Also, the aid reduction from Russia and China is viewed as a potential trigger point for absorption by the South.

There are four likely scenarios or a combination thereof which political scientists believe will characterize a reunification of North and South Korea. They are:

1) Unification through peaceful integration and negotiation

2) Unification through absorption following a collapse of North Korea

3) Unification through conflict or war

4) Sustained disequilibrium and potential external intervention

South Korea hopes for a peaceful integration called a soft landing. We would prefer to avoid a hard landing, or an absorption following a total economic collapse, but the North with its *juche* philosophy may hold on to the very end. Worse still would be conflict or war in an act of desperation by the North to maintain sovereignty.

g. Economic Summary

Absent an egregious economic downturn in the region and with recognition of the 1997 crisis, the South Korean economy is assumed to experience a GDP growth rate on the order of 4 percent per annum through 2005. Beginning with a GDP of $344 B(US) in exchange rate (XR) terms (as opposed to purchasing power parity), ROK will average $387 B(US) annually throughout epoch 1.[1] ROK defense expenditures remain constant at 3.5 percent of GDP or an average of $12.8 B(US) per annum in XR terms. The military spending is allocated traditionally with 70 percent assigned to current operations, maintenance, personnel (salary/food/clothing), facility operation and construction, and US Forces Korea support. The remaining 30 percent was

[1] RAND, *Asian Economic Trends and Their Security Implications*, presented to Naval Postgraduate School by Dr. Charles Wolf, Jr, December 1999.

assigned to Force Improvement Programs (FIP). The FIP allocation includes research and development, and equals about four percent of the overall defense budget.

There is a paucity of reliable economic data available with regard to the size and efficiency of the North Korean economy. The economic data and subsequent calculations discussed herein are recognized to be imprecise. However, the calculations are within a rough first order of magnitude and suffice for comparison purposes. In 1999, the DPRK was reported to have a GDP in PPP terms as $15.8 B(US).[2] Comparing the relative ratio of ROK to DPRK GDP in PPP and applying the ratio to the XR estimate of ROK GDP allowed an optimistic and useful conversion of DPRK GDP. In PPP terms, during epoch one, the total ROK ($4191 B(US)) to DPRK ($93B(US)) GDP ratio was 45.2. Applying that ratio to the ROK (XR) GDP yielded a DPRK GDP of $8.6 B(US). The DPRK real GDP growth was projected at 6.2 percent throughout the epoch with DPRK defense spending between 27 and 30 percent of GDP. During the first epoch, the assumption is that actual defense spending by the DPRK was 30 percent of GDP. Allocation of this defense expenditure was not postulated.

h. South Korean Strategy

The first epoch's NSS (National Security Strategy) revolved around the tenants of peace, stability, and war deterrence through peaceful coexistence. Additionally, a focus on international cooperation sought to share security resources and diffuse peninsular tensions.

The NMS (National Military Strategy) ultimately sought to deter an invasion by North Korea and protect the sea lines of communication. South Korea also desired to strengthen military ties with other regional powers. Modernization efforts focused on a smaller, more lethal force structure that capitalized on strengthening external military ties.

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[2] The Economist Intelligence Unit Ltd., June 30, 2000 from Bank of Korea and National Statistical Office, Seoul, Republic of Korea.

2. National Defense

a. South Korea's Force Improvement Plans[3]

In light of the rapid changes in the security environment, the types of future warfare, and the accelerated development of advanced weapon systems, it was imperative to restructure ROK's military force. The current restructuring placed an emphasis on the acquisition of essential capability that could be employed against North Korea's military provocations with regard for future security uncertainties. Given the limitations in defense resources, however, it was particularly important to promote a qualitative improvement in inter-service force capabilities and a balanced force structure. Since restructuring required years of advanced planning, the ROK armed forces intended to implement it as a long-term plan. The ROK armed forces are transforming the current personnel-based structure to a quality-oriented, technology-intensive one and have placed a first priority on securing core capability. Taking also into account the changing role of the USFK, the prospects for South-North Korean security relations, and the limitations in defense resources, the ROK armed forces will promote a balanced development of three services, thus maximizing the joint force capability.

To lay the foundation for the 21st century and national unification, the ROK armed forces have implemented defense modernization programs in manpower management, information, and science and technology with modernization in defense information as the top priority project. The December 1994 switch of the OPCON to the ROK has added urgency to the project. Modernization in defense science and technology, guided by the principle that South Korea will make all vital weapon systems indigenously, has proceeded with the selection and development of priority weapon systems and improvement of the defense R & D system. C3I modernization is a critical element in combat operations. It is a "force multiplier" that combines military assets

[3] Reference: http://www.shaps.hawaii.edu/security/korea/milit1-1.html#1

organically and enhances the overall effectiveness of military power. The ROK armed forces have endeavored to create an automated command system, which will significantly shorten time to sense, decide, and respond to any threat. In tandem with the development of joint war fighting capability under the command of the Joint Chiefs of Staff, the armed forces have focused on real-time war fighting in terms of different services, echelons, and functions. In connection with the defense information management system, the Korean C3I system will be on par with that of advanced industrial nations.

1) ROK Army (ROKA)

On August 31st 1998, the North Korean government shocked the world when they tested a Daepo-dong missile with a range of 2000 km. President Kim Dae Jung's predecessors had previously promised to purchase either a US Patriot or a Russian-made S-300 missile defense system, but not before the year 2000. A Patriot battalion would cost the ROK in excess of $1 billion while the Russian system would cost significantly less. It now appears that President Kim has changed course. He has instructed the ROK's Agency for Defense Development to accelerate work on a medium-range surface-to-air missile that will have a range of 40 km. It is being designed to intercept invading North Korean military aircraft and Scud-type missiles. The system will not be operational until 2008 and the decision had been to go ahead with the purchase of the Russian S-300[4] system that appeared to be comparable in performance with the US Patriot but significantly lower in costs. Korea also continued to invest in upgrading its fleet of tanks and armored fighting vehicles with the locally made Hyundai K1 MBT and

[4] Detailed description of the S-300 is available in the Annex 3D3

Daewoo's KAFV[5]. Following an increasing worldwide market trend of having a powerful armored vehicle, Daewoo Heavy Industries (DHI) developed the Korean Armored Fighting Vehicle (KAFV) by reinforcing its firing power to the standard KIFV[6]. The KAFV, with its increased firing power and survivability, can be operated as organizational equipment in the mechanized infantry and cavalry units. The KAFV 40/50 was developed indigenously by DHI and has a 40mm grenade and a 50-caliber machine gun that is currently operated by the Korean Army. This vehicle can transport a squad over all terrain to the target area and can fire during maneuvering, even at night. With a total combat weight of 13.9 tons including turret system, KAFV can be operated at a maximum speed of 70km per hour. A gunner operates its turret and the target is observed by visible sight. The KAFV successfully completed their test & evaluation trials in overseas countries as well as in Korea in the year 1995, and currently draws much attention from several countries.

Combat System	2000	Procurement	Demobilization	2005
Active Divisions	23	-	-	23
Personnel (thousands)	560	-	-	560
Reserve Divisions	23	-	-	23
Tanks	2100	66	66	2100
APC / AIFV[7]	2500	66	66	2500
Attack Helicopters	100	48	48	100
Gun Artillery	4550	-	-	4550
Rocket Artillery	180	-	-	180
Surface-to-Surface Missiles	12	-	-	12
Air Defense Artillery	600	-	-	600
Surface-to-Air Missiles	1000	20	35	985

Table 3-2. ROK Army Force Structure 2005

[5] Information on the KAFV is borrowed from the Federation of American Scientist and more detailed information is available in Annex 3D3.
[6] Detailed description of the KIFV is available in Annex 3D3.
[7] Armored Personnel Carrier / Armored Infantry Fighting Vehicle.

2) ROK Navy (ROKN)

The term "Naval Power" means a lot more than just having a few good modern ships and subs, or even an aircraft carrier. It also means having the political will and financial ability to use them whenever and wherever necessary in an effort to try and dictate the outcome or course of events in a crisis or hot spot. Recognizing the viable DPRK force to the north, focusing South Korean naval projection in that direction would seemingly deplete resources probably better used on defense of the SLOC's, if required. However, with a communist neighbor still hard to trust, the focus will remain sharply on the North for some time. The new FFG/DDG types ensure more powerful and self-sufficient forces at sea in case USN assistance is slow in responding. If the ROK did want for whatever reason to have a more influential maritime effect on the region, then it will probably need more than a few modern destroyers to do so.

The 3,900 ton King Kwang-Gae-To-Dae-Wang was commissioned in 1998, and was the first of the KDX-1 class FFGs fitted with 8 Block 1C Harpoons, and RIM-7P Sea Sparrow in the Mk 48 VLS. The second of the class was commissioned in 1999, and according to Janes, the third of the KDX-1 class ships Xangmanchae was commissioned by the end of 1999. They are designated DD type. By the year 2005 the ROK navy possess nine KDX destroyers inclusive of the KDX-3 that are Aegis-class destroyers. They represent a major leap forward for the ROK Navy in providing a modern fighting capability. The KDX-2 and KDX-3 have a comprehensive area defense SAM system fitted (using SM-2MR), and the KDX-3 will be a 7,000-9,000 ton class vessel fitted with the Aegis combat system and radar. Nine hulls were produced for the KDX program, three of each type. They rival the latest destroyers from China and Japan in modern war fighting capability. The American Mk 45 Mod 4 5"/62 lightweight gun system was chosen for the KDX-2 DDG. It was co-produced under license in South Korea. The Rolling Air Frame missile (RAM) was chosen for the KDX-2. Service date for the first KDX-2 was December 2005. In addition, the ROK Navy has taken delivery of its 9th Chang Bogo (Type 209) class SSK (diesel-electric). Additionally, the design for the first of three follow-on class submarines is confirmed to be the German Type 214 submarines with a block order of six additional units under the 5-year defense. Moreover, an additional nine Kang Keong class MCMVs are planned as well. The YangYang is the lead ship in an improved Kang Keong MCMV class, seven or eight of this new type are planned.

Within the ROK naval air arm, an additional twelve Super Lynx are on order to form a second squadron. In addition to their ASW role, they are fitted with Sea Skua ASM. The planned purchase of an additional eight P-3C’s also materialized in epoch one. Other projects under construction include three new minesweepers, and two 7,500-ton class underway replenishment vessels. The ROK Navy is unlikely to emerge as a major naval power in the region, at least not for some time, and only if it decides it wants to have a far greater influence in regional affairs. However, they do have tremendous potential emerging as a warship builder.

Combat System	2000	Procurement	Demobilization	2005
Maritime Patrol A/C	8	8	-	16
Submarines	18	2	5	15
Destroyer	5	4	-	9
Frigates	16	-	5	11
Coastal Patrol	118	-	-	118
Amphibious	33	-	3	30
Mine Warfare	15	5	3	17

Table 3-3. ROK Navy Force Structure 2005

3) ROK Air Force (ROKAF)[8]

The ROKAF received its first F-16 aircraft in 1986-88. Deliveries of the second ROKAF buy of F-16s, known as the Korean Fighter Program (KFP), began in 1994. The first few were built at Lockheed Martin Tactical Aircraft Systems (LMTAS) with the remainder being produced under license at Samsung Aerospace in Sachon, Korea. Major upgrades are either in development or being incorporated so that all F-16 versions remain modern and fully supportable well into the next century. Additional F-16 sales were finalized in 2000. LMTAS completed modifying the first Korean F-16 with the AN/ALQ-165 Airborne Self-Protection Jammer (ASPJ) [9] with Korea accepting the aircraft on February 26, 1999, according to schedule.

Combat System	2000	Procurement	Demobilization	2005
Fighter	485	-	-	485
Ground Attack	0	-	-	0
Bomber	0	-	-	0
Air Refueling	0	-	-	0
AEW / ESM	0	-	-	0
Reconnaissance /UAV	38	90	-	128
Trainer A/C	153	45	-	198
Transport A/C	12	-	-	12

Table 3-4. ROK Air Force Structure 2005

[8] Reference: http://www.pcarena.com/sim/news/f16.htm
[9] Refer to Annex 3F2-A for detail description of ASPJ.

b. North Korea's Force Improvement Plans

With the economic difficulties faced in the North, it can only be very selective in its investment decisions. Not much has changed since 2000. Emphasis has been placed in the areas of ballistic missile and special force developments. The following tables represent the resulting force structures for the DPRK armed forces.

Combat System	2000	Procurement	Demobilization	2005
Active Divisions	80	-	-	80
Personnel (thousands)	1000	-	-	1000
Reserve Divisions	37	-	-	37
Tanks	3500	-	-	3500
APC / AIFV[10]	2500	-	-	2500
Attack Helicopters	50	-	-	50
Gun Artillery	8200	-	-	8200
Rocket Artillery	2300	-	-	2300
Surface-to-Surface Missiles	55	-	-	55
Air Defense Artillery	6000	-	-	6000
Surface-to-Air Missiles	5500	-	-	5500

Table 3-5. DPRK Army Structure 2005

Combat System	2000	Procurement	Demobilization	2005
Maritime Patrol A/C	-	12	-	12
Submarines	25	-	-	25
Destroyer	-	-	-	-
Frigates	3	-	-	3
Coastal Patrol	448	-	-	448
Amphibious	266	-	-	266
Mine Warfare	24	-	-	24

Table 3-6. DPRK Navy Structure 2005

[10] Armored Personnel Carrier / Armored Infantry Fighting Vehicle

Combat System	2000	Procurement	Demobilization	2005
Fighter	241	-	-	241
Ground Attack	321	-	-	321
Bomber	80	-	-	80
Air Refueling	-	-	-	-
AEW / ESM	-	-	-	-
ASW / Patrol	-	-	-	-
Reconnaissance /UAV	-	-	-	-
Trainer A/C	263	-	-	263
Transport A/C	304	-	-	304

Table 3-7. DPRK Air Force Structure

1) Strategic Weapons Development

North Korea's WMD programs pose a major threat to the Korean peninsula and its surrounding neighbours. This threat has advanced considerably over the past five years, particularly with the enhancement of North Korea's missile capabilities. There is significant evidence that undeclared nuclear weapons development activity continues, including efforts to acquire uranium enrichment technologies and recent nuclear-related high explosive tests. This means that the South cannot discount the possibility that North Korea could produce additional nuclear weapons outside of the constraints imposed by the 1994 Agreed Framework.

In the last five years, North Korea's missile capabilities have improved dramatically. North Korea has produced, deployed and exported missiles to Iran and Pakistan, launched a three-stage missile (Daepo-Dong 1), and continues to develop a larger and more powerful missile (Daepo-Dong 2). Unlike before, North Korea can now strike even the United States with a missile which is capable of delivering high explosive, chemical, biological, or possibly nuclear weapons. The United States and its allies are currently unable to defend against this threat. The progress that North Korea has made over the past five years in improving its missile capabilities and its record as a major proliferator of ballistic missiles and missile technology, when combined with its development activities on nuclear, biological and chemical weapons, ranks North Korea as one of the greatest missile proliferation threats in the world.

a) Nuclear Weapons

Based upon North Korea's efforts to acquire plutonium, it can be concluded that Pyongyang set out to build first-generation, implosion-type plutonium bombs comparable to the "Fat Man" bomb that the United States dropped on Nagasaki in 1945 which used 6.2 kilograms of plutonium and produced an explosive yield of 23 kilotons. It took the United States about four years to produce the first-ever plutonium bomb. By comparison, North Korea has had decades to work on a bomb and has had ample opportunity to exploit large amounts of declassified information on nuclear weapons programs. With respect to weapon design, North Korea reportedly has produced and tested explosive triggers for detonating nuclear weapons as recently as November 1998. As a general rule, the biggest hurdle for a would-be nuclear power is the acquisition of fissile material such as enriched uranium or plutonium. It is reasonable to assume that North Korea has made or could make a nuclear explosive device capable of producing a significant nuclear yield. While such a device Might not compare favorably to the most modern weapons possessed by the five *de jure* nuclear weapon states, even a few kilotons of yield could approach the level of destruction experienced at Hiroshima or Nagasaki.

b) Chemical and Biological Weapons

North Korea possesses biological weapons production and dispensing technology, including the capability to deploy chemical or biological weapons on missiles. The DPRK is generally credited with possessing a full range of chemical warfare agents including nerve, blister, choking and blood agents. The South Korean government believes that the DPRK followed the Russian pattern of developing chemical warfare weapons for a wide range of weapons systems, including artillery above 82 mm, multiple rocket launchers, Soviet-derived FROGs (Free Rocket Over Ground), SCUD missiles, aerial bombs and spray tanks. Additionally, the DPRK biological weapons (BW) effort is believed to focus on traditional agents: plague, typhoid, cholera, anthrax, smallpox, yellow fever, botulinum toxin, and hemorrhagic fevers. It is generally assumed that, to the extent capable, the DPRK would seek to provide BW munitions for the same range of weapons as it does with chemical munitions.

c) Ballistic Missiles

Development in ballistic missiles continues to receive top priority in the North Korean People's Army. The resulting force structure for 2005 is shown below:

Combat Systems	2000	Procurement	Demobilization	2005
Scud B	100	-	-	100
Hwasong 5	150	-	-	150
Hwasong 6	250	-	-	250
No-Dong 1 / 2	36	50	-	86
Daepo-Dong 1	-	25	-	25

Table 3-8. DPRK Ballistic Missile Structure 2005

3. Net Assessment

a. Introduction

The static net assessment was chosen as a tool to highlight deficiencies in defense capabilities. A perspective towards military force structure asking the question, “What if?” was taken to answer the question, “Are we covered?” The static net assessment was chosen over the more robust dynamic or campaign and vulnerability analysis due to time, information and resource constraints. It is recognized that the static assessment may not always take into account the qualitative technological advantage that some systems may possess, nor are reliability or maintainability issues evident. Additionally, doctrine, survivability and some specific system performance measures were not included. This point illustrates that these assessments are first order approximations. The fidelity attendant to information regarding logistics, proximity, mobility, and operational factors such as detection and engagement times are not precise enough to go beyond a first order approximation. However, these approximations generated rough draft deficiency lists for further discussion and proposed solutions that may mitigate any glaring deficiencies. Ultimately, the deficiencies and the proposed solutions were prioritized for procurement funding and subsequent acquisition of fielded systems.

A number of scenarios were considered for their ability to provide meaningful insights. The scenarios were based upon the Korean NSS supported by the NMS. Within this established boundary, the “neighborhood” powers and their potential as a threat to national security are discussed. Required military capabilities are identified if this “neighbor” became an aggressor and a scenario that balanced testing of those capabilities was developed.

The net assessment for epoch one is derived from scenarios that are congruent with the ROK inward focus on peaceful peninsular coexistence as unification talks are looked upon by the general military planning staff with an optimistic suspicion.

b. Scenario One: Overland Invasion by North Korea

Scenario One is an overland invasion by North Korea against the US and South Korean Alliance's Combined Forces Command (CFC). South Korean and US Forces Korea military personnel constitute the CFC. The purpose of this scenario is to illustrate the military capabilities and deficiencies of S. Korean-US alliance in the event of a NK invasion. The intention is to evaluate the capabilities of the CFC alliance against the DPRK without any external intervention factors.

1) Army Order of Battle

On the ground, the North has over one million active duty soldiers. This is nearly 30 percent of all North Korean males between the ages of 13 to 32. This compares with the South's 560,000 soldiers. North Korea has two times the number of tanks (4,000 to 2,000), field artillery units (10,200 to 5,000), and surface-to-air missiles (5500 to 985). It also has the world's largest organized special operations forces, approximately 88,000 personnel. Its troops are positioned close to the DMZ, which minimizes preparations needed for an attack and it has invested heavily in artillery which includes long-range systems that can reach across the border into Seoul itself. While the accuracy of this artillery may be questioned, the sheer volume of fire available is formidable.

Combat System	DPRK	CFC	ROK	USFK
Active Divisions	80	24	23	1
# Personnel (K)	1000	588	560	27.5
Reserve Divisions	37	23	23	--
MBT	3500	2240	2100	140
APC / AIFV	2500	2670	2500	170
AH	50	172	100	72
Gun Artillery	8200	4580	4550	30
Rocket Artillery	2300	210	180	30
SSM	55	12	12	--
ADA	6000	600	600	--
SAM	5500	985	985	--

Table 3-9. DPRK and CFC Army Order of Battle

2) Navy Order of Battle

At sea, the North has 25 attack and smaller non-attack submarines, to the South's 15, which includes nine of the newly acquired attack submarine. The North originally had 26 submarines, but one was lost during the September 1996 incident while the rest were decommissioned with upgrading work performed on the remainder. The ROK navy has a reasonable force in numbers, and also has the ability to project that power beyond territorial waters or regional confines. South Korea’s primary core force comprises 11 Ulsan class Frigates and 7 Chung Buk (ex-US Gearing class) destroyers and small force of modern diesel fast attack submarines. However, the addition of the new KDX-1/2/3 classes over the last few years has strengthened this projection capability. This contrasts with the DPRK fleet comprised primarily of coastal patrol types. ROK has a good number of similar types to counter them, as well as a far more effective air force capability. In the case of a conflict, the DPRK fleet would be highly vulnerable.

Combat System	DPRK	CFC	ROK	USFK
Maritime Patrol A/C	12	16	16	--
Submarines	25	15	15	--
Destroyers	--	9	9	--
Frigates	3	11	11	--
Coastal Patrol Boats	448	118	118	--
Amphibious	266	30	30	--
Mine warfare	24	17	17	--

Table 3-10. DPRK and CFC Navy Order of Battle

3) Air Force Order of Battle

The DPRK Air Force, while near parity to the ROK Air Force in terms of aggregate combat aircraft, lacks modern capability. Their vintage former Soviet equipment is hardly a match for the more modern ROK air assets. Their MiG-21 Fishbed and MiG-23 *Flogger* fighters are aging, and the limited numbers of capable MiG-29 *Fulcrums* are not much of a match for the ROK's F-16 *Falcon's*, F-4 *Phantom's* and F-5 *Tigershark's*. The ROK maintenance and upgrade programs have kept the older vintage aircraft (*Phantom* and *Tigershark*) more capable than the daylight visual MiG-21's and MiG-23's. See Annex 3D2 for a specific breakdown of aircraft types and quantities.

Combat System	DPRK	CFC	ROK	USFK
Fighter	241	555	485	70
Ground Attack	321	20	--	20
Bomber	80	--	--	--
Air Refueling	--	--	--	--
AEW / ESM	--	8	8	--
Recce / UAV	--	129	128	1
Trainer A/C	263	198	198	--
Transport A/C	304	20	12	8

Table 3-11. DPRK and CFC Air Force Order of Battle

4) Concept of Operation

The primary objective of Pyongyang in conducting an overland invasion of South Korea is to facilitate unification of the two Koreas by force. North Korea's first action in a war scenario would be the launch of a ballistic missile attack on South Korea. We would also expect them to target naval forces patrolling the Pacific. A simultaneous stage would be a barrage from the thousands of artillery tubes positioned just north of the DMZ, resulting in heavy casualties for the CFC headquarters, supply stations and transportation units. Other components of a North Korean attack include strikes against airfields and fortified military targets by fighters and bombers. Meanwhile, Seoul and its 13.5 million people would be in a state of panic.

On the same day, North Korea would be expected to execute a rapid naval operation that would transport its special task force consisting of 88,000 men into the South along the eastern seaboard. Using a variety of means such as submarines, hovercraft, small planes, helicopters, rafts, hang gliders and fishing boats, the first units would probably land in the Kang Neung area in northeastern Korea. A second unit could land in the Pohang area. In the Pusan area, a third unit could land to deliver maximum surprise and damage to the CFC.

The North Korean special operations team would be working simultaneously with underground forces that would then emerge through tunnels dug underneath Seoul and surrounding cities. There are over 25 major tunnels that have been discovered in Seoul and outlaying areas. In effect, thousands of special operations teams would be inserted into the South to attack critical targets such as command and communication centers, air defense systems, airfields and supply depots.

The ensuing ground battle would be centered on how successful the North Koreans are in penetrating the South. While CFC forces are deployed along the eastern coast to defend against the Special Forces, a large portion of the North Korean million-man army would cross the DMZ. The terrain along the DMZ is, however, very rugged and favors the defending CFC. Still, the North Koreans would have a significant advantage because of their sheer numbers.

Penetrating into Seoul would be a difficult task for the North, as CFC air support would mount a strong effort to prevent any enemy units and reinforcements from crossing defensive lines. Within the second week, the South would be able to use its air superiority to do essentially what North Korea used its long-range systems for, the destruction of transportation units, roads, logistical centers, supply centers, etc. At that point, the primary focus for air attacks would be destroying roads and columns. Should North Korean forces reach the battlefield, CFC ground forces would be engaged in defensive battles and counterattacks to push back any penetration into Seoul. Unfortunately for the South, there would not be time for any major deployment from the United States unless reinforcements were already in place as a result of a long period of tension.

If the CFC forces are successful in repelling the North back across the DMZ, how far the front line advances beyond the DMZ will largely depend on politics -- in particular, Chinese sensitivity to movement north of Pyongyang. The danger facing the CFC is an escalation of the hostilities toward a war with China. China would only support the DPRK in war if Seoul was clearly the aggressor or if China desired for some reason to expel the US from Asia. However, direct confrontation appears unlikely as China demonstrates a deep commitment to long-term economic development.

5) Committed Forces Comparison (DPRK vs. CFC)

From the arrayed orders of battle, the most probable commitment of forces by each side is illustrated. Based upon resource, proximity and readiness issues, the assumptions made were that DPRK commits 60-70 percent of its forces against 100 percent of CFC forces to the conflict.

Combat System	DPRK	DPRK Committed	CFC Committed	CFC
Active Divisions	80	50	24	24
# Personnel (K)	1000	650K	587.5	588
Reserve Divisions	37	25	23	23
MBTs	3500	2300	2240	2240
APC / AIFV	2500	1700	2670	2670
AH	50	30	172	172
Gun Artillery	8200	5500	4580	4580
Rocket Artillery	2300	1500	210	210
SSM	55	40	12	12
ADA	6000	7300	600	600
SAM	5500	7300	985	985

Table 3-12. DPRK Vs CFC Army Assessment

Combat System	DPRK	DPRK Committed	CFC Committed	CFC
Maritime Patrol A/C	6	4	16	16
Submarines	25	16	15	15
Destroyers	--	--	9	9
Frigates	3	3	11	11
Patrol Boats	448	298	118	118
Amphibious	266	177	30	30
Mine warfare	24	16	17	17

Table 3-13. DPRK Vs CFC Navy Assessment

Combat System	DPRK	DPRK Committed	CFC Committed	CFC
Fighter	241	160	555	555
Ground Attack	321	264	30	30
Bomber	80	53	--	--
Air Refueling	--	--	--	--
AEW / ESM	--	--	1	1
Recce / UAV	--	--	129	129
Trainer A/C	263	175	198	198
Transport	304	202	20	20

Table 3-14. DPRK Vs CFC Air Force Assessment

6) Results.

a) CFC

The CFC's advantages are: a strong defensive position, a world-class regional air force assisted by the US Air Force, dominance over the seas, and better training. Perhaps the greatest advantage the CFC enjoys is the South's economic and industrial resources that would be readily available. If there were to be any success at all against the South Korean-US alliance, it would depend largely on how the North Koreans decided to start the war. However, any significant interruption of the CFC C3 network could change the face of the conflict.

b) DPRK

The DPRK is arguably well suited and prepared to carry out a massive surprise attack. If the DPRK were to commence such an attack, it would be in a time of moderate tension, where it would be able to catch CFC forces in garrison and its air forces on the ground. Currently, North Korea's front-line infantry and artillery units are positioned forward with attack supplies (ammunition, fuel, etc.). However, if the conflict becomes protracted, North Korea would be unable to sustain their forces.

Sustainment depends upon oil, food, and weapons supply lines to the battle area, which is currently a major weakness in the DPRK.

7) Conclusions

CFC will win a bloody war as the DPRK lacks the sustainment capability to conduct a successful operation. The only hope North Korea has for success is if it reenacts an offensive rush to the city of Pusan, similar to the attack of 1950. The North must be able to prosecute and end the war before the USFK are allowed reinforcement, which would give DPRK temporary control of the peninsula. However, the North's success in the 1950s depended on the balance of military capabilities on the peninsula, as well as the absence of the US and the slow arrival of its reinforcements. The balance in the 1990s is now firmly in Seoul's favor and US assistance during the event of war would help expel the invaders. Yet, without question, the end result of a war in this era would be the loss of thousands, perhaps millions, of lives on both sides. While the CFC would utilize its naval and air superiority, the North Koreans would prove difficult to expel because of their ability to take cover in caves, mountains, valleys and man-made tunnels. The tunnels, built since 1964, would easily cause severe problems in search and destroy operations since the element of surprise is in the favor of North Korea.

The DPRK retains the capability to deploy chemical and biological weapons. If used, chemical and biological agents would severely restrict the ability of the CFC to defend. However, it would also bring an overwhelming response and political pressure from global leaders, including the US.

c. Scenario Two: North Korea/China (Red Team) vs. South Korea/USFK (CFC)

We will now consider the possibility of a behind the scenes involvement of China to support a North Korean overland invasion. Before delving into the net assessment proper, it is important to first examine how the involvement of China changes the balance of forces in this conflict. To do that, we will again adopt the approach of comparing the respective orders of battle, then describe the possible invasion scenario, perform the net assessment and conclude with the findings from the net assessment.

1) PRC Army Order of Battle[11]

For the ground forces, China's presence reinforces the already huge number of troops of North Korea. See Table below.

Combat System	PRC	DPRK	RED	CFC	ROK	USFK
Active Divisions	44	80	124	24	23	1
# Personnel (K)	1983	1000	2983	588	560	27.5
Reserve Divisions	80	37	117	23	23	--
MBTs	6750	3500	10250	2240	2100	140
APC / AIFV	9060	2500	11560	2670	2500	170
AH	500	50	550	172	100	72
Gun Artillery	14500	8200	22700	4580	4550	30
Rocket Artillery	3800	2300	6100	210	180	30
SSM	?	55	55+	12	12	--
ADA	15000	6000	21000	600	600	--
SAM	?	5500	5500+	985	985	--

Table 3-15. Red Team and CFC Army Order of Battle

2) PRC Navy Order of Battle

In terms of the Navy Order of Battle, China possesses a large number of surface combatants like destroyers, frigates and a large number of missile and torpedo boats as

[11] For greater details on actual year 2000 Chinese Army Order of Battle, refer to http://www.periscope.ucg.com/nations/asia/china/army/index.html.

well as a large number of submarines. China's entry thus brings about a numerical superiority in the number of naval forces for all classes.

Combat System	PRC	DPRK	RED	CFC	ROK	USFK
Maritime Patrol	30	12	42	16	16	--
Submarines	69	25	94	15	15	--
Destroyers	27	--	27	9	9	--
Frigates	41	3	44	11	11	--
Patrol Boats	219	448	667	118	118	--
Amphibious	90	266	356	30	30	--
Mine warfare	83	24	107	17	17	--

Table 3-16. Red Team and CFC Navy Order of Battle

3) PRC Air Force Order of Battle[12]

Below is the Air Force Order of Battle. Notice that China's involvement brings to the table for North Korea the possibility of employing large numbers of fighters and bombers.

Combat System	PRC	DPRK	RED	CFC	ROK	USFK
Fighter	2851	241	3092	555	485	70
Ground Attack	--	321	321	20	--	20
Bomber	235	80	315	--	--	--
Air Refueling	10	--	10	--	--	--
AEW / ESM	16	--	16	8	8	--
Recce / UAV	--	--	--	129	128	1
Trainer A/C	--	263	263	198	198	--
Transport	322	304	626	20	12	8

Table 3-17. Red Team and CFC Air Force Order of Battle

4) Scenario Description

The second scenario, an overland invasion, portrays North Korea soliciting and obtaining military support from China. Recall the first scenario involved North Korea pitting its forces against the Combined Forces Command (CFC). The weakness that led

[12] For greater details on actual Chinese Air Force Order of Battle, refer to http://www.periscope.ucg.com/nations/asia/china/airforce/index.html.

to the North's defeat by the CFC was its lack of sustainment capability; a deficiency that has remained the DPRK's Achilles heel since the conclusion of the Korean conflict in 1953.

5) Concept of Operations

Again, the objective in conducting an overland invasion of South Korea is to facilitate unification of the two Koreas by force. North Korea's military strategy would remain similar to the first scenario. The availability of Chinese support to overcome identified deficiencies such as sustainment capability, establishing naval blockades to choke off South Korea from the sea, and achieving air superiority through the provision of bombers and fighters to complement the existing North Korean Air Force.

The important thing to note is that China's participation allows North Korea to fully commit its forces in the overland invasion, which in the previous scenario demanded that North Korea maintain some forces behind to establish rear security. China's participation is, however, limited to the provision of weapons systems and operators (bombers, fighters, and ships) rather than army manpower. This is due to political reasons of not wanting to be perceived as an aggressor.

As in the first invasion scenario, North Korea's first action in a war scenario would be the launch of a conventional Ballistic Missile (BM) attack on South Korea.[13] However, the DPRK is now able to launch three times as many BMs due to the provision of these added missiles from China. Additionally, China would provide North Korea with surface combatant ships from three of its seven in the Chinese East Sea Fleet, together with 500

[13] A reason for the North's invasion of the South is the securing of the economic infrastructure of the South to avert North Korea's possible economic collapse. Consequently, the use of nuclear weapons is deemed highly improbable as it would mean the total destruction of just these resources that the North so desperately seeks. A possible alternative is the employment of nuclear weapons in high altitude blasts to generate huge EMPs to disrupt the command, control, and communications assets of the more modern South Korea military.

fighters and 60 bombers. The conduct of the conflict would play out as per the first scenario. Again, the invasion scenario ignores the influence of US forces not already in Korea from the onset of the conflict. In other words, these two invasion scenarios portray a worst-case picture for the CFC.

6) Committed Forces Comparison.

a) Army

With the commitment of the entire North Korean Army against the South Koreans, we see that the numbers have now shifted in favor of the North.[14] The South Korea/US force only possesses a distinctive advantage in its Attack Helicopter (AH) numbers.

Combat System	Red Team	Red Team Committed	CFC Committed	CFC
Active Divisions	124	80	24	24
# Personnel (k)	2983	1000	588	588
Reserve Divisions	117	37	23	23
MBT	10250	3500	2240	2240
APC/AIFV	11560	2500	2670	2670
AH	550	50	172	172
Gun Artillery	22700	8200	4580	4580
Rocket Artillery	6100	2300	210	210
SSM	55+	55+	12	12
ADA	21000	6000	600	600
SAM	5500+	5500	985	985

Table 3-18. Red Team vs. CFC Army Assessment

[14] Yi Young-hui, a leading South Korean intellectual, argued in a Korea's Congressional testimony in 1988 that the South's military is stronger than the North, a view that the South Korea's own military acknowledged in 1990. Hangyore Sinmum reiterated the view in a 1995 editorial that "South Korea's military strength is a match for that of North Korea or, as some people estimate, is superior to that of North Korea given the capability of South Korea's state-of-the-art weapons." Suh, Jae-Jung. Duality to Reciprocity: America's Two-War Doctrine and Peace on the Korean Peninsula. University of Pennsylvania. 22 Oct 2000. http://focusweb.org/focus/pd/sec/SuhJaeJung.html.

b) Navy

The navy figures also portray a gloomy picture for the South Koreans. China's numerous missile and torpedo boats blockading the various SLOCs in the East China Sea will effectively cut off South Korea from the South. The presence of these boats will also serve to delay the entry of the US 7th Fleet into the Combat Zone.

Combat System	Red Team	Red Team Committed	CFC Committed	CFC
Maritime Patrol	30	20	16	16
Submarines	94	24	15	15
Destroyers	27	4	9	9
Frigates	44	8	9	11
Coastal Patrol Boats	667	350	118	118
Amphibious	356	278	30	30
Mine warfare	107	36	17	17

Table 3-19. Red Team vs. CFC Navy Assessment

c) Air Force

Chinese support to the North Koreans has diminished the South Korea/US air advantage from the first scenario. The provision of numerous bombers by the Chinese means that South Korea/US ground forces are more vulnerable to air attack.

Combat System	Red Team	Red Team Committed	CFC Committed	CFC
Fighter	3092	717	555	555
Ground Attack	321	321	20	20
Bomber	315	113	--	--
Air Refueling	10	2	--	--
AEW / ESM	16	2	---	--
Recce / UAV	--	--	129	129
Trainer A/C	263	--	--	--
Transport	626	304	20	20

Table 3-20. Red Team vs. CFC Air Force Assessment

7) Results

In Scenario Two, we deduce that the Red Team prevails - a reversal of results from Scenario One. The important lesson that we derive from the net assessment is that a technologically inferior force can still defeat a technologically advanced force through the employment of sheer overwhelming numbers. In our case, the CFC is defeated because South Korea/US forces are essentially overwhelmed by the numerical superiority of the Red Team, though their weapons are antiquated and technologically inferior. An added point is the pivotal role the Chinese Navy plays in delaying the arrival of US Navy reinforcements into Korea long enough for North Korea forces to secure the South and establish a stubborn defense capable of repulsing a US counterattack.

The CFC Air Forces no longer enjoy air superiority. At best, air parity is attained. The employment of DPRK Special Forces is still a very big threat since air insertion is still viable. Chinese naval support does effectively choke off South Korea from the East China Sea and delays the entry of the US Navy into the theater.[15] This also effectively takes away the sustainment advantage enjoyed by South Korea over the North in Scenario One. The North eventually overwhelms the South on the ground. A substantial advantage in terms of numbers of the North's SAMs may nullify the CFC AH advantage.

d. Epoch One Net Assessment Conclusions

From the conduct of static net assessments of the two scenarios, we are able to highlight the following :

[15] The North must be able to end the war before the US Army enters the fray, which would give them temporary control of the peninsula. NSCF Task Force on Korean Security. South Korea's Modernization Program and North Korea's Military Strategy. 1998. http://www.nscf.net/South%20Korean%20Modernization %20Program.htm.

1) DPRK

The DPRK military will need to bolster its sustainment capability before it can even consider an invasion of the ROK. In quantitative terms, North Korea has sufficient numbers of weapons to overwhelm the ROK (if US is not involved). The age of these weapons, however, will reduce their combat effectiveness against the more modern but smaller South Korean military. Thus, for South Korean planners, overtures of China/North Korean cooperation, especially military related ones must be viewed with great suspicion.

2) ROK

For the South, the present deficiencies are two-fold. Foremost, is the dependence on US military presence on the peninsula. This dependency could tip the balance of power between the two Koreas in the event that US pulls out for whatever reasons. Second, we have identified that the key to defeat by the Red Team was due to a lack of early warning/situational awareness of the enemy's disposition such that allied forces could not be brought to bear in time to win the necessary engagements.

North Korea's invasion is thus all bark and no bite but grows teeth when supported by China.

4. Technology Development

a. Overview

Before beginning the discussion on Team Korea's justifications for the technology paths pursued in our study, several points require mentioning. The technological approach for the two Koreas first started with some baseline documents.

For North Korea, a conscious decision had been made to adapt whatever scarce information is available to tell the story of the North's technology base and its Research and Development (R&D) program. Consequently, the assertions made herein are the author's assessments. For the study on South Korea, the baseline was essentially the White Paper 1998 and 1999. It must, however, be clarified that these two documents did not provide details on South Korea's industrial capacity or capability. The technological industry assessments made in the various epochs were thus the author's own observations and deductions.

A common approach adopted by the author and applied to both Koreas was the policy that it was better to invest in areas that maintained each country's military advantage than to invest in entirely new areas, unless favorable conditions already existed in the country. Keeping in mind these points, the following story traces the defense technology developments and acquisitions of North and South Korea and also a subsequent unified Korea from January 2001 to December 2020.

b. Approach

The approach used in determining the two Korea's technological investment decisions was based on the following framework. First, a study was made to understand each country's defense technology-related goals and its strategy for achieving these goals. Next the defense industrial base existing within the country was assessed for its strengths and weaknesses. The extent this industrial base was able to support current acquisitions and the capacity of the industry to support subsequent and future programs was estimated. The vulnerabilities and deficiencies of each country's present force structures were next evaluated and from there possible technological solutions were listed.

From this list, an assessment was made to how these technologies were to be acquired. Essentially, the technological solutions could take either one of the four acquisition methods, namely indigenous R&D/production, joint R&D/production, licensed production, or direct import. Having listed all the relevant choices and understanding the possible capacity of the supporting defense industrial base, a final assessment was made of the enabling technologies required to bring up the country's R&D and production capability from its current state to the desired state and the approximate time required. This consequently constitutes the country's long-term R&D programs.

c. Technology Assumptions of Study

From historical trends, there are seven identified factors that affect the technological advancements pursued by countries that also apply to the two Koreas in our study. These factors are: performance, economics, and average cost of a system[16], religion, environment, education levels, and politics.[17] With these considerations, a common set of working assumptions was defined to describe the workings and global treatment of technology. Of utmost importance to this study was the applicability of Moore's Law.

1) Moore's Law

The prediction put forth by Moore's Law that computing power capability increases exponentially is assumed to be valid for the timeframe of our study. The governing rule

[16] Average cost of a system, based on Moore's Law follows an exponential growth and doubles every 5 years.
[17] Harney, R.C. Technological Assessment for Military Strategic Planning and Innovation. 21.

of thumb that applies to microprocessor-related technology[18] has the following implications. First, the half-life for technological advancement is about 15 years and follows an exponential curve. This implies that the capability of any particular technology doubles between 12 to 18 years[19]. Second, the assumption that cost doubles every five years means that the forecasting of the country's R&D budget must take this into account. And more importantly, microprocessor clock speeds will double every 18 months.

2) Cost as an Independent Variable (CAIV)

The general trend shows that countries are pursuing efficient force improvement programs that emphasize improving quality economically, considering the rapidly changing science and technology and security environment. This has the effect of countries adopting more efficient defense acquisition policies.[20]

3) Controls over Technology Transfer

This assumption reflects the global trend of countries today in building up a defense industry as a significant revenue-generating extension of their economies. With economic growth as the fundamental driver in the cultivation of a defense industry, countries naturally could adopt protectionist policies to ensure that they would be able to derive substantial benefit from their own technological inventions and innovations. Consequently, any country attempting to cultivate and develop its own defense industry must adopt one of several approaches.

[18] For every technological marvel in 2000, there will be three new such marvels in 2025. Harney, R.C. Technological Assessment for Military Strategic Planning and Innovation. 21.
[19] A deviation of three years is the author's own assessment.
[20] White Paper 1998. 160.

a) One, the country can acquire this technology through investment in its own defense and industrial R&D capability. This course is only economically viable if the necessary infrastructure is already available. Otherwise, a huge commitment in its economic resources must be first made to develop this infrastructure.

b) Two, a country could share in a joint R&D and production of the technology.. Economically, such an arrangement would result in monetary savings and even shorten the acquisition time for the countries concerned. This option is good as it pulls together more resources than would otherwise be available to the individual countries.

c) A country could engage in the licensed production of particular weapon systems. Such a course is good for countries to pursue when they possess the prerequisite civilian industrial base for production but not the required military technology.

d) Four, the last and least preferred method is through direct sales of weapon systems from one country by another. This course does not facilitate any technology transfer though the process does allow the country purchasing the equipment to acquire capabilities provided by the weapons, which it would otherwise not have.

4) Dual-Use Technology Policy

As initially covered under the introduction on licensed production above, the global trend is the development of a defense industry in parallel with civilian industry.

d. DPRK's Technology Focus

1) Goals and Strategy for Defense Technology

DPRK's first epoch technological goals remain focused on its philosophy of *juche*, The country's limited availability of resources forces its technology acquisition strategy to remain primarily on the reverse engineering of outdated former-Soviet Union and China weapons from the 1950s. DPRK has also actively sought technology transfers from sympathetic nations[21]. This strategy is, however, becoming less and less viable due to North Korea's deplorable economy, which makes hard currency unavailable.

2) Defense R&D Budget

Maintaining the budget allocations defined earlier, the tables below summarize the epoch one defense and R&D budget breakdowns.

	GDP	Defense	O&M	FIP
%GDP	100.0%	27.0%	18.9%	8.1%
%Def Bud	-	100.0%	70.0%	30.0%
%Growth	6.2%			
Year	US$ Bil	US$ Bil	US$ Bil	US$ Bil
2001	8.071	2.179	1.525	0.654
2002	8.572	2.314	1.620	0.694
2003	9.103	2.458	1.720	0.737
2004	9.667	2.610	1.827	0.783
2005	10.267	2.772	1.940	0.832
Total	45.680	12.334	8.634	3.700
Average	9.136	2.467	1.727	0.740

Table 3-21. DPRK Defense Budget Breakdown

	Army	Navy	Air Force	DBA	R&D
%GDP	4.1%	1.6%	2.4%	0.4%	2.8%
%	50.0%	20.0%	30.0%	5.0%	35.0%
%Def Bud	9.0%	3.6%	5.4%	1.5%	10.5%
Year	US$ Bil	US$ Bil	US$ Bil	US$ Bil	US$ Bil
2001	$0.196	$0.078	$0.118	$0.033	$0.229
2002	$0.208	$0.083	$0.125	$0.035	$0.243
2003	$0.221	$0.088	$0.133	$0.037	$0.258
2004	$0.235	$0.094	$0.141	$0.039	$0.274
2005	$0.249	$0.100	$0.150	$0.042	$0.291
Total	$1.110	$0.444	$0.666	$0.185	$1.295
Average	$0.222	$0.089	$0.133	$0.037	$0.259

Table 3-22. DPRK FIP Budget Breakdown

[21] Of which the two biggest contributors used to be China and the former Soviet Union.

	R&D	BM/Nuclear Program	SOF Program	Reverse Engineering	Others
%GDP	2.8%	2.0%	0.4%	0.3%	0.1%
%	35.0%	70.0%	15.0%	10.0%	5.0%
%Def Bud	10.5%	7.4%	1.6%	1.1%	0.5%
Year	US$ Bil	US$ Bil	US$ Bil	US$ Bil	US$ Bil
2001	$0.229	$0.160	$0.034	$0.023	$0.011
2002	$0.243	$0.170	$0.036	$0.024	$0.012
2003	$0.258	$0.181	$0.039	$0.026	$0.013
2004	$0.274	$0.192	$0.041	$0.027	$0.014
2005	$0.291	$0.204	$0.044	$0.029	$0.015
Total	$1.295	$0.907	$0.194	0.130	0.065
Average	$0.259	0.15	0.03	0.022	0.011

Table 3-23. DPRK R&D Budget Breakdown

e. DPRK's Technology Investments.

DPRK's technological strength continues to reside in its ability to reverse-engineer major ex-Soviet Union weapons. Most of its factories continue to operate well below their capacity due to a lack of available resources. For the first epoch, DPRK had concentrated on upgrading its massive inventory of land-based weapons, especially in its armored and artillery forces.

f. DPRK's R&D Program.

From the table below, the first epoch continued the reverse engineering efforts of old Soviet and Chinese equipment. Though unconfirmed, ROK suspects that DPRK continues to pursue indigenous R&D on its satellite and SOF insertion capabilities program. DPRK also continued with its secret development of chemical and biological weapons.

Indigenous R&D and Production	Joint R&D and Production
Tanks	BM (Iran, Pakistan, Israel)
Artillery	Chemical and Biological Weapons
Armored Vehicles	
Small Naval Craft	
Small Arms	
Satellite	

Table 3-24. DPRK Defense Systems Acquisition Method Summary

Regarding Ballistic Missile (BM) research, ROK is quite convinced that DPRK has been secretly working in collaboration with Iran and Pakistan, with Israel's involvement highly suspect. DPRK's BM-related technologies continue to use 1980s technology. Due to the DPRK's use of older generation technology (of at least two generations behind ROK), the country's present inventory of missiles is not accurate. Consequently, Team Korea feels that the bulk of its technological investments will be spent on investing and developing BM-related technologies, especially in the field of missile control guidance. In summary, as of 2005, DPRK is still devoting much of its R&D efforts in BM technology.

g. ROK's Technology Focus.

1) Goals and Strategy for Defense Technology

The ROK goals for the first epoch continue to follow those of early 2000 in its quest for self-reliance and indigenous defense production. The focus has, however, started to become more regional with a reduced emphasis on the ROK Army, especially in the attainment of a credible blue-water ROK Navy. Foremost priority for the ROK Navy is the protection of ROK's sea lines of communications (SLOCs). Supporting the Navy's SLOC protection priority is the ROK Air Force's emphasis on achieving and maintaining air superiority. This emphasis has in turn translated into the acquisition of an advanced air combat capability. And supporting the ROK Air Force's air superiority priority, the army's emphasis is the build-up of air and coastal defense capabilities. MND had identified that the need for space and maritime surveillance systems. Consequently, MND placed emphasis on space developments to answer the DBA needs.

The strategy for the first epoch essentially remained similar to that of the previous decade. ROK had, however, started actively dealing with Israel to solicit US technology and also Russia (as part of its loan repayment arrangements to ROK) in its quest to reduce the ROK's dependence on the US for its technology.

2) Defense R&D Budget

Maintaining the budget allocations defined earlier, the tables below summarize the epoch one defense and R&D budget breakdowns.

	GDP	Defense	O&M	FIP
%GDP	100.0%	3.5%	2.5%	1.1%
%Def Bud	-	100.0%	70.0%	30.0%
%Growth	4.0%			
Year	US$ Bil	US$ Bil	US$ Bil	US$ Bil
2001	357.760	12.522	8.765	3.756
2002	372.070	13.022	9.116	3.907
2003	386.953	13.543	9.480	4.063
2004	402.431	14.085	9.860	4.226
2005	418.529	14.649	10.254	4.395
Total	1,937.744	67.821	47.475	20.346
Average	387.549	13.564	9.495	4.069

Table 3-25. ROK Defense Budget Breakdown

	Army	Navy	Air Force	DBA	R&D
%GDP	4.1%	1.6%	2.4%	0.4%	2.8%
%	50.0%	20.0%	30.0%	5.0%	35.0%
%Def Bud	9.0%	3.6%	5.4%	1.5%	10.5%
Year	US$ Bil	US$ Bil	US$ Bil	US$ Bil	US$ Bil
2001	$0.935	$1.247	$0.935	$0.150	$0.488
2002	$0.973	$1.297	$0.973	$0.156	$0.508
2003	$1.012	$1.349	$1.012	$0.163	$0.528
2004	$1.052	$1.403	$1.052	$0.169	$0.549
2005	$1.094	$1.459	$1.094	$0.176	$0.571
Total	$5.066	$6.755	$5.066	$0.814	$2.645
Average	$1.013	$1.351	$1.013	$0.163	$0.529

Table 3-26. ROK FIP Budget Breakdown

	FDP (80% of R&D)			ADD (20% of R&D)				
	Army	Navy	AF	EO	MW	AC	UWA	WS
% R&D Budget	24.0	32.0	24.0	5.5	5.9	6.1	1.6	1.0
Year	US$ bil	US$ bil	US$ bil	US$ bil	US$ bil	US$ bil	US$ bil	US$ bil
2001	0.117	0.156	0.117	0.027	0.029	0.030	0.008	0.005
2002	0.122	0.163	0.122	0.028	0.030	0.031	0.008	0.005
2003	0.127	0.169	0.127	0.029	0.031	0.032	0.008	0.005
2004	0.132	0.176	0.132	0.030	0.032	0.033	0.009	0.005
2005	0.137	0.183	0.137	0.032	0.034	0.035	0.009	0.005
Total	0.635	0.846	0.635	0.146	0.155	0.160	0.042	0.025
Average	0.106	0.141	0.106	0.024	0.026	0.027	0.007	0.004

Table 3-27. ROK R&D Budget Breakdown

h. ROK’s Technology Investments

1) National Defense Plan

From the 2001-2005 Mid-term Defense Budget, the following weapons systems were acquired by the three services through December, 2005. These procurements are categorized into DBA (which encompassed Information and Command/ DBA and Strategic Strike investments), the ROK Army, Navy and Air Force.

Capability/ Purpose	2001-2005 Direction	Items to procure
Information & Command/ DBA	Early warning & surveillance Self-command systems Defense Digitization	GSR 2 Comms Satellites 1 Spy Satellite Joint C3I System
Strategic Strike	Space Launch Capability	Space Launch Platform
Ground Operations	Improved lethality, agility Tactical Situational Awareness	K1 MBT AH-X SAM-X Q37-type radar
Naval Control	Long range surveillance and early warning Anti-Submarine protection Coastal defense Develop surface combat capability Protection of SLOCs	8 P-3Cs 13 Super Lynx 3 K. Keong MHC 3 Chang Bogo 4 KDX
Air Operations	Advanced Air Combat Advanced Trainer Capability	10 A-50 1 E3 AWACS 45 KT-1 Trainer 10 KOX-1 FAC 80 UAV 150 AMRAAM

Table 3-28. ROK Weapon Systems Acquisition

2) Existing Capabilities

As of 2005, the ROK's indigenous efforts and capacity remain unchanged from the previous decade. ROK possesses an indigenous capability to build major and minor surface ships and ground combat systems, but a limited indigenous capability to produce combat aircraft[22]. The aerospace industry is still on the path to maturity. In spite of the advances in ROK's capability to produce weapon platforms, it does not, however, yet

[22] By this time, however, South Korea has developed and built its indigenous KT-2 jet trainers. It decided on its choice of the F-X fighter program to replace the aging RF-4s. The end state of this program is that South Korea effected a licensed production capability thereby securing technology transfers relating to manufacturing modern fighter aircraft. Ultimately, this brought South Korea even closer to achieving its long-term aim of indigenously producing its own advanced combat fighter aircraft. Team Korea assesses this possibility of occurring around 2020.

possess an indigenous capability to produce high technology armaments like AAM, ASM, or SAM[23].

Indigenous R&D and Production	Joint R&D and Production	Licensed Production	Import
Major Surface Ships (KDX) Minor Surface Ships (Minesweepers) Armored Vehicles (KIFV) Trainer Aircraft (KT-1) Small Naval Craft Small Arms	Combat Aircraft (KF-16) Tanks (K1 MBT) Helicopter Artillery (K-200) Trainer Aircraft (A/T-50) Submarines (T209/T214) Comm/Spy Satellites	Submarines (T209/T214) Helicopters (KH-60) Combat Aircraft (KF-16) Artillery Radars UAV	UAV SAM AAM ASM AWACS Maritime Surveillance (P3) Attack Helicopter (AH-64)

Table 3-29. ROK Defense Systems Acquisition Method Summary

The epoch witnessed the joint production of ROK's first pair of spy satellites, with US's assistance. These satellites were similar to the IKONOS in terms of specifications and dimensions, except that these spy satellites the resolution was only up to three meters. For the ROK Air Force, the FX fighter was finally chosen. The ROK also successfully began the licensed production on its next generation of Air Independent Propulsion (AIP) submarines, the German-designed Type-214. Due to the need to overcome ROK's deficiencies in air surveillance, MND had decided to effect foreign military sales (FMS) with the US on the AWACS and P-3Cs.

i. Assessed Vulnerabilities and Deficiencies from Epoch One

From the Net Assessment performed at the end of epoch one, the ROK's identified vulnerabilities include coastal defense, protection of SLOCs, protection against rear area attacks, and over-reliance on the United States for its strategic and tactical aviation needs, its Navy, and

[23] South Korea has, however, assembled the Pegasus SAM system, which is essentially an integration of a HAWK SAM system onto a K-200 platform.

its leadership responsible for training and readiness. The key weaknesses were essentially the protection of SLOCs and ROK's over-reliance on the US. This resulted from ROK's deficiencies in the number of blue water ships and its lack of airborne and space-based sense systems.

Based on the weaknesses identified, ROK's solutions to these deficiencies are to focus its technological investment in acquiring a better DBA capability, hardware modernization to build-up its blue water capability, and acquisition of tactical aviation systems, and advanced munitions.

j. ROK's R&D Programs

The two focus set forth by MND in epoch one follows from the earlier decade, which are to invest heavily in the development of high-tech weapons and to secure the ability to develop core technologies suitable for the Korean military environment. The table below thus summarizes the major R&D efforts for the first epoch.

2001-2005	
Direction	Items to procure
Upgrade & Modernization of present systems	FX
	Air Mine Field
Advanced Fighter Technology	KSR-1
Advanced Surface Combatant Technology	Micro Air Sensor
Miniaturized Systems	KDX-III
Space Launch systems	T-214
AIP Propulsion	

Table 3-30. ROK Major R&D Emphasis

To address the deficiencies, however, the R&D focus for the upcoming epoch became the acquisition of even better blue water capabilities than the existing KDX-1/-2 destroyers and even greater surveillance coverage capabilities and platforms with emphasis on space-based systems. Based on the FDP (Force Development Program) allocations, the table below summarizes the services and DBA R&D investments. The programs of interest that will be elaborated further essentially deal with the DBA investments. The point to note is that a significant proportion of the DBA and R&D spending focuses on the space and defense digitization efforts.

Army		Navy		Air Force		DBA	
R&D Program	US$ Bil	R&D Program	US$ Bil	R&D Program	US$ Bil	R&D Program	US$ Bil
AH-64D	$0.150	Torpedoes	$0.030	FX	$0.200	Communications Satellites	$0.080
KIFV	$0.020	Submarine (T-214)	$0.150	A/T-50	$0.050	Spy Satellites	$0.220
K1-A1 MBT	$0.050	KDX-2/3	$0.300	E3 AWACS	$0.080	Launch Vehicle (KSR-1)	$0.100
SAM (A-300)	$0.100	HPM	$0.150	KT-2	$0.015	Aerostat	$0.080
Tactical Radar (GBS)	$0.030			KOX-1	$0.025	Micro Air Sensor	$0.080
				UAV	$0.010	Defense Digitization	$0.215
				AAM	$0.020		
Others	$0.285	Others	$0.216	Others	$0.235	Others	$0.039
Total	$0.635	Total	$0.846	Total	$0.635	Total	$0.814
Budget Allocated	$0.635	Budget Allocated	$0.846	Budget Allocated	$0.635	Budget Allocated	$0.814

Table 3-31. ROK R&D Programs

1) Defense Digitization for the New Millennium

The end of the first epoch also saw the conclusion of phase one of the defense digitization effort. In this phase, the defense digitization effort included completing the computerization of the MND’s information system, consolidation of mega data processing centers, and the establishment of the digitization training centers.

With MND’s decision to fully computerize its information system in 2001 in support of its top priority of integrating command and control information systems, some 200 data processing computer centers were consolidated into five to seven mega centers. This consolidation was completed in 2005.[24] In concert with this consolidation in 2001, the military also placed importance on the establishment of an integrated command, control, communication, computer, intelligence, surveillance, and reconnaissance (C4ISR) system.[25] Hence, the idea for the JC3IS took on new meaning. At end 2001, MND completed its goal of installing office automation systems in all parts of the military and systems providing services to civilians. Then in end 2002, the military also completed the establishment of 150 digitization training centers nationwide. By end 2005, the first phase of the defense digitization effort is almost completed.

2) Space Program Development Update

In 2001, MOST (Ministry of Science & Technology) announced that it would build its own space center at a cost of 130 billion won ($102 M(US)) on the island of Woe Narodo, Kohung province, off the southern coast to launch a satellite by 2005.[26] With its construction completed in 2004, South Korea finally achieved the ability to launch its own rockets into space in 2005, thereby achieving a significant milestone in its space program. Finally in 2004 and 2005, South Korea's first two spy satellites were put into orbit with US assistance.

3) Micro-Air Sensor Network (MASN) – Korea's Strategic DBA Solution

Concurrent with the ROK feasibility study on space-based sensors, the idea of the micro-air sensor network was born. Based on revolutionary advances already taking

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[24] "Defense Ministry aims to upgrade computer-based information systems", The Korea Herald, January 30, 2001. http://www.koreaherald.co.kr/SITE/data/html_dir/2001/01/31/200101310039.asp.

[25] "Defense Ministry aims to upgrade computer-based information systems", The Korea Herald, January 30, 2001. http://www.koreaherald.co.kr/SITE/data/html_dir/2001/01/31/200101310039.asp.

[26] Building the space center on an island would be less costly to expand facilities than other places. The blueprint calls for the purchase of the site, ordering of equipment and groundwork completed by 2003, with buildings completed by 2004. This would facilitate the launch of a low-orbit satellite in 2005. "South Korea to build space center on remote island", Space Wire, January 30, 2001. http://www.spacedaily.com/news/010130082438.nyawlsl4.html.

place in 2000 in the fields of nanotechnology and bioengineering, MND projected and set the goal of putting in place a micro-air sensor network by the year 2020. The risk of this investment was classed as moderately high and a total program budget of US$3.5 billion spaced over 20 years was approved. To make the program affordable, MND solicited the participation from industry due to its commercial potential and dual-use technology. Thus the development of the MASN concept is tied closely to the development of the ROK's space program.

The concept of the Micro-Air Sensor Network (MASN) is similar to the application of nano-satellite technology for military applications, that of employing a swarm of miniature satellites communicating with micro sensors on a battlefield and conveying important surveillance and tactical information.[27] In the case of the MASN, however, the platform differs as micro-air vehicle (MAV) and/or super pressure balloons instead of nano-satellites are utilized as the primary sensing platform. A more detailed discussion of the concept is found in Annex 3E3.

4) Aerial Mine Field System (AMFS)

Similarly, in concept with the MASN development, is the exploration and planned development of the AMFS that also exploits in nanotechnology and MEMS. Instead of providing a sense capability, the AMFS is a passive offensive weapon used for enhancing ROK's air defense capability. As discussed earlier, the AMFS comprises MAVs armed as weapons that could either be titanium-tipped or carry a shaped-charge plastique.[28] Conceptually, the AMFS is just what its namesake implies – that of forming a mine field

[27] "PicoSat Constellations Debuts November", Spacedaily, October 11, 1999.

[28] Titanium-tipped MAVs would result in a rain of red-hot fragments through thousand pounds of jet fuel and ammunition when sucked into jet engine air intakes would fracture the whirling turbine blades. Jim Wilson, "Micro Warfare: Small, smart and deadly, micro air vehicles swarm onto the battlefield", Popular Mechanics, February 2001. http://www.popularmechanics.com.

in three-dimensional space. Upon attaining technology maturity and mass production, MND predicts that the individually-armed mines could cost as little as US$5. A more detailed discussion of the concept is also covered in Annex 3E3.

k. Enabling Technologies.

1) Micro-/Nano-/Pico-satellite[29] Program – Long-Term R&D Effort

Towards the end of 2000, based on preliminary concept studies embarked by the ROK military in with consultation with MOST and KARI (Korean Aerospace Research Institute) among other ministries, it was concluded that many potential military applications were deemed to exist. Due to the US's lack of openness in sharing such technology, ROK had to form a strategic alliance with Israel to obtain access to technology. ROK's satellites would eventually incorporate Israel's TechSat stabilization system that allows it to be launched into an arbitrary orientation with no spin yet stabilize and orient itself after release. Concurrently, ROK also continued its joint efforts with traditional partners – the United Kingdom and France; the former in micro-satellite technology and the latter in rocket platform and launch technology.

Due to considerations arising from a need to reduce launch costs, micro-satellite technology was viewed as an enabling technology. Based on Year 2000 US estimates, micro-satellites cost ranged from US$100,000 to several million dollars, with development cycles ranging from a few months to a few years.[30]

[29] The distinctions of the three types of satellites referred to in the heading is borne out by the satellite's core weight. Pico-satellites have core weights less than 1 kg, nanosatellites range between 1 to 10 kg, and micro-satellites range between 10 to 100 kg.

[30] Bruce Moomaw, "MicroSats Are Go At AeroAstro", Spacedaily, September 1, 1999. In another 2000 mission, the US also tested the Nanosat Constellation Trailblazer mission, comprising three nanosats (octagons measuring 16 inches across and 8 inches high) at a cost of US$28 million.

2) Micro-Air Vehicles (MAV).

Towards 2002, ROK embarked on its MAV program in support of its MASN concept. For purpose of comparison, ROK's MAV technology base was assumed to be five years behind the US. Based on initial concept studies conducted in 2001, MND projected that by end 2015, ROK would possess the ability to produce its own line of MAVs to support the MASN concept, namely a "hovering spy craft only 23 centimeters across" adapted from the US.[31] As an indication of R&D costs involved, the US has put upward of US$50 million to create the flapping-wing airframes, microscopic jet engines and molecule-size avionics packages needed to make MAVs a reality.[32]

Present developments of MAVs for military applications involve merging the aerodynamics of insects with GPS navigation and molecular physics to create an arsenal of tiny reconnaissance tools. Used as weapons, these MAVs could either carry a shaped-charge plastique or be titanium-tipped[33]. For propulsion, the present generation of MAVs utilize piezoelectric motors that produce linear rather than rotator motion.[34] The most powerful power source to date is the British Defense Evaluation and Research Agency's (DERA) 13mm Microjet demonstrated at the Farnborough International 2000 Air Show, with flight duration times of up to 1 hour attained by mixing hydrogen peroxide with

[31] The hovering craft weighed 1.4 kilograms and managed to takeoff, hover, and move around in at slow and medium speeds, with an endurance of about an hour on the 200 grams of fuel it carried. This craft was built and tested by Micro Craft, a US aerospace company. K. Kleiner, "Backpack Drone Peers Behind Enemy Lines", Spacewar, October 21,2000.

[32] Jim Wilson, "Micro Warfare: Small, smart and deadly, micro air vehicles swarm onto the battlefield", Popular Mechanics, February 2001. http://www.popularmechanics.com.

[33] Titanium-tipped MAVs would result in a rain of red-hot fragments through thousand pounds of jet fuel and ammunition when sucked into jet engine air intakes would fracture the whirling turbine blades. Jim Wilson, "Micro Warfare: Small, smart and deadly, micro air vehicles swarm onto the battlefield", Popular Mechanics, February 2001. http://www.popularmechanics.com.

[34] At the Center for Intelligent Mechatronics at Vanderbilt University, researchers have successfully applied this theory to build tiny piezoelectric actuators that can flap wings. Jim Wilson, "Micro Warfare: Small, smart and deadly, micro air vehicles swarm onto the battlefield", Popular Mechanics, February 2001. http://www.popularmechanics.com.

kerosene or a similar fuel.[35] For the MAV's payload, the eventual goal is a half-ounce payload allowance for guidance system, video camera, and transmitter requirements.[36]

To reinforce the MND's decision on investing in MEMS and miniaturization technology, microelectronics is identified as the driving force behind shrinking systems. In accordance with Moore's Law, on-board computational capabilities per unit volume will continue to increase. As of 2000, GPS receivers weigh as little as 6 grams and measure 3 inches. And through the use of infrared (IR) ports, instructions could be programmed into MAVs or used to send coordinating instructions within a swarm.

As of 2001, the leading concepts for MAVs were the Black Widow and the Bat. The Black Widow, a six-inch, electrically powered disc-shaped MAV that launches at the touch of a button from a shoulder-carried unit, features a 2-gram microflight control system for remote operation of the front-mounted propeller and two control flaps. It has already flown for 16 minutes with a cruising speed of 35 mph. It is equipped with a commercial low-resolution, sugar-cube-sized video camera weighing less than a penny, drastically reducing the camera's size and weight.[37] The Bat, on the other hand, is not too far removed from a radio-controlled model airplane that relies on an off-the-shelf internal combustion engine for propulsion. Its video images can be transmitted from as far as a mile away.[38]

In 2001, UCLA made a breakthrough in coaxing ringlike groups of rotaxane molecules to exhibit the on/off behavior of transistors thereby creating the potential to put

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[35] Jim Wilson, "Micro Warfare: Small, smart and deadly, micro air vehicles swarm onto the battlefield", Popular Mechanics, February 2001. http://www.popularmechanics.com.
[36] David Pescovitz, "Tiny Spies in the Sky", Discovery Online – Micro Air Vehicles. http://discovery.com/stories/technology/microplanes/microplanes.html.
[37] David Pescovitz, "Tiny Spies in the Sky", Discovery Online – Micro Air Vehicles. http://discovery.com/stories/technology/microplanes/microplanes.html.
[38] David Pescovitz, "Tiny Spies in the Sky", Discovery Online – Micro Air Vehicles. http://discovery.com/stories/technology/microplanes/microplanes.html.

computing power of 10 Pentium processors in one-hundredth the space of one of these tiny chips. And because rotaxane molecule transistors could be switched on and off using light, there are no bulky wire interconnections needed.[39] Many researchers agree that MEMS, stamped out like integrated circuits, are the key to making MAVs that can fly on autopilot. MEMS accelerometers could enable onboard computers to calculate the MAV's coordinates relative to its launch point.[40] It's possible that microwave transmissions and wafer-thin solar panels could help charge the MAV's batteries but fossil fuels are still the most efficient source of power.[41]

3) Balloons/Super Pressure Balloons

As an alternative pursuit to satellites as a high altitude surveillance platform, MND also considered the military application of balloon-based[42] sensor platforms. Complementing the development of MAVs too is the exploration of super pressure balloons as the delivery platform for the MASN and AMFS concepts. In this development, low-cost, high-altitude, and extended on-station times are the driving requirements.[43] The goal is the ultimate attainment of Very Long Endurance (VLE)

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[39] Jim Wilson, "Micro Warfare: Small, smart and deadly, micro air vehicles swarm onto the battlefield", Popular Mechanics, February 2001. http://www.popularmechanics.com.

[40] David Pescovitz, "Tiny Spies in the Sky", Discovery Online – Micro Air Vehicles. http://discovery.com/stories/technology/microplanes/microplanes.html.

[41] One gram of petroleum provides 13.1 W-h of power, while a 1-gram lithium battery kicks out only 0.3 w-h of juice. David Pescovitz, "Tiny Spies in the Sky", Discovery Online – Micro Air Vehicles. http://discovery.com/stories/technology/microplanes/microplanes.html.

[42] HAE airplanes or balloons can do exactly what a satellite does, but with more flexibility and with less investment. For some communications applications, these platforms enjoy the following critical advantages over satellites: distance, location, and recovery. Epley, Lawrence E. "Stratospheric Aircraft, Blimps, Balloons, and Long Endurance Vehicles." Future Aeronautical and Space Systems. Ahmed K. Noor and Samuel L. Venneri. ed. Progress in Astronautics and Aeronautics. Vol. 172. Virginia: American Institute of Aeronautics and Astronautics, Inc, 1997. 211. Also, balloon-launched payloads are ideal for high-resolution optical and infrared telescopes. As a quick reference, the radar horizon at 20 km is approximately 500 km.

[43] Epley, Lawrence E. "Stratospheric Aircraft, Blimps, Balloons, and Long Endurance Vehicles." Future Aeronautical and Space Systems. Ahmed K. Noor and Samuel L. Venneri. ed. Progress in Astronautics and Aeronautics. Vol. 172. Virginia: American Institute of Aeronautics and Astronautics, Inc, 1997. 211.

mission systems[44], whose requirements translate to aircraft that minimize the propulsive power to maintain a station through efficient airfoils, and have low wing loading, high aspect ratio wings, and an efficient powerplant that consumes minimum fuel at loiter power.[45] An analysis of ROK's DBA requirements shows that speed and mobility are not important factors other than to maintain a geostationary position over the earth in the presence of winds.

Additionally, the analysis of available wind pattern data reveals that the lower stratosphere around 20 km is an optimum region for these operations,[46] and that higher in the stratosphere, winds begin to increase in speed and follow global scale and patterns that are regular and predictable with season and location.[47] The data also shows that balloon drift patterns over ten days follow fairly narrow patterns.[48] Thus, missions that require extremely long endurance, very large area views, long distance communications relays, electronics intelligence collection, missile launch detection and destruction, and

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[44] VLE missions typically last in terms of days and involve communications relay, jamming, or electronic jamming and earth surveillance.

[45] Epley, Lawrence E. "Stratospheric Aircraft, Blimps, Balloons, and Long Endurance Vehicles." Future Aeronautical and Space Systems. Ahmed K. Noor and Samuel L. Venneri. ed. Progress in Astronautics and Aeronautics. Vol. 172. Virginia: American Institute of Aeronautics and Astronautics, Inc, 1997. 212.

[46] Epley, Lawrence E. "Stratospheric Aircraft, Blimps, Balloons, and Long Endurance Vehicles." Future Aeronautical and Space Systems. Ahmed K. Noor and Samuel L. Venneri. ed. Progress in Astronautics and Aeronautics. Vol. 172. Virginia: American Institute of Aeronautics and Astronautics, Inc, 1997. 214. Marcy, W. L., and Hookway, R. O., "Propulsion Options for the HI-SPOT Long Endurance Drone Airship," Martin Marietta Corp., Sep 1979.

[47] Epley, Lawrence E. "Stratospheric Aircraft, Blimps, Balloons, and Long Endurance Vehicles." Future Aeronautical and Space Systems. Ahmed K. Noor and Samuel L. Venneri. ed. Progress in Astronautics and Aeronautics. Vol. 172. Virginia: American Institute of Aeronautics and Astronautics, Inc, 1997. 214.

[48] After ten days, most balloons completed between one-half global circumnavigation and one complete global circumnavigation. The mean difference in latitude at that time was 8.5 degrees, or a ground distance of approximately 950 km. At an altitude of 36 km, the balloon has a line-of-sight footprint on the ground of 730 km radius. Thus even with a drift distance of 950 km, the balloon retains visibility of a sizeable portion of the original footprint. Other points to note are that ending latitude was found to be dependent upon starting latitude and month but not on starting longitude, and starting longitude was not found to be a significant factor, except for an Equator launch in the 30 day category. Reitinger, Kurt C. Analysis of Simulated Drift Patterns of a High Altitude Balloon Surveillance System. NPS. June 1993. 43.

the survivability provided at extremely high altitudes are candidates for stratospheric unmanned aircraft.[49]

From the above consideration, a choice was available to pursue either the employment of super pressure balloons or high altitude endurance unmanned aerial vehicles (HAE UAV). Based on ROK's indigenous technology and cost analysis (against the use of satellites and with each other), MND decided that the former was the more economical and realizable of the two options,[50] with the added requirement that such a system must perform surveillance missions at an altitude of 20 km and deployable for up to 10 days. As a comparison in 2001, the cost of producing a new super-pressure Ultra Long Duration Balloon (ULDB) totals approximately $2.5 M(US).[51] And so began ROK's balloon development program.

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[49] Fulghum, D. A., "Tier 2+ Tricks Enemy Missiles," *Aviation Week and Space Technology*, July 10, 1995.

[50] As an example, at under 15 miles altitude, solar airplanes (HAE UAVs) are much closer to the ground than any satellite, allowing use of much cheaper transmitters and reuse of scarce frequency spectrum. Because solar airplanes can land and take-off as needed, their payloads can incorporate the latest technology and avoid obsolence. At well under $10 mil each in production, solar airplanes can also be significantly less expensive than satellites, which can cost up to $100 mil or more to build and launch. "Solar Aircraft One Step Closer to Commercial Satellite Substitute", SpaceDaily, December 17, 1998. http://www.spacedaily.com/news/solarcell-98m.html. When compared with using balloons, a quick estimate used here is that costs for balloon operations will probably only amount to 10% to 30% of the HAE UAV operation costs. Also, the basic technology (for modern stratospheric balloons) is mature and mission success rates are well above 95%. Epley, Lawrence E. "Stratospheric Aircraft, Blimps, Balloons, and Long Endurance Vehicles." Future Aeronautical and Space Systems. Ahmed K. Noor and Samuel L. Venneri. ed. Progress in Astronautics and Aeronautics. Vol. 172. Virginia: American Institute of Aeronautics and Astronautics, Inc, 1997. 219.

[51] "New Super-Pressure Research/Exploration Balloon Prototype Successfully Launched for NASA," http://www.ifai.com/ NewsDetails.php? ID=179.

Epoch One Summary

Singularly the largest topic between the two Koreas in the last decade, reunification planning took a decisive turn this epoch. Leaders from the opposed states signed a bilateral covenant outlining an agreement to formally pursue unification options.

Despite the formal start of unification planning, military restructuring during this epoch is largely based on legacy decisions and is centered on the acquisition of capabilities employed against North Korea's military provocations. The ROK armed forces are in the process of transforming the current personnel-based structure to a quality-oriented, technology-intensive one with an emphasis on joint operations.

This epoch's net assessment scenarios highlighted the deterring and stabilizing effect the US presence had on the peninsula; e.g. that early warning and situational awareness are pivotal to defense of South Korean soil and that the North is incapable of sustaining an invasion of the South without aid from China.

While North Korea's technological developments focused on its ballistic missile program, South Korea concentrated on developing its defense digitization, space program, micro-air sensor network, and air mine field system. To set in motion the South's goal of reducing its reliance on the US for its military systems, South Korea actively solicited Israel and Russia's technology for its weapons programs. And so, the country set in place policies to support the development of the necessary infrastructure for pursuing these technologies for future military applications.

B. Epoch Two (2006 – 2010)

1. Strategy

a. Introduction

Epoch two is the time period from January 2006 until December 2010. Highlighted below are the significant events of the epoch.

Epoch Two Events 2006 - 2010
DPRK threatens collapse
Bailout of DPRK by ROK
Preconditions for unification
US begins withdrawal of forces
Phased unification plan
DPRK reduces Army by 20% -- creation of Civil Conservation Corps
Formation of Confederation

Table 3-32. Epoch Two Significant Events

Towards the end of epoch one, the ROK and DPRK formalized an agreement to investigate and pursue unification options. While the DPRK's economic situation worsened to the point of imminent collapse, statesmen from both nations established the preconditions for unification and the ROK provided an aid package averaging $10 B(US) annually to help the DPRK save face and maintain its national sovereignty. Among the preconditions, the United States was invited to begin withdrawing troops from the peninsula and the DPRK demobilized 15 divisions, or 20 percent of their force. By the end of the epoch, the two Koreas completed the first stage of Kim Dae Jung's "Sunshine Policy" with the formation of a confederation.

b. The North Korean Collapse

DPRK's primary reasons of reaching a point of imminent collapse in the second epoch revolved around its failure to act *quid pro quo* with respect to four main dilemmas. First, the DPRK attempted to sustain an increasingly sclerotic command economy while continuing to invest 25-30 percent of a dwindling GDP on defense. Second, party leaders attempted to compensate for acute structural problems in the economy without relaxing their hold on central political control. Third, the DPRK continued to participate in bilateral and multilateral accords and negotiations, thereby gaining international assistance, while refusing concessions that might challenge Pyongyang's larger diplomatic and political strategies. And finally, the DPRK attempted to maintain its foreign policy opening to the United States while avoiding the full scale relations with South Korea that could undermine the North's national sovereignty and exclusive claims to legitimacy on the peninsula. This failure to give 'something for something' led to the DPRK's imminent collapse.

c. Preconditions for Unification

In a remarkable show of bilateral cooperation, statesmen from both Korea's agreed in concept to the following preconditions for unification:

DPRK	ROK
US forces must withdraw from South Korea	DPRK must democratize and move towards market economy
ROK must abolish anti-communistic security laws	DPRK must downsize military
	Must reach arms control agreement
	Must seek social and cultural homogeneity

Table 3-33. Preconditions for Unification

The DPRK's first priority was to rid the peninsula of US military presence while the ROK demanded democracy and a move towards a market economy in the North. The bottom line for the North was that they had no other choice. An aid-based foreign policy strategy was essential to the DPRK's prospects for near- and mid-term survival, especially with respect to provisions of energy supplies and foodstuffs. Although the North remained stubbornly resistant to change and the opening of its system, reform was its only escape from continued erosion and eventual collapse. By this logic, it was to the advantage of both the ROK and the DPRK to entertain an incremental transition, allowing the North regime to avoid extinction and ultimately permit a longer-term process of reconciliation with the South.

d. The United States Begins Withdrawal from South Korea

While the world applauded the efforts of the two Koreas to bring the 50-plus year armistice to a peaceful conclusion, the US had little recourse but to honor the wishes of the ROK and abide by the preconditions for unification. Returning US servicemen received a hero's welcome complete with a ticker tape parade through Times Square and virtually every American hometown. As the world watched the media spectacle, USFK continued to send all non-essential personnel home. In the end, the US avoided reduction in significant combat units and withdrew a mere 10 percent by 2010. Influential media sources worldwide reported the concerns of peninsular policy makers that the US is dragging her feet.

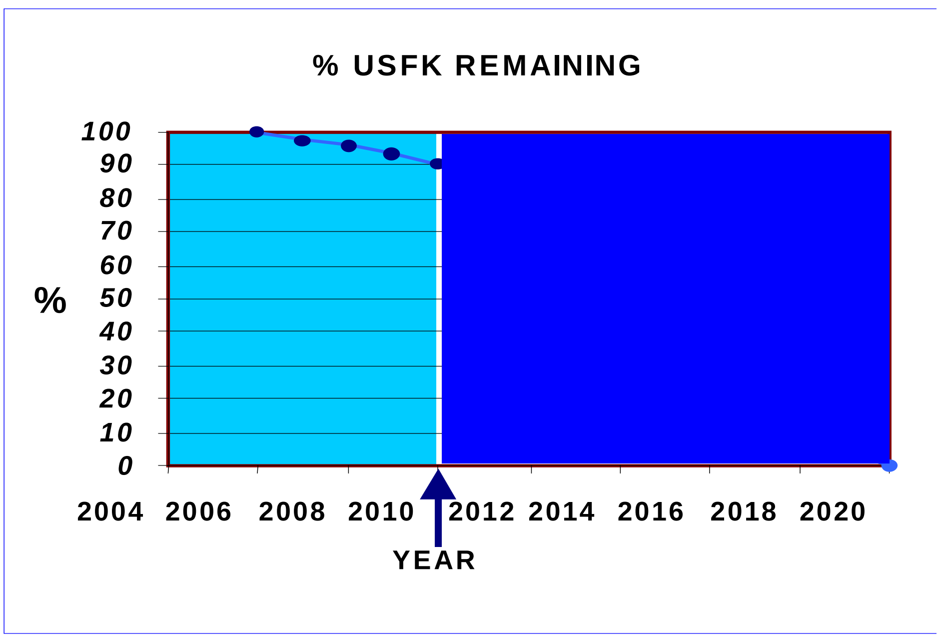

Figure 3-1. US Withdrawal Timeline

e. Phased Unification Plan

The most significant step toward a unified Korea was the Phased Unification Plan that called for incremental changes designed to boost confidence, establish collaborative programs and policies, and resuscitate struggling economies. Foreign investors gained access to virgin markets in the North allowing China, Russian, and US investments to see a potential return on their decades of gratis support. In exchange, the DPRK agreed to launch comprehensive biological and chemical clean-up programs and re-channel the excess manpower from demobilizing forces into the Conservation Corps to work on infrastructure improvements.

f. Economic Summary

Economically, two percent of ROK's GDP went to the DPRK in the form of a $10 B(US) average annual aid package targeting infrastructure improvements and social programs. Although the DPRK continued to commit up to 30 percent of its GDP to defense expenditures, no part of the ROK aid package was allowed to be used to that end. Both states realized roughly six percent[52] annual growth and started mutual projects including an oil pipeline from Siberia and the reconnection of the Trans-Korea railroad.

g. Confederation

In this epoch we witnessed the beginning formation of a confederation characterized as one nation with two states and two independent governments and institutionalization of inter-Korean cooperation. A co federal council is stood up to address the larger policy issues. Significant contributions by the co federal council weren't to begin until the third epoch.

[52] Discussion with Professor Robert G Frank, School of Business and Public Policy, Naval Postgraduate School, Monterey, CA. October 23, 2000. Discussion focused on two scenarios that would allow calculation of credible ROK GDP growth rates. Scenario analogous to German unification of the 1990's (DPRK collapse and subsequent takeover by ROK) and the US Marshall Plan of post World War II era (Confederation of DPRK and ROK with ROK as senior partner). The German case established the upper bound of 5% of ROK GDP to the DPRK, while the Marshall case established the lower boundary of 2% of ROK GDP to DPRK. Based upon a 15-20 year plan for unification the 2% of ROK GDP as an aid package seemed reasonable, with a resultant 5.9% ROK GDP growth rate through 2010.

2. National Defense

a. South Korea's Force Improvement Plans

The ROK Defense Improvement Plan was initiated in 1976 to modernize and improve the combat effectiveness of the ROK armed forces. In epoch two the ROK forces continued modernization and improvements in many key areas through indigenous weapons production, co-production, and procurement through FMS and direct commercial channels. This was a period where the two Koreas engaged one another through mutual cooperation with the implementation of the seven- year phased plan. Korea has moved away from preparing strictly for an inter-peninsular war to building a force with new subs, destroyers, long-range aircraft and AWACS for promoting its regional interests as well, perhaps in preparation for a unified Korea.

Early in the epoch, the ROK focused on securing tactical early warning systems and achieving major improvements in current combat capability. Later, this focus shifted to acquisition of advanced weapon systems to further increase war-deterring capability. Economic success makes it possible for the ROK to share a larger proportion of security-related costs on the Korean Peninsula. However, it must be noted that these contributions come while the ROK is also modernizing its force structure, establishing a more modern command and control system, improving the quality of life for its armed forces, and experiencing increasing political pressures to expand spending on domestic programs.

b. Republic of Korea Army (ROKA)

ROKA is intent on modernizing its forces, with emphasis on maneuver warfare, activation of additional attack helicopter battalions, and enhancement of its special operations forces. There will continue to be an emphasis on indigenous production and co-production —this focus is driven by national pressure to enhance the Korean industrial base by acquiring advanced technologies.

Indigenous development and production include an advanced artillery fire control system, and the PRC-999K tactical radio. The ROKA is also developing tracked air defense systems[53] and has deployed one system in the Seoul area. Co-production programs with the US include the K-1 main battle tank, K-200 Korean Infantry Fighting Vehicle, K-55 self propelled 155mm howitzer, M-9 Armored Combat Earthmover, and the UH-60P utility helicopter. These have been successful programs. Additionally, the ROK is actively pursuing the procurement of additional battalions of MLRS and long range Army Tactical Missile Systems (ATACMS). The ROK ultimately wishes to acquire the most advanced versions, M270A1 and ATACMS Block 1A, of the systems.

The ROKA aviation modernization program is another ambitious effort designed to infuse new technology, expand force structure, and develop a day/night engagement and sustainment capability. Lift and cargo capabilities continue to receive attention, and there is now a renewed emphasis on procurement of an advanced attack helicopter such as the US RAH-66 Comanche. In addition, the United States and Seoul have made significant progress in talks over the extension of the range of Seoul's missile armaments.

In a 1970s agreement with Washington, South Korea voluntarily set its missile range limit at 180 kilometers in order to receive US missile technology. The KARI with a view to developing its own satellite launch vehicles had developed a series of KSR research rockets. The KSR-1 single-stage solid-propellant sounding rocket has had two successful launches. A KSR-2 two-stage rocket is being developed and will be 11.21 m long, have a launch weight of 1,930 kg and

[53] ChunMa "Pegasus". Refer to Annex 3F-5 for system description.

will carry a 150 kg payload to around 200 km altitude. A three-stage rocket, KSR-3, capable of reaching an altitude of 350 km, is planned for development.

In 2006, the United States agreed to Seoul's proposal of boosting the missile range to 300 km for deployment and 500 km for scientific research development so as to effectively cover all of North Korea's territory. With this, a secondary use for these rocket development programs became manifest into a series of ballistic missiles with ranges from 100 to 900 km. The KSR-1 has a launch weight of 1,400 kg, a payload of 200 kg and a range of 180 km. South Korea had expended much effort in developing a 300 km range SRBM with a 500 kg payload (within the MTCR guidelines), to be able to counter any ballistic missile attacks from North Korea.

Combat System	2006	Procurement	Demobilization	2010
Active Divisions	23	-	-	23
Personnel (thousands)	560	-	-	560
Reserve Divisions	23	-	-	23
Tanks	2100	100	100	2100
APC / AIFV[54]	2500	100	100	2500
Attack Helicopters	100	72	50	122
Gun Artillery	4550	-	250	4300
Rocket Artillery	180	-	-	180
Surface-to-Surface Missiles	12	-	-	12
Air Defense Artillery	600	-	-	600
Surface-to-Air Missiles	985	28	35	978

Table 3-34. ROK Army Force Structure 2010

c. Republic of Korea Navy (ROKN)

As the ROKN expands the strategic range of its primary surface and subsurface combatant forces, it continues to upgrade its Naval Air Force's ASW/Maritime patrol capability. All planes have been outfitted with inverse synthetic aperture radar that will significantly increase its maritime patrol capabilities. ROK Navy is aggressively pursuing the acquisition of additional

[54] Armored Personnel Carrier / Armored Infantry Fighting Vehicle

improved P-3X aircraft with the first four being delivered in epoch two. The aircraft, along with the major support facilities (supply warehouse, hangar, maritime Air Operations Center, weapons magazine, maintenance facilities) at Pohang gives the ROK Navy a robust maritime surveillance capability in the Asian littoral.

Germany's HDW was widely regarded as the most promising bidder among industry sources for the follow-on submarine program due to its involvement in the nation's first-stage submarine program, "KSS-1," which started in 1991. Under the KSS-1 plan, which calls for the construction of nine 1,200 ton-class submarines for the Navy by 2000, the German firm has provided technology for the production of its Type 209 submarines to the Koreans. Daewoo Shipbuilding has served as the local contractor. The Defense Ministry had eventually selected Germany's HDW as its contractor for its 1.27 trillion-won ($1.12 B(US)) submarine project as it excelled in terms of prices and logistics support over France's DCNI, which championed its 'Scorpene' submarine. Daewoo Shipbuilding & Marine Engineering and Hyundai Heavy Industries were the joint contractors MND had selected to supply the 1,800-ton Type 214[55] submarines to the navy by 2009.

The ROKN force improvement program also calls for the continual replacement of its aging destroyer class ships (old US Navy FRAM I and II hulls) with a modern indigenous naval force based on an a 7000 ton class Aegis-class ship called KDX-III. As of 2006, the inventory stood at three of each class of KDX-I / II / III class ships. The navy will embark on the indigenous construction of a modified KDX destroyer that will serve as the battle ship of the 21st century. In addition, the ROK Navy is executing a major C3I upgrade commencing in 2000 using the US Navy’s Global Command & Control System – Maritime (GCCS-M) and UHF SATCOM as the communications backbone. The current plans include UHF SATCOM, Navy Order Wire, and

[55] Refer to Annexes for detailed description.

GCCS-M for operational shipboard and command center use. The Korean OSIS Evolutionary Development (KOED) is a wide area network intelligence fusion and dissemination system connecting the fleet commanders and ROK Navy Headquarters; installation is in progress. The third component of the master ROK Navy C3I upgrade architecture is the Korean Naval Tactical Data System (KNTDS).

Combat System	2006	Procurement	Demobilization	2010
Maritime Patrol	16	4	-	20
Submarines	15	3	6	12
Destroyer	9	4	-	13
Frigates	11	-	5	6
Coastal Patrol	118	5	-	113
Amphibious	30	3	-	33
Mine Warfare	17	-	5	12

Table 3-35. ROK Navy Force Structure 2010

d. Republic of Korea Air Force (ROKAF)

ROKAF procurement initiatives in epoch two include airborne C3I, and airborne early warning capability. Service Life Extension Programs (SLEP) across the ROKAF fleet (F-4, F-16 Falcon, and possible F-5 modernization) are measures pending delivery of Korean Fighter Program F-16s, the Future Fighter (FX), and the Korean Trainer (KTX-II) aircraft.

Lockheed Martin Aeronautics Company and Korea Aerospace Industry (KAI) signed a joint marketing agreement on the T-50 advanced jet trainer. The T-50 is an advanced jet trainer that will prepare pilots for modern jet fighters. A derivative known as the A-50, is a fighter-lead-in trainer and light attack aircraft. The T-50 is equipped with the most modern subsystems and will be an ideal trainer for the KF-16s and other modern fighter aircraft," said M.K. Chang, senior vice president of KAI and T-50/A-50 program director. The T-50 program is currently in full-scale development with Lockheed Martin as a subcontractor to KAI for development and production. Lockheed Martin Aeronautics' responsibilities include the wings, flight controls and avionics integration. The first test aircraft was rolled out late 2000 with first flight in June 2002. The ROKAF plans to replace its T-38, F-5 and A-37 fleets with the T-50/A-50. The initial production order is expected to be approximately 100 aircraft with first delivery in 2005. The following table shows the resulting force structure for the ROKAF at the year 2010.

Combat System	2006	Procurement	Demobilization	2010
Fighter	485	15	130	370
Ground Attack	10	50	-	60
Bomber	-	-	-	-
AEW / ESM	1	2	-	3
Reconnaissance / UAV	128	10	-	138
Air Refueling	-	-	-	-
Trainer A/C	198	238	130	306
Transport A/C	12	-	-	12

Table 3-36. ROK Air Force Structure 2010

e. North Korea Force Improvement Plans

Unable to match the CFC's technologically advanced war-fighting capabilities, especially in a period of economic difficulties, the North's leadership focused on high-payoff investments in developing asymmetrical capabilities such as ballistic missiles, special operations forces, and weapons of mass destruction. A huge proportion of the North’s defense budget was invested in completing the ballistic missile development and for weapons of mass destruction. Conventional forces, though obsolete, are numerically overwhelming. Aging equipment and weapon systems are being retired with the rest being upgraded to retain combat effectiveness while reducing the cost for maintenance. The bulk of the demobilization was across the army while the navy and air force remained relatively unchanged from epoch one.

f. Korean People’s Army (KPA)

North Korea fields an artillery force of over 10,000 self-propelled and towed weapon systems. Without moving any artillery pieces, the North could sustain up to 500,000 rounds an hour against the CFC defenses for several hours. The artillery force includes 500 long-range systems deployed over the past decade. The proximity of these long-range systems to the Demilitarized Zone (DMZ) threatens all of Seoul with devastating attacks.

As a gesture of goodwill to secure foreign aid in its failing economy, North Korea agrees to re-channel approximately 20 percent of its troops into a conservation corps to assist in the building of the Trans-Korea railway and other infrastructures in an attempt to revive its faltering economy. This is seen in the reduction of 20 divisions, inclusive of reserves in the army and across the army's huge inventory of combat system. The following table shows the resulting force structure for the KPA in the year 2010.

Combat System	2006	Procurement	Demobilization	2010
Active Divisions	80	-	15	65
Personnel (thousands)	1,000	-	187	813
Reserve Divisions	37	-	5	32
Tanks	3,500	-	700	2,800
APC / AIFV[56]	2,500	-	500	2,000
Attack Helicopters	50	-	10	40
Gun Artillery	8,200	-	875	7,325
Rocket Artillery	2,300	-	300	2,000
Surface-to-Surface Missiles	55	-	-	55
Air Defense Artillery	6,000	-	1,750	4,250
Surface-to-Air Missiles	5,500	-	2,500	3,000

Table 3-37. DPRK Army Structure 2010

g. Korean People's Navy (KPN)

North Korea retired its aging fleet of Whisky class submarines. From Moscow, it secured two Kilo class submarine at a "friendship price". These Kilo class submarines came complete with the upgraded Type 53 (test-71) 533mm torpedoes – the newest version of which is in service with the Russian Navy. Weighing 1,820kg, the torpedo has a 205kg explosive warhead

[56] Armored Personnel Carrier / Armored Infantry Fighting Vehicle.

and is powered by a silver-zinc single-use ampoule battery. Maximum speed is 40kts and range is claimed to be up to 20km. Target detection ranges are 1,500m for submarines and 180m for surface vessels.

Combat System	2006	Procurement	Demobilization	2010
Maritime Patrol	12	-	-	12
Submarines	25	2	4	23
Destroyer	-	-	-	-
Frigates	3	-	-	3
Coastal Patrol	448	-	-	443
Amphibious	266	-	-	266
Mine Warfare	24	-	-	24

Table 3-38. DPRK Navy Structure 2010

h. Strategic Weapons Development

1) Ballistic Missiles

The North's asymmetric forces are formidable, heavily funded, and cause for concern. The progress of the North's ballistic missile program indicates that it remains a top priority. DPRK's ballistic missile inventory now includes over 500 SCUDs of various types. The production and deployment of medium-range Ro-dongs capable of striking US bases in Japan also continues. Pyongyang is developing multi-stage missiles with the goal of fielding systems capable of striking the continental United States. The 2,000-kilometer range Daepo-dong 1 is operational and the North Koreans are continuing on works on the 5,000 plus kilometer Daepo-dong 2.

Combat Systems	2005	Procurement	Demobilization	2010
Scud B	100	-	-	100
HwaSong 5	150	-	-	150
HwaSong 6	250	-	-	250
Ro-dong 1 / 2	86	40	-	136
Daepo-Dong 1	25	50	-	75
Daepo-Dong 2	0	25	-	25

Table 3-39. DPRK Ballistic Missile Structure 2010

2) Weapons of Mass Destruction (WMD)

WMD are essentially used as bargaining chips to solicit for concessions from the world. The North Koreans agreed to a biological and chemical clean up by allowing UN led inspection teams into Pyongyang. However, by now the North Korean are able to effectively and accurately deliver nuclear capable systems and have extracted enough weapons-grade plutonium for up to 6 warheads.

i. United States Forces in Korea (USFK)

Trade friction between North and South Korea is on the rise as is anti-Americanism in South Korea. Many younger Koreans blame the United States for the continued division of Korea. South Korea, meanwhile, is becoming more capable of defending itself, and the United States Department of Defense is expected to withdraw some 7,000 military personnel from Korea within the first next 5 years as part of the pre-conditions to reunification between the two Koreas. This amounts to a 10percent reduction in USFK. The resulting force structure in 2010 is as follows.

US Army		US Air Force	
Personnel	25,000	Fighters	60
Active Divisions	1	Ground Attack	18
MBTs	120	Reconnaissance	1
APC / AIFV	150	Transport	--
Attack Helicopter	65		
Gun Artillery	25	Rocket Artillery	25

Table 3-40. USFK Structure 2010

3. Net Assessment

This epoch is marked by South Korea's militarily cautious and suspicious stance towards unification as the defense of the country still focuses towards the DPRK as the most likely aggressor.

a. Scenario One: Overland Invasion by North Korea

Scenario One is an overland invasion by North Korea against the US and South Korean Alliance's CFC. The purpose of this scenario is to illustrate the military capabilities and deficiencies of the US-ROK alliance in the event of a DPRK invasion. The intention is to evaluate the capabilities of the CFC alliance against the DPRK without any external intervention factors.

1) Order of Battle (DPRK vs. CFC)

The aggregate categorical orders of battle have changed very little since the previous epoch. The only exceptions are the demobilization of twenty percent of the DPRK Army and the procurement and modernization efforts by the ROK. See Annex 3D for the orders of battle for the DPRK and ROK forces. The US Forces Korea combat strength remains the same.

2) Scenario Description

The scenario is a full-scale invasion of the ROK by the DPRK. Some of the key assumptions include:

a) The relative exclusion of USFJ (US Forces Japan) in the conflict is due to the agile operational concept of the DPRK. Other US forces in Japan are caught off-guard and are unable to get there in time. The element of surprise is accomplished by DPRK.

b) The preponderance of the US Seventh fleet is out of the region conducting Indian Ocean operations. This includes the entire Carrier Battle Group (CVBG). No other Pacific carrier battle group is able to sortie in a timely manner.

c) Due to the economic and political imprudence, North Korea will only use WMD as a bargaining chip.

d) Conventional attack will include ballistic missiles.

3) Objectives

The objectives of surprise and violence attempt to negate the CFC's mobility and prevent any major reinforcement by the US. The strategy includes artillery and missile attacks, the use of covert operational facilities and amphibious SOF insertion. This is in addition to SOF forces that presumably have already infiltrated South Korean territory.

4) Committed Forces Comparison

DPRK commits two-thirds of their forces while holding one-third in reserve. One hundred percent of CFC forces are committed to the defense of ROK territory as complete SOF infiltration overwhelms the CFC and necessitates total commitment.

a) Army

For the armies involved, there is near parity in personnel and gun artillery. DPRK has an advantage in rocket artillery, ADA, SAM, and SSM assets. The CFC has a distinct advantage in the AH, AIFV, and APC categories.

b) Navy

For the naval assets, DPRK enjoys a numerical advantage in submarines, patrol boats and amphibious vehicles. The CFC has a distinct advantage in destroyers and frigates, with a slight advantage in maritime patrol aircraft, and mine warfare assets.

c) Air Force

In the air forces, there is near quantitative parity when aggregating fighter, ground attack and bomber aircraft categories. However, as in epoch one the technological superiority of the CFC aircraft is a distinctive advantage. There is a definite numerical advantage for the CFC with respect to AEW, Reconnaissance, and UAV platforms.

Combat System	DPRK	DPRK Committed	CFC Committed	CFC
Active Divisions	65	44	24	24
# Personnel (K)	813K	542K	585K	585K
Reserve Divisions	32	22	23	23
MBT	2800	1870	2320	2320
APC / AIFV	2000	1400	2650	2650
AH	40	30	188	188
Gun Arty	7325	4880	4325	4325
Rocket Arty	2000	1300	205	205
SSM	55	36	12	12
ADA	8250	5500	600	600
SAM	3000	2000	512	512

Table 3-41. Scenario One Army Committed Forces

Combat System	DPRK	DPRK Committed	CFC Committed	CFC
Maritime Patrol	12	12	20	20
Submarine	23	18	12	12
Destroyer	--	--	13	13
Frigate	3	3	11	11
Coastal Patrol	443	296	121	121
Amphibious	266	200	33	33
Mine warfare	24	16	20	20

Table 3-42. Scenario One Navy Committed Forces

Combat System	DPRK	DPRK Committed	CFC Committed	CFC
Fighter	241	160	430	430
Ground Attack	321	214	78	78
Bomber	80	53	--	--
Air Refueling	--	--	--	--
AEW / ESM	--	--	3	3
Recce / UAV	--	--	139	139
Trainer A/C	263	175	306	306
Transport	304	200	37	37

Table 3-43. Scenario One Air Force Committed Forces

5) Results

The results of the static net assessment shows that the CFC and DPRK armies are at near parity with reference to personnel. Superiority on the ground is not assured, as there is significant SOF impact on command and control, synchronization and the overall capability of joint operations. The CFC and DPRK navies are comparable in overall numbers of combat vessels with the exception of amphibious vehicles, which appear to be overwhelming in DPRK waters. However, the CFC possesses technically superior weapon systems and it is postulated that they would enjoy a capability equivalent to three times greater than that of a technologically inferior foe, even considering asymmetric attack. The CFC and DPRK air forces are at near parity in the category of combat aircraft. However, the qualitative advantage is evident when factors of maintainability, reliability and technology influence the true war fighting capabilities and overall combat effectiveness of the CFC. Anecdotal evidence of the disparity between DPRK and CFC aircrew in annual flight time and training exercises is significant. It is these measures of readiness that are critical to eventual CFC victory in the conflict.

6) Scenario One Conclusions

The bottom line is that "Not much has changed since epoch one" in an overland invasion scenario without external intervention. In the ROK, the US withdrew ten percent of assigned personnel from non-mission essential billets, the ROK defense establishment continued unimpeded on a total force modernization roadmap, and is assessed to remain victorious in a conflict of this dimension. Meanwhile, the DPRK demobilized twenty percent of their army as economic and social conditions caused defense programs to remain stagnant and technically inferior, and the regime to remain in the survival mode. Excepting possibly artillery and missile attacks, the DPRK is yet unable to sustain any type of major offensive against the ROK as defended by the CFC.

b. Scenario Two: North Korea/China (Red Team) vs. South Korea/USFK (CFC).

Scenario Two is a hypothetical overland invasion by DPRK with the support of coastal attacks by Chinese forces against the CFC. In this scenario, China will assist in so far as much to bolster DPRK chances of victory without appearing as the aggressor in the global political realm. This statement is tenuous, as we do not intend to say conflict with China, but rather conflict with a foe assisting DPRK with capabilities similar to that of the Chinese. Or, in other words, some country is providing the DPRK with resources necessary for sustainment.

1) Orders of Battle (DPRK/China vs. CFC)

Listed in the table are the complete combat units of all of the Chinese, DPRK, and CFC forces. We postulate the PRC Army forces will be held in reserve.

Combat System	PRC	DPRK	RED	CFC	ROK	USFK
Active Divisions	44	65	105	24	23	1
# Personnel (K)	1983	813	2796	585	560	25
Reserve Divisions	80	32	112	23	23	--
MBT	6750	2800	9550	2220	2100	120
APC / AIFV	9060	2000	11060	2650	2500	150
AH	500	40	540	165	100	65
Gun Arty	14500	7325	21825	4575	4550	25
Rocket Artillery	3800	2000	5800	205	180	25
SSM	?	55	55+?	12	12	--
ADA	15000	8250	23250	600	600	--
SAM	?	3000	3000+?	1000	1000	--

Table 3-44. Scenario Two Army Forces

Combat System	PRC	DPRK	RED	CFC	ROK	USFK
Maritime Patrol	30	12	42	20	20	--
Submarine	69	23	92	12	12	--
Destroyer	27	--	27	13	13	--
Frigate	41	3	44	11	11	--
Patrol Boat	219	443	662	121	121	--
Amphibious	90	266	356	33	33	--
Mine warfare	83	24	107	20	20	--

Table 3-45. Scenario Two Navy Forces

Combat System	PRC	DPRK	RED	CFC	ROK	USFK
Fighter	2851	217	3068	430	370	60
Ground Attack	--	359	359	78	60	18
Bomber	235	80	315	--	--	--
Air Refueling	10	--	10	--	--	--
AEW / ESM	16	--	16	3	3	--
Recce / UAV	--	--	--	139	138	1
Trainer A/C	--	263	263	306	306	--
Transport	322	304	626	37	29	8

Table 3-46. Scenario Two Air Forces

2) Scenario Description / Objectives

This overland invasion utilizes the same objectives and strategies as the first scenario. However, this scenario includes sustainment provision of POL, weapons, and food that the DPRK forces previously lacked. Additionally, utilizing one-seventh of its overall naval assets, the PRC eastern fleet conducts a naval blockade of the entire peninsula that impedes the passage of any US reinforcements. The DPRK gains air superiority with covertly deployed PRC aircraft in DPRK territory. The total asset support package approximates 90 ships, 500 fighters and 60 bombers. PRC support essentially triples the DPRK ballistic missile capability.

3) Committed Forces Comparison

For the DPRK, approximately sixty-seven percent of their forces are committed. This is in addition to the proportions of PRC assets discussed in the scenario description paragraph. Due to the proximity of CFC bases, one hundred percent of CFC forces are committed. The overall threat numbers appear overwhelming for the CFC Army, Navy, and Air Forces.

Combat System	Red Team	Red Team Committed	CFC Committed	CFC
Active Divisions	105	80	24	24
# Personnel (K)	2796	1000	588K	588K
Reserve Divisions	112	37	23	23
MBTs	9550	3500	2216	2216
APC / AIFV	11060	2500	2637	2637
AH	540	50	172	172
Gun Artillery	21825	8200	4595	4595
Rocket Artillery	5800	2300	180	180
SSM	55	55	12	12
ADA	23250	11000	600	600
SAM	3000+	3000	1000	1000

Table 3-47. Scenario Two Army Committed Forces

Combat System	Red Team	Red Team Committed	CFC Committed	CFC
Maritime Patrol	42	20	20	20
Submarine	92	50	12	12
Destroyer	27	27	13	13
Frigate	44	13	11	11
Coastal Patrol	662	296	121	121
Amphibious	356	200	33	33
Mine warfare	107	31	20	20

Table 3-48. Scenario Two Navy Committed Forces

Combat System	Red Team	Red Team Committed	CFC Committed	CFC
Fighter	3068	717	430	430
Ground Attack	359	321	78	78
Bomber	315	113	--	--
Air Refueling	10	2	--	--
AEW / ESM	16	2	3	3
Recce / UAV	--	--	8	8
Trainer A/C	--	--	139	139
Transport	263	263	306	306

Table 3-49. Scenario Two Committed Air Forces

4) Results

The general results indicate that the CFC Army takes heavy casualties, the naval blockade is effective in delaying arrival of US reinforcements, and SOF again plays significant role. The hostile takeover of the South would succeed if supported by the Chinese.

5) Conclusions

ROK military deficiencies identified include: coastal defense, detection, targeting, and air defense. These deficiencies will serve to focus the procurement and modernization roadmap for subsequent epochs. US presence is required at least for now as the Seventh Fleet's presence acts as a deterrent; and if hostilities break out, as a warfighting force to hasten or prevent interdiction of reinforcements. The ROK is not capable of surviving a conflict of the size and scope represented by this scenario nor does it desire to embark upon an economically debilitating arms race to remedy quantitative and capability deficiencies.

c. Overall Net Assessment Conclusions

The overall conclusion from both scenarios is that unless supported by some outside entity, an invasion of ROK by the DPRK is not sustainable, nor prudent on their part.

4. Technology Development for DPRK and ROK

a. DPRK's Technology Focus

1) Goals and Strategy for Defense Technology

North Korea's quest for a credible nuclear ballistic missile capability continues through its cooperation with rogue states like Pakistan and Iran.

2) Defense R&D Budget

The tables below summarize the epoch two defense and R&D budget breakdowns.

	GDP	Defense Budget	O&M	FIP
%GDP	100.0%	27.0%	18.9%	8.1%
%Def Bud	-	100.0%	70.0%	30.0%
%Growth	6.2%			
Year	US$ Bil	US$ Bil	US$ Bil	US$ Bil
2006	10.903	2.944	2.061	0.883
2007	11.579	3.126	2.189	0.938
2008	12.297	3.320	2.324	0.996
2009	13.060	3.526	2.468	1.058
2010	13.869	3.745	2.621	1.123
Total	61.709	16.661	11.663	4.998
Average	12.342	3.332	2.333	1.000

Table 3-50. DPRK Defense Budget Breakdown

	Army	Navy	Air Force	DBA	R&D
%GDP	4.1%	1.6%	2.4%	0.4%	2.8%
%	50.0%	20.0%	30.0%	5.0%	35.0%
%Def Bud	9.0%	3.6%	5.4%	1.5%	10.5%
Year	US$ Bil	US$ Bil	US$ Bil	US$ Bil	US$ Bil
2006	$0.265	$0.106	$0.159	$0.044	$0.309
2007	$0.281	$0.113	$0.169	$0.047	$0.328
2008	$0.299	$0.120	$0.179	$0.050	$0.349
2009	$0.317	$0.127	$0.190	$0.053	$0.370
2010	$0.337	$0.135	$0.202	$0.056	$0.393
Total	$1.500	$0.600	$0.900	$0.250	$1.749
Average	$0.300	$0.120	$0.180	$0.050	$0.350

Table 3-51. DPRK FIP Budget Breakdown

	R&D	BM/Nuclear Program	SOF Program	Reverse Engineering	Others
%GDP	2.8%	2.0%	0.4%	0.3%	0.1%
%	35.0%	70.0%	15.0%	10.0%	5.0%
%Def Bud	10.5%	7.4%	1.6%	1.1%	0.5%
Year	US$ Bil	US$ Bil	US$ Bil	US$ Bil	US$ Bil
2006	$0.309	$0.216	$0.046	$0.031	$0.015
2007	$0.328	$0.230	$0.049	$0.033	$0.016
2008	$0.349	$0.244	$0.052	$0.035	$0.017
2009	$0.370	$0.259	$0.056	$0.037	$0.019
2010	$0.393	$0.275	$0.059	$0.039	$0.020
Total	$1.749	$1.225	$0.262	0.175	0.087
Average	$0.350	0.24	0.05	0.035	0.017

Table 3-52. DPRK R&D Budget Breakdown

b. DPRK's Technology Investments

DPRK's technological strength continues to reside in its ability to reverse-engineer major Soviet Union weapons systems. The downsizing of the DPRK military has resulted in more funds being made available for the upgrade of its aging inventory of weapons. This funds in turn have been channeled into improving the infrastructure to increase the rate at which upgrading was being performed. Throughout epoch two, DPRK continued its emphasis on the nuclear BM and SOF enhancement programs as reflected in its R&D spending.

c. DPRK's R&D Program

From the table below, the second epoch witnessed the continued joint R&D efforts in BM with Iran and Pakistan. The bulk of its technological investments were spent on investing and developing BM-related technologies, especially in the field of missile control guidance. In spite of earlier US predictions that DPRK would have a credible nuclear BM threat by 2005, this has yet to materialize. The latest estimates, however, place DPRK's nuclear weapons program to be almost mature such that it could probably field up to 6 nuclear missiles within the next three years. Also, as part of its reunification agreement, DPRK discontinued its secret development of chemical and biological weapons at end 2010.

Indigenous R&D and Production	Joint R&D and Production
Tanks Artillery Armored Vehicles Small Naval Craft Small Arms Satellite(?)	BM (Iran, Pakistan, Israel)

Table 3-53. DPRK Defense Systems Acquisition Method Summary

d. ROK's Technology Focus

1) Goals and Strategy for Defense Technology

ROK's regional focus continued in this epoch as it focused on enhancing its blue water navy and advanced air combat capabilities. Foremost priority for the ROK Navy continues to be the protection of ROK's SLOCs, with an emphasis on the development of a sub-surface capability. The ROK Air Force's priority continues to be in the acquisition of air fighter assets. The ROKA's emphasis lies in the acquisition of night-fighting and coastal defense capabilities. From ROK's DBA requirements, MND maintains its need for space and maritime surveillance systems.

The strategy for the second epoch continued from that of the first epoch. ROK continued to pursue joint developments with Israel, Russia, France, and Germany to effect the necessary technology transfers[57]. These efforts were all in concurrence with the ROK efforts to reduce its dependence on US technology. Incidentally, the availability of US technology also became more difficult to acquire as a result of the US withdrawal imposed as part of the reunification preconditions.

2) Defense R&D Budget

[57] ROK's joint efforts with Israel focuses on its UAV and sensor technology, with Russia focuses on its missile, aircraft, high power microwave and space technology, with France focuses on its missile and fighter technologies, and with Germany focuses on its submarine and artillery technology.

Maintaining the budget allocations defined earlier, the tables below summarize the epoch two defense and R&D budget breakdowns.

	GDP	Defense Budget	O&M	FIP
%GDP	100.0%	3.5%	2.5%	1.0%
%Def Bud	-	100.0%	70.0%	30.0%
%Growth	5.9%			
Year	US$ Bil	US$ Bil	US$ Bil	US$ Bil
2006	443.222	15.513	10.859	4.654
2007	469.372	16.428	11.500	4.928
2008	497.065	17.397	12.178	5.219
2009	526.392	18.424	12.897	5.527
2010	557.449	19.511	13.657	5.853
Total	2,493.499	87.272	61.091	26.182
Average	498.700	17.454	12.218	5.236

Table 3-54. ROK Defense Budget Breakdown

	Army	Navy	Air Force	DBA	R&D
%GDP	4.1%	1.6%	2.4%	0.4%	2.8%
%	50.0%	20.0%	30.0%	5.0%	35.0%
%Def Bud	9.0%	3.6%	5.4%	1.5%	10.5%
Year	US$ Bil	US$ Bil	US$ Bil	US$ Bil	US$ Bil
2006	$1.159	$1.545	$1.159	$0.186	$0.605
2007	$1.227	$1.636	$1.227	$0.197	$0.641
2008	$1.300	$1.733	$1.300	$0.209	$0.678
2009	$1.376	$1.835	$1.376	$0.221	$0.719
2010	$1.457	$1.943	$1.457	$0.234	$0.761
Total	$6.519	$8.692	$6.519	$1.047	$3.404
Average	$1.304	$1.738	$1.304	$0.209	$0.681

Table 3-55. ROK FIP Budget Breakdown

	FDP (80% of R&D)			ADD (20% of R&D)				
	Army	Navy	AF	EO	MW	AC	UWA	WS
% R&D Budget	24.0	32.0	24.0	5.5	5.9	6.1	1.6	1.0
Year	US$ B	US$ B	US$ B	US$ B	US$ B	US$ B	US$ B	US$ B
2006	0.145	0.194	0.145	0.033	0.036	0.037	0.010	0.006
2007	0.154	0.205	0.154	0.035	0.038	0.039	0.010	0.006
2008	0.163	0.217	0.163	0.037	0.040	0.041	0.011	0.006
2009	0.172	0.230	0.172	0.040	0.042	0.044	0.011	0.007
2010	0.183	0.243	0.183	0.042	0.045	0.046	0.012	0.007
Total	0.817	1.089	0.817	0.188	0.200	0.206	0.054	0.032
Average	0.163	0.218	0.163	0.038	0.040	0.041	0.011	0.006

Table 3-56. ROK R&D Budget Breakdown

e. ROK's Technology Investments

1) National Defense Plan

From the 2006-2010 Mid-term Defense Plan, these were the weapon systems acquired by the three services by end 2010. These procurements are categorized into DBA (which encompassed Information and Command/ DBA and Strategic Strike investments), the Army, Navy and Air Force.

2006-2010		
Capability/ Purpose	Direction	Items to procure
Information & Command/ DBA	Early warning & surveillance Space Communications Self-command systems Defense Digitization	10 Aerostats 1 Spy Satellite 2 Comms Sat Joint C3I System GBR
Strategic Strike	Long Range Ballistic Delivery Capability < 300 km	KSR-1
Ground Operations	Improved lethality, agility Tactical Situational Awareness	K1 MBT AH-X SAM-X Q37-type radar
Naval Control	Long range surveillance and Information Dominance Develop sub-surface combat capability Develop ocean going navy capability Strategic control of SLOCs	4 P-3Xs 3 Type 214 3 KDX -III
Air Operations	Advanced Air Combat Precision Strike	50 A-50 15 FX 2 E3 AWACS 10 KOX-1 FAC 94 T-50 Jet Tng 94 KT-2 Woong 50 KT-1 Tng 50 AIM-9X 100 Harm Blk 6 50 AGM-130/142

Table 3-57. ROK Weapon Systems Acquisition

2) Existing Capabilities

At 2010, ROK has gained the ability to indigenously produce its own heavy torpedoes. Additionally, ROK has embarked on projects focusing on micro and unmanned weapon systems. ROK had already laid the groundwork during the earlier periods such that enable production of its own submarines, combat aircraft, attack helicopters and other major ground systems by 2015, with sustained production capability from 2020 onwards.

To acquire high-cost weapon systems or technologically advanced weapons, which the ROK is unable to produce locally, the country, cooperates to jointly procure such systems with other friendly nations. Such systems include: HAE UAV, UCAV, Micro Air Vehicles (MAV), and satellites. Also, as the production of missiles requires a technological infrastructure that ROK does not yet possess and that is not economical for its industry to sustain, the country continues to depend on external allies to supply its missiles.

Indigenous R&D and Production	Joint R&D and Production	Licensed Production	Import
Major Surface Ships (KDX)	Combat Aircraft (KF-16)	Submarines (T209/T214)	UAV
Minor Surface Ships (Minesweepers)	Tanks (K1 MBT)	Helicopters (KH-60)	SAM
Torpedoes	Helicopters	Combat Aircraft (KF-16)	AAM
Armored Vehicles (KIFV)	Artillery (K-200)	Artillery	ASM
Trainer Aircraft (KT-1)	Trainer Aircraft (A/T-50)	Radars	AWACS
Small Naval Craft	Submarines (T209/T214)	UAV	Maritime Surveillance (P3)
Small Arms	Comms/Spy Satellites		Attack Helicopter (AH-64)
	Aerostat		
	UCAV		
	Micro Air Vehicle		

Table 3-58. ROK Defense Systems Acquisition Method Summary

f. Assessed Vulnerabilities and Deficiencies from Epoch Two

From the epoch two net assessment, ROK identified its two key weaknesses as that of maintaining air superiority and protecting its SLOCs (as per epoch one). South Korea's weakness of maintaining its air superiority arises from its lack of a long-range strike capability, its lack of DBA (especially with the USFK's eventual withdrawal), and its perceived insufficiency of AAM/SAM. Regarding the protection of SLOCs, this weakness arises from South Korea's lack of anti-shipping/-submarine strike capability, and its lack of a sufficient blue-water naval capability.

To embark on solutions for the vulnerabilities, ROK's investment decisions for the second epoch was to acquire the following new technology systems. For the army, it would continue acquiring the next generation of attack helicopters and improved SAMs. For the navy, it would enhance its strike capability by acquiring SSMs and better torpedoes. For the air force, it would also enhance its strike capability by acquiring ASMs and an air refueling capability. Note that ROK's industrial base has now shifted to include focus on building attack helicopter systems for the army; developing anti-shipping/-submarine missile capability to include developing deep sea and UUV capabilities for the navy; and maturing the submarine building industry.

g. ROK's R&D Programs

From the net assessments, ROK derived its long-term technology development needs to continue in the areas of miniaturization technology, sensor fusion technology, and long-range targeting technology. These long-term R&D programs already started in the first epoch focuses on the following programs: For DBA, ROK is working on projects employing micro air sensor networks, micro satellites, and next generation UAVs. For air defense, ROK intends to continue to develop an aerial mine field system that takes the fight to the enemy. It is also progressing with projects on high power microwave weapons, advanced combat platforms and advanced munitions. The table below summarizes the major R&D efforts for the second epoch.

2006-2010	
Direction	Items to procure
Unmanned Vehicle/Weapons	UCAV
Miniaturized Systems	JSTAR
Space Launch systems	Air Mine Field
Directed Energy Technology	KSR-1/2
	Micro Air Sensor
	HPM

Table 3-59. ROK Major R&D Emphasis

ROK's current industrial base possesses the necessary technological knowledge and infrastructure to pursue these projects with moderate risks. Consequently, ROK is already developing and eventually shaping its forces with an emphasis on introducing micro- and unmanned fighting and sensor platform systems, that with Moore's Law, makes the fielding of such weapon systems a definite possibility in the 2020 timeframe.

Army		Navy		Air Force		DBA	
R&D Program	US$ Bil	R&D Program	US$ Bil	R&D Program	US$ Bil	R&D Program	US$ Bil
AH64D	$0.080	SAM (SM-2)	$0.070	FX	$0.250	Communications Satellites	$0.125
KAH66	$0.200	Torpedoes	$0.030	UCAV	$0.050	Spy Satellites	$0.260
AGM-11X	$0.030	KDX-X	$0.280	AWACS	$0.040	Launch Vehicle (KSR-1)	$0.125
SAM (A-400)	$0.160	Submarine (T-214)	$0.200	Harm Blk 6	$0.060	Aerostat	$0.080
Tactical Radar	$0.030	HPM	$0.200	JSOW/ JDAM	$0.050	Micro Air Sensor	$0.080
Others	$0.317	UUV	$0.020	Tanker	$0.025	Defense Digitization	$0.250
		SS-N-26 Integration	$0.025	MAV	$0.055	Others	$0.127
		Others	$0.264	Others	$0.287		
Total	$0.817	Total	$1.089	Total	$0.817	Total	$1.047
Budget Allocated	$0.817	Budget Allocated	$1.089	Budget Allocated	$0.817	Budget Allocated	$1.047

Table 3-60. ROK R&D Programs

To address the deficiencies, however, the R&D focus for the upcoming epoch will continue to be on the acquisition of even better blue-water capabilities and even greater surveillance coverage capabilities and platforms started on the first epoch. The significant point to note is that the focus on DBA and R&D spending on the space and defense digitization efforts continues.

1) Defense Digitization/JC3IS Program Update

The first phase implementation of the defense digitization program was completed in 2006 and the system is now fully operational. The successful implementation of the JC3IS has thus enhanced ROK's warfighting capability as its interoperability demand now allows the three Services to be linked via internet technology, making possible for combat leaders from the army, navy and air force to share a common and integrated operational and situational picture.

2) Space Program Development Update

In this epoch, South Korea began to seek the participation of the Russians in its space program. There were several reasons. First, Russia was anxious to reassert its dominance in space technology and the measures implemented in 2001, by President Vladimir Putin[58], were starting to raise Russia's space program to eminence again beginning 2006. Second, Russia wanted to exploit the export of its space technology as a means of repayment of its ballooning debt to South Korea. Consequently, South Korea's space program was able to make quantum progress in its military satellite and nanosatellite programs. A joint R&D effort was made between Russia and South Korea to develop Korea's first indigenous spy satellite. With its own launch facilities in Woe

[58] Putin stressed the importance of international cooperation in space, which promotes Russian technology on world markets and depends trust between partners at the Millennium Summit in New York. "Putin Says Russia Must Maintain Space Prowess", Spacemart, January 30, 2001.

Narodo, South Korea finally launches two of these indigenously produced spy satellites in end 2010/early 2011. This brought the total number of spy satellites in space to four.

3) Micro-Air Sensor Network (MASN) Update

Using commercially available CCD technology, ROK has managed to integrate and produce several sensor prototypes. Through the packaging of the sensor to a super pressure balloon platform, developmental test and evaluation (DT&E) efforts thus began in earnest during this epoch.

4) Air Mine Field System (AMFS) Update

Development in the MAV platform is still progressing as ROK restructures some of its semiconductor industry to actively support the R&D efforts. The feasibility of the concept is approved and validated during simulation testing. Concurrently, R&D work into the AMFS's delivery and dispersion mechanism also began during this epoch.

h. Technology Summary

In summary, MND believes that the key enabling technologies leading to ROK's eventual successes are to be found in Microelectronic Mechanical Systems (MEMS) and Biotechnology. These two fields will support other developments in nanotechnology, artificial intelligence systems, neural networks, intensive data processing technology, and wireless internet technology. And through these technologies, ROK will be able to create and produce the micro- and unmanned weapon systems that will give it the necessary parity if not superiority in future conflicts.

Epoch Two Summary

As grotesque images of famine and severe poverty in North Korea flooded the news networks, South Korean and the US statesmen completed a plan to rescue the North. What began in epoch one as a soft landing was rapidly deteriorating into a hard landing, which is absorption of the North by the South following a total economic collapse. The ROK contributed two percent of its GDP in the form of a $10 B(US) annual aid package targeting infrastructure improvements and social programs. Although not specified by the South as a condition for the aid, the North agreed to launch comprehensive biological and chemical clean-up programs. At the same time, the "Preconditions for Unification" which were drafted earlier in the epoch called for US forces to begin withdrawing from the peninsula.

In view of the departing US military, strategic military planners recognized that critical capabilities especially in the areas of early warning and intelligence had to be enhanced. The ROK therefore focused on securing tactical early warning systems and other major improvements in current combat capabilities. Korea moved away from preparing strictly for an inter-peninsular war to building a more strategic force with new subs, destroyers, and long-range aircraft.

North Korea continued to develop its ballistic missile program by expanding its collaboration efforts with Pakistan and Iran. South Korea focused its long-term technology development needs in the areas of miniaturization, sensor fusion, and long-range targeting technologies. The initial digitization of South Korea's military was completed and the JC3IS was thus fully operational and interoperable. Initial approval for its micro-air sensor network and air mine field system were also given, leading to greater R&D efforts in these developments.

C. Epoch Three (2011-2015)

1. Strategy

a. Introduction

Epoch three is the time period from January 2011 until December 2015. Highlighted here are the significant events of this epoch.

Epoch Three Events 2011 - 2015
Declaration of unification
Unified Korean team to 2012 Olympics
Establishment of co federal council
Beginnings of inter-ministerial meetings
Merging of economies; Korean international currency
Admission to UN Council
US withdrawn to 50percent; collection of fissile materials
Increased cooperation with ASEAN and EU
Inter-Korean railway fully operational

Table 3-61. Epoch Three Significant Events

As the unification process continues, terminology within this analysis shifts from reference to North and South Korea as DPRK and ROK respectively, to K(N) and K(S) as a reflection of one country with two separate regions. North and South from this point forward are regional distinctions.

The signing of the Panmunjom Treaty marking the formal declaration of unification and an end to the longest armistice in modern history marked this epoch's dramatic beginning. The stand-up of the co federal council in the previous epoch launched this epoch's inter-ministerial meetings shaping policy for the unified nation. The United Nations invited a single Korean statesman to represent the nation. Although the US presence has shrunk to half of its 2005 size, it continued to provide a stabilizing element on the peninsula. The North offered up its fissile materials in a show of good faith and for the first time, the two Koreas fielded a single team in the 2012 Olympics.

b. Co Federal Council Acts

Epoch two witnessed the first official stage of unification beginning with the formation of a confederation and the activation of a co federal council addressing the larger policy issues in the unification of the two states. Early in this epoch, world leaders applauded the efforts of the council for removing the political boundaries to allow the merger of the two economies as well as focusing on state-supported family reunions to reconnect long separated families. Informal talks and discussions centered on foreign policy arrangements with the four powers as well as long-range defense planning by way of a joint military council.

In these final stages of unification, statesmen in the co federal council remained mostly aligned with Kim Dae Jung's "Sunshine Policy" with one exception. Instead of a federation, the council settled on a varied confederation characterized as one nation, one flag, one state, two separate systems, and two autonomous regional governments.[59] The central government is responsible for foreign relations and matters of diplomacy while regional governments administer remaining internal matters.

c. Economic Summary

The merging of the two economies signaled the unified Korea's commitment to re-establishing itself as an economic contender in world markets[60]. The intra-Korean currency chi-won (new-won) became internationally recognized and found its way onto international currency exchanges. As the two Koreas merged in significant ways, social policies were emplaced to curb massive migration to the South. While still receiving two percent of the South's GDP in aid packages, the North's economy began to show signs of life as evidenced by double-digit growth

[59] As opposed to Kim Dae Jung's Sunshine Policy Stage two calling for ONE SYSTEM as per section 3B1e of Epoch 1.

[60] Although the economies are merged, we have elected to keep growth and GDP calculations separate to illustrate relative trends.

(12 percent). Economic experts however, suggested the North's unprecedented growth is not sustainable. The South's GDP is roughly 33 times that of the North, and positive economic growth continued at 5.9 percent.

d. Military Spending Factors

During the second half of the last decade, the two Koreas were focused internally on healing the broken economy of the North and building confident relations between the two nations. As such, the North was no longer viewed as the primary threat to the former South Korea and the nation takes on a more global defensive posture, that is, a 360-degree view of the world characterized as a "Useful Porcupine," indicating the South's peaceful but guarded security intent.

This posture witnessed the four powers jockeying for positions of favor with Korea. Each has reasons beyond militarily strategic significance. China is deeply interested in the commerce implications of railway access while Russia has her eye on the Korean Peninsula's natural resources, technology transfer, and cash opportunities to the opening market. Not unlike Russia, the United States too is interested in security matters, and technology transfer, as well as trade opportunities. And Japan, still reeling from the 1990's Asian economic crisis, is fixated on trade and investments on the Korean peninsula that promise high rates of return.

Military spending in the North averaged $4.8 B(US) annually during this epoch. Almost 30 percent or nearly $1.5 B(US) of that went to force improvement. Further broken down, a third was devoted to R&D, over half to the services, and five percent to dominant battle space awareness programs. Although nearly five times more, the South's $23.2 B(US) annual defense expenditure is in comparable proportions with 30 percent to force improvement. Of the force improvement slice, 13 percent went to R&D, four percent to dominant battle space awareness projects, and the remaining 83 percent was divided among the services with 30 percent to the army, 40 percent to the navy, and 30 percent to the air force.

e. Denuclearization

Following an agreement to halt its ballistic missile sales, Korea (N) also agreed to cap its nuclear development program and surrender fissile materials in the quantity equivalent to six nuclear warheads to the IAEC as a gesture of goodwill and sincerity towards unification and the end of hostilities.

f. Unified Korean Strategy

The unified NSS is marked by a focus on the preservation of national sovereignty, independence, and protection of international trade. This translates to a shift in the NMS from borders to a regional security posture. Korea aims to be an independent and self-reliant state, protecting its major trade and capital flows since a healed economy is pivotal to the success of the country.

The NMS is an outward looking posture characterized as 360-degree defensive coverage with protection of the sea lines of communications vital to its survival. Finally, the nation will capitalize on available technology transfers from the United States, China and Russia.

2. National Defense

South Korea’s defense planning during the past ten years centered on how to deter and defend the South against the North’s formidable military threat. With the declaration of unification and end of hostilities in 2011, Seoul and Pyongyang can now afford to adopt a 360-degree outward looking posture in anticipation of a completely unified Korea.

a. South Korea’s Force Improvement Plans

The ministry of defense looked beyond the immediate Korean (N) threat toward the development of operational capabilities relevant to contingencies that a unified Korea Might encounter in defending itself and it’s interests. This is evident in a notable increase in naval and air capabilities in the past five years. The vibrant economic growth has allowed the continued allocation of reasonable amounts to defense. Together with force modernization, Korea (S) aspires to take a more important role in defense as a result of the reduction of US forces in the peninsula. Korea recognizes that it has to take the leading role in defending the homeland, while awaiting external intervention from the international observers. To create a high-quality military force, Seoul and Pyongyang are restructuring with an emphasis on the creation of forces suitable for the information age. Korea (S) is transforming its labor-intensive force structure into technology-intensive in an effort to meet requirements stemming from information warfare. Ground forces stress the importance of improving strategic and tactical intelligence to high-speed, air-land battle capabilities. The navy focused on improving joint operation capabilities in extension to its blue-water concept. The air force concentrated on improving combat capabilities and early warning. In anticipation of future unification, the force structure also underwent a change from a ground-centered to a more balanced force structure among the three services. This is because a ground-centered force structure alone cannot effectively attain defense goals against future military threats. Korea (S) intends to advance its information warfare capabilities with three principles in mind: find the enemy first, make a quicker decision, and attack the enemy before the enemy attacks. In this regard, early modernization of command, control, communications, computer, and information (C4I) projects take priority. Although South Korea has relied on the Combined Forces Command (CFC) for informational warfare technology, it now has systems to advance its self-reliant surveillance, early warning, and electronic combat capabilities as a part of the force improvement programs.

1) Army

The mission is to deter any possible overland invasion and prevent coastal landings. FIP priorities focus on transforming the army into one that is lean and mean. This is achieved through decommissioning of outdated equipment and replacing them with those that provide more lethality and requires lesser effort to maintain. The army will continue to modernize so as to take out the enemy early. Should deterrence fail, the army must be to be able to secure a swift and decisive victory.

a) Major Acquisition / Upgrades

Along with the move towards the end of hostilities between the two Koreas, a further personnel reduction of 30 percent was seen in the North with the decommissioning of fifteen more active divisions leaving it at 50 divisions strong. Older generations of T-54 battle tanks and equivalent combat inventory were retired. New Russian T-80 main battle tanks, attack helicopters and surface-to-air missiles were purchased. In the South, the army continues to invest in the locally produced Type 88 (K-1) main battle tanks and KAH-66 “Comanche” helicopters so as to enhance strike lethality. The resulting force structure for the army in the year 2015 is as shown below:

Combat System	2011	Procurement	Demobilization	2015
Active Divisions	23	-	-	23
Personnel (thousands)	560	-	-	560
Reserve Divisions	23	-	-	23
MBT	2100	100	100	2100
APC / AIFV	2500	100	100	2500
Attack Helicopters	123	96	-	218
Gun Artillery	4300	-	250	4050
Rocket Artillery	180	-	-	180
Surface-to-Surface Missiles	12	-	-	12
Air Defense Artillery	600	-	-	600
Surface-to-Air Missiles	978	48	50	976

Table 3-62. Korea (S) Army Force Structure 2015

Combat System	2011	Procurement	Demobilization	2015
Active Divisions	65	-	15	50
Personnel (thousands)	813	-	206	607
Reserve Divisions	32	-	15	17
MBTs	2,800	100	700	2,200
APCs / AIFV	2,000	40	500	1,540
Attack Helicopters	40	24	40	24
Gun Artillery	7,325		875	6,450
Rocket Artillery	2,000	-	300	1,700
Surface-to-Surface Missiles	55	-	-	55
Air Defense Artillery	4,250	-	1750	2,500
Surface-to-Air Missiles	3,000	48	2500	548

Table 3-62. Korea (N) Army Force Structure 2015

2) Navy

The navy's priorities fall essentially on the protection of vital sea lines of communications. The North actively retired ships greater than 35 years of age and leverage on its political friendship with Russia and China for technology transfers and weapons upgrades to its coastal patrol crafts and FFGs. This manifested the early stages with missile and torpedoes upgrades. In the South, the dream of having a navy capable of sea control and protection of critical sea lines of communications is in its infant stage. Korea (S) set a 12-mile zone of territorial sea and fielded an upgraded sea patrol to protect the territorial sea and sea-lanes of communication. The long-term goal is to be able to effectively retain control of territorial waters in the East Sea and the Korean Straits where the major ports are located. In the event of a naval blockade, the navy must be able to ensure the safe passage of commercial shipping through the waters, up to at least 600 nautical miles into the South China Sea. Information dominance and the ability to conduct aggressive underwater operations are vital so as to keep any aggressor at bay.

a) Major Acquisition / Upgrades

Decommissioning continued in the North beginning with the huge inventory of coastal patrol crafts and amphibious ships. Upgrading work was performed on 10 of the fleet of 21 Romeo submarines with the addition of new Russian torpedoes and weapon systems. In the South, additional German Type 214 submarines were built and equipped. Improved versions of the KDX destroyers are also configured to include the SM-3 surface-to-air missiles and extended range SS-N-21 surface-to-surface missile[61]. This boosted the destroyer and submarine fleet to 15 and 19 respectively. Improved maritime surveillance aircraft P-3X were also added to enhance situational awareness.

b) Shkval / 'Squall' Torpedoes[62]

The major addition to the navy's inventory includes the introduction of the Russian-made Shkval torpedoes. Fired from standard 533mm torpedo tubes, Shkval

[61] Refer to Annex 3D3 for detailed description of SS-N-21 "Samson."
[62] Details of the Shkval Torpedoes are excerpts from the Federation of American Scientist.

has a range of about 7,500 yards. This weapon clears the tube at fifty knots, upon which its rocket fires, propelling the missile through the water at 360 km/h [about 100 m/sec / 230 mph / 200-knots], three or four times as fast as conventional torpedoes. The solid-rocket propelled "torpedo" achieves high speeds by producing a high-pressure stream of bubbles from its nose and skin, which coats the torpedo in a thin layer of gas and forms a local "envelope" of supercavitating bubbles. Carrying a possible nuclear warhead initiated by a timer, it would destroy any hostile submarine. The Shkval high-speed underwater missile is guided by an autopilot rather than by a homing head as on most torpedoes. Since there were no evident countermeasures to such a weapon, its employment could put adversary naval forces at a considerable disadvantage. One such scenario is a rapid attack situation wherein a sudden detection of a threat submarine is made, perhaps at relatively short range, requiring an immediate response to achieve weapon on target and to ensure survival.

c) SM-3 Upgrade

The K (S) Navy's Theater Wide (NTW) TBMD or `upper tier' is planned to provide the new improved version of the KDX destroyers with vertical launch SM-3s to meet longer-range ballistic missile threats. The SM-3 replaces the conventional warhead with a Lightweight Exo-Atmospheric Projectile (LEAP) kinetic warhead (formerly kinetic kill vehicle (KKV)) and a dual-pulse third-stage rocket motor. The kinetic warhead weighs 18.2 kg and is ejected from the missile and then accelerates to an intercept velocity reported at 4,000 m/s. There are separate Solid Divert and Attitude Control System (SDACS) for lateral movement that enable the kinetic warhead to strike the target's warhead with sufficient kinetic energy that even a grazing hit will ensure destruction. Acquisition and aim-point selection is performed by means of an IR seeker with a tracking accuracy measured in micro radians and employing a 256 x 256 element focal plane array in the long-range band. The SM-3 is 6.55m long with a diameter of 34.8cm (the booster having a diameter of 53.3 cm) and weighs 1,501 kg. The resulting force structure for the navy in the year 2015 is as shown below:

Combat System	2011	Procurement	Demobilization	2015
Maritime Patrol	20	8	-	28
Submarines	12	3	-	15
Destroyer	13	6	-	19
Frigates	6	-	6	0
Coastal Patrol	113	3	4	112
Amphibious	33	-	-	33
Mine Warfare	12	-	-	12

Table 3-63. Korea (S) Navy Structure 2015

Combat System	2011	Procurement	Demobilization	2015
Maritime Patrol	12	-	-	12
Submarines	23	2	11	14
Destroyer	-	-	-	-
Frigates	3	-	1	2
Coastal Patrol	448	-	107	341
Amphibious	266	-	43	223
Mine Warfare	24	-	-	24

Table 3-64. Korea (N) Navy Structure 2015

3) Air Force

The air force’s mission lies in defending Korea through control and exploitation of air and space. In the North, air force modernization revolved around replacing and upgrading the aging equipment. In the South, the air force brought three core competencies to the fight: air, space and information superiority so as to maintain the tactical advantage in offensive and defensive counter air operations; agile combat support aircraft to extend the combat radius with longer loiter time over the target; and finally to possess the ability to deliver more lethal and accurate weapon systems autonomously.

a) Major Acquisition / Upgrades

In the North, the old MIG 17, 19 and 21 fighters and ground attack Su-7 and Su-25 aircraft were retired. New unmanned aerial vehicles were introduced for surveillance and possible offensive actions. Older generation trainer and transport aircraft were also replaced. In the South, with the delivery of the new FX fighters, old F-5E aircraft were decommissioned together with the F-4 and F-5 reconnaissance aircraft. Significant in this epoch is the introduction of KC-X (Variant) air-to-air refueling tanker that extended the range of air force operations.

b) FX Fighters

The FX is the air force's top long-term modernization priority. It is a truly revolutionary aircraft, a national asset that will allow military commanders to dominate friendly and enemy airspace early in a conflict. Over the last decade, other nations have introduced a number of aircraft that are approximately equal or even superior to the F-16 in many respects. This includes the Japanese version of the F-22. Foreign air-to-air missiles are improving, and some are as good or better than the Korean equivalents. Advanced surface-to-air missiles are improving and proliferating. Conceptually, the FX will meet and defeat these threats well into the future.

The FX will use a synergistic combination of stealth, super cruise (non-stealthy flying at supersonic speeds at military power), and advanced integrated avionics to achieve a level of technological and battlefield superiority unknown in previous years. Stealth will limit the range at which enemy radars can detect the FX, and disrupt enemy air defense through all phases of an engagement. Super cruise flight further reduces enemy reaction time and will allow the pilot to fly at supersonic speeds efficiently, increasing his time on station, range, combat radius, and effective weapons range. Advanced avionics, through a combination of on- and off-board sensors and integrated displays, will provide the FX pilot a comprehensive picture of the battlespace, identifying ground and air threats and friendly forces. The pilot will be able to avoid enemy threats, and position his aircraft optimally for the coming battle.

The FX will also have a ground attack capability. It will carry Joint Direct Attack Munition (JDAM) variant and Joint Stand-off Weapon (JSOW) equivalent that will allow it to strike targets with great accuracy, night or day, and in adverse weather. In combination, these new enabling technologies will allow the FX pilot to detect and destroy ground and air threats long before the FX is detected. It will be able to do this on the first day of conflict, over heavily defended enemy airspace, fighting with far fewer support assets than other fighters. In doing so, it will enable faster, safer deployment of naval and ground forces. And it will allow Korean interdiction aircraft to more effectively attack enemy forces, infrastructure, and key military targets such as chemical, biological, and nuclear weapons sites and production facilities. It will also protect key surveillance, reconnaissance, and ballistic missile defense assets that must loiter near the theater to be effective. The FX will be designed to carry with it the advantages of ease of maintenance, high reliability, reduced airlift support requirements (half that of the F-16), and higher sortie rates (at least twice that of the

F-16). Each of these factors is a combat multiplier in itself, freeing critically needed air force assets to be used for other tasks.

Combat System	2010	Procurement	Demobilization	2015
Fighter	370	55	100	325
Ground Attack	60	100	-	160
Bomber	-	-	-	-
AEW / ESM	3	6	-	9
ASW / Patrol	8	-	-	8
Reconnaissance /UAV	138	40	28	150
Air Refueling	-	5	-	5
Trainer A/C	306	40	-	346
Transport	12	50	-	62

Table 3-65. Korea (S) Air Force Structure 2015

Combat System	2010	Procurement	Demobilization	2015
Fighter	241	-	-	241
Ground Attack	321	-	107	214
Bomber	80	-	-	80
AEW / ESM	-	-	-	-
ASW / Patrol	-	-	-	-
Reconnaissance /UAV	-	10	-	10
Air Refueling	-	-	-	-
Trainer A/C	263	30	98	195
Transport	304	4	190	118

Table 3-66. Korea (N) Air Force Structure 2015

b. Strategic Weapons Development.

1) Nuclear

To reaffirm its sincerity towards a peaceful process of integration with the South and the rest of the world, the North agrees to give up an amount of weapons grade plutonium equivalent to six warheads to a UN inspection team during meetings with the International Atomic Energy Agency (IAEA). Should the need arise, with the existing infrastructure, ballistic missile building capability, and the expertise of a future combined nuclear development team, Korea possesses the capability to assemble nuclear weapons with considerable ease; especially with the aid of countries like France, Russia and even the Chinese in uranium refining.

2) Ballistic Missiles

Ballistic missile program remains a top priority. Russian-made SS-n-21 Scarab short-range ballistic missile and their TELs had been shipped from Syria to Korea (N) for reverse engineering. This has provided Korea (N) with guidance and solid-propellant motor technologies that significantly improve the performance of the short-range missile. The development of Daepo-dong 2 rockets as part of the ongoing project to achieve a satellite launch capability continues to receive top priority. The satellite is said to be part of an ongoing project aimed at promoting scientific research and peaceful use of outer space. The Daepo-dong rockets are deemed to be fully operational. Full-scale production is on the way with the inventory stacking up to approximately 160 pieces each.

Combat Systems	Range (km)	2010	Add	Minus	2015
Scud B	300	100	-	-	100
HwaSong 5	330	150	-	-	150
HwaSong 6	500	250	-	-	250
Ro-dong 1 / 2	1,300	80	40	-	120
Daepo-dong 1	2,000	75	30	-	105
Daepo-dong 2	6,000	25	30	-	55
KSR-1	180	25	50		25
Hyon Mu	300	-	25	-	25

Table 3-67. Korea (N) and (S) Ballistic Missile Structure

3. Net Assessment

a. Scenario One: Korea (N) vs. Korea (S)

Scenario One is an overland invasion by North Korea (K(N)) against the South Korean (K(S)) forces and remainder of US Forces Korea. While we believe that this scenario may not be entirely plausible, it serves as a final examination and validation of the South Korean procurement process through 2015.

1) Orders Of Battle (K(N) vs. CFC)

For the OOB (Order of Battle) comparison, see annex 3D2. Korea (N) has demobilized an additional 20 percent of the army, US Forces in Korea have withdrawn to fifty percent of their original year 2000 strength and Korea (S) has begun to field an extremely modernized force in each of the three services.

2) Scenario Description

While both K(S) and K(N) remain fully engaged by unification issues, there is an attempt by hard-line loyalist remnants of the Kim Jung Il regime that secretly organize and initiate a *coup d' tat*. This movement is significant enough to gain control of the K(N) armed forces that subsequently launch a full scale invasion of K(S) in an attempt to takeover the Blue House in Seoul, facilitating K(N)'s desire to become the senior partner in the unification process and ultimately perpetuate a socialist state. The North agreed with the PRC that although China would not support an unprovoked attack on the South, it would take measures to ensure that the North would not get "steamrolled" in any subsequent South Korean counteroffensive. This allowed the coup to proceed with a Northern assumption of status quo *ante bellum*. As a deterrent to PRC involvement and to reinforce fully participative USFK personnel, the 7th Fleet Battle Group and the 3rd US Marine Division were enroute at the onset of hostilities.

3) Objectives

The objectives of this unprovoked and surprising attack include the occupation of the “Blue House” in Seoul to install a government sympathetic to loyalist beliefs. The coup and subsequent military action are characterized by swift and decisive movement on the part of the K(N) with the element of surprise being vital. The strategy includes an overland invasion accompanied by SOF insertion and heavy missile and artillery attacks against Korean (S) centers of gravity.

4) Committed Forces Comparison

Although we believe that the loyalist faction could not garner the support of the entire military in a coup such as this, we have committed 100percent of Korean (N) forces to the conflict in order to validate the “worst case” boundary of the conflict scope and spectrum. Based upon their proximity to the action, remaining USFK and 100percent of the Korean (S) forces are committed. The USFK and K(S) personnel make up the Combined Forces Command (CFC).

a) Army

For the Armies involved there is near parity in personnel, SAMs and MBT’s. North Korea has an advantage in ADA, SSM, and rocket artillery. The CFC has an advantage in AH, AIFV’s, and APC’s categories.

Combat System	K (N)	K (N) Committed	CFC Committed	CFC
Active Divisions	50	50	23	23
# Personnel (K)	617K	617K	573K	573K
Reserve Divisions	17	17	23	23
MBTs	2200	2200	2370	2370
APC / AIFV	1500	1500	2590	2590
AH	78	78	182	182
Gun Artillery	6450	6450	4065	4065
Rocket Artillery	1700	1700	195	195
SSM	55	55	12	12
ADA	5500	5500	600	600
SAM	1006	1006	1018	1018

Table 3-68. Scenario one Army Committed Forces

b) Navy

For the navies involved, there is now near parity in submarines. Korea (N) has numerical advantage in patrol boats, amphibious vehicles and mine warfare assets. Korea (S) has a distinctive advantage in maritime patrol aircraft, and destroyers.

Combat System	K (N)	K (N) Committed	CFC Committed	CFC
Maritime Patrol	12	12	28	28
Submarines	18	18	15	15
Destroyers	--	--	19	19
Frigates	3	3	--	--
Coastal Patrol	341	341	115	115
Amphibious	223	223	33	33
Mine warfare	24	24	15	15

Table 3-69. Scenario one Navy Committed Forces

c) Air Force

The air forces show near quantitative parity when aggregating fighter, ground attack and bomber aircraft categories. There is a definite numerical advantage for the Korean (S) Air Force with respect to fighter, AEW, reconnaissance, aerial refueling aircraft and UAV platforms, which collectively offer a distinct warfighting advantage with respect to firepower and mobility.

Combat System	K (N)	K (N) Committed	K (S) Committed	K (S)
Fighter	201	201	355	355
Ground Attack	214	214	169	169
Bomber	40	40	--	--
Air Refueling	--	--	5	5
AEW / ESM	--	--	9	9
Recce / UAV	10	10	151	151
Trainer A/C	195	195	346	346
Transport	118	118	66	66

Table 3-70. Scenario one Committed Air Forces

5) Results

The results conclude that the K(S) Army experienced heavy casualties from a massed infantry battle of annihilation. Superiority on the ground was assured with supporting air and DBA assets. K(N) SOF units continued to impact K(S) command and control functions, synchronization and the conduct of joint operations. The South enjoyed a defenders advantage. Sustainability was not on the side of K(N). Korean (S) maritime patrol aircraft and destroyer advantages negated North Korean quantitative advantage in amphibious craft and patrol boats. The K(S) Air Force (with USFK) showed a definite numerical advantage with respect to fighter, AEW, reconnaissance, air refueling aircraft and UAV platforms, which collectively contributed to superior mobility and firepower.

6) Conclusion

The bottom line is not much has changed since 2001. Korea (N) has demobilized an additional 20 percent of the Army, or nearly 40 percent since 2001. With this demobilization, the withdrawal of 50 percent of original US combat personnel and with continued force modernization; Korea (S) is assured air, land, littoral, and at least regional sea supremacy. Land victory is aided by supporting air assets and DBA. However, casualties will be high.

Although some may argue the plausibility of this scenario, it serves to validate the strengths of a retrospectively inward looking national and military security strategy that established the requirements and procured the forces of today (2015). Although not much has changed with respect to the outcome of an unprovoked invasion by the North, we are confident that the Korean (S) military can defend against such aggression and deliver a *coup de gras* to those instigating a conflict in scope similar to this.

b. Scenario Two: PRC vs. Korea

Scenario Two is a hypothetical invasion on a limited scale by the PRC against a unified Korean force. The war is limited in the sense that PRC is not mounting a full-scale unlimited war. An unlimited war is characterized by mobilization of the entire arsenal to include military force, reserves, and economy to support the war effort.

The purpose of this scenario is to illustrate military capabilities and highlight deficiencies of a now outwardly looking and unified Korean force structure when confronted with military aggression by China. Some assumptions include that USFK (all combat forces) are now completely withdrawn, and the US 7th Fleet and 3rd US Marine Division are enroute at the outbreak of hostilities. There is an overwhelming potential for escalation of this conflict. The scenario is similar to the circumstances that characterized the 1950 Korean War.

1) Orders of Battle

What does China bring to the fight? Listed below is their complete combat capability beginning with the PRC Army, then Navy and finally the Air Force. Noteworthy is the significant modernization and accompanying demobilization of combat aircraft since the previous epochs.

Combat System	PRC	Korea	K(S)	K(N)
Active Divisions	44	73	23	50
# Personnel (K)	1690	1167	560	607
Reserve Divisions	80	40	23	17
MBT	6750	4500	2300	2200
APC / AIFV	9060	4000	2500	1500
AH	500	224	146	78
Gun Artillery	14500	10500	4050	6450
Rocket Artillery	3800	1880	180	1700
SSM	55	67	12	55
ADA	15000	6100	600	5500
SAM	3000+	2024	1018	1006

Table 3-71. Scenario Two Army Forces

Combat System	PRC	Korea	K(S)	K(N)
Maritime Patrol	30	40	28	12
Submarines	63	33	15	18
Destroyers	36	19	19	--
Frigates	52	3	--	3
Coastal Patrol	229	451	115	336
Amphibious	109	256	33	223
Mine warfare	83	39	15	24

Table 3-72. Scenario Two Navy Forces

Combat System	PRC	Korea	K(S)	K(N)
Fighters	1080	523	325	201
Ground Attack	--	272	60	212
Bombers	50	40	--	40
Air Refueling	13	5	5	--
AEW / ESM	15	9	9	--
Recce / UAV	80	160	150	10
Trainer A/C	--	546	346	200
Transport	200	180	62	118

Table 3-73. Scenario Two Air Forces

2) Objectives

The overall objective of the PRC is occupation of the Korean peninsula and control of the vital SLOC's. The military strategy includes a land invasion across the Yalu River and the northern border that extends for over 1450 km. This runs concurrent with a naval blockade by the Chinese eastern fleet extending from the littoral areas of the Yellow Sea and East China Sea eastward to Japanese territorial waters and southward from the Korean peninsula near Cheju-do Island to approximately 350 km north of Taiwan. This area covers nearly 50,000 sq km and interdicts 80 percent of the Korean SLOC and maritime trade routes. Additionally, China will attempt to gain and maintain air superiority in support of the invasion and naval blockade. Note that the East Sea is not a primary attack route and operations in this area would be challenged by the US.

Figure 3-2. Scenario Two Naval Blockade

3) Committed Forces Comparison

Based upon the non-proximity of the entire Chinese order of battle to the Korean Peninsular, only a percentage will participate. We have committed 50 percent of the PRC Air Force to OCA and Interdiction missions. Nearly 67 percent of the PRC Army is committed to occupation and penetration of Korean territory. Finally, 33 percent of the PRC Navy is committed to SLOC interdiction and littoral presence in the Yellow and East China seas. The PRC will not use WMD in this scenario. However, as will be seen, there is a significant capability with respect to cruise and ballistic missiles.

a) Army

Again, with 67 percent of the PRC Army and 100 percent of Korean forces committed, the overall numbers show a credible Korean capability and near parity in most areas. PRC shows a numerical advantage in the AH, APC, AIFV and ADA categories.

Combat System	PRC	PRC Committed	Korea Committed	Korea
Active Divisions	44	29	73	73
# Personnel (k)	1690	1115	1167	1167
Reserve Divisions	80	26	40	40
MBTs	6750	4455	4500	4500
APC / AIFV	9060	5980	4000	4000
AH	500	330	224	224
Gun Artillery	14500	9570	10500	10500
Rocket Artillery	3800	2508	1880	1880
SSM	55	36	67	67
ADA	15000	9900	6100	6100
SAM	3000+	1980+	2024	2024

Table 3-74. Scenario two Army Committed Forces

b) Navy

The Korean Navy shows an advantage in maritime patrol aircraft, patrol boats, amphibious and mine warfare assets. Aggregation of the frigate and destroyer categories yields near parity.

Combat System	PRC	PRC Committed	Korea Committed	Korea
Maritime Patrol	30	10	40	40
Submarines	63	21	33	33
Destroyers	36	12	19	19
Frigates	52	17	3	3
Coastal Patrol	229	76	451	451
Amphibious	109	36	256	256
Mine warfare	83	27	39	39

Table 3-75. Scenario two Navy Committed Forces

c) Air Force

The air forces show a distinctive advantage in favor of the Koreans, especially in the ground attack role. Parity in fighter aircraft is assumed as both forces have modern and technologically advanced forces.

Combat System	PRC	PRC Committed	Korea Committed	Korea
Fighters	1080	540	526	526
Ground Attack	-	-	272	272
Bombers	50	25	40	40
Air Refueling	13	7	5	5
AEW / ESM	15	8	9	9
Recce / UAV	80	40	160	160
Trainer A/C	-	-	546	546
Transport	200	100	180	180

Table 3-76. Scenario two Committed Air Forces

d) Cruise/Ballistic Missiles

The findings of a comparison of cruise and ballistic missile capabilities illustrate a distinctive mismatch of arrayed and committed missiles that can negate any apparent advantage of the Korean force structure.

Combat System	Range	PRC	Korea
Ballistic Missiles	Short	1125	700
	Medium	90	195
	Intermediate	32	75
Cruise Missiles	Land Attack	7800	-
	Anti-Surface	7640	-

Table 3-77. Scenario Two Committed Ballistic Missile Forces

4) Results

The general results indicate that both armies takes heavy casualties, the naval blockade is somewhat effective in interdicting the SLOC's, and while air assets are formidable once airborne, peninsular aircraft remain at risk from cruise missile attacks while on the ground. This mismatch in the area of cruise and ballistic missiles illustrates a war winning capability for the PRC and an obvious offensive deficiency and defensive vulnerability for Korea.

5) Conclusions

The military deficiencies highlighted by this assessment include lack of an offensive long-range precision strike capability with cruise missiles, general ballistic missile defense and the detection and engagement of enemy cruise missiles. Any conflict with the PRC will be prolonged, protracted, and bloody. Korea remains a "Useful Porcupine." The PRC, if they chose an aggressive course of action similar to this scenario would find that absent offensive cruise and ballistic missile capabilities, their fielded military forces would be challenged. Additionally, the significant level of effort both militarily and in the global political realm may deter Chinese aggression. The debilitating effects on the infrastructure and eventually the economy are grave.

c. Net Assessment Conclusions

In general, this assessment allowed us to turn our focus outward as a unified country and fighting force as we proceed forward with the unification. It highlighted specific and serious deficiencies in the area of ballistic and cruise missiles while concurrently validating our credibility as a total force with capabilities on land, sea, and in the air. It also highlights the question regarding ballistic and cruise missiles: How do we catch up? Some may suggest pursuit of technologies and programs to mitigate the cruise and ballistic missile threat, while others may argue for pursuit of an alternative deterrent. This ultimately allows us to focus our efforts in epoch four (2016-2020) towards posturing our forces with capabilities to support security for a unified and sovereign Korea.

4. Technology Development for Korea (N) and Korea (S)

a. Korea (N) Technology Focus

1) Goals and Strategy for Defense Technology

At the end of 2015, Korea (N)'s technological goals continue to focus on its philosophy of *juche*, and to enhance its BM and SOF capabilities. Nothing much has changed except that the North's modernization effort has now shifted towards the reverse engineering of modern Russian weapons of the 1990s.

2) Defense R&D Budget

Maintaining the budget allocations defined in earlier epochs, the tables below summarize the epoch three defense and R&D budget breakdowns.

	GDP	Defense Budget	O&M	FIP
%GDP	100.0%	27.0%	18.9%	8.1%
%Def Bud	-	100.0%	70.0%	30.0%
%Growth	12.0%			
Year	US$ Bil	US$ Bil	US$ Bil	US$ Bil
2011	15.534	4.194	2.936	1.258
2012	17.398	4.697	3.288	1.409
2013	19.486	5.261	3.683	1.578
2014	21.824	5.892	4.125	1.768
2015	24.443	6.600	4.620	1.980
Total	98.684	26.645	18.651	7.993
Average	19.737	5.329	3.730	1.599

Table 3-78. Korea (N) Defense Budget Breakdown

	Army	Navy	Air Force	DBA	R&D
%GDP	4.1%	1.6%	2.4%	0.4%	2.8%
%Def Bud	9.0%	3.6%	5.4%	1.5%	10.5%
Year	US$ Bil	US$ Bil	US$ Bil	US$ Bil	US$ Bil
2011	$0.629	$0.151	$0.226	$0.063	$0.440
2012	$0.705	$0.169	$0.254	$0.070	$0.493
2013	$0.789	$0.189	$0.284	$0.079	$0.552
2014	$0.884	$0.212	$0.318	$0.088	$0.619
2015	$0.990	$0.238	$0.356	$0.099	$0.693
Total	$3.997	$0.959	$1.439	$0.400	$2.798
Average	$0.799	$0.192	$0.288	$0.080	$0.560

Table 3-79. Korea (N) FIP Budget Breakdown

	R&D	BM/Nuclear Program	SOF Program	Reverse Engineering	Others
%GDP	2.8%	2.0%	0.4%	0.3%	0.1%
%Def Bud	10.5%	7.4%	1.6%	1.1%	0.5%
Year	US$ Bil	US$ Bil	US$ Bil	US$ Bil	US$ Bil
2011	$0.440	$0.308	$0.066	$0.044	$0.022
2012	$0.493	$0.345	$0.074	$0.049	$0.025
2013	$0.552	$0.387	$0.083	$0.055	$0.028
2014	$0.619	$0.433	$0.093	$0.062	$0.031
2015	$0.693	$0.485	$0.104	$0.069	$0.035
Total	$2.798	$1.958	$0.420	0.280	0.140
Average	$0.560	0.39	0.08	0.056	0.028

Table 3-80. Korea (N) R&D Budget Breakdown

b. Korea (N)'s Technology Investments

As in epoch two, nothing much has changed with its industrial base, other than the North's economic growth has allowed dormant factories to be rebuilt, reopened and operated. This has subsequently led to an increase in its rate of production of weapons. Its technology investments continue to focus heavily on BM and SOF capability acquisitions.

c. Korea (N)'s R&D Program

The most significant event is that Korea (N) finally attains a credible BM capability at the end of 2015. Its collusion with Iran and Pakistan (and still unconfirmed Israel) has built a strong exchange such that the three countries have decided to embark on the development of a new generation of BM that is MIRV-capable, with even greater range and more accuracy. As part of the reunification process, an infant reunified Korea had declared the ending of its known nuclear weapons program. Consequently, Korea (N)'s next generation BM R&D only focuses on enhancing its range and accuracy for the delivery of conventional warheads.

Indigenous R&D and Production	Joint R&D and Production
Tanks	Next Generation BM (Iran, Pakistan, Israel)
Artillery	
Armored Vehicles	
Small Naval Craft	
Small Arms	
Satellite	
BM	

Table 3-81. Korea (N) Defense Systems Acquisition Method Summary

d. Korea (S)'s Technology Focus

1) Goals and Strategy for Defense Technology

Korea (S)'s stated technological goals remain unchanged from earlier epochs. Its intention to be a "Useful Porcupine" has however prompted a greater focus in increasing the lethality and combat power of its forces, as the march towards an information- and technology-centered force continued. This shift in emphasis was reflected in the priorities for the various services. Foremost priority for the K(S) Navy was the acquisition of an enhanced strike capability. The K(S) Air Force also shared a similar priority for precision strike. The K(S) Army's emphasis lay in the acquisition of ground strike and tactical situational awareness capabilities. From Korea (S)'s DBA requirements, MND maintains its need for early warning surveillance and identification systems.

2) Defense R&D Budget

	GDP	Defense Budget	O&M	FIP
%GDP	100.0%	3.5%	2.5%	1.1%
%Def Bud	-	100.0%	70.0%	30.0%
%Growth	5.9%			
Year	US$ Bil	US$ Bil	US$ Bil	US$ Bil
2011	590.338	20.662	14.463	6.199
2012	625.168	21.881	15.317	6.564
2013	662.053	23.172	16.220	6.952
2014	701.114	24.539	17.177	7.362
2015	742.480	25.987	18.191	7.796
Total	3,321.154	116.240	81.368	34.872
Average	664.231	23.248	16.274	6.974

Table 3-82. Korea (S) Defense Budget Breakdown

	Army	Navy	Air Force	DBA	R&D
%GDP	4.1%	1.6%	2.4%	0.4%	2.8%
%Def Bud	9.0%	3.6%	5.4%	1.5%	10.5%
Year	US$ Bil	US$ Bil	US$ Bil	US$ Bil	US$ Bil
2011	$1.159	$1.545	$1.159	$0.186	$0.605
2012	$1.227	$1.636	$1.227	$0.197	$0.641
2013	$1.300	$1.733	$1.300	$0.209	$0.678
2014	$1.376	$1.835	$1.376	$0.221	$0.719
2015	$1.457	$1.943	$1.457	$0.234	$0.761
Total	$6.519	$8.692	$6.519	$1.047	$3.404
Average	$1.304	$1.738	$1.304	$0.209	$0.681

Table 3-83. Korea (S) FIP Budget Breakdown

	FDP (80% of R&D)			ADD (20% of R&D)				
	Army	Navy	AF	EO	MW	AC	UWA	WS
% R&D Budget	24.0	32.0	24.0	5.5	5.9	6.1	1.6	1.0
Year	US$ bil	US$ bil	US$ bil	US$ bil	US$ bil	US$ bil	US$ bil	US$ bil
2011	0.193	0.258	0.193	0.045	0.047	0.049	0.013	0.008
2012	0.205	0.273	0.205	0.047	0.050	0.052	0.014	0.008
2013	0.217	0.289	0.217	0.050	0.053	0.055	0.014	0.009
2014	0.230	0.306	0.230	0.053	0.056	0.058	0.015	0.009
2015	0.243	0.324	0.243	0.056	0.060	0.061	0.016	0.010
Total	1.088	1.451	1.088	0.250	0.266	0.275	0.072	0.043
Average	0.218	0.290	0.218	0.050	0.053	0.055	0.014	0.009

Table 3-84. Korea (S) R&D Budget Breakdown

e. Korea (S)'s Technology Investments

1) National Defense Plan

To embark on solutions for the vulnerabilities in epoch two, Korea (S)'s investment decisions from the second epoch resulted in the following new systems coming on line are summarized in the table below:

Capability/ Purpose	2011-2015	
	Direction	Items to procure
Information & Command/ DBA	Miniature space communications, warning & surveillance systems Self-command systems Defense Digitization	10 Aerostats / 10 Microsats 2 spy satellite 10 Micro spy sats Joint C3I system GBR
Strategic Strike	Long range ballistic delivery capability <500 km	KSR-1
Ground Operations	Improved lethality, agility Tactical situational awareness	AH-X SAM-X Q37-type radar Multi-sensor array
Naval Control	Improved C4ISR system Strategic control of SLOCs Improve ship building capacity Enhanced defensive/offensive combat capability	8 P-3X / 3 Type 214 4 KDX-III / 2 KDX-X SAMs / Torpedoes
Air Operations	Advanced air combat Enhanced AEW Precision strike	100 A-50 / 50 FX 5 UCAV / 40 KT-2 4 AEW / 50 C-130 5 KC-xxx / 2 JSTARSx 40 UAV / 50 Harm Blk 6 100 AA-X ERAAM 100 AIM-9X 50 JSOW / 50 JDAM

Table 3-85. Korea (S)'s Weapon Systems Acquisition

Korea (S)'s acquisition of AWACS and tankers has given the K(S) Air Force an enhanced air situational awareness and a new air refueling capability. Operationally, this translates to either increased hang time over an engagement or increased range at which the South can project its air influence.

For the K(S) Navy, the addition of KDX-IIIs and the new generation KDX-X destroyers reflect the attention to address its blue-water naval deficiency. Together with the acquisitions of submarines and P-3Xs, the Korea (S) Navy of 2015 does pack sufficient punch and a situational awareness capability. Similarly for the Korea (S) Army, the country has also focused on improving its lethality and agility and tactical situational awareness.

2) Existing Capabilities

At end 2015, Korea (S)'s aircraft industry has matured giving it the ability to indigenously design and build the next generation of advanced combat fighters. This capability, however, has been a long and arduous path, with the experience gained through its licensed production experiences with the KFX and FX programs. Additionally, the South's industrial base can now support the indigenous design and construction of conventional 1800-ton submarines, a new generation of tanks and artillery, and utility/scout helicopters. The country has also acquired the capacity to perform its own indigenous production of advanced attack helicopters.

The defense industry base has also embarked on the joint R&D and production of the second generation of satellites and micro-/nano-satellites as well as High Altitude and Endurance Unmanned Aerial Vehicles (HAE UAVs), both for communications and surveillance purposes. MEMS and miniaturization technological advances have also resulted in numerous breakthroughs for our joint R&D on the MASN and AMFS concepts.

Reiterating that missile production is neither economical nor supportable by the South's technological infrastructure, Korea (S) will continue to depend on external allies for supplying its missiles. The country has, however, already negotiated for existing agreements to allow for the licensed production of SAMs, AAMs, and ASMs. Korea (S) begins its quest to attain full self-sufficiency in its defense production capability to perform R&D and production of weapon platforms and systems.

Indigenous R&D and Production	Joint R&D and Production	Licensed Production	Import
Major Surface Ships	Comms Satellite (2d Gen)	Torpedo (Squall)	BMD
Minor Surface Ships	Spy Satellite (2d Gen)	Attack Helo	SAM
Submarines	Attack Helicopter (KAH)	(AH-64)	AAM
Combat Aircraft	Tanks / Aerostat	SAM	ASM
(FX)	HAE UAV / UCAV	AAM	Radars
Trainer Aircraft	Micro Air Vehicle	ASM	AWACS
Helicopter(KHX)	UUV	Maritime	
Tanks	BMD	Surveillance (P3)	
Armored Vehicles			
Artillery			

Table 3-86. Korea (S) Defense Systems Acquisition Method Summary

f. Assessed Vulnerabilities and Deficiencies from Epoch Three

From the epoch three net assessment, MND identified the need to continue increasing its blue-water naval capability to ensure the protection of Korea's territorial SLOCs, the need for a long-range precision strike capability, and the need to defend against CM and BM attacks. More specifically, Korea (S)'s need for a long-range precision strike capability forces the military to examine the purchase of either bombers or cruise missiles, both weapons of which are not in its present inventory. Based on cost and utility considerations, MND has decided that the purchase of cruise missiles is more prudent and economical.[63] Against both CM and BM attacks, Korea's key weaknesses were its lack of a sufficient detection capability and an effective strike capability to take out the BMs in the event of an attack.

[63] The purchase of bombers as a long-range precision strike system encompasses costs such as the acquisition of aircrews and pilots and their training, in addition to the acquisition and life cycle costs of the weapon platform and ordnance. This contrasts with the direct purchase of cruise missiles. With the present level of technology, maintainability and reliability the cruise missile acquisition requires a large up front acquisition cost commitment, but subsequent O&M costs are minimal.

g. Korea (S)'s R&D Programs

MND continues to focus on investing heavily in the development of high-tech weapons and securing the ability to develop core technologies suitable for the Korean military environment. The table below thus summarizes the major R&D efforts for the third epoch.

Capability/ Purpose	2011-2015	
	Direction	Items to procure
R&D	Air Defense Miniaturized System Strategic Surveillance Systems Directed Energy Beam Technology High Altitude Flight Technology	Air Mine Field Micro Air Sensor KLENS KSR-2

Table 3-87. Korea (S) Major R&D Emphasis

To address the deficiencies in this epoch, the R&D focus shifted to finding technological solutions to the urgent needs for CM and BM defenses, and also for a precision strike capability. Beginning with the detection problem for CM, Korea (S)'s present network of ground-based radars was deemed insufficient for the task. Thus, MND immediately pursued the study of suitable detection alternatives. At the same time, MND also studied the feasibility of employing the AMFS as a suitable CM defense. To meet the urgent need of dealing with the CM threat, MND decided that the fastest way was to acquire through direct import of a tactical high-energy laser system (THEL), which was already available in the military export market. The employment of high power microwave weapons was also deemed a suitable technological solution, with the assumption that Korea was willing to absorb the impact of CM "duds". To respond to the BM threat, Korea (S) assessed that it probably had the capability to detect regional BM launches but that the technological solution to overcoming the vulnerability was to acquire an advanced SAM defense as the employment of a high energy laser defense system like the US BMD concept was economically unfeasible. Based on the FDP allocations, the table below summarizes the services and DBA R&D investments.

Army		Navy		Air Force		DBA	
R&D Program	US$ Bil	R&D Program	US$ Bil	R&D Program	US$ Bil	R&D Program	US$ Bil
KAH66	$0.250	MSO/MHO	$0.070	FX	$0.275	Micro-satellite	$0.125
AGM-11	$0.050	Mine Layer	$0.080	HAE UAV	$0.150	Micro Spy Sat	$0.150
SAM(S400)	$0.180	SAM (SM-3)	$0.100	UCAV	$0.080	Spy Sat	$0.250
Tac Radar	$0.050	KDX-X	$0.325	MAV	$0.055	(KSR-2)	$0.155
THEL	$0.020	HPM	$0.325	AAM	$0.040	KLENS	$0.100
Others	$0.458	UUV	$0.080	Air Mines	$0.150	Micro Air Sensor	$0.180
		Torpedo (Squall)	$0.050			Defense Digitization	$0.285
		Others	$0.421	Others	$0.338	Others	$0.150
Total	$1.008	Total	$1.451	Total	$1.088	Total	$1.395
Budget Allocated	$1.088	Budget Allocated	$1.451	Budget Allocated	$1.088	Budget Allocated	$1.395

Table 3-88. Korea (S) R&D Programs

1) Defense Digitization/JC3IS Program Update

The first phase implementation of the defense digitization program was completed in 2006 and the system is now fully operational. The successful implementation of the JC3IS has enhanced Korea (S)’s warfighting capability as its interoperability demand now allows the three Services to be linked via internet technology, making possible for combat leaders from the Services to share a common and integrated operational and situational picture.

2) Space Program Development Update

Recapping the development of the micro-satellite program and for purpose of prediction in this study, Korea (S)’s was assumed to be technologically behind the US by ten years. Consequently, Korea (S)’s R&D results of developing such satellite technology only began to appear in the third epoch. As such, between 2011 and 2015, Korea had already launched and maintained several micro-, nano-[64] and pico-satellites[65] in LEO through Russian and Israel's help. The purpose was to test out such systems in terms of detection and sense resolution of a military nature. A key feature of pico-sats and of planned mass-producible nano-satellites is the use of MEMS for miniature integrated space systems.[66] Also of interest, is the characterization of nano-satellite architecture and assembly employing mass production using semiconductor technology and incorporating high-level building blocks called application-specific integrated micro-instruments (or ASIMs).[67] Additionally, Korea (S) also launched another two spy and communications satellites each to complete its constellation network of satellites in support of its MASN concept.

3) Micro-Air Sensor Network (MASN) Update

As of end 2015, Korea (S) possesses the ability to produce its own line of MAVs to support the MASN concept, namely a "hovering spy craft only 23 centimeters across" adapted from the US.[68] Additionally, several other prototypes are developed and tested, together with integration studies pursued of merging sensors onto the MAV platform.

[64] Nanosatellites would provide low-cost, rapidly deployable, innovative systems well suited to commercial, scientific and/or military ventures. "AeroAstro Wins Air Force Contract to Study Tactical Nanosatellites", Spacedaily, September 13, 1999.

[65] In 2000, the US already demonstrated the feasibility of picosatellites affected through MEMS. This mission was the first-ever to demonstrate the principles of miniature satellites released from a "mother ship" flying in concert and communicating via a local network as nanosatellites . "PicoSat Constellations Debuts November", Spacedaily, October 11, 1999. The picosatellites (measuring 4-by-3-by-1 inches and weighing less than one-half pound each) were released by a "mother" satellite in orbit, combined proven missile technology with pioneering satellite technology. Also the picosatellites communicated with its ground station via a microwave radio, accomplished on chip-based digital cordless telephone technology (Low-Power Wireless Integrated Microsensors program). The signals were received on Earth by a 50-meter dish antenna. "Smallest Satellites Ever Await Critical Moment", Spacedaily, January 29, 2000.

[66] "Smallest Satellites Ever Await Critical Moment", Spacedaily, January 29, 2000.

[67] In epoch three, Korea (S) would have also looked at cooperative constellations, sparse aperture antennas, local swarms of nanosatellites, and extremely flexible launch-on-demand options, which include gun and balloon-assisted launches. "PicoSat Technology Gets Serious", Spacedaily, October 11, 1999.

[68] The hovering craft weighed 1.4 kilograms and managed to takeoff, hover, and move around in at slow and medium speeds, with an endurance of about an hour on the 200 grams of fuel it carried. This craft was built and tested by Micro Craft, a US aerospace company. K. Kleiner, "Backpack Drone Peers Behind Enemy Lines", Spacewar, October 21,2000.

The tests with the balloon-platform have been successful and MND is now in the process of reviewing the MASN's employment concepts.

4) Air Mine Field System (AMFS) Update

The restructuring of the semiconductor industry to actively support the AMFS R&D efforts was completed in 2014. Concurrently, R&D breakthroughs also take place in the AMFS's delivery and dispersion mechanism. And so, the AMFS begins limited production at end 2015 to allow for further tests and evaluation. Also in response to the CM threat, MND began exploring the possibility of modifying the AMFS as a suitable CM defense.

Epoch Three Summary

Ending the longest armistice in modern history, the Pamunjon Treaty marked the formal declaration of unification. Although remaining US forces continued to provide a stabilizing influence, the nation began learning how maintain current military operations without the US. The merging of the two economies signaled the unified Korea's commitment to re-establishing itself as an economic contender in world markets and the intra-Korean currency chi-won became an international denomination. While still receiving two percent of the South's GDP in aid packages, the North's economy began to show signs of life as evidenced by double-digit growth (12 percent).

The ministry of defense could now look beyond the old threat to the north and toward the development of operational capabilities relevant to contingencies that a unified Korea Might face. This was evident in a notable increase in naval and air capabilities in the five years. Net assessments highlighted specific and serious deficiencies in the area of ballistic and cruise missiles while concurrently validating our credibility as a total force with capabilities on land, sea, and in the air.

The rate of production of indigenous weapon systems increased in the north as technological breakthroughs gave the country a credible ballistic missile capability. Efforts in the south focus on defense digitization and the launch of micro, nano, and pico-satellites with Israel and Russia's help. To attain full self-sufficiency, Korea also re-negotiated existing agreements to allow for the licensed productions of missile weaponry. This epoch's deficiencies, however, forced military planners to urgently seek out technological solutions to deal with the cruise and ballistic missile threats.

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D. Epoch Four (2016 – 2020)

1. Strategy

a. Introduction

Epoch four is the time period from January 2016 until December 2020. Highlighted here are the significant events of this epoch.

Epoch Four Events 2016 - 2020
Korean (Democratic) Federation formed
Korean prefectural elections 2018
Complete withdrawal of US military forces
US calls for Japan to leadership in region
Siberian pipeline complete
China replaces US as #1 trading partner
Competition for scarce resources; tensions between Japan and Korea at all time high
Strategic and economic alliance with China

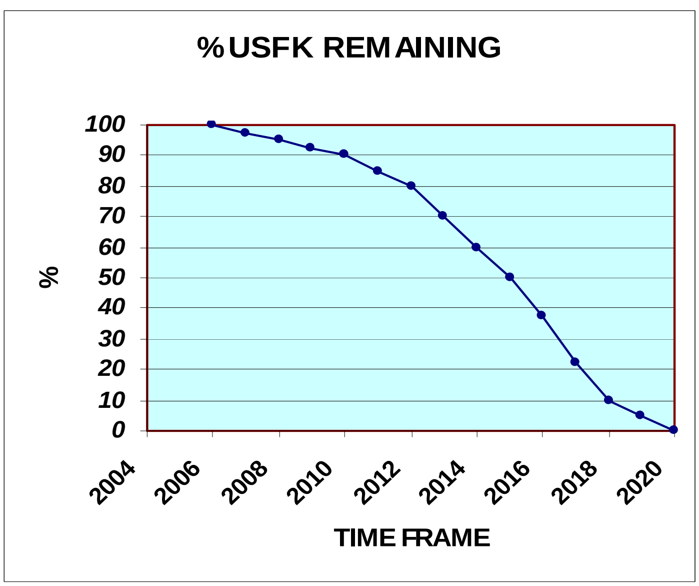
Table 3-89. Epoch Four Significant Events

Early in the epoch, Korea transitioned from a varied confederation to a federation setting the stage for the first prefectural elections in 2018. The year 2024 was set as the target date for a Korean national presidential election. The United States held closing ceremonies at the US Army Base in Yeongsan signifying the formal end to US military presence. In a curious and unsettling foreign policy maneuver, the US called upon Japan to take the lead in ensuring regional stability. Korean statesmen, in turn, urged US leadership to continue in their role as senior partner in the region to keep Japan and others "in check". This and several additional events increased tensions between Korea and Japan and raised concerns about the United State's commitment to regional stability. First, the completion of the Siberian pipeline under Korea's ultimate control, with Japan afraid they would be excluded from the benefits. Second, several territorial skirmishes including an illegal mining operation near the Korean territorial Tok-Do Island. Finally, China's move into the place of Korea's top trading partner, which pushed Japan further down the trade billing. This long line of destabilizing events led ultimately to Korea's unilateral strategic and economic lean toward the PRC.

b. Federation Formed

The only significant difference between the third epoch's confederation and fourth's federation is a move from two systems to a single system. In this case, the system is a democratic form of government modeled closely after the former South Korea. As in the varied confederation, the central government is responsible for foreign relations, defense, and matters of diplomacy while regional governments administer remaining internal matters. Prefectural elections marked the first democratically elected leaders in the North. The activation of a unified military command marked the final stage in the reorganization efforts of Korea's military forces. Even today, the command continues to focus on sealing the gaps left by retreating US Forces and the redistribution of war fighting equipment throughout the peninsula.

c. United States Completes Withdrawal



2005: North and South formally agree to pursue unification options
2006: "Preconditions for unification" agreed upon by North and South
2006-2012: US makes "Big Show" of withdrawal; US must be <,= 50% by 2015
2011: Formal declaration of unification, US must be out by 2020
2018: Small US security force and advisory staff only.
2020: No US military presence on Peninsula

Figure 3-3. US Withdrawal #2

Figure 3-3 provides a retrospective look at the United States' withdrawal from the peninsula. Although Korea continues to adjust in several important ways to the loss of direct US support and the inherent security it offered, the Korean people offered a bittersweet, if not melancholy farewell and celebrated their independence from their US benefactors. Korean statesmen were surprised by the United States' apparent abandonment of previously assured security and stability provisions when the US called for Japan to take the lead in ensuring regional stability. With over a century of distrust fueled by poignant memories of Japanese occupation, the stories of which have been kept alive and passed from generation to generation, the peaceful people of Korea felt especially vulnerable despite their strength and independence.

d. Territorial Disputes – The Final Straw

Several significant events contributed to renewed fear and distrust of the Japanese. Not least of which is the 2019 Tok-Do Island incident. The tiny Island of Tok-Do, measuring approximately 1600 square meters of uninhabitable rock is approximately 200 nautical miles off of Korea's central East Coast. It has been the source of a long-standing territorial dispute between Japan and Korea dating back to the Shilla Dynasty in 500 AD. But as early as 1667, Japan admitted that Tok-Do was a Korean territory. The island is a known golden fishing zone, provides a strategic over-watch of the East Sea and is known to be a source of

Figure 3-4. Tok Do Island

hydrate and natural gas reserves. Korea has held Tok-Do as a radar site since the late 20th century.

In 1998, in an effort to ease tensions over rights to waters around the disputed islands, South Korea and Japan signed an agreement which set new fishing boundaries and quotas but preserved Korea's ultimate territorial rights. A significant increase in activities in and around the protected island raised Korean suspicions, and in 2019, Japanese hydrate prospectors posing as fishermen were discovered to be drilling off Tok-Do. A hostile exchange ensued when the "fishermen" were challenged by Korean coastal authorities, and although no one was seriously injured during the incident, it served to raise suspicions and distrust for the Japanese by Koreans to an all-time high.

e. Korea – China Alignment

Although Korea welcomed independence from the United States, its historic and ethnic ties to China proved a powerful lure to her protective embrace. Adding to substantial trade relations and growing concerns over Japanese militarism while devoid of the stabilizing force of the United States, Korean leaders welcomed China's invitation to political alignment. Where once during this epoch Korea's policy was characterized by benevolent neutrality, it is now explicitly bilateral.

f. Economic Review

(US$ bil)		2016	2017	2018	2019	2020	Average
GDP	N	27.4	30.3	33.2	36.0	38.6	33.1
	S	786.3	832.7	881.8	933.8	988.9	884.7
GDP Growth	N	12.0	10.8	9.5	8.0	7.2	9.5
	S	5.9	5.9	5.9	5.9	5.9	5.9
Defense	N	7.4	8.2	9.0	9.7	10.4	8.9
	S	27.5	29.1	30.1	32.7	34.6	31.0

Table 3-89. Economic Summary

A summary of the economic data is shown in Table 3-89 above. In order to highlight the continuing disparity in scale of GDP between the northern and southern regions, the figures are broken down by region. The former South Korean economy sustained an average GDP growth rate of 5.9 percent. Their partners in the North began to return to a steady-state GDP growth rate as unsustainable double-digit growth in the third epoch waned from 12 percent to 7.2 percent by the end of the year 2020. The region enjoyed a significantly optimistic economic outlook brought about by the resurgence of global confidence in regional economic growth and perceived stability.

g. Unified Korean Strategy (NSS and NMS)

Korea's NSS remained largely unchanged with a focus on protection of national sovereignty, trade routes, and all commerce activities. However, Korea's alignment with China ensured increased security especially from an overland invasion, which in turn translated to a significantly more focused and lethal NMS aimed at deterring an adversary's use of cruise or ballistic missiles against Korean territories, protection from sea invasion, and a direct defense against SLOC blockages or disruption.

2. National Defense

a. Force Improvement Plans

With the prefectural elections in 2018, Korea saw a shift in the priorities and role of the unified defense force. The ministry of defense anticipated that it had to prepare for possible social unrest or even military provocation in the region. Consequently, the Korean military must support the government's peaceful reunification policy, and conscientiously prepare to meet the prospective changes in the future strategic environments. The top priority for national defense was to develop a future-oriented high-quality modern military force.

b. Army

With unification, the army's mission shifted to include assisting the authorities in maintaining social order in a unified Korea. Force improvement priorities now centered on transforming the Korean Army into one that was versatile and able to deal with a variety of situations as well as keeping the lethal punch to serve as a deterrent to potential aggressor. The Korean Army also continued to streamline and upgrade its forces so as to keep it lean and mean. Major issues concerning integration of doctrine and equipment became pivotal to the success of a unified army. Due to changes in the security environment as well as the nature of future war, Korea's ground force modernization focused on improving its mobility.

The army reorganized its corps, infantry divisions and brigades (mostly for the front-line units) into mechanized ones and increased the unit combat effectiveness with new weapons and equipment. The decrease in cross border threats arising from unification allowed the army to rapidly downsize its force bringing it to about 860,000 strong. Outdated equipment and inventory, especially those from the North were retired and replaced with indigenous production units to reduce the effects of integration. Armor forces, to improve its three-dimensional high-speed mobile combat capability, received new Korean-designed tanks and armored vehicles with excellent firepower mobility and survivability characteristics. With these improvements, the army thus enhanced the lethality of each unit and established a basis for successful mobile warfare operations. The standing armored and mechanized divisions were also gradually equipped with self-propelled howitzers to improve fire support capability, to enhance mobility, and to shorten operational reaction time. Artillery firing accuracy was being enhanced through computerization of fire control systems, modernization of target acquisition systems, and positioning equipment. To help ensure the mobility and survivability of self-propelled artillery, fire direction centers and armored ammunition carriers were acquired as well.

With its diverse functions, air-mobile combat will play a leading role in future warfare. The army continues to introduce new models of next-generation attack helicopters, multi-purpose helicopters and scout helicopters. At the same time, to enhance survivability and operational effectiveness, avionics equipment is improving night operations capability and precision firing capability.

Combat System	2015	Procurement	Demobilization	2020
Active Divisions	73	-	20	53
Personnel (thousands)	1167	-	304	863
Reserve Divisions	40	-	15	25
MBT	4300	430	1850	2880
APC / AIFV	4040	230	1230	3040
Attack Helicopter	242	144	-	386
Gun Artillery	10500	-	2250	8250
Rocket Artillery	1880	-	500	1380
Surface-to-Surface Missiles	67	-	-	67
Air Defense Artillery	3100	-	1950	1100
Surface-to-Air Missiles	1524	114	500	1138

Table 3-90. Korean (N and S) Army Force Structure 2020

c. Navy

Korea's desire for sea power was not one of solely military power play, but part of a broad maritime agenda based on national growth and resource needs linked to a growing Korean coastal economy. Korea sits on the doorstep to a maritime environment. With the imminent rise of two maritime powers in the region, namely Japan and China, Korea's maritime mission had never been more important and significant. The navy must modernize quickly so as to keep up with those in the region who might threaten Korea's strategic lines of communications. Naval combat power was enhanced to adjust to three-dimensional warfare, following the global trend and the changing strategic environment around the Korean peninsula.

For the fourth epoch, the navy's modernization saw the balanced improvement of its surface, underwater, and air capabilities and the acquisition of a strategic strike capability. Besides being able to operate in the littoral and blue waters, the navy also had to influence land battles. This shift from littoral protection to projection of power in the blue water is best observed by the increase procurement of advanced Aegis-class destroyers and submarines. To establish an early warning system and obtain long-range surface patrol capability, new model surface patrol aircraft were procured to replace outdated models.

For the improvement of underwater combat power, a procurement program for submarines had been started since the late 1980s. In May 1994, then Defense Minister Lee Chun Ham launched the first submarine built with domestic technology that provided the initial momentum for development of underwater operations. Korea thus continued to acquire new-model submarines equipped with advanced weapon systems to establish a basis for its underwater combat capability. Improvements to surface combatants were enhanced with the surface reconnaissance and surveillance capability of the new Korean-designed Aegis class destroyers.

These ships, designed to carry state of the art weapon systems like the improved SM-2x and SM-3x anti-air guided missiles, new light and heavy torpedoes and extended range anti-ship cruise missiles, were modeled after the US and Russian systems. New model helicopters were also acquired in accordance with the naval force improvement plans. In addition, submarines and surface combatants were also upgraded to provide a missile-launch capability for use with land attack cruise missiles (SS-N-21 "Samson"[69]) to negate the vulnerability from the loss of the nuclear deterrent in epoch three and provide an alternative platform for strike. The resulting force structure at the year 2020 is shown below.

Combat System	2016	Procurement	Demobilization	2020
Maritime Patrol	40	12	-	52
Submarine	29	8	-	37
Destroyer	19	6	-	25
Frigate	2	-	2	0
Coastal Patrol	450	-	93	357
Amphibious	256	-	158	98
Mine Warfare	42	-	-	42

Table 3-91. Korean (N and S) Navy Force Structure 2020

d. Air Force

Air combat is one of the most powerful forces for modern warfare. The Korean Air Force's mission lies in defending Korea through control and exploitation of air and space. Korea will continue to develop a future-oriented advanced air combat power, aimed at increased war-deterrence and successful defense of Korea's territorial airspace. Efforts continued to focus on improving Korea's tactical and support air assets and various operations systems for better response and flexibility. These included the gradual acquisition of advanced aircraft that were suitable for a future operational environment. The resulting force structure was qualitatively far more superior even though the quantity remained relatively unchanged.

[69] Refer to Annex for detailed description of SS-N-21 "Samson."

These aircraft possessed the capabilities for rendering prompt fire support to the ground and naval forces. Complementing the capabilities of these advanced aircraft were arming with air-to-air missiles for extended-range attacks and of air-to-surface missiles for strategic and precision strikes on ground and surface targets. An increasing number of UAVs with greater range and endurance capabilities were deployed for intelligence, surveillance and reconnaissance. Unmanned Combat Air Vehicles (UCAV), capable of operating autonomously or in cooperation with manned aircraft, will soon lead to increased operational flexibility and reduced aircrew exposure during high risk missions. The air force's main challenge lay in the search for the best combined force mix of manned aircraft, unmanned air vehicles and conventional long-range stand –off strike missile aircraft. The resulting force structure at the year 2020 is shown below.

Combat System	2015	Procurement	Demobilization	2020
Fighter	566	118	216	468
Ground Attack	374	118	156	336
Bomber	80	-	40	40
Air Refueling	5	5	-	10
AEW / ESM	9	4	-	13
ASW / Patrol	8	-	-	8
Reconnaissance /UAV	160	90	-	250
Trainer A/C	541	80	140	481
Transport	180	8	-	188

Table 3-92. Korean (N and S) Air Force Structure 2020

e. Strategic Weapons Development

1) Ballistic Missiles

SSMs are not only a force equalizer, but also a means of striking at distant targets and of offsetting the enemy's qualitative advantage. Improved SSMs gave Korea greater flexibility of action as well as the ability to threaten the enemy's sensitive military targets such as airfields, headquarters and war reserve storage units, especially in the initial hours of a war. With the diminished cross border threat, the emphasis thus centered on protecting the region around Korea against players in the region. Korea's ballistic force of approximately 1000 is primarily dedicated to a strategy of minimum deterrence, which means that no potential enemy would launch a strike against Korea without suffering retaliation from Korea's second strike capability. Priority for this epoch was given to the development of long-range missiles by a combined Korean development team. Short-range Scud B missiles were retired and replaced with the more accurate Ro-dong 3.

Combat Systems	Range (km)	2016	Add	Minus	2020
KSR-1	180	50	-	-	75
Scud B	300	50	-	50	0
Hyon Mu	300	0	25	-	25
Hwasong 5	330	150	-	50	100
Hwasong 6	500	250	-	-	250
Ro-dong 1 / 2	1,300	216	-	-	216
Ro-dong 3	1,300	-	80	-	80
Daepo-dong 1	2,000	105	30	-	135
Daepo-dong 2	6,000	55	30	-	85

Table 3-93. Korean (N and S) Ballistic Missile Force Structure 2020

2) WMD

Despite the surrendering of fissile materials in epoch three and the chemical and biological clean up in epoch two, Korea (N) retains the capabilities to reassemble WMD, not least of which are nuclear weapons. This is made especially possible by the readily available refining capabilities of Russia, China and France.

3. Net Assessment

a. Introduction

As part of the introduction to this section, it is helpful to keep in mind that all previous net assessment scenarios were seen from the perspective of the South Korean military. This is the first time a unified Korea assesses capabilities as an integrated and joint force. It is recognized that the military services are at varied stages of integration. Additionally, previous net assessments inwardly focused on confrontation between the former North and South Koreas, and outwardly on aggression of forces from countries such as Japan and China. This epoch focused on an internal debate regarding the correct size of the integrated military of a unified Korea and the balance of capabilities within each service against a regional foe.

A number of scenarios were considered for their ability to provide meaningful insights. The initial consideration was a Chinese invasion and blockade. This scenario was, however, dismissed because of Korea's newly fostered strategic ties with China, and the fact that Korean procurement did not mitigate the cruise and ballistic missile threats seen in a similar scenario from the previous epoch . That is, Korean and Chinese force structures have not changed appreciably since the previous epoch and Korea remains a "useful porcupine."

Next, a Japanese amphibious invasion was considered. However, it was found that if Japan could gain air and sea superiority and conduct the invasion, they would still be outnumbered by an 8:1 ratio when they reached Korean shores. This disparity in personnel exacerbated by a Korean defensive advantage, would not allow the Japanese to occupy any portion of the Korean peninsula. Although Japan possessed the capability to transport their forces to the Korean Peninsula, their force structure was not optimized to conduct an operation of this nature. This scenario was thus dismissed as well. The bottom line was that neither scenario provided any additional insight about the aggregate Korean force structure.

b. Scenario: Japanese Naval Blockade of Korea's SLOCs

The sole scenario settled upon to conduct the net assessment for this epoch was a naval blockade and a sea line of communication interdiction effort by Japan that significantly affected Korea's trade in the region. The purpose of this scenario was to evaluate the capability of existing forces to protect Korea's maritime trade routes and sea lines of communication. Based on this scenario, a seemingly endless list of circumstances could precipitate the blockade, such as disturbed oil flow to Japan from the Korean pipeline, trade competition, or territorial island disputes.

The real issue attendant to the assessment scenario remained the determination of Korea's military force balance: how much and of what flavors? This scenario allowed a first-order approximation of the Korean capabilities, deficiencies and vulnerabilities given the limited force structure information available from the Japan team with respect to number and capabilities of weapons. As such, doctrine, reliability, survivability and some specific system performance measures were not included. The effects of cruise and ballistic missiles used during the conflict were analyzed separately. The potential for escalation of this conflict to include the participation of the United States and China was strong, but for simplicity, their involvement was not included in the assessment.

c. Concept of Operations / Objectives

The Japanese objective of conducting the naval blockade was to interdict maritime trade routes and sea lines of communication. Japanese strategy was to ensure naval presence in support of the blockade by intercepting, escorting, influencing and if required, destroying any shipping which was either Korean flagged, or enroute to or proceeding from Korea, with the air force providing necessary air support. The blockade took place within an area bounded by the following: 100 nm NE of Tsushima Straits to 200 nm NE of Taiwan and the leeward side of the Japanese Ryukyu Islands to include the Korean territorial portion of Yellow Sea.

The Korean objective was the restoration of its maritime trade routes and SLOCs by gaining air superiority, and employing a joint operational concept in confronting JMSDF vessels with air assets and surface units. Korea's strategy would only be limited to attacks on Japanese sea or airborne military assets. The Japanese mainland would not be struck.

d. Orders of Battle: Japan vs. Korea (Unified)

Comparison of the Japanese Ground Self Defense Force with the unified Korean Army was not germane to this scenario and the army order of battle comparison was thus omitted.

Japan brought capable naval assets to the fight, as highlighted by its Kongo and DD-21 variant destroyers, P-3C maritime patrol aircraft and submarines.

Combat System	Japan	Korea
Maritime Patrol	55	52
Submarines	22	37
Destroyers	60	25
Coastal Patrol	--	357
Amphibious	42	98
Mine warfare	47	42

Table 3-94. Japan vs. Korea Naval Forces Order of Battle

Japan and Korea showed near qualitative and quantitative parity with respect to their air forces. For air assets, Japan touted its F-22 variant fighter while Korea had a similar FX variant equipped with new extended-range air-to-air missiles. Because of speed and agility, Japanese UAV assets appeared qualitatively more capable than those of Korea. Both countries had a small UCAV strike capability.

Combat System	Japan	Korea
Fighters	450	468
Ground Attack	150	336
Bombers	--	40
Air Refueling	60	10
AEW / ESM	17	13
Recce / UAV	300	250
Trainer A/C	--	481
Transports	44	188

Table 3-95. Japan vs. Korea Air Forces Order of Battle

e. Committed Forces Comparison

The calculations of the forces committed to the engagements were broken down into sea, air, and land.

1) Sea

Due to proximity and other operational constraints the Japanese Navy committed 80 percent of its fleet to the conflict while Korea committed 90 percent. Both forces were supported by a robust underway replenishment force that had the capability to re-supply with fuel, food, weapons and repair assets. While it was assumed that the preponderance of the Japanese Navy vessels were already positioned to act, a finite amount of time (approximated at 42 to 48 hours) did, however, exist until the Korean Navy was able to fully engage.

2) Air

Japan, due to readiness, proximity and other operational issues, only devoted 75 percent of its air assets to the conflict. Of these, assuming a 1.5-hour mission time and 2-hour ground turn time, approximately 25 percent of their assets devoted to the conflict were airborne at any one time. Korean air assets shared similar readiness and operational issues, but with varying proximity and operational constraints, devoted 80 percent of its assets to the conflict and similarly, 25 percent of those were airborne at any one time.

3) Land

Both countries will utilize their armies for coastal defense. Other than for surface-to-air, cruise and ballistic missile capabilities, a study of the armies is not germane.

The net assessment began with the committed forces of each navy. For the assets relevant to this scenario, Korea appeared to have a slight numerical advantage in maritime patrol aircraft. Additionally, while qualitatively similar, Korea enjoyed a definite numerical advantage with respect to submarines. Japan has a quantitative advantage in the destroyer category. Together, these generalizations showed that each naval force had some distinct numerical advantages and disadvantages. The way that these manifest themselves in actual conflict was dependent on the concept of operations and doctrine.

Combat System	Japan	Japan Committed	Korea Committed	Korea
Maritime Patrol	55	44	48	52
Submarines	22	18	30	33
Destroyers	60	48	23	25
Coastal Patrol	--	--	321	357
Amphibious	42	34	88	98
Mine warfare	47	38	38	42

Table 3-96. Japan vs. Korea Committed Naval Forces

For the air force assets, Korea and Japan are at near parity in the number of fighters. Korea has a numerical advantage in the ground attack category. This is significant when comparing the Korea air force's anti-shipping missile capability against Japanese navy vessels. Japan may enjoy more mobility with the availability of air refueling assets.

Combat System	Japan	Japan Committed	Korea Committed	Korea
Fighters	450	84	94	468
Ground Attack	150	28	67	336
Bombers	--	--	8	470
Air Refueling	60	11	2	10
AEW / ESM	17	3	3	13
Recce / UAV	300	56	50	250
Trainer A/C	--	--	96	481
Transports	44	8	38	188

Table 3-97. Japan vs. Korea Committed Air Forces

Comparison of air power versus surface vessels shows that Korean KDX destroyers with 608 SM-2x long-range variant missiles have an advantage in range by over 50 percent. The JASDF ground attack aircraft will be engaged prior to release range of their air to surface missiles at 80 nautical miles. Conversely, the Korean air force and its investment in long-range standoff anti-shipping missiles possess the capability to deliver those missiles from outside maximum effective engagement range of the Japanese destroyer SM-2 variant missiles, which allow Korea's aircraft to retire after launching their weapons without being engaged. Some specific firepower calculations are included below to illustrate the advantage of the Korean firepower. Although an attrition rate of 10 percent would be considered unacceptable, consider it for the following illustration.

> Assuming a 10 percent attrition per mission cycle and a 0.2 (low by most standards) probability of firepower kill given release of those missiles, Korea's Air Force could "kill" 54 surface vessels from a standoff range of over 150 nautical miles (assuming that targeting is solved) by expending 260 missiles in 7.5-hours of continuous coverage. In this time, Korea would lose 60 aircraft or 23 percent of their ground attack fleet while decimating the entire Japanese destroyer fleet. Moreover, the Korean Air

Force slightly outnumbered the Japanese Air Force in numbers of aggregate combat aircraft. Additionally, when factoring in the 300 AA-x missiles (Extended Range AMRAAM's), deployed on the FX, F-16 and even unmanned combat aircraft, Korea also enjoyed an advantage of over 25 nm in employment range. Depending on the aggressiveness, tempo and timing of Japanese air operations, these firepower advantages could make the battle for air supremacy costly for both sides. Consideration for including a discussion on response times and airborne combat air patrols quickly became mired in an infinite number of "what ifs" that confused the larger picture.

4) Ballistic Missiles

Here is a quick-look at the ballistic missile capabilities of both countries. The Korean descriptions are listed with only the number of Japanese equivalent weapons.

Cruise Missile	Range	Korea	Japanese Equivalent
KSR-1	180 km	75	--
Hyon Mu	300 km	25	--
HwaSong 5	330 km	100	--
HwaSong 6	500 km	250	--
Ro-dong 1 /2	1300 km	216	--
Daepo-dong 1	2000 km	135	--
Daepo-dong 2	6000 km	85	10
SS-N-21 Surface Launch	2750 km	500	--
SS-N-21 Sub Launch	2750 km	200	--
Type-03	2750 km	--	20,000
Total		1666	20,010

Table 3-98. Japan vs. Korea Committed Ballistic Missile Forces

The Japanese had an aggregate offensive cruise / ballistic missile strike capability that was numerically superior to that of Korea. Korean cruise missile procurement has concentrated on mobility on sea vessels while Japan has concentrated on mobile land launch capability for cruise missiles. Ultimately, Japan enjoyed an overwhelming advantage in the aggregate cruise / ballistic missile category. Defensively, Korea possesses a credible detection capability, but its ability to engage cruise missiles is not as robust. This was especially alarming with the significant mismatch in quantity of offensive missiles possessed by the Japanese.

f. Results

Absent the use of cruise and ballistic missiles by Japan, Korea possesses the capability to defeat the effort and re-open the SLOC. This essentially is a war of attrition with firepower and range being the discriminator. The use of offensive cruise and ballistic missiles by the Japanese would disrupt Korean military operations and defensive capabilities. Escalation to these weapons would necessitate use of Korean air assets against Japanese military bases. Depending on the degree of disruption, some ground attack aircraft would be able strike a blow to the Japanese military establishment as the Japanese do not possess a robust defensive capability against aircraft armed with stand-off precision weapons. The Koreans may give consideration to an attack on enemy land bases from the first sign of Japanese offensive cruise and ballistic missile use. An assessment considering air attack on Japanese soil may require a dynamic analysis and modeling and simulation. Doctrine along with other operational factors needs to be considered. The potential for escalation is strong. Korea could expect some form of US and Chinese involvement by default. Due to seemingly bi-polar regional relationships between China/Korea and the US/Japan, one may expect a *quid pro quo* involvement from China and the US that may bring about a conflict of grand scale. The conditions would be much like the pre-World War II Japanese expansionist era.

g. Net Assessment Conclusions

Militarily, Korea requires a better defensive cruise missile capability. The representative threat-based capabilities required by Korea will be realized with a realignment and balance of individual service priorities and funding. This may include a decrease in army ground forces, increase in the navy with steady levels in the air force. Offensive cruise missile along with defensive cruise and ballistic missile capabilities should remain high on the priority list.

The instability and conflict in the region would dampen investment and continued trade. As coined in "The Lexus and the Olive Tree"[70] a book on globalization, the "electronic herd" would flee and cause economic devastation to both Korea and Japan, sending associated shockwaves to others in the region and around the globe.

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[70] *The Lexus and the Olive Tree*, Friedman, Thomas L., Anchor Books, New York, 2000.

4. Technology Development for Reunified Korea

a. Korea's Technology Focus

1) Goals and Strategy for Defense Technology

The merger of the two former Korean militaries in epoch four into a unified command has resulted in a shift in Korea's technological goals. To assimilate the ex-North's military into the existing ex-South's structure, the focus has been the continued modernization of the entire military into a high-technology force able to exploit information technology. Additionally, cruise and ballistic missile defense development continue to be a high priority based on the lack of satisfactory solutions to these vulnerabilities.

2) Defense R&D Budget

The unification of Korea has brought together the two military's R&D establishments. Consequently, Korea's R&D budget (combined) for epoch four amounted to $10.7 B(US)[71]. Of this sum, the same proportional funds allocation[72] remained as from previous epochs. The South's defense and R&D budget breakdown are presented below.

[71] The contributions are $6.04B(US) from the ex-South and US$4.7B(US) from the ex-North.
[72] This 80/20allocation is for Force Development Programs and ADD Programs respectively.

	GDP	Defense Budget	O&M	FIP
%GDP	100.0%	3.5%	2.5%	1.1%
%Def Bud	-	100.0%	70.0%	30.0%
%Growth	5.9%			
Year	US$ Bil	US$ Bil	US$ Bil	US$ Bil
2016	786.286	27.520	19.264	8.256
2017	832.677	29.144	20.401	8.743
2018	881.805	30.863	21.604	9.259
2019	933.832	32.684	22.879	9.805
2020	988.928	34.612	24.229	10.384
Total	4,423.528	154.823	108.376	46.447
Average	884.706	30.965	21.675	9.289

Table 3-99. ROK Defense Budget Breakdown

	Army	Navy	Air Force	DBA	R&D
%GDP	4.1%	1.6%	2.4%	0.4%	2.8%
%Def Budget	9.0%	3.6%	5.4%	1.5%	10.5%
Year	US$ Bil	US$ Bil	US$ Bil	US$ Bil	US$ Bil
2016	$2.031	$2.708	$2.031	$0.330	$1.073
2017	$2.151	$2.868	$2.151	$0.350	$1.137
2018	$2.278	$3.037	$2.278	$0.370	$1.204
2019	$2.412	$3.216	$2.412	$0.392	$1.275
2020	$2.554	$3.406	$2.554	$0.415	$1.350
Total	$11.426	$15.235	$11.426	$1.858	$6.038
Average	$2.285	$3.047	$2.285	$0.372	$1.208

Table 3-100. ROK FIP Budget Breakdown

	FDP (80% of R&D)			ADD (20% of R&D)				
	Army	Navy	AF	EO	MW	AC	UWA	WS
% R&D Budget	24.0	32.0	24.0	5.5	5.9	6.1	1.6	1.0
Year	US$ bil	US$ bil	US$ bil	US$ bil	US$ bil	US$ bil	US$ bil	US$ bil
2016	0.258	0.343	0.258	0.059	0.063	0.065	0.017	0.010
2017	0.273	0.364	0.273	0.063	0.067	0.069	0.018	0.011
2018	0.289	0.385	0.289	0.066	0.071	0.073	0.019	0.011
2019	0.306	0.408	0.306	0.070	0.075	0.077	0.020	0.012
2020	0.324	0.432	0.324	0.075	0.079	0.082	0.021	0.013
Total	1.449	1.932	1.449	0.334	0.355	0.366	0.096	0.058
Average	0.290	0.386	0.290	0.067	0.071	0.073	0.019	0.012

Table 3-101. ROK R&D Budget Breakdown

b. Korea’s Technology Investments

1) National Defense Plan

To embark on solutions for the vulnerabilities identified in the third epoch, Korea’s investment decisions has resulted in the following new systems coming on line in this epoch and are summarized in the table below:

Capability/ Purpose	2016-2020	
	Direction	Items to procure
Information & Command/ DBA	Early warning & surveillance	20 KLENS
	Self-command systems	20 Microsats
	Defense digitization	10 Micro spy sats
		Micro Air Sensor
		Joint C3I System
		GBR
Strategic Strike	Long-range precision strike	KSR-2
	Long-range ballistic delivery capability < 800 km	Cruise missiles
Ground Operations	Improved lethality, agility	AH-X
	Tactical situational awareness	SAM-X
		Q47-type radar
		Multi-sensor array
Naval Control	Improved C4ISR system	12 P-3Xs
	Strategic control of SLOCs	4 Type 214
	Superior underwater capability	6 KDX-X
	Enhance Defensive/Offensive combat capability	2 Submarine rescue
		4 UWAV
	Improve ship building capacity	3 MHO
		3 ML
		SAMs / Torpedoes upgrades
Air Operations	Advanced air combat	50 FX / 50 UCAV
	Enhanced AEW	4 AEW / 5 KC-xxx
	Anti-shipping strike	100 A-50 / 40 UAV
		20 KT-2 / 8 C-130
		100 Harm Block 6
		100 JSOW
		100 JDAM
		150 ASM-xx Anti-ship
		150 AGM-x JASSM
		100 AIM-9x
		200 AA-x ERAAM

Table 3-102. Korea Weapon Systems Acquisition

Korea's emphasis in its acquisition this epoch reflects its commitment to overcome its deficiencies in dealing with the CM and BM threats. As had been highlighted in the last epoch, Korea recognizes that a US-type National Missile Defense (NMD) is beyond the economic and (in a limited way) technological means of the country. It simply cannot commit sufficient resources and talent towards that attainment of such a lofty goal. Consequently, MND had made a conscious decision that Korea would instead pursue a BM defense comprising two main SAM umbrellas. For sense, Korea will employ its spy satellites and GBR network. Once a BM launch is detected, the data is then passed on to the JC3IS where the information is processed and disseminated. Simultaneously, Korea's sense assets will continue to track the trajectory of the incoming BM and provide an intercept course.

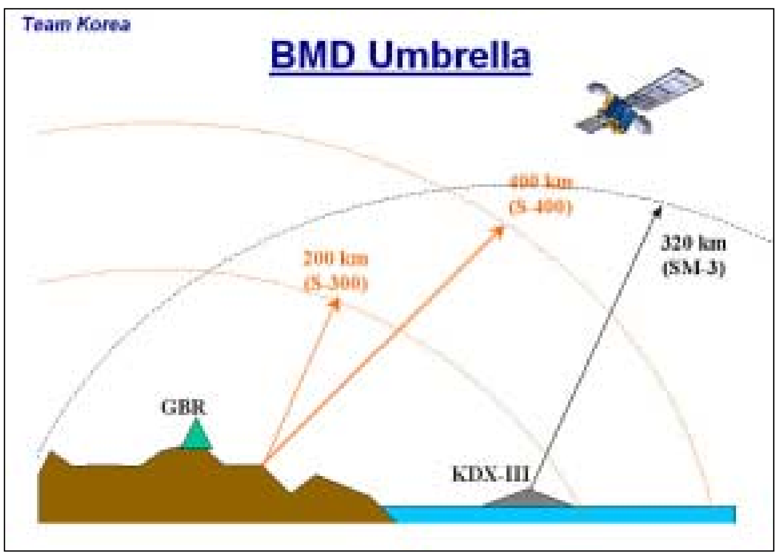

Figure 3-5. Korea's BMD Umbrella in 2020

The point of intercept is then sent down to the various action assets, comprising the SM-3, S-400, and S-300 systems. The acquisition of the SM-3s and the S-400 system thus constitutes the outer umbrella, with the inner umbrella formed by the earlier S-300 systems. As a desperate last line of defense, tactical high energy lasers (THELs) and land- and ship-based high power microwave (HPM) weapons urgently acquired to provide CM defense, could also be used. This use is, however, a misuse of the weapon systems since the BM warheads would be too close to the ground to effectively prevent any casualties or collateral damage.

For CM defense, which incidentally also enhances Korea's air defense capability, this epoch witnessed the acquisition and employment of THELs and HPM weapons. To detect CM attacks, Korea has indigenously produced the Korean Land Attack Cruise Missile Defense Elevated Netted Sensors (KLENS), which integrates into Korea's air defense network via the JC3IS (see under R&D Programs for a more detailed description). KLENS was also acquired to complement the indigenously R&D and produced Air Mine Field (AMF) concept (see Annex 3E4). As part of its efforts to enhance Korea's DBA capability, the network of ground-based radars (GBRs) located along Korea's coast were also upgraded to a mixture of phased array and bi-static systems, utilizing the latest reconfigurable antenna technology.

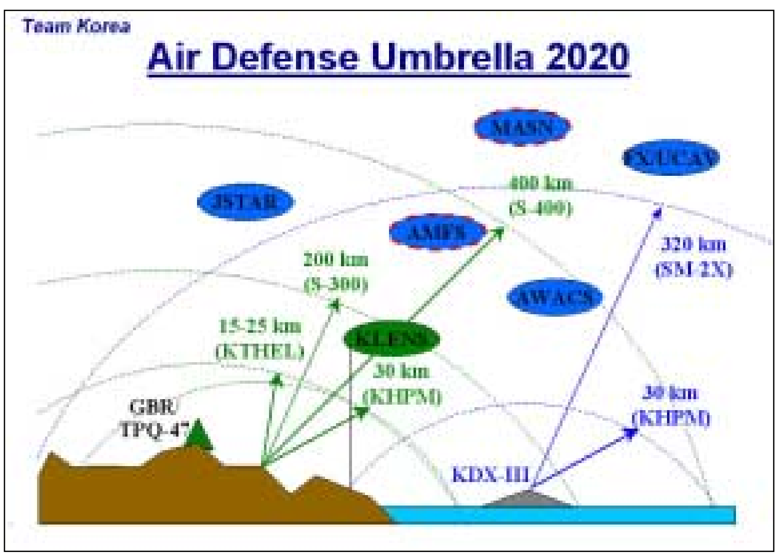

Figure 3-6. Korea's Air Defense Umbrella in 2020

To take out the incoming CMs and air threats, Korea will employ three lines of defense. The outer most umbrella will be provided by the FX and UCAV fighters, as well as the SM-3 and S-400 SAMs. The middle layer will be provided by the S-300 and the deployment of the AMFS. Finally, the last line close-in defense will be provided by Korea's latest directed energy weapons (DEW) – Korea's THEL and HPM weapons.

2) Existing Capabilities

One of the most significant consequences of Korean unification has been the convergence of ballistic missile (BM) technology from the ex-North and guidance and semiconductor technology from the ex-South. Hence, this epoch has witnessed the quantum leap in Korea's indigenous capability to produce its own nuclear-capable BMs with an accuracy (CEP 150 m) not previously possible during the North Korean program. An unintended consequence has also been the leap in launch and delivery capacity in the ex-South's space program.

The industrial focus has also shifted in this epoch. Korea has now focused on acquiring miniaturized weapon systems and directed energy weapons. In greater cooperative efforts with Israel in these two areas, and also with China and France, Korea now has several programs jointly researching and developing HPM weapons for use in the air defense role. We have also collaborated with Israel to jointly produce our first Korean Tactical High Energy Laser (KTHEL) – a field deployable tactical laser.

The efforts made in the licensed production of SAMs, AAMs, and ASMs from the last epoch are beginning to show results. Korea has also begun the full-scale production of the various missiles in its inventory. This effort, though unprofitable due to Korea's lack of industrial maturity is, however, necessary for self-reliance purposes. From the

Russians, Korea has obtained the technical knowledge to license produce its own rocket-propelled Squall torpedoes. Coupled with technological advances, Korea has successfully extended the range of this weapon from five to ten nautical miles.

To meet Korea's urgent need to possess an effective countermeasure against the CM and BM threats, the military has purchased several US-Israel Tactical High Energy Systems (THELs) from Israel. This initial acquisition is intended to support the efforts in jointly producing the KTHEL system. To address Korea's identified need for a long-range precision strike capability, the military has decided to import the SS-N-21 cruise missiles from the Russians.

Indigenous R&D and Production	Joint R&D and Production	Licensed Production	Import
Major Surface Ships	Micro Spy Satellite	Torpedo (Squall)	BMD
Minor Surface Ships	Attack	Attack Helicopter	SAM
Submarines	Helicopter(KAH)	(AH-64)	AAM
Combat Aircraft (FX)	High Power	SAM	ASM
Trainer Aircraft	Microwave Aerostat	AAM	Radars
Tanks	HAE UAV	ASM	
Armored Vehicles	UCAV	Maritime	
Artillery	AWACS	Surveillance (P3)	
BM	Micro Air Vehicle		
	UUV		
	BMD		

Table 3-103. ROK Defense Systems Acquisition Method Summary

c. Assessed Vulnerabilities and Deficiencies from Epoch Four.

The epoch four net assessment bore out the requirement for a better CM defense. Additionally, based on Japan's quantitative superiority in CMs, Korea recognizes that it would need greater numbers of cruise missiles to hit the enemy with a long-range precision strike capability. The point to highlight is that defensively, Korea possesses a credible detection capability, but their ability to engage cruise missiles is not as robust, especially with the significant mismatch in quantity. Also identified from epoch two but not adequately addressed so far is Korea's need for BM Defense.

d. Korea's R&D Programs.

MND continues to focus on investing heavily in the development of high-tech weapons and securing the ability to develop core technologies suitable for the Korean military environment. The table below thus summarizes the major R&D efforts for the fourth epoch.

2016-2020	
Direction	Items to procure
Miniaturized systems	Air Mine Field (AMF)
Ballistic & cruise missile detection & defense systems	KSR-3
	KLENS
Directed energy beam technology	
High-altitude flight technology	

Table 3-104. ROK Major R&D Emphasis

To address the deficiencies in this epoch, the R&D focus continued to look for technological solutions provided by directed energy weapons (DEW). Besides providing an effective means of negating the incoming enemy threats, tactical DEWs are also relatively affordable. An added point is that DEW technology at 2020 is sufficiently mature that Korea should not face significant problems in developing its own systems, based on its self-reliance philosophy. Consequently, Korea's subsequent R&D investments will aim towards building better tactical DEWs by incrementally increasing their ranges. Based on the FDP allocations, the table below summarizes the services and DBA R&D investments.

Army		Navy		Air Force		DBA	
R&D Program	US$ Bil	R&D Program	US$ Bil	R&D Program	US$ Bil	R&D Program	US$ Bil
KAH66	$0.200	KDX-X	$0.190	FX	$0.150	Microsatellites	$0.250
AGM-11X	$0.030	SS-N-21 Integration	$0.045	UAV HAE	$0.100	Micro spy sats	$0.360
SAM(A-400)	$0.050	HPM	$0.280	UCAV	$0.125	Launch Vehicle (KSR-3)	$0.225
Tac Radar	$0.050	SSM/CM	$0.200	MAV	$0.100	KLENS	$0.150
THEL	$0.500	ASW	$0.200	AAM	$0.040	Micro Air Sensor	$0.280
Others	$0.619	UUV	$0.125	ABL	$0.300	Defense Digitization	$0.355
		Next-Generation Submarine	$0.350	Air Minefield	$0.175	Others	$0.238
		Others	$0.542	Others	$0.459		
Total	$1.449	Total	$1.932	Total	$1.449	Total	$1.858
Budget Allocated	$1.449	Budget Allocated	$1.932	Budget Allocated	$1.449	Budget Allocated	$1.858

Table 3-105. ROK R&D Programs

1) Defense Digitization/JC3IS Program Update

Based on the increased demand for information, the existing framework became unable to adequately support user needs. Consequently, MND decided at end 2015 that it would implement phase two of the defense digitization program. For phase two, this entailed embarking on an upgrade of the existing network to identify the critical data chokepoints and replace them where possible with a higher bandwidth communications system.

From the available market technology[73], MND identified that it would adopt laser communications processes into the existing networks to boost its capacity to a high

[73] A US BMDO-funded program begun in 1995 demonstrated the ability of using lasers to transmit data at high rates (>1.2 Gbps) with low-bit error rates at ranges up to 150 km between two mountaintops. From a late 1999 experiment using Lasercom technology, it was established that it was possible to establish a laser communication link, using imagery and video data, between a low earth satellite (TSX-5) and two portable ground stations with

bandwidth system capable of two Gbps data transfer rates. The laser source utilized is a solid-state laser diode operated at 60 mW optical power, with direct intensity modulation as the applied modulation scheme. The links are operated at optical frequencies at a wavelength of 800 to 860 nm.[74] To communicate with satellites from the ground, the laser light will be transmitted via a 25-cm aperture telescope providing a beam width of 10 μrad.[75] As of 2020, MND's utilization of new network technologies has resulted in the JC3IS possessing the capacity to meet the high bandwidth demands of the modern battlefield.

2) Space Program Development Update

Continuing Korea's policy of exploiting space as the next dimension of warfare, MND continued its improvements in its space surveillance capabilities by launching an additional 20 micro-satellites and 10 micro spy satellites. Subsequent R&D efforts were also made to improve the capabilities of its nano- and pico-sats according to the technological advances in MEMS.

3) Micro-Air Sensor Network (MASN) Update

As of end 2020, the MASN is now fully operational and thus affords Korea an affordable and almost continuous daytime maritime surveillance. The MASN is also at times employed for secret reconnaissance missions of its regional neighbors according to the wind patterns. MAV technology has also matured sufficiently that Korea now possesses the option of mounting its miniaturized sensor payload onto either a balloon- or

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ranges up to 2000 km and data rates up to 1 Gbps. "Laser Communications: The Answer to High Data Rate Communications", http://www.smdc.army.mil/FactSheets/Laser.html.

[74] Adapted from the SILEX system. "ESA launches laser comms system", SpaceDaily, March 25, 1998. http://www.spacedaily.com/spacecast/news/laser-98b.html.

[75] Adapted from the SILEX system. "ESA launches laser comms system", SpaceDaily, March 25, 1998. http://www.spacedaily.com/spacecast/news/laser-98b.html.

MAV-platform. In concert with Korea's nano- and pico-sat sensor payload developments, Korea has also begun exploring the possible use of these micro sensors to exploit the IR wavelength region. The ultimate aim here is that the successful miniaturized sensor fusion of an infrared sensor (IR) sensor together with the existing optical wavelength sensors would provide a truly continuous airborne and space surveillance capability. The present limitation using optical sensors only allows for daytime surveillance. A successful sensor fusion effort would also allow Korea to expand the employment of its suite of MAS and miniature satellites.

4) Aerial Mine Field System (AMFS) Update

The AMFS has also attained full operational capability having successfully undergone an extremely stringent operational test and evaluation program that lasted over two years. Korea's indigenous acquisition of the AMFS thus provides its air defense with a revolutionary capability that should allow it to enjoy some distinct advantages over its enemy in a conflict.

5) Korean Land Attack CM Defense Elevated Netted Sensors (KLENS)

The Korean Land Attack CM Defense Elevated Netted Sensors (KLENS) is a cost-effective, airborne sensor platform for providing over-the-horizon cruise missile defense, modeled after the US JLENS system. This system enhances cruise missile detection and engagement ranges with Korea's existing air defense weapons. The system consists of the platform subsystem (aerostat bag, tether and mooring station), the payload subsystem (a precision track-illumination radar and surveillance radar) and the processing station, which gathers the payload radar data and processes the radar track information for passage to friendly weapon engagement systems.[76]

Following the identification of a deficiency in cruise missile detection in 2015, MND directed the army to take the lead in establishing the KLENS program office. Concept studies were initiated in early 2016 and based on a comparison made on existing and available systems in the market, the KLENS program office decided that it was feasible for Korea to design and produce its own airborne-based cruise missile detection system. Total program value, including options for system development/demonstration and operation and sustainment was estimated at $300 M(US). Acquisition requirements for the KLENS was determined to be 20 complete systems at a value of $600 M(US).[77]

Figure 3-7. Picture of KLENS in Static Deployment

Initial delivery of the first KLENS was accepted in 2018 with final delivery expected in 2022.

The KLENS is a land- or sea-based tethered aerostat[78] about 80 m long, and filled with about 22,000 cubic meters

[76] KLENS could provide friendly units up to 10 minutes additional warning of the approach of hostile aircraft and cruise missiles before any blue ground-based radar can acquire the enemy's air tracks. Adapted from "JLENS", Soldier Armed, December 1999. http://www.ausa.org/armyzine/soldierDEC99.html.

[77] A reason for its low acquisition cost is that the aerostat and radar employed are of the COTS variety. The KLENS program is merely an integration of the suitable radar of choice with its existing aerostat platforms.

[78] Aerostats differ from blimps in that blimps are powered while aerostats are tethered or anchored to the ground. This tether also serves as a connection to the power source which may be positioned on the ground rather than within the aerostat.

of non-explosive, non-flammable helium.[79] The aerostat can stay aloft up to 30 days at a time and provides 24-hour per day coverage over extended areas.[80] Deployable at up to 5,000 m (or 15,000 ft), the KLENS sensor provides an all-round sense capability that can locate and track terrain masked targets up to 320 km, and provide an effective fire-control solution for joint theater air and missile defense weapon systems up to 250 km, through its interoperability with Korea's existing JC3IS.[81] Incidentally, KLENS addition to the JC3IS provides Korea's air defense network with a Cooperative Engagement Capability (CEC). Its low maintenance also provides the system with an operational availability rate greater than 90 percent.[82]

The use of elevated surveillance and precision tracking sensors, and the combination of all surface and air based sensor data into a single integrated air picture allows over-the-horizon detection, classification, identification tracking and engagement of threat cruise missiles. Achieving an elevated fire control quality sensor also allows the conduct of air directed missile engagements and the opportunity to achieve intercepts at the maximum effective kinematic range of these interceptors. This was not previously possible due to line-of-sight constraints created by terrain masking and the earth's curvature.

6) Korean Tactical High Energy Laser (KTHEL)

MND's decision to venture into the DEWs arose from an urgent need to provide an effective counter to the cruise missile threat identified in epoch three's net assessment and also in the air defense role. Based on its technology maturity and affordability in 2016, MND decided that it would be an economical technology investment to pursue.

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[79] Adapted from JLENS pamphlet http://www.smdc.army.mil/JLENS/JLENS_Office.htm.
[80] Adapted from Joint Land Attack Cruise Missile Defense Elevated Netted Sensor [JLENS]. http://www.fas.org/spp/starwars/program/jlens.htm.
[81] Information adapted from JLENS (to get website address).
[82] Information adapted from JLENS (to get website address).

Concept studies undertaken by the army had already been initiated as early as 2010 and supported by indigenous R&D into laser weapons, MND agreed that the military would acquire the US-Israel Tactical High Energy Laser (THEL) [83] system from Israel.

The ultimate goal was set for the joint R&D and production with Israel of a Korean-variant, known as KTHEL, short for the Korean Tactical High Energy Laser. It would essentially be a THEL system integrated onto the indigenously produced K-200 tracked platform. Korea's joint efforts with Israel are keyed towards the acquisition of its beam director technology and chemical laser production unit.

As a historical reference, the THEL demonstrated in 2000 that it was able to detect, track and destroy multiple Katyushas in a single engagement when it twice successfully shot down a series of two-rocket salvo tests.[84] The THEL utilizes a Deutirium-Flouride Laser capable of producing up to several tens of MW of laser power. KTHEL's goal is for its system to engage targets between 25-50 km.

Figure 3-8. Conceptual Drawings of KTHEL

[83] THEL, was originally developed under Project Nautilus, and its purpose was to detect and intercept 122mm Katyusha and other short-range rocket attacks against civilian and military sites in northern Israel. "THEL approaches crucial tests", Jane's Defence Weekly, March 18, 2000.
[84] "Ray Gun Shoots Down Multi Targets", SpaceDaily, September 22, 2000. http://www.spacedaily.com/news/laser-001.html.

Epoch Four Summary

At the same time the gates are permanently closed at the US Army Base in Yeongsan, US leaders call on Japan to lead the way in ensuring regional stability. This unsettling maneuver left Korea feeling especially vulnerable and triggered a sequence of events, which lead ultimately to Korea's bilateral alignment with the PRC. The region enjoyed a significantly optimistic economic outlook brought about by the resurgence of global confidence in regional economic growth and perceived stability.

Korea recognizes a shift in the priorities and roles of the unified defense force. The ministry of defense prepared plans to counter violent social outbreaks and any rogue military provocations. With the imminent rise of Japanese and Chinese maritime powers in the region, Korea's defense spending followed suit with an increased share of the budget to the Navy and the air force. The army continued to streamline and upgrade its forces to keep it lean but mean. Major integrating issues between the North and South remained a key issue for force structure planners.

The reunification of the two Korean militaries brought together missile delivery technology (North) and guidance technology (South), thus giving a unified Korea the capability to possess a credible nuclear-capable ballistic missile. However, a unified Korea has not, by the end of the epoch, fielded nuclear weapons. From its urgent need to deal with the cruise missile threat, Korea started to look at directed energy weapons to provide the technological solutions to meeting its deficiency. Given advances in communications technology, Korea also upgraded its JC3IS with laser communications to meet the high bandwidth demands of the modern battlefield. Finally, the country's efforts in developing its micro-air sensor network and air minefield system succeeds as the end of the epoch also signals the systems' fielding into Korea's military.

Korea stands unified with a strong economy, a capable conventional military force, strategically aligned with China, and feeling the need to possess a second strike nuclear deterrent.

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Annex 3A: BACKGROUND INFORMATION (2000 and prior)

1. Strategy

The reunification of North and South Korea will be a decisive strategic change in Northeast Asia during the next 20 years.   In 1999, the United States Army Sponsored the RAND Corporation's study of Korean reunification scenarios and the operational implications for the US Army. The study entitled, *Preparing for Korean Unification, Scenarios and Implications* was adopted as the baseline for this work's unification themes. The 14 pages that follow are summaries and paraphrased portions of the RAND study which apply specifically to the initial conditions of this work.

a. The Korean Crisis

More than 46 years of fragile peace have marked the history of "post-war" Korea, where the longest armistice remains in force. Called the final Cold War frontier, South and North Korea are in a technical state of war with the military confrontation between the two states constituting the most heavily armed face-off on the globe. An outbreak of hostilities on the peninsula carries potentially catastrophic consequences given North Korea's ballistic missile, artillery, and chemical weapons capabilities.

Not unlike the reunification of Germany a decade before, inter-Korean dynamics will shift fundamentally over the next decade. Economic and political instability will lead the list of causes for this potential change. Among the consequences of this vulnerability is the changing character of North Korea's alliance with Russia and China. With an economic output roughly half of what it was in 1990, Pyongyang's long-term viability is specifically challenged by the fragility of subsidies from Moscow and Beijing. The defining imperative of the North Korean state is no longer to present itself as an alternative model for Korean unification, but to avoid extinction as a political, economic, and social system. Regime survival has superseded all other national goals.[1]

Notwithstanding the periodic military excursions undertaken by the North against the South, peace has been maintained in Korea for nearly five decades. But North Korea's increasing vulnerabilities create a growing likelihood of major change. Though it is impossible to predict with confidence the timing and dimensions of such change, it will entail major strategic and operational consequences for the Republic of Korea (ROK), the United States, and for the military forces of both countries.

b. Security Environment

The near-certain probability of major political-military change in the North is the key strategic driver for security planning on the peninsula. Despite the downward spiral of Pyongyang's economic posture over the past decade, the North has been able to leverage its growing Weapons of Mass Destruction (WMD) capabilities for political and economic gain. And while the likelihood of a major conventional conflict has declined in recent years, the range and spectrum of conflict possibilities on the peninsula has expanded markedly, from WMD use on one end to military operations other than war (MOOTW) on the other.[2]

US and ROK defense planners are challenged in their planning assumptions by the possibility of state or regime collapse in the North. Certainly no one would disagree that the most preferable outcome of the political and economical instability in the North is a gradual reformation absent of violence and upheaval. Apart from being remote, such an outcome would enable incremental steps towards unification and a diminishing threat of military confrontation.

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[1] Jonathan D. Pollack, Chung Min Lee, *Preparing for Korean Unification; Scenarios and Implications* (Washington: RAND, 1999), Pg.xi.
[2] Jonathan D. Pollack, Chung Min Lee, *Preparing for Korean Unification; Scenarios and Implications* (Washington: RAND, 1999), Pg.xii.

However, even in the face of Kim Dae Jung's major initiatives, Pyongyang is holding steadfast to its *juche* or self-reliance ideology and appears uninterested in pursuing meaningful political accommodations with Seoul.

In his February 1998 inaugural address, President Kim put forward three basic principles that would govern the promotion of "peace, reconciliation, and cooperation" in South-North relations: no armed provocation by North Korea will be tolerated; a takeover or absorption of North Korea will not be attempted; reconciliation and cooperation will be expanded."[3]

South Korea was impacted by the 1997 East Asian economic crisis. Entrenched in economic preoccupations and given the extraordinary costs of the unification process, South Korea is content to avoid abrupt change in the North. However despite President Kim Dae Jung's declaration that the ROK does not seek to absorb North Korea or to hasten unification, such policies could easily be overtaken by events.

The North Korean military of the early 21st Century presents a different threat than that of the pervious two decades. This is particularly true with respect to North Korea as allied with the PRC and Russia. Russia is no longer committed to automatic military involvement in a crisis and China has conveyed that it is not prepared to come to North Korea's defense should Pyongyang launch an unprovoked attack on the ROK. As will be demonstrated during the Net Assessment segment of this study, North Korea is simply incapable of launching a sustained decisive campaign without the explicit support of China and/or Russia. Further evidence of this is Pyongyang's increased exploitation of WMD as a source of political and economic leverage. Although the possibility of a full-scale conventional war including the use of WMD can never be ruled out, that particular military threat has diminished appreciably since the late 1980s. Though

[3] Jonathan D. Pollack, Chung Min Lee, *Preparing for Korean Unification; Scenarios and Implications* (Washington: RAND, 1999), P.7.

Russian and Chinese behavior might prove different in a crisis, their policy declarations are a testimony to an appreciably diminished security relationship between Pyongyang and its erstwhile allies.

Despite more than a decade of economic decline, acute food shortages, and steep reductions in industrial production, North Korea continued to allocate more than 25 percent of its shrinking GDP to military expenditure into the early 21st Century. The number of people serving in the armed forces remained largely constant.[4] Major fuel shortages, reduced defense industrial output, limitations on spare parts availability, and non-combat military assignments undertaken by the Korean People's Army (KPA) have almost certainly impinged on war readiness.

The U.S.-ROK Combined Forces Command (CFC) continues to plan for a full range of contingencies on the peninsula, including major theater war. Though the near-term nuclear threat was ostensibly contained through the U.S.–North Korean Agreed Framework accord of October 1994, there is no assurance that North Korea has ceased work on a clandestine nuclear program. This is partly evidenced by the North's periodic threats to restart its nuclear weapons program which, no doubt, is further designed to elicit economic and energy assistance from the United States and others.[5] Intelligence estimates suggest that nuclear weapons development could be resumed at a major underground site at Kumchang-ri. According to the congressional testimony of General John Tilelli, Jr., (Commander in Chief of the Combined Forces Command and of United States Forces Korea (USFK) from July 1996 until December 1999), the intelligence community judges the Kumchang-ri construction effort "large enough to house a plutonium production facility and possibly a reprocessing plant." Although the project remains

[4] Defense White Paper, 1997–1998 (Seoul: The Ministry of National Defense, Republic of Korea, 1998), pp. 55–56

[5] Elisabeth Rosenthal, "North Korea Says It Will Unseal Reactor," The New York Times, May 13, 1998; Kevin Sullivan, "North Korea Threatens Revival of Its Nuclear Program," Washington Post, May 15, 1998.

years from completion, General Tilelli expressed "deep concern that the North is continuing a covert nuclear weapons program."[6]

The pivotal assumption governing the reformulation of ROK strategy toward the North is the belief that, over the longer run, North Korea will have no alternative but to undertake reform and accommodation with the South. In the words of the Council on Foreign Relations report, "It is clear that Pyongyang has lost the competition between the two Koreas. Though the North remains stubbornly resistant to change and the opening of its system, *reform is now its only escape from continued erosion and eventual collapse*."[7] By this logic, an incremental transition in the North will enable the regime to avoid extinction, ultimately permitting a meaningful, longer-term process of reconciliation with the South.

The North Korean leadership also recognizes that there is leverage in its acute economic vulnerabilities and pervasive shortages of energy, food, and related essentials. International aid that seeks to prevent a major humanitarian crisis in the North has increased markedly, helping to compensate Pyongyang for the loss of external assistance from Russia and China. An "aid-based" foreign policy strategy may be judged essential to North Korea's prospects for near-to-midterm survival, especially with respect to provision of energy supplies and foodstuffs. In essence, such a life-support strategy(which the ROK government estimates totaled nearly $1 billion between 1995 and 1998) has saved the leadership from having to make larger adaptations in its domestic or external strategies.[8] Such calculations have also been abundantly evident in the negotiations over U.S. access to the suspect nuclear site at Kumchang-ri. For example, the

[6] Statement of General John H. Tilelli, Jr., to the House National Security Committee, March 3, 1999. In mid-March 1999, the United States and North Korea reached an agreement allowing U.S. inspectors access to the suspect site, with the initial inspection in May 1999. David E. Sanger, "U.S. Aides in Pact with North Korea on a Suspect Site," The New York Times, March 17, 1999.
[7] Managing Change on the Korean Peninsula, p. 5. Emphasis added.

March 1999 agreement stipulated that, in return for access to the site, North Korea will receive 600,000 tons of grain from the United States and various non-governmental organizations.

c. North Korea

North Korea's prospects and capabilities must be understood in terms of the country's internal dynamics and the decisions of its supreme leader, Kim Jong Il. The extreme personalization of political power in the North will largely determine North Korea's responses to four key policy dilemmas which, in turn, may decide regime survival: reversing the decline of a hardening command economy while continuing to spend 30 percent of a shrinking gross domestic product (GDP) on defense; attempting to overcome acute structural problems in the economy without introducing major reforms that could erode central political control and trigger larger internal consequences; continuing to participate in bilateral and multilateral accords and negotiations, gaining additional international assistance, while avoiding concessions that would undermine Pyongyang's larger diplomatic and military strategies; maintaining its foreign policy opening with the United States while avoiding full-scale relations with South Korea that could undermine the North's national sovereignty and claims of legitimacy.[9]

1) North Korea's Economic Decline

The Kim Jung Il regime has three alternatives to reverse the erosion of the North's economy. First, it can implement major economic reforms, beginning with the introduction of more market oriented policies. Second, it can permit piecemeal cosmetic changes, including the solicitation of foreign investment for special economic zones. And third, it can seek to "muddle through" by

[8] The Unification Ministry estimates the total assistance between 1995 and 1998 from the United States, ROK, United Nations, and various nongovernmental organizations (NGOs) to be $950.98 million. "North Korea Receives $950 Million in International Aid," Korea Times, October 7, 1998.

[9] Jonathan D. Pollack, Chung Min Lee, Preparing for Korean Unification; Scenarios and Implications (Washington: RAND, 1999), P.xiv.

tactical economic adjustments and expectations of international provision of foodstuffs, energy, and various forms of humanitarian assistance.

Drawing from the lessons of the former Soviet Union, if the North Korean regime launched major market-oriented economic reforms, the country would likely face massive socioeconomic disruption and a challenge to its political legitimacy. But if the leadership resists major change, the economy will decline further, ultimately threatening the regime’s viability. This is a dilemma for which the North Korean leadership has no long-term answer, though it will seek to delay a major reckoning as long as possible. Pyongyang will therefore likely pursue a “muddling along” strategy for the present, since this could yield critical infusions of external assistance without requiring major internal changes. But this alternative cannot be considered a long-term solution. However, a larger shift in economic policy would entail substantial political risks to the Kim Jong Il regime, since Kim’s political legitimacy rests on loyalty to juche strategies established by his father, Kim Il Sung.

Absent an appreciable economic recovery, the regime’s longer-term prospects seem increasingly grim. This progressive decline can be characterized as a descending spiral in which the North’s prospects for survival steadily narrow through six potential stages:

a) Economic and political atrophy
b) Economic breakdown
c) Political instability
d) Regime breakdown
e) Regime and/or state collapse
f) Conflict or absorption

Gradual strategic

Accelerated strategic

The first three stages constitute characteristics of overall strategic decay, whereas the second three stages are manifestations of accelerated strategic decay.

d. The roles of Japan, China, and Russia

The possibility of destabilizing change in the North is increasingly recognized by Japan, China, and Russia, the other major powers with major strategic interests on the Korean peninsula. All three states have repositioned their national strategies and policies, including increased attention to crisis-management requirements as well as planning for longer-term peninsular dynamics. Tokyo, Beijing, and Moscow all offer lip service to the goal of unification, but it is doubtful that any are eager for it. Each concurs with the predominant goals of U.S. policy on the peninsula: deterrence and defense, preventing WMD proliferation, and avoiding an acute humanitarian crisis or abrupt collapse. In the near-to-middle term, each shares a common interest in maintaining stability, as seen from their separate vantage points. But the interests and potential response options of all three powers vary considerably, and warrant separate discussion.

1) Japan

As the cornerstone U.S. ally in Northeast Asia, Japan will play a crucial role in a major peninsular crisis. The Japanese are clearly worried about the implications of pronounced instability on the peninsula, but they are also acutely concerned about the security implications of North Korean missile development. The three-stage *Daepo-dong 1* missile launched on August 31, 1998, ostensibly in an effort to place a North Korean satellite in orbit, directly over-flew Japanese territory and underscored Pyongyang's ability to put Japanese targets at risk. It generated support within Japan for more active exploration of Theater Missile Defense (TMD) options and it reinforced Tokyo's incentives to remain closely aligned with the United States.

At the same time, Japan remains highly constrained in its potential crisis response options especially with respect to its constitutional limitations on defense. An equally important factor is Japan's history of occupation and colonialism in Korea and profound sensitivities within Korea concerning overt Japanese involvement in any future crisis. For all these reasons, Japan has been largely content to follow rather than lead with respect to planning for peninsular instability.

The inescapable reality is that Japan could find itself drawn into a future Korean crisis, though not in a direct combat role. In a range of scenarios, internal developments in the North could have pronounced spillover consequences: a major humanitarian or refugee crisis; the need for noncombatant evacuation operations (NEO) of Japanese nationals residing on the peninsula; logistics and related support functions for U.S. forces in Japan; and U.S. use of Japanese bases in a crisis. These considerations have all been raised in deliberations over revisions of the U.S.-Japan Defense Guidelines and in U.S. encouragement for a heightened ROK-Japanese bilateral defense dialogue. Thus, despite Japan's preferences for gradual transition paths in the North,[10] there is a need to prepare for an array of internal scenarios with respect to North Korea and the potential repercussions. A major crisis on the peninsula therefore represents one of the touchstone contingencies underlying U.S.-Japan relations and the internal security debate within Japan.

2) China.

If China decides to substantially augment its assistance to the North, the regime's chances for survival would be considerably enhanced. Though the Chinese have increased their energy and food aid in recent years, leaders in Beijing seem disinclined to undertake heroic

[10] Christopher W. Hughes, "Japanese Policy and the North Korean 'Soft Landing,'" *The Pacific Review*, Vol. 11, No. 3, 1998, pp. 389–415.

measures on behalf of the North. But there appear to be three circumstances under which the Chinese might weigh such a course of action:

a) If the North (despite a clear aversion to dependence on China) signals its readiness to "tilt" toward Beijing in exchange for enhanced economic and political support.

b) If the indicators of instability in the North and its repercussions for stability and security in contiguous border areas convince the Chinese that they need to act to manage the risks to their security and ensure their long-term interests.

c) If the ROK and the United States embark on unilateral actions to counter instability in the North that China believes would undermine its long-term political and security interests.

However, the prospect of such major shifts in Chinese policy seems unlikely. Should the signs of an impending crisis in the North begin to mount, Beijing might well opt to heighten its consultations with Washington and with Seoul, even while also enhancing its capacity to act unilaterally. The Chinese clearly retain a substantial capability to shape longer-term peninsular outcomes But such possibilities underscore the additional need for much closer consultations among the United States, ROK, and China.

Chinese interests on the peninsula, while having some similarities with those in Japan, place it in a potentially pivotal position. Like Tokyo, Beijing has a predominant interest in sustaining the status quo, with most Chinese observers uneasy about the prospect of rapid unification. Unlike Tokyo, the Chinese maintain substantial equities with both Koreas, and if the peninsula unifies, they would immediately encounter substantial political and security consequences. The Chinese have begun to acknowledge (albeit circumspectly) signs of instability in the North, and their economic support to Pyongyang (primarily in terms of grain supplies and crude oil) has increased from its lower levels during the first half of the decade. Moreover, Beijing and Pyongyang both make explicit reference to this assistance.[11] Some Chinese analysts voice (also quietly) increased worry about North Korean WMD activities, though nearly all-public statements remain unusually circumspect. Indeed, Chinese statements assert that the United States and Japan are using the “pretext” of the North Korean missile test as a justification for enhancing TMD development.

At the same time, even as China has steadily expanded its economic and political ties with the ROK (two-way trade at present approaches $25 billion, with China now the ROK’s third largest trading partner), Chinese wariness persists over various Seoul-centered unification scenarios. Given that China’s links to both Koreas afford it substantial leverage in relation to future outcomes on the peninsula, there is still ample uncertainty and evident internal debate over its preferred strategy under more stressful circumstances.

Thus, future Chinese behavior (i.e., Beijing’s incentives and readiness to cooperate with caution, or alternatively to oppose U.S. and ROK actions in a severe crisis) remains uncertain The Chinese have reason to pursue loose diplomatic coordination with the United States and ROK and this might extend to consultations over humanitarian assistance in the absence of major crisis. But Chinese responses to internal upheaval in the North that threatened to spill outward could prove highly “scenario dependent.” For example, though the Chinese would seem to have ample reason to avoid direct embroilment in North Korean internal affairs, their incentives to control and contain a potential humanitarian crisis near their border with the

[11] See, for example, Xinhua, October 15, 1998, in BBC Selected World Broadcasts—Far East, No. 3366, October 29, 1998, p. D6. According to a Chinese military analyst, China’s gratis assistance to the North in 1998 included 100,000 tons of grain, 20,000 tons of chemical fertilizers, and 80,000 tons of crude oil. Zhang Jinbao, “An Important Year in the Development of the Situation on the Korean Peninsula in 1998,” International Strategic Studies, No. 1, 1999, p. 41. Aggregate Chinese assistance levels to the North are in all likelihood much higher.

North seem self-evident. Increased refugee flows into China have led to crackdowns by Chinese security personnel against some of these refugees.

3) Russia

For much of the Cold War, Moscow was Pyongyang's largest benefactor. With the collapse of the Soviet Union, however, Moscow became progressively marginalized in its peninsular role. Indeed, given the substantial ROK economic interactions with China, Russia is no longer able to compete credibly with its neighbor for the attention of the South. Russia feels excluded from policy developments on the peninsula in a number of realms: the Korean Peninsula Energy Development Organization (KEDO) process has blocked possible Russian reactor sales to the North; Moscow (as well as Tokyo) has no seat at the four-party talks; and Russia's economic and security linkages with the North have clearly diminished. This said, Russia may well retain some historical linkages to senior North Korean officials, though these could prove a diminishing asset. But Russian assertions indicate a continued strategic interest in regional security and in the context of how the unification process might unfold.[12] The more immediate issue, however, is whether and how Russia could be credibly involved in future peninsular outcomes. Unlike the 1961 treaty of alliance and mutual assistance, the new treaty on interstate relations initialed in March 1999 commits Russia to consultations with the North in the event of a crisis, but it does not obligate Russia to automatic military involvement.[13] Thus, it is far from certain that major internal change in the North—especially if it produced larger external repercussions—would appreciably increase Russia's leverage and involvement, given Moscow's own internal preoccupations. But a surviving and

[12] "The Consequences of Korea's Unification for Russia and Security in Northeast Asia," Far Eastern Affairs, No. 4, 1997, pp. 23–40.

recovering North could well see opportunities to strengthen its links to Russia, suggesting one means by which Moscow could reemerge as a more credible actor on the peninsula.

e. Implications for Defense Planners

Preferred outcomes such as a significant reduction in the military threat, stabilization and reform in North Korea, major gains in South-North relations, and improved ties between North Korea and the United States are self-evident. But movement towards an endgame in which all sides achieve an acceptable outcome at tolerable levels of political, military, and economic risk and commitment cannot preclude the need for planning against very divergent possibilities. Three challenges in particular warrant closer attention.

First, future defense planning has to assess how current deterrence and defense capabilities need to be reconfigured in response to unconventional scenarios or to major deviations within familiar scenarios.

Second, a triggering event or series of events could begin a chain reaction that expedites unification. The experiences in Eastern Europe and the former Soviet Union during the late 1980s and early 1990s are a possible guide in this respect. An incremental transformation remains unlikely in North Korea, and a process of compressed change on the peninsula could result in abrupt unification. Even though all external actors clearly prefer a gradual reduction of tensions leading to integration and a political *modus vivendi*, the latent possibility of rapid unification remains.

Third, the United States and South Korea will confront new alliance management requirements, including political and military responses if and when peninsular stability is seriously threatened. The concerns of various regional powers would increase substantially in a

[13] ItarTass, March 17, 1999, in BBC Summary of World Broadcasts, No. 3486, March 18, 1999, p. D2; see also the remarks of Russian Deputy Foreign Minister Grigoriy Karasin, Kyoto, April 2, 1999, in BBC Summary of World

severe crisis, depending on the depth and speed of change in the North. This is particularly true for China, given its shared border and its longstanding historical ties with North Korea. If a crisis should escalate into a military clash or expand into a major conflict, Japan's role will also be critical in the context of a range of support requirements for U.S. forces. Despite Russia's limited political or military roles at present, Moscow also continues to maintain ties with the North and may feel compelled to react in order to secure its own interests in a major Korean crisis.

Thus, U.S.-South Korean joint planning and coordination may be insufficient to address a range of potential outcomes that are now much more plausible than in the past. The alliance must therefore be prepared to cope with rapid unification and a spectrum of new issues that will surface in the post-unification era. A host of factors—the size, composition, and location of U.S. forces in a unified Korea; future political and command arrangements; strategic and operational adjustments for U.S. forces in Korea and elsewhere in the region; managing rapid demobilization in the North; dismantling North Korea's WMD infrastructure; and many other pressing military and security issues—will have to be addressed between the United States and a unified Korea.

The unification of Korea could also emerge as a pivotal geopolitical factor in the strategic equation of Northeast Asia in the early 21st century. If Korea is unified in the near future, it will be the first time in nearly one hundred years that it has been a single, independent actor. A unified Korea may become more nationalistic and could pursue a more diversified national strategy. For example, owing to historical, strategic, and economic considerations, a unified Korea might pursue a closer relationship with China, even if it maintains a primary affiliation with the United States.

Broadcasts, No. 3500, April 5, 1999, p. E1.

Figure 3-8. Korean Peninsula and Surrounding Region

f. Geography

The following table highlights the key geographical characteristics of the Korean Peninsula.

	ROK	DPRK
Area (square km)	Total: 98,480 Land: 98,190 Water: 290	Total: 120,540 Land: 120,410 Water: 130
Boundaries (km)	Total: 238 (N. Korea)	Total: 1,673 China: 1,416 So Korea: 238 Russia: 19
Coastline (km)	2,413	2,495
Climate	Temperate with rainfall heaviest in Summer	
Terrain	Mostly hills and mountains; wide coastal plains in West and South	Mostly hills and mountains separated by deep, narrow valleys; coastal plains wide in West, discontinuous in East
Natural Resources	Coal, tungsten, graphite, molybdenum, lead, hydropower	Coal, lead, tungsten, zinc, graphite, magnetite, iron ore, copper, gold, pyrites, salt, fluorspar, hydropower
Land Use	Arable Land: 19 % Permanent Crops: 2 % Permanent Pastures: 1 % Forests/woodland: 65 % Other: 13 %	Arable Land: 14 % Permanent Crops: 2 % Permanent Pastures: 0 % Forests/woodland: 61 % Other: 23 %
Irrigated Land (Sq km)	13,350	14,600
Note		Strategic location bordering China, South Korea, and Russia. Mountainous interior is isolated, nearly inaccessible, and sparsely populated

Table 3-106. North and South Korea Geography

g. Demographics

The following table highlights the key demographic characteristics of the Korean Peninsula.

	ROK	DPRK
Population	47,470,969	21,386,109
Age Structure	0-14 years: 22 % 15-64: 71 % Over 65: 7 % Nearly even split between sexes	0-14 years: 26 % 15-64: 68 % Over 65: 6 % Nearly even split between sexes
Population growth rate	0.93%	1.45%
Birth rate	15.12 births/1,000	21.37 births/1,000
Death rate	5.85 deaths/1,000	6.92 deaths/1,000
Migration rate	0/1,000	0/1,000
Sex ratio	At birth: 1.13 male/female Under 15: 1.12 male/female 15-64: 1.03 male/female $\geq$ 65: 0.63 male/female	At birth: 1.05 male/female Under 15: 1.05 male/female 15-64: 0.96 male/female $\geq$ 65: 0.45 male/female
Infant mortality rate	7.85 deaths/1,000 live births	25.52 deaths/1,000 live births
Life expectancy	Total: 74.43 Male: 70.75 Female: 78.54	Total: 70.07 Male: 67:41 Female: 72.86
Total fertility	1.72 children born/woman	2.3 children born/woman
Ethnic groups	At birth: 1.13 male/female Under 15: 1.12 male/female 15-64: 1.03 male/female $\geq$ 65: 0.63 male/female	At birth: 1.05 male/female Under 15: 1.05 male/female 15-64: 0.96 male/female $\geq$ 65: 0.45 male/female
Religions	49 % Christian 47 % Buddhist 3 % Confucianism 1 % other	Buddhism and Confucianism, some Christianity and syncretic Chondogyo. Note: Autonomous religious activities now almost nonexistent; government-sponsored religious groups exist to provide illusion of religious freedom.

Table 3-107.   North and South Korea Demographics

h. Economics

The uncertainties on the Korean peninsula have been compounded by the East Asian financial and economic crisis. As the world's 11th largest economy, South Korea was the most industrialized of East Asia's "Four Tigers," and it had continued to register GDP growth rates averaging 6 to 7 percent throughout the early and middle 1990s. Notwithstanding Korea's highly credible macroeconomic performance, a surge in short-term international debt, estimated by the International Monetary Fund (IMF) at $157 billion, triggered a major crisis. South Korea's backward financial and banking systems, political corruption, bankruptcies among several leading *chaebols* (conglomerates), and rising wages (the second highest in East Asia after Japan) all contributed to a rapid deterioration in economic conditions during 1997.

Indeed, many telling indications of the looming crisis were evident months before the onset of the larger East Asian crisis triggered by the collapse of the Thai currency in July 1997. The bankruptcy of the Hanbo Group in January 1997, as described by one well-informed economic observer, "revealed many weaknesses of the Korean economic system to the international financial community, such as excessive reliance on bank borrowing by conglomerates, political collusion between conglomerates and politicians, lack of transparency in business accounts, and ineffective bank supervisory mechanisms."[14] The critical issues over the longer run are twofold: first, the rate of recovery in the economy as a whole (unemployment is approaching 2 million workers, its highest level in over three decades, with the economy contracting by 5.8 percent during 1998 [15]), and the capability of the ROK's political leadership to address the deeper maladies affecting the business climate. Despite unexpectedly robust economic growth during

14 SungMok Suh, The Korean Economic Crisis: What Can We Learn From It? (Stanford: Asia/Pacific Research Center, Stanford University, May 1998), p. 12. Suh's reconstruction of the crisis and its consequences is first-rate.
15 Michael Schuman, "South Korea's Economy May Have Turned a Corner," The Asian Wall Street Journal, March 24, 1999.

early 1999, fueled by strong export performance and major increases in foreign direct investment, the longer-term economic challenges remain substantial.

The economic crisis also entailed substantial national security implications. The government has deferred a number of force modernization programs, and additional cutbacks are likely for at least the next two years. The ROK Ministry of National Defense has also announced cuts in the planned acquisition of AWACS early-warning aircraft for the air force and next-generation submarines for the navy.[16] Indeed, the defense ministry's budget plan for 1999 shows a 0.4 percent decrease in defense spending, the first decrease ever recorded in the ROK's fifty-year history. Though Korean defense planners project renewed budgetary growth in the five-year plan that begins in the year 2000, these outcomes will remain contingent on future economic performance.[17] Thus, if South Korea's economic recovery proceeds more slowly than is currently anticipated, there could be longer-term security repercussions.

The ROK's current economic preoccupations have reinforced widespread unease about "unification through absorption." Even before the outbreak of the economic crisis, there was a growing internal consensus that unification costs could prove prohibitive for South Korea. In the aftermath of the crisis and the significant financial burden posed by South Korea's need to pay back loans to the IMF and other agencies, it remains doubtful that South Korea could afford to absorb the North solely on the basis of its own resources. In this respect, President Kim's policy initiatives toward the North have made a virtue out of necessity. Thus, the strategy of engagement, including support for a "soft landing" in the North, could gain additional political

16 Chosun Ilbo, January 12, 1998.
17 "Defense Ministry Proposes First-Ever Budget Cuts," The Korea Herald, September 22, 1998. The annual increases in defense expenditure in the past had ranged between 9.3 percent to 12.6 percent. The growth in 1998 was 0.1 percent. The budget for the year 2000 projects an increase of 5.5 percent with an average annual increase over the full five-year defense plan between 4 and 5 percent. Yonhap, February 12, 1999, in BBC Summary of World Broadcasts, No. 3458, February 13, 1999, p. D4.

momentum in the United States and South Korea, even as it rests on highly problematic assumptions.

The full impact of the economic crisis on longer term defense modernization goals for South Korea is still difficult to determine, given that most ongoing force upgrade programs were decided before the crisis.

South Korea's economic setbacks also have ramifications for the U.S.-ROK alliance. On the one hand, the level of defense cooperation is unlikely to change and could even be enhanced, given uncertainties in North Korea.

2. National Defense[18]

a. Military Preparedness

To achieve the defense objectives, the ROK armed forces have made concerted efforts to deter enemy provocation in peacetime, while developing contingency plans to prepare for any form of enemy provocation. The armed forces have also promulgated combat readiness through combined exercises and trainings (Team Spirit and the Rim of the Pacific (RIMPAC)), joint exercises and training , as well as specific army, naval, and air force training.

b. Military Strategy

The military strategy was devised with two objectives; first to guarantee national security and prosperity in peacetime by deterring external military threat and armed attack, and second deterrence fail, the ministry of defense would be engaged in the active defense strategy of the ROK-US to defeat the enemy and thus establish the foundation for national unification. Not withstanding the efforts to deter war on the peninsula, if the North were to provoke a war, the ROK would employ the strategic concept of active defense giving priority to the security of the

[18] Information contained in this section is excerpted from the "*Defense White Paper 1999*", Ministry of Defense, Republic of Korea.

Seoul metropolitan area, try to undermine the enemy's will to continue the war, destroy the enemy main force and create a basis for national unification. To safeguard lasting peace and prosperity in the Asia-Pacific region, the ROK will gradually promote and develop all-directional military cooperation with surrounding countries. By gradually weeding out causes of conflict and disputes in advance, the ROK will actively contribute to the establishment of a peaceful and stable security environment in the region. Furthermore, ROK will actively participate in the peacekeeping activities of the UN to contribute to lasting world peace and co-prosperity for all mankind.

c. Operational Posture

In the event of an all-out offensive by North Korea, it is anticipated that they would try to conquer the entire peninsula in the shortest time possible by simultaneously attacking both the front and rear areas in a combination of conventional and guerrilla warfare. To prepare for the eventuality, early warning systems had been improved and quick-response posture enhanced. South Korea’s strategic response is to intercept and repel an attack at the front line and to strike a severe blow to an incoming enemy during the initial stages of war. In addition, thorough operational preparations have been made to prevent North Korean troops infiltrating the front and rear areas from linking up with each other. Their operational objectives would be frustrated early so that a full-scale counterattack could be staged.

d. Quick-Response Posture

In light of the formidable destructive power of modern weapons and considering North Korea's *blitzkrieg* war plans the outcome of any future war on the Korean peninsula would be determined during the first days of engagement. Based on the principles of ROK’s active defense strategy, the armed forces have focused on the improvement of quick-response.

First, with respect to operational command and control (C2), an integrated operational command system has become a crucial factor in modern warfare. Second, North Korea has since the early 1990's concentrated its efforts on developing a variety of long-range missiles and has already deployed some of these missiles. The ROK has increased the defensive capabilities against this type of threat, in the main forces and at important facilities of the nation located within enemy missile range. The ROK is pushing to obtain requisite weapons and equipment for surveillance activities on North Korean guided missile sites, and for intercepting the missiles.

Third, to wage a successful *blitzkrieg*, the North has continued to expand its mechanized units numerically. To prepare for a concentrated attack of these mechanized units, the ROK has employed an integrated management of the available ground, sea and air combat resources, including a variety of different kinds of firepower as well as anti-tank barriers, along the major avenues of approach. Fourth, North Korea has forward-deployed advanced night-time and all-weather fighter aircraft and low-altitude, low-speed aircraft for infiltrating commando troops. High-speed landing craft are also deployed at forward sectors near the DMZ. To counteract this threat, the armed forces have reinforced the air and sea defense through integration of our air defense capabilities, including improvements in our air interception and maritime strike capabilities, joint-operations posture of the ground, sea and air forces, and air and sea early warning system.

Fifth, contrary to the international efforts for nonproliferation of chemical weapons, North Korea has not only refused to sign the Chemical Weapons Convention, but has also continuously reinforced its chemical warfare capabilities by increasing its massive stockpile of chemical weapons. To prepare for a possible North Korean chemical attack, an early-warning system has also been established to detect chemical attacks in both front and rear areas. Equipment and materials have also been secured to protect civilians and military personnel and regular anti-chemical warfare defense drills at all levels of the ROK armed forces have been implemented. Sixth, to overcome the panic at the initial stage of war and to carry out effective operations, an integrated operational command system is very crucial. The armed forces, therefore, have established an efficient operational command system for joint operations and for dealing with integrated movement of civilians, government personnel, and the military. Seventh, the operational posture of reserve forces is also important to mobilize the required forces at the preliminary and initial stages of a war and to increase war sustainability. The military has established an effective operational reserve forces posture and has improved the quality of reserve forces by developing a national mobilization system, by promoting the efficient resource management of reserve forces and by developing the management of mobilization affairs.

e. Defense of the Capital and Rear Areas

South Korea’s capital city of Seoul, located about 40 km south of the DMZ, is the weakest point in the ROK defense. Because a large portion of the population and national wealth is concentrated in the Seoul metropolitan area, the defense of Seoul is critical. For the defense of the capital area, the incoming enemy main force would have to be intercepted and blocked near the DMZ, thereby alleviating the immediate threat to the capital area. At the same time, the armed forces must be prepared for deceptive attacks or irregular warfare by enemy SOF units, air assaults, and long-range artillery units. In addition to the preparations by the military, civil defense capabilities are bolstered in such functional areas as medical treatment, water and food supplies, and evacuation of residents by activating civil defense organizations through individual administrative units. Considering North Korea's basic strategy of combining regular and irregular warfare, it is expected that special commando units would infiltrate on a large scale into the rear areas by land, sea and air, trying to incapacitate the ROK's military operations. To counter any North Korean attack at the rear area, the ROK armed forces have constructed a multi-layered defense system. They have also developed the operational concepts of waging regular war in the rear areas to counter a simultaneous attack on front and rear areas.

f. Territorial Sea and Air Defense

Geopolitically, the Korean peninsula is a bridge between the continental and maritime powers. It is bordered by the sea on three sides: east, west and south. The ROK depends almost completely on the sea for transportation of exports and imports. With these unique conditions in mind, the armed forces are upgrading their sea patrol operations to maintain tight control over South Korea's territorial waters and to protect its sea lines of communication (SLOCs). For this purpose, the Joint Operation Sea Areas (JOSAs) were established for the early detection, identification, and control of enemy vessels intruding into South Korea's territorial waters.

To prevent unnecessary friction with North Korea, the ROK armed forces have established and managed the Northern Boundary Line (NBL) in the East Sea and the Northern Limit Line (NLL) in the Yellow Sea, based on the same concept as the Military Demarcation Line (DML) on the land. Since the truce was declared in 1953, however, North Korea has frequently penetrated the NLL near the five northernmost islands, thereby heightening tensions between North and South Korea. To deal with such provocations, the armed forces have taken measures in coordination with relevant government agencies to control fishing activities in the sensitive zones and to counter territorial violations by North Korea with firm military response.

On the other hand, with the Third UN Agreement on the Law of the Sea having come into effect as of November 16, 1994, many nations have been proclaiming Exclusive Economic Zones (EEZ's). In relation to this, the ROK military has been conducting continuous maritime operations to maintain the sea control authorized by this agreement. Considering the importance of air superiority in modern warfare it should be recognized that the effective defense of the territorial airspace is directly connected with the survival of the nation. The Korea Air Defense Identification Zone (KADIZ) and the Korea Air Defense Area (KADA) had been established to defend the territorial airspace. KADIZ is created to identify and control aircraft quickly, while the KADA is for identifying, placing under constant surveillance, and controlling any flights in the area by enemy aircraft. The geographical boundary of the KADA over the water is the same as that of the JOSAs. To identify aircraft entering the airspace and to intercept enemy aircraft, the ROK air force operates a 24-hour surveillance and early warning system, combat air reconnaissance flights, ground alert aircraft, and maintains a high level of air defense readiness. The Flight Information Region (FIR) is also operational for flight safety. Within this zone, authorized aircraft are provided with the necessary air traffic control. In addition, help and assistance are provided for search and rescue.

g. Countermeasures against Localized Armed Provocation

Since the armistice in July 1953, North Korea has made repeated provocations against the South. Their aborted raid on the presidential Blue House in 1968, the 1976 ax-murder incident at Panmunjom, the hijacking of many of our fishing boats on the East Sea and the Yellow Sea, intrusion of armed troops into the Joint Security Area (JSA) in the DMZ, and frequent penetrations across the NLL are typical examples of North Korean provocation., It is quite possible that North Korea will attempt local provocations to reduce visibility of current difficulties such as their regime crisis, economic struggle, and isolation from the international community. In attempting such provocations, they would expect to create political, economic, and social disorder in the South by making a tense situation, testing the operational posture of our forces, securing the pretext for an all-out war, or attempting to secure advantage in political negotiations. Examples of this kind of provocation may include a violation of the Korean Armistice Agreement which is a valid international agreement; and various provocations in other specific areas, including northwest islands belonging to the ROK that are near the Northern territory. With respect to these provocations by Pyongyang, the ROK Armed Forces have enhanced the surveillance and warning posture, established countermeasures against possible types of provocations, and strengthened operational exercises.

h. Countermeasures against Infiltration and Terrorism

North Korea has executed provocations and terrorist activites such as the Ulchin and Samchok commando infiltration in 1968, the bombing at the Aungsan Cemetery in Rangoon, Burma, in 1983, the bombing of KE 858 in 1987.. With respect to the infiltration, the ROK has maintained a 24-hour surveillance and warning system comprised of new radar systems and various surveillance equipment. A locally integrated civilian-government-military defense system has been established to detect and destroy enemy units of inland infiltration at an early stage. Countermeasures have been prepared against indirect infiltrations through airports and harbors. Additionally. comprehensive countermeasures against terrorism are denying international terrorists penetration inland and the capabilities of our special counter-terrorist units has been improved with modern counter-terrorism equipment.

i. Countermeasures against Psychological Warfare

To build a favorable atmosphere of unifying the entire peninsula on its own terms, North Korea has waged psychological warfare largely through the launching of political and ideological offensives. In recent years, it has intensified self-praise propaganda activities in the hopes of overcoming its political crisis, utilizing all available means of psychological warfare.

j. South Korea’s Force Improvement Plans

The United States has been largely responsible for the Korean Nuclear Framework Agreement and it is the prime force behind the Four Way Talks. The United States has provided US$8 billion in economic assistance to South Korea, and 640,000 American troops would be sent to the peninsula in the event of a major attack. The most significant new military development appears to be the "Sunshine Policy" announced by President Kim in his inaugural address. This policy is designed to relax tensions between North and South Korea. The President is calling for "a new chapter of reconciliation, exchanges and cooperation. Let us initiate a good relationship for mutual prosperity and coexistence." The danger of the "sunshine policy" is that the President does not appear to be a vigorous proponent of the strong defense policies advocated by all of his predecessors.

A major decision confronting President Kim is the future of South Korea's military modernization program. This involves key decisions such as what to do when the ROK's aging 270 F-4 and F-5 jet fighters need to be replaced. A Korea Fighter Program already exists and the ROK Air Force will receive the final delivery of 120 KF-16 jet fighters in the year 2000. Samsung Aerospace is manufacturing them under U.S. license. However, the Kim Administration is in the process of deciding which aircraft to select for the next generation. From 1995 through 1997 the South Korean government imported military items from the United States worth more than US$4.7 billion. This has led to significant criticism within President Kim's ruling National Congress for New Politics. Key lawmakers such as Rep. Lim Bok-jin are now publicly saying the ROK government is far too dependent on American defense manufacturers. “Our domestic arms market is now characterized by an oligopoly of U.S. arms companies.   Five U.S. companies supplied 62 percent of our defense items during this period and we definitely need to diversify our suppliers.   A major priority should be developing our own weapons or at least weapons parts," the Congressman said recently. Other lawmakers and officials associated with the President are now complaining about American export policies. They say the United States is hindering ROK manufacturers because they need U.S. government approval to export weapons made with American technology to a third country.   Since 1996, South Korean defense companies have not received a single U.S. government approval to sell weapons to third countries. Kim's military posture is particularly surprising in light of North Korea's continued aggression.   However, an ambitious 5-year defense plan announced in 1999 called for defense budget increases of between 4-6% between 2000-2004.

k. Republic of Korea Army (ROKA)

The ROK Army makes up the core of the South’s national defense. Its mission in peacetime is deterring war with the help of the Navy and the Air force; its wartime mission is to bring all ground combat to victory.

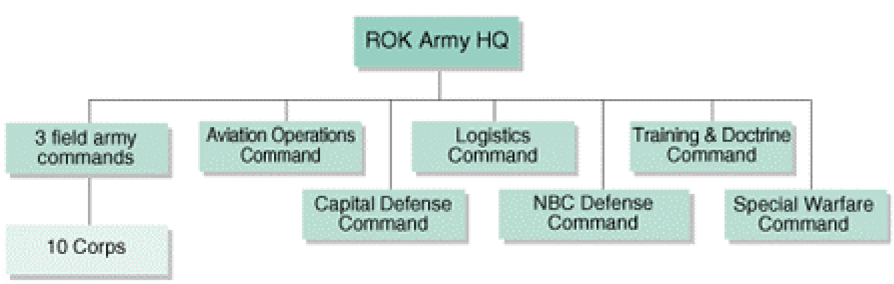

Figure 3-9. Organization of the ROK Army.

1) Organization

Organized into the ROK Army Headquarters, three field army commands, the Aviation Operations Command, the Special Warfare Command, and units to support these commands, the ROK Army consists of 11 corps (Capital Defense Command included), and approximately 50 divisions and 20 brigades. Approximately five hundred sixty thousand troops make up the army, and its core equipment include some 2,250 tanks, 4,850 pieces of field artillery, and 2,300 armored vehicles. Figure 3-9 shows the main components of the army.

2) Mission Assignment

Two of the three field army commands have the mission to defend the region that ranges from the Military Demarcation Line (MDL) to the Seoul area. Each army command consists of several corps commands, divisions and brigades. The troops under these two commands, in response to surprise attacks or high-speed mobile warfare launched by North Korea, have deployed tanks developed especially for Korea's mountainous terrain, various sorts of artillery, anti-tank missiles and surface-to-air missiles along the major avenues of approach that connect Seoul to North Korea. The other field army command is responsible for defending the entire rear area, including the coastline that starts from the rear of the two aforementioned forward-area army commands. Several corps commands, divisions, or brigades make up this command. The core tasks of this army are designed to repel North Korean infiltration by land, sea and air, and should the North successfully conduct an infiltration, annihilate the infiltration force. These tasks include guarding the coastline, defending major facilities and sea lines of communications (SLOCs), and managing reserve forces and materiel for wartime mobilization. Organized into one aviation brigade and several battalions, the Aviation Operations Command possesses various types of helicopters equipped with rockets, TOWs, Vulcan guns, and machine guns. The command provides maneuver forces with fire support, airlift and reconnaissance support, and if necessary, moves into the enemy's rear area to conduct timely fire support and air strikes. The Special

Warfare Command consists of several brigades. Its main tasks include collecting intelligence, and locating enemy targets. The Capital Defense Command consists of several divisions, and focuses on the mission of maintaining the security of Seoul as well as protecting the infrastructure of the city. One reconnaissance and one decontamination battalion, and the Chemical Defense Research Institute make up the CBR (chemical, biological, and radiological) Defense Command. The command supports CBR operations, and conducts research and evaluates issues related to chemical warfare agents.

l. Republic of Korea Navy (ROKN).

Aside from war deterrence in peacetime, the ROK Navy's missions include upholding national sovereignty by protecting maritime rights, supporting government foreign policies, and enhancing national prestige. The navy, during war, exercises control over the sea and the SLOCs that will ensure the safety of maritime activities, prevents the enemy from exercising its own maritime operations, and carries out surprise landing operations on the enemy's flanks and in rear areas.

1) Organization.

The ROK Navy Headquarters, Operations Command, Marine Corps Headquarters, and support units make up the ROK Navy. The navy has 67,000 troops including marines, and it operates approximately 200 vessels including submarines and 60 aircraft.

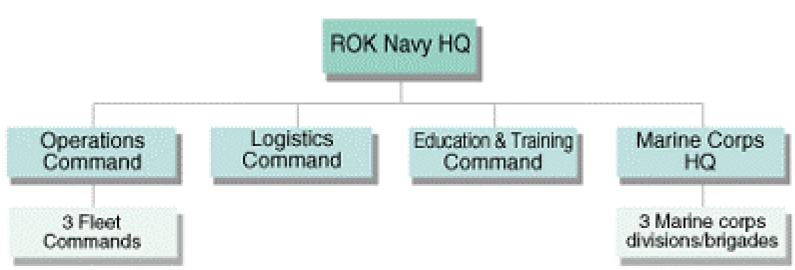

Figure 3-10. Organization of the ROK Navy

2) Mission Assignment

Under the ROK Navy Operations Command, three fleets are based in the East Sea, the Yellow Sea and the Korea Strait, respectively. To guard its operational zone of responsibility, each fleet possesses combatants or combat vessels, e.g., destroyers, escorts, high-speed boats, etc. The Operational Command also has its own vessels and aircraft to conduct major naval component operations such as anti-submarine warfare (ASW), mine operations, landing, salvage, and special operations.

3) Marine Corps

The Marine Corps Headquarters is organized into two divisions and one brigade. For amphibious landing operations, the marines possess a wide range of landing equipment, such as amphibious tanks, and their own of fire support.

m. Republic of Korea Air Force (ROKAF)

The air force constantly keeps a watchful eye on the enemy while at the same time maintaining a firm combat readiness posture, which will enable immediate retaliation, should the enemy attempt any provocation. The mission of the air force during war is to achieve air superiority so as to prevent the enemy from having access to our air space, to neutralize the enemy's will by destroying its principal and potential warfighting capability, and finally, to give full support to ground and naval operations.

1) Organization

The ROK Air Force Headquarters, Operations Command, Logistics Command, Training Command, and two wings constitute the ROK Air Force. The two aforementioned wings are directly subordinate to the headquarters; the Anti-Aircraft Artillery Command, Air Traffic Center, and nine tactical fighter wings come under the Operations Command. The command

Figure 3-11. Organization of the ROK Air Force.

currently operates one training wing as well. Air force personnel number 63,000 and the air force possess more than 780 aircraft including KF-16 fighters.

2) Mission Assignment

Air operations are under direct control of the Theater Air Control Center. At present, the air force operates aircraft that can carry precision-guided munitions, long-range air-to-air missiles. It can provide support to ground and naval forces with close air support as part of joint air-ground-sea operations. The ROKAF received its first F-16 aircraft in 1986-88. Deliveries of the second ROKAF buy of F-16s, known as the Korean Fighter Program, began in 1994. The first few were built at LMTAS, and the remaining are being produced under license at Samsung Aerospace in Sachon, Korea. The F-16 is the world's most sought-after fighter. Over 3,800 have been delivered to the air forces of 19 countries from assembly lines in five countries. Major upgrades are being incorporated, or in development, for all F-16 versions to keep the fleet modern and fully supportable well into the next century. Additional F-16 sales are anticipated to be finalized later in the epoch. Lockheed Martin Tactical Aircraft Systems (LMTAS) has modified the first Korean F-16 with the AN/ALQ-165

Airborne Self-Protection Jammer (ASPJ) [19]. The aircraft was accepted on February 26, 1999, on schedule.

n. United States Forces in Korea (USFK). [20]

The ROK-US security relationship continues to be viable, and has been the main factor contributing to peace and stability in maintaining the cease-fire on the peninsula and Northeast Asia for over forty-six years. The relationship is based on the ROK-US Mutual Defense Treaty signed on October 1, 1953, and is backed up by the Status of Forces Agreement of July 1966, and the Wartime Host Nation Support Agreement signed in November 1991. The ROK-US security relationship, based on a strong military posture, deters North Korean aggression and serves as a cornerstone of US presence in this very important region. The US 2nd Infantry Division (-) has two ground maneuver brigades (one heavy and one light), an aviation brigade, and its organic divisional artillery.

Major US ground weapons systems currently deployed in the ROK include: M-1A1 Main Battle tanks, M-2A2 and M-3A2 Bradley fighting vehicles, 155MM self-propelled howitzers, Multiple Rocket Launchers (MLRS), a PATRIOT battalion and a two-squadron AH-64 Brigade. Additionally, there is a pre-positioned heavy brigade set of equipment. The US 7th Air Force, headquartered at Osan Air Base, consists of the 51st Fighter Wing and the 8th Fighter Wing. Squadrons within the 51st Fighter Wing, also at Osan, are equipped with 24 F-16C/D LANTIRN, and 22 A-10s. Also stationed at Osan are U-2s from the 9th Reconnaissance Wing, Beale AFB, California. At Kunsan, the 8th Fighter Wing is equipped with 42 F-16Cs. As of 29 March 29, 2000, there were 35,584 US troops assigned to in the ROK: Army (26,782), Air Force (8,305), Navy (407) and Marines (90).

[19] Refer to Annex for detail description of the ASPJ

[20] Reference: http://www.defenselink.mil/news/Sep2000/korea09122000.html &

Key US capabilities would play essential roles throughout all phases of operations. The US would enhance or provide the following critical capabilities to the combined war effort: a) airlift and sealift, b) pre-positioned heavy equipment and supplies, c) battlefield command, control and communications, d) advanced munitions, d) aerial refueling, e) intelligence, surveillance, and reconnaissance, and f) counter-fire against the massive North Korean artillery barrage. The US Forces Korea (USFK) is the symbol of ROK-US alliance and it is organized as follows:

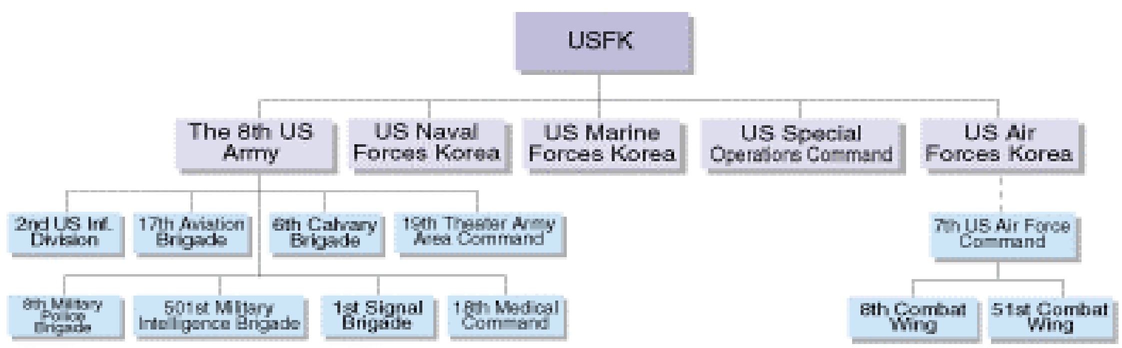

Figure 3-12. Organization of the USFK

o. North Korea's Force Improvement Plans

North Korea remains the major threat to stability and security in Northeast Asia and could potentially involve the United States in a large-scale war.

To secure an independent war execution capability when the crucial moment arrives, the "Four-Point Military Guidelines" were adopted at the fifth plenary meeting of the fourth Korean Workers' Party Central Committee in December 1962. Excerpt from the *Chosun Rodongdang* (Korean Workers' Party) Regulations: "The immediate goal of the *Chosun Rodongdang* is achieving a complete victory of socialism in the northern half of the republic, thereby successfully accomplishing its revolutionary mission of liberating the Korean people and establishing people's democracy. The ultimate goal of the party is to spread ‘Juche Thought’ and construct a communist society throughout the world.” The contents of the Four-Point Military Guidelines include instilling cadre potential in every soldier, modernizing the entire military, arming the entire population, and turning the whole territory into a fortress. These guidelines reflect the idea of turning the entire North Korean society into one gigantic military system.

North Korea's military strategy toward the South is a short-term *blitzkrieg* aimed at creating great panic in the South in the early stages of a war. The organization of North Korea’s People’s Armed Forces is as shown:

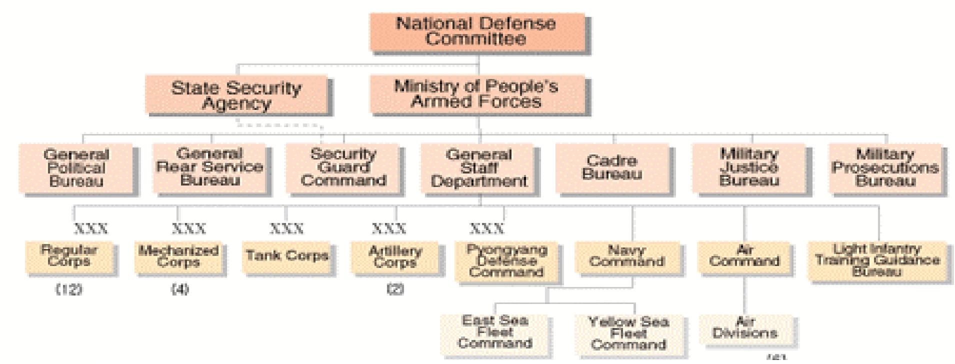

Figure 3-13. North Korea’s Military Command System

p. Korea’s People Army (KPA)

North Korean ground forces are composed of 20 corps including four corps in the forward area, four mechanized, one tank and two artillery corps, as well as the Light Infantry Training Guidance Bureau (LITGB) supervising the SOF. A total of 176 divisions and brigades make up the major combat units, including 33 infantry divisions/ brigades, 10 security brigades, 37 Reserve Military Training Unit (RMTU) divisions, one missile division, etc. Figure 3-14 shows the composition of North Korean ground force combat units.

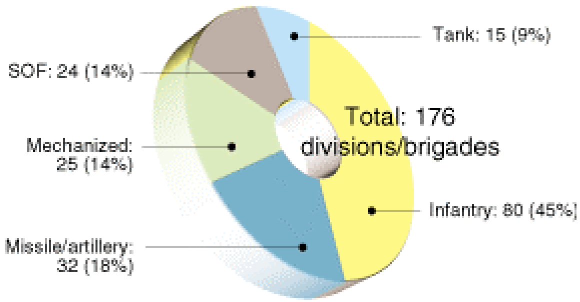

Fig 3-14. Composition of Major Ground Units

The old-model T-54/55/59 tanks still comprise the majority of its tanks. Recently, however, the North has domestically produced Chonmaho tanks and T-62 tanks with enlarged calibers. These tanks have been deployed extensively in forward areas and around Pyongyang. The T-62 and Chonmaho tanks are equipped with snorkels that enable them to cross a river up to 5.5 meters deep. North Korea possesses BTR-series and type M-1973 armored vehicles, but recently, it has added to its collection the BMP series vehicles with the capabilities of a light tank. North Korean ground forces also possess artillery of various calibers and ranges; more than half of the North's artillery is self-propelled. Most of all, the North has a large number of multiple rocket launchers (MRLs) ranging from 107mm to 240mm, which could shower rounds over the Seoul area in a short time. For air defense weapons, North Korea possesses diverse anti-aircraft artillery ranging from 14.5mm to 100mm, as well as SA-7 anti-air missiles. Forward area forces and the Engineering Forces Bureau, in particular, possess river-crossing equipment such as K-61 amphibious vehicles and sectional S-shape pontoon bridges, thus enabling the military to rapidly cross most rivers.

North Korea has deployed approximately 10 corps and some 60 divisions and brigades in the forward area south of the Pyongyang-Wonsan line, and is prepared to launch a surprise attack and invade the South without redeploying its units. Deployment are as follows: four corps in the forward area from the eastern to the western fronts; five corps in the central and Pyongyang areas; and four in the rear area. A total of five mobile corps, one tank, two mechanized infantry and two artillery corps are deployed south of the Pyongyang-Wonsan line. Mechanized infantry and tank units, organized from corps to brigade, are positioned in depth along the major avenues of attack.

It is estimated that these units would be employed as the core mobile/operational units for exploiting a breakthrough and penetrating into the heart of the ROK military's rear area. Artillery units are capable of providing in-depth fire support from hardened underground sites. Also, these units possess mobile fire support capability. Self-propelled MRLs enable massive concentrated strikes to be launched from various locations. By operating amphibious vehicles and sectional pontoons, river-crossing engineering forces can support rapid operations for units with troops and weapons. It is estimated that North Korea will infiltrate approximately 100,000 SOF troops into the forward and rear areas of the ROK. In addition, the North is estimated to have built underground tunnels along the front line. It can insert massive units into the South through these tunnels avoiding the obstacles positioned along the DMZ before launching an all-out surprise attack against the South. Some twenty tunnels are suspected to be built under the DMZ by the North Koreans; the four that have been discovered thus far are all situated under the major corridors of approach into South Korea's forward area. North Korea's Special Operations Forces are the largest in the world. They consist of over 100,000 elite personnel and are significant force multipliers providing the capability to simultaneously attack both our forward and rear forces.

q. Korea’s People Navy (KPN).

The East Sea Fleet, with 10 battle groups and some 570 vessels, and the Yellow Sea Fleet, with six battle groups and approximately 420 vessels, are under the direct control of the North Korean navy. Most North Korean combat vessels, such as light destroyers, patrol ships, guided missile boats, torpedo boats, and fire support boats are small. Some 40 guided missile boats pose a substantial threat as they have the capability of launching missile attacks against our large vessels and are equipped with two to four 46-km-range Styx anti-ship missiles. At present, over 60% of North Korean combat vessels are deployed to forward bases. Submarines (20-some), most of which are of the Romeo-class, are outdated and slow, but they are sufficiently capable of blocking sea lanes. These vessels could attack ROK surface vessels, emplace mines anywhere within the ROK maritime territory, or secretly infiltrate commandos into the South.

Support vessels are composed of amphibious vessels including personnel landing craft, landing craft air cushion (LCAC), surface patrol boats and mine countermeasure vessels. These support vessels, however, have a limited role in long-distance operations. Also operated by the navy are two amphibious surface sniper brigades and some 140 LCACs. One of these domestically produced LCACs can land armed troops equivalent to the size of a platoon on a specific target. Because LCACs can be operated on tidal flats, they can land in most parts of the east and west coasts. With high-speed mobility of 50 nautical miles per hour or more, these vessels are effective in the simultaneous launch of multi-dimensional surprise attacks in the early stage of a war.

North Korea also deploys eighty 95 km-range ground-to-ship Samlet and Silkworm missiles on both east and west coasts. Silkworm missiles, deployed in the forward area, are able to launch anti-ship attacks as far as Tokjok-do in the Yellow Sea and Sokcho and Yangyang on the east coast.

r. Korea’s People Air Force (KPAF).

There are six air divisions under direct control of the Air Command, one per military district: three fighter and bomber divisions, two support aircraft divisions, and one training division. Over 50% of North Korean aircraft aged models such as MiG-15s/17s and Il-28s. The core of the air fleet is made up of slightly more capable MiG-19s and 21s. The North is also equipped with highly advanced fighters such as MiG-23s and 29s as well as Su-25s. According to the Pyongyang government's policy of fostering the aircraft industry, some fighter spare parts are domestically produced. In the early 1990s it assembled modern MiG-29s domestically with Russian technological support.

Two air force sniper brigades are organized under the air force, and they have approximately 300 An-2s capable of flying slowly at low altitudes. An-2s can easily deliver SOF troops deep into the South's rear areas. Fighter planes are deployed at bases where they can launch surprise attacks throughout the entirety of South Korea in a short period of time. Taking into account wartime sustainability and the construction of forward bases, approximately 70 air bases including reserve and emergency runways are built throughout various areas of the North. A strong air defense network has been built and is maintained over the Pyongyang area and around major nuclear facilities, including early-warning systems, air defense surveillance radars, low-altitude anti-aircraft artillery, and mid/high-altitude missiles.

s. Strategic Weapons Development.

1) Nuclear Developments

Pyongyang has exerted full efforts in nuclear development since the 1950s for two purposes: to communize the entire peninsula and to strengthen its international influence. North Korea has mines containing four million tons of uranium ore. In the 1960s, it established a large nuclear research complex in Yongbyon, imported an atomic reactor for research purposes from the Soviet Union, and has since been accumulating nuclear weapons technology and training nuclear specialists. In the 1970s Pyongyang concentrated its nuclear research on the nuclear fuel cycle refining, conversion and processing technologies. It successfully enlarged the power generation capacity of its research atomic reactor through its own technology, and in 1980 started the construction of a 5Mw-level research reactor, the so-called "second reactor.

In the 1980s the North focused on the practical uses of atomic energy and the completion of a nuclear research and development infrastructure. Thus, it began to operate uranium refining and conversion facilities. In 1989 Pyongyang embarked upon the construction of a 200Mw-atomic energy power plant and large reprocessing facilities, in Taechon and Yongbyon, respectively. Additionally, the North conducted detonations to test triggering devices with high explosives. It was estimated that by the 1990s, North Korea completed the entire nuclear fuel cycle from the acquisition of nuclear fuel to its reprocessing. Nevertheless, due to difficulties in developing detonation devices and delivery systems that require advanced, precision technologies, it is doubtful whether Pyongyang has actually finished producing or possesses usable nuclear weaponry. Considering its capability to extract plutonium from spent nuclear fuel, North Korea is estimated to be capable of assembling and producing approximately six crude nuclear weapons.

To freeze North Korea's nuclear weapons development program, the United States and North Korea signed the Geneva Agreed Framework in October 1994. The US agreed to build two light-water reactors for the North, and provide it with 500,000 tons of heavy oil each year until the completion of the first reactor. Under the agreement, the Korean Peninsula Energy Development Organization (KEDO) and North Korea went on to sign the Light-Water Reactor Supply Agreement in December 1995, a tangible benefit for Pyongyang. The construction of the reactor site kicked off in August 1997 and is in its last stage of completion. In January 1996, North Korea officially announced it would allow the

International Atomic Energy Agency (IAEA) to make regular and ad hoc inspections. It still prohibits, however, IAEA inspection of undeclared facilities, refuses to submit records of its 5Mw atomic reactor to be examined, and does not allow the IAEA inspection team to collect samples of materials for examination nor to examine spent fuel rods.

On February 11, 1997, Pyongyang refused to sign the Comprehensive Test Ban Treaty, and did not participate in the UN annual nuclear and arms reduction conference held on February 25, 1997. Furthermore, Pyongyang announced in April 1998 that it would stop the process of sealing spent nuclear fuel rods because of the delay in the light-water reactor construction and deliveries of the heavy oil. Despite this, the sealing process of spent nuclear fuel rods from its 5Mw atomic reactor had already finished by the end of March 1998. The world has kept wary eyes on the Kumchang-ri area since mid-1998, but the US on-site inspections in May 1999 showed that what had previously been suspected of containing nuclear underground facilities was nothing but a large empty cave.

2) Chemical and Biological Weapons.

According to the directives of Kim Il Sung since the early 1960s, North Korea has established chemical and biological (CB) weapon research institutes and production facilities, and has exerted its utmost efforts to produce CB weapons. As a result, the North has maintained the capability to mass-produce and attack with chemical weapons since the 1980s. By 1980, it had succeeded in its experiments in bacteria and virus cultivation for biological weapons, and by the late 1980s completed live experiments with such weapons. At present, North Korea maintains eight chemical factories, four research facilities, and six storage facilities for mass-producing chemical agents. It also possesses a large quantity of poison agents such as blister, nerve, blood and tear gas. The North is also suspected of maintaining many facilities for cultivating and producing biological weapons.

To enhance its nuclear, biological and chemical (NBC) operations, the North Korean military has organized chemical platoons down to the regiment level. Furthermore, following Kim Il Sung's directives in February 1992, North Korea has provided protective masks to the entire population. Not only military personnel, but also paramilitary personnel and civilians must participate in regular NBC defense drills. In addition, the North possesses various vehicles and equipment for launching chemical munitions. Using mortars, field artillery, MRLs, and Frog, Scud and Rodong-1 missiles on land, fire support vessels at sea, and fighters, bombers and transport aircraft in the air, the North has the capability of launching chemical munitions into forward areas and as far south as Pusan and Mokpo. The North may also dare to launch such an attack through its SOF troops armed with chemical weapons. North Korea will attempt to maintain its CB production capabilities despite its serious economic difficulties and the global movement to ban CB weapons. North Korea will continue this policy because these weapons can be produced at a low cost, they are effective, and it is relatively easy to destroy the evidence of such programs.

3) Mid- and Long-range Guided Weapons.

Since the early 1980s, North Korea has embarked on the development of ballistic missiles. It has already domestically produced and deployed 500 km-range Scud-Cs by upgrading Soviet Scud-Bs. In 1993 it succeeded in test-firing a 1,300-km-range Rodong-1 missile. Rodong-1 missiles are now deployed for operational purposes. In August 1998 Pyongyang attempted to launch a small satellite into orbit using the transformed launch system of a *Daepo-dong* missile. Although the attempt failed, the missile's engine combustion, body separation, and guidance systems functioned without problems. From the test, it can be inferred that North Korea does have the capability to develop mid- and long-range missiles.

The maximum ranges of *Daepo-dong 1* and *Daepo-dong 2*, which the North Korea is feverishly developing at the moment, are estimated to reach 2,500km and 6,700km respectively. Such a capability poses a great threat not only to South Korea but also to neighboring countries in Northeast Asia. Pyongyang is currently under scathing criticism from the international community for exporting the missiles to the Middle East and Southwest Asia.

Since 1996, the US and North Korea have proceeded with missile talks concerning North Korean participation in the Missile Technology Control Regime (MTCR). During the talks, the US has pressured the North to suspend its production and export of missiles with ranges over 300km. The talks, however, still have not produced any significant results. Pyongyang recently deployed in the forward area twenty SA-5 surface-to-air missiles with a range of 250km; enough to reach the central region of the South. In addition, it possesses Frog-5/7 ground-to-ground free rockets with ranges from 50km to 70km, 170mm self-propelled artillery pieces, and 240mm MRLs. When launched near the DMZ, these rockets and guns can strike as far south as a line linking Seoul, Chunchon and Sokcho.

The reasons for producing and possessing mid- and long-range missiles with CB weapons are simple: they provide the means for North Korea to respond to the expanding military influence of the US and Japan, and to use them as a bargaining chip at negotiation talks for regime survival. These weapons can also be used to conduct decisive tactical and operational roles to simultaneously attack major cities and strategic targets in the South, as the North attempts to realize its military *blitzkrieg* strategy.

3. Technology Development for DPRK and ROK

a. DPRK's Technology Focus

1) Goals and Strategy for Defense Technology.

North Korea's technological goals essentially focused on its philosophy of *juche* – that of achieving a self-reliant production capability of major weaponry. To this end, the country aimed to achieve a credible Ballistic Missile (BM) capability, to build upon its nuclear, biological, and chemical stockpile of Weapons of Mass Destruction (WMD), and to enhance its SOF insertion capability. Thus, the DPRK's goals were three-fold.

2) Defense R&D Budget.

As no available sources were available for providing the actual budget figures, it was assumed that the DPRK's defense budget would be pegged at a constant 27% of the country's GDP as discussed in the section on Economy. The defense budget was divided according to the ROK model (for the entire study) following a 70/30 allocation for Operational and Maintenance (O&M) costs and Force Improvement Plans (FIP) respectively.

	GDP	Defense Budget	O&M	FIP
%GDP	100.0%	27.0%	18.9%	8.1%
%	100.0%	27.0%	70.0%	30.0%
%Def Bud	-	100.0%	70.0%	30.0%
Year	US$ Bil	US$ Bil	US$ Bil	US$ Bil
%Growth	6.2%			
2000	7.600	2.052	1.436	0.616

Table 3-108. Year 2000 DPRK Defense Budget Breakdown

From the FIP allocation, the budget was further broken down with 60% going towards the services' procurements[21], 5% towards Dominant Battlespace Awareness (DBA) procurements, and the remaining 35% towards Research and Development (R&D) programs. For the study's baseline, Table 3-109 summarizes the 2000 defense budget breakdown.

	FIP	Army	Navy	Air Force	DBA	R&D
%GDP	8.1%	4.1%	1.6%	2.4%	0.4%	2.8%
%	30.0%	50.0%	20.0%	30.0%	5.0%	35.0%
%Def Bud	30.0%	9.0%	3.6%	5.4%	1.5%	10.5%
Year	US$ Bil	US$ Bil	US$ Bil	US$ Bil	US$ Bil	US$ Bil
2000	$0.616	$0.185	$0.074	$0.111	$0.031	$0.215

Table 3-109. Year 2000 DPRK FIP Budget Allocation

For DPRK's R&D budget allocation, Team Korea assumed that its defense R&D budget would be a constant 10.5% of the total national defense budget. For the 2000 DPRK R&D budget, this amounted to **US$0.215 billion**. From this allocation, 70% was spent on its Ballistic Missile/ Nuclear Weapons Program[22], 15% for SOF capability research, 10% for reverse engineering of weapons, and 5% for others (which includes chemical and biological warfare research).

	R&D	BM/Nuclear Program	SOF Program	Reverse Engineering	Others
%GDP	2.8%	2.0%	0.4%	0.3%	0.1%
%	35.0%	70.0%	15.0%	10.0%	5.0%
%Def Bud	10.5%	7.4%	1.6%	1.1%	0.5%
Year	US$ Bil	US$ Bil	US$ Bil	US$ Bil	US$ Bil
2000	$0.215	$0.151	$0.032	$0.022	$0.011

Table 3-110. Year 2000 DPRK R&D Budget Breakdown

[21] Team Korea further divided the services' FIP budget into a 50/20/30 percent allocation to the Army, Navy, and Air Force respectively.

[22] Apart from its nuclear and ballistic missile research programs, North Korea is not known to be engaged in significant research efforts in advanced technology programs with military applications. North Korea is concentrating on acquiring technology from foreign suppliers and is especially interested in obtaining nuclear-related equipment and advanced missile, chemical warfare, and biological warfare technologies. "North Korea: The Foundations for Military Strength – Update 1995", December 1995. http://libweb.uoregon.edu/asia/nk/nk1995/1510-101_chp3.html.

b. DPRK's Technology Policies

1) DPRK's Defense Development/International Cooperation

Since the conclusion of the Korean War in 1953, the DPRK had depended heavily on the Russians and Chinese for its defense development. This trend, however, became less and less realizable as the DPRK progressed into the 1990s. This situation was a consequence of the US-led economic sanctions imposed on the country as a result of its nuclear program and the occurrence of natural calamities like drought and famine during the mid to late 1990s. This drove the DPRK to solicit cooperation with "rogue" nations like Syria, Iran, and Pakistan in its pursuit of a credible nuclear ballistic missile capability.

2) DPRK's Education Policies in Support of Defense Technology

From DPRK's propaganda, there has been a movement in place since the 1990s, consisting of a 3-Year Plan to develop science and technology.[23] This responsibility rests with the National Academy of Sciences. DPRK boasted that it "possessed a firm foundation and a well-established national structure to develop its science and technology."[24] At the end of 2000, this program is currently in place, training young scientists and engineers to be excellent specialists.

c. DPRK's Technology Investments

1) Existing Capabilities

The DPRK has an extensive defense production capability that reflected its commitment to self-reliance. Since the 1970s, DPRK has been developing variants of standard Soviet and Chinese equipment, as well as indigenously designed versions of APCs, SP Arty, light tanks,

[23] PK Interview with Dr Chang Byong-Tae on DPRK's Scientific and Technological Development. http://www.korea-np.co.jp/pk/144th_issue/2000072504.htm.
[24] PK Interview with Dr Chang Byong-Tae on DPRK's Scientific and Technological Development. http://www.korea-np.co.jp/pk/144th_issue/2000072504.htm.

high-speed landing craft and submarines. For the Navy, the *Sango* submarine and hovercraft remain priority projects. For the Air Force, DPRK possesses a small-scale aircraft production and assembly capability limited to tactical transports and helicopters for the Air Force.[25] A continuing priority in recent years has been the increased production of ammunition for the offensive weapons it has produced.[26] It has been estimated that North Korea operates 134 arms factories that are either completely or partially concealed underground and also 115 nonmilitary factories with a dedicated wartime material production mission. The hardening of its critical defense industries meant that DPRK should be capable of significant production output even during conflict.

DPRK's technological strength resides in its ability to reverse engineer major former Soviet Union weapons systems. With regards to DPRK's BM-related technologies, it was assessed to be using 1980s level of technology. Due to the DPRK's use of older generation technology (of at least two generations behind ROK), the country's present inventory of missiles are not very accurate. Consequently, the bulk of its technological investments will be spent on developing BM-related technologies, especially in the field of missile control and guidance. According to US estimates, North Korea will possess an accurate nuclear BM capability by 2005.[27]

2) Defense Acquisition Roadmap

Based on the DPRK's technological strengths and R&D emphasis, the long-term plan for weapons acquisition is presented below.

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[25] "North Korea: The Foundations for Military Strength – Update 1995", December 1995. http://libweb.uoregon.edu/asia/nk/nk1995/1510-101_chp4.html.

[26] "North Korea: The Foundations for Military Strength – Update 1995", December 1995. http://libweb.uoregon.edu/asia/nk/nk1995/1510-101_chp4.html.

Acquisition. Method	2000-2005	2006-2010	2011-2015	2016-2020
Indigenous R&D and Production	Tanks Artillery Armored Vehicles Small Naval Craft Small Arms Satellite	Tanks Artillery Armored Vehicles Small Naval Craft Small Arms Satellite	Tanks Artillery Armored Vehicles Small Naval Craft Small Arms Satellite BM	Tanks Artillery Armored Vehicles Small Naval Craft Small Arms Satellite BM
Joint R&D and Production	BM (Iran, Pakistan, Israel) Chemical and Biological Weapons	BM (Iran, Pakistan, Israel) Chemical and Biological Weapons	Next Generation BM (Iran, Pakistan, Israel)	Next Generation BM (Iran, Pakistan, Israel)

Table 3-111. DPRK Defense Acquisition Roadmap

d. ROK's Technology Focus

1) Goals for Defense Technology

In the 1999 ROK White Paper 1999, ROK's stated technological goals was, foremost, to achieve an indigenous production capability of major weaponry.[28]. Second, the ROK would apply technology towards transforming the present manpower-centered force structure into a technology-centered force. Third, ROK would adopt a "Use Domestic Weapons First" policy in support of its domestic defense industry. Additionally, the long-term force improvement is based on 2 systems: focusing on Basic Force Capability System and Core Force Capability.[29] Consequently, ROK's pursuit of defense acquisition serves two goals. First is the acquiring and fielding high performance weapon systems at a reasonable cost

[27] This date of 2005 is the original milestone pegged to the National Missile Defense to be operational.
[28] Key lawmakers such as Rep. Lim Bok-jin are now publicly saying (in 1998) the ROK government is far to dependent on American defense manufacturers. "Our domestic arms market is now characterized by an oligopoly of US arms companies. Five US companies supplied 62 percent of our defense items during this period and we definitely need to diversify our suppliers. A major priority should be developing our own weapons or at least weapons parts." NSCF Task Force on Korean Security, "South Korea's Modernization Program and North Korea's Military Strategy", 1998. http://www.nscf.net/South%20Korean%20Modernization %20Program.htm.
[29] White Paper 1998. 168. The Basic Force Capability System is the concept of achieving perfect combat readiness to deter North Korean provocations, while the Core Force Capability focuses on coping with uncertain future threats.

within the requested time frame. Second is the obtaining of R&D capabilities for certain key weapon systems.

2) Defense Technology Acquisition Strategy

There are essentially four different paths that ROK can pursue the development and buildup of its indigenous defense capability to affect the necessary technology transfer as discussed above for DPRK.[30] For South Korea, the following policies apply:

The adoption of a "Use Domestic Weapons First" policy was in line with the National Security Strategy of self-reliance. To support such a policy, the ROK military pursued an economical acquisition process of weapon systems through the adoption of eight acquisition and development principles[31], and a reformation of its acquisition process. Ultimately, the ROK also improved its domestic R&D capability, decreased its dependence on foreign countries in acquiring weapon systems, and bred an internationally and domestically competitive defense industry to realize its "Use Domestic Weapons First" policy.

The modernization and development strategy of the ROK's defense technology program began in the mid-1970s. Back then, the force improvement programs (FIPs)[32] comprised building quantity-based defense capability against the DPRK, with the weapons mostly imported and about 31.4% of total defense spending invested in building military capability.[33] During the 1980s, FIPs focus shifted to achieving qualitative superiority over North Korea. This then began South Korea's accumulation of advanced technology,

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[30] Methods of arms acquisition in South Korea, 1970. Arms Procurement Decision Making Volume 1: China, India, Israel, Japan, South Korea and Thailand. Ravinder Pal Singh ed. SIPRI, Oxford University Press. 1998. 200. Tbl 6.8
[31] White Paper 1998. 160.
[32] FIPs are often long-term and continuous programs that take ten to fifteen years for acquisition.
[33] White Paper 1998. 157.

enlargement of its defense industry, and expansion of its domestic production of major combat equipment and weapon systems.[34]

Following the Gulf War in the 1990s, where the US clearly demonstrated its technological dominance and impact on the battlefield, ROK's focus promptly shifted to the development of a future-oriented military force. Exploiting the ROK-US alliance, the ROK was thus able to directly purchase technologically advanced weapons systems and to secure technology transfer for defense expenditures greater than 10 million won.[35].

3) Defense R&D Budget

The two goals of the FIP budget are to establish the foundation for deterrence against DPRK and to negate the current weakness of the ROK military.[36] Concurrently, the ROK military would concentrate on developing its own weapon systems to replace imported onesIAs assumed above the ROK's defense budget would be pegged at a constant 3.5%[37] of the country's GDP. the defense budget was divided according to a 70/30 allocation for O&M and FIP costs respectively.

	GDP	Defense Budget	O&M	FIP
%GDP	100.0%	3.5%	2.5%	1.1%
%Def Bud	-	100.0%	70.0%	30.0%
%Growth	4.0%			
Year	US$ Bil	US$ Bil	US$ Bil	US$ Bil
2000	344.000	12.040	8.428	3.612

Table 3-112. Year 2000 ROK Defense Budget Breakdown

[34] White Paper 1998. 158.
[35] White Paper 1998. 161-62.
[36] White Paper 1999. 133.
[37] The proportion of defense outlay to GNP has decreased sharply from 4.7% in 1985 to 3.1% in 1998. Proportion of defense budget to the total government budget has consistently decreased. The South Korean government, however, acknowledges that two tasks of utmost priority in preparation for future war are rapid progress in Military Science and Defense Digitization. Based on these requirements, the estimated required defense budget will have to maintain at least 3% of GDP in order for the military to construct and maintain a force capability able to respond effectively to external threats. White Paper 1999. 132-33.

From the FIP allocation, the budget was further broken down with 83% going towards the services' procurements[38], 4% towards Dominant Battlespace Awareness (DBA) procurements, and the remaining 13% towards Research and Development (R&D) programs. For the study's baseline, Table 3-113 summarizes the 2000 defense budget breakdown.

	FIP	Army	Navy	Air Force	DBA	R&D
%GDP	1.1%	0.3%	0.4%	0.3%	0.04%	0.1%
%	30.0%	30.0%	40.0%	30.0%	4.0%	13.0%
%Def Bud	30.0%	7.4%	9.8%	7.4%	1.2%	3.9%
Year	US$ Bil	US$ Bil	US$ Bil	US$ Bil	US$ Bil	US$ Bil
2000	$3.612	$0.899	$1.199	$0.899	$0.144	$0.470

Table 3-113. Year 2000 ROK FIP Budget Allocation

For ROK's R&D budget allocation, Team Korea assumed that its defense R&D budget would be a constant 3.9% of the total national defense budget. For the 2000 ROK R&D budget, this amounted to $470 M(US). From this allocation, the funds were further broken down into a fixed 80/20 allocation between Force Development Programs[39] and Agency for Defense Development (ADD) Operation Programs[40]. This translates to US$0.376 billion spent on R&D that enhanced current force capabilities and US$0.094 billion on R&D that would provide South Korea's military with new capabilities.

[38] We further divided the services' FIP budget into a 50/20/30 allocation to the Army, Navy, and Air Force respectively.

[39] Force Development Programs are programs that look into system upgrades through the substitution of component(s) with newer technology thereby enhancing the system's performance or capability. In such programs, no new system is produced; the shell essentially remains the same though the contents may have changed. An example of a Force Development Program is the replacement of an aircraft with a more powerful radar which either enhances its detection range, increases its reliability or reduces its maintenance efforts. The R&D here deals with existing technology inventions and the risk of success is low to moderate. For this study, we employed the same proportional allocation as that used in the FIP allocation for the three services.

[40] ADD Programs essentially focus on programs embarked by the five specialized research centers (electro-optics, microwave, underwater acoustics, automatic controls, and weapon systems). These programs focus on R&D that would eventually lead to breakthroughs that provides either a quantum leap in existing capabilities or an innovative synergy of applying technology to provide new capabilities. The R&D here deals with more current or future technology and the risk of success is moderate to high. The allocations were derived from the budget figures found in the White Paper 1999.

2000 ROK R&D Budget: US$ 0.215 bil								
	FDP (80% of R&D)			ADD (20% of R&D)				
	Army	Navy	AF	EO	MW	AC	UWA	WS
% R&D Budget	24.0	32.0	24.0	5.5	5.9	6.1	1.6	1.0
US$ bil	0.113	0.150	0.113	0.026	0.028	0.028	0.007	0.005

Table 3-114. Year 2000 ROK R&D Budget Breakdown

e. ROK's Technology Policies.

Generous legislation has passed in recent years to support and promote ROK's defense technology capability build-up. These include: Special Law for Science and Technology Innovation; Formation of 5-year Plan for Science and Technology Innovation (1997-2002); Highly Advanced National (HAN) Project; Creative Research Initiative; National Long-Term Plan for Science and Technology Committee formed in Mar 99; Post HAN Projects (21st Century Frontier R&D Program); and Brain Korea 21 (BK 21).

1) Establishment of Ministry of National Defense (MND)[41]

Examining its march towards nationhood since 1953, the ROK had paid less attention to the development of defense science and technology, which demanded long-term investment. A policy reversal first occurred in the 1990s. Since then, the ROK government had recognized the importance of defense science and technology. Consequently, the MND was established and charged with the primary task of "modernization of defense science and technology".

Since its establishment, MND has implemented development of advanced, Korean-model weapon systems like the KF-16, K-1 MBT. During the mid-1990s, MND selected 14 main weapon systems that South Korea should concentrate its resources on to develop. Additionally, the essential technologies pertaining to developing these systems were

[41] White Paper 1998. 164-67.

classified into 11 fundamental technologies with the intention of developing them intensively under a mid- to long-term schedule. This also forms part of MND's policy guidelines of developing defense science and technology, pursuing cost-effective defense acquisition[42], ensuring high performance of weapon systems and combat effectiveness of integrated systems, promoting acquisition projects in line with national industrial development, and enhancing efficiency, professionalism, and transparency in acquisition procedures.

Classification	Locus	Establish Date
Automatic Controls	Seoul National University	December 1994
Electro-Optics	Korea Advanced Institute for Science and Technology	December 1994
Microwave	Pohang University of Science and Technology	December 1994
Weapon Systems	Advanced Institute for Military Science and Technology	January 1997
Underwater Acoustics	Seoul National University	February 1997
Source: Korea White Paper 1998		

Table 3-115. Establishment of Specialized Research Centers

Expanding support for R&D of high-tech weapons suited for the Korean Military, MND established the R&D Office in Dec 1998 to assist with the national defense R&D effort. Additionally, a Law on Expediting Dual-Use Technology Program was enacted in Apr 1998 to promote defense science and technology in connection with progress of national science and technology. Institutionally, defense R&D was to be conducted through a cooperative research system among industry, academies, and research centers with the designation of five research centers[43] and the creation of Agency for Defense Development (ADD)[44]. To

[42] White Paper 1999. 137. Cost effective acquisition will be sought by diversifying the sources of weapon systems and broadening international cooperation in defense industry and technology.

[43] These were the Electro-Optics, Microwave, Automatic Research Control, Underwater Acoustic, and Weapon Systems Research Centers.

[44] The ADD serves to develop core weapon systems and key technologies and parts through applied research and test development.

complement these efforts, MND also encouraged civilian industrial sector to execute R&D in fields where it had accumulated a certain level of technology, thus fostering and developing a civilian-led defense industry centered on technology development.

Sector	Functions and Roles
Academia	Specialized university research institutes lead the development of basic technologies which the military is expected to employ Research calling for urgent development of weapon systems
Industry	Developing and enhancing performance of conventional and general precision weapons Developing general technologies and parts Taking initiative in industry-led R&D and technology tests
Government-funded research institutes	Developing dual-use technologies Establishing a system in which research projects can be commissioned to government-funded science and technology research institutes which can execute the functions of ADD technical research offices
Source: White Paper 1998	

Table 3-116. Functions and Roles in R&D

2) Improving 1997 Acquisition Management[45]

To streamline and reduce wastage in the acquisition process, MND improved the acquisition management process by reducing the nine-step acquisition procedure to six-steps in 1997. This reduced the decision-making process and shortened the entire acquisition cycle. Additionally, MND passed new regulations to ensure that long-term requirement projects demanding domestic R&D would be determined first.

Development of First- and Second-Tier Defense Companies. In Jan 1999, the Special Law on the Defense Industry was enacted to provide more opportunities for qualified firms with advanced technologies to participate.[46] At the same time, efforts were also made to encourage contractors to consolidate the defense industrial infrastructure. Further, with the

[45] White Paper 1998. 167-68.
[46] As an example, a Special consumption tax exemption system pertaining to the imported raw materials for producing defense equipment lasting till 2004 was put into effect

enactment of the Foreign Investment Encouragement Law in Sep 1998, MND has allowed foreigners to acquire and merge with some of the domestic companies.

3) ROK's International Defense Industry Cooperation

MND's ultimate goal is to enhance the competitiveness of the domestic defense industry. Through the devising of institutional methods for fostering assurance of quality, and the devising of exchanges of scientists and data technologies, these were just some of the positive steps taken by MND to develop and mature the local defense industry. MND also hosted the Seoul International Air Show in 1996 and 1998 to foster the domestic aerospace industry.

f. Technology-Related Projects

At the national level, ROK decided in the investment of technology projects in four areas. These were the G7 Projects, strategic national R&D projects, giant scientific R&D projects, and the creative research promotion projects.

1) G7 Projects[47]

This program, initiated in 1992, has as its goal of bringing up the level of South Korean technology to those of G7 countries by the year 2001. To attain this goal, the government selects target strategic technologies and provides substantial long-term supports for R&D activities in industries, universities, and national labs. The total estimated costs for G7 projects from 1992 to 2001 are about 4.7 trillion won (~US$4.7 B). There are currently 16 R&D topics under G7 Projects. These are: New drugs and agro-chemicals, Broadband integrated services and Data network (B-ISDN), Next-Generation Vehicle Technology, Advanced Manufacturing Systems, Advanced Materials for Information, Electronics and

[47] ATIP97.034: Update on Status of Science and Technology in Korea. 10 Apr 1997. http://www.atip.or.jp/public/atip.reports.97/atip97.034r.html.

Energy, New Functional Biological Materials, Environmental Engineering, New Energy, Next-Generation Nuclear Reactor, ASIC (Application Specific Integrated Circuits), Next-Generation Flat Panel Display Devices, Medical Engineering, Micro Precision Machinery, Next-Generation Super-Conducting Nuclear Fusion Reactor Development, Human Ergonomics Engineering, and High-Speed Electric Railway System.

2) Strategic National R&D Projects

Under this category, the government selects R&D topics and directs R&D activities in order to solve urgent technology problems. There are at present more than 15 such projects[48], and are as follows: Life Engineering Technology (10 billion won), Disaster-Prevention Technology (5 billion won), and CFC Substitution Materials (900 million won).

3) Giant Scientific R&D Projects

These are projects that entail enormous commitments and two fields of R&D currently focus the pursuit of technologies for space and deep-sea developments.

1) *Creative Research Promotion Projects.*

This national project aims at encouraging creative basic research, especially among young scientists and engineers. Such projects tie in with the Brain Korea 21 (BK21) program.

g. ROK's Technology Investments

1) 2001-2005 Mid-term Defense Program (MDP)[49]

According to the MDP published in 1999, the foremost goal was laying "the foundation for a self-reliant defense capability." Based on the reforms stated earlier that were taken, the 2001-2005 MDP was the first mid-term defense program to be backed by an actual

[48] 8 such projects (in 1994) with 7 added in 1997.
[49] White Paper 1999. 130-31.

government-approved budget.[50] From the 2001-2005 Mid-term Defense Program, it was decided that weapon systems acquisition include large attack helicopters, unmanned reconnaissance planes, KDX-III, next-generation fighters[51], SAM-X[52], etc., whereas the acquisition of high-tech equipment such as early-warning systems would be postponed.

Ground Ops	Naval Control	Air Ops
• Chonma, Piho – Next generation anti-aircraft system • Domestically build UH-60 and BO-105 • Upgrade night vision capability for attack helicopters • Upgrade of K-1 tanks • Secure additional 230 mm multiple launching rocket system (MLRS) • Purchase portable anti-air guided missiles • Plans to procure thermal surveillance radars to attain an all-weather surveillance and fire control capability	• MND promoting the acquisition of large landing ships and high speed landing craft, • Finalization of design for 10000 ton cargo ship • Annually acquiring 3000 ton KDX-I multi-purpose battleships • Domestically build 4200 ton KDX-II destroyers • Domestically build next generation submarine and minesweeper	• Deploy new long-range radars • Secure new AWACS variant systems • Domestically develop KT-1 training aircraft • Next-generation Fighter (F-X) Program – MND intends to purchase a total of 40 F-Xs

Table 3-117. Status of FIPs in 2000

2) Existing Capabilities

ROK has been developing its defense industry since the early 1980s. As of 2000, there are almost 80 companies in the defense industry producing 350 odd defense items. The

[50] The MDP actually covers the period 2000 to 2004. The MDP used in this study has been modified to fit in nicely with the epoch timeframes of the study.
[51] A major decision confronting the future of South Korea's military modernization program involves key decisions on what to do when the ROK's F-4 and F-5 jet fighters need to be replaced in a few years. A Korean Fighter Program already exists and the ROK Air Force will receive the final delivery of 120 KF-16 jet fighters next year. They are being manufactured under US license by Samsung Aerospace. NSCF Task Force on Korean Security. South Korea's Modernization Program and North Korea's Military Strategy. 1998. http://www.nscf.net/South%20Korean%20Modernization %20Program.htm.
[52] President Kim has "instructed the ROK's Agency for Defense Development (ADD) to accelerate work on a medium-range surface-to-air missile which will have a range of 40 km. It is being designed to intercept invading North Korean military aircraft and Scud-type missiles. The system will not be operational until 2008. NSCF Task Force on Korean Security. South Korea's Modernization Program and North Korea's Military Strategy. 1998.

operation rate of the domestic defense industrial firms stands at just 51%, aggravating the difficulties the companies are already experiencing. The ground weapons industry is the most mature, especially when supported by a strong and developed automotive industry. As for the defense shipbuilding industry, it has been cultivated since the 1990s and currently has the indigenous capability to build major and minor surface ships. The aerospace industry, still on its march towards maturity, was cultivated since late-1980s. More recently, the industry was consolidated into the Korean Aerospace Industry (KAI) [53], a single entity, as a result of the Asian financial crisis. An interesting note is that South Korea's defense industrial capacity makes it possible to field a new system from program commencement on an average of 7 years.

Acquisition Method	Average Time Span
Direct Foreign Purchase	4 years 10 months
Domestic Production with Foreign Technology	5 years 5 months
Production through Domestic R&D	7 years 1 month
Average Time Span for Acquisition	6 years 9 months

Source: South Korean Ministry of National Defense, [The Yulgok Project: Yesterday, Today, and Tomorrow] (MND:Seoul, 1994), p95.

Table 3-118. Technology Acquisition Timelines

Based on the present infrastructure, the strength of the ROK defense industry is its highly developed semiconductor and information technology (IT) industry. From its experience in performing licensed and joint productions of various military and civilian programs, ROK also has a strong reverse engineering capability and the development of platforms for weapons systems capability, especially from the US. The industry has not demonstrated much creativity or originality in its indigenous defense products. In essence, the South

http://www.nscf.net/South%20Korean%20Modernization %20Program.htm.

[53] KAI aims to be among the world's top 10 aerospace companies by 2010 with approximately $600 million in aerospace sales, one third of which will be defense-related. Defence Production and R&D, South Korea. 10 May 2000. Jane's Sentinel Security Assessment – China and Northeast Asia – Update 6.

Koreans have been copying US technology by adopting a strategy of first co-producing the weapon systems through licensed production and then performing the system integration in-country. Such a strategy has allowed South Korea's defense industry to mature. But this process has been long and arduous and one such cycle takes at least ten years. Accordingly, the ROK defense acquisition roadmap is summarized in Table 3-119.

Acq. Method	2000-2005	2006-2010	2011-2015	2016-2020
Indigenous R&D and Production	Major Surface Ships (KDX) Minor Surface Ships (Minesweepers) Armored Vehicles (KIFV) Trainer Aircraft (KT-1) Small Naval Craft Small Arms	Major Surface Ships (KDX) Minor Surface Ships (Minesweepers) Torpedoes Armored Vehicles (KIFV) Trainer Aircraft (KT-1) Small Naval Craft Small Arms	Major Surface Ships Minor Surface Ships Submarines Combat Aircraft (FX) Trainer Aircraft Helicopter(KHX) Tanks Armored Vehicles Artillery	Major Surface Ships Minor Surface Ships Submarines Combat Aircraft (FX) Trainer Aircraft Tanks Armored Vehicles Artillery
Joint R&D and Production	Combat Aircraft (KF-16) Tanks (K1 MBT) Helicopter Artillery (K-200) Trainer Aircraft (A/T-50) Submarines (T209/T214) Comm/Spy Satellites	Combat Aircraft (KF-16) Tanks (K1 MBT) Helicopters Artillery (K-200) Trainer Aircraft (A/T-50) Submarines (T209/T214) Comm/Spy Satellites Aerostat UCAV Micro Air Vehicle	Comm Satellite (2d Gen) Spy Satellite (2d Gen) Attack Helicopter(KAH) Tanks Aerostat HAE UAV UCAV Micro Air Vehicle UUV BMD	Micro Spy Satellite Attack Helicopter(KAH) High Power Microwave Aerostat HAE UAV UCAV AWACS Micro Air Vehicle UUV BMD
Licensed Production	Submarines (T209/T214) Helicopters (KH-60) Combat Aircraft (KF-16) Artillery Radars UAV	Submarines (T209/T214) Helicopters (KH-60) Combat Aircraft (KF-16) Artillery Radars UAV	Torpedo (Squall) Attack Helicopter (AH-64) SAM AAM ASM Maritime Surveillance (P3)	Torpedo (Squall) Attack Helicopter (AH-64) SAM AAM ASM Maritime Surveillance (P3)

Acq. Method	2000-2005	2006-2010	2011-2015	2016-2020
Import	UAV SAM AAM ASM AWACS Maritime Surveillance (P3) Attack Helicopter (AH-64)	UAV SAM AAM ASM AWACS Maritime Surveillance (P3) Attack Helicopter (AH-64)	BMD SAM AAM ASM Radars AWACS	BMD SAM AAM ASM Radars

Table 3-119. ROK Defense Acquisition Roadmap

A crucial weakness is ROK's lack of capacity to develop and produce missiles. As of 2000, the assessment is "ROK possesses the ability to produce its own weapons systems by integrating locally produced platforms with imported commercial-off-the-shelf (COTS) technologies."

More specifically, for the army, ROK has the capacity to build major platform-centric systems and to develop and manufacture night vision capability. For the navy, ROK can build the platforms for and perform assembly of KDX-class destroyers, build and develop indigenous heavy torpedoes, and its defense shipbuilding industry limited to building surface combatants up to 10000 tons. ROK has the capacity to build airframes and perform local assembly of advanced combat aircraft like the KF-16. ROK does not, however, yet possess an indigenous capability to produce high technology armaments like AAM, ASM, or SAM. An exception is the ROK's development (with French missile technology) of its *Chonma* SAM with a range of 10 km.

h. ROK's R&D Programs

Foremost, R&D would be pursued under the principle of "priority to domestically produced weapons." Next, cost-effective acquisitions would be sought by diversifying the sources of weapon systems and broadening international cooperation in defense industry and technology.

This also meant the acquisition of integrated systems and the promotion of dual-use technology. Based on assessments of ROK's industrial development and infrastructure, the country decided that technological investments in MEMS and biotechnology would be the key technologies for enhancing the military's capabilities.

1) Defense Digitization for the New Millennium Developments

The idea for the Joint C3I System (JC3IS) was first implemented in early 1998 as part of the ROK's military's efforts to transform the military from a manpower- to technology-centered force. The two goals were: first, to focus on constructing a C4I system and a resource management system, and two, to establish an infrastructure that makes it possible to operate these systems. The main roles of JC3IS were to direct national war performance and secure the joint operation of the three services.

The JC3IS consists of the Joint Information Fusion System (JIFS) that integrates and analyzes military information from various collecting channels; the Joint Operation Planning and Execution System(JOPS) that draws up and evaluates operation plans while distributing timely information necessary to plan and execute joint operations; and the Joint Combat Service Support System (JCSSS) that tackles the logistics requirements pertinent for the successful conduct of joint operations.[54] Before elaborating further, some background information laying the groundwork for the realization of this concept is necessary. In 1995, MND created the Information Systems Bureau to conduct feasibility studies for defense digitization. Concurrently, MND also enacted the Provision on Defense Information Systems Management. Then in Dec 1996, MND established the Defense Information Development Plan for policy directions and mid- and long-term development plan for defense digitization.

In Nov 1998, MND introduced the Chief Information Officer (CIO) system to plan and coordinate a vast sea of information resources. Assisting the CIO was the Defense CIO Council whose mission was to proliferate the spirit of digitization throughout the entire defense sector. The Council had the MND vice minister for its Chairman and comprised members who were the Vice Chairman of JCS and each service. The following month, MND reorganized the Information Systems Bureau into the Information Planning Office to concentrate the functions of establishing and coordinating defense digitization policies. Through the recommendations of the Council, MND standardized the Defense Information Technical Architecture (DITA) with the ROK military subsequently formulating its Defense Information Infrastructure Master Plan (DIMP). From the DIMP, it identified that the foremost goal of the ROK military was to establish an integrated information network that guaranteed the dissemination of information per battlefield function. An added goal was the automation of the battlefield functions of tactical echelons below the corps-level and establishment of an integrated combat management system.

In Mar 1999, the ROK government proclaimed its vision of “Cyber Korea 21” which envisioned national digitization. To support this vision, the MND set the goal that it would install office automation systems in all parts of the military and systems providing services to civilians by end 2001. Additionally, the military established approximately 150 digitization training centers with government funds between 1998 and 2002 to nurture the necessary qualified manpower for digitization, specifically targeted at the officers and men at the brigade-level units or higher.

[54] White Paper 1998.

2) Development of Space Program

ROK had realized prior to 2000 that numerous future developments would hinge on technological solutions. Thus, in concert with the MND's ADD, the Ministry of Science and Technology (MOST) and the Korean Aerospace Research Institute (KARI) cooperated with the MND to embark on a space development program. The realization by MND was that developments in space technology and the exploitation of space[55] would hold the key to future R&D opportunities affording ROK's military to make the quantum leap in acquiring new capabilities. With this fundamental thrust, the pursuit of space development became a national priority, and was reflected in ROK's national policies.

a) Korean Multipurpose Satellite (KOMPSAT) Program.[56]

Prior to KOMPSAT, South Korea had launched its first satellite in 1992, a 50-kg microsat known variously as Kitsat 1, Oscar 23, and Uribyol 1. Its orbit was a 1,300 km by 1,400 km orbit inclined at 66 degrees to the equator.[57] The satellite was created with the help of the University of Surrey, England, which specializes in micro satellites. Also, South Korea being unable to construct its own geosynchronous earth orbit (GEO) communications spacecraft, it contracted with Lockheed-Martin to launch two 3000 series satellites in 1995, each carrying 15 Ku-band transponders of which three are high powered (120 W).

[55] Control of Earth Space not only guarantees long-term control of the outer reaches of space, it provides a near-term advantage on the terrestrial battlefield. From early warning and detection of missile and force movements to target planning and battle damage assessment, space-based intelligence gathering assets have already proven themselves legitimate combat force multipliers. In future wars involving at least one major military power, space-support will be the decisive factor as nations rely ever more heavily on the force multiplying effect of 'the new ground'. Everett C. Dolman, 'Geostrategy in the Space Age: An Astropolitical Analysis,' Geopolitics: Geography and Strategy. Colin S. Gray and Geoffrey Sloan, ed. Great Britain: Frank Cass Publishers, 1999. 93.
[56] "TRW Delivers Korean Multipurpose Satellite", Spacedaily, April 22, 1998.
[57] Kitsat 2 was launched in 1993 and inserted into an orbit of 795 km by 805 km at an inclination of 98.7 degrees. "South Korea and Earth Observation Systems", FAS Space Policy Project World Space Guide.

In 1998, TRW delivered the first of two spacecraft comprising the Korean Multipurpose Satellite (KOMPSAT) program to the Republic of Korea's space agency, the Korean Aerospace Research Institute (KARI). KOMPSAT was seen to enhance Korea's space development infrastructure and was a key component of its 20-year plan. The KOMPSAT flight model was assembled , integrated and tested at KARI facilities by Korean engineers with support from TRW.

In 1999, a Taurus booster launched the first KOMPSAT into a low-Earth-orbit at an altitude of 685 km[58]. KOMPSAT's scientific payloads were for ocean color imaging, multi-spectral sensing and space physics measurements. The satellites also included an electro-optical camera with seven-meter resolution built by TRW. This camera provided the cartography data for developing digital elevation maps of the Korean peninsula for land use and planning purposes.[59] More importantly, KOMPSAT represented the first joint satellite development undertaken by KARI. KOMPSAT's development saw the close effort Korean Industrial companies[60] had with TRW to build high-reliability, space-qualified hardware for KOMPSAT.

b) Development of Space Launch Facilities.[61]

In 1999, a Memorandum of Understanding between the two nations was signed between the US and South Korea that set forth the developmental guidelines for both launch vehicles that would be used for commercial purposes as well as new generations

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http://sun00781.dn.net/spp/guide/skorea/earth/. Both satellites were placed in sun-synchronous orbits. "South Korea and Satellite Communication Systems", FAS Space Policy Project World Space Guide. http://sun00781.dn.net/spp/guide/skorea/comm/

[58] "South Korea and Earth Observation Systems", FAS Space Policy Project World Space Guide. http://sun00781.dn.net/spp/guide/skorea/earth/.

[59] This capability is dual-use as the cartographic data can also be used for creating digital maps for military use.

[60] Daewoo provided the attitude and orbit control subsystem; Halla and Hanwah, the propulsion subsystem; Hyundai, electrical power system components; Korean Air and Doowon, the structural and thermal subsystem; and Samsung, the on-board computer and satellite system test equipment.

of ballistic missiles. This agreement took off all restrictions on the range and payload capability of "commercial launch vehicles" and allowed the range limit for military ballistic missiles to increase to 300 kilometers.[62] Also, in response to North Korea's missile launch attempt in 1998, President Kim Dae Jung announced at end-1999 a five-year initiative to design, build and launch a commercial space cargo rocket, and to use the launcher to create a commercial launch business for the country, with the goal of using only South Korean industries and engineering expertise.[63]

c) Spy Satellite Program

In 2000, South Korea began plans laying the foundation for its spy satellite program. Based on its requirements, the South Korean military predicted that it would require a constellation of four spy satellites flying in a LEO. Due to the infancy of its satellite industry, ROK decided that it would solicit US assistance. The projected cost of ROK's first spy satellite was estimated (in 2000) at between US$190-285 million if purchased from the US or around US$500 million to indigenously develop, build and launch.[64] Korea planned to buy from US the instruments to control the direction of the optical sensors and to send and analyze images taken by the planned satellites.

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[61] Frank Sietzen, Jr, "US/South Korea To Sign Launch Agreement", Spacedaily, April 29, 1999.

[62] The reason for South Korea's enhanced missile performance points to the incorporation of French rocket technology. This cooperation is supported by French assistance in South Korea's development of the *Chonma* ground-to-air missile. In the joint-venture accord between Samsung Electronics and Thomson, both companies agreed to provide a complete range of systems and equipment in electronic imagery, military communications, naval combat and ground-to-air missiles. C.W. Lim, "France Helps South Korea Build New Missiles", Spacedaily, November 15, 1999.

[63] Jescovon Puttkamer, "Space Flight 1999 - Asian Space Activities". http://www.hq.nasa.gov/osf/1999/yearinrev/99asia.html. See also, Frank Sietzen, "A New Asian Space Race Emerges", Space.com, January 25, 2000. http://www.space.com/businesstechnology/business/korea_space_000124.html.

[64] "Japan To Use US SpySat Technology", Spacedaily, September 24, 1999. The costs for South Korea's program uses Japan's spy satellite program as an estimate.

i. Enabling Technology - Hyperspectral Imaging (HSI).[65]

To support the satellite program as an effective space-based surveillance system, R&D investments were made to understand the potential applications of hyperspectral imaging into ROK's satellites. A brief description of this technology thus follows below.

Hyperspectral imaging is a satellite-based technology that uses hundreds of very narrow wavelengths to "see" reflected energy from objects on the ground. This energy appears in the form of "spectral fingerprints" across the light spectrum and enables the collection of much more detailed data and produce a much higher spectral resolution of a scene than possible using other remote sensing technologies. Once these fingerprints are detected, special algorithms then assess them to differentiate various natural and manmade substances from one another. Ultimately, "signature" libraries would be used to identify specific materials.

Image processing equipment then portrays the various types of terrain and objects upon it in different colors forming a "color cube," each based on the wavelength of the reflected energy captured by the image. These colors are subsequently "translated" into maps that correspond to certain types of material or objects to detect or identify military targets such as a tank or a mobile missile launcher. Algorithms can also categorize types of terrain and vegetation detecting features such as disturbed soil, stressed vegetation, and whether the ground will support the movement of military vehicles. Upon maturity of this technology, theater commanders will be able to use mobile ground stations to process in real-time information transmitted by the satellites.

HSI, like Multispectral Imaging (MSI), is a passive technique, but unlike MSI, HSI creates a large number of images from contiguous, rather than disjoint, regions of the spectrum, typically with much finer resolution.[66]

[65] "The Warfighter's Edge: First Hyperspectral Images From Space", Spacedaily, September 8, 2000.
[66] In MSI, multiple images of a scene or object are created using light from known parts of the spectrum. "Hyperspectral Imaging", FAS Intelligence Resource Program. http://www.fas.org/irp/imint/hyper.html

Annex 3B: SUMMARY MATRIX OF KOREA STUDY

Epoch	2000-2005		2006-2010		2011-2015	2016-2020
Analogy Theme	Détente Muddle Along		The Juggler Phased Co-existence		Useful Porcupine Varied Confederation	Adopted Son Federation
Country	ROK	DPRK	ROK	DPRK	Korea	Korea
Geo-political Situation	• Sunshine policy	• Internal sufferings • Impending Economic collapse • US engages in Nuclear NPT talks	• Policy of National Self-Preservation • ROK agrees to make US withdraw half of its troops for closer ties with DPRK; 10% withdrawn by 2010 • Formation of Confederation	• Face saving economic bailout for DPRK • Chemical and Biological weapons cleanup in exchange for economic aid • Formation of Conservation Corps	• Declaration of Unification and end of hostilities between the two Koreas (2011) • Establishment of Confederal Council • Admission to UN seat • Beginning of Inter-Ministerial Meetings • Unified Korean Team to Olympics (2012) and World Cup (2014) • Increased cooperation with ASEAN and EU (ARF & ASEM) • US begins to withdraw up to half of its forces in Korea by 2015 • Rise of Japan militarism	• Korea Federation formed • First Unified Korean Prefecture elections in 2018 • Complete withdrawal of US troops from Korea. 10% left (2018); 0% (2020) • Tok-do Island dispute • Korea leans closer to China • US calls on Japan to play a regional leadership role
Economy /Budget (US$)	• Establishment of Intra-Korean currency • • 4% GDP growth • 390 B GDP/yr	6.2% GDP growth 9 B GDP/yr	• Building of Trans-Korea Railroad starting 2006 • 2% GDP/yr to K(N) • 5.9% GDP growth/yr 498 B GDP/yr	• Building of Oil pipeline from Siberia to Japan via Korea starting 2006 6.2% GDP growth/yr 9 B GDP/yr 10 B AID Package/yr	• Merging of Economies – single Korean Chwon currency (2011) • Trans-Korea Railway fully operational (2015) • 2% GDP to K(N)/yr • +5.9%/yr +12%/yr • 660 B/yr 18 B/yr 13 B AID Package/yr	• China replaces US as #1 trading partner • Oil pipeline construction complete 2% GDP to K(N)/yr +5.9%/yr +12-7%/yr 884 B/yr 29 B/yr 18 B AID Package/yr Policy: Mass Migration South? Welfare?

Annex 3B: SUMMARY MATRIX OF KOREA STUDY

Epoch	2000-2005		2006-2010		2011-2015		2016-2020	
Analogy Theme	Détente Muddle Along		The Juggler Phased Co-existence		Useful Porcupine Varied Confederation		Adopted Son Federation	
Country	ROK	DPRK	ROK	DPRK	Korea		Korea	
National Security Strategy	• Deter war by improving inter-Korean relations and foster peaceful coexistence • Strengthen international cooperation to set the stage for national stability, prosperity and progress		• Promote stability • National Self-Preservation • Economic Bailout of DPRK Use economy to drive unification effort	• Use of BM as bargaining chip	• Preserve National Sovereignty • Independent, self-reliant Korea • Protection of Capital Flows ie. ship, rail, pipeline		• Maintain sovereignty • Strategic agreement with China to overcome weakness in repelling overland invasion • Benevolent Neutrality • Economic Revival – protection of commerce/SLOCs	
National Military Strategy	• Deter DPRK invasion • Protect SLOCs • Advanced, high quality national defense • Strengthen external military ties	• To unite Korea by Force	• Deter overland invasion • Protect SLOCs – Blue water capability • Conduct annihilation battle against DPRK	• Conduct attrition battle against ROK	• 360-degrees coverage • Protection of SLOCs • Technology Transfer		• Deterrence from cruise and ballistic missiles • Protection from sea invasion • Protection from SLOC blockage (600 nm pie)	
Defense $ %GDP (US$)	3.5% (13.6 B/yr)	27% (2.5 B/yr)	3.5% (17.5 B/yr)	27% (3.3 B/yr)	3.5% (23.2 B/yr)	27% (5.3 B/yr)	3.5% (31.0 B/yr)	27% (8.9 B/yr)
O&M %GDP (US$)	70% (9.5 B/yr)	70% (1.7 B/yr)	70% (12.2 B/yr)	70% (2.3 B/yr)	70% (16.3 B/yr)	70% (3.7 B/yr)	70% (21.7 B/yr)	70% (6.3 B/yr)

Annex 3B: SUMMARY MATRIX OF KOREA STUDY

Epoch	2000-2005		2006-2010		2011-2015		2016-2020	
Analogy	Détente		The Juggler		Useful Porcupine		Adopted Son	
Theme	Muddle Along		Phased Co-existence		Varied Confederation		Federation	
Country	ROK	DPRK	ROK	DPRK	Korea		Korea	
Procurement (US$)	30% FIP (4.1 B/yr)	30% FIP (0.7 B/yr)	30% FIP (5.2 B/yr)	30% FIP (1.0 B/yr)	30% FIP (7.0 B/yr)	30% FIP (1.6 B/yr)	30% FIP (9.3 B/yr)	30% FIP (2.7 B/yr)
Army (US$)	30% of 83% (1.013 B/yr)	50% of 60% (0.222 B/yr)	30% of 83% (1.304 B/yr)	50% of 60% (0.300 B/yr)	30% of 83% (1.716 B/yr)	50% of 60% (0.799 B/yr)	30% of 83% (2.285 B/yr)	50% of 60% (1.342 B/yr)
Navy (US$)	40% of 83% (1.351 B/yr)	20% of 60% (0.089 B/yr)	40% of 83% (1.738 B/yr)	20% of 60% (0.120 B/yr)	40% of 83% (2.228 B/yr)	20% of 60% (0.192 B/yr)	40% of 83% (3.047 B/yr)	20% of 60% (0.322 B/yr)
Air Force (US$)	30% of 83% (1.013 B/yr)	30% of 60% (0.133 B/yr)	30% of 83% (1.304 B/yr)	30% of 60% (0.180 B/yr)	30% of 83% (1.716B/yr)	30% of 60% (0.288 B/yr)	30% of 83% (2.285 B/yr)	30% of 60% (0.483 B/yr)
DBA (US$)	4% (0.16 B/yr)	5% (0.04 B/yr)	4% (0.21 B/yr)	5% (0.05 B/yr)	4% (0.28 B/yr)	5% (0.08 B/yr)	4% (0.37 B/yr)	5% (0.13 B/yr)
R&D (US$)	13% (0.53 B/yr)	35% (0.26 B/yr)	13% (0.67 B/yr)	35% (0.34 B/yr)	13% (0.91 B/yr)	35% (0.56 B/yr)	13% (1.21 B/yr)	35% (0.94 B/yr)
Net Assessment	• Overland invasion between ROK/USFK and DPRK • Overland invasion between ROK/USFK and DPRK/PRC		• Overland invasion between ROK/USFK and DPRK • Overland invasion between ROK/USFK and DPRK/PRC		• Overland Invasion by Korea (N) • Overland invasion with Sea Blockade by China		• SLOC Blockade with Air Interdiction by Japan	
Deficiencies	• Coastal Defense • Maintaining Air Superiority		• Coastal Defense • Maintaining Air Superiority • Protection of SLOCs		• Need for Long Range Precision Strike Capability • Defense Against Ballistic Missile Attacks • Defense Against Cruise Missile Attacks		• Require a Better CM Defense • Need for Long Range Precision Strike • Need for BM Defense	

Annex 3C: ECONOMICS; Appendix 1: GDP / DEFENSE BREAKDOWN

		GDP		Defense Budget		O&M		FIP	
		ROK	DPRK	ROK	DPRK	ROK	DPRK	ROK	DPRK
	%GDP			3.5%	27.0%	2.5%	18.9%	1.1%	8.1%
	%			3.5%	27.0%	70.0%	70.0%	30.0%	30.0%
	%Def Bud			100.0%	100.0%	70.0%	70.0%	30.0%	30.0%
	Year	US$ Bil	US$ Bil	US$ Bil	US$ Bil	US$ Bil	US$ Bil	US$ Bil	US$ Bil
Epoch 1	%Growth	4.0%	6.2%						
	2000	344.000	7.600	12.040	2.052	8.428	1.436	3.612	0.616
	2001	357.760	8.071	12.522	2.179	8.765	1.525	3.756	0.654
	2002	372.070	8.572	13.022	2.314	9.116	1.620	3.907	0.694
	2003	386.953	9.103	13.543	2.458	9.480	1.720	4.063	0.737
	2004	402.431	9.667	14.085	2.610	9.860	1.827	4.226	0.783
	2005	418.529	10.267	14.649	2.772	10.254	1.940	4.395	0.832
	Total	**1,937.744**	**45.680**	**67.821**	**12.334**	**47.475**	**8.634**	**20.346**	**3.700**
	Avg	**387.549**	**9.136**	**13.564**	**2.467**	**9.495**	**1.727**	**4.069**	**0.740**
Epoch 2	%Growth	0.059	0.062						
	2006	443.222	10.903	15.513	2.944	10.859	2.061	4.654	0.883
	2007	469.372	11.579	16.428	3.126	11.500	2.189	4.928	0.938
	2008	497.065	12.297	17.397	3.320	12.178	2.324	5.219	0.996
	2009	526.392	13.060	18.424	3.526	12.897	2.468	5.527	1.058
	2010	557.449	13.869	19.511	3.745	13.657	2.621	5.853	1.123
	Total	**2,493.499**	**61.709**	**87.272**	**16.661**	**61.091**	**11.663**	**26.182**	**4.998**
	Avg	**498.700**	**12.342**	**17.454**	**3.332**	**12.218**	**2.333**	**5.236**	**1.000**
Epoch 3	%Growth	0.059	0.120						
	2011	590.338	15.534	20.662	4.194	14.463	2.936	6.199	1.258
	2012	625.168	17.398	21.881	4.697	15.317	3.288	6.564	1.409
	2013	662.053	19.486	23.172	5.261	16.220	3.683	6.952	1.578
	2014	701.114	21.824	24.539	5.892	17.177	4.125	7.362	1.768
	2015	742.480	24.443	25.987	6.600	18.191	4.620	7.796	1.980
	Total	**3,321.154**	**98.684**	**116.240**	**26.645**	**81.368**	**18.651**	**34.872**	**7.993**
	Avg	**664.231**	**19.737**	**23.248**	**5.329**	**16.274**	**3.730**	**6.974**	**1.599**
Epoch 4	%Growth	0.059	12.0 - 7.2%						
	2016	786.286	27.376	27.520	7.391	19.264	5.174	8.256	2.217
	2017	832.677	30.332	29.144	8.190	20.401	5.733	8.743	2.457
	2018	881.805	33.244	30.863	8.976	21.604	6.283	9.259	2.693
	2019	933.832	36.037	32.684	9.730	22.879	6.811	9.805	2.919
	2020	988.928	38.631	34.612	10.430	24.229	7.301	10.384	3.129
	Total	**4,423.528**	**165.621**	**154.823**	**44.718**	**108.376**	**31.302**	**46.447**	**13.415**
	Avg	**884.706**	**33.124**	**30.965**	**8.944**	**21.675**	**6.260**	**9.289**	**2.683**

		FIP		Army		Navy		Air Force		DBA	
		ROK	DPRK	ROK	DPRK	ROK	DPRK	ROK	DPRK	ROK	DPRK
	%GDP	1.1%	8.1%	0.3%	4.1%	0.4%	1.6%	0.3%	2.4%	0.0%	0.4%
	%	30.0%	30.0%	30.0%	50.0%	40.0%	20.0%	30.0%	30.0%	4.0%	5.0%
	%Def Bud	30.0%	30.0%	7.4%	9.0%	9.8%	3.6%	7.4%	5.4%	1.2%	1.5%
	Year	US$ Bil	US$ Bil	US$ Bil	US$ Bil	US$ Bil	US$ Bil	US$ Bil	US$ Bil	US$ Bil	US$ Bil
Epoch 1	%Growth										
	2000	$3.612	$0.616	$0.899	$0.185	$1.199	$0.074	$0.899	$0.111	$0.144	$0.031
	2001	$3.756	$0.654	$0.935	$0.196	$1.247	$0.078	$0.935	$0.118	$0.150	$0.033
	2002	$3.907	$0.694	$0.973	$0.208	$1.297	$0.083	$0.973	$0.125	$0.156	$0.035
	2003	$4.063	$0.737	$1.012	$0.221	$1.349	$0.088	$1.012	$0.133	$0.163	$0.037
	2004	$4.226	$0.783	$1.052	$0.235	$1.403	$0.094	$1.052	$0.141	$0.169	$0.039
	2005	$4.395	$0.832	$1.094	$0.249	$1.459	$0.100	$1.094	$0.150	$0.176	$0.042
	Total	**$20.346**	**$3.700**	**$5.066**	**$1.110**	**$6.755**	**$0.444**	**$5.066**	**$0.666**	**$0.814**	**$0.185**
	Avg	**$4.069**	**$0.740**	**$1.013**	**$0.222**	**$1.351**	**$0.089**	**$1.013**	**$0.133**	**$0.163**	**$0.037**
Epoch 2	%Growth										
	2006	$4.654	$0.883	$1.159	$0.265	$1.545	$0.106	$1.159	$0.159	$0.186	$0.044
	2007	$4.928	$0.938	$1.227	$0.281	$1.636	$0.113	$1.227	$0.169	$0.197	$0.047
	2008	$5.219	$0.996	$1.300	$0.299	$1.733	$0.120	$1.300	$0.179	$0.209	$0.050
	2009	$5.527	$1.058	$1.376	$0.317	$1.835	$0.127	$1.376	$0.190	$0.221	$0.053
	2010	$5.853	$1.123	$1.457	$0.337	$1.943	$0.135	$1.457	$0.202	$0.234	$0.056
	Total	**$26.182**	**$4.998**	**$6.519**	**$1.500**	**$8.692**	**$0.600**	**$6.519**	**$0.900**	**$1.047**	**$0.250**
	Avg	**$5.236**	**$1.000**	**$1.304**	**$0.300**	**$1.738**	**$0.120**	**$1.304**	**$0.180**	**$0.209**	**$0.050**
Epoch 3	%Growth										
	2011	$6.199	$1.258	$1.525	$0.629	$2.033	$0.151	$1.525	$0.226	$0.248	$0.063
	2012	$6.564	$1.409	$1.615	$0.705	$2.153	$0.169	$1.615	$0.254	$0.263	$0.070
	2013	$6.952	$1.578	$1.710	$0.789	$2.280	$0.189	$1.710	$0.284	$0.278	$0.079
	2014	$7.362	$1.768	$1.811	$0.884	$2.415	$0.212	$1.811	$0.318	$0.294	$0.088
	2015	$7.796	$1.980	$1.918	$0.990	$2.557	$0.238	$1.918	$0.356	$0.312	$0.099
	Total	**$34.872**	**$7.993**	**$8.579**	**$3.997**	**$11.438**	**$0.959**	**$8.579**	**$1.439**	**$1.395**	**$0.400**
	Avg	**$6.974**	**$1.599**	**$1.716**	**$0.799**	**$2.288**	**$0.192**	**$1.716**	**$0.288**	**$0.279**	**$0.080**
Epoch 4	%Growth										
	2016	$8.256	$2.217	$2.031	$1.109	$2.708	$0.266	$2.031	$0.399	$0.330	$0.111
	2017	$8.743	$2.457	$2.151	$1.228	$2.868	$0.295	$2.151	$0.442	$0.350	$0.123
	2018	$9.259	$2.693	$2.278	$1.346	$3.037	$0.323	$2.278	$0.485	$0.370	$0.135
	2019	$9.805	$2.400	$2.412	$1.459	$3.216	$0.350	$2.412	$0.525	$0.392	$0.146
	2020	$10.384	$2.400	$2.554	$1.565	$3.406	$0.375	$2.554	$0.563	$0.415	$0.156
	Total	**$46.447**	**$12.167**	**$11.426**	**$6.708**	**$15.235**	**$1.610**	**$11.426**	**$2.415**	**$1.858**	**$0.671**
	Avg	**$9.289**	**$2.433**	**$2.285**	**$1.342**	**$3.047**	**$0.322**	**$2.285**	**$0.483**	**$0.372**	**$0.134**

		FIP		R&D			Force Development R&D				
		ROK	DPRK	ROK	Force Development	ADD Operation	Army	Navy	Air Force	Electro-optics RC	Microwave RC
	%GDP	1.1%	8.1%	0.14%	0.11%	0.03%					
	%	30.0%	30.0%	13.0%	80.0%	20.0%	30.0%	40.0%	30.0%	27.6%	29.4%
	%Def Bud	30.0%	30.0%	3.9%	3.1%	0.8%					
	Year	US$ Bil	US$ Bil	US$ Bil	US$ Bil	US$ Bil	US$ Bil	US$ Bil	US$ Bil	US$ Bil	US$ Bil
Epoch 1	%Growth										
	2000	$3.61	$0.62	$0.470	$0.376	$0.094	0.113	0.150	0.113	0.026	0.028
	2001	$3.76	$0.65	$0.488	$0.391	$0.098	0.117	0.156	0.117	0.027	0.029
	2002	$3.91	$0.69	$0.508	$0.406	$0.102	0.122	0.163	0.122	0.028	0.030
	2003	$4.06	$0.74	$0.528	$0.423	$0.106	0.127	0.169	0.127	0.029	0.031
	2004	$4.23	$0.78	$0.549	$0.439	$0.110	0.132	0.176	0.132	0.030	0.032
	2005	$4.39	$0.83	$0.571	$0.457	$0.114	0.137	0.183	0.137	0.032	0.034
	Total	**$20.35**	**$3.70**	**$2.645**	**$2.116**	**$0.529**	**0.635**	**0.846**	**0.635**	**0.146**	**0.155**
	Avg	**3.39**	**0.62**	**0.44**	**0.35**	**0.09**	**0.106**	**0.141**	**0.106**	**0.024**	**0.026**
Epoch 2	%Growth										
	2006	$4.7	$0.9	$0.605	$0.484	$0.121	0.145	0.194	0.145	0.033	0.036
	2007	$4.9	$0.9	$0.641	$0.513	$0.128	0.154	0.205	0.154	0.035	0.038
	2008	$5.2	$1.0	$0.678	$0.543	$0.136	0.163	0.217	0.163	0.037	0.040
	2009	$5.5	$1.1	$0.719	$0.575	$0.144	0.172	0.230	0.172	0.040	0.042
	2010	$5.9	$1.1	$0.761	$0.609	$0.152	0.183	0.243	0.183	0.042	0.045
	Total	**$26.2**	**$5.0**	**$3.404**	**$2.723**	**$0.681**	**0.817**	**1.089**	**0.817**	**0.188**	**0.200**
	Avg	**$5.2**	**$1.0**	**0.68**	**0.54**	**0.14**	**0.163**	**0.218**	**0.163**	**0.038**	**0.040**
Epoch 3	%Growth										
	2011	$6.2	$1.3	$0.806	$0.645	$0.161	0.193	0.258	0.193	0.045	0.047
	2012	$6.6	$1.4	$0.853	$0.683	$0.171	0.205	0.273	0.205	0.047	0.050
	2013	$7.0	$1.6	$0.904	$0.723	$0.181	0.217	0.289	0.217	0.050	0.053
	2014	$7.4	$1.8	$0.957	$0.766	$0.191	0.230	0.306	0.230	0.053	0.056
	2015	$7.8	$2.0	$1.013	$0.811	$0.203	0.243	0.324	0.243	0.056	0.060
	Total	**$34.9**	**$8.0**	**$4.533**	**$3.627**	**$0.907**	**1.088**	**1.451**	**1.088**	**0.250**	**0.266**
	Avg	**$7.0**	**$1.6**	**0.91**	**0.73**	**0.18**	**0.218**	**0.290**	**0.218**	**0.050**	**0.053**
Epoch 4	%Growth										
	2016	$8.3	$2.2	$1.073	$0.859	$0.215	0.258	0.343	0.258	0.059	0.063
	2017	$8.7	$2.5	$1.137	$0.909	$0.227	0.273	0.364	0.273	0.063	0.067
	2018	$9.3	$2.7	$1.204	$0.963	$0.241	0.289	0.385	0.289	0.066	0.071
	2019	$9.8	$2.4	$1.275	$1.020	$0.255	0.306	0.408	0.306	0.070	0.075
	2020	$10.4	$2.4	$1.350	$1.080	$0.270	0.324	0.432	0.324	0.075	0.079
	Total	**$46.4**	**$12.2**	**$6.038**	**$4.830**	**$1.208**	**1.449**	**1.932**	**1.449**	**0.334**	**0.355**
	Avg	**$9.3**	**$2.4**	**1.21**	**0.97**	**0.24**	**0.290**	**0.386**	**0.290**	**0.067**	**0.071**

Annex 3D: NATIONAL DEFENSE; Appendix 1: FORCE IMPROVEMENT PLANS

Army

North Korea		Epoch 1		Epoch 2		Epoch 3		Epoch 4			
Designation	**Unit**	**QTY**	**Total**	**QTY**	**Total**	**QTY**	**Total**	**QTY**	**Total**	**Comments**	**Total**
NEW CAPABILITY											
Attack Helo	18	0	0	0	0	24	432	48	864	AH64D	**72**
Missiles	0.2	0	0	0	0	1500	300	2500	500	AGM11X	**4000**
Ballistic Missiles	1	100	100	200	200	200	200				
SAM	35	0	0	0	0	48	1680	66	2310	A300V/400	**114**
REPLACEMENTS											
Miscelaneous			1010		1300						
MBT	7		0		0	100	700	100	700	K1?	**200**
APCs	4		0		0	40	160	200	800	M2/M3	**240**
Soldier Systems	0.01	0	0	0	0	52500	525	150000	1500	Various	**202500**
Total Obligated			1110		1500		3997		6674		
Available in Epoch			1110		1500		3997		6708		
Remaining			0		0		0		34		

South Korea	Unit	Epoch 1		Epoch 2		Epoch 3		Epoch 4			
Designation	**(M$US)**	**QTY**	**Total**	**QTY**	**Total**	**QTY**	**Total**	**QTY**	**Total**	**Comments**	**Total**
NEW CAPABILITY											
Attack Helo	18	48	864	48	864	48	864	0	0	AH64D	**144**
Scout/Atk Helo	35	0	0	24	840	48	1680	96	3360	RAH66	**168**
Missiles	0.2	2500	500	2500	500	2500	500	2500	500	AGM 11X	**10000**
Ballistic Missiles	1	0	0	25	25	75	75	200	200		**300**
Tactical DBA	5	20	100	28	140	48	240	48	240	GBS	**144**
SAM	35	20	700	28	980	0	0	0	0	A300V	**48**
SAM	55	0	0	0	0	48	2640	48	2640	A400V	**96**
DBA Interfaces	10	100	1000	50	500	50	500	10	100	FAAD C2I, MCS	**210**
Night Vision Devices	0.01	20000	200	20000	200	10000	100	10000	100		**60000**
Navy Cruise Missiles	1	0	0	0	0	0	0	1000	1000		**1000**
REPLACEMENTS											**0**
MBT	7	66	462	100	700	100	700	230	1610	K1/M1	**496**
APCs	4	66	264	100	400	100	400	230	920	M2/M3	**496**
Soldier Systems	0.01	75000	750	75000	750	75000	750	75000	750	Various	**300000**
Total Obligated			4840		5899		8449		11420		
Available in Epoch			5066		6519		8579		11426		
Remaining			226		620		130		6		

Annex 3D: NATIONAL DEFENSE; Appendix 1: FORCE IMPROVEMENT PLANS

Navy

South Designatio	Unit Cost	Epoch QTY	Total	Epoch QTY	Total	Epoch QTY	Total	Epoch QTY	Total	Comment	Total
NEW											
Type 214	1120	0	0	3	3360	3	3360	4	4480		**9**
Chang Bogo	1000	2	0		0		0		0		**3**
Submarine	400		0		0		0	2	800		
KDX -	900		0		0	2	1800	6	5400	Indigeniou	**7**
KDX III	1000	3	3000	4	4000	4	4000		0	KDX III	**12**
KDX II	400	1	0		0		0		0	KDX II	**1**
MSC /	500	3	1500		0		0		0	Kang	**6**
MSO /	500		0		0		0	3	1500		
Mine	500	2	1000		0		0	3	1500	Won	**5**
Alligator	400	3	1200		0		0		0	Alligator	**3**
Amphibious	300			3	900		0		0		**3**
UnRep	200	1	200		0	2	400		0		**4**
Patrol	400				0	3	1200		0		**6**
Super	25	13	325		0	6	150		0		**13**
P-3C	30	8	240	0	0	0	0	0	0		**8**
P-3X	30	0	0	4	120	8	240	12	360		**8**
UWAV	200		0		0		0	4	800	Technology	**5**
Upgrade											
Chang Bogo	50	3	150		0		0		0	Equip	
SSM	0.8	150	120	140	112	0	0		0		
SSM (SS-N-	0.7	0	0	0	0	150	105	500	350		
SS-N-	0.7		0		0	0	0	200	140		
SS-N-21	0.7		0		0	0	0	500	350		
SAM (SM-	0.2	500	100	500	100		0		0		
SAM (SM-	1		0		0	200	200	500	500		
ASW	0.1	1000	100	1000	100	700	70	700	70		
ASW	0.1	0	0	0	0	350	35	350	35		
Transfer											
Army	1					0	0	-1000	-1000		
Air Force	1	-1200	-1200			-125	-125	-225	-225		
Total			6735		8692		11435		15060		
Available in Epoch			6755		8692		11438		15235		
Remainin			20		0		3		175		

North Designatio	Unit Cost	Epoch QTY	Total	Epoch QTY	Total	Epoch QTY	Total	Epoch QTY	Total	Comment	Total
NEW											
Maritime Aircraft	30	12	360	0	0	6	180	6	180	Ilyushin Il-20 Coot	
Patrol	300	0	0	2	600	2	600	4	1200	Russia	
UPGRADE											
Patrol	4	14	56	0	0	6	24	0	0		
Corvette	5	5	25	0	0	0	0	0	0		
Romeo	5	0	0	0	0	10	50	0	0		
SSM (SS-N-	0.7	0	0	0	0	150	105	0	0		
SS-N-	0.7	0	0	0	0	0	0	128	89.6		
SS-N-21	0.7	0	0	0	0	0	0	200	140		
Total			441		600		959		1609.6		
Available in			$444		$600		959		1,610		
Remainin			3		0		0		0.4		

Air Force

Epoch 1 Air Force Procurement

South Korea Designation	Quantity	MIL US $ Unit Cost [67]	MIL US $ Total	Comments
New Capability:				
A-50	10	45	450	New Ground Attack
E-3 / AWACS	1	150	150	New AEW
KOX-1	10	10	100	Fwd Air Control (FAC)
KT-1	45	6	270	Trainer - Prop
UAV	80	10	800	Israeli Pioneer
KOX/KT-1 Program	1	300	300	T&E/DIB Improve
FX-x Program	1	1400	1400	T&E/DIB Improve
UAV Program	1	200	200	T&E//Integrate
AA/AG Missiles	1	20	20	Program $$
NAVY Integration	1	1200	1200	Navy Shortfall
Upgrades:				
AIM-120A/B/C	150	0.5	75	New Missiles

Total Obligated	$4,965
Available in Epoch 1	$5,066
Remaining	$101

North Korea Designation	Quantity	MIL US $ Unit Cost [67]	MIL US $ Total	Comments
New Capability:				
AS-x Missile	50	0.8	40	Air-Surface Missile
Upgrades:				
Mig-29 Fleet	35	5.71	200	Radar/Avionics
Su-25 Fleet	36	5.56	200	Radar/Avionics

Total Obligated	$440
Available in Epoch 1	$666
Remaining	$226

[67] *Weapons Systems Costs*, Nicholas, Ted and Rossi, Rita. Data Research Associates, Fountain Valley, CA. April 2000. Figures in the table are based upon actual cost data of US representative systems with some adjustments for producibility improvements, incentives, and learning curves in future programs.

Epoch 2 Air Force Procurement Proposal

South Korea Designation	Quantity	MIL US $ Unit Cost [68]	MIL US $ Total	Comments
New Capability:				
A-50	50	30	1500	New Ground Attack
E-3/AWACS	2	150	300	New AEW
KOX-1	10	8	80	FAC
KT-1	50	6	300	Trainer-Prop
KT-2	94	8	752	Trainer-Woong Bee
T-50	94	20	1880	Trainer-Jet
FX-x	15	45	675	F-22 variant
Harm Block 6	100	0.5	50	SEAD
Aim-9x	50	0.4	20	High Off-boresight IR
AGM-130/142	50	0.8	40	Air-SFC Missile
A-50 (E-3Delivery)	30	30	900	Epoch3-Delivery
Upgrades:				

Total Obligated	$6,497
Available in Epoch 2	$6,519
Remaining	$22

North Korea Designation	Quantity	MIL US $ Unit Cost [68]	MIL US $ Total	Comments
New Capability:				
			0	
Upgrades:				
Miscellaneous*	10	80	800	Parts/Readiness
			0	

Total Obligated	$800
Available in Epoch 2	$900
Remaining	$100

* Miscellaneous is allocated to programs for parts support in any major readiness degradation category. This placeholder is intended to signify the dire condition of the DPRK Air Force assets. They cannot afford anything else.

[68] *Weapons Systems Costs,* Nicholas, Ted and Rossi, Rita. Data Research Associates, Fountain Valley, CA. April 2000. Figures in the table are based upon actual cost data of US representative systems with some adjustments for producibility improvements, incentives, and learning curves in future programs.

Epoch 3 Air Force Procurement Proposal

South Korea Designation	Quantity	MIL US $ Cost [69]	MIL US $ Total	Comments
New Capability:				
Air Refueling A/C	5	60	300	KC-7xx
UAV	40	15	600	UAV- HAE
E-3/AWACS	4	150	600	New AWACS
C-130x	50	40	2000	SOF Capable
JDAM/JSOW Derivative	100	0.25	25	
UCAV	5	15	75	
HARM Block 6	50	0.35	17.5	SEAD
AIM-9x	100	0.35	35	HOBS
KF-X	50	45	2250	F-X Variant
KT-2	40	20	800	
A-50	10	30	300	
E/RC/JSTARS	2	200	400	US J-8 Variant
Upgrades:				
Air-to-Air Upgrade	1	500	500	
DBA	1	500	500	
AA-x Missiles	100	0.5	50	
Navy Integration	1	125	125	Navy Shortfall
		Total Obligated	$8,578	
		Available Epoch 3	$8,579	
		Remaining	$1	

North Korea Designation	Quantity	MIL US $ Unit Cost [69]	MIL US $ Total	Comments
New Capability:				
UAV/Recce	10	10	100	UAV Assets
KT-2	30	10	300	Primary -KT-2
C-130	4	40	160	SOF Capable
Helo	15	20	300	SOF Capable
Upgrades:				
M-23/29 Upgrade	1	500	500	Performance+Rdr
		Total Obligated	$1,360	
		Available Epoch 3	$1,439	
		Remaining	$79	

[69] *Weapons Systems Costs,* Nicholas, Ted and Rossi, Rita. Data Research Associates, Fountain Valley, CA. April 2000. Figures in the table are based upon actual cost data of US representative systems with some adjustments for producibility improvements, incentives, and learning curves in future programs.

Epoch 4 Air Force Procurement

South Korea Designation	Quantity	MIL US $ Cost [70]	MIL US $ Total	Comments
New Capability:				
Air Refueling A/C	5	55	275	KC-7xx
UAV	40	15	600	HAE
E-3/AWACS	4	180	720	
C-130x	8	45	360	SOF Capable
JDAM/JSOW Derivative	200	0.25	50	
UCAV	50	20	1000	
F-X	50	40	2000	
AGM-x ASM	150	0.5	75	Anti-Shipping w/ATR
AA-x Missiles	200	0.4	80	AIM-xx ERAAM
KT-2	20	8	160	KT-2
A-50	100	28	2800	
A-50 (E3 Delivery)	60	28	1680	Epoch 3 Delivery
Upgrades:				
Air-to-Air Upgrade	1	550	550	F-16 / A-50 / FX-x
DBA Integration	1	450	450	
AIM-9x	100	0.4	40	
AGM-88 Harm	100	0.5	50	Block 6
Navy Cruise Missile	1	225	225	Cruise Missile Integrate
AGM-xx JASSM	150	0.8	120	ER Stand-off Weapon
		Total Obligated	$11,235	
		Available in Epoch 4	$11,426	
		Remaining	$191	

North Korea Designation	Quantity	MIL US $ Cost [70]	MIL US $ Total	Comments
New Capability:				
UAV	50	8	400	UAV HAE
FX-x	18	30	540	New Fighter
A-50	18	30	540	New Ground Attack
KT-1	30	6	180	Primary- Prop
T-50	30	20	600	Trainer - Jet
Upgrades:			0	
		Total Obligated	$2,260	
		Available in Epoch 4	$2,415	
		Remaining	$155	

[70] *Weapons Systems Costs,* Nicholas, Ted and Rossi, Rita. Data Research Associates, Fountain Valley, CA. April 2000. Figures in the table are based upon actual cost data of US representative systems with some adjustments for producibility improvements, incentives, and learning curves in future programs.

Ballistic Missile

Designation	Unit (mil)		Epoch 1 QTY	Epoch 1 Total		Epoch 2 QTY	Epoch 2 Total		Epoch 3 QTY	Epoch 3 Total		Epoch 4 QTY	Epoch 4 Total	Comment	Total
North Korea															
No-Dong	1		50	50		50	50		80	80		80	80		**260**
Taepo-Dong	2		25	50		75	150		60	120		60	120		**220**
				0			0			0			0		**0**
Total Obligated				100			200			200			200		
Available in North Korea				100			200			200			0		
Remaining				0			0			0					

Designation	Unit (mil)		Epoch 1 QTY	Epoch 1 Total		Epoch 2 QTY	Epoch 2 Total		Epoch 3 QTY	Epoch 3 Total		Epoch 4 QTY	Epoch 4 Total	Comment	Total
South Korea															
KSR-1	1			0		25	25		50	50			0		**75**
Hyon Mu	1			0			0		25	25			0		**25**
				0			0			0			0		**0**
Total Obligated				0			25			75			0		
Available in South Korea				0			25			75					
Available in Unified Korea													200		
Remaining				0			0			0			0		

DBA PROGRAMS

2001-2005		2006-2010		2011-2015		2016-2020	
DBA Programs	Amount US$ Bil	DBA Programs	Amount US$ Bil	DBA Programs	Amount US$ Bil	DBA Programs	Amount US$ Bil
Communications Satellites	$0.100	Communications Satellites	$0.125	Microsatellites	$0.200	Microsatellites	$0.250
Spy Satellites	$0.200	Spy Satellites	$0.260	Micro Spy Satellites	$0.300	Micro Spy Satellites	$0.360
Launch Vehicle	$0.100	Launch Vehicle	$0.125	Launch Vehicle	$0.125	Launch Vehicle	$0.175
Aerostat	$0.080	Aerostat	$0.080	JLENS	$0.080	JLENS	$0.150
Micro Air Sensor	$0.120	Micro Air Sensor	$0.150	Micro Air Sensor	$0.180	Micro Air Sensor	$0.280
Defense Digitization	$0.035	Defense Digitization	$0.060	Defense Digitization	$0.125	Defense Digitization	$0.145
Others	$0.179	Others	$0.247	Others	$0.385	Others	$0.498
Total	$0.814	Total	$1.047	Total	$1.395	Total	$1.858

Annex 3D: NATIONAL DEFENSE; Appendix 2: ORDER OF BATTLE

<u>Army</u>

North Korea		Epoch 1			Epoch 2			Epoch 3			Epoch 4			Korea
Combat System	*Start*	*Procure*	*Demob*	*End/Start*	*Procure*	*Demob*	*End/Start*	*Procure*	*Demob*	*End/Start*	*Procure*	*Demob*	*End*	*EndState*
Active Divisions	**80**			**80**		15	**65**		15	**50**		15	**35**	**53**
# Personnel (K)	**1000**			**1000**		187	**813**		206	**607**		182	**425**	**863**
Res Divisions	**37**			**37**		5	**32**		15	**17**		4	**13**	**25**
MBTs	**3500**			**3500**		700	**2800**	100	700	**2200**	200	900	**1500**	**2880**
APCs / AIFVs	**2500**			**2500**		500	**2000**	40	500	**1540**			**1540**	**3040**
AHs	**50**			**50**		10	**40**	24	40	**24**	48		**72**	**386**
Gun Arty	**8200**			**8200**		875	**7325**		875	**6450**		1750	**4700**	**8250**
Rkt Arty	**2300**			**2300**		300	**2000**		300	**1700**		500	**1200**	**1380**
SSMs	**55**			**55**			**55**			**55**			**55**	**67**
ADA	**6000**			**6000**		1750	**4250**		1750	**2500**		1750	**750**	**1100**
SAM	**5500**			**5500**		2500	**3000**	48	2500	**548**	66		**614**	**1138**

South Korea		Epoch 1			Epoch 2			Epoch 3			Epoch 4		
Combat System	*Start*	*Procure*	*Demob*	*End/Start*	*Procure*	*Demob*	*End/Start*	*Procure*	*Demob*	*End/Start*	*Procure*	*Demob*	*End*
Active Divisions	**23**			**23**			**23**			**23**		5	**18**
# Personnel (K)	**560**			**560**			**560**			**560**		122	**438**
Res Divisions	**23**			**23**			**23**			**23**		11	**12**
MBTs	**2100**	66	66	**2100**	100	100	**2100**	100	100	**2100**	230	950	**1380**
APCs / AIFVs	**2500**	66	66	**2500**	100	100	**2500**	100	100	**2500**	230	1230	**1500**
AHs	**100**	48	48	**100**	72	50	**122**	96		**218**	96		**314**
Gun Arty	**4550**			**4550**		250	**4300**		250	**4050**		500	**3550**
Rkt Arty	**180**			**180**			**180**			**180**			**180**
SSMs	**12**			**12**			**12**			**12**			**12**
ADA	**600**			**600**			**600**			**600**		250	**350**
SAM	**1000**	20	35	**985**	28	35	**978**	48	50	**976**	48	500	**524**

Korea (N) Navy

		Epoch 1		Epoch 2		Epoch 3		Epoch 4			
Category	**Specific**	**Begin**	**"+ / -"**	**Begin**	**"+ / -"**	**Begin**	**"+ / -"**	**Begin**	**"+ / -"**	**Force 2020**	
Submarines	Romeo	21		21		21	-11	10		10	Romeo
	Kilo	0		0	2	2	2	4	4	8	Kilo
	Whisky	4		4	-4	0		0		0	Whisky
	Total	**25**	**0**	**25**	**-2**	**23**	**-9**	**14**	**4**	**18**	**Total Submarines**
Sumersible	Sang-O	31		31		31		31		31	Sang-O
	Yugo / P-4	36		36		36	-16	20	-20	0	Yugo / P-4
				0		0		0		0	
				0		0		0		0	
				0		0		0		0	
				0		0		0		0	
	Total	**67**	**0**	**67**	**0**	**67**	**-16**	**51**	**-20**	**31**	**Submersible**
Frigates	Soho	1		1	-1	0		0		0	
	Nanjing	2		2		2	-2	0		0	
	Total	**3**		**3**		**3**		**0**		**0**	
				0		0		0			
Corvettes	Sariwon	3		3		3		3		3	Sariwon
	Tral	2									
	Total	**5**		**5**		**5**		**5**		**5**	**Total Corvettes**
Coastal Patrol	Osa 1	8		8		8		8		8	Osa 1
	Huangfen	4		4		4		4		4	Huangfen
	Soju	15		15		15		15		15	Soju
	Komar	6		6		6		6		6	Komar
	Sohung	6		6		6		6		6	Sohung
	Hainan	6		6		6		6		6	Hainan
	SO 1	19		19		19		19		19	SO 1
	Taechong I	7		7		7		7		7	Taechong I
	Taechoong II	5		5		5		5		5	Taechoong II
	Shang Hai II	12		12		12		12		12	Shang Hai II
	Chong Ju	6		6		6		6		6	Chong Ju
	Chaho	62		62		62		62		62	Chaho
	Chong Jin	48		48		48		48	-48	0	Chong Jin
	Sinpo / Sinnam	24		24		24		24		24	Sinpo / Sinnam
	P6 Shantou	15		15		15	-15	0		0	P6 Shantou
	Ku Song	92		92		92	-92	0		0	Ku Song
	KimJin	63		63		63		63		63	KimJin
	YongDo	45		45		45		45	-45	0	YongDo
				0		0		0		0	
	Total	**443**	**0**	**443**	**0**	**443**	**-107**	**336**	**-93**	**243**	**Total Coastal Patrol**
Aircraft	Maritime Patrol	0	12	12		12		12		12	**Total MPA**
				0		0		0		0	
Amphibious	Hantae	10		10		10		10		10	Hantae
	Nampo D	5		5		5		5		5	Nampo D
	Nampo B	73		73		73		73	-73	0	Nampo B
	Nampo A	18		18		18	-18	0		0	Nampo A
	Hanchon	7		7		7	-7	0		0	Hanchon
	Hungnam	18		18		18	-18	0		0	Hungnam
	KongBang	135		135		135		135	-85	50	KongBang
	Total	**266**	**0**	**266**	**0**	**266**	**-43**	**223**	**-158**	**65**	**Total Amphibious**
Mine Warfare	Yukto 2	5		5		5		5		5	Yukto 2
	Yukto 1	19		19		19		19		19	Yukto 1
	Total	**24**	**0**	**24**	**0**	**24**	**0**	**24**	**0**	**24**	**Total Mine Warfare**

Annex 3D: NATIONAL DEFENSE; Appendix 2: ORDER OF BATTLE

Korea (S) Navy

		Epoch 1		Epoch 2		Epoch 3		Epoch 4			
Category	**Specific**	**Begin**	**"+ / -"**	**Begin**	**"+ / -"**	**Begin**	**"+ / -"**	**Begin**	**"+ / -"**	**Force 2020**	
Submarines	Tolograe	2	-2	0		0		0		0	Tolograe
	Dolphin	9	-3	6	-6	0		0		0	Dolphin
	Chang Bogo	7	2	9		9		9		9	
	Type 214	0		0	3	3	3	6	4	10	
	Total	**18**	**-3**	**15**	**-3**	**12**	**3**	**15**	**4**	**19**	**Total Patrol Subs**
Destroyers	KDX-1	3		3		3		3		3	KDX-1
	KDX-2	2	1	3		3		3		3	KDX-2
	KDX-3	0	3	3	4	7	4	11		11	KDX-3
	KDX-X	0		0		0	2	2	6	8	KDX-X
	Total	**5**	**4**	**9**	**4**	**13**	**6**	**19**	**6**	**25**	**Total Destroyers**
Frigates	Ulsan	9	-3	6		6	-6	0		0	
	Gearing F1	5		5	-5	0		0			
	Gearing F2	2	-2	0		0		0		0	
	Total	**16**		**11**		**6**		**0**		**0**	
				0		0		0			
Corvettes	Po Hang	24		24		24	-6	18		18	Po Hang
	Dong Hae	4		4	-4	0		0			
	Total	**28**	**0**	**28**	**-4**	**24**	**-6**	**18**	**0**	**18**	**Total Corvettes**
Coastal Patrol	Pae Ku	5		5	-5	0		0		0	Pae Ku
	Sea Dolphins	85		85		85		85		85	Sea Dolphins
	Dolphin-X	0		0	3	3	3	6		6	Dolphin-X
	Total	**90**	**0**	**90**	**-2**	**88**	**3**	**91**	**0**	**91**	**Total Coastal Patrol**
Aircraft	Super Lynx	11	13	24		24	6	30		30	**Total MPA**
	P-3C	8	8	16		16		16		16	
	P-3X	0		0	4	4	8	12	12	24	
	Total	**19**		**40**		**44**		**58**		**70**	**Total**
Amphibious	Alligator	4	3	7		7		7		7	Alligator
	Pung To	3		3		3		3		3	Pung To
	LCVPs	20		20		20		20		20	LCVPs
	Uh Bong	6	-6	0		0		0		0	Uh Bong
	New	0		0	3	3		3		3	New
	Total	**33**	**-3**	**30**	**3**	**33**	**0**	**33**	**0**	**33**	**Total Amphibious**
Mine Warfare	Kang Keong	6	3	9		9	3	12		12	Kang Keong
	MSC 268	3	-3	0		0		0			
	MSC 289	5		5	-5	0		0			
	Won San	1	2	3		3	3	6		6	Won San
	Total	**15**	**2**	**17**	**-5**	**12**	**6**	**18**	**0**	**18**	**Total Mine Warfare**

Korea (N) Air Force

		Epoch 1		Epoch 2		Epoch 3		Epoch 4			
Category	**Specific**	**Begin**	**+ / -**	**Begin**	**+ / -**	**Begin**	**+ / -**	**Begin**	**+ / -**	**Force 2020**	
Fighter	Mig-29	35		35		35		35	-15	20	Mig-29
	Mig-23	46		46		46		46	-26	20	Mig-23
	Mig-21	160		160		160		160	-60	100	Mig-21
	F-X			0		0		0	18	18	F-X
	Total	241	0	241	0	241	0	241	-83	158	**Total Fighter**
Ground Attack	Su-7	18		18		18		18		18	Su-7
	Su-25	36		36		36		36	-16	20	Su-25
	A-5	40		40		40		40	-20	20	A-5
	F-6(Mig-19)	120		120		120		120	-120	0	F-6(Mig-19)
	F-5(Mig-17)	107		107		107	-107	0		0	F-5(Mig-17)
	A-50			0		0		0	18	18	A-50 P3I
	Total	321		321		321	-107	214	-138	76	**Total Ground Attack**
Bomber	H-5/Il-28	80		80		80		80	-40	40	H-5/Il-28
		80	0	80	0	80	0	80	-40	40	**Total Bomber**
				0		0		0			
AEW/ESM				0		0		0		0	
Recce/FAC/UAV	UAV	0		0		0	10	10	50	60	UAV
		0		0		0	10	10	50	60	**Total Recce/FAC/UAV**
Air Refuel				0		0		0		0	
Trainer	Mig-29	5		5		5		5		5	Mig-29
	Mig 21/23	40		40		40		40	-20	20	Mig 21/23
	F-5(Mig-17)	25		25		25	-25	0		0	F-5(Mig-17)
	Yak-18	158		158		158	-73	85	-85	0	Yak-18
	Mig-15	35		35		35		35	-35	0	Mig-15
	KT-2			0		0	30	30		30	KT-2
	KT-1			0		0		0	30	30	KT-1
	T-50			0		0		0	30	30	T-50
		263	0	263	0	263	-68	195	-80	115	**Total Trainer**
Transport	Y-5	120		120		120	-60	60		60	Y-5
	An-2	162		162		162	-130	32		32	An-2
	An-24 Coke	6		6		6		6		6	An-24 Coke
	Tu-76 Candid	3		3		3		3		3	Tu-76 Candid
	Il-62 Classic	1		1		1		1		1	Il-62 Classic
	IL/Tu-14/18/134/154	12		12		12		12		12	IL/Tu-14/18/134/154
	C-130			0		0	4	4		4	C-130
		304	0	304	0	304	-186	118	0	118	**Total Transport**
Helo Transport	Helo	275		275		275	15	290		290	Helo
		275		275		275	15	290		290	**Total Helo**
Air-Air Missiles	AA-2 Atoll			0		0		0		0	AA-2 Atoll
	AA-7 Apex			Accurate data unavailable.						0	AA-7 Apex
	AA-11 Archer									0	AA-11 Archer
	AA-10 Alamo									0	AA-10 Alamo
	AA-xx									0	AA-xx
				0		0		0		0	
		0	0	0	0	0	0	0	0	0	
Air-Ground Missiles				0		0		0		0	
	AS-x		50	50		50		50		50	AS-x
				0		0		0		0	
				0		0		0		0	
				0		0		0		0	
				0		0		0		0	
		0	50	50	0	50	0	50	0	50	

Korea (S) Air Force

		Epoch 1		Epoch 2		Epoch 3		Epoch 4			
Category	**Specific**	**Begin**	**+/-**	**Begin**	**+/-**	**Begin**	**+/-**	**Begin**	**+/-**	**Force 2020**	
Fighter	F-5E	195		195		195	-100	95	-95	0	F-5E
	F-4D	130		130	-130	0		0		0	F-4D
	F-16C/D	160		160		160		160	-20	140	F-16C/D
	F-X			0	15	15	50	65	50	115	F-X
	UCAV			0		0	5	5	50	55	UCAV
	Total	485	0	485	-115	370	-45	325	-15	310	**Total Fighter**
Ground Attack	A-50	0	10	10	50	60	100	160	100	260	A-50
	Total	0	10	10	50	60	100	160	100	260	**Total Ground Attack**
Bomber				0		0		0		0	
				0		0		0		0	
AEW/ESM	E-3 AWACS	0	1	1	2	3	4	7	4	11	E-3 AWACS
	E/RC-767			0		0	2	2		2	E/RC-767
Recce/FAC/UAV	RF-4/RF-5	28		28		28	-18	10		10	RF-4/RF-5
	OV-2	10		10		10	-10	0		0	OV-2
	KOX-1	0	10	10	10	20		20		20	KOX-1
	UAV	0	80	80		80	40	120	40	160	UAV
		38	90	128	10	138	12	150	40	190	
Air Refuel	KC-7xx			0		0	5	5	5	10	KC-7xx
Trainer	Hawk	18		18	-10	8		8		8	Hawk
	T-41	25		25	-25	0		0		0	T-41
	T-37	50		50	-50	0		0		0	T-37
	T-38	30		30	-30	0		0		0	T-38
	F-5	25		25	-15	10		10		10	F-5
	KT-1	5	45	50	50	100		100		100	KT-1
	KT-2			0	94	94	40	134	20	154	KT-2
	T-50			0	94	94		94		94	T-50
		153	45	198	108	306	40	346	20	366	**Total Trainer**
Transport	C-130	12		12		12	50	62	8	70	C-130
	Msc VIP			0		0		0		0	Msc VIP
		12	0	12	0	12	50	62	8	70	**Total Transport**
Helo Transport	Helo	30		30		30		30		30	Helo
Air-Air Missiles	AIM-7 Sparrow	200		200		200		200		200	AIM-7 Sparrow
	AIM-9 S-winder	250		250		250		250		250	AIM-9 S-winder
	AIM-120 AMRAAM	150	150	300		300		300		300	AIM-120 AMRAAM
	AA-x ER Rdr/IR			0		0	100	100	200	300	AA-x ERAAM Rdr/IR
	Aim-9x			0	50	50	100	150	100	250	Aim-9x
		600	150	750	50	800	200	1000	300	1300	**Air-Air Missiles**
Air-Ground Missiles	AGM-88 Harm	100		100	100	200	50	250	100	350	AGM-88 Harm
	Harpoon	100		100		100		100		100	Harpoon
	AGM-65 Maverick	150		150		150		150		150	AGM-65 Maverick
	AGM-130/142	100		100	50	150		150		150	AGM-130/142
	JSOW			0		0	50	50	100	150	JSOW
	JDAM			0		0	50	50	100	150	JDAM
	ASM-xx Anti-Ship								150	150	ASM-xx Anti-Ship
	AGM-xx JASSM			0		0		0	150	150	AGM-xx JASSM
		450	0	450	150	600	150	750	600	1350	**Total Air-Ground Missiles**

Army

HYUNDAI K1 MAIN BATTLE TANKS

Development. Following proposals from a number of armored fighting vehicle manufacturers, in 1980 the South Korean government selected the now General Dynamics Land Systems of the United States to design and build two prototypes of a new MBT to meet its own specific requirements. The first of two prototypes of the XK-1 MBT was completed in 1983, the Automotive Test Rig (ATR). It was shipped to Aberdeen Proving Grounds in November 1983 for automotive performance, endurance and reliability testing. The ATR was a fully payloaded tank fitted with a non-operational turret. The second prototype, called the Fire-Control Test Rig (FCTR), was rolled out at a ceremony at Selfridge Air National Guard base in

December 1983 and shipped to Aberdeen Proving Grounds in February 1984 to begin fire-control tests. Production of the XK-1 began in South Korea in 1984 and first production vehicles were completed in 1985. The vehicle was subsequently type-classified as the K1 MBT and the tank made its first appearance in September 1987, by which time several battalions had been equipped with it. The first production batch of 210 vehicles was completed in 1987 with the second batch consisting of 325 vehicles. Many key components of the K1, such as the Computing Devices Company (now owned by General Dynamics Land Systems) ballistic computer, MTU diesel engine, Renk transmission and SFIM roof-mounted sight are now being manufactured in country. By 1999, total production of the K1 MBTs and variants amounted to just over 1,000 units with production still under way. As of 1999, the K1 MBT and its variants had not been exported. A variant of the vehicle, designated the K1-M, has been designed and manufactured to meet the future Malaysian MBT requirement. This has a number of modifications to satisfy the Malaysian Army requirement including the installation of an air conditioning system, NBC system, laser warning system and explosive reactive armor as well as a reduction in the combat weight of the vehicle to less than 50 tonnes As one of its marketing efforts, Hyundai exhibited the K1 MBT, K1 ARV and K1 AVLB at the DSA '96 show in Malaysia in 1996. Following the exhibition Hyundai carried out an operation and mobility performance in front of the Malaysian Army officers at the Malaysian Armour School located on Port Dickson.

Description. The layout of the K1 MBT is conventional, with the driver's compartment at the front, fighting compartment in the center and engine and transmission at the rear. Over the frontal arc of the K1 MBT, including the nose, turret front and sides, advanced armor of the Chobham type is fitted, which is manufactured in the US; this provides protection from both kinetic and chemical energy attack. The driver is seated front left and is provided with a single-piece hatch cover pivoted on the left that lifts upwards to open. This has three integral day periscopes, the center one of which can be replaced by a passive night driving periscope. The commander is seated on the right of the turret with the gunner below and forward of his position and the loader on the left. The commander has a French SFIM (now part of the SAGEM group) two-axis independent stabilized panoramic sight, which has a magnification of ×3 and ×10, periscopes for all-round observation, and a single-piece hatch cover that opens to the rear. This is manufactured in South Korea by Samsung Electronics Co Ltd, under license from SFIM. The gunner's two-axis stabilized day/night sight device incorporates a laser range finder and thermal imaging system which is similar to that installed in the M1A1 MBT and has magnifications of ×1 and ×10 (day) and ×3 and ×10 (night). The gunner's articulated auxiliary sight is provided by the Electro-Optical Division of the Kollmorgen Corporation and Opto Mechanik Inc (OMI). This has a magnification of ×8. The latest Texas Instruments (now part of the Raytheon Systems Company) Gunner's Primary Tank Thermal Sight incorporates an eye-safe carbon dioxide laser range finder with final integration and testing taking place in South Korea. Turret drive and weapon elevation is electrohydraulic with manual controls for emergency use. Stabilization is provided in both elevation and traverse. The fire-control system includes a Computing Devices Company digital ballistic computer with a number of sensors including crosswind and allows the tank to engage both stationary and moving targets while it is stationary or moving itself. Main armament comprises a US-designed 105 mm M68A1 rifled gun which is also fitted on many South Korean M48A5 MBTs and for which ammunition is made in South Korea, including APFSDS. The barrel has a fume extractor, thermal sleeve and a muzzle reference system. A 7.62 mm M60E2 machine gun is mounted coaxially with the main armament. The loader has a 7.62

mm M60D roof-mounted machine gun while the commander has a 12.7 mm K6 roof-mounted machine gun. Mounted either side of the forward part of the turret is a bank of six electrically operated smoke grenade dischargers. An unusual feature of the K1 is the hybrid suspension system with improved torsion bars in the center and hydropneumatic suspension units at each end. This allows the tank to kneel so that the main armament can be depressed to -10º. The remote track adjusting system has two mode settings. The drive sprocket is at the rear, idler at the front, with six dual rubber-tyred road wheels, track-return rollers with the upper part of the track being covered by an armored skirt. For the track, either the replaceable or integral rubber pad can be fitted. The rear-mounted power pack consists of a German MTU MB 871 Ka-501 1,200 hp diesel coupled to a German Renk LSG 3000 fully automatic transmission with acceleration from 0 to 32 km/h in 9.4 seconds. Standard equipment includes a passive image intensification periscope for the driver, hydraulic bilge pump, heater, automatic Halon fire detection and suppression system for both crew and engine compartments and a VRC-947K and/or VRC-964K and a VIC-7K for intercom system. The NBC system consists of an M8A1 alarm system and an M13A1 gas particle filter.

K1A1 MBT. In 1996, Hyundai completed two prototypes of the K1A1 MBT based on the proven mobility and fire-control system of the earlier M1 MBT. These two prototype vehicles successfully passed all severe testing conducted through February 1997. These trials were carried out by the Republic of Korea government under a variety of weather and terrain conditions. The K1A1 MBT has an increased firepower performance over the earlier K1 MBT owing to the adoption of a Korean Commander's Panoramic Sight (KCPS), which has been locally developed. This has a greatly improved performance and function compared with the existing Commander's Panoramic Sight (CPS) for the K1. The K1A1 is also armed with the 120 mm M256 smoothbore gun which is also installed in the General Dynamics Land Systems M1A1 and M1A2 Abrams MBTs. The main characteristics of the K1A1 MBT have been summarized by the manufacturer as follows: (a). The significantly enhanced armor penetration power and combat firing range due to the installation of a 120 mm M256 smoothbore gun instead of the 105 mm M68A1 rifled gun of the earlier K1. (b). Improved performance in the driving and stabilization of the gun and turret by improving the gun/turret drive system for the 120 mm gun. (c). Enhanced processing speed and capability of the ballistic computer. (d). Enhanced night combat and operation capability by adding a thermal imaging capability to the commander's panoramic sight. (e). Improved sealing capability in fording operations and the turret slewing characteristics during moving by improvement of the race ring (or turret bearing) as well as enhanced survivability for the crew by adoption of the improved fire suppression system including thermal wire sensor for the engine bay. (f). Easier maintainability and lowered maintenance cost by utilizing a track with replaceable pads.

Future MBT. It is understood that based upon the capability and experience of research and development for the development of the K1 and K1A1 MBTs, Korea is now developing a new concept MBT taking into account the 21st century battlefield environment. While no characteristics of this new MBT have been officially disclosed, it is assumed that the following factors have been considered: (a). Significantly enhanced firepower with the main gun utilizing the latest gun technology. (b). Significantly enhanced crew survivability by adoption of special armor utilizing new materials and active defense system. (c). Automated and intelligent fire-control system and other control systems. (d). Maximized combat efficiency by adoption of vetronics and battlefield management system. (e). It is understood that ADD, an agency of the

Korean government and Hyundai, prime contractor of the M1 and M1A1 MBTs, undertook the concept study and funding for the Future Main Battle Tank (FMBT) for the Korean government.

Armored vehicle-launched bridge. Early in 1989, Vickers Defense Systems of the UK was awarded a contract by Hyundai Precision and Industry Co Ltd to design and build the prototype of an Armored Vehicle-Launched Bridge (AVLB) system and bridge. The AVLB will launch a scissors-type bridge similar to the British No 8 tank bridge that is carried and launched over the front of a Chieftain. This bridge has an overall length of 22 m and can span a gap up to 20.5 m depending on the firmness of the bank. The bridge and its associated launching system was built at Vickers Defense Systems' Newcastle-upon-Tyne facility and shipped to South Korea in 1990 where it was integrated with the chassis, based on the K1 MBT, designed and built by Hyundai Precision and Industry Co Ltd. Late in 1993, Hyundai awarded Vickers Defense Systems a contract worth £23 million to supply the bridges for the K1 AVLB. The contract covers the manufacture of eight bridges and 41 launching mechanisms in the UK that will be installed on the K1 AVLB chassis by Hyundai. The total South Korea requirement is for 56 K1 AVLBs and the balance of the bridges and launching mechanisms will be built in South Korea by Hyundai under a technology transfer agreement. The bridge takes 3 minutes to be launched and 10 minutes to be recovered, with maximum bank height differences being 2.4 m. The K1 AVLB has a total weight of 54.70 tonnes and in traveling configuration are 12.56 m long, 4.0 m wide and 4.0 m high. The bridge itself weighs 12.9 tonnes and is MLC 66 (this means that it can take AFVs to a maximum combat weight of 60 tonnes). It has a crew of two and is armed with a 7.62 mm M60D machine gun. Full details of this are given in *Jane's Military Vehicles and Logistics 1999-2000*, page 123.

Armored recovery vehicle. Hyundai Precision and Industry Co Ltd has developed an ARV based on the chassis of the K1 in co-operation with the German company MaK. In appearance it is similar to the ARV based on the Leopard 1 and Leopard 2 MBT chassis that MaK developed to meet the requirements of the German Army. Standard equipment includes a front-mounted dozer/stabilizer blade, main winch with a maximum capacity of 35 tonnes (70 tonnes with pulley) and 150 m of cable, with a crane being mounted at the front right side of the hull. When traveling this is stowed alongside the right side of the hull. It can be traversed through 270º and has a maximum lifting weight of 25 tonnes. An auxiliary winch, auxiliary power unit, electric impact wrench and welding equipment are also provided. In November 1991, Hyundai of South Korea, prime contractor for the K1 family of MBTs, awarded MaK System Gesellschaft mbH a production contract for subsystems for the K1 ARV. Following extensive trials of a prototype K1 ARV using MaK System Gesellschaft mbH-designed recovery equipment, MaK was awarded a production contract for recovery equipment except for some localized components. Production of these is undertaken at MaK System Gesellschaft mbH's Kiel facility, with first deliveries completed late in 1993. This vehicle is now in service, with the first order being for 90 vehicles followed by a second order for 59. The recovery equipment is integrated into the chassis by Hyundai that then delivers the complete vehicle to the South Korean Army. Hyundai is building the remainder of the recovery equipment such as dozer, winch and crane system in South Korea as part of a technology transfer from MaK System Gesellschaft mbH. The K1 ARV has a crew of four and weighs 52 tonnes, or 57 tonnes when carrying a spare power pack. It is armed with a 12.7 mm machine gun operated by the vehicle commander. Full details of this are given in *Jane's Military Vehicles and Logistics 1999-2000,* page 41.

K1 mine clearing vehicle. For trials purposes the K1 MBT has been fitted with a roller type mineclearing system at the front of the hull.

K1 Combat mobility vehicle. Studies are already under way on a combat mobility version of the K1 that would use a similar hull to that of the K1 ARV previously described but would carry special equipment to undertake the engineer role.

Specifications

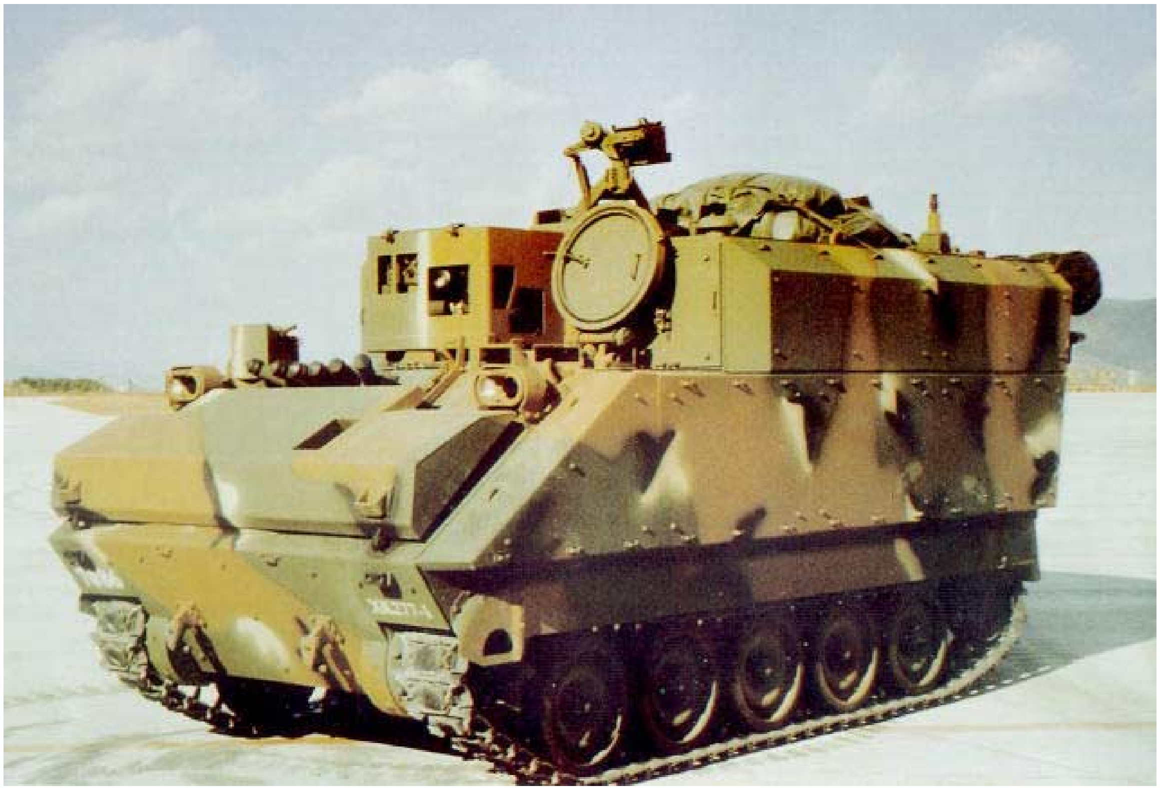
K1

Crew: 4
Combat weight: 51,100 kg
Power-to-weight ratio: 23.48 hp/t
Ground pressure: 0.87 kg/cm^2
Length:
(gun forward) 9.672 m
(hull) 7.477 m
Width: (over skirts) 3.594 m
Height: (to turret top) 2.248 m
Ground clearance: 0.46 m
Max road speed: 65 km/h
Average cross-country speed: 40 km/h
Speed on 60% gradient: 8 km/h
Cruising range: 437 km
Fording:
(without kit) 1.2 m
(with kit) 2.20 m
Gradient: 60%
Side slope: 30%
Vertical obstacle: 1 m
Trench: 2.74 m
Engine: MTU MB 871 Ka-501 diesel developing 1,200 hp at 2,600 rpm
Transmission: Renk LSG 3000 automatic with mechanical lock-up, 4 forward and 2 reverse gears
Braking: hydraulic and mechanical, two circuits
Suspension: torsion bar/hydropneumatic
Electrical system: 24 V
Batteries: 6 × 12 V, 100 Ah
Generator: 23 hp
Armament:
(main) 1 × 105 mm M68A1 rifled gun
(coaxial) 1 × 7.62 mm M60E2 MG
(commander) 1 × 12.7 mm K6 MG
(loader) 1 × 7.62 mm M60D MG
Smoke-laying equipment: 2 × 6 smoke grenade dischargers
Ammunition:
(105 mm) 47
(12.7 mm) 1,000
(7.62 mm coaxial) 7,200
(7.62 mm loaders) 1,400
Gun control equipment
Turret power control: electrohydraulic/manual
(by commander) yes
(by gunner) yes
Commander's fire-control override: yes
Turret traverse: 360º
Gun elevation/depression: +20º/-10º
Gun stabilizer:
(vertical) yes
(horizontal) yes
NBC system: yes
Night vision equipment: yes

Manufacturer

Hyundai Precision & Industry Co Ltd.

DAEWOO KOREAN INFANTRY FIGHTING VEHICLE



Development. In 1981, the Korean Army issued a request for proposals for a new Korean Infantry Fighting Vehicle (KIFV) and Daewoo Heavy Industries was subsequently awarded a contract for development and production of this vehicle. The KIFV entered production in 1985 and is sometimes referred to as the Type K200 and by 2000 it is estimated that over 2,000 vehicles, including variants, had been built for the home and export markets with production still under way. Based on the experience in the development and production of the KIFV, in 1994, Daewoo Heavy Industries developed a further model called the KIFV (K200A1). This has a number of improvements over the earlier vehicle including the installation of a 350 hp turbocharged MAN diesel engine and a new fully automatic Allison X200 transmission. It is expected that earlier K200 vehicles will be brought up to the K200A1 standard as the new power pack gives an improved power-to-weight ratio and greater acceleration. In the earlier K200 the driver used sticks to steer the vehicle but in the K200A1 he uses a steering handle, which reduces driver fatigue.

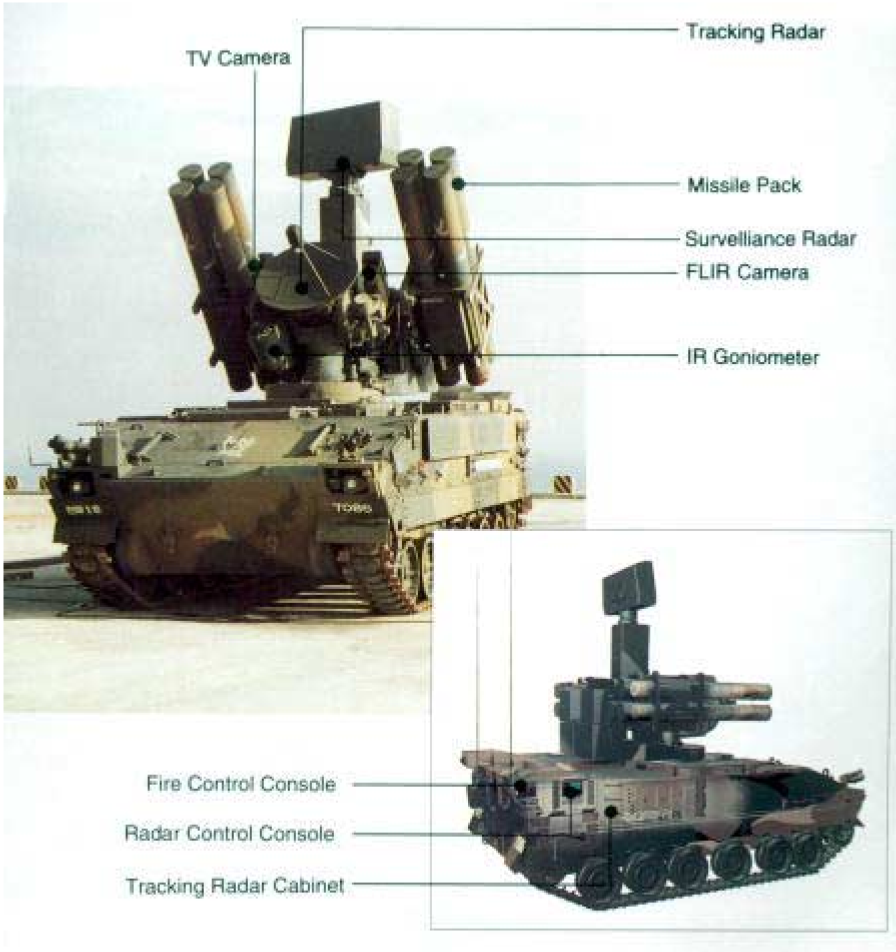
Description. The hull of the KIFV is of all-welded aluminum armor with an additional layer of spaced laminate steel armor bolted to it. This composite armor provides better protection for less weight. According to the manufacturer, protection from small arms fire is provided up to 12.7 mm piercing-piercing rounds fired from the front and flanks. The engine compartment is located at the front right of the vehicle and is separated from the remainder of the KIFV by a bulkhead. The engine compartment is fitted with a fire extinguishing system that can be operated by the driver or from outside the vehicle. The air inlet, air outlet louvres and the exhaust pipe are located on the roof of the vehicle. The complete power pack consists of the engine, transmission with integrated hydrostatic steering system and hydraulic service and multidisc friction brake, final drives and associated drive shaft and universal joint. Power is transmitted through two shafts to the final drives that can be disconnected to remove the power pack. The latest KA200A1 is powered by the German MAN D2848T V-8 water-cooled direct injection turbocharged diesel engine that develops 350 hp at 2,300 rpm. This is manufactured under license by Daewoo Heavy Industries. The latest KA200A1 has the US Allison X200-5K transmission, which is an automatic shift and steering transmission with four forward and one reverse gears and a hydrostatic steering system. The driver is seated at the front of the vehicle on the left side and has a single-piece hatch cover that can be opened upwards by means of a locking hook placed on the hatch ring. Four M17 day periscopes are used for forward observation and a locally produced KAN/VVS-2 passive periscope can be installed in his roof hatch for driving at night. The gunner is seated behind the engine compartment and the cupola for the gunner can be traversed smoothly through 360º even on a slope. The gunner is provided with five M17 day periscopes and a single-piece hatch cover that opens to the rear and forward mounted on his cupola is a 12.7 mm M2 machine gun. The gunner is provided with front, side and rear protection. For operations in Bosnia, a number of Malaysian KIFV have had their 12.7 mm M2 machine guns replaced by a 40 mm automatic grenade launcher with the gun shield being retained. To the rear of the driver is another gunner's position armed with a 7.62 mm machine gun, the cupola is similar to that fitted to the M113 series and has five M17 day periscopes and a single-piece hatch cover that opens to the rear. The troop compartment is at the rear of the KIFV and the troops enter and leave via a hydraulically operated downward-opening ramp in the rear; this is also provided with a ramp door in the left side. There is a roof hatch over the troop compartment that opens to the rear and in either side are two firing ports with a vision block above. There are also two firing ports in the rear ramp. Torsion bar suspension either side consists of five dual rubber-tyred roadwheels with the drive sprocket at the front and idler at the rear, which is connected to the tension adjuster to maintain track tension. There are no track-return rollers. The first, second and last roadwheel stations are provided with a telescopic shock absorber and the steel tracks have replaceable pads. The vehicle is fully amphibious, being propelled in the water by its tracks. Before entering the water a trim vane is erected at the front of the vehicle and the two bilge pumps are switched on. The two bilge pumps are located in the bottom of the hull, below the floor level, one in the rear of the personnel compartment and the other in the front of the engine compartment. These have a total discharge capacity of 348 litres/min. Mounted on the forward part of the hull above the trim vane is a bank of six electrically operated smoke grenade launchers that fire forwards.

Specifications

Model	K200	K200A1
Crew	3 + 9	3 + 9
Combat weight	12,900 kg	13,200 kg
Unloaded weight	10,700 kg	11,000 kg
Power-to-weight ratio	21.7 hp/t	26.5 hp/t

Model	K200	K200A1
Ground pressure	0.63 kg/cm^2	0.64 kg/cm^2
Length		
(overall)	5.486 m	5.486 m
(hull)	5.345 m	5.345 m
Width		
(overall)	2.846 m	2.846 m
(over tracks)	2.540 m	2.540 m
Height		
(hull top)	1.93 m	1.93 m
(MG shield)	2.518 m	2.518 m
Ground clearance	0.41 m	0.41 m
Track width	381 mm	381 mm
Angle of approach/departure	68º/45º	68º/45º
Max speed		
(road)	74 km/h	70 km/h
(water)	6 km/h	7 km/h
Fuel capacity	400 litres	400 litres
Cruising range	480 km	480 km
Fording	amphibious	amphibious
Gradient	60%	60%
Side slope	30%	30%
Vertical obstacle	0.64 m	0.64 m
Trench	1.68 m	1.68 m
Engine	MAN D 2848T V-8 diesel 280 hp at 2,300 rpm	MAN D 2848T V-8 diesel 350 hp at 2,300 rpm
Transmission	T-300 semi-automatic 7 forward, 7 reverse	X200-5K full-automatic hydrodynamic mechanical, 4 forward, 1 reverse
Suspension	torsion bar in tube	torsion bar in tube
Electrical system	28 V	28 V
Batteries	2 × 6TN, 100 Ah	2 × 6TN, 100 Ah
Armament		
(main)	1 × 12.7 mm M2 MG	1 × 12.7 mm M2 MG
(secondary)	1 × 7.62 mm M60 MG	1 × 7.62 mm M60 MG
Smoke-laying equipment	1 × 6 smoke grenade launchers	1 × 6 smoke grenade launchers
NBC system	optional	optional
Night vision equipment	yes	yes

DAEWOO CHUN MA (PEGASUS) SURFACE-TO-AIR MISSILE SYSTEM



Development. Early in 1996, details were released of the Chun Ma (Pegasus-Winged Horse) Surface-to-Air Missile (SAM) system for which the prime contractor is the Special Products Division of Daewoo Heavy Industries. The system was developed in combination with the state-run Agency for Defense Development and some 12 locally based subcontractors and Thomson-CSF of France. Development of the missile for the Chun Ma system began in 1987 to meet the operational requirements of the Republic of Korea Army for a self-propelled all-weather SAM system to protect its mechanized forces. At present, the main self-propelled air defense system in service is the 20 mm Vulcan system based on the full tracked locally built KIFV chassis. This is a clear weather system only and has an effective range of around 2,000 to 2,500 m. Details of this system are given in the Self-propelled anti-aircraft guns section. The full-tracked chassis used for the Chun Ma SAM system is the latest in a long line of chassis developed by Daewoo to meet the operational requirements of the Republic of Korea Army. So far the company has built over 2,000 Korean Infantry Fighting Vehicles (KIFV) and variants for the Republic of Korea Army and for export to Malaysia for deployment in Bosnia as part of United Nations forces. The full tracked chassis used for the Chun Ma SAM system is much larger than that of the KIFV and is being used for a number of other applications including an ammunition resupply vehicle and as the basis for the Flying Tiger twin 30 mm self-propelled air defense gun system now in production. Details of the Flying Tiger are given in the Self-propelled anti-aircraft guns section earlier in this volume. By early 1996, two prototypes of the complete Chun Ma SAM system had been completed and firing trials were begun in 1997. Low rate preproduction of the system is believed to have started in late 1997 with some subsystems being imported. The first production of Pegasus began in early 1999 for operational deployment with the South Korean Army in late 1999. Cost of an individual Chun Ma is 15 billion won and of a missile 280 million won (at 1999 prices).

Description. The Chun Ma chassis is of all-welded armor construction that provides the occupants with protection from small arms fire and shell splinters. The driver is seated front left with the powerpack to the right and this leaves the rear two-thirds of the vehicle clear for the missile system. The powerpack consists of a 520 hp Daewoo D2840L 10 V 4-cycle, turbo-inter-cooled diesel engine coupled to a fully automatic transmission that gives a maximum road speed of 60 km/h and acceleration from 0 to 32 km/h in around 10 seconds. Total weight of the system is 26 tonnes. The crew is three. It is believed that a 43 hp auxiliary power unit is fitted and standard equipment includes an NBC system and an automatic fire detection and suppression for the engine and crew compartments. Mounted on top of the chassis is an electro-hydraulically power-operated unmanned turret with two banks of four SAM each side. In the center of the turret is the sensor package that consists of the E/F-band solid-state pulse-Doppler surveillance radar with a range of 20 km. This has a track-while-scan capability and can track eight targets at once with automatic threat evaluation. Mounted below the surveillance radar is the circular Ku-band TWT pulse-Doppler tracking radar with a range of 16 km. This has been designed to track hovering helicopters, fighters and other aircraft traveling at a maximum speed of M2.6. Both radars are of the frequency agility pulse compression type and, when traveling, the surveillance radar is lowered to the rear to reduce the overall height of the system. To the left of the tracking radar is the FLIR (Forward Looking Infra-Red) camera with two fields of view and a range of 15 km. To the right is the daylight TV camera with a range of 10 km, with the IR goniometer below used for initial gathering of the missile following launch. The latter has a 10º field of view. According to Daewoo, the Chun Ma system can engage targets under day and night conditions regardless of battlefield clutter and hostile ECM conditions. The whole turret, sensor package and the internal components were supplied by Thomson-CSF Airsys of France and are virtually identical to that used by the Crotale NG SAM that is in service with Finland (on a 6 × 6 Patria chassis) and France (shelter-mounted). The missile used in the South Korean Chun Ma is of a different design to those used in the Crotale NG and has been developed in South Korea. The 86.2 kg launch weight missile is in a sealed tube and is fitted with a laser proximity fuse and a 12 kg focused fragment warhead, which is claimed to give a high kill probability. Maximum speed of the missile is asserted to be M2.6, effective range 10 km with a maneuverability of 30 *g*. It has four fixed-wings two-thirds of the way from the nose and four control fins at the rear. Guidance is command-to-line of sight with maximum effective range quoted as 10 km, this being shorter than that of the French Crotale NG. Once expended, missiles are reloaded manually there being no provision for automatic loading of new missiles. The turret has 360º continuous traverse capability and elevation limits of -1 to +65º. The missile operator is provided with a full color multiwindow display console and the software allows the Chun Ma to be integrated with other battlefield air defense assets and command systems. Mounted at the front of the hull are two banks of four electrically operated smoke grenade launchers that fire over the frontal arc.

Status. Low-rate preproduction began in 1997 with six systems delivered by early 1999. Entered operational service in December 1999.

Manufacturer. Daewoo Heavy Industries, Special Products Division.

ALMAZ S-300 (SA-10 ‘GRUMBLE’) FAMILY OF LOW-TO-HIGH ALTITUDE SURFACE-TO-AIR MISSILE SYSTEMS[71]

Development/Description. The Russian `Almaz' Scientific Industrial Corporation (also known as the Almaz Central Design Bureau) S-300 designated (US/NATO codenamed SA-10 `Grumble') missile system began development in 1967. It was specifically designed as a semi-mobile all-weather strategic air defense system to replace the obsolete S-25 Berkut (US/NATO codenamed SA-1 `Guild') missile network around Moscow and for use against low-altitude air breathing threats such as cruise missiles. The system development was assigned to Boris V Bunkin, the Almaz general designer, whilst development of the accompanying missile was allocated to the `Fakel MKB' (formerly the `Grushin') missile design bureau. By 2000, there were some 1,900 plus SA-10 launchers in service with the Russian air defense force. These had not only replaced the S-25 system but had basically supplanted the S-75 (US/NATO codenamed SA-2 `Guideline') and S-125 (US/NATO codenamed SA-3 `Goa') static SAM systems. Over the years a number of S-300 developments have been made. These include the following:

[71] Descriptions of the Russian S-300 missile systems are borrowed from Jane’s Missiles and Rockets.

S-300P (US/NATO codenamed SA-10a `Grumble'). The S-300P system (P = *podvizhnyi*, Russian for mobile) used towed semi-trailer erector-launchers with four missiles mounted in pairs and erected towards the semi-trailer's front for launching. A set of outriggers at the front of the semi-trailer were erected to stabilize the platform before a launch could occur. Emplacement time was stated to be over 30 minutes. The engagement radar used was the 30N6 (NATO codenamed `Flap Lid') I/J-band phased-array set. The usual battery configuration was three semi-trailer launchers and a single `Flap Lid' radar. The battery could simultaneously engage up to a maximum of three targets with six missiles under command guidance. The radar was designed specifically for low altitude performance against air breathing targets. As a result, the antenna could be mounted on a mobile tower that consisted of a 15 m long elevating mast on a ChMAP semi-trailer. The radar/engagement operators were located in an F-9 shelter unit that was located away from the radar mast. The F-9 served as the equivalent to the American Patriot system's Engagement Control Station (ECS). The original missile used with the S-300P was the Fakel 5V55K, which was the first ***Russian missile*** to incorporate a significant level of solid-state electronics in its guidance system. The command guidance flight data was received from the battery's engagement radar. Maximum effective engagement range was 47,000 m with the single-stage missile using a solid propellant rocket motor. The weapon was ejected from its container-launcher to a height of 25 m before the rocket motor fired. At regimental and brigade level the PO Iskra manufactured 36D6 (NATO codenamed `Tin Shield') 3-D S-band surveillance radar was used. This was available in two versions: the basic system mounted on a semi-trailer unit; and the enhanced low altitude capability 40V6M1 tower assembly built specifically for use with the S-300P system. Operational parameters were: (a). against a B-1 sized bomber with 1 m^2 radar cross section at 100 m altitude - basic version detection range 45,000 m, mast version detection range 52,000 m (b). against a cruise missile type target with 0.1 m^2 radar cross section at 50 m altitude - basic version detection range 28,000 m, mast version detection range 38,000 m. The S-300P units, which entered service in 1980, were integrated into the national Russian PVO air defense network fixed command and control system. Co-ordination of multiple static S-300P brigades is undertaken by the Proton NPO Universal-1E C^3I system. However, due to inadequate range problems the S-300P system was rapidly upgraded to a later longer-range missile standard and supplemented by more modern mobile versions.

S-300PM (US/NATO codenamed SA-10b `Grumble'). This was the standard production version and accepted for operational service around 1982. Designated by the Russians S-300PM (M = *modifikatsionniy,* Russian for modified) this utilized the definitive 5P85T semi-trailer launcher with KRAZ-260 (6 × 6) heavy truck tractors. The 5P85T erects its four paired missile container-launchers to the rear of the semi-trailer thus avoiding the need to uncouple the tractor unit, hence considerably reducing the time needed to deploy the system. The 5P85T launchers remain an option for use with the later S-300PMU and S-300PMU-1 systems. Two new missiles were developed for the S-300PM system, the Fakel 5V55R with a 133 kg conventional HE-fragmentation warhead and the 5V55V with a nuclear warhead (no longer deployed). Missile guidance was changed to the Track-Via-Missile (TVM) radar type using a modified `Flap Lid' engagement radar for control. An uprated rocket motor was used to increase the effective missile engagement range to a more acceptable 75,000 m.

**S-300PMU (US/NATO codenamed SA-10c `Grumble').** The S-300PMU (U = *usovershstvovanniy* or `improved') system entered service in 1985 and was the third generation version of the S-300 family. It was specifically designed to improve system mobility and is basically the key elements of the S-300 system repackaged to fit on modified MAZ-543 (8 × 8) cross-country truck chassis. By employing these vehicles, emplacement time on an unsurveyed site is reduced to about 5 minutes. The firing battery is preceded into its launch area by a 1T12-

2M survey vehicle that prepares the site for battery occupation. The self-propelled 5P85 series launchers are accompanied by the self-propelled 30N6 engagement radar, which is also mounted on a MAZ-543 chassis derivative. Supporting elements for the battery include 5T58 missile transport vehicles and 22T6 missile reloading vehicles. A full range of training facilities can also be provided. The engagement radar has been modified for the S-300PMU system to permit it to control enlarged batteries of up to 12 launcher vehicles. This has increased the simultaneous engagement capability to six targets with up to two missiles per target allowed. As a result the S-300PMU brigade was reorganized to have six batteries, each with two-three launcher vehicles and an engagement radar. Each reorganized battery has one 5P85SU launcher vehicle (identified by the presence of a command shelter located behind the vehicle cab) and one or two simplified 5P58DU launcher vehicles (identified by the absence of the command shelter behind the cab). The Front level command element of S-300 mobile brigades was formed around either the Proton NPO Baikal-1 command vehicle system or the Belarus Agat NPO originated D4M Polyana C^3I system, which co-coordinated the actions of the brigades and interfaced with higher PVO echelon and other missile assets. The Baikal-1 is the equivalent of the American Patriot system's Information Co-ordination Center (ICC). The regimental/brigade level 30D6 surveillance radar is supplemented by the LEMZ manufactured 76N6 (NATO codenamed `Clam Shell') low-altitude detection radar. This was made in two versions for the S-300PMU system: the 23.8 m high 40V6M mast assembly which takes 1 hour to deploy; or the 38.8 m high 40V6M2 mast assembly which takes 2 hours to deploy. The `Clam Shell' radar has a detection range of 90,000 m against targets flying at 500 m altitude. It can also track up to a maximum of 180 targets. The missile used is the Fakel 5V55RUD (UD = *usovershstvovanaya dalnost*, Russian for improved range) which had further rocket motor improvements to increase the maximum effective engagement range to 90,000 m. The minimum effective range is 5,000 m.

Altitude limits are 10 to 27,000 m with target velocity up to 1,200 m/s. The system is capable of defeating tactical missiles with ranges of up to 300 km at distances of up to 30,000 m. The rate of fire is one missile every 3 to 5 seconds.

S-300PMU1 (US/NATO codenamed SA-10d `Grumble'). The S-300PMU1 was developed from 1985-89 and was first shown at the 1992 Moscow Air Show. It had previously been accepted for operational service in 1992. It differs from the earlier system in having more modern technology integrated into its various elements and by a major update of the software used in the high-speed computers. The principal improvements over the S-300PMU include: (a). the use of the 7.5 m long, 1,800 kg weight 48N6 (SA-10d) missile variant with a 143 kg HE fragmentation warhead that increases the maximum effective intercept range of aircraft type targets to 150,000 m and reduces the minimum effective intercept altitude to 10 m. Minimum engagement range is 3,000 m. Missile diameter is increased to 0.515 m. Maximum missile velocity attained is 1,900 m/s within 12 seconds of launch. The weapon can withstand lateral *g*-loads amounting to 20 units. The missile in its container-launcher weighs 2,580 kg. (b). the successful engagement of ballistic type targets launched at ranges of up to 1,000 km at distances up to 40,000 m using target designation from the 83M6E2 command and control system. (c). increasing the maximum target velocity capability from 1,167 m/s (4,200 km/h) to 2,788 m/s (10,000 km/h). (d). increasing the sector-scan radar coverage limits to improve the system's autonomous engagement capabilities. (f). adding extra crew training equipment to improve the level and standard of training. (g).the use of an improved 45,500 kg vehicle mounted engagement radar, the 36N85 (also known by export designation 30N6E1). This has many improvements including a new-generation fire-control computer. There are three scan modes available: a 1º elevation × 90º azimuth for low altitude targets; a 13º elevation × 64º azimuth and 5º elevation × 64º azimuth for medium and high altitude targets; and 10º elevation × 32º azimuth for ballistic missile direction. Once the target is acquired the radar can be switched to either 4º elevation × 4º azimuth or 2º elevation × 2º azimuth sectors for automatic tracking and missile guidance. The radar is connected to the launchers by landlines, radio links or both. The radar antenna can also be mounted on the 40V6M tower if required. The maximum number of targets engaged by an enhanced battery remains at six with up to a maximum of 12 missiles at any one time being guided simultaneously. The battery deployment time remains the same at 5 minutes as does the firing rate of one missile every 3 seconds from a launcher. The maximum total of missiles available in the S-300PMU1 battery is 32 rounds. The S-300 PMU1 system and its 86M6 command post can be upgraded to the S-300 PMU2 capability through use of software upgrades as a field modification kit.

96L6 3D Low-altitude detection, surveillance and command post system. The Lianozovo electromechanical plant and the Lira KB design bureau displayed a model of their 96L6 radar vehicle at the IDEX `97 exhibition. The phased-array centrimetric system is mounted on a MAZ-7930 (8 × 8) truck chassis and is intended for use with the S-300PMU and S-300PMU1 air defense systems as an upgrade to replace several existing radars with a single, more capable system. The 96L6 can function as a low-altitude detection set, surveillance radar and as the battery command post. The maximum detection range is 300 km and it can track up to 100 targets simultaneously at speeds between 30 to 2,750 m/s. If required, the radar antenna assembly can be fitted to a 40 V6M tower unit for better low-altitude coverage. The 96L3 is considered an all-weather all-altitude radar system.

Almaz 83M6 Brigade command and control system. The command and control system used at brigade level with the S-300PMU missile battery system is designated the 83M6 and it is also designed to be used with the S-300PMU series, S-200DE and S-200VE air defense systems. A typical Russian brigade has an 83M6 system with up to six batteries. Deployment time is said to be 5 minutes. Two variants of the 83M6 are available: (a). a mobile system mounted on MAZ-543 cross-country chassis. (b). a semi-mobile system mounted on transportable shelters for use at static sites. The six-man 83M6 comprises two elements: (a) the 54K6 command post, which provides the command and control functions for a group of up to six launcher batteries. The control of the group is based on the data obtained from its associated radar and the airspace management information from the batteries under its control, the command and control systems of adjacent groups and from higher echelon air defense command and control networks. The 54K6 automatically performs the following functions: control of the associated 64N6 radar system; the acquisition, identification and tracking of up to 100 targets; Identification Friend or Foe (IFF) interrogation; prioritization of target threats and selection of the most dangerous to hand-off to the individual batteries under its control; command and control of group's ECCM subsystems in a heavy ECM environment; co-ordination of the batteries' autonomous actions; and co-coordinating the group's actions with adjacent and higher echelon command and control centers. The command post is fitted with operator consoles, a multiprocessor computer system and the various communication and monitoring systems to manage an air defense battle with the group's available assets. Full crew training software and hardware is also fitted to train the command post crew in autonomous group and combined battle management protocols. (b). a 64N6 (NATO designation `Tombstone') 3-D long-range surveillance radar, which comprises a hydraulically raised antenna assembly and radar shelter mounted on a common semi-trailer. The phased-array antenna set has a double-sided antenna aperture. Its 3-D performance is obtained by rotation of the antenna once every 12 seconds and electronically scanning the antenna beam in both azimuth and elevation. Scan sector capability for detecting tactical ballistic missiles is also provided. This can detect aircraft and cruise missile type targets at ranges of up to 300 km and ballistic missiles with launching ranges of up to 1,000 km using the sector scan facility. An IFF transponder subsystem is fitted. The radar is used for target detection and tracking in normal, clutter and severe ECM environments. The data obtained are relayed to the command post for processing and assessment. The radar can detect targets with speeds of up to 2,788 m/s (10,000 km/h). The export designation of the system is 83M6E. The S-300PMU-2 system designation is 83M6E2.

S-300PMU-2 Favorit (believed to be NATO/US designation SA-10e `Grumble'). A further modification of the S-300 system was revealed at the 1997 MAKS air show in Zhukovsky. The third-generation S-300PMU-2 Favorit uses an improved missile round, the 48N6E2 with increased ballistic target interception capability and a maximum engagement range of 200,000 m. The warhead weighs 180 kg with each fragment produced having 40 kJ of destructive energy. The missile is optimized for intercepting tactical and ballistic missiles with a radar cross section of approximately 0.002 m^2. Target speed can be up to 2,800 m/s and can consist of ballistic missile type targets launched from ranges of up to 1,000 km away. The 48N6E2 missile warhead is designed to destroy the missile warhead at ranges up to 40,000 m. Minimum missile range remains 3,000 m and altitude limits 10 to 27,000 m. Existing 48N6E missiles can be used. System tests were successfully conducted in 1995 against `Scud' type targets. The PMU-2 uses the 83M6E2 command and control system, with a 56K6E2 battle management center, up to six S-300PMU-2 air defense launcher units (each with a 30N6E2 multifunctional illumination and guidance radar and up to 12 5P85SE or 5P85TE launchers), and a 300 km range 64N6E2 3D acquisition radar or a 96L6E 3D radar command post system.

Missile upgrade. Almaz in conjunction with the Fakel missile design bureau has developed a missile upgrade package suitable for the S-300 family (see separate entry).

Mobile repair base. Antey also market a mobile repair base facility comprising trailer mounted (4 × 4) workshops - a checkout and diagnostic workshop, a technological workshop, a machine workshop, a spare parts, tools and accessories facility, a communications facilities checkout and diagnostics workshop and power generating units with their own tractor trucks. The checkout and diagnostics workshop uses the AS5-2 automated system to check and diagnose at least 90 per cent of the systems electronic components.

Variants. The `Altair' Research and Development Corporation as prime naval contractor, initiated in 1969 a joint development program with the Almaz design bureau for a navalised version of the S-300 system called the S-300F Fort. This uses the 3M41 missile (alternative designation 5V55RM, a navalised counterpart to the land based 75 km range 5V55R missile), the 3S41 vertical launcher system with either 6-round B-203 or 8-round B-204 launcher units and the 3R41 `Volna' (NATO codename `Top Dome') I/J-band fire-control radar. The system is designated SA-N-6 `Grumble' in the US/NATO series and is fitted to the first three Project 1144 `Orlan' (NATO `Kirov' class) nuclear-powered missile cruisers and the four Project 1164 `Atlant' (NATO `Slava' class) conventionally powered cruisers. The system was originally trialled on the single Project 1134BE `Berkut' (NATO `Kara' class) cruiser named *Azov* over a six-year period from December 1977. The *Azov* was fitted with four B-204 vertical launcher assemblies and a single `Top Dome' radar. Final Russian naval service acceptance came in 1984.

The export version of the Fort system was first shown in 1993 and is named by the Russians *Rif* (Russian for coral reef). The equivalent naval version to the S-300PMU-1 system is the S-300FM Fort-M system. This uses the latest 48N6 missile and a navalised version of the `Tombstone' fire control radar. The Fort-M has been seen fitted to the fourth and final Project 1144 cruiser, the *Petr Vealiky*.

Specifications

5V55K missile

Length: 7.25 m

Diameter: 0.507 m

Wing span: 1 m

Launch weight: 1,640 kg

Propulsion: solid fuel rocket motor

Guidance: command

Warhead: 133 kg HE fragmentation with proximity and contact fuses

Max speed: M6

Max effective range:

(target altitude 2,000 m plus) 47,000 m

(target altitude 25 m and below) 25,000 m

Min effective range: n/avail

Max effective altitude: 30,000 m

Min effective altitude: 25 m

Max target speed: 1,167 m/s

Rate of fire: 1 missile/3 s

Provisional 9P85S TEL

Crew: 4

Chassis: MAZ-543 (8 × 8)

Combat weight: 42,150 kg

Length: 9.4 m

Width: 3.1 m

Height: 3.7 m

Max speed: (road) 60 km/h

Max range: (road) 650 km

Engine: D12A-525 V-12 water-cooled diesel developing 525 hp at 2,100 rpm

Armor: none

Unit of fire: 4 × SA-10 missiles

Manufacturer

Almaz Scientific Industrial Corporation.

ALMAZ MISSILE UPGRADE FOR THE S-300PMU MISSILE FAMILY SYSTEMS

Development/Description. Almaz, the designers of the S-300PMU missile system, released details at the 1998 Athens-based Defendory Exhibition of a new family of Fakel design bureau missiles aimed at the Greek requirement for a new long surface-to-air missile system. Flight trials took place in 1999 with production started in 2000. The missiles can be used with the existing S-300PMU series of launchers and the Almaz S-400 Trioumf (Triumph) system and are designated the 9M96E and the 9M96E2. They are identical except in the amount of solid propellant rocket fuel they carry. Both weapons are cold-launched and after reaching an altitude of 30 m ignite their main sustainer rocket motor. The weapons have a full 360º capability and are smaller and lighter than the existing S-300PMU weapons. They also have a number of new features including a new high energy solid propellant fuel and upgraded guidance system (that includes a transverse guidance engine unit which is used to ensure the missile hits the designated target in its terminal guidance phase) and enhanced control software. Flight control is by four rear fins that unfold on launch and four moveable control surfaces towards the nose. Four weapons are carried in a standard sealed S-300 missile cylindrical container-launcher, which is then discarded after all have been fired. Weight of the canister with four 9M96E missiles is 2,300 kg and with four 9M96E2 missiles 2,700 kg. In addition to engaging aircraft, the missiles are claimed to be highly effective against ballistic and tactical type missile targets. The hit probability against aircraft is said to be at least 90 per cent, while against ballistic missiles it is at least 80 per cent and against parts of missiles such as warheads at least 70 per cent. The high hit rate is due to the transverse guidance engine that reduces the chance of missing a target in the final stage of the missile's terminal homing phase to zero. In many respects the missiles are similar to the Lockheed Martin PAC-3 extended range interceptor weapon. The 9M96E2 is 0.9 m longer than the 9M96E.

Variants. The missile can also be used in the naval versions of the S-300 system, for example, the S-300F Fort and S-300FM Fort-M.

Specifications

Weight:

(9M96E) 333 kg

(9M96E2) 420 kg

Warhead: 24 kg HE fragmentation

Max engagement range:

(9M96E) 40,000 m

(9M96E2) 120,000 m

Min engagement range: 1,000 m

Max altitude limit:

(9M96E) 25,000 m

(9M98E2) 30,000 m

Min altitude limit: 5 m

Status

Trial firing phase in 1999 took place with elements of both the S-300PMU-1 and S-400 systems. Entered production in 2000. Offered for export.

Manufacturers

Almaz Central Design Bureau (modification package).

Fakel Design Bureau (missiles).

ALMAZ S-400 TRIEUMF (TRIUMPH) (SA-20) LOW- TO HIGH-ALTITUDE SURFACE-TO-AIR MISSILE SYSTEM

Development/Description. The fourth-generation S-400 Triumph system (US designation SA-20) is being developed by the prime contractor Almaz Central Design Bureau in conjunction with a number of other Russian manufacturers, including the Fakel Machine Building Design Bureau (missiles), the Novosibirsk Research Institute of Measuring Instruments and the St Petersburg Special Machine Design Bureau. The S-400 is designed for use against all envisaged existing and future air threat systems including cruise missiles, tactical and strategic missiles, low-signature stealth aircraft, AWACs type aircraft and standoff jammers. The system employs a multimode phased-array radar and signal processor system, advanced highly automated crew stations and highly advanced target engagement algorithms together with a variety of missile types to create a multilayered defense. For use with the system, Fakel has developed the active radar seeker equipped 9M96E family of missiles, which use a gas dynamic flight control system for improved maneuverability and were publicly revealed in 1998. There is also a further long-range missile family under advanced development by Fakel. These are to have an engagement range of up to 400 km and both semi-active and active engagement modes. The seeker can be switched to a search mode by ground command and can home onto a target independently. At least one version will have an Over-the-Horizon (OTH) capability against jamming aircraft/airborne early warning aircraft. The S-400 can also use the 48N6E missiles of the S-300PMU-1 and the 48N6E2 missile of the S-300PMU-2 Favorit missile systems. An S-400 system uses a central command and control vehicle with the multimode radar assembly and eight launcher units. A launcher can carry either four of the standard 48N6/48N6E2 missile container launchers (with one missile each), four of the 9M96 missile container launchers (with four missiles each) or a mixture of both. In all cases a cold launch sequence ejects the weapon to a safe height whereupon the main solid propellant rocket motor ignites. At the initial and middle flight phases, inertial guidance with radio command corrections is used. For the final phase the appropriate terminal guidance for the missile type is activated.

Status. Initial manufacturer's trials started in early 1999 and were completed in January 2000 at the Kasputin Yar missile range in Southern Russia. Pre-series production systems were delivered to the Russian Air Forces air defense units in late 2000 for troop trials using missiles of the available S-300 systems. When funding permits, full operational deployment will begin - projected to be not before the end of 2002 when the new 400 km range missile and further long range target acquisition radars of 600 km range are expected to become operational. The first squadron to be equipped with the pre-series model is due to defend the Moscow area.

Manufacturer. Almaz Central Design Bureau.

NAVY

`Kilo' class[72]

Type. Diesel electric patrol submarine.

Description. The `Kilo' class design dates back to the 1970s and the first vessel, for the then Soviet Navy, was launched in 1979. Since then it has undergone continual improvements. The `Kilo' has been developed from the previous `Foxtrot' and `Tango' designs, but shows an improved hull form. However, it is still fairly basic compared to its modern Western counterparts. The basic variant is the Project 877; the Project 877K has an improved fire-control system; while the Project 877M is fitted to fire wire-guided torpedoes from two tubes. The latest variant is the Project 636, which is available for export. This model is 1.2 m longer than previous variants and features improved stealth technology with a redesigned propulsion system that is claimed to generate half the noise of its earlier variants. Capability has been improved with an

[72] Description of 'Kilo' class submarine obtained from Jane's Defense

automated combat information system that can track up to six targets simultaneously and provide simultaneous fire-control data on two targets. The forward hydroplanes are mounted on the hull just forward of the fin. The pressure hull is divided into six compartments separated by pressure bulkheads and has a reserve of buoyancy of 32 per cent at normal load and is heavily compartmented, the boat remaining buoyant with any compartment flooded. Normal diving depth is 240 m and maximum depth is 350 m.

Electronic equipment is all of Russian manufacture, the sonar suite comprising the hull-mounted, low-/medium-frequency passive search and attack Shark Teeth (MGK-400EM), and the hull-mounted, high-frequency active search/attack sonar Mouse Roar. The Shark Teeth, although primarily a passive search and attack sonar, also has some active capability. The Indian boats are additionally fitted with the low-/medium-frequency, passive search Whale series. The electronic warfare suite consists of either the Brick Group, Stop Light or Squid Head radar warning system and Quad Loop D/F. For navigation the ships are fitted with the I-band Snoop Tray radar. Standard armament comprises six torpedo tubes firing a mixture of TEST-71ME/TEST 71/96 wire-guided ASW active/passive homing and Type 53-65 ASV passive wake homing torpedoes with a total of 18 weapons being carried. At least two torpedo tubes are equipped to fire wire-guided anti-submarine weapons. As with most submarines, mines can be carried in lieu of the torpedoes, up to a total of 24. In addition, some vessels are fitted to carry an SA-N-5/8/10 shoulder-held SAM launcher with 6-8 missiles. The containerized portable missile launcher is carried in a well between the snort and communications masts. Propulsion is provided by two 4-2AA-42M diesels (in the export variants and the latest variant the Type 636 in service with the Russian Navy) developing 2.68 MW powering two generators. The single shaft is driven by a single electric motor developing 4.34 MW and powering a slow turning seven-bladed propeller. In addition, two small MT-168 auxiliary motors developing 150 kW are fitted and a low powered electric motor of 95 kW for economic running and slow speed operations (6 kt) in ultra quiet mode. Two 120 cell storage batteries are accommodated in the first and third compartments. Battery capacity is 9,700 kWh. Fuel reserves total 51.6 tonnes normal and 172 tonnes maximum. The Iranians experienced difficulties with their batteries that, having been designed for operation in cold water regions, suffered from overheating in the warm waters of the Gulf. The Indians are said to have suffered similar problems with their `Kilos' and from their experience, have assisted the Iranians to overcome their difficulties with modifications to the battery cooling system. The Indians are also said to be considering changing the diesels in their boats.

Specifications

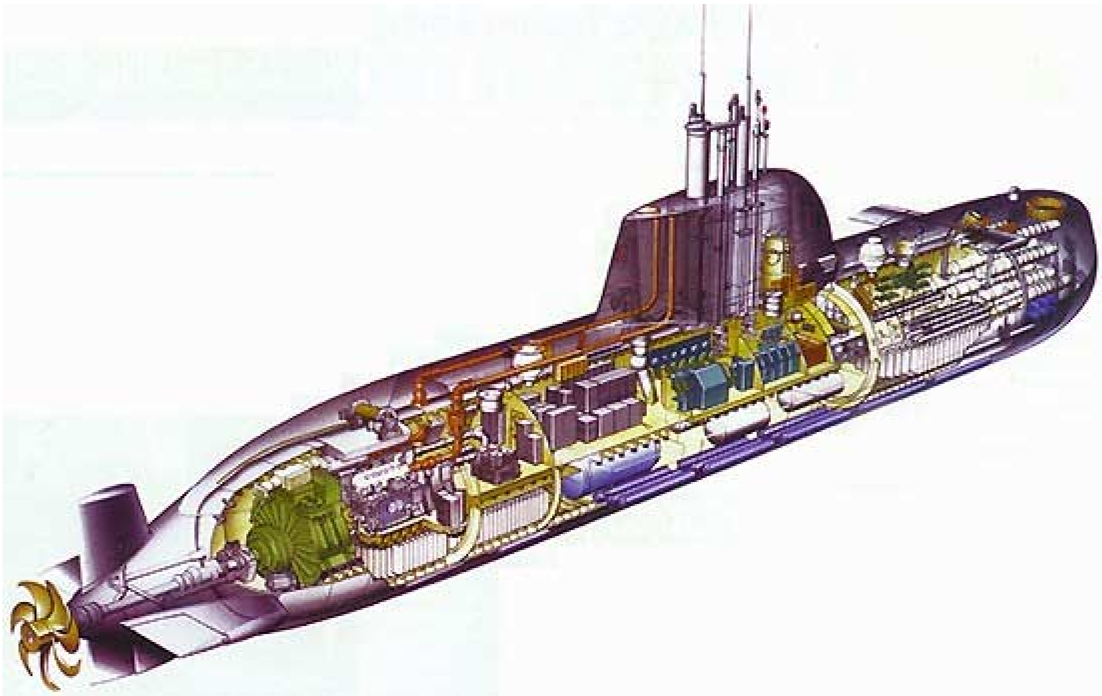
Displacement: 2,356/3,076 t

Length: 72.6 m (73.8 m in some E and EKM variants and some boats in Russian Navy)

Beam: 9.9 m

Draught: 6.6 m

GERMAN TYPE 212 / 214 SUBMARINE



The U212 submarine is capable of long distance submerged passage to the area of operation. The German Navy have ordered four of the submarines, the first ship will be commissioned in the year 2003. The Type 212 is being constructed by Howaldtswerke-Deutsche Werft GmbH (HDW) of Kiel and Thyssen Nordseewerke GmbH (TNSW) of Enden. Two U212 submarines are being built by Fincantieri for the Italian Navy. The first is expected to launch in 2002 and commission in 2005.

COMMAND SYSTEM. The Type 212 is equipped with a highly integrated command and control system that interfaces with sensors, weapons and navigation system. The system is based on a high performance data bus and a centralized computer, the Basic Command and Weapons Control System (BCWCS).

TORPEDOES. There are six torpedo tubes in two groups of three. Type 212 is equipped with a water ram expulsion system for torpedo launch. The submarine is equipped with the DM2A4 heavyweight torpedo weapon system from STN Atlas Elektronik.

COUNTERMEASURES. DaimlerChrysler Aerospace (now merged with Aeropsatiale-Matra of France and CASA of Spain to form the EADS company) and Racal Thorn Defense have been awarded a contract to develop the FL1800U electronic warfare system for the German and Italian navies' U212 submarines. The 1800U is a submarine version of the FL1800 S-II that is in service on the Brandenburg and Bremen class frigates. A consortium lead by STN ATLAS Elektronik and Allied Signal ELAC are responsible for the development of the TAU 2000 torpedo countermeasures system. TAU 2000 has four launch containers each with up to ten discharge tubes equipped with effectors. The effectors are small underwater vehicles, similar in appearance to a torpedo. The effectors are jammers and decoys with hydrophones and acoustic emitters. Multiple effectors are deployed in order to counter torpedoes in re-attack mode.

SENSORS. The submarine is equipped with an integrated DBQS sonar system which has: cylindrical array for passive medium frequency detection; a TAS-3 low frequency towed array sonar; FAS-3 flank array sonar for low/medium frequency detection; passive ranging sonar; and hostile sonar intercept system. The active high frequency mine detection sonar is the STN Atlas Elektronik MOA 3070. The search periscope is the Zeiss-Eltro Optronic (ZEO) SERO 14 with optical rangefinder, thermal imager and global positioning system. The ZEO SERO 15 attack periscope is equipped with laser rangefinder.

PROPULSION. The propulsion system combines a conventional system consisting of a diesel generator with a lead acid battery, and an air independent propulsion (AIP) system, used for silent slow cruising, with a fuel cell equipped with oxygen and hydrogen storage. The system consists of nine PEM (polymer electrolyte membrane) fuel cells, providing between 30 and 50 kW each. For higher speeds, connection is made to the high performance lead acid battery. An MTU 16 V- 396 diesel engine powers the generator from Piller GmbH for charging the battery installed on the lower of the two decks at the forward section of the submarine. The diesel generator plant is mounted on a swinging deck platform with double elastic mounts for noise and vibration isolation. The propeller motor is directly coupled to the seven bladed screwback propeller.

TYPE 214

HDW is developing the Type 214 submarine, which is a further improvement on the Type 212. The Greek Navy has ordered three Type 214 submarines, the first to be delivered in 2005. The first vessel will be built at the HDW Kiel shipyard, while Hellenic Shipyards will build the second and third vessels at Skaramanga. South Korea has also ordered three Type 214, to enter service in 2007, 2008 and 2009. These will be built by Hyundai Heavy Industries. The Type 214 will have an increased diving depth of over 400 m, due to improvements in the pressure hull materials. Hull length is 65 m and displacement 1700 tons. Four of the eight torpedo tubes will be capable of firing missiles. Performance of the AIP system has been increased with two Siemens PEM fuel cells that produce 120 kW per module and will give the submarine an underwater endurance of two weeks. A hull shape that has been further optimized for hydrodynamic and stealth characteristics and a low noise propeller combine to decrease the submarine's acoustic signature. The Integrated Sensor Underwater System ISUS, from STN ATLAS Elektronik integrates all sensors, command and control functions on board the submarine. The sensor suite of the U214 submarine consists of the sonar systems, an attack periscope and an optronic mast. The submarine's electronic support measures system and Global Positioning System sensors are also installed on the optronic mast.

KDX DESTROYERS[73]

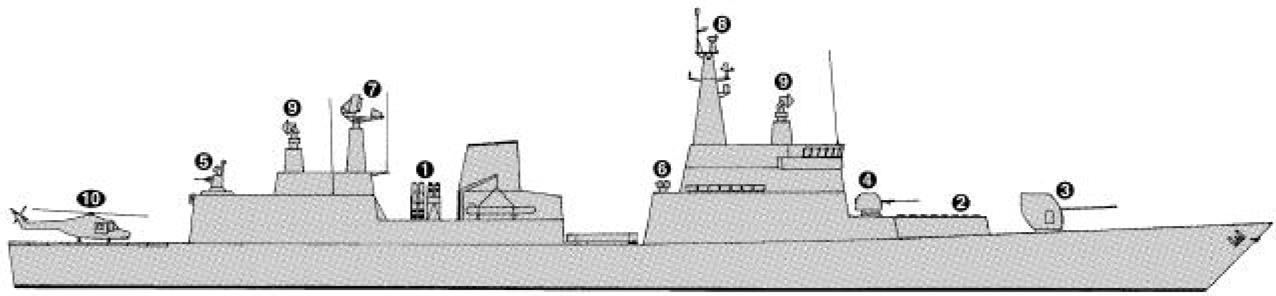
The 3,900-ton *King Kwang-Gae-to-dae-wang* was commissioned in 1998, and is the first of the KDX-1 class FFGs. It is fitted with 8 Block 1C Harpoons, and RIM-7P *Sea Sparrow* in Mk 48 VLS. The 2nd of the class was commissioned in 1999, and according to Jane's, the 3rd of the KDX-1 class ships *Xangmanchae* was commissioned by the end of 1999. They have apparently being designated DD types. By the year 2006 the ROK navy would possess at least 9 KDX destroyers inclusive of the KDX-3 that are Aegis class destroyers. They represent a major leap forward for the ROK navy in providing a modern fighting capability, and indeed the KDX-2 and KDX-3 will have a comprehensive area defense SAM system fitted (using SM-2MR), and apparently the KDX-3 will be a 7,000-9,000 ton class vessel fitted with the *Aegis* combat system and radar. Up to 9 hulls are planned for the KDX program, 3 of each type, and when complete will rival the latest from China and probably Japan in modern war fighting capability. It was announced recently that the American Mk 45 Mod 4 5"/62 lightweight gun system has been chosen for the KDX-2 DDG, and it will be co-produced under license in South Korea. RAM has also been chosen for the KDX-2. Service date for the first KDX-2 is expected to be late 2005.

Update. The Republic of Korea Navy (RoKN) has selected the Mk 31 Mod 1 rolling airframe missile (RAM) guided missile weapon system for its KDX Batch 2 destroyer program. Hyundai Heavy Industries in Ulsan is under contract to build an initial three destroyers. Raytheon Systems Company of the USA will provide the RoKN with three 21-round Mk 49 Guided Missile Launching Systems as a direct commercial sale under a firm fixed-price contract worth $24.9 million. The contract also covers logistical, technical and integration support services. The first launcher is due for delivery next year. The RIM-116B missiles are to be procured under a separate Foreign Military Sales (FMS) contract from fiscal year 2001 (FY01). The RoKN last

[73] Reference: http://warships1.com/index_ships_Asia99-00.htm

year requested the sale of 64 Mk 44 Guided Missile Round Packs and RIM-116B missiles under FMS. RAM was selected over the Israel Aircraft Industries/Rafael Barak-1 and France's Thomson-CSF Crotale-NG point defense missile systems following a multiple-stage competitive selection process. The RoKN will be the third customer for the RAM weapon system after the US and German navies. Developed and produced co-operatively by Raytheon and the German RAM-System GmbH consortium, which comprises Daimler-Chrysler Aerospace, Diehl and BGT, RAM is a lightweight, rapid-reaction, ship self-defense missile deployed on more than 30 US Navy and 25 German Navy ships to date. Over 60 more US and German installations are planned. RAM uses a dual-mode infrared/ radio-frequency passive seeker. The new Block 1 version selected by the RoKN employs an improved 'home all the way' wide-field-of-view infrared seeker. This improved variant recently completed its US Navy operational evaluation and has received Milestone III approval for full-rate production. During development and operational testing, 23 target kills were achieved from 24 missiles launched. Both Harpoon and Exocet missiles featured as targets during the live-fire tests. RAM is the third KDX-2 weapon system to be contracted in recent months. Late last year it was announced that the three ships would each be fitted with the United Defense LP Mk 45 Mod 4 5in/62-calibre gun system, built under license by local prime contractor Kia Heavy Industries Corporation. A $22 million co production deal was signed last December covering the manufacture of three Mk 45 Mod 4 systems, plus associated spares, technical assistance and training. KDX-2 ships will also be fitted with one Signaal Goalkeeper 30mm close-in weapon system. A contract for three Goalkeepers was signed last December, with deliveries to begin in June 2002.

KDX-II



Displacement, tons: 4,800 full load

Dimensions, feet (meters): 506.6 × 55.5 × 14.1 *(154.4 × 16.9 × 4.3)*

Main machinery: CODOG; 2 GE LM 2500 gas turbines; 58,200 hp *(43.42 MW)* sustained; 2 MTU 20V 956 TB92 diesels; 8,000 hp (m) *(5.88 MW)*; 2 shafts

Speed, knots: 29. **Range, miles:** 4,000 at 18 kt

Complement: 200 (18 officers)

Missiles: SSM: 8 Harpoon (Block 1C) (2 quad).

SAM: Standard SM-2 MR (Block IIIA); Lockheed Martin Mk 41 32 cell VLS launcher; Raytheon RAM Mk 31 Mk 1 with Mk 116 Block I missiles.

A/S: ASROC VLS Mk 48.

Guns: 1 United Defense 5 in *(127 mm)*/62 Mk 45 Mod 4 [Ref 3].

1 OTOBreda 3 in *(76 mm)*/62 [Ref 4].

1 Signaal Goalkeeper 30 mm [Ref 5]; 7 barrels per mounting.

Countermeasures: 4 chaff launchers [Ref 6]. ESM/ECM.

Combat data systems: BAeSema/Samsung KD COM-2; Link 11.

Weapons control: Marconi Mk 14 weapons direction system.

Radars: Air search: Raytheon SPS-49(V)5 [Ref 7]; C/D-band.

Surface search: Signaal MW08 [Ref 8]; G-band.

Fire control: 2 Signaal STIR 240 [Ref 9]; I/J/K-band.

Sonar: DSQS-23; hull-mounted; active search; medium frequency. Daewoo Telecom towed array; passive low frequency.

Helicopters: 1 Westland Super Lynx Mk 99 [Ref 10].

Programs: Approval for first three given in late 1996 but the final decision was not taken until 1998. Contract to design and build the first of class won by Daewoo in November 1999. A second batch of three ships is expected.

Structure: The drawing shows a larger version of 'Okpo' class incorporating SM-2 missiles but retaining the same command systems. Some details are still speculative as Daewoo is reworking the original Hyundai design.

KDX-III

The KDX-3 project is a program for large destroyers (9-10,000 ton) equipped with a phased-array radar and capable of operating helicopters. The details of the requirement are not known but the three-year design process, which is to start in 2001, is likely to include consideration of the Japanese `Kongou' class. In-service date of the first ship is not expected before 2009.

SS-N-21 `SAMPSON' (P-1000 3M70 VULKAN/3M10/3M54 GRANAT)/SS-N-27 (3M51 BIRYUZA/ALFA)

Type

Long-range land attack and anti-ship missile.

Development

Probably aware of development of the United States' Tomahawk land-attack/long range anti-ship missile and seeking a replacement for the Ametist/Malakhit systems the Politburo authorized on 15 May 1979 development of a new submarine-launched land-attack missile system. The task was apparently handed to the Chelomey Design Bureau who began designing a system designated 3M70 or P-1000 Vulkan (Vulcan).

Land-based trials of the system began in July 1982 and the first submarine-launched trial was conducted on 22 December 1983 from a Project 675 MKV Atomic-Powered Cruise Missile Submarine ('Echo II' class) with the 3K70 missile replacing the 4K80 of the P-500 Bazal't system. Trials appear to have been successful and the system was formally accepted into service by the Politburo on 18 December 1987. It was designed specifically for the new classes of nuclear-powered attack submarines (known as Atomic-Powered Submarine in Soviet terminology) and can be launched from torpedo tubes, as with Tomahawk, and it appears it is this system which has received the NATO designation SS-N-21 'Sampson', a ground-launched version (RK-55) being designated SCC-4 'Slingshot'. Initially 'Sampson' equipped the Project 971 Shchuka-B ('Akula' class) submarines, of which the first ship *Delfin*, was commissioned in September 1986, these ships having to be redesigned to operate the Vulkan system. They were later fitted into the Project 945/945A Barracuda/Kondor (`Sierra I/II' class) and eight Project 671 RTM ('Victor III' class) while seven Project 667 ('Yankee' class) ballistic missile submarines were rebuilt to take this system as Project 667AT Grusha ('Yankee Notch' class).

The nuclear-tipped versions were withdrawn under American-Russian agreements for nuclear disarmament but it appears the missile has been adapted for the anti-ship and/or land-attack role with a conventional warhead as 3M10 Granat (Grenade), the missiles probably being simply converted. The weapon is extensively used by the Russian Navy and is now being exported as 3M54 Granat with the first customer being India for use in Project 887/636 ('Kilo' class) diesel electric submarines *Sindhuvir* and *Sindhuraj* being refitted in Russian yards from 1997 and 1999 respectively. India is also the first customer for surface-launched versions of this system with 'Krivak III' class frigates. The original conventional version (reportedly 3K54E1) had a unitary warhead but a new version was developed for the Russian Navy during the 1990s in which the front of the weapon became a rocket-propelled pay-load stage (reportedly 3K45E) and this system apparently completed development *circa* 1998.

It is reported that a successor system to 'Sampson' has been under development from the same design bureau since *circa* 1985 and is known as 3M51 Biryuza or Alfa (not to be confused with another project called Alpha). This appears to be based upon an air-launched weapon but there are few details and some skepticism about the system's status although it has been given the NATO designation SS-N-27. It is reported to have been selected for the new Project 885 Atomic-Powered Cruise Missile Submarines ('Yansen' class) and that it may later be issued to the Type 877 diesel-electric submarines ('Kilo' class). Indian sources suggested late in 1998 that SS-N-27 rather than SS-N-21 would be selected for the 'Krivak' class and that the export version was designated Klub or Klab-N.

Description

The SS-N-21 `Sampson' systems (3M70; 3M10/3M54) consist of the 3K70 or 3K10/3K54 missile, a weapon direction system and launchers. Externally the missile is a long, slim, cylinder with a rounded nose that tapers towards the rear. Along each side is a cable conduit and midway along the body are two narrow chord wings which fold away into the fuselage. At the end are four small, folding, tail surfaces. At the rear is a rocket booster and underneath is a retractable air scoop. Internally there is an ARGS-54 radar homing seeker in the nose with the payload section behind it. The guidance compartment appears to be behind the payload and features inertial guidance unit, a computer that may also be used for radar terrain comparison, and a radar altimeter. The fuel tanks are behind this compartment and in the rear is the jet engine, reported to be a TRDD-50 turbofan, and the actuation system.

The payload varies and detailed data is available only for the export versions, although this undoubtedly reflects the Russian versions. The 3K54E1 has a 450 kg high explosive warhead and may based upon the 3K70 while the 3K54E has a rocket-powered guided payload with 200 kg warhead and may be based upon the 3K10. A 200 kT nuclear warhead was carried in the 3K70 but has been withdrawn from service. The missile is usually launched from a 533 mm (53.3 cm) torpedo tube with the missile inserted into the tube like a torpedo. The tube is flooded and the weapon may be pushed out of the tube by a pulse of water and then rises to the surface igniting the booster as it breaches or nears the surface. No information is yet available about the surface-ship launcher but the missile is compatible with both angled and vertical versions. The weapon direction system is probably a console in which platform and target location and movement data are inserted into the missile inertial navigation system before launch. It is possible that target radar characteristics may also be inserted before launch of the anti-ship version.

Upon launch the booster carries the missile to an altitude of 150 meter where it is jettisoned as the turbofan is started and the aerodynamic surfaces are deployed. In anti-ship operations the missile then enters the cruise phase descending to 10-15 meters above the sea. At a distance of

16-21.5 n miles (30-40 km) the missile climbs and the ARGS-54 radar seeker begins searching for the target. The seeker is effective in conditions up to Sea State 5-6 and has a maximum range of 32 n miles (60 km) scanning from +/-45° in azimuth and +10 to -20° in elevation. Once acquired the 3K54E1 locks onto the target and guides the missile into a dive attack. In the 3K54E after the seeker has locked on the payload is released and the rocket takes it to a speed of some Mach 3.25 until it is some 10.75 n miles (20 km) from the target at which point it descends to 3-5 meters altitude for the terminal phase. No information is currently available about the guidance used in the payload that may simply be the front-end of the missile. The land-attack version reportedly uses radar comparison and inertial navigation to reach its target but it is unclear whether the cruising phase is at high or low altitude but it has been reported that the radar altimeter allows the missile to fly as low as 200 m.

The 3K51 missile in SS-N-27 Alfa is externally also a slim cylinder but with pointed nose and a projecting section which houses the wings when they are folded. The rear of the missile is similar to 3K54 but there is a shaped air scoop on the underside. It would appear that this weapon might have the same rocket-propelled payload as 3K54 and possibly a similar seeker.

Operational status

Some 45 SS-N-21 systems and 300 missiles have been produced and it remains in production for both domestic and export customers. About half-a-dozen SS-N-27 systems may be in production for the Russian Navy.

Specifications

	3K54E	3K54E1	3K51
Length (m)	8.09	6.2	8.5
Diameter (cm)	51	51	N/k
Wing span (m)	3.1 m	3.1 m	3.1 m
Weight (kg)	1,750	1,750	2,000
Range in nm (km)	1,600 (3,000) *	160 n miles (300 km)	108 (200)
Speed	Mach 3.25	Mach 0.7	Mach 2
Guidance	Inertial with active radar homing		

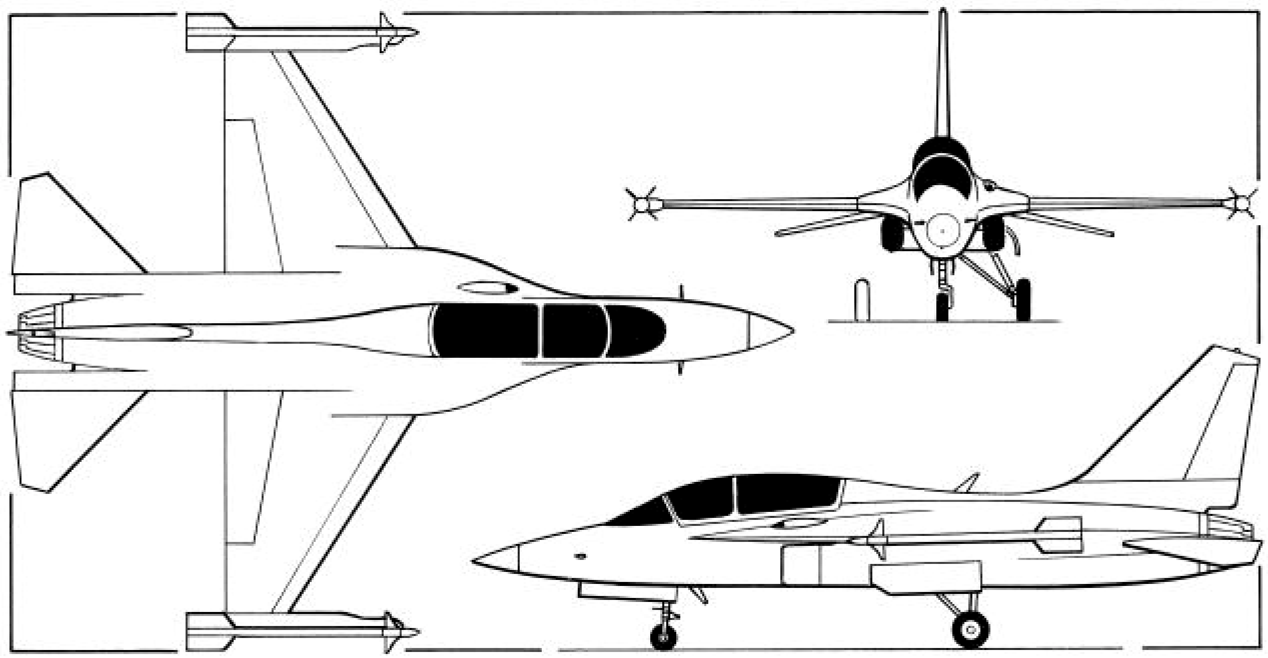
Note:* Land attack version

Contractor

Novatar Design Bureau

AIR FORCE

KAI T-50 and A-50 GOLDEN EAGLE



Type. Advanced jet trainer/light attack jet.

Program. Begun by Samsung Aerospace (SSA) in 1992 under designation KTX-2 (Korean Trainer, Experimental); initial design assistance to Samsung by Lockheed Martin Tactical Aircraft Systems as offset in F-16 Korean Fighter Program; early design (see 1994-95 *Jane's*) featured shoulder-mounted wings and twin tail unit; revised later to present configuration; basic configuration established mid-1995; full-scale development originally planned to begin in 1997, subject to finding risk-sharing partner; government go-ahead given on 3 July 1997; Samsung/Lockheed Martin agreement September 1997 to continue joint development until 2005; Lockheed Martin Aeronautics at Fort Worth responsible for wings, flight control system and avionics; development phase funded 70 per cent by South Korean government, 17 per cent by Samsung/KAI and 13 per cent by Lockheed Martin. FSD contract, signed 24 October 1997, calls for two static/fatigue test and four flying prototypes (two T-50A and two T-50B; roll-out targeted for October 2001 and first flight in June 2002); production aircraft to begin manufacture in August 2003. Work split 55 per cent in USA, 44 per cent in South Korea and 1 per cent elsewhere. Preliminary design review (PDR) completed 12 to 16 July 1999; wind tunnel testing completed (4,800 hours) and aerodynamic design frozen November 1999. Critical design review (CDR) passed in August 2000. KTX-2 was redesignated T-50 and A-50 in early 2000. T-50 International Company (TFIC) established September 2000 (following July MoU) by KAI and LMAS to market aircraft outside South Korea. Deliveries to RoKAF planned to begin in October 2005 and be completed in 2009.

Current Versions (planned)

T-50A: Advanced trainer.

T-50B: Lead-in fighter trainer.

A-50: Proposed light combat version.

Customers. Initial RoKAF requirement for 94 T-50s (50 T-50s and 44 A-50s), with options for up to 100 more, including further A-50s. Aimed also at F-5 replacement market. Exports (from 2006) estimated potentially at 600 to 800.

Costs. Development program cost estimated at US$2,000 million (1995); but re-assessed in 1996 as US$1,500 million, and only US$1,200 million by early 1997. Initial October 1997 FSD contract valued at approximately US$1,270 million. Development phase re-estimated at US$1.8 billion to US$2.1 billion in mid-2000; unit cost US$18 million to US$20 million for trainer, US$20 million to US$22 million for attack version (2000).

Design Features. Mid-mounted, variable camber wings, swept back on leading edges only; leading-edge root extensions (LERX); all-moving tail plane; sweptback fin leading edge. Single turbofan engine, with twin side-mounted intakes. KIAT developing fuselage and tail unit. Avionics to include HUD and color MFDs. Designed for service life of more than 8,000 hours.

Flying Controls. Digital fly-by-wire control of elevons, tail plane and rudder. Moog actuators.

Structure. Lockheed Martin, wings; KAI, fuselage, tail unit and final assembly.

Landing Gear. Messier-Dowty KIA retractable tricycle type, with single wheel and oleo-pneumatic shock absorber on each unit. Main wheels retract into engine intake trunks, nose wheel forward.

Power Plant. One General Electric F404-GE-402 turbofan (78.7 kN; 17,700 lb st with afterburning), equipped with FADEC.

Accommodation. Crew of two in tandem; stepped cockpits; Martin-Baker ejection seats.

Systems. Onboard oxygen generating system. Hamilton Sundstrand power generation system. Argo-Tech fuel system.

Avionics. *Comms:* UHF/VHF radio; IFF. *Radar:* Lockheed Martin AN/APG-67 in T-50B and A-50. *Flight:* Digital fly-by-wire flight controls; nav/attack system for fighter lead-in training; ring laser gyro INS; radar altimeter. *Instrumentation:* BAE Systems HUD; two 127 mm (5 in) color MFDs; Honeywell instrumentation displays (eight 76 mm; 3 in displays, including HSI, attitude indicator, electronic altimeter and Mach speed indicator). S*elf-defense:* A-50 provision for EW pods and RWR.

Armament (T-50B and A-50). Internal 20 mm M61 Vulcan cannon with 208 rounds (port LERX). Seven external stations (one on centerline, two under each wing and AAM rail at each wingtip) for AAMs, ASMs, gun pods, rocket pods or bombs. Expected to include AIM-9 Sidewinder and AGM-65 Maverick missiles and Mk 82/83/84 series bombs.

Dimensions, External

Wing span: over missiles	9.17 m (30 ft 1 in)
excl missiles	9.11 m (29 ft 10½ in)
Length overall	12.98 m (42 ft 7 in)
Height overall	4.78 m (15 ft 8¼ in)

Weights and Loadings

Weight empty	6,263 kg (13,808 lb)
Max T-O weight: clean	8,890 kg (19,600 lb)
with external stores	11,974 kg (26,400 lb)

Performance (design)

Max level speed	M1.4
Max rate of climb at S/L	10,058 m (33,000 ft)/min
Service ceiling	14,500 m (47,570 ft)
g limits	+8/-3

AIRBORNE SELF-PROTECTION JAMMER (ASPJ).

ASPJ is a state-of-the-art internal electronic countermeasures system used to defeat or degrade tracking by threat radar systems and will enhance the survivability of the F-16 in combat. The system is built by a team of Northrop Grumman and ITT and is currently in service with some fighters in the U.S Navy, Marine Corps and several international customers' versions of similar fighters. Korea is the first international customer to incorporate ASPJ on the F-16s. ASPJ is the fourth type of internal electronic countermeasures equipment that has been integrated into the F-16. Addition of the ASPJ countermeasures set will give the Republic of Korea Air Force (ROKAF) F-16s a robust self-protection capability. These aircraft also have the ALR-56M radar warning receiver and the ALE-47 chaff/flare dispenser. The current program to install the ASPJ in ROKAF F-16s began in April 1997. The modified aircraft is the ROKAF's latest version of the F-16, which was delivered in late 1994 and was flown back to the United States for modification and testing. This aircraft was modified at Fort Worth, will undergo testing in the anechoic chamber, and will then be ferried to Edwards Air Force Base, Calif., for several months of flight testing. The remainder of the F-16s scheduled for the ASPJ upgrade will be modified in Korea by the ROKAF beginning in mid-2000.

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Annex 3E: TECHNOLOGY; Appendix 1: METHODS OF ARMS ACQUISITION

Acquisition	2000-2005	2006-2010	2011-2015	2016-2020
Indigenous R&D and Production	Major Surface Ships (KDX) Minor Surface Ships (Minesweepers) Armored Vehicles (KIFV) Trainer Aircraft (KT-1) Small Naval Craft Small Arms	Major Surface Ships (KDX) Minor Surface Ships (Minesweepers) Torpedoes Armored Vehicles (KIFV) Trainer Aircraft (KT-1) Small Naval Craft Small Arms	Major Surface Ships Minor Surface Ships Submarines Combat Aircraft (FX) Trainer Aircraft Helicopter(KHX) Tanks Armored Vehicles Artillery	Major Surface Ships Minor Surface Ships Submarines Combat Aircraft (FX) Trainer Aircraft Tanks Armored Vehicles Artillery BM (nuclear-capable)
Joint R&D and Production	Combat Aircraft (KF-16) Tanks (K1 MBT) Helicopter Artillery (K-200) Trainer Aircraft (A/T-50) Submarines (T209/T214) Comms/Spy Satellites	Combat Aircraft (KF-16) Tanks (K1 MBT) Helicopters Artillery (K-200) Trainer Aircraft (A/T-50) Submarines (T209/T214) Comms/Spy Satellites Aerostat UCAV Micro Air Vehicle	Comms Satellite (2d Gen) Spy Satellite (2d Gen) Attack Helicopter(KAH) Tanks Aerostat HAE UAV UCAV Micro Air Vehicle UUV BMD	Micro Spy Satellite Attack Helicopter(KAH) High Power Microwave Aerostat HAE UAV UCAV AWACS Micro Air Vehicle UUV BMD
Licensed Production	Submarines (T209/T214) Helicopters (KH-60) Combat Aircraft (KF-16) Artillery Radars UAV	Submarines (T209/T214) Helicopters (KH-60) Combat Aircraft (KF-16) Artillery Radars UAV	Torpedo (Squall) Attack Helicopter (AH-64) SAM AAM ASM Maritime Surveillance (P3)	Torpedo (Squall) Attack Helicopter (AH-64) SAM AAM ASM Maritime Surveillance (P3)
Import	UAV SAM AAM ASM AWACS Maritime Surveillance (P3) Attack Helicopter (AH-64)	UAV SAM AAM ASM AWACS Maritime Surveillance (P3) Attack Helicopter (AH-64)	BMD SAM AAM ASM Radars AWACS	BMD SAM AAM ASM Radars

Annex 3E: TECHNOLOGY; Appendix 2: MAJOR ARMS PROCUREMENT

	2000-2005		2006-2010		2011-2015		2016-2020	
Major Capability/ Purpose	Direction	Items to procure	Direction	Items to procure	Direction	Items to procure	Direction	Items to procure
Information & Command	• Early warning & surveillance • Self-command systems • Defense Digitization	• GSR • 2 Comms Satellites • 1 Spy Satellite • Joint C3I System	• Early warning & surveillance • Space Communications • Self-command systems • Defense Digitization	• 10 Aerostats • 1 Spy Satellite • 2 Comms Sat • Joint C3I System • GBR	• Miniature space communications, warning & surveillance systems • Self-command systems • Defense Digitization	• 10 Aerostats • 2 Spy Satellite • 10 Microsats • 10 Micro spy sats • Joint C3I System • GBR	• Early warning & surveillance • Self-command systems • Defense Digitization	• 20 JLENS • 20 Microsats • 10 Micro spy sats • Micro Air Sensor • Joint C3I System • GBR
Strategic Strike	• Space Launch Capablity	• Space Launch Platform	• Long Range Ballistic Delivery Capability < 300 km	• KSR-1	• Long Range Ballistic Delivery Capability <500 km	• KSR-1	• Long Range Precision Strike • Long Range Ballistic Delivery Capability < 800 km	• KSR-2 • Cruise Missiles
Ground Operations	• Improved lethality, agility • Tactical Situational Awareness	• K1 MBT • AH-X • SAM-X • Q37-type radar	• Improved lethality, agility • Tactical Situational Awareness	• K1 MBT • AH-X • SAM-X • Q37-type radar	• Improved lethality, agility • Tactical Situational Awareness	• AH-X • SAM-X • Q37-type radar • Multi-sensor array	• Improved lethality, agility • Tactical Situational Awareness	• AH-X • SAM-X • Q37-type radar • Multi-sensor array
Naval Control	• Long range surveillance and early warning • Anti-Submarine protection • Coastal defense • Develop surface combat capability • Protection of SLOCs	• 8 P-3Cs • 13 Super Lynx • 3 K. Keong MHC • 3 Chang Bogo • 4 KDX	• Long range surveillance and Information Dominance • Develop sub-surface combat capability • Develop ocean going navy capability • Strategic control of SLOCs	• 4 P-3Cs • 3 K. Keong MHC • 3 Type 214 • 3 KDX -III	• Improved C4ISR system • Strategic control of SLOCs • Improve ship building capacity • Enhance Defensive/Offensive combat capability	• 8 P-3Cs • 3 Type 214 • 4 KDX-III • 2 KDX-X • SAMs / Torpedoes developments	• Improved C4ISR system • Strategic control of SLOCs • Superior underwater capability • Enhance Defensive/Offensive combat capability • Improve ship building capacity	• 12 P-3Cs • 6 super Lynx • 4 Type 214 • 6 KDX-X • 2 Submarine rescue • 10 UWAV • 3 MHO • 2 ML • SAMs / Torpedoes upgrades
Air Operations	• Long range surveillance and early warning • Anti-Submarine protection • Coastal defense • Develop surface combat capability • Protection of SLOCs	• 8 P-3Cs • 13 Super Lynx • 3 K. Keong MHC • 3 Chang Bogo • 4 KDX	• Long range surveillance and Information Dominance • Develop sub-surface combat capability • Develop ocean going navy capability • Strategic control of SLOC's	• 4 P-3Cs • 3 K. Keong MHC • 3 Type 214 • 3 KDX -III	• Improved C4ISR system • Strategic control of SLOCs • Improve ship building capacity • Enhance Defensive/Offensive combat capability	• 8 P-3Cs • 3 Type 214 • 4 KDX-III • 2 KDX-X • SAMs / Torpedoes developments	• Improved C4ISR system • Strategic control of SLOCs • Superior underwater capability • Enhance Defensive/Offensive combat capability • Improve ship building capacity	• 12 P-3Cs • 6 super Lynx • 4 Type 214 • 6 KDX-X • 2 Submarine rescue • 10 UWAV • 3 MHO • 2 ML • SAMs / Torpedoes upgrades

	2000-2005		2006-2010		2011-2015		2016-2020	
Major Capability/ Purpose	Direction	Items to procure	Direction	Items to procure	Major Capability/ Purpose	Direction	Items to procure	Direction
Research & Development	• Upgrade & Modernization of present systems • Advanced Fighter Technology • Advanced Surface Combatant Technology • Miniaturized Systems • Space Launch systems • AIP Propulsion	• FX • Aerial Mine Field • KSR-1 • Micro Air Sensor • KDX-III • T-214	• Unmanned Vehicle/Weapons Technology • Miniaturized Systems • Space Launch systems • Directed Energy Technology	• UCAV • JSTAR • Aerial Mine Field • KSR-1/2 • Micro Air Sensor	• Air Defense Miniaturized Systems • Strategic Surveillance Systems • Directed Energy Beam Technology • High Altitude Flight Technology	• Aerial Mine Field • Micro Air Sensor • JLENS • KSR-2	• Miniaturized systems • Ballistic & Cruise Missile detection & defense systems • Directed Energy Beam Technology • High Altitude Flight Technology	• Aerial Mine Field • KSR-3 • JLENS

ARMY R&D EXPENDITURE

2001-2005		2006-2010		2011-2015		2016-2020	
R&D Program	US$ Bil	R&D Program	US$ Bil	R&D Program	US$ Bil	R&D Program	US$ Bil
AH-64D	$0.150	AH64D	$0.080	KAH66	$0.250	KAH66	$0.200
KIFV	$0.020	KAH66	$0.200	AGM-11X	$0.050	AGM-11X	$0.030
K1-A1 MBT	$0.050	AGM-11X	$0.030	SAM(A-400)	$0.180	SAM(A-400)	$0.050
SAM (A-300)	$0.100	SAM (A-400)	$0.160	Tactical Radar (GBS)	$0.050	Tactical Radar (GBS)	$0.050
Tactical Radar (GBS)	$0.030	Tactical Radar (GBS)	$0.030	THEL	$0.020	THEL	$0.500
Others	$0.285	Others	$0.317	Others	$0.458	Others	$0.619
Total	$0.635	Total	$0.817	Total	$1.008	Total	$1.449
Budget Allocated	$0.635	Budget Allocated	$0.817	Budget Allocated	$1.088	Budget Allocated	$1.449

NAVY R&D EXPENDITURE

2001-2005		2006-2010		2011-2015		2016-2020	
R&D Program	US$ Bil	R&D Program	US$ Bil	R&D Program	US$ Bil	R&D Program	US$ Bil
Torpedoes	$0.030	SAM (SM-2)	$0.070	MSO/MHO	$0.070	KDX-X	$0.190
Submarine (T-214)	$0.150	Torpedoes	$0.030	Mine Layer	$0.080	SS-N-21 Integration	$0.045
KDX-2/3	$0.300	KDX-X	$0.280	SAM (SM-3)	$0.100	HPM	$0.280
HPM	$0.150	Submarine (T-214)	$0.200	KDX-X	$0.325	SSM/CM	$0.200
		HPM	$0.200	HPM	$0.325	ASW	$0.200
		UUV	$0.020	UUV	$0.080	UUV	$0.125
Others	$0.216	SS-N-26 Integration	$0.025	Torpedo (Squall)	$0.050	Next Generation Submarine	$0.350
		Others	$0.264	Others	$0.421	Others	$0.542
Total	$0.846	Total	$1.089	Total	$1.451	Total	$1.932
Budget Allocated	$0.846	Budget Allocated	$1.089	Budget Allocated	$1.451	Budget Allocated	$1.932

AIR FORCE R&D EXPENDITURE

2001-2005		2006-2010		2011-2015		2016-2020	
R&D Program	US$ Bil	R&D Program	US$ Bil	R&D Program	US$ Bil	R&D Program	US$ Bil
FX	$0.200	FX	$0.250	FX	$0.275	FX	$0.150
A/T-50	$0.050	UCAV	$0.050	UAV HAE	$0.150	UAV HAE	$0.100
E3 AWACS	$0.080	AWACS	$0.040	UCAV	$0.080	UCAV	$0.125
KT-2	$0.015	Harm Blk 6	$0.060	MAV	$0.055	MAV	$0.100
KOX-1	$0.025	JSOW/JDAM	$0.050	AAM	$0.040	AAM	$0.040
UAV	$0.010	Tanker	$0.025	Air Minefield	$0.150	ABL	$0.300
AAM	$0.020	MAV	$0.055			Air Minefield	$0.175
Others	$0.235	Others	$0.287	Others	$0.338	Others	$0.459
Total	$0.635	Total	$0.817	Total	$1.088	Total	$1.449
Budget Allocated	$0.635	Budget Allocated	$0.817	Budget Allocated	$1.088	Budget Allocated	$1.449

DBA PROGRAMS EXPENDITURE

2001-2005		2006-2010		2011-2015		2016-2020	
R&D Program	US$ Bil	R&D Program	US$ Bil	R&D Program	US$ Bil	R&D Program	US$ Bil
Communications Satellites	$0.080	Communications Satellites	$0.125	Microsatellites	$0.125	Microsatellites	$0.250
Spy Satellites	$0.220	Spy Satellites	$0.260	Micro Spy Satellites	$0.150	Micro Spy Satellites	$0.360
Launch Vehicle (KSR-1)	$0.100	Launch Vehicle (KSR-1)	$0.125	Spy Satellites	$0.250	Launch Vehicle (KSR-3)	$0.225
Aerostat	$0.080	Aerostat	$0.080	Launch Vehicle (KSR-2)	$0.155	KLENS	$0.150
Micro Air Sensor	$0.080	Micro Air Sensor	$0.080	KLENS	$0.100	Micro Air Sensor	$0.280
Defense Digitization	$0.215	Defense Digitization	$0.250	Micro Air Sensor	$0.180	Defense Digitization	$0.355
Others	$0.039	Others	$0.127	Defense Digitization	$0.285	Others	$0.238
				Others	$0.150		
Total	$0.814	Total	$1.047	Total	$1.395	Total	$1.858
Budget Allocated	$0.814	Budget Allocated	$1.047	Budget Allocated	$1.395	Budget Allocated	$1.858

Micro-Air Sensor Network (MASN) – Korea's Strategic DBA Solution

Introduction

Concurrent with the ROK feasibility study on space-based sensors, the idea of the micro-air sensor network was born. Based on revolutionary advances already taking place in 2000 in the fields of nanotechnology and bioengineering, MND projected and set the goal of putting in place a micro-air sensor network by the year 2020. The risk of this investment was classed as moderately high and a total program budget of US$3.5 billion spaced over 20 years was approved. To make the program affordable, MND solicited the participation from industry due to its commercial potential and dual-use technology. Thus the development of the MASN concept is tied closely to the development of the ROK's space program.

Concept

The concept of the Micro-Air Sensor Network (MASN) is similar to the application of nanosatellite technology for military applications, that of employing a swarm of miniature satellites communicating with micro sensors on a battlefield and conveying important surveillance and tactical information.[74] In the case of the MASN, however, the platform differs as micro-air vehicle (MAV) and/or super pressure balloons instead of nanosatellites are utilized as the primary sensing platform.

Requirement

To support Korea's DBA goal of information superiority and the need for a surveillance system to support its military missions, especially in the protection of Korea's SLOCs, the ROK military identified a need to acquire a low-cost, high-altitude, with extended on-station times ,

[74] "PicoSat Constellations Debuts November", Spacedaily, October 11, 1999.

and high reliability surveillance system that would provide continuous surveillance coverage. In this development, low-cost, high-altitude, and extended on-station times are the driving requirements.[75]

Solution

Based on the technology that currently existed in 2000, the possible technological solutions to answer this requirement were the use of satellites, high altitude endurance UAVs (HAE UAV), and tactical UAVs. These options, however, had their respective strengths and weaknesses, summarized below:

Surveillance System	Satelllite	HAE UAV	Tactical UAV
Sensor Payload	Fixed, multi-sensor capable	Variable, payload catered to mission	Variable, payload catered to mission
Technology Maturity	Mature and proven	Recent and immature	Mature and proven
Area of Coverage	Large	Large	Small
Time of Coverage	Fixed and predictable based on orbital period	Long	Limited
Resolution	~ 1 m (IKONOS)	< 1 m	< 1 m
Cost to Acquire	High	Moderate	Low
Cost to Operate	High	Moderate	Low
Time to Acquire	At least 3 years	At least 1.5 years	About 3 months
Technology Upgrade	None	Easy	Easy

Table 3-120. Comparison Between Different Available Airborne Surveillance Systems

From the above analysis of present technological solutions, MND concluded that none of the systems would meet its requirements. Consequently, the decision was made to indigenously design, R&D and produce a new class of high altitude surveillance system suited to Korea's military operations. Such a system, it was decided, would employ the revolutionary advances already taking place in the fields of nanotechnology and bioengineering. Specifically, this new system would merge the micro-air vehicle, microsatellite, and miniaturization technologies to

[75] Epley, Lawrence E. "Stratospheric Aircraft, Blimps, Balloons, and Long Endurance Vehicles." Future Aeronautical and Space Systems. Ahmed K. Noor and Samuel L. Venneri. ed. Progress in Astronautics and

create a new capability. And so, the idea of the MASN concept began to take on a more concrete form.

Parameters.

The initial parameters put forth by MND aimed to foremost address the most current deficiency of the lack of a credible maritime surveillance and identification system. The MASN involves the deployment of numerous miniaturized sensors timed according to predicted wind patterns. Each MAS would consist of a surveillance platform and a sensor payload. Simply put, the MAS is a high resolution digital camera mounted on a high-altitude capable platform. From the study of wind patterns, MND stated that the MAS would be deployed at the lower stratosphere around 20 km,[76] with a mission time of ten days.[77]

a. Sensor Payload

Utilizing low-cost and commercially available CCD and focusing technology found in today's (2001) digital cameras, and operating in the optical and near IR region, the sensor payload would have dimensions not more than 10 cm (4 inches) on any given side and its weight would be less than 500 grams. Its power requirements would be not more than 1 Watt per hour.

Aeronautics. Vol. 172. Virginia: American Institute of Aeronautics and Astronautics, Inc, 1997. 211.

[76] The stratosphere is comparatively stable (when compared to the troposphere) and turbulence is far less energetic.[76] In the lower stratosphere, winds begin to decrease with altitude and reach a minimum around 20 km. At that level wind in the mid-altitude is typically below 10 m/s. This minimum wind zone presents an opportunity to conduct a variety of missions. Epley, Lawrence E. "Stratospheric Aircraft, Blimps, Balloons, and Long Endurance Vehicles." Future Aeronautical and Space Systems. Ahmed K. Noor and Samuel L. Venneri. ed. Progress in Astronautics and Aeronautics. Vol. 172. Virginia: American Institute of Aeronautics and Astronautics, Inc, 1997. 214.

[77] Research data shows that balloon drift patterns over ten days follow fairly narrow patterns. After ten days, most balloons completed between one-half global circumnavigation and one complete global circumnavigation. The mean difference in latitude at that time was 8.5 degrees, or a ground distance of approximately 950 km. At an altitude of 36 km, the balloon has a line-of-sight footprint on the ground of 730 km radius. Thus even with a drift distance of 950 km, the balloon retains visibility of a sizeable portion of the original footprint. Other points to note are that ending latitude was found to be dependent upon starting latitude and month but not on starting longitude, and starting longitude was not found to be a significant factor, except for an Equator launch in the 30 day category. Reitinger, Kurt C. Analysis of Simulated Drift Patterns of a High Altitude Balloon Surveillance System. NPS. June 1993. 43.

This would make the incorporation of a chargeable battery with the supplementation of solar energy a possible power source

As a baseline, the optical resolution as of 2001 is 6 megapixels. Based on Moore's Law and advances in digital imaging technology, the optical resolution of the MAS should easily achieve upwards of 15 megapixels. Once the imagery is optically captured, this data must then be processed using some intelligent matching algorithm into useable information. Acknowledging the limitations of bandwidth, some form of compression algorithm must also be used to reduce the bandwidth requirement. Preliminary estimates put this bandwidth requirement at 2 Mbps for operating a network of 200 MAS.[78] This information is then communicated at a fixed interval rate via an IR port to either an orbiting satellite or a roving UAV, before being subsequently transmitted to dedicated ground receiving stations, where further data processing would be executed and the intelligence gathered disseminated via the JC3IS.

b. Surveillance Platform

To achieve a 20 km altitude, MND narrowed the platform to the use of either MAVs or balloons/super pressure balloons[79] or a combination of both ie. a super pressure MAV blimp. The advantage of combining the two platforms into a super pressure MAV blimp is the reduced power requirements.[80] The advantages of employing either of these platforms have already been covered in the main write-up in epoch one.

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[78] Assuming a conservative data compression that reduces the file size by half, the initially processed information would take up 3 megapixels. With a transmission interval refresh rate of 5 minutes (300 sec), the bandwidth requirement for an individual MAS then works out to 10 kbps. With a bandwidth transmission capability of 2 Mbps, this would allow for the simultaneous deployment of up to 200 MASs.

[79] The use of super pressure balloons would be necessary for extended missions at constant altitude. Regular balloons change altitudes throughout the day due to thermal expansion.

[80] For example, a 100m long blimp-type craft (at 20 km altitude) could hover over a point on the Earth with less than 1 kW of net propulsive power. In another example, it was estimated that a 23,000m^3 airship can maintain station in average midlatitude winds (15 kts) with a 0.15 kW net propulsive power. Marcy, W. L., and Hookway, R. O., "Propulsion Options for the HI-SPOT Long Endurance Drone Airship," Martin Marietta Corp., Sep 1979.

The parameters put forth in their requirements in 2000 were the MAV would be less than 4-inches in any one dimension, possessing an inertial/GPS positioning capability up to 1 m accuracy, with an ability to hover or float in air at over 30 km altitude for up to 3 months, and utilize passive multi-/hyper-spectral sensor (depending on technology maturity), employ one-way microwave transmitters, and utilizing solar power coupled with rechargeable battery for power requirements. The entire MASN would be rocket-/missile- or balloon-delivered depending on mission.

Its small dimensions would make the sensors virtually undetectable. To meet the inertia GPS needs, the sensor platform would employ commercially available fiber-optic gyro and etched silicon accelerometer-based inertial measurement units. The requirement for these micro-air sensors to hover or float in air at over 30 km altitude for up to 3 months, in essence, wpould allow the South to maintain a continuous surveillance coverage over its area of interest. To effect a viable means of communications, these could take the form of optical communication via fiber optic tethers and other cluster architectures for miniature satellites for which experience with tethers is useful.[81]

Capability

Assuming a field of field of 20 degrees, the area of coverage a MAS will provide is approximately a circle of radius 3.5 km. With a network of 200 MAS employed cooperatively, the equivalent coverage that results from such a system is equivalent to a circle of radius 49.5 km. Also assuming a focal length of 1 cm with a pitch of 10 microns per pixel, the MAS will be able to provide a spatial resolution up to 5 cm (from Rayleigh's criterion) in the optical region of operation. This system resolution thus allows Korea to possess a high quality identification surveillance system that meets its need for a maritime surveillance system.

Advantages Over Existing Systems.

The advantages of the MASN concept are its low life cycle costs, its expendability, easy upgrade ability, almost continuous coverage, high reliability, and low observability. Comparing these traits with satellites and HAE UAVs, the choice of employing the MASN is obvious. When compared to tactical UAVs, however, the MASN does not enjoy the operator control such a system offers due to its dependence on weather patterns. However, its operational control limitations are offset by the cost advantages that the MASN enjoys. Based on 2000 figures, a tactical UAV costs at least US1 million. Assuming the MAS in its most simple form as that of attaching a floating device to a 6 megapixel digital camera, the cost of a MAS unit with mass production effected works out to the order of US$500. Thus, with a US$1 million budget, the trade-off is summarized below:

Surveillance System	MASN	Tactical UAV
Sensor Payload	Variable, payload catered to mission	Variable, payload catered to mission
Per Unit Cost (US$)	500	1 million
Qty for US$1 million	2000	1
Instantaneous Coverage Area (km^2)	~80,000	~1
Technology Maturity	Recent	Mature and proven
Time of Coverage	Up to 10 days	Limited
Resolution	5 cm	< 1 m
Cost to Acquire	Low	Low
Cost to Operate	Low	Low
Time to Acquire	<1 month	About 3 months
Technology Upgrade	Easy	Easy

Table 3-121. Cost Analysis Between MASN and Tactical UAV

The use of the optical wavelength region limits the MAS to a day time maritime surveillance capability. Looking at the threat environment formed mainly by the East Sea, however, this is not a significant limitation as the movement of ships is rather slow and makes tracking by the

[81] "PicoSat Technology Gets Serious", Spacedaily, October 11, 1999.

MASN with a continuous coverage time over the area of interest very possible. This again is not the same case as that for a UAV.

Conclusion

To conclude this discussion, Korea believes that its investment in MASN is a realizable technological goal over the twenty year time frame. To better predict the flight patterns and coverage of the MAS, there is a need to understand the weather patterns associated with the East Sea as well as the regional seas constituting Korea's SLOCs. Hence, Korea will have to become a member of the International Weather Consortium.

Aerial Mine Field System (AMFS) – Korea's Air Defense Solution

Introduction

In concert with the MASN development is the exploration and planned development of the Aerial Mine Field system (AMFS) that also exploits nanotechnology and MEMS. Instead of providing a sense capability, the AMFS is a passive offensive weapon used for enhancing ROK's air defense capability. As will be discussed below, the AMFS comprises MAVs armed as weapons that could either carry a shaped-charge plastique or be titanium-tipped.[82] Upon attaining technology maturity and mass production, MND predicts that the individually-armed mines could cost as little as US$5. The introduction of the AMFS into Korea's military operations serves to enhance its air defense capabilities.

Concept

Conceptually, the AMFS is just what its namesake implies – that of forming a mine field in three-dimensional space. Similar in its employment as world war two barrage balloons and flak, the purpose of the AMFS is to deny enemy air threats the use of Korea's airspace by forcing enemy pilots to deviate from its planned flight path and to consequently channel these deviations into planned SAM kill zones such that Korea's SAM arsenal is able to effectively neutralize the enemy air threat. The only exception to barrage balloons and flak is the AMFS's low observability that translates to operational surprise for Korea. From the analysis of wind dispersion patterns, these air mines would have a deployment time of up to 30 minutes before they effect self-destruction.

[82] Titanium-tipped MAVs would result in a rain of red-hot fragments through thousand pounds of jet fuel and ammunition when sucked into jet engine air intakes would fracture the whirling turbine blades. Jim Wilson, "Micro Warfare: Small, smart and deadly, micro air vehicles swarm onto the battlefield", Popular Mechanics, February 2001. http://www.popularmechanics.com.

Requirement

To achieve and maintain it's declared goal of air and space superiority[83], MND concluded that Korea needed to maintain an effective air defense capability. Existing Korean air defense systems are essentially reactive systems because they must first sense the presence of the enemy air threat before countering the threats by "throwing" missiles at it. Consequently, the enemy is able to deploy countermeasures to defeat the incoming missile or to out maneuver the missile. Additionally, present SAMs are physically visible both visually and on the radar screens. This cue thus enables enemy pilots to be successful in undertaking the necessary evasive maneuvers.

From the above analysis, MND decided that Korea wanted an air defense weapon system that would take the fight to the enemy. Hence, MND explored the feasibility of applying MEMS and miniaturization technology as well as its space and MASN program developments to create a deployable low cost, high lethality air defense weapon system with low probability of detection and observability, minimal maintenance needs, and with a limited self-destruct deployment time and a fire-and-forget capability. The system would also be Higher Level Architecture (HLA) compliant and interoperable with the Joint C3I System (JC3IS) software to integrate with the existing air defense network systems.

Solution

From concept explorations done, several technological solutions were considered. These solutions comprised either acquiring an advanced SAM or air-to-air combat capability. Essentially, the above technological solutions entailed the acquisition of better missiles. MND

[83] Air superiority is a necessity. Since the German attack onPoland in 1939, no country has won a war in the face of enemy air superiority, no major offensive has succeeded against an opponent who controlled the air, and no defense has sustained itself against an enemy who had air superiority. John A. Warden III. "Air Superiority – the Concept" from The Air Campaign: Planning for Combat. Brassey's Air Combat Reader. Boyne, W.J. and Handleman, P., ed. Washington: Batsford Brassey's, Inc. 1999. 309.

deemed that this was appropriate but still wanted a new capability and this was captured in the AMFS concept.

The AMFS aims to complement Korea's existing suite of air defense assets. The AMFS is meant to primarily overcome the enemy air threat posed by its advanced combat fighters, with a secondary capability being the negation of incoming cruise missile threats. Based on modern combat aircraft operations, MND wanted this air defense weapon system to be deployable anywhere between 50 m to as high as 15,000 m altitude[84]. The air mines will be armed with contact-detonated explosives (at least for the first generation). Depending on the mission scenarios, these mines will be either rocket-, missile- or balloon-delivered. Mines "kill" Aircraft and CMs by either destroying their airframes or detonating internally after the mines get sucked into the air intakes.

Parameters

The initial parameters put forth by MND aimed specifically at answering the defensive air defense mission through the exploitation of Korea's terrain to influence and shape the airspace. And these parameters were arrived at from performing a threat analysis.

a. Projected Enemy Doctrine, Strategy, and Tactics.

Korea's assessments had identified the needs to achieve and maintain air superiority and to enhance its coastal defenses. These conclusions were borne out by the existence of enemy advanced air fighters and cruise missiles. Based on enemy intelligence analysis of Korea's terrain and SAM deployments as well as its fighter or cruise missile control authorities[85], all possible air corridors and flight paths to be used as ingress and egress routes would be identified

[84] The maximum altitude threshold is established from Korea's present and planned inventory of missile or rocket delivery systems

[85] By control authorities, it is meant to imply accounting for the airframe's maneuverability in terms of altitude, speed, and turn radius to conclude the feasibility of flying any particular flight profile for a given air tasking order.

and prioritized. To assure the survivability of the enemy's air assets sufficient enough to at least accomplish its mission, one of its supporting goals would be to minimize the detection of these assets by Korea's sense systems. To accomplish this, the enemy could fly either above the SAM ceiling or below the radar coverage height.

Once the enemy's air assets attempt to fly over Korea, it is very likely that these fighters or cruise missiles would fly nap-of-the-earth. Consequently, the AMFS would be deployed in places where the enemy least expects – inside the valleys where he attempts to fly nap or at the altitudes above the SAM umbrella. Alternatively, the AMFS could also be deployed at higher altitudes beyond that of Korea's SAM ceiling. The deterrence effect of repelling the enemy's forces is attained through the "unexplained" kill of his aircrafts. From world war two data analysis, it was shown that a deterrence effect to influence an enemy air threat to change his operational plans enroute is achieved if he suffers 5% attrition.[86] Consequently, this became the MND baseline requirement for the AMFS concept – the employment of miniaturized air mines dispersed in a given volume of space sufficient to effect at least a kill probability of 0.05, where the kill is defined as either a soft or hard kill. Also, each air mine would consist of a "kill" mechanism attached to some floating device.

During MND's net assessment in the third epoch, the need to defend against cruise missiles (CM) was also identified. This then led to an additional requirement to study the feasibility of employing the AMFS as a suitable CM defense. For this requirement, MND set the probability of kill at 0.3.

b. Kill Mechanism

The primary "kill" element of the AMFS consists of micro air mines armed with contact-detonated explosives based on shaped-charge plastique. In such a case, the air mines would "kill" enemy aircrafts or cruise missiles by sufficiently puncturing the airframe to cause aerodynamic instability. Additionally, these air mines could also be titanium-tipped whereby this would result "in a rain of red-hot fragments through thousand pounds of jet fuel and ammunition [upon ingestion] into jet engine air intakes by [fracturing] the whirling turbine blades."[87]

c. Floating Device

As promulgated by the MASN concept, the air mines would "float" in air by attaching the kill mechanism to either a MAV or balloon-platform. When attached to a balloon, employing MEMS technology to regulate the air pressure contained within the balloons could then control the altitude of the dispersion pattern.

Capability

From the extensive terrain and control authority analyses conducted by Korea's military, MND has identified all the possible air corridors and flight paths that the enemy will use as ingress and egress routes. The AMFS would thus be deployed in places where he least expects ie. inside the valleys where he attempts to fly nap or above the SAM ceiling if he so decides to fly "high".

Assuming that Korea possesses a network of ground-based sensors that performs a radar gating function, this ability would then give a constant update of an incoming air threats position in time and space. Consequently, a track of the air threat's path would be obtained and its precise location in time and space at a discrete increment of time be predicted with sufficient certainty. With this precondition, an intercept solution could be determined based on a pre-programmed targeting algorithm identifying a suitable volume of space to deploy the AMFS

[86] This fact was pointed out to the author during a discussion with Professor Mike Melich on 12 Feb 2001.

such that the mine field would be in place out to two minutes ahead of the air threat's arrival. Through the use of firing theory, the mine density was determined.[88] And this calculations will be elaborated below.

			PK	0.05			
			z	0.0641			
	σ (m)	50	100	150	200	250	500
	Size of Mine Field, r* (m)	12.60	35.57	71.15	106.72	142.29	177.87
Area of Air Threat	Radius of Air Threat	Optimal Number of Mines Required					
a (m^2)	r (m)	n(σ=50m)	n(σ=100m)	n(σ=150m)	n(σ=200m)	n(σ=250m)	n(σ=500m)
6.75	1.466	149	596	1342	2385	3727	14907
6.80	1.471	148	592	1332	2368	3699	14797
6.85	1.477	147	588	1322	2350	3672	14689
6.90	1.482	146	583	1312	2333	3646	14583
6.95	1.487	145	579	1303	2316	3619	14478
7.00	1.493	144	575	1294	2300	3594	14375
7.05	1.498	143	571	1285	2284	3568	14273
7.10	1.503	142	567	1275	2268	3543	14172
7.15	1.509	141	563	1267	2252	3518	14073
7.20	1.514	140	559	1258	2236	3494	13975

Table 3-122. Optimum Number of Mines Against Aircraft for Pk = 0.05

Against cruise missiles, the requirement was to attain a 30% kill rate to complement the other air defense weapons and hence provide an overall effective air defense shield against CMs. From the assumptions above, a mine field density of about 2000 mines with a circularly dispersed radius of around 15m achieves the desired effect. Based on the same considerations discussed earlier, the volume requirement is $2m^3$.

[87] Jim Wilson, "Micro Warfare: Small, smart and deadly, micro air vehicles swarm onto the battlefield", Popular Mechanics, February 2001. http://www.popularmechanics.com.

[88] The SULR formula $p(z) = \left(1 - e^{-\sqrt{z}}\right)\left(1 - e^{-\left(\frac{na}{2\pi\sigma^2}\right)\sqrt{z}}\right)$ was used to perform the mine density determination.

			PK	0.30			
			z	0.6296			
	σ (m)	10	15	20	25	50	100
Size of Mine Field, r* (m)		12.60	18.90	25.19	31.49	62.99	125.97
Area of Air Threat	Radius of Air Threat	Optimal Number of Mines Required					
a (m^2)	r (m)	n(σ=10m)	n(σ=15m)	n(σ=20m)	n(σ=25m)	n(σ=50m)	n(σ=100m)
0.05	0.126	7912	17801	31646	49447	197788	791151
0.10	0.178	3956	8900	15823	24723	98894	395575
0.15	0.219	2637	5934	10549	16482	65929	263717
0.20	0.252	1978	4450	7912	12362	49447	197788
0.25	0.282	1582	3560	6329	9889	39558	158230
0.30	0.309	1319	2967	5274	8241	32965	131858
0.35	0.334	1130	2543	4521	7064	28255	113022
0.40	0.357	989	2225	3956	6181	24723	98894
0.45	0.378	879	1978	3516	5494	21976	87906
0.50	0.399	791	1780	3165	4945	19779	79115

Table 3-123: Optimum Number of Mines Against Cruise Missiles for Pk = 0.30

Advantages Over Existing Systems

MND’s analysis shows that the AMFS enjoys the following advantages, namely the aerial mine field once deployed is virtually undetectable or observable. In terms of cost, MND estimates that given the advances of miniaturization and advantages of mass production, each mine could cost as little as US$5 in 2020. Using the cost for manufacturing the bomblets contained in a SADARM projectile for example, the costs of mass producing the AMFS is probably a very affordable option for Korea. From the system requirements calculated, the cost of a 2000 mine payload would cost about US$10,000. Estimating the cost of the delivery system at US$30,000, a deployable AMFS would cost US$40,000 per missile.

Another advantage of the AMFS is its simplicity of application. Essentially, the AMFS can be compared to a simple missile with a timed fuze that detonates and deploys the mines at the pre-determined altitude. There is simply no requirement for the use of complicated electronic circuits found in AAMs, for example, due to the lack of a seeker.

Conclusion

As the examples of history have shown with the barrage balloons of world war two, the AMFS concept can also shape the air battlespace. As the enemy now realizes that he needs to be aware whether his next flight will be his last, this influences him to either fly higher or not at all, thereby facilitating Korea's goal attainment of air superiority.

Annex 3F: GLOSSARY OF ACRONYMS

AAM	Air-to-Air Missiles
AA-X	Extended Range AMRAAM
AC	Automatic Control
ADA	Air Defense Artillery
AEW	Airborne Early Warning
AF	Air Force
AIFV	Armored Infantry Fighting Vehicles
AIP	Air Independent Propulsion
AH	Attack Helicopters
AMFS	Aerial Mine Field System
AMRAAM	Advanced Med Range Air-to-Air Missile
APC	Armored Personnel Carriers
ASIM	Application Specific Integrated Micro-Instruments
ASPJ	Airborne Self Protection Jammer
ASW	Anti-Submarine Warfare
ATACMS	Army Tactical Missile Systems
AWACS	Airborne Early Warning And Control Systems
BM	Ballistic Missiles
BMD	Ballistic Missiles Defense
BW	Biological Weapons
C3I	Command, Control, Communications and Intelligence
C4I	Command, Control, Computer, Communications and Intelligence
CAIV	Cost As an Independent Variable
CEC	Cooperative Engagement Capability
CFC	Combined Forces Command
CM	Cruise Missiles
DBA	Dominant Battle Space Awareness
DHI	Daewoo Heavy Industries

Annex 3F: GLOSSARY OF ACRONYMS

DMZ	De-militarized Zone
DPRK	Democratic People's Republic of Korea
EO	Electro-Optics
ESM	Electronic Support Measures
FDP	Future Development Plans
FIP	Force Improvement Priorities
FMS	Foreign Military Sales
FX	Future Fighter
GCCS-M	Global Command & Control System – Maritime
GDP	Gross Domestic Product
GNP	Gross National Product
GSR	Ground Surveillance Radar
HAE	High Altitude Endurance
HPM	High Power Microwave
IAEA	International Atomic Energy Agency
JASSM	Joint Air-to-Surface Stand Off Missile
JC3IS	Joint Command, Control, Communications, Intelligence System
JDAM	Joint Direct Attack Munitions
JEC	Joint Economic Council
JFPC	Joint Foreign Policy Council
JMC	Joint Military Council
JSC	Joint Social Council
JSOW	Joint Stand Off Weapon
KAFV	Korean Armored Fighting Vehicle
KAI	Korea Aerospace Industry
KEDO	Korean Peninsular Energy Development Organization
KLENS	Korean Land Attack Cruise Missile Defense Elevated Netted Sensors
KNTDS	Korean Naval Tactical Data System
KOED	Korean OSIS Evolutionary Development

Annex 3F: GLOSSARY OF ACRONYMS

KFP	Korean Fighter Program
KPA	Korean People's Army
KPN	Korean People's Navy
KPAF	Korean People's Air Force
KT	Korean Trainer
K (N)	Korea (North); after declaration of unification
K (S)	Korea (South); after declaration of unification
LMTAS	Lockheed Martin Tactical Aircraft Systems
MASN	Micro Air Sensor Network
MAV	Micro-Air Vehicle
MEMS	Microelectronic Mechanical Systems
MBT	Main Battle Tanks
MCMV	Mine Counter Measures Vessels
MIRV	Multiple Independent Re-entry Vehicle
MLRS	Multiple Launch Rocket System
MND	Ministry of Defense
MPA	Maritime Patrol Aircrafts
MTCR	Missile Testing Control Regime
MW	Microwave
NATO	North Atlantic Treaty Organization
NMS	National Military Strategy
NSS	National Security Strategy
O&M	Operations and Maintenance
OPCON	Operational Control
P-3X	Improved Variant of P-3C
PLA	People's Liberation Army
PPP	Purchasing Power Parity
PRC	People's Republic of China
R&D	Research and Development

ROK	Republic of Korea
ROKA	Republic of Korea Army
ROKN	Republic of Korea Navy
ROKAF	Republic of Korea Air Force
SAM	Surface-to-Air Missiles
SATCOM	Satellite Communications
SLEP	Service Life Extension Program
SLOC	Sea Lines of Communications
SM	Standard Missiles
SOF	Special Operation Forces
SRBM	Short Range Ballistic Missiles
SSM	Surface-to-Surface Missiles
THEL	Tactical High Energy Lasers
TMD	Theater Missile Defense
UAV	Unmanned Aerial Vehicles
UCAV	Unmanned Combat Air Vehicles
UHF	Ultra-High Frequency
ULDB	Ultra Long Duration balloon
UN	United Nations
US	United States
USFK	United States Forces in Korea
USN	United States Navy
UWA	Under Water Acoustics
VLE	Very Long Endurance
VLS	Vertical Launch System
WMD	Weapons of Mass Destruction
WS	Weapons Systems
XR	Exchange Rate

Lieutenant Commander

Gordon R. Oliver II

Lieutenant Commander Oliver was raised in Moon Township, Pennsylvania and graduated from the United States Naval Academy in 1986 with a Bachelors Degree in Ocean Engineering. Following flight training in Pensacola, Florida and Beeville, Texas he was designated Naval Aviator in April 1988. After initial A-7E training with VA-122 at NAS Lemoore, California, he joined the VA-27 "*Royal Maces*" in April 1989. He deployed to the Western Pacific onboard USS CARL VINSON (CVN-70) in 1990, subsequently transitioned to the FA-18A *Hornet* in 1991, and began pre-deployment work-ups aboard USS KITTY HAWK (CV-63). While with VA/VFA-27, he served as the Line Division, Maintenance Quality Assurance, Training and Landing Signals Officer. He was the 1992 recipient of the Commander, Strike Fighter Wing, U.S. Pacific Fleet Admiral Wesley L. McDonald Leadership Award for Junior Officers from among all Pacific Fleet FA-18 pilots.

Lieutenant Commander Oliver then reported to the VMFAT-101 *Sharpshooters* at MCAS El Toro, California as an Instructor Pilot and Landing Signals Officer. After 16 months, he was ordered to join CVW-9 underway during their 1993 Western Pacific/Arabian Gulf deployment onboard USS NIMITZ (CVN-68) as the Staff Landing Signals Officer. He also served as the staff Administrative and assistant Operations Officer.

In 1995, Lieutenant Commander joined the staff at the Naval Strike Warfare Center at NAS Fallon, Nevada as the Precision Strike Tactics Officer and an Overall Evaluator for Air Wing Training.

His next tour was with theVFA-147 *Argonauts* at NAS Lemoore, California serving as the Safety, Maintenance and Operations Officer. He made the 1997-98 World Cruise aboard USS NIMITZ (CVN-68) to the Western Pacific/Arabian Gulf flying missions over the skies of Iraq in support of Operation SOUTHERN WATCH. During this deployment he spent 30 days attached to staff of Commander, Joint Task Force-Southwest Asia as a Liaison Officer in support of contingency operations.

In June 1998 Lieutenant Commander reported to the Naval Postgraduate School for study in the Systems Engineering and Integration curriculum. He graduated (With Distinction) from the Naval War College Command and Staff Non-Resident Program in December 2000, and received a Master of Science Degree in Systems Integration in March 2001 with follow-on orders to Operational Test and Evaluation Squadron NINE (VX-9) at Naval Air Weapons Station China Lake, California.

Lieutenant Commander Oliver has accumulated 2850 flight hours with over 1900 hours in the FA-18 *Hornet*, 600 hours in the A-7E *Corsair II*¸ and 535 landings on ten different aircraft carriers. His awards include the Air Medal (1st Strike Flight), Navy Commendation Medal (four awards), Air Force Achievement Medal, Navy Achievement Medal (two awards) and various unit and service awards.

Lieutenant Commander and his wife Sandee enjoy time spent with their daughter Meredith.

Major
NG Boon Heong

MAJ Ng joined the Singapore Armed Forces in March 1989 and was awarded the Company Best Trainee for Basic Military Training. He was then selected and commissioned as an officer in Apr 1990 after graduating from the Officer Cadet School as Echo Company's Best Trainee. In Apr 1990, he assumed his duties at the First Battalion, Singapore Infantry Regiment as a platoon commander for a period of one year. He then left active duty to further his education at the Nanyang Technological University graduating with Bachelors Degree in Electrical and Electronics Engineering (Hons). In May 1994, MAJ Ng reported back to active duty at the 3rd Battalion, Singapore Infantry Regiment to assume the appointment as a Company second-in-command where he served for one year. In 1995, while serving as a Commanding Officer at the Basic Military Training Center, MAJ Ng attended and graduated 3rd in class from the Company Tactics course. He was then assigned back to the First Battalion, Singapore Infantry Regiment first as a Officer Commanding of an active company. After graduating second in class in the Battalion Intelligence Officer's Course, MAJ Ng was assigned as Battalion Intelligence Officer (S2) in the same unit. Incidentally, the First Battalion, Singapore Regiment won the coveted SAF Best Combat unit that same year. He moved on the next year as an officer instructor at the School of Military Intelligence. In June 1999, MAJ Ng was selected to join the Army Planning Branch and was reassigned to the Naval Postgraduate School where he received a Master of Science in Systems Integration. Upon Graduation, MAJ Ng was reassigned to the Headquarters Ministry of Defense, Singapore where he will serve as an Army Weapons Staff Officer. MAJ Ng's Awards include the Good Conduct Medal and the Jungle Confidence badge.

Captain
Thomas M. Fugate

Captain Fugate joined the U.S. Army in the December 1984. During his enlistment, he served as an Infantry Team Leader and Anti-Tank Section Leader at Fort Ord, California. In May 1988, he left active duty for the California Army National Guard where he served for three years while attending college and the ROTC program at the California State University in Chico, California. A Distinguished Military Graduate, Captain Fugate received his Regular Army Commission in May 1991. Following Flight School, Airborne, Air Assault, and Ranger Schools, Captain Fugate reported to the 2nd Infantry Division in Korea where he served as an Aero-Weapons (AH-1 Cobra) Platoon Leader in 5-17th Cavalry. In 1993 Captain Fugate returned to Fort Rucker for the Apache Qualification course and reported to the 24th Infantry Division at Hunter Army Airfield and Fort Stewart, Georgia. Captain Fugate served as an Attack Helicopter Platoon Leader (AH-64 Apache) and Battalion S-1 in 1-24th Aviation until June 1996. Following the Aviation Officer Advanced Course, Captain Fugate and family reported to 1-4th Aviation Regiment at Fort Hood, Texas in December 1996. He served initially as the Assistant Battalion S-3 and later Commander, Bravo Company, 1-4 Aviation. In June 1999, Captain Fugate was selected to serve in the Army Acquisition Corps and was reassigned to the Naval Postgraduate School where he received a Master of Science in Systems Integration. Upon graduation, CPT Fugate was reassigned to Fort Rucker, Alabama where he is serving as an Army Aviation Combat Developer. Captain Fugate's awards and decorations include the Meritorious Service Medal, Army Commendation Medal, the Senior Army Aviator Badge, Ranger Tab, Airborne and Air Assault Badges. Captain Fugate is married to the former Diana Hankinson, a Registered Nurse from Enterprise, Alabama. Their children are Ian and Hannah.

Captain
LO Weng Wah Christopher

CPT Lo enlisted in the Singapore Army in March 1990 and was awarded the second best trainee in Delta Company for Basic Military Training (BMT). Upon completing BMT, CPT Lo was selected for Officer Cadet School where nine months later he was commissioned as an Infantry Second Lieutenant. In March 1991, CPT Lo became a Platoon Commander for Delta Company, Platoon 16 in the School of Basic Military Training. Following this stint, CPT Lo was awarded the Singapore Armed Forces Military Training Award to pursue his undergraduate studies and professional development at the United States Military Academy at West Point. While at West Point, CPT Lo completed Air Assault and Rappel Master School. He graduated in 1995 seventh in a class of over 1000 and was a Distinguished Graduate in Bachelor of Science (Engineering Physics). As an undergraduate, CPT Lo was also a nominee for the 1995 Rhodes Scholarship. He completed the Field Artillery Officer's Conversion Course in February 1996 with top honors and was assigned as a Battalion Recce Officer with the 23rd Battalion, Singapore Artillery. In December 1998, he held his Battery Command in the 24th Battalion, Singapore Artillery. Accorded the SAF Postgraduate Award in September 1999, CPT Lo received his Master of Science in Systems Integration degree at the Naval Postgraduate School in Monterey, California in March 2001. Upon graduation, CPT Lo returned to Headquarters Singapore Artillery to assume the appointment of Weapons Staff Officer. Captain Lo's awards and decorations include the Good Conduct Medal, National Defense Service Medal (US), and the Air Assault (US) and Airborne Badges. Captain Lo is married to the former Tan Ai Lin, a homemaker. They were recently joined by their daughter, Ashley, who was born in November 2000.

CHAPTER 4 - AUSTRALIA

Australia 2021: Defense in the Era of Growth

Executive Summary

During the past 20 years, Australia's role in international affairs has grown. At the beginning of the 21st century the leadership role in Southeast Asian affairs was undertaken. The past two decades have been marked by vast increases in wealth for many Pacific Rim nations. Australia was a major participant in this economic renaissance with a Gross Domestic Product (GDP) growth rate between 3 and 4.5% since the year 2000. This unprecedented period of sustained growth was facilitated by a variety of factors including increased trade, knowledge sharing, emerging technologies and effective governmental policies. This growth created a unique opportunity for a defense force built to accomplish the country's national goals and objectives.

The defense of the homeland has always been the primary task of the Australian Defense Force (ADF). While this objective did not appreciably change during the last 20 years, the ADF was directed to undertake additional chores. Responding to the challenges of the 21st century and the global economy, Australia added the prevention of the spread of weapons of mass destruction (WMD) and the maintenance of key Sea Lines of Communication (SLOC). Coalition operations and Military Operations Other Than War (MOOTW) were emphasized in the Defense White Paper of 2000 and were a recurring phenomenon in the Pacific Rim.

The force structure that arose from the Defense Ministry's vision was systematically designed for difficult joint, combined, and low intensity environments. The structure notably served the nation well in the United Nations-sponsored operation in Irian Jaya in the year 2015.

To accomplish the goals established in the Defense White Paper of 2000, the percent of defense spending as a total of GDP was increased from 1.9% to 2.45% in the first epoch. Figure (1) illustrates the GDP growth and the percentage spent on defense over the 20-year period.

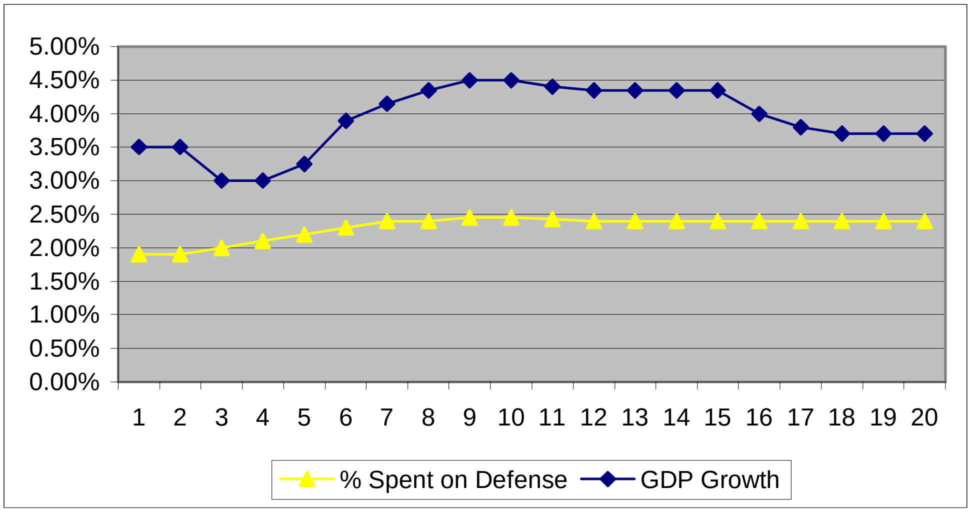

Figure 1. GDP Growth and % Spent on Defense

Additionally the allocation of funds was changed to leverage monies into the building of new systems. The current operations budget decreased over the period 2000-2010. Funds were reallocated to the future procurement and Research and Development (R&D). As the size of the force structure and the demands on it grew, it became apparent that a larger percentage of the total budget would be required to be reallocated to current operations. In the year 2020 the allocation by function was similar to the base year of 2000. This is illustrated in figure (2).

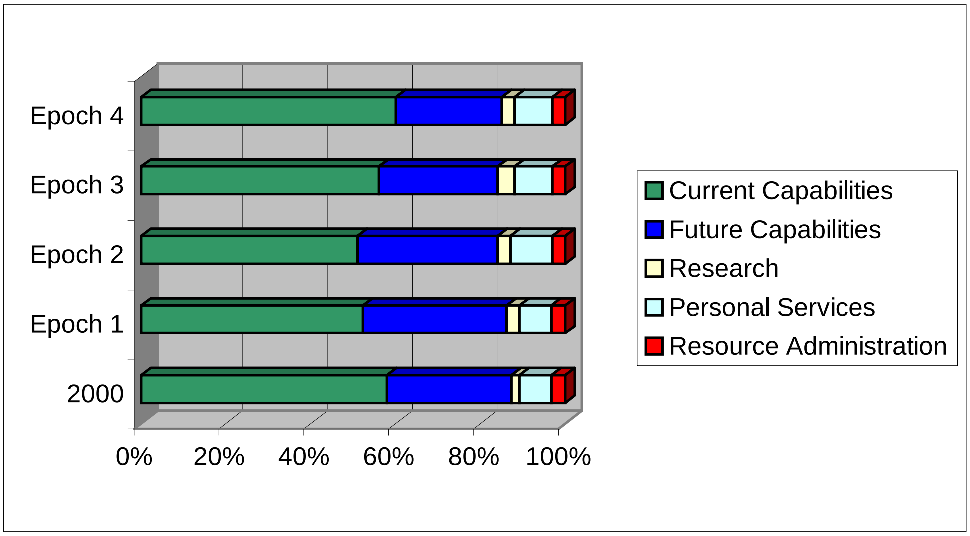

Figure 2. Broad Function Allocation

Australia's position as a smaller nation has always required linking their security strategy to the global powers. The Defense White Paper of 2000 put forward the concept of the Howard Doctrine, which closely aligned Australia to the interests and objectives of the United States. This role was revised during the past 20 years as a result of world events, including a hollowing of the US presence in the Pacific Rim. Multiple operations in all corners of the globe combined with slowing economic growth and public sentiment for reducing defense spending have caused a retrenchment of the US military in the region. The reunification of the Koreas and the subsequent removal of US troops from that region and from southern Japan have caused a relative vacuum. In the same period, China's increasingly hegemonic claims and actions have also been a cause for concern to Australia. Their increased presence in the South China Sea (SCS), their basing intentions in the Philippines and their most recent overtures to the unstable government of Indonesia have extended their reach to new extremes.

The Indonesian instability has continued into the 21st century. Most recently the breakaway province of Irian Jaya was occupied in 2015 by an Australian-led peacekeeping force. The archipelagic waterways have been threatened as a result. These SLOCs have taken on increased significance in recent years as Australia's exports of energy resources and iron ore to Japan have greatly increased. This maritime problem remains one of Australia's primary concerns.

Force structure is complicated. Military planners must tell the national leadership what tasks the military force can and cannot do. The vulnerabilities or weaknesses of the force structure can be addressed via future planning scenarios in order to identify alternatives to eliminate or mitigate each of the vulnerabilities. This process comes full circle when the newly acquired systems are pitted in combat against an adversary.

Australia does not possess the resources necessary to tackle every issue and problem and must look for financially responsible solutions. The lack of robust industrial base and/or R&D in some areas means Australia can't indigenously produce some military systems. Accordingly, Australia has linked itself closely with the United States for procurement of modern military systems. Australia benefits from this arrangement by receiving military systems without the associated high cost of development and the United States benefits by having a strong, interoperable ally in the Asia Pacific region.

Over the series of epochs, Australia produced an order of battle that supported the national and military strategies and was effective against postulated threats. The first epoch was characterized by the continuation and modernization of existing systems. With this solid foundation in place, the second epoch embarked on a plan to expand military capability and size. The third epoch realized even greater capability and expansion of the force and infrastructure. The final epoch saw the introduction of state-of-the-art technology in laser systems for maritime and air defense.

As a result of the 20-year development, the ADF force structure fully supports the nation's military strategy. Two key insights have become apparent. The first insight is that the ADF is a modern force with a demonstrated level of lethality and firepower. These attributes allow the ADF to operate autonomously within 1000 NM of the northern Australian coast in support of their national interests and those of their allies.

The second insight is that Australia offers attractive basing for the United States in the Pacific. With relative stability in Northeast Asia the dominant theme in 2020 and beyond, the focus of future military operations is likely to spread to Southeast Asia and Indonesia. As a hedge, the northern port facility of Darwin was developed to support such a basing plan. Ship berthing facilities were expanded to support the additional ships and assets from a United States carrier battle group. This expansion includes deep draft capability for the carrier and other major assets from the battle group. The infrastructure was also modernized to support troop basing, training, and operations as well as the aircraft from the carrier battle group. To protect these valuable resources of Australia and the United States, the air defenses surrounding Darwin are laser-based systems capable of intercepting short and intermediate range surface-to-surface missiles, cruise missiles, and aircraft.

Australia offers many capabilities in the future. Close cooperation with allies can expand the reach and influence of the ADF beyond the inner arc in support of multinational and coalition operations. In short, Australia is poised and ready to support military operations throughout the Pacific.

The development of the net assessment scenarios has provided useful examinations of the Australian military force structure in regional contingencies. The scenarios were developed based on two spheres of influence in terms of range. These two spheres are separated into the inner arc within 1,000 NM of Australia's shoreline and the outer arc as shown in figure 3.

Figure 3. Inner and Outer Arc

During the first epoch, the ability of Australia to project forces into the outer arc was limited to frigate-sized surface vessels and its Collins-class submarine. The distance involved also removed any ability to project air power. Within the inner arc, there are growing problems in Indonesia and a need to project military forces to regional hotspots like East Timor and Irian Jaya. Land force capability to deal with Indonesia was lacking at the beginning of this time period. The land force capability was beefed up with the introduction of the 21st Century Soldier concept to enhance the fighting capability of individual troops.

To enhance the force projection capabilities of the military in the outer arc, Australia procured Spruance class destroyers during the second epoch. Even with this procurement, Australia realized the limitations in conducting military operations at extended ranges. The successful conduct of operations in this sphere requires close cooperation with regional powers.

In the third epoch, Australia focused on maintaining its economic lifeline by protecting the SLOCs within the inner arc. This requirement stems from China's military expansionist behavior in the South China Sea, threatening major SLOCs through the region. Australia offers an alternative SLOC through Darwin and can provide maritime security within the inner arc. Advanced maritime assets like the introduction of the new Howard-class Aegis destroyers and the F/A-18 E/F Hornet fighters sealed Australia's authority as a regional maritime power.

Australia also developed an amphibious assault force to fill a capability gap for force projection to regional hotpots. This force comes in the form of two Marine brigades and their associated amphibious vehicles and tilt-rotor aircraft.

By the fourth epoch, Australia raised two additional infantry brigades to further enhance regional force projection capabilities. Australia addressed its SLOC security requirements with its advanced maritime force. In its participation in military activities in the outer arc, Australia continues to rely on cooperation with regional allies to maintain security.

In terms of technology R&D, Australia is in a unique position given its large landmass but relative small population and GDP. As such, Australia specifically chose to explore and capture certain technological niches for an edge both in the economy and military. The focus is on building technologies that incorporate existing strengths.

The Howard doctrine encourages an intimate defense relationship with the United States. Australia’s R&D into future capabilities is very much developed along the line of US military technology. As a result of this and limited resources, Australia specifically chose to develop technology niches in energy storage and supply technology as well as space launching capabilities.

In the first epoch, initial technology feasibility studies of nanotechnology, space launching technology, high-density energy storage and supply, and new energy resource technology were initiated. These initial studies led to more comprehensive studies into space launching technology and energy R&D.

In the second epoch, Australia's initial investment in space launching infrastructure in Cape York, Melville Island and Christmas Island was completed in 2008 with the commencement of commercial launching projects following shortly thereafter. Concurrently, R&D into electro-magnetic assisted launch continued. R&D into remote sensing resulted in the ability to image and map offshore oil reserves. This capability, coupled with the lower cost of deep sea drilling and the consistently high (US $30 per barrel) price for oil, fueled the aggressive export of oil to Japan, China and other Asian countries. Australia also realized a breakthrough in photovoltics technology causing a shift in the internal energy requirement of Australia from less than 10% solar energy to 50% solar energy allowing export of energy resources to other countries. Additional breakthroughs in fluidized-bed technology for coal burning resulted in an aggressive development of coal as a source of energy. High-density liquefied natural gas (LNG) transportation was yet another export. Looking forward, Australia also continued R&D of energy storage and supplies concentrating on quartz technology, fuel cell and photovoltics.

In the third epoch, the electro-magnetic assisted launch ability was realized, reducing per launch costs by utilizing solar energy. Energy R&D breakthroughs in quartz technology allowed the development of high-density storage, thus providing the ability to power small commercial and military equipment. Increased efficiency in fuel cells also led to widespread use in automobiles, miniature airframes, and military systems.

In the final epoch, Australia's R&D was in three key defense projects. The first project was a High Energy Laser (HEL) missile defense system codenamed DPAMDS (Darwin Port Anti-Missile Defense System). DPAMDS is essentially a two-tier system consisting of the upgraded version of the HEL and tactical HEL previously available in the US and Israel in 2000.

This upgraded version incorporates Australia's new niche in energy storage and supply technology and produces an enhanced range. The second key military project was Project BOLDEAGLE, a R&D effort to acquire the technological capability of developing a Theater Ballistic Missile (TBM) defense system using airborne lasers and/or ground Free Electron Lasers (FEL). The third key project undertaken by the ADF was the integration of a diode pumped solid-state laser anti-ship missile defense system on the existing fleet of frigates and destroyers. This project, codenamed STINGRAY, provides an unlimited defense against anti-ship missiles. Besides giving the Navy a quantum leap in anti-ship missile defense, the project also serves to operationalize the ADF in fighting with directed energy weapons.

Twenty years of development for Australia has highlighted a number of issues and insights. On the geopolitical scale, the geographic isolation of Australia coupled with relative economic self-sufficiency provides a buffer zone from the perils of globalization. Additionally, Asia will be the primary world focus in the coming era. Finally, small nations must accurately assess the participation of global powers in key theaters to formulate a defense force that is able to project power beyond a minimal range. The actions of the "elephants" greatly influence the decision making process of the smaller and less influential nations.

Economically, nations with a relatively small GDP, population, and industrial base must focus on specific niches in R&D or the entire effort will be diluted. Australia's significant investment and expertise in energy resource and supply technology enhances its position in the world. The investment in R&D infrastructure will allow Australia to leverage new technologies for commercial and military applications.

On the force structure front, a mix of revolutionary, evolutionary and legacy systems will exist at any given time and challenge the abilities of the force planner to integrate these systems seamlessly. The ADF modernized throughout the 20-year period, and although small by China and US standards, the ADF is a presents a capable and formidable force. The technological advances of the 21st century in information technology and weaponry make the ADF seem larger than it really is. Accordingly, the advance in ability to conduct a wide range of operations may be viewed as an increased capability to conduct multiple or simultaneous operations. As a result, the final Australian force structure may become overextended during multiple operations in widely separated theaters. The government and its leaders must be careful to only assume those operations that are a direct threat to or of interest to Australia and avoid the "able to do all" mentality. Australia has confirmed that alliances and coalitions still are an integral part of the nation's national security strategy in spite of possessing a modern and lethal force. Finally, future operations will entail the protection of SLOCs throughout the Asia Pacific region. Australia's ability to influence and control the SLOCs will be key to maintaining these vital lanes open for all nations. Basing at Darwin may be an important capability for the US in the future.

A. Epoch One (2000-2005)

1. Australian Security Environment in the Year 2005

The dawn of the 21st century heralded important changes for the Australian Defense Force. The Defense White Paper of 2000 contained guidance, which in many ways increased the scope of potential tasks to be performed by the ADF. The alliance with the United States was emphasized as a key tenant of the new vision. Our role as the US deputy in the region was buoyed by the new US administration in the early part of the epoch. Secretary of State, Colin Powell was quoted as saying, "In the Pacific we are very, very pleased that Australia… has displayed a keen interest in what is happening in Indonesia. And so we will coordinate our policies, but let our ally, Australia, take the lead as they have done so well in that troubled country."[1] The support of the Bush administration for the Howard Doctrine has further solidified the vision put forward in the Defense White Paper. Accordingly changes to operational doctrine and future force development were undertaken.

Operationally, joint combined operations were emphasized and trained for intensively. The land and maritime forces participated in a variety of exercises with US, Japanese and other regional armed forces helping to solidify and consolidate tactics and system compatibility issues. Joint service teams addressed the issues of terrorism, cyber-war and narcotics trading. These teams were charged with developing various scenarios and vulnerabilities with the aim of minimizing potential damage and risk. Their conclusions have become the basis for the development of future doctrine and training for all members of the ADF in their respective areas.

The other objectives of the ADF were also pursued. These objectives were prioritized by region by the Defense White Paper of 2000 and are illustrated by Figure (4). The inner arc

[1] Colin Powell in US Senate Confirmation Hearing. January 2001.

region primarily contains the nations of New Zealand, Papua New Guinea, Fiji and Indonesia. This region is key to Australia's domestic security as a significant portion of our trade flows through the SLOCs in the region.

The instability of Indonesia in recent years has caused significant concern. As stated in the White Paper, "Australia cannot be secure in an insecure region." [2]

Figure 4. Australia's Defense Priorities[3]

The ASEAN nations remained an important secondary priority for the ADF. With the size of our armed forces, we cannot expect to play a major role in affecting events in the region beyond the inner arc. Future military capabilities may someday allow us to effectivly operate at these ranges.

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[2] Commonwealth of Australia, *Defense 2000, Our Future Defence Force*, December 2000, p. 29.
[3] Unattributed. *Australia Aims for Active Security Role in Asia Pacific*, Stratfor.com, December 22, 2000.

2. Economic Development and Defense Spending

a. Policies of Growth

Australia's Economic Ministry made some fundamental changes in this epoch designed to set the economy on a course for sustainable growth. The use of diplomatic channels to establish trade relationships and agreements was one tool. The opening of import and export markets has already demonstrated benefits in the form of new markets, comparative advantages and economic efficiencies for all nations.

Additional monetary and fiscal policy measures were instituted with the aim of producing sustained growth. Short-term lending rates and the money supply were tightly controlled so that investment was stimulated but without significant inflationary pressures. The increased defense and entitlement spending was a net positive for the economy.

Information system efficiencies were felt as Australian businesses became more adept at lowering overhead and automating many functions. Retraining programs for displaced workers were also introduced with the aim of filling the demand for trained technology workers.

Labor demand for these technology workers was one area that was identified as a limit on future growth. Along with educational initiatives at the elementary and secondary levels and worker retraining, the Australian government relaxed immigration quotas for skilled workers. This program was successful in drawing talent from many nations including India, Malaysia, Indonesia and China. The relaxation of the immigration quotas must be carefully monitored to ensure the needs of our growing nation and economy are met without overburdening the entitlement system.

b. Growth Results

The growth of the economy in the first epoch was between 3.0% and 3.5% with a slight downturn in the years 2002 and 2003. This retrenchment was as a result of general global economic malaise driven by a slowdown of economic growth in the United States. This indication of a business cycle effect was short lived as a relatively quick recovery was noted both in the US and in the international community. Figure (5) illustrates the Australian economic growth by year and the percentage of GDP allocated to defense during the time period.

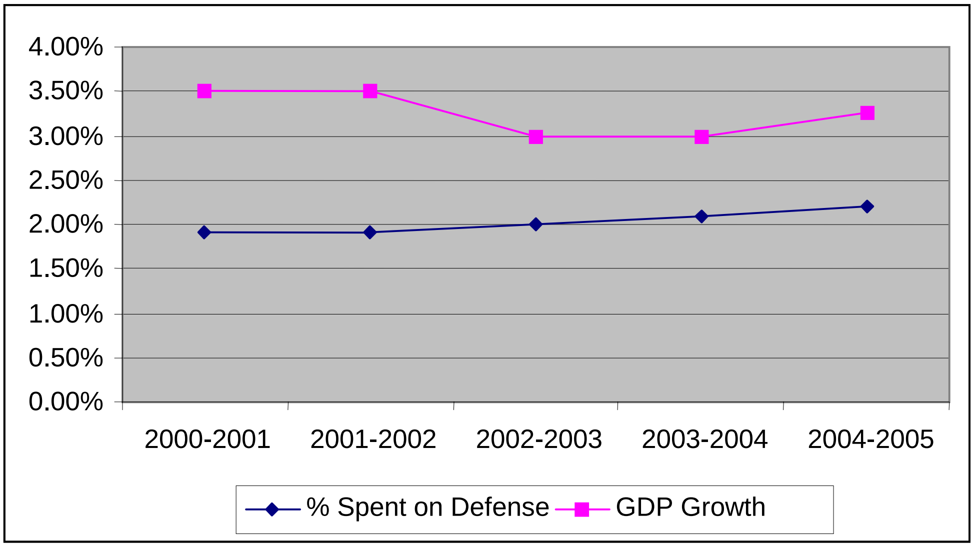

Figure 5. GDP Growth and % Spent on Defense

c. Cost Cutting and Budget Reallocation in the ADF

The leadership of the ADF elected to undertake some difficult steps to secure a credible force. These fundamental changes targeted wasteful policies in the areas of personal services and administration and also shifted some funds from the current operations to future capabilities budget. In 2000, 57.9% of the entire defense budget was allocated to current operations and 29.3% to future capabilities or system procurement. By comparison, at the end of the epoch, only 50% was allocated to current operations and 35.7% to procurement. This reduction in the current operations budget allowed the modernization of the force. This action was undertaken only after careful assessment of the near-term impact and probability of war. The essentially secure geographical nature of Australia combined with a lack of credible threat in the region made this course of action best suited to meet the long-range goals. The absence of a major conflict in the last decade has supported the wisdom of this decision and several large leaps in capability were made in this epoch as discussed in detail in the force structure section below.

3. Australian Force Structure 2005

The force structure of the ADF at the end of the first epoch is a result of the 2000 Defense White Paper, previously initiated programs and projects, and efforts to resolve identified capability weaknesses. For the most part, changes to the Service's force structure were a result of previously initiated programs and projects.

As part of the study, static net assessments were used to evaluate one military force against another in a given scenario. Vulnerabilities identified as part of this process will be used to highlight the changes necessary in the force structure to mitigate or eliminate the vulnerability.

In the case of Australia in the year 2000, the ADF faced several weaknesses and vulnerabilities in each of their military components. These vulnerabilities were addressed as part of the military force planning effort in the first epoch. Accordingly, the force structure for the individual service components of the ADF is discussed below. As a manner of practice, the vulnerabilities identified for each service component will be discussed followed by the service order of battle, trends, and the rational behind any changes.

a. The Royal Australian Navy (RAN)

For the RAN, the vulnerabilities identified as a result of the 2000 Defense White Paper are:

(1). Anti-ship missile defense for ANZACs

(2). Long range air-defense capability

(3). Limited replenishment capability

(4). Submarine platform and combat systems

(5). Patrol craft are aging

(6). Limited amphibious lift capability.

In an effort to address these issues, several programs were initiated. Specifically, the ANZAC class of frigates underwent an improvement in its anti-ship missile defense and the Harpoon missile system was introduced.

The Collins submarine program included engineering and system changes to reduce platform noise and correct the combat systems deficiencies. The weapons capability was also enhanced through the procurement of the Mk-48 ADCAP or Advanced Capability torpedo. This weapon offers an increased weapons range at higher search speeds via digital signal processing. These improvements resulted in the Collins being one of the most advanced diesel electric submarines in the world.

The Navy force structure for 2005 is provided below.

(1). Surface Combatants

- (a). 6 FFG
- (b). 8 ANZAC FF
- (c). 15 Patrol Boats (PB)
- (d). 2 oiler/replenishment ships
- (e). 1 Heavy Amphibious Lift Ship (HALS)
- (f). 2 Amphibious Lift (LPA)
- (g). 15 Landing Craft Medium (LCM)
- (h). 6 Landing Craft Heavy (LCH)

(2). Mine Warfare

- (a). 2 Inshore Mine Countermeasure ships (MCM)
- (b). 6 Huon-class MCM
- (c). 2 Dive Teams

(3). Submarine Force

(a). 6 Collins-class SS

(4). Navy Air

(a). 16 Sea Hawk helicopters

(b). 7 Sea King helicopters

(c). 10 Super Sea Sprite helicopters

(d). 19 P-3C Orion maritime patrol aircraft

Australia's remaining guided missile destroyer (DDG) was decommissioned in 2001 after a 35-year service life. The loss of this ship removes the only RAN)three-dimensional surveillance radar from the maritime forces and exacerbates the poor air defense and surveillance capability of the RAN.

The ANZAC frigate production line started in the late 1990s resulted in a total of ten ships being constructed. Eight of these ships went into the RAN and the other two ships went to the New Zealand Navy. All ANZAC frigates in the inventory were outfitted with the latest anti-ship missile defense systems and the Harpoon offensive anti-ship missile.

Four additional Huon-class minesweepers were added to the inventory. The Huon-class minesweeper is considered to be one of the most advanced ships available.

The Collins submarine construction program resulted in three additional ships being added to the inventory. These modern submarines are equipped with the latest torpedo and fire control systems and have proven to be an excellent platform for countering the proliferation of modern diesel electric submarines. The remaining Oberon-class submarine was decommissioned in 2001.

As an integral part of the surface ship procurement process, helicopters were purchased to serve as deployable assets on those platforms. A total of ten Super Sea Sprite helicopters were purchased to equip the ANZAC class frigates with anti-submarine capability. The anti-submarine capability of the P-3C Maritime Patrol Aircraft (MPA) was upgraded with the introduction of the MK-50 torpedo, an advanced lightweight torpedo.

As a result of the 2005 force structure, the fleet is still faced with the lack of long-range air-defense ships. Current studies are focusing on the development of such a ship that will be producible in Australia. Additionally, the replenishment and amphibious lift capability of the fleet remains an issue of concern. Finally, the replacement of the Fremantle patrol boat was postponed until the second epoch.

b. The Australian Army

For the Australian Army, the vulnerabilities identified as a result of the 2000 Defense White Paper are:

(1). Army's small size

(2). No heavy armored force

(3). Slow modernization of equipment.

As identified in the 2000 Defense White Paper, the size and constitution of the Australian Army is small as compared to its nearest neighbors. This small size is considered adequate given that Australia faces no significant conventional threat on the ground. Accordingly, the focus of the army has shifted to MOOTW and coalition operations. While the army may be small, significant improvements were instituted to provide the latest technology improvements for the individual soldiers as well as for their vehicles, equipment, and firepower.

As an armored force, the army has few heavy tanks and artillery. Again, a large armored force is not necessary given the threat, use of the army, and the cost associated with maintaining heavy armor capabilities. Accordingly, the army will retain its current armor capability and does not expect to expand it in the future. Australia believes light forces suitably equipped and supported will be sufficient for the types of military operations it expects to be involved in as well as capable of homeland defense.

The Army force structure for 2005 is provided below.

(1). Special Forces (1 regiment SASR/1 Commando regiment)

(2). Mechanized Force (1 brigade)

(3). Light Infantry Force (1 brigade)

(4). Motorized Infantry Force (1 brigade)

(5). Army Aviation Force

(6). Ground-Based Air Defense

(7). Combat & Logistics Support

(8). Army Reserve Force

(9). Army Aviation (helicopters)

(a). 36 S-70A Black Hawk

(b). 6 CH-47D Chinook

(c). 25 UH-1H Iroquois

(d). 43 Kiowa Light Observation

(e). AS305BA Squirrel

(f). 24 Apache Armed Reconnaissance

(10). Air Defense

(a). 12 RBS-70 laser guided firing units (b). 10 Patriot firing units

(11). Reserve Units

(a). 11^{th} Brigade (North & Central Queensland)

(b). 4^{th} Brigade (Victoria)

(c). 5^{th} Brigade (NSW)

(d). 8^{th} Brigade (NSW)

(e). 9^{th} Brigade (SA & Tasmania)

(f). 13^{th} Brigade (WA)

(12). Reserve Surveillance Units

(a). Northwest Mobile Force (NORFORCE)

(b). Pilbara Regiment (WA)

(c). Far North Queensland Regiment

The size and composition of the army's mechanized, light infantry, and motorized infantry forces remained the same from 2000 to 2005. The major changes in the army's forces are in the areas of equipment modernization, aviation and air defense.

For the individual soldiers, an entire modernization program, dubbed the 21^{st} Century Soldier, was started to supply the latest in body armor, weapons, night vision goggles, and communications equipment.

To support these soldiers, an extensive upgrade to the army's armored personnel carriers was developed. This program involved modifying M113A1 vehicles to an M113A3 standard. The modifications provide significant improvements to the vehicle's firepower, protection, mobility and habitability.

To further support the infantry soldier, additional purchases of the Bushranger Infantry

Mobility Vehicle (IMV) and the Australian Light Armored Vehicle (ASLAV) were executed. These vehicles provide a range of operational mobility to the soldiers in the mechanized and motorized infantry brigades. Additionally, shoulder-fired weapons were added to the inventory to bolster the offensive firepower against armored vehicles, bunkers, and buildings.

In the aviation branch, the procurement of Apache armed reconnaissance and attack helicopters supplemented the capability previously provided by the Kiowa and UH-1 helicopters. The Apache will provide battlefield reconnaissance and aerial fire support. It will have a nose-mounted cannon as well as pod-mounted rockets, air-to-ground missiles, and an extensive electronic warfare self-protection suite. In all, the expansion of the helicopter fleet will enhance future battlefield firepower and the mobility of troops in the field.

The army's air defense capability was significantly improved through the introduction of the Patriot missile system. The Patriot system supplements the RBS-70 system and replaces the Rapier system currently in the inventory. The Patriot system, with eight launchers in each firing unit, provides 32 missiles and their associated radar and tracking systems for air defense purposes. The addition of the Patriot ensures that Australia has the most capable air defense systems available to support and defend its troops and infrastructure, either at home or abroad.

In 2005, the army will be a light force with limited heavy armor capability and resources. Given the types of operations Australia expects to undertake over the coming decade, this vulnerability is offset by the improvements to the soldiers and their equipment. This light force is better equipped and positioned to integrate with other coalition forces in support of operations in the region while providing firepower sufficient to ensure homeland defense. The army continues to struggle with the role and composition of the reserve forces.

c. The Royal Australian Air Force (RAAF)

For the RAAF, the vulnerabilities identified as a result of the 2000 Defense White Paper are:

(1). Limited air combat capability with respect to regional defense forces (modernization issue)

(2). Aging of air-to-air refueling

(3). Long-term replacement for F/A-18 and F-111

The RAAF faces modernization issues on several fronts. Specifically, the relative air combat capability of the F/A-18 fleet with respect to regional forces is expected to lag without considerable upgrades. Also, the ability to support the air combat mission as well as the strike mission will be severely curtailed unless a replacement air-to-air refueling aircraft is not obtained. And finally, the replacement aircraft to conduct the air combat and strike role in the 2012 to 2015 timeframe is unknown. To address these issues several upgrades and new procurement initiatives were implemented.

The resulting RAAF structure 2005 is provided below.

(1). 71 F/A-18 Hornet

  (a). 53 A, 18 B

(2). 35 F-111

  (a). 21 C, 14 G

(3). 24 C-130 Hercules

  (a). 12 H, 12 J

(4). 14 DHC-4 Caribou

(5). 4 AEW&C Boeing 737-700

(6). 5 Boeing 767 Tankers

(7). EWSP upgrades for all air platforms

(8). Trainer fleet

To address the air combat modernization and capability issues, the F/A-18 Hornets were upgraded including the installation of new and improved radar, advanced air-to-air missiles, advanced tactical data links, and helmet-mounted cueing.

The strike capability inherent in the F-111 platform is valuable, but the platform is aging and will require replacement. A suitable replacement platform for this aircraft that specifically meets the needs of Australia may become available in the future. In order to maintain the F-111 as a capable platform, several enhancements and improvements were initiated. These include the acquisition of standoff weapons and electronic warfare self-protection systems. These improvements will make the F-111 a viable asset into the near- to mid-term future.

The most crucial addition was the Airborne Early Warning and Control (AEW&C) aircraft. The AEW&C aircraft provide early warning, surveillance, command and control, and air-defense warning for our surface ships and fighter aircraft. In short, these aircraft give the ADF the capability to maintain the tactical picture throughout a theater engagement.

The replacement of the tanker fleet was addressed with the procurement of five Boeing 767 tanker aircraft. These aircraft provide the critical air-to-air refueling capability of the entire air force inventory. Without this capability, the best aircraft in the world are limited in their ability to operate without restrictions.

To ensure their protection, an extensive electronic warfare self-protection system (EWSP) was developed for all the aircraft. This system provides the latest protection available against the emerging threats to aircraft. This enhancement is scalable in size and threat based, so adaptation to fixed-wing aircraft as well as to helicopters is achievable.

In 2005, the RAAF is well positioned to engage regional combat aircraft and achieve success. The improvements and enhancements to the F/A–18 Hornets allow the ADF to maintain pace with regional forces, but a replacement aircraft must be identified and purchased during the second epoch. The replacement of the F-111 must also be identified in the near term.

d. Information Capability

In the area of information, the vulnerabilities identified as a result of the 2000 Defense White Paper are:

(1). Limited indigenous intelligence capability (signals, imagery, processing, dissemination)

(2). Obsolete communications (harness growing IT innovations)

(3). Command & Control

The status of the country's Command, Control, Communications, and Computers Intelligence, Reconnaissance and Surveillance (C4ISR) capability was on par with other regional countries. In order to move Australia to the forefront of the area, significant improvements were initiated to improve information collection as well as the dissemination of that information and the associated command and control. Harnessing the quantum leap in information technology was the key to these improvements.

Additionally, in the area of communications and command and control, the ability to build a robust system to tie the battlefield elements together across the Services was determined to be a real challenge.

The Information Capability force structure for 2005 is provided below.

(1). Operational Command

(a). Deployable HQ (one)

(b). Communications (SATCOM, HF, Networks)

(c). Command and Information Management Systems

(2). Strategic Intelligence

(3). Strategic Surveillance

(4). Geospatial Information

(5). Hydrographic Survey Force

To ensure the ADF acts as a coherent unit during deployed operations, a deployable headquarters provides focused command and control functions for theater operations. Communication facilities and capabilities were upgraded in order to harness the latest in information technology. These communications systems include satellite-based communications as well as networked communications systems to tie the strategic and tactical battlefields together. The command and control system to link all of these elements together was an integral part of this development process.

In the areas of intelligence and surveillance, significant improvements were made. Cooperative efforts with the United States and the exploitation of new collection opportunities have provided an intelligence edge to the ADF. The introduction of the Jindalee Over-The - Horizon (OTH) radar and the AEW&C aircraft significantly improved the surveillance of the northern approaches. This provides a sustained 24-hour picture that can be fused with other information systems to provide an integrated national surveillance picture.

As with all networked information systems, the possibility of exploitation of the information by the enemy increases substantially as new systems are chained together. To combat this effort, investment in counter information warfare was initiated. It is expected that this investment will yield systems that are impenetrable by enemy information warfare. This will ensure the continuity and legitimacy of the information provided to the ADF forces.

In 2005, the challenge of the future will be maintaining pace with the changing information technology. Future costs and the derived benefits from a proposed change will determine the answer.

Note: The baseline forces and the construction and development plans discussed in this section were derived from the following sources. Due to the breadth of information, footnotes were not used.

Commonwealth of Australia, *Defence 2000, Our Future Defence Force*, December 2000

Department of Defence, Commonwealth of Australia, *Defence Review 2000 - Our Future Defence Force, A Public Discussion Paper*, June 2000

Department of Defence, Commonwealth of Australia, *The Australian Defence Force, Capability Fact Book*, June 2000

4. Scenarios for Static Net Assessment

a. Introduction

A Static Net Assessment (SNA) based on two likely scenarios to be faced by the Australian military is presented to determine if Australia's military structure projected at year 2005 can deal with the scenarios.

The first scenario takes place in the South China Sea during a combined maritime exercise between the US, Australia, and Japan. The heavy presence of military elements so close to their doorstep antagonizes the Chinese government. The Chinese leaders decide to stage a show of force in the region with military combatants dangerously close to those of the coalition forces.

The second scenario occurs in Australia's backyard. A military coup has occurred in Indonesia and the military regime quells resulting unrest in the populace. To divert attention from internal problems to a nationalist agenda, they attempt to reunite the Indonesian archipelago by taking back East Timor from the Western infidels. Once the Indonesian troops cross into East Timor, the United Nations (UN) peacekeeping force stationed there is quickly overrun. Although the Indonesian authorities try to limit the level of force, many casualties are taken on the UN side. The resulting international outcry calls for Australia to retaliate by taking back East Timor.

b. Scenario 1: Military Confrontation in the South China Sea (SCS)

Here, an Australian force of about four frigates with a Collins-class submarine join a SCS exercise along with the US and Japan.

Japan is providing continuous maritime surveillance with six P-3C MPA operating around the clock in the SCS. Two Kongo-class destroyers and a diesel submarine are also supporting the exercise.

The United States is providing the main force in the exercise with a carrier battle group (CVBG). The air power in the exercise is provided by the CVBG with up to 85 F-14s and F/A-18s. Two cruisers and a Spruance-class DDG are escorting the CVBG. Two nuclear submarines are also in the area of operations. The force contributions by each nation in the RIMPAC West exercise is as summarized:

(1). US CVBG

(a). 1 x CVN

i. 24 x RIM-162B, ESSM AAW missiles

(b). 2 x Ticonderoga-Class CG

i. 6 x Mk-46 ASW torpedoes

ii. 8 x Harpoon anti-ship missiles

iii. 22 x RIM-116B, RAM AAW missiles

iv. 83 x Tomahawk missiles

v. 39 x SM-2 missiles

(c). 2 x Arleigh Burke-Class DDG

i. 6 x Mk-46 ASW torpedoes

ii. 8 x Harpoon anti-ship missiles

iii. 90 x Tomahawk missiles

iv. 39 x SM-2 missiles

(d). 2 x Seawolf-Class SSN

i. 50 x Mk-48/Tomahawk weapons (8 tubes)

(2). Japan

(a). 2 x Kongo-Class DDG

i. 6 x Mk-46 ASW torpedoes

ii. 8 x Harpoon anti-ship missiles

iii. 90 x RIM-66C, SM-2MR, AAW/RUM-139A, VLA ASW missiles

(b). 1 x Oyashio-Class SS

i. 6 x G-11/2 ASW/Harpoon anti-ship missiles and torpedoes

(3). Australia

(a). 4 x Anzac-Class FF

i. 6 x Mk-54 ASW torpedoes

ii. 8 x RIM-162A ASuW/AAW missiles

(b). 1 x Collins-Class SS

i. 6 x Mk-48 torpedoes/Harpoon anti-ship missiles

China will have the luxury of proximity to the region and this advantage is clearly shown in its air force of some 400 jet fighters. Chinese forces are as summarized below.

(1). 4 x Luda Class DDG

(c). 6 x A244 ASW torpedoes

(d). 16 x C-801 AsuW missiles

(e). 8 x HQ-7 AAW missiles

(2). 2 x Soveremenny Class DDG

(a). 8 x TE-2 ASW/AsuW torpedoes

(b). 48 x SA-N-12 Grizzly AAW missiles

(c). 8 x SS-N-22 Sunburn AsuW missiles

(3). 2 x Kilo Class SS

(a). 12 x SA-N-8 Gremlin AAW missiles

(b). 2 x TEST 96 ASW torpedoes

(c). 4 x 56-65 KE ASuW torpedoes

(4). 1 x Han Class SSN

(a). 6 x SET-65E ASW torpedoes

The following table compares numerically and in aggregate the coalition forces versus those of China.

Country	**Aircraft**	**Surface Vessels**	**Submarines**
Australia	0	4	1
Japan	50	2	1
US	85	3	2
Coalition	135	9	4
China	400	6	3
Conclusion	*Inferior*	*Superior*	*Superior*

Table 1. Military Assets Comparison between Coalition Force and China

It can be seen that due to distance, projection of airpower by the coalition force is limited to carrier-based platforms. China can project its air power from land bases. Australia is predicted to be unable to provide any major air assets to any regional coalition operating outside 3000 NM from its borders. In the case of major surface combatants, the coalition force has a definite advantage, overall having three more vessels than China. Furthermore, the American and Japanese vessels are far superior in terms of technology to the Chinese vessels.

With only slight numerical advantage for submarines, the coalition leads the Chinese by one unit. Again, the coalition force's vessels are superior in technology and capabilities.

In summary, Australia's contribution in this scenario can be seen to be quite significant. In terms of surface vessels, Australia's assets makes up for close to 50%, but it is only in the form of frigates that are far less capable than the US and Japanese destroyers and cruisers. Its contribution of a Collins-class submarine is very significant as it shifts the balance between the coalition and the Chinese forces. All in all, the US may view an Australian alliance as significant in the region.

Additionally, the provision of air support by Australia in the region is limited. It is unlikely that this will change in the near future. The use of air-to-air refueling may alleviate the problem. However, we feel that Australia should still maintain its strategic priority, focusing on its interests within its inner arc.

c. Scenario 2: Indonesian Invasion of East Timor

The Indonesian army is comprised of over 200,000 personnel. Due to the unrest caused by the military coup, the military would be busy maintaining security throughout the archipelago. An infantry division is envisioned to be occupying and controlling East Timor after the initial invasion. Resupply of this force can be done relatively easily and economically via land from West Timor. Although not a heavy division, about 120 tanks and armored fighting vehicles are present on the island.

The likely Indonesian naval force in the region would be no more than six frigate-sized vessels and an older German diesel submarine (Type 209). The available air force comprises only 40 fighter aircraft. Overall, the maritime force of Indonesia presents a significant threat to any Australian task force attempting to project a forcible landing onto East Timor.

The most notable shortfall of the current ADF is the lack of significant ground forces. The best force available for insertion is comprised of a light infantry brigade (3rd Bde) and a motorized infantry brigade (7th Bde). These are not amphibious elements and landing them under hostile conditions would be very risky. Even if landed intact, they will face a severe threat from the Indonesian army division present on the island. The force on force ratio is a definite disadvantage for the Australian Army.

On the other hand Australian maritime assets are far superior to those of Indonesia.

Australia is likely to be able to obtain maritime superiority in the theater of operations. However, with the terrain in East Timor, the maritime assets can provide limited support for the land forces other than resupply. A long war will have significant disadvantages for the Australians. The following table compares the Australian and Indonesian forces.

Country	**Army Pers**	**Tanks/AFV**	**Surface Vessels**	**Aircraft**	**Submarines**
Australia	6,000	40	12	104	3
Indonesia	10,000	120	6	40	1
Conclusion	*Inferior*	*Inferior*	*Superior*	*Superior*	*Superior*

Table 2. Force Comparison between Australia and Indonesia

In summary, the use of army troops is a crucial ingredient in taking back East Timor. As the Australian force is not amphibious, landing these troops would be highly risky. Nevertheless, with superior maritime assets, it is believed Australia can execute a successful landing provided the insertion of special forces (SAS and Commando Battalions) to secure beachheads had been achieved, coupled with the attainment of maritime superiority.

In spite of a superior maritime force to facilitate a successful landing, Australia is unlikely to succeed in a long land campaign to forcefully retake East Timor. Australia believes this confrontation can only be successful with external intervention and support. The availability of US Marines to secure the landing areas would be most helpful.

5. Technology Niches and R&D Report

a. Introduction

In terms of technology R&D, Australia sees herself in a unique position, given its large landmass but relative small population and GDP. As such, Australia specially chose to explore and capture certain technological niches that provide an edge both in the economy and military. The focus is on building technologies that incorporate existing strengths. Such technology will be developed with the intent of establishing a technological edge for both commercial and military application.

These technological niches will provide Australia with huge commercial and economic benefits as well as quantum leaps in military capabilities in the future. The technology R&D will be a joint effort between the Defense Science and Technology Organization (DSTO), commercial sector and foreign partnerships and collaboration.

Australia's technology R&D approach revolves around three key ideologies. The main thrust of the R&D efforts are the national R&D projects, which serve to boost our economy and technological expertise, however, in specific cases, these would also allow Australia to incorporate new technology into their military equipment, thus enhancing military capability.

The second ideology is being attributed to the Howard doctrine, which encourages an intimate defense relationship with the US. As such, R&D into future capabilities is very much developed along the lines of US military technology.

Finally, given the country's limited resources, Australia specifically chose to develop technology niches in energy resources technology (storage and supply) as well as space launching capabilities.

b. Initial Feasibility Studies

In the first epoch, initial technology feasibility studies were initiated in the following broad areas: nano-technology, specifically the customization of advanced smart materials; space launching technology including electromagnetic launch, trans-atmospheric flight and laser propulsion; high-density energy storage and supplies technology including silica gel energy storage as well as new generation fuel cell; and finally, new energy resource technology such as remote sensing, deep sea drilling, photovoltics, 'clean' burning of coal, and high-density transportation of Liquefied Natural Gas (LNG).

In each of the specific technological niches, the following factors were examined for feasibility:

(1). Related/specific area of technology advancement

(2). Significant military impact

(3). Significant commercial impact

(4). Possible R&D partners

(5). Examples of specific application

(6). Projected annual budget

(7). Projected industry worth

(8). Project timeline and milestones

The findings of the feasibility study are indicated in Table (3) and a brief description of the various technologies is provided. The initial feasibility studies occurred from 2000 – 2002. Total investment in these studies was US$500 million of which DSTO contributed US$100 million, industry contributed US$150 million and private collaborations contributed US$250 million.

Table 3. Possible Technology Edge for R&D

Technology Niches	Related / Specific Area of Technology Advancement	Military Impact	Commercial Impact	Possible Partners	Examples of Specific Application	Projected Annual Budget	Projected Industry Worth
Launch Capabilities	Electromagnetic Launch Technology	Ability to launch military Sat rapidly and at low cost. Ability to deploy space based weapons and Trans-atmospheric vehicles.	Commercial launch industry for Sat. May lead to profitable space tourism. Possibility of space colonization	US, Japan, UK	Commercial and Military Sat and other Trans-atmospheric vehicles Launching Service.	300 million	1-2 billion
	Laser Propulsion	Eliminate engine hardware from Military Weapons.	Increases payload and weight in commercial vehicles.	US, Japan	New generation of compact Laser propelled air/space vehicles.	50 million	200 million
	Trans-atmospheric Vehicles	Reducing reaction times and minimizing periods of aircraft vulnerability. Ability to conduct strategic bombing, reconnaissance and Sat replacement mission	Permits global transportation.	US, Japan, UK, Germany etc	Hypersonic speed TAA for numerous military applications such as strategic bombing, RECON and Sat repair.	200 million	1-2 billion

	Solar Energy Technology	More efficient means of powering military equipment when coupled with proper storage.	Excellent source of power.	NA	Solar power military weapons coupled with efficient energy storage devices.	5 million	10 million
Nano-technology	Sintering of Advance Materials	Creation of advance materials customized materials for military applications e.g. high strength, low weight, high temperature resistance etc.	Advance material could be used for a wide variety of commercial applications.	US, Japan	Customized materials for military and commercial applications.	250 million	1 billion
High Density Energy Storage and Supplies	Extremely compact and practical high-density power supply.	Ability to power portable Direct Energy Weapon.	Reduction in size for commercial equipment, which requires high energy density to operate.	US, Japan	Compact batteries with the capability to power military weapons systems.	50 million	500 million

c. Detailed Studies

Results from the feasibility studies drove the focus of technology effort in two specific areas, space launching capability (commercial space launch facilities) and energy R&D (R&D into new energy resource technology and high-density energy and supplies). The detailed studies occurred from 2003 to 2005. The total investment in space launching capability was US$500 million of which DSTO contributed US$100 million while the industry and private collaboration contributed the reminding US$400 million. Energy R&D investments totaled US$250 million of which DSTO contributed US$100 million while the industry and private collaboration contributed the remaining US$150 million.

d. Technology Description

Nanotechnology[4] is the revolutionary area of science and technology. The science refers to the ability to manipulate individual atoms and molecules, making it possible to build machines using molecular building blocks or creating materials and structures from the bottom up and designing the properties by controlling the structure. In the nanoworld, objects are measured in nanometers -- 1 billionth of a meter. That's about four times wider than an atom and more than 1,000 times narrower than a human hair. Nanotechnology could change the way almost everything, from medicines to computers to objects not yet imagined, are designed and manufactured.

Interrelated areas of nanoscale science and engineering research focus goals are:

(1). Biosystems at the nanoscale - learning how nature operates on a nanoscale.

(2). Nanoscale structures, novel phenomena and quantum control - how to overcome existing limits to miniaturization.

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[4] *Nanotechnology Magazine: The Technology of the 21st Century* (http://www.nanozine.com)

(3). Device and system architecture - integrating nanoscale devices into measurement and control assemblies.

(4). Nanoscale processes in medicine - new approaches to visualizing, trapping and releasing nutrients and drugs.

(5). Molecules - Understanding single molecule mechanics, different length scales, and correlating material properties of molecular assembly.

(6). Modeling and simulation at the nanoscale - needed to understand, control and accelerate the development of new nanoscale processes and regimes.

Some of the applications that might be achieved through the evolution of nanoscale science and engineering in the future are:

(1). Materials - new materials many times stronger or far lighter than anything known today, chemical sensing, and optical switching

(2). Information technology - quantum computing and computer chips that store trillions of bits of information on a pinhead device

(3). Medical - improved drug and gene delivery, biocompatible materials for implants and nanoscale sensors for detection of disease

Nanotechnology is molecular manufacturing or, more simply, building things one atom or molecule at a time with programmed nanoscopic robot arms. Utilizing the well-understood chemical properties of atoms and molecules (how they "stick" together), nanotechnology proposes the construction of novel molecular devices possessing extraordinary properties. The trick is to manipulate atoms individually and place them exactly where needed to produce the desired structure.

Potential technical feasibilities include:

(1). Self-assembling consumer goods

(2). Computers billions of times faster

(3). Extremely novel inventions

(4). Safe and affordable space travel

(5). Medical Nano (virtual end to illness and aging)

(6). No more pollution and automatic cleanup of already existing pollution

(7). Molecular food syntheses

Nanotechnology also provides the ability to produce “super materials”. Atomic precision construction capable through the use of nanotechnology could produce metal structures devoid of microscopic imperfections, dramatically increasing strength. Bearings made to atomic precision (every atom in "round") would last far longer, run cooler and bear greater loads. Nano construction can also produce materials with a great strength at low weight. For example, in diamond form, carbon is 50-70 times stronger than steel and less than one-fourth the weight. Buckytubes built using nanotechnology would be 100 times as strong and conduct electrons like copper. Much of the carbon needed to build those is available now from the billions of pounds of fossil fuel burned in the atmosphere since the industrial revolution. The raw material delivers itself.

Nanotechnology can also provide for smart materials. If you're one of the few million or so in the US who use nail polish, imagine applying a clear liquid to your nails that changes color on some, or all of the surface, at your verbal command! Additionally, no more broken nails! The smart coating also infiltrates the nail with a diamond lattice, effectively creating a composite at strength physically safe for the tips of one's nails. If a nail should be damaged in any way, the coating automatically makes repairs. Or maybe lay your hand on the fabric of your outfit and verbally command the liquid to search the array of complimentary colors until one suits your desires. By rearranging surface atoms in appropriate patterns, the smart material will utilize the same light diffraction technique used in butterfly wings to produce color. Smart materials will undoubtedly be popular and find their way into many amazing applications especially military applications such as camoflauge.

Electromagnetic launch[5] involves the use of magnetic forces to accelerate “projectiles” into the air. Electromagnetic launch of spacecraft might basically involve a combination of levitation and acceleration. A direct current (DC) magnetic field levitates the carrier to eliminate frictional losses. This mechanism is composed of numbers of coils through which a high current is discharged. Such discharge produces a strong field gradient, resulting in different magnetic pressure on each side of the superconductor thus producing the acceleration.

Electromagnetic launch of spacecraft offers significant advantages. Once infrastructures are available, the cost of launching a payload will be little more than the cost of electricity. In the case of Australia, where widespread solar energy is available, and if coupled with advancements in energy storage and supplies technology, the costs are drastically reduced.

Technology R&D into new energy resources can greatly enhance Australia’s economy given its vast energy resources. Possible developments in this area includes fluidized bed coal burning technology, which allow micro coal particles to be mixed with a highly combustible combination of gases to ensure more efficient and complete burning. This method will increase the energy conversion efficiency as well as significantly lower the amount of harmful by-products. As such, with this particular technology, coal will increasingly become popular as a form of energy. In addition, LNG is fast becoming a popular form of energy given its “clean”

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[5] Harney, Robert C. (2000), *The Enemy's Access Denial System*, Institute for Joint Warfare Analysis, p. 353.

environmental properties. The current pitfall is the issue of transporting this flammable cargo. As such, the investment into the ability of transporting LNG at high densities will greatly increase the amount of energy that could be transported and thus lower the cost of transportation.

Many potential military systems require extremely compact, high-energy power supplies to be practical. As such, Australia with its inherent expertise in chemistry related to the fields of fuel and energy, is well positioned to explore this technology niche. Such compact and lightweight "super batteries" will have tremendous military and commercial applications such as powering directed energy weapons and military and commercial vehicles. One possible version of these super batteries is the de-hydrated silica gel, which when deprived of the water content, its remaining physical structure exists as an amorphous structure with extremely high surface area to volume ratio, similar to the familiar "cotton candy". Such structures have been found to store a large amount of electrical charge, which has the potential to serve as compact super batteries. Another high-density storage media under development is that of fuel cells that incorporate the use of methanol.

6. Summary

The first five years of the 21st century was relatively uneventful for the Australian Defense Force. The change in vision put forth by the Defense White Paper of 2000 gradually became a part of ADF doctrine. The diplomatic arrangements with the US were emphasized and Australia's role as the US deputy in the region was strengthened. Participation of Australian maritime and ground forces in exercises with the US and other allies was increased with the aim of developing common operational philosophies. Trade arrangements with the Association of South East Asian Nations (ASEAN), Japan and China were finalized, which will help secure Australia's place as a valued member of the Asia Pacific community.

The relationship with the global powers remained relatively unchanged during this period. At times competitive rhetoric from China and the troubled North Korea was heard but there were no major threats of conflict. Closer to Australian soil, Indonesia remained a concern due to instability caused by separatist movements and religious differences. Their economic situation has not improved significantly and they are beginning to fall farther and farther behind their Asian neighbors.

The basic objectives and functions of the ADF remained largely unchanged. Efforts were made to address some of the emerging threats of the new millennium. Special joint military teams were set up to address the emerging non-military threats of terrorism, cyber-war, narcotics trading and illegal immigration. The dilemma of the proliferation of weapons of mass destruction was also addressed in national and international forums. Australia believes these considerations will remain paramount in the coming years.

Australia had a stable and prosperous economic beginning of the new millennium. The GDP grew at a rate between 3.0 and 3.5 % during the five-year period. A brief slowdown in

2002-2003 was caused by a global slowdown of growth due to a brief contraction of the US economy. Evidence of an increase in the rate of growth was seen towards the end of the epoch. The percentage of GDP spent of defense increased during this period. The Australian people have been resoundingly supportive of the Howard Doctrine and their ADF and have rallied around the growth of the defense sector.

Cost cutting initiatives and reapportionment of assets were instituted in this epoch. Efforts to reform the administrative and personal services sectors of the ADF were made so that more money could be spent to develop new weapons systems. Additionally, a cut in the current operational budget was undertaken with the leveraging of these future systems in mind.

The development of the ADF during this epoch was primarily a result of previously initiated programs and projects. These programs and projects were clearly identified in the 2000 Defense White Paper. Additionally, the white paper highlighted the identified vulnerabilities of each of the military services and the actions that were being taken to eliminate or mitigate the issues.

In the navy, several existing shipbuilding programs came to fruition resulting in the ANZAC frigate, the Collins submarine, and the Huon minesweeper. These modern and state-of-the-art ships form the nucleus of the navy and the basis for further construction and development. In the army, existing programs provided new and improved infantry vehicles to enhance the mobility of the soldiers. To make those soldiers more lethal, modern technology enabled the development of support equipment and weaponry necessary to equip the 21st century soldier. Advances in army aviation and air defense improved the battlefield firepower and defensive capability. The air force struggled with several modernization issues, specifically with combat, strike, and tanker aircraft. Ultimately, the combat and strike aircraft received upgrades to improve their tactical capabilities and the tanker aircraft was replaced with modern airframes. The most critical development in the air force was the addition of the Airborne Early Warning and Control (AEW&C) aircraft, providing crucial surveillance and command and control functions to the entire ADF. Information capability improved with the development of an integrated command and control system supported by a robust communications suite.

To access the effectiveness of the ADF, this epoch saw Australia attempting to project power beyond 1000 NM through participation in a RIMPAC type exercise with the US and Japan against a potentially hostile China. Australia's contribution in this exercise can be seen to be quite significant. In terms of surface vessels, Australia's assets makes up for close to 50%, but is only in the form of frigates that are far less capable than the US and Japanese destroyers and cruisers. Provision of air support by Australia in the region is limited. It is unlikely that this will change in the near future. The use of air-to-air refueling may alleviate the problem.

In the inner arc, Australia force planners examined the scenario of taking back East Timor. The use of Australian army troops is a crucial ingredient. As the Australian force is not amphibious capable, landing these troops would be highly risky. The smallness of Australia ground forces tilts the balance against them. Nevertheless, with superior maritime assets, it is believed Australia can execute a successful landing provided the beachheads can be secured by special forces and maritime superiority can be attained.

In spite of a superior maritime force to facilitate a successful landing, Australia is unlikely to succeed in a long land campaign to forcefully retake East Timor. Australia believes this confrontation can only be successful with external intervention and support.

In the R&D area, initial technology feasibility studies into nanotechnology, space launching technology, high-density energy storage and supplies technology, and new energy resource technology were undertaken. Results from these feasibility studies drove Australia's R&D focus in two specific areas, space launching technology and energy. Initial investment into space launching capability R&D was US$500 million and energy totaled US$250 million.

B. Epoch Two (2006 – 2010)

1. Australia Security Environment in the Year 2010 (White Paper Addendum)

Note: Due to an attempt to format this document in a manner similar to the Defense White Paper of 2000, there are notable similarities.

When the last Australian White Paper was issued in December 2000, it contained a comprehensive blueprint for the shape of the Australian Defense Force. The document was intended to look forward for an entire decade to create a defense vision that would describe the objectives and priorities of the Australian people and would provide guidelines for the development of the supporting force structure. Some of the themes addressed in that document were the emergence of globalization, the increased importance of Military Operations Other Than War (MOOTW), and the primacy of the US in the region. The period from 2000 to 2010 was remarkably similar to these projections. The emergence of the ADF designed to work within these parameters was well underway by 2010.

a. Globalization

Globalization was perhaps the most dominant trend of the decade. The importance of the economic underpinnings of this trend is articulated in the following section entitled Economic Development and Defense Spending. The synergies created by trade have lead to unprecedented economic growth in the region. While this has provided many nations with the wealth necessary to be viable members of the international community, it has also created international codependency that has set the stage for small disagreements on trade issues to flare into potential conflicts. On the positive side, Australia sees less reason for nations to resort to conflict when most disputes are more advantageously resolved at a regional diplomatic forum. In short, the nature of the global economy is both a positive and a negative from the standpoint of probability of war.

Perhaps tipping the scale in the direction of insecurity was the growing rift in nation's energy requirements and their available resources. Many nations of the Asia Pacific Rim were limited in growth as the result of constrained fuel resources. This phenomena and Australia's response to the dilemma will be addressed in depth in the R&D section.

b. MOOTW

The trend of low intensity regional conflict was examined in the Defense White Paper of 2000. Regional hot spots such as East Timor and Somalia in the 1990's were examples of this sort of conflict. Australia continued to participate in these operations in the first decade of the new millennium. In particular we worked closely with the Indonesian government to curtail conflict on the island of Irian Jaya. We also continue to support the edict of the United Nations by augmenting the forces in the Balkans as well as the Middle East. We expect that stopping future intrastate conflicts, humanitarian relief and peacekeeping missions will be necessary in the upcoming epochs. Australia will continue to participate in these operations when our national interests are at stake.

c. Non-Military Threats

Australia still faces many security concerns other than those involving military force. The 2000 Defense White Paper considered this trend and steps were taken to remedy the situation. These threats include cyber attack, organized crime and terrorism. They also include concerns over illegal immigration, the drug trade, illegal fishing, piracy and quarantine infringements.

Many of these problems, such as illegal immigration, involve the challenge of effective surveillance, patrolling and policing of maritime approaches. Illegal incursions into the Exclusive Economic Zone (EEZ) and territorial waters, and onto our territory, constitute an ongoing problem for Australia. Given the size of our maritime jurisdiction, this is a significant and growing challenge.

A major review of coastal surveillance and enforcement activities, including the significant contribution made by the ADF to these efforts was conducted in the early 2000's. That review proposed important enhancements, including improved surveillance capacity through the acquisition Airborne Early Warning and Control (AEW&C) aircraft and the establishment of an integrated surveillance center.

The ADF will continue to have a major part to play in these activities. Our patrol boats, maritime surveillance aircraft and intelligence capabilities are fully engaged in the day-to-day monitoring and policing of our maritime approaches.

d. Australian Defense Priorities

The strategic environment that Australia faced in this decade was as predicted. Our nation's primary objectives and priorities have not changed a great deal but do deserve some reexamination.

At its most basic, Australia's strategic policy aims to prevent or defeat any armed attack on Australia. This is the bedrock of our security and the most fundamental responsibility of government. Our armed forces need to be able to do more than simply defend our coastline. We have strategic interests and objectives at the global and regional levels. Australia is an outward looking country. We are engaged in many different ways - economic, cultural and personal - with the nearest region and the world beyond. We are a major trading nation, with our prosperity dependent on our engagement with other countries. Australia therefore cannot be secure in an insecure region, and as a middle-size power, there is much we can and should do to help to keep our region secure, and support global stability. Working with others we can do a lot more than we can do by ourselves.

At the same time we must be realistic about the scope of our power and influence and the limits to our resources. We need to allocate our effort carefully. To do that, we need to define and prioritize our strategic interests and objectives. We do that in the following paragraphs, listing our interests and objectives in priority order.

We have given highest priority to the interests and objectives closest to Australia. In some circumstances a major crisis far from Australia may be more important to our future security than a minor problem close at hand. But in general, the closer a crisis or problem to Australia, the more important it would probably be to our security and the more likely we would be able to help to do something about it.

The existence of strategic interests in a situation does not determine how Australia would respond in the event of a crisis that challenged those interests. Australia would always have a range of options and the government of the day would need to determine how best to respond. In particular, careful consideration would always need to be given before the serious step of deploying forces was taken. That consideration would need to balance the Australian interest at stake with the human, financial, political, diplomatic, and wider costs of committing military forces. Nevertheless, our defense planning recognizes that the Government may decide that such a commitment could be warranted in some circumstances. It is of course intrinsic to Australia's approach to regional affairs that such commitments would be undertaken in collaboration with regional friends and allies, and with full respect for other countries' sovereignty and territorial integrity.

In summary, the defense priorities remain as stated in the 2000 Defense White Paper. For brevity and clarity, the defense priorities are:

(1). Ensure the defense of Australia and its direct approaches

(2). Foster the security of our immediate neighborhood

(3). Promote stability and cooperation in Southeast Asia

(4). Support strategic stability in the wider Asia Pacific region

(5). Support global security

(6). Prevent the spread of weapons of mass destruction (WMD).

e. Australia's Military Strategy

The military strategy developed as a result of the national strategy, objectives, and defense priorities remains unchanged from the 2000 Defense White Paper. To reiterate, the tasks are:

(1). Defend Australian territory from any credible attack, without relying on help from the combat forces of any other country. This provides a clear basis for our defense planning. We are confident that forces built primarily to defend Australia will be able to undertake a range of operations to promote our wider strategic objectives. The Government's approach to this task is shaped by the principles of self-reliance, maritime strategy, and proactive operations.

(2). Ensure security of our immediate neighborhood. Australia needs to be able to work with our neighbors to respond in the very unlikely event of armed aggression against them. We also need to be able to join UN-sanctioned international operations, regional peacekeeping, and humanitarian relief operations. We should be prepared to be the largest force contributor to such operations. Our planning needs to acknowledge that we could be called upon to undertake several operations simultaneously, as we were in East Timor, Bougainville and the Solomon Islands.

(3). Contribute effectively to international coalitions of forces to meet crises beyond our immediate neighborhood where our interests are engaged. Such coalitions might involve operations ranging from peacekeeping and disaster relief to relatively high-intensity conflict. In general, the closer a crisis to Australia, the larger the contribution we would want to be able to provide.

(4). In addition to these core tasks in support of Australia's strategic objectives, the ADF will also be called upon to undertake a number of regular or occasional tasks in support of wider national interests. These include specific and ongoing commitments to coastal surveillance and emergency management, as well as ad hoc support to wider community needs.

f. Examining the Regional Powers

The United States in 2010 has a preponderance of military capability and strategic influence that is still unparalleled. The past decade has shown a narrowing of the gap however. Australia believes that US strength supports a generally stable global strategic environment. The primacy of the United States is built on the strength of its economy, the quality of its technology, the willingness of the US government and voters to accept the costs and burdens of global power, and the acknowledgement by most countries that US primacy serves their interests.

The Australian Government believes that US presence in the region will ultimately promote economic, social and political developments that align with our interests and values. To this end, an aggressive diplomatic campaign to the US government has been undertaken, which extends increased US force basing privileges and calls for increased US/Australian Joint and combined exercises. We believe that the combination of our forces will achieve our joint objectives in spite of the lessened US presence in the theater. Other nations such as Japan have also shown an interest in joining an alliance. Abroad, no country in the world will have the military or economic power to challenge a combined force of US, Australian, and Japanese global primacy over the next few decades.

This document has reiterated the thinking of the Australian government in the area of defense spending and of our force structure. The specifics of the economic and structural constraints of defense and research areas will be addressed in the coming sections.

2. Economic Development and Defense Spending

The policies initiated at the advent of the new millennium continued into the second epoch and the economic benefits became apparent. The economy expanded at an increasing rate resulting in an annual growth between 3.89 and 4.5%. The fiscal and monetary policies allowed this growth without a great deal of inflation. The tight labor market still exists but the immigration and education policies instituted in the last epoch have begun to reap the rewards of a larger and more stable workforce. The percentage of GDP allocated towards defense remained constant at 2.4% over the epoch.

The global trade economy was strengthened during this epoch. Australia was able to tap some of its abundant natural resources to assist our allies in obtaining the energy reserves at reasonable prices. The diversification of Asia's energy resources caused by new sources and technologies has further contributed to international growth. The rate of GDP growth was directly affected by this new Australian market in the latter portion of the epoch. Australia expects these energy markets to account for an even greater portion of our economic growth in the coming years. Gains that had been largely dominated by pure business efficiencies brought on by new information technology capabilities neared the point of diminishing returns as the absorption of these assets neared completion.

This unprecedented growth and the continued support of the Australian people for a robust military capability have given the nation a rare opportunity to purchase new systems designed to fight the battles of the future. The shift of assets from the current operations to the future capabilities budget continued in this epoch allowing more money to be spent on procurement of new systems. The future remains bright for the Australian nation, economy, and the armed forces.

3. Australian Force Structure 2010

As part of any force structure assessment process, several factors must be reviewed. First, the national strategy and its relationship to the military strategy must be evaluated and updated as required to reflect the changing state of the world. Second, the known vulnerabilities from the previous assessment process must be reviewed and evaluated for the adequacy of the corrective actions taken. Finally, vulnerabilities identified as a result of net assessment or interactions with other armed forces must be reviewed. The combination of these factors results in changes to military force structure.

In the case of Australia in the year 2006, the ADF still faced several weaknesses and vulnerabilities in each of their military components. These vulnerabilities, along with the highlighted issues discovered as part of the net assessment process, were addressed as part of the military force planning effort in the second epoch. The national and military strategy for Australia and its armed forces did not change from the first to second epoch. Accordingly, the force structure for the individual service components of the ADF is discussed below. In review, some of the force structure vulnerabilities were not completely eliminated, but were mitigated by our 2010 force structure.

a. The Royal Australian Navy (RAN)

For the RAN, the vulnerabilities identified during the first epoch are as follows:

(1). Long range air-defense capability

(2). Limited replenishment capability

(3). Patrol craft are aging

(4). Limited amphibious lift capability

The issues of replenishment and amphibious lift capability were addressed through the development of a Multi-Role Auxiliary (MRA) ship.[6] This auxiliary was designed to assume the roles of amphibious transport as well as to provide afloat logistics support. As a multi-role ship, this auxiliary will ultimately serve as a replacement for the current landing platform ships, the heavy-lift amphibious ship, and the underway replenishment ships, all of which are due to be decommissioned over the next 10 years. While not optimized for specific missions, it is believed that this ship will achieve a significant life cycle cost savings by combining the various roles into a single hull form. As mentioned, this ship will serve as a replenishment ship, a transport ship for 1200 troops and their equipment, an aviation support ship, a logistics support ship, or a combination of these roles. The ship will resemble an amphibious assault ship, but will be fitted with cranes of sufficient capacity to enable the over-the-side loading of landing craft. The possibility of configuring the ship with a well deck to support amphibious craft is a possibility and will be examined as part of the overall design effort.

The replacement of the Fremantle patrol craft was addressed by the procurement of a similar craft built to civilian standards. These vessels will continue to perform the role analogous to the United States Coast Guard and are invaluable to this end.

Studies into the design and construction of the next generation air defense ship for the RAN were started this epoch. It is expected that the first ship will be commissioned into the navy in the third epoch.

The Navy force structure for 2010 is provided below.

(1). Surface Combatants

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[6] Bostock, Ian. *Australia devises multi-role ship*. Jane's Defence Weekly, July 18, 2000 (http://www.janes.com/regional_news/asia_pacific/news/jdw/jdw000718_1_n.shtml)

(a). 6 FFG

(b). 14 ANZAC FF

(c). 4 Spruance DDG

(d). 4 High-speed Catamarans

(e). 30 Patrol Boats (PB)

(f). 2 Multi-Role Auxiliary (MRA) ship

(g). 1 oiler/replenishment ship

(h). 2 Amphibious Lift (LPA)

(i). 15 Landing Craft Medium (LCM)

(j). 6 Landing Craft Heavy (LCH)

(2). Mine Warfare

(a). 2 Inshore Mine Countermeasure (MCM) ships

(b). 12 Huon class MCM

(c). 4 Dive Teams

(3). Submarine Force

(a). 8 Collins class SS

(4). Navy Air

(a). 16 Sea Hawk helicopters

(b). 7 Sea King helicopters

(c). 40 Super Sea Sprite helicopters

(d). 19 P-3C Orion

(e). 10 LAMPS Mk-III helicopters

The ANZAC frigate's production line was continued through this epoch resulting in an additional six ships in the inventory. Maintenance of this industrial base is strongly desired since Australia wants to build the next generation of air-defense ships in country. The modular construction techniques learned and developed during the ANZAC construction will prove invaluable to the development of this follow-on air-defense platform. Of note, all ANZAC frigates in the inventory will have the latest anti-ship missile defense systems and the Harpoon offensive anti-ship missile.

Spruance destroyers were purchased from the United States as part of an effort to bolster the RAN's firepower. These ships, configured with vertical launch missile tubes capable of firing the Tomahawk cruise missile, fulfill two roles. First, these ships allow the RAN to redevelop and refine the concepts behind capital ship operations prior to the introduction of an air-defense ship in the third epoch. With the decommissioning of the DDGs in 2001, the RAN has lost the expertise and knowledge of operating its forces around a maritime action group. Second, these ships will provide a sea-based strike capability that will augment and serve as an eventual replacement for the current F-111 air strike capability. Early procurement of this capability in advance of the F-111 retirement in the later epochs will allow the navy to build its expertise in this critical war fighting area.

To boost the amphibious lift and transport capability, high-speed catamarans were added to the inventory. One of these vessels, previously leased, proved to be invaluable to operations in East Timor and provide a rapid transit option throughout the region. The catamarans can carry up to 500 combat ready troops and equipment. Their 40-knot speed puts most areas of the region within a 12 to 24 hour transit window. These ships allows for rapid and timely response to regional contingencies by significantly boosting military sealift within the inner arc region.

The multi-role auxiliary ship was developed to replace the capability of the amphibious and replenishment ships. During this epoch, one MRA replaced the heavy-lift amphibious ship TOBRUK and the second replaced the oldest replenishment ship in the inventory.

As envisioned by the majority of the world's navies, the threat of sea-based mines in the future will be of great significance. In an effort to bolster the RAN's mine-clearing capability, the construction program of the Huon minesweeper was continued and the inventory doubled over this epoch. The Huon continues to be one of the most advanced MCM ships available. Continuing the construction of this vessel maintains the industrial base and allows for foreign military sales.

Two additional Collins submarines were purchased to supplement the submarine force. The proliferation of modern quiet diesel electric submarines is best countered with another submarine, and the Collins has proven to be an excellent platform for this role.

The ANZAC construction program and the Spruance DDG procurement left Naval aviation short of airborne assets to deploy with these ships. Accordingly, additional helicopters were purchased to serve as deployable assets on those platforms. The LAMPS Mk-111 helicopters were purchased to supplement the anti-submarine role of the Spruance-class destroyers and additional Super Sea Sprite helicopters were purchased for the ANZAC-class frigates.

As a result of the 2010 force structure, the navy is still faced with the lack of long-range air-defense capable ships. Current studies are focusing on the development of such a ship that will be producible in Australia. With the advent of the multi-role auxiliary ship, the replenishment and amphibious lift capability of the fleet is improving. The MRAs provide the heavy lift capability while the addition of the catamarans significantly enhances the lift capability for light forces. Future purchases of the MRA will continue this positive trend in both mission areas.

b. The Australian Army

For the Australian Army, the vulnerabilities identified during the first epoch are as follows:

(1). Army's small size

(2). Smaller reserve force

As identified in the last epoch, the size of the Australian Army is small as compared to its nearest neighbors. Given the operations participated in during this epoch and those it expects to undertake in the coming decades, Australia considers this small force adequate. The lack of a conventional threat to the Australia homeland further supports the maintenance of a small army.

The Army force structure for 2010 is provided below.

(1). Special Forces (2 regiment SASR/2 Commando regiments)

(2). Mechanized Force (1 brigade)

(3). Light Infantry Force (1 brigade)

(4). Motorized Infantry Force (1 brigade)

(5). Army Aviation Force

(6). Ground Based Air Defense

(7). Combat & Logistics support

(8). Army Reserve Force

(9). Army Aviation (helicopters)

(a). 36 S-70A Black Hawk

(b). 6 CH-47D Chinook

(c). 24 Apache Armed Reconnaissance

(d). 12 Troop Lift

(10). Air Defense

(a). 12 RBS-70 laser guided

(b). 10 Patriot firing units

(c). 12 Patriot PAC-3 firing units

(11). Reserve Units

(a). 11^{th} Brigade (North & Central Queensland)

(b). 4^{th} Brigade (Victoria)

(c). 8^{th} Brigade (NSW)

(12). Reserve Surveillance Units

(a). Northwest Mobile Force (NORFORCE)

(b). Pilbara Regiment (WA)

(c). Far North Queensland Regiment

The size and composition of the army's forces remained essentially the same between the two epochs. The Special Forces gained an additional regiment in both the Special Air Service (SAS) and commando branches. These additional regiments will further enhance Australia's special operations capability. The size of the mechanized, light infantry, and motorized infantry remain the same with respect to their individual composition. The major change in the army's forces was in the utilization and composition of the reserves.

In the aviation branch, the procurement of Apache armed reconnaissance and attack helicopters allowed the retirement of the Kiowa and UH-1 helicopters. Additional next-generation troop-lift assets were added to provide aircraft to support amphibious operations aboard the newly acquired multi-role auxiliaries. The expansion of the helicopter fleet continues to provide light lift for troop transportation.

The army's air defenses continued to improve through the introduction of the Patriot PAC-3 missile system. The PAC-3 system supplements the RBS-70 and Patriot systems currently in the inventory. The Patriot PAC-3 system quadruples the number of missiles in each of the individual launcher systems by providing 128 missiles per firing unit.

The army reserve has undergone the largest and most extensive transformation in its history. In the past, the reserves were viewed as a mobilization base in the time of a major conflict, a remote possibility at best. Operations in the beginning of the century highlighted the importance of the reserves in meeting contemporary and concurrent operations. To fully support MOOTW during this period, more Australian reservists served on full-time active duty than since the end of World War II. As a result of these operations, the focus of the reserves shifted from mobilization to support a major conflict to mobilization to support non-traditional military operations. The reserves will be used to sustain these operations abroad as well as provide a surge capacity to cover tasks at home. As with all modern-day reserve components, support of the reserve mission and individual by the general public, especially the employing public, is crucial to its success. In the case of Australia, the public has wholeheartedly supported this increased in the reserve's mission.

To support these future operations with well-trained and equipped personnel, the number of reserve brigades was reduced from six to three. While this may not seem the correct action given the future role of the reserves, decreasing the number of reserve brigades was required to ensure fully trained and equipped personnel were readily available. The equipment from the three decommissioned brigades was transferred to the three remaining brigades to ensure a full compliment of equipment. Training was enhanced for the remaining brigades resulting in an improved overall capability of the reserve components. In the future, the reserves will provide critical back up and support of the active forces, both in operations home and abroad.

In 2010, the army will remain a light force with limited heavy armor capability and resources. Additionally, the net assessment process revealed that Australia lacks an opposed landing amphibious capability. The ADF does have the equipment to move troops amphibiously, but does not have the sustained firepower and protection to land troops on an opposed beach.

c. The Royal Australian Air Force (RAAF)

For the RAAF, the vulnerability identified during the first epoch is the long-term replacement of F/A-18 and F-111 aircraft. This replacement is a modernization issue. The replacement aircraft to conduct the air combat and strike role in the 2012 to 2015 timeframe remains unknown.

The RAAF force structure for 2010 is provided below.

(1). 50 F/A-18 Hornet

  (a). 32 A, 18 B

(2). 40 F/A-18 E/F Hornet

(3). 35 F-111

  (a). 21 C, 14 G

(4). 24 C-130J Hercules

(5). 14 C-27J Spartan

(6). 7 AEW&C Boeing 737-700

(7). 8 Boeing 767 Tankers

(8). EWSP upgrades for all air platforms

(9). 20 Global Hawk UAV

To maintain a modern air combat fleet, the F/A-18 Hornet A/B models were gradually phased out as the follow-on air combat platform, F/A-18 Hornet E/F models, were purchased from the United States. These aircraft, with the latest hardware and systems, will enable the air force to maintain pace with the regional forces while allowing for a smooth transition from one airframe to another. This procurement will continue throughout the coming epochs to replace the older model Hornets.

The replacement aircraft for the F-111 has proven to be more elusive. Investigations and analysis of existing programs causes Australia to believe a suitable replacement platform for this aircraft that specifically meets the needs of Australia will not exist in the future. Accordingly, Australia is planning to phase out the F-111 upon reaching its end of life between 2015 and 2020. To maintain the strike capability in the ADF, this role will be shifted to the Spruance DDGs and the follow-on air-defense ship. Fulfilling the strike mission using large transport aircraft is not outside the realm of possibilities.

The medium airlift capability was improved with the purchase of the C-27J Spartan aircraft. These platforms replaced the aging Caribou transport aircraft.

The procurement of the Airborne Early Warning and Control (AEW&C) aircraft continued during this epoch. An additional three aircraft were added to the fleet bringing the total number of AEW&C aircraft to seven.

Additional tanker aircraft were added to the inventory bringing the total number of tankers tanker aircraft to eight. The new tankers, a Boeing 767 design, have the capability to refuel not only the F/A-18 but also the F-111 and the AEW&C aircraft. This enhanced capability extends the reach of all the tactical and strategic fixed-wing aircraft in the Australian inventory.

The electronic warfare self-protection program developed during the first epoch was extended to cover the new aircraft entering the fleet. This indigenous system allows it to be adapted to fit many different airframes, including helicopters, and a wide range of threats.

As part of a cooperative development effort with the United States, the Global Hawk Unmanned Aerial Vehicle (UAV) was added to the inventory. This UAV increases the surveillance and monitoring capability of the ADF in both the maritime approaches and potential land operating sites. This UAV also provides a baseline of operating expertise for future unmanned vehicles, possibly even unmanned air combat vehicles.

In 2010, the air force continues to be well positioned to engage regional combat aircraft and achieve success. The replacement of the older F/A–18s with the latest E/F model will gives Australia a potent and formidable air combat force. The continuing procurement of the E/F model will further this capability. While the loss of the F-111 to retirement will remove specific strike aircraft from the inventory, Australia feels this is negated through the introduction of strike capability in the maritime forces.

d. Information Capability

In the area of information, the vulnerability identified during the first epoch was how to maintain pace with changing technology. This issue is essentially a measure of where, when, and how to allocate resources to improve the information capability. With the rapid changes in information technology taking place every 18 to 24 months, implementing changes on this time schedule would be cost prohibitive. A reasonable development process and schedule must be adopted to initiate these changes.

The force structure for 2010 is provided below.

(1). Operational Command

(a). Single Joint Headquarters

(b). Deployable HQ (two)

(c). Communications (SATCOM, HF, Networks)

(d). Command and Information Management Systems

(2). Strategic Intelligence

(3). Strategic Surveillance

(4). Geospatial Information

(5). Hydrographic Survey Force

To ensure the ADF acts as a coherent unit, a single integrated command headquarters was developed. This headquarters, along with the deployable headquarters, provides focused command and control functions for national, theater, and deployed operations. To link these headquarters together, communication facilities and capabilities continue to be upgraded in order to harness the latest in information technology.

Counter information warfare efforts continue in this epoch to further isolate and support Australia's information systems against foreign forces and elements. These actions are crucial to the success of the ADF in operations against the enemy.

In 2010, the challenge will continue to be how to maintain pace with the changing information technology.

4. Scenarios For Static Net Assessment

a. Scenario 1: Conflict in the Philippine Sea

This scenario is similar to the one discussed in epoch one. The significant changes to the scenario are the location of the exercise (Philippine Sea vice the South China Sea) and the order of battle for the participants.

The exercise, dubbed RIMPAC West, occurs in 2010 with a coalition force from the US, Japan, and Australia. The presence of large number of foreign ships creates tension in the region and Chinese leaders produce their own show of force and stage their military forces in the Philippine Sea. There are no significant force changes for the US contingent. In the case of the Japanese contingent, there is an additional Kongo class DDG deployed. For the Australian force, the new force structure is as listed:

(1). 2 x Spruance Class DDG

(a). 6 x Mk-46 ASW torpedoes

(b). 8 x Harpoon anti-ship missile

(c). 8 x RIM-7H Sea Sparrow missile

(d). 61 x Tomahawk missile

(2). 2 x Anzac Class FF

(a). 6 x Mk-54 ASW torpedoes

(b). 8 x RIM-162A ASuW/AAW missile

(3). 2 x Collins Class SS

(a). 6 x Mk-48/Harpoon anti-ship missile

The significant change in this structure from the first epoch is the addition of the Spruance DDG. Instead of four frigates, Australia will only be sending two for this epoch. The submarine force remains unchanged.

The disposition of the coalition force in the theater of operations is as shown:

Figure 6. Coalition Force Disposition in Philippines Sea

The exercise scenario is one of anti-submarine warfare with the submarines in a line east of the surface vessels. The Japanese Kongo destroyers are located at the top of the picture nearest Japan. The US CVBG is in the middle of the picture with the two SSNs directly to the east. The Australian force is positioned to the south of the CVBG with the two Collins submarines directly north of the Australian surface vessels. The goal of the CVBG is to penetrate the submarine screen.

In response to the coalition force build-up, the Chinese responded with the following military assets:

(1). 4 x Luda Class DDG

(a). 6 x A244 ASW torpedoes

(b). 16 x C-801 ASuW missiles

(c). 8 x HQ-7 AAW missiles

(2). 3 x Sovremenny Class DDG

(a). 8 x TE-2 ASW/ASuW torpedoes

(b). 48 x SA-N-12 Grizzly AAW missiles

(c). 8 x SS-N-22 Sunburn ASuW missiles

(3). 2 x Kilo Class SS

(a). 12 x SA-N-8 Gremlin AAW missiles

(b). 2 x TEST 96 ASW torpedoes

(c). 4 x 56-65 KE ASuW torpedoes

(4). 1 x Han Class SSN

(a). 6 x SET-65E ASW torpedoes

The disposition of the Chinese forces is as shown:

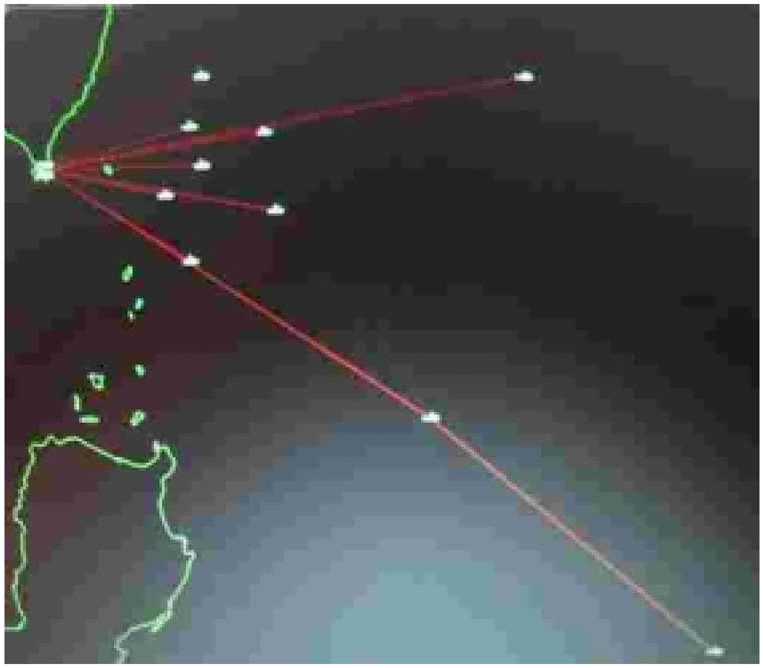

Figure 7. Chinese Force Disposition

Each of the warfare capabilities of the coalition and Chinese forces were examined and evaluated against one another.

The anti-air capabilities of the coalition force are as shown:

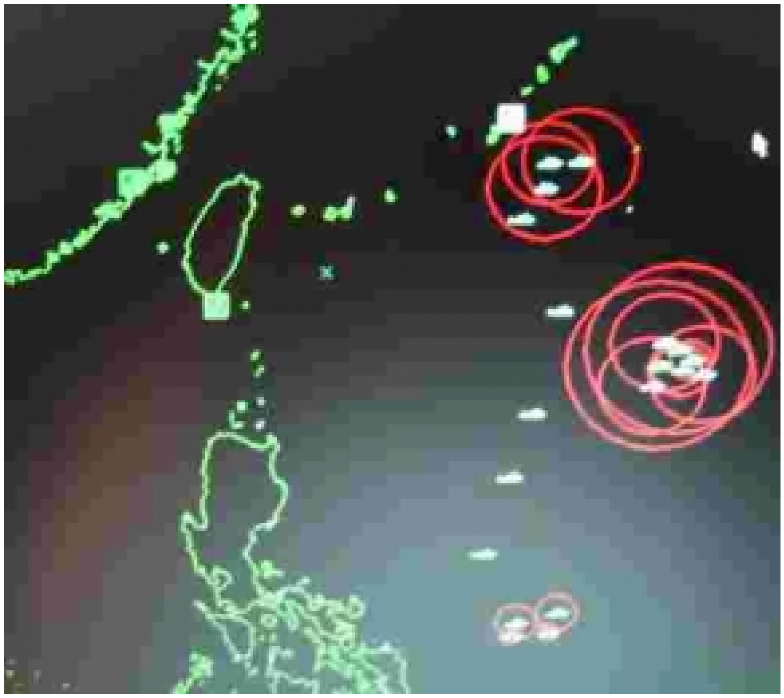

Figure 8. Anti-air weapons range of Coalition Force

The circles show the range of the anti-air weapons. Equipped with the Aegis anti-air systems, the Japanese and US fleets offer far superior anti-air capabilities as compared to the Australians (lower portion).

The Chinese air defense is as shown:

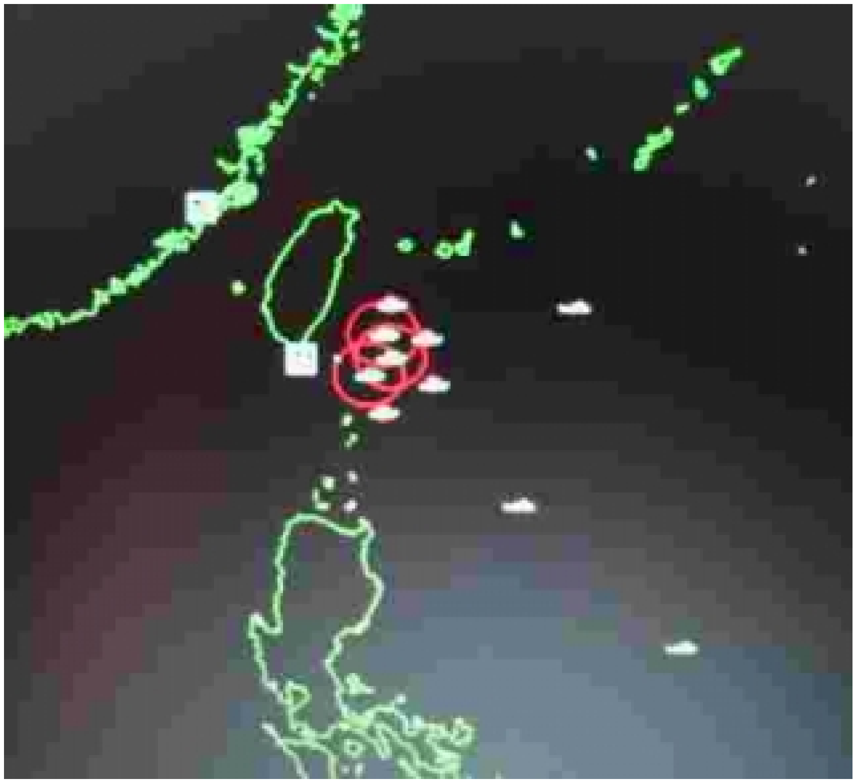

Figure 9. Air Defense Weapons Range of Chinese Force

The Sovremenny destroyers provide decent air defense. The Luda DDG provides only meager air defense capabilities as seen by the weapon ranges.

In terms of anti-ship capabilities, the coalition force's umbrella is as shown:

Figure 10. Anti-Ship Weapons Range of Coalition Force

With Harpoon anti-ship missiles, all the coalition force's capabilities are similar. The Collins submarines have slightly shorter striking range than their US and Japanese counterparts.

The Chinese vessels have superior anti-ship capabilities in their vessels as shown:

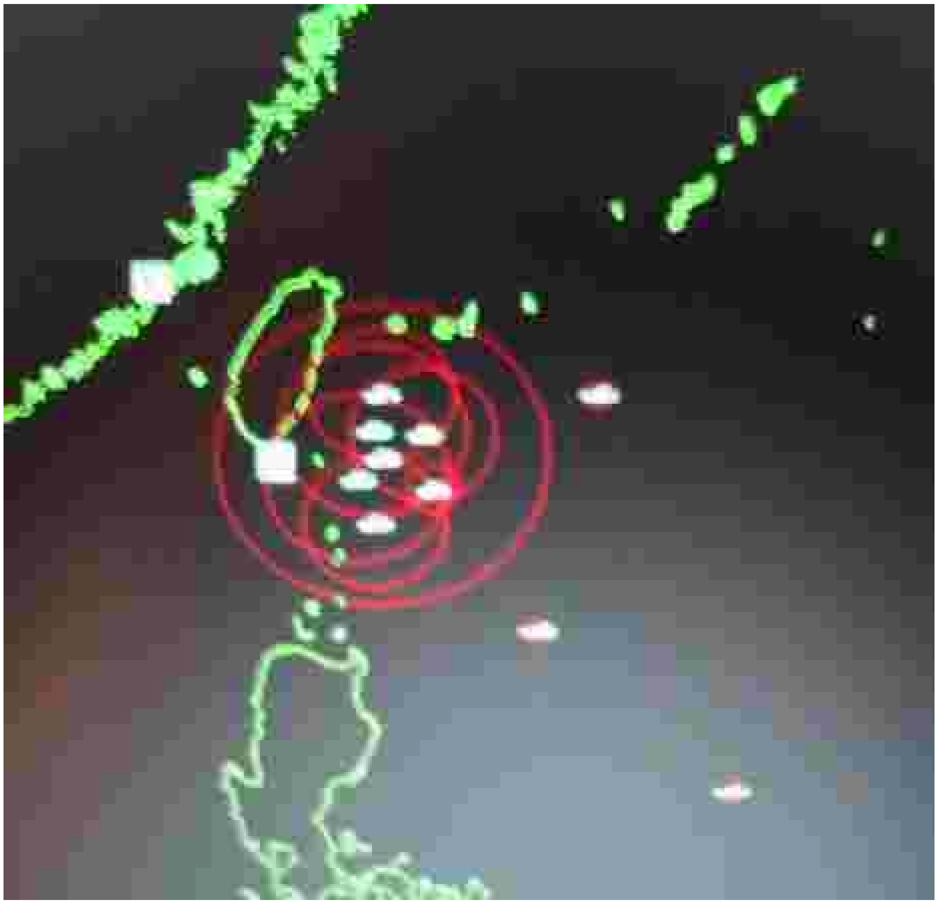

Figure 11. Anti-Ship Weapons Range of Chinese Force

The long range is attributed to the new Sunburn missiles found on the latest Sovremenny destroyer.

Anti-submarine capabilities are as shown for the coalition force:

Figure 12. Anti-Submarine Weapons Range of Coalition Force

In terms of pure range comparisons, only the submarine force contains any credible anti-submarine capabilities for the Australian force. Again, the Japanese and US vessels offer superior range as compared to the Australian vessels.

The Chinese anti-submarine capabilities are as shown:

Figure 13. Anti-Submarine Weapons Ranges of Chinese Force

The three Sovremenny destroyers possess the bulk of the Chinese anti-submarine capabilities. The Kilo and Han Class provide adequate anti-submarine weapons.

b. Scenario 1: Numerical Comparison

Numerically speaking, Australian force contribution is quite substantial as shown in the following table:

Country	**Surface Vessels**	**Submarines**	**Aircraft**
US	4	2	100
Japan	3	1	50
Australia	4	2	0
Total Coalition	*11*	*5*	*150*
China	*7*	*3*	*200*

Table 4. Numerical Comparison of Coalition Force and Chinese Force

Australia's surface and submarine contribution accounts for 30-40% of the entire coalition force. Nevertheless, in terms of added capabilities, the contribution is still not significant enough to tip the balance.

c. Scenario 1: Summary of Capabilities

Overall, the Chinese possesses slightly better anti-ship capabilities with their latest Sunburn missiles. However, in terms of anti-air defense, the coalition force has a definite technological advantage with the Aegis air defense systems. The anti-submarine capabilities of the forces are about evenly matched. The Australian contribution of Spruance DDGs is much better than the previous epoch's contribution of only ANZAC surface vessels. Nevertheless, the Australian vessels are still inferior in terms of capabilities when compared to the US and Japanese forces.

d. Scenario 2: Invasion Of East Timor

As in the first epoch, the second scenario is an invasion of East Timor by Australian forces to retake the province. While similar in nature to the first epoch, the scenario in this epoch conducts a complete comparison of the weapons systems and capabilities of the individual platforms and their effectiveness against an opposing force.

This scenario occurs under the veil of a military coup in Indonesia in 2010. The military regime that took over the government had to quell whatever civil unrest existed. They chose to divert attention from internal problems to a nationalist agenda of attempting to reunite the Indonesian archipelago by taking back East Timor from the Western infidels. Once the Indonesian troops crossed into East Timor, the UN peacekeeping force stationed there is quickly overrun. Although the Indonesian military authorities attempted to limit the amount of force used, many casualties occurred on the UN side. This resulted in an international outcry and Australia, being the major force in East Timor, decided to retaliate.

In view of the economic turmoil Indonesia is expected to face in the 2000-2010 decade, Australia projects that very limited military upgrades have occurred in the Indonesian Defense Force (TNI). The expected Indonesian force allocation in the theater of operations is as follows:

(1). 7 x Ahmad Yani Class FF

(a). 6 x Mk-46 ASW torpedoes

(b). 4 x Harpoon anti-ship missiles

(c). 8 x Sea Cat SAM missiles

(2). 1 x Fatahillah Class FF

(d). 6 x Mk-46 ASW torpedoes

(e). 4 x Exocet ASuW missiles

(3). 1 x Whiskey Class SS

(a). 4 x 53-65 ASuW torpedoes

(b). 2 x SET-65 ASW torpedoes

(4). 1 x Type 206 SS

(a). 8 x Seehecht ASW/ASuW torpedoes

The disposition of these forces is as shown:

Figure 14. Indonesian Force Disposition

In comparison, the ADF has grown in terms of size and capability due to economic growth and force expansion in line with our military doctrine. The Australian maritime assets in the theater of operations are as follows:

(1). 4 x Spruance Class DDG

(a). 6 x Mk-46 ASW torpedoes

(b). 8 x Harpoon anti-ship missiles

(c). 8 x RIM-7H Sea Sparrow missiles

(d). 61 x Tomahawk missiles

(2). 3 x Collins Class SS

(a). 6 x Mk-48/Harpoon weapons

(3). 4 x Anzac Class FF

(a). 6 x Mk-54 ASW torpedoes

(b). 8 x RIM-162A ASuW/AAW missiles

(4). 4 x Knox Class FF

(a). 4 x Mk-46 ASW/ASuW torpedoes

(b). 8 x Harpoon anti-ship missiles

The disposition of the Australian forces is as shown:

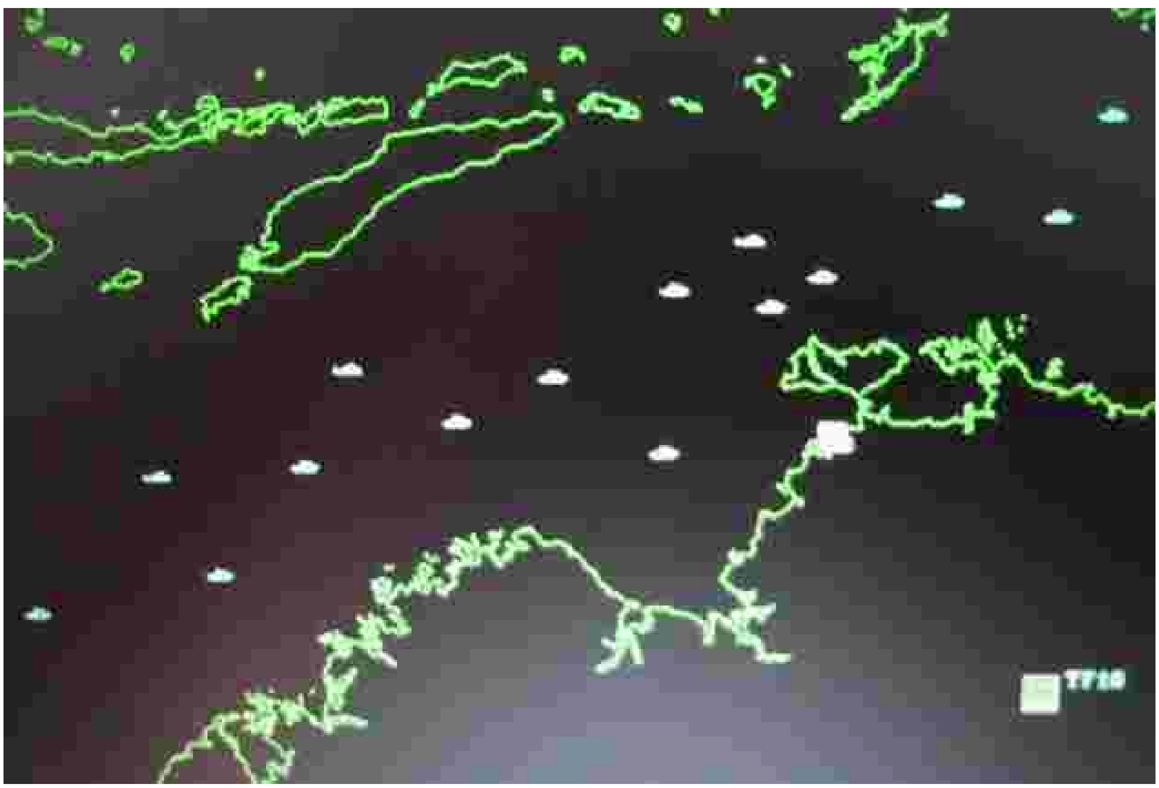

Figure 15. Australian Force Disposition

Comparing capabilities, the following two diagrams illustrate the anti-air umbrella of the Indonesian and Australian forces respectively:

Figure 16. Anti-Air Weapons Range of Indonesian Force

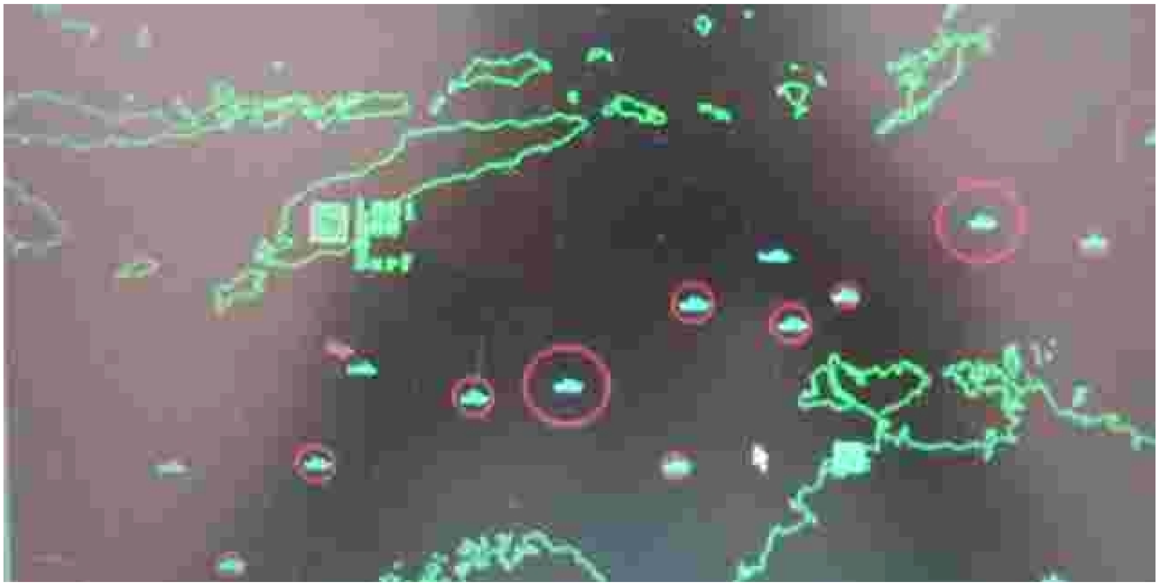

Figure 17. Anti-Air Weapons Range of Australian Force

Figure (16) shows the limited air defense capabilities of the Indonesian force. The Fatahillah Class FF offers the best air defense range for the surface vessels. The two aircraft in the theater are the Skyhawk (to the west) and F-16. Only the F-16 has any significant anti-air (radar or weapon) range. Figure (17) shows that the Australian forces, in comparison, offer superior anti-air capabilities. The Spruance DDG provides the best anti-air defense for surface vessels. The Australian military possesses the F/A-18 Hornet (A/B model) that are of equivalent capabilities (fourth generation fighter) as the F-16s of the Indonesian force but with upgraded missiles and protective measures. The Indonesian Skyhawks are inferior to the F/A-18s.

The following two diagrams compare the anti-surface capabilities for Indonesian and Australian forces respectively:

Figure 18. Anti-Ship Weapons Range of Indonesian Force

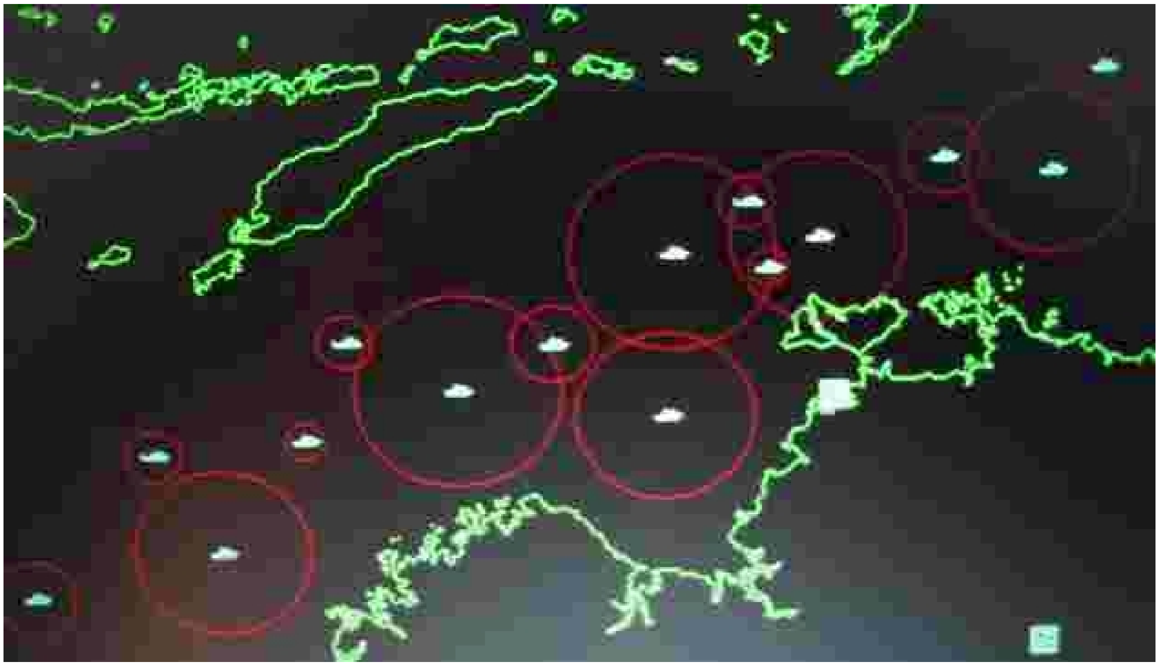

Figure 19. Anti-Ship Weapons Range of Australian Force

Here, the comparison is more evenly matched. The Ahmad Yani Class ships in the Indonesian inventory provide very capable anti-ship capabilities in the form of Harpoon missiles. The Fatahillah Class only offers the Exocet and is less impressive in terms of range. The Australian vessels are similarly equipped, as they possess similar Harpoon missiles. The Knox Class frigates are outdated in this comparison.

The anti-submarine capabilities of the Indonesian and Australian forces are as illustrated in the following two diagrams respectively:

Figure 20. Anti-Submarine Weapons Range for Indonesian Force

Figure 21. Anti-Submarine Weapons Range for Australian Force

From the figures, it is seen that the submarine vessels offer the major anti-submarine capabilities. The Collins SS provides the advanced Mk-48 ADCAP torpedo that is superior in range to the weapons of their Whiskey and Type 206 counterparts.

This capabilities comparison concludes that the ADF has superior maritime assets over her Indonesian counterparts. In a straight numerical comparison, the following table summarizes the size of the respective force in conflict for this scenario:

Country	**Surface Vessels**	**Submarines**	**Aircraft**	**Land Force**
Australia	12	3	80	1 Inf Div
Indonesia	8	2	40	2 Inf Bde

Table 5. Numerical Comparison of Australian vs Indonesian Forces

The army component in the comparison is skewed in favor of the Indonesians. The projected Indonesian land forces amounts to some 10,000 personnel compared with 6,000 from the Australian Army. This hypothetical comparison is based on the assumption that the ADF can comfortably defeat the Indonesian maritime forces and land their assault troops (which is still non-amphibious capable) unopposed in East Timor.

Although the ADF is shown to possess much more capable maritime assets and able to gain control of the seas, it is difficult to land troops without control of the port due to very limited amphibious assets. In all likelihood, there would be some opposition in landing Australian ground troops, and being non-amphibious, they are highly vulnerable in this process.

The Australian troops are much better trained and equipped than the Indonesian troops. The equipment enhancements include night vision capabilities, networked communications, and body protective gear. Overall, the Australian soldier would produce a higher kill capability than the Indonesian counterpart. Applying a *Lanchester Square Law model*[7], we can derive the following attrition table:

Australian Force Attrition Factor (Alpha)	Indonesian Force Attrition Factor (Beta)	Indonesian Troops Remaining
1	1	8000
1.2	1	7537
1.4	1	7043
1.6	1	6512
1.8	1	5933
2	1	5292
2.2	1	4561
2.4	1	3688
2.6	1	2530
2.7	1	1673
2.8	1	Parity Attained

Table 6. Lanchester Square Law for Land Force Comparison

The model is based on the following formula with Alpha value being the attrition factor for the Australian soldier and Beta being that of the Indonesian soldier (held constant for comparison purposes).

$$\beta\left(x_0^2 - x^2\right) = \alpha(y_0^2 - y^2)$$

$$\therefore y = \left(\frac{\alpha y_0^2 - \beta x_0^2}{\alpha}\right)^{\frac{1}{2}}$$

If both sides have equivalent attrition factors, then the Australian forces would be annihilated at the end of the battle with 8,000 Indonesian troops still standing. However, if the Australian attrition factor improves to 2.8 times that of the Indonesian counterparts, the attrition

[7] Taylor, James G. (1983), *Lanchester Models of Warfare*, Ketron Inc., Arlington, VA.

of both forces would be equivalent.

This does not seem like an incredible capability improvement. With the enhanced capability developed between 2001 and 2010, the Australian infantry soldier has seen an improved capability in the following areas:

(1). Body armor for increased survivability

(2). Enhanced communications for better command and control capability

(3). Improved small arms with higher lethality

Although the improvements above can significantly raise the kill ratio for Australian troops, the need to attain a 1:4 numerical advantage for an offensive force would dictate a far higher kill factor than 2.8. The Australian land force projection capability is severely handicapped in view of the numerical deficiencies. Besides increasing the numerical numbers, important force projection capabilities like amphibious assault vehicles are also painfully absent for the Australian force. In short, to accomplish an opposed landing of ground troops to East Timor would be very difficult.

e. Scenario 2 Conclusion

These comparisons point out certain Indonesian maritime weaknesses in terms of anti-air and anti-submarine capabilities. With the procurement of more capable Spruance DDGs and F/A-18E/F fighters, Australia is poised to take advantage of these weaknesses and comprehensively exploit them. The main shortfall comes from the lack of an amphibious force designed to effectively neutralize enemy's coastal defense. Even if the full complement of land forces could somehow be landed, the Indonesian troops still possess an overwhelming numerical advantage.

However, with the emphasis on better training and utilization of technology, it is believed that the Australian forces can provide sufficient kill factor to counter the Indonesian's numerical advantage. Compared to the last epoch, Australia's ability to win this conflict is significantly improved.

5. Technology Niches and R&D Report

a. Introduction

In this epoch, investment in space launching infrastructure in Cape York, Melville Island and Christmas Island was completed in 2008 with the commencement of commercial launching projects. Concurrently, continued R&D into electro-magnetic assisted launch feasibility proceeds as planned. R&D into remote sensing resulted in the ability to discover offshore oil reserves. This development, coupled with the lower cost of deep sea drilling and the consistently high price for oil (US$30 a barrel), gave rise to the aggressive exportation of oil to Japan, China and other Asian countries.

Australia also realized the breakthrough in photovoltics technology causing a shift in the internal energy requirement of Australia from less than 10% solar energy to 50% solar energy dependent. This further allowed an increased export of energy resources to other countries. Breakthroughs in fluidized bed technology for coal burning also resulted in the increased and aggressive interest in coal as a source of energy. This is an inherent advantage for Australia since they have the fourth largest coal reserve in the world and has been the largest coal exporter since the end of the 20th century. High-density LNG transportation allows yet another alternate energy resource for export.

In terms of future technology R&D in the area of energy storage and supplies, Australia concentrated on the following areas: quartz technology (silica gel) or miniature energy storage, fuel cells (methanol) and photovoltics.

b. History of Australia's Space Program since 2000[8]

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[8] Australia in Orbit: Space Policy and Program, written by Matthew James, Technology Advisor, Science, Technology, Environmental and Resource Group.

Space programs provide an important variety of services to Australia. However, they require a degree of independent capability to best serve a population with limited technological resources. The diffusion of knowledge and innovation across industry and society is an important aspect of space capability and is a potential catalyst for creating new and valuable spin-off technologies. These spin off technologies include bioengineering, robotics, optics, materials, software, electronics, power cells, ground control systems, data processing and advanced manufacturing technologies. Project management, space education and training follow as important support structures. The development of commercially viable spacecraft launchers has been a growing activity since the beginning of the 21st century, so is the growth of collaborative international space ventures, both public and private.

Australia has been primarily involved the three main applications of space technology since 2000, namely, remote sensing of Earth, communications systems, and scientific exploration. Remote sensing studies the atmosphere, oceans, ice and land and how they interact. This helps Australians to better understand the changing environment over a diverse continent and the surrounding seas. The work also assists the Australian space industry to gain the best possible position in international markets for satellite systems, ground support stations and data services. Remote sensing satellites provide images of the Earth in optical, infrared, radar and other types of electromagnetic spectrum channels. However, the unique properties of the Australian landmass require special observing techniques and processing for success. Such satellite data are used in a myriad of ways, from monitoring vegetation cycles, studying earthquake deformations, forecasting the weather and climate modeling, through to mineral prospecting, fishing stock mapping, urban planning and nature conservation.

Satellite communications and multimedia linked with navigation systems enable global services for mobile terminals and applications such as aircraft contact, shipping logistics, tele-medicine, Internet use and tele-education. Broadcasting satellites provide direct regional television and radio and specialized local services. Telecommunications satellites offer flexible, high-capacity routes for voice and data services, providing backup in the event of undersea cable failure. Defense satellite communications and monitoring provide the basis for intelligence, treaty observance and military deployments. Given the rate of change in the information revolution, space systems will play a major future role for Australia and the rest of the world.

Lastly, together with Earth-based astronomy, space science helps man to better understand the solar system, our galaxy, the universe and ourselves. Special scientific instruments on spacecraft collect and interpret data on radiation levels, forces, magnetism and the electromagnetic spectrum of emissions. Bursts in the solar wind can disrupt power transmissions on Earth and also damage satellites. Investigation of the role of gravity in the evolution of plants can also lead to understanding in the causes of demineralization of human bones and muscle atrophy. The pharmaceutical industry has interest in the growing of high-quality protein crystals in space, while the study of influenza viruses in low gravity helps our understanding of Earth based biological processes. The study of space debris and the space environment and its hazards emerged as an area of interest since 2000.

Since 2000, space activities have been important to Australia in both monetary and utility terms. In 2000, Australia spent over US$500 million annually on satellite systems, but mostly overseas and with no guarantee that local industry will derive benefit and involvement in such programs. Australia purchased Intelsat and Inmarsat satellite system access, but our industry has not participated in the spacecraft or component assembly contracts. Other nations provided Australia with meteorological and remote sensing imagery and navigational satellite services, but with no certainties over continuation of service or the future costs. Australia considered these arrangements unsatisfactory and embarked on the program to develop their own space launching infrastructure and support activities.

As a result, several programs were initiated and came to fruition. To demonstrate the development and launch of small satellite payload demonstration projects, the FedSat program was started. The FedSat program focused on the design and construction of a multi-purpose spacecraft in time for the Centenary of Federation. The privately funded ARIES program capitalized on local expertise in imaging systems through development of a small commercial remote sensing satellite. A number of private commercial satellite launch vehicle proponents view the Australian landmass as offering stable potential for cost-effective rocket operations. All of these launching activities involve the use of derivative overseas rocket systems launched from sites as diverse as Woomera, Darwin, Gladstone, Cape York or Christmas Island. The feasibility of these launch programs relied heavily on the world market for communications and imaging satellite systems, a market that international competitors are also keen to secure.

Accordingly, Australia invested heavily in its space launching capability. The proximity of Australia to the equator provides for a higher initial launch velocity and the landmass offers a stable potential for cost effective rocket operation. Additionally, Australia gained significant experience in feasibility studies, design, and management of space missions as a service provider. The FedSat program enabled the initial development of service supplier capabilities and was a stepping stone towards more demanding and complex launch projects Australia's share of the remote sensing industry market increased to about 5% and the and grew substantially to over US$500 million annually by the year 2005.

In 2000, the market for the space launch industry was derived from two principle requirements: development of a new generation of mobile communications satellites in low-Earth orbit and, high capacity satellite systems operating in the higher geostationary Earth orbit. The explosion of information technology at the beginning of the century called for new mobile communications systems on small, low-Earth orbit satellites to provide global telecommunications by handheld telephones, no matter where users call from on Earth. Growth in national, direct-to-home TV broadcasting satellites includes new geostationary systems for several Asian nations. As a matter of history, by the end of 1997, there were 95 civilian geostationary communications satellites providing services to the Asia Pacific region. Of these, some 24 satellites provided Australia with telecommunications or broadcasting type coverage. In 2000, China and Russia remained the only current commercial launch service providers in the region with Japan and India not far behind. Other parties proposed rocket flights from Australia. Since 2000, the various competing launcher proposals for Australia comprise the Kistler venture, the International Resource Corporation (IRC) Soyuz program, the Space Transportation Systems (STS) plan, or United Launch Systems (ULS) Unity rocket program. Together, these proposals represent an investment of Aus$1.85 billion. Table (7) and Figure (22) show the location of the various proposed space launch sites around Australia and the sites of the major active space facilities.

Launch Sites:	IRC-Soyuz: on Cape York Queensland or Christmas Island, Kistler-K1: Woomera SA, STS-Proton: Melville Island or Gunn Point NT, and ULS-Unity: off Gladstone Queensland.
Adelaide:	DSTO, Institute for Telecommunications Research-University of SA, British Aerospace Australia, Codan, Vipac, Woomera (Nurrungar), NT-Pine Gap.
Brisbane:	Space Centre Satellite Navigation-University of Queensland., S.C.Microwave Technology-Griffith University, Qld. Univ. of Technology, Geoimage, Mitec.
Canberra:	NASA Canberra Deep Space Communications Complex, ADFA, ACRES, CSIRO-COSSA-CRC, ANU, Auspace, Electro-Optics, Departments.
Melbourne:	Bureau of Meteorology, KEL Aerospace, LaTrobe Univ., Sigtec.
Sydney:	Optus, Telstra, D-Space, Hawker de Havilland, Spot, TFS, Universities.
Perth:	Telstra, Optus, ERM, Universities, Geraldton Defence Satellite Station.

Table 7. Australian Space Launch Site Proposals and Space Support Facilities.

Figure 22. Australian Space Launch Site Proposals and Space Support Facilities.

c. History of Energy R&D since 2000[9]

Australia is a member of the OECD, the British Commonwealth, and the World Trade Organization (WTO). With an extremely low population density, Australia has ample natural resources for its own energy needs and, since 2000, is one of the few OECD countries that is a significant net energy exporter. Australia's hydrocarbon consumption habits are similar to those of other large, industrialized countries such as the United States and Canada.

(1). Oil

Australia's proven oil reserves (not counting shale oil) increased from 1.8 billion barrels in January 1998 to 2.9 billion in January 1999. Oil reserve estimates remain at 2.9 billion barrels as of January 2000. Record levels of petroleum discoveries and exploration were central to the surge in oil reserves in 1998. Production increased in 1999 to 621,000 barrels per day from 619,000 barrels per day in 1998. The Australian Bureau of Agricultural and Resource Economics (ABARE) projects further increases in oil production in 2000 and beyond.

(2). Natural Gas

Australia's proven natural gas reserves more than doubled from 19.4 trillion cubic feet (Tcf) in 1998 to 44.6 Tcf as of January 2000. Natural gas production increased gradually throughout the 1990s, but larger increases are expected in the coming decades. According to the Australian Gas Association, Australian natural gas consumption will double from its 1998 total of 1.1 Tcf by 2015. As of 2000, demand increases did not keep pace with supply increases, leading to an over-supply.

Australia is a growing LNG producer and exporter. The North West Shelf project, an

[9] EIA: Energy Information Adminstration.

equal joint venture between Woodside (operator), Chevron, Shell, BHP, BP Amoco, and Japan Australia LNG (which is a joint venture of Mitsubishi and Mitsui), is the only source of exports, mostly bound for Japan. In November 1999, Australia LNG (ALNG), a marketing organization established in 1999 aimed at matching up Asian demand for LNG with Australian suppliers, signed a Memorandum of Understanding with the Taiwanese gas company Tunex to supply that country with Australian LNG. The agreement increased Australian LNG exports by 50% and exports to Taiwan began in 2003. Additionally, ALNG researched the possibility of supplying India with LNG to fire its Gopal power project in Orissa. China developed as another potential customer for Australian LNG, and the North West Shelf project started supplying LNG to China in 2005 for its Guandong pilot project.

(3). Coal

Since the mid-1980s, Australia has been the world's largest coal exporter. Exports more than doubled from 87 million short tons (Mmst) in 1984 to 184 Mmst in 1998. Over half of Australia's total coal production is exported, with around 70% bound for Japan and the rest to other Asian markets. Australia has about 100 billion short tons (Bst) of recoverable reserves (fourth largest in the world), with about 52 Bst of black coal and 47 Bst of brown coal. Australian coals have good coking properties, low sulfur content (between 0.3% and 0.8%), and many are low in phosphorus.

BHP is Australia's largest coal producer and exporter. The company mines coking and thermal coal in Australia and abroad in the United States and Indonesia. Japanese steel mills are a key consumer of Australian exports. ABARE predicted that Asian coal demand would increase in 2005, led by the recovery of the Japanese steel industry. The weak Australian dollar made Australian exports especially attractive. The opening of China's markets further boosted

Australia's coal exports. The removal of Chinese coal subsidies and tariffs made Australian coal very competitive in China.

d. Economics Benefits of Technology and R&D in 2010

With the established space launching industry, Australia expects the space launch and support industries to contribute 0.5% to the GDP during this epoch. Additionally, energy exports will contribute 1% to the GDP. Of this total, oil production will be 1.5 million barrels per day (approximately 5% of the combined OPEC production) and be worth US$16 billion. Coal production will be 300 Mmst at an estimated value of US$9 billion. Finally, LNG production will be 9 Tcf at an estimated value of US$300 million.

6. Summary

The period between 2005 and 2010 was marked by significant growth for the Australian Defense Force. Carrying forward the doctrine developed in the Defense White Paper of 2000, changes in the structure of the ADF and the way it conducts warfare were well underway. Alliances with the United States, Japan and the ASEAN nations were still being cultivated. The peaceful reunification of China and Taiwan was accomplished and the superpower continued to grow economically and militarily. However, questions began to arise about the role of China as a peaceful neighbor. Japan has begun to show signs of concern about the Chinese role in Korea and the South China Sea. Closer to home, Indonesia remained in a cloud of political instability and tedious economic growth.

Australia's military tasks and objectives remained unchanged during this period. The ADF's primary focus was on adapting our forces to fit the mobile and efficient force called for by the government. Increased attention was paid to maritime patrols and surveillance in the inner arc as these sea-lanes became busier than ever in this period.

The economic expansion that began at the advent of the new millennium continued throughout this epoch. The rate of GDP growth increased from 3.89% to 4.5% as a result of increased trade, business efficiencies and some new market development. Globalization continued to be a dominant trend in economic and political affairs. Continued monetary and fiscal policy measures were utilized to help produce this sustained growth. The percentage allocation of government funds towards defense steadied out at a mean rate of 2.4%.

The ADF entered the second epoch with a solid baseline and force structure inventory to support its military strategy. With this solid baseline established, the Services focused on the expansion of their inventories. Each of the services still faced several weaknesses and vulnerabilities. These issues formed the basis for the force planning effort during the second epoch.

In the navy, action taken to resolve the lack of a robust amphibious and replenishment capability resulted in the development of a Multi-Role Auxiliary (MRA) ship. This ship was designed to serve as replenishment, troop transport, aviation support, or a logistics ship. The combination of these roles will result in significant life cycle cost savings. High-speed catamarans were purchased to augment the light lift capability and provide a means of rapid transportation or troops to regional contingencies. The catamarans and the MRAs will provide the foundation for future amphibious doctrine and operations. The success of the ANZAC frigate, Collins submarine, and the Huon minesweeper construction programs provided justification to continue these programs into the second epoch. The continuation of these programs maintains the industrial base and provides additional hulls to the inventory. Finally, vertical-launch equipped Spruance destroyers were purchased from the United States to bolster the RAN firepower and strike capability.

The size and composition of the regular army remained virtually unchanged during this epoch. Additional aviation and air defense assets were provided to support the amphibious and troop transport roles. The biggest change in the army structure was in the reserves. The reserve components went through the most extensive change in their history resulting in a smaller, better trained, and better equipped force. Integration of this reserve force with or in place of regular troops continues to shape their mission.

The air force underwent a major transformation in its combat aircraft fleet. To replace the older F/A-18 A/B Hornet aircraft, new E/F models were purchased from the United States. This aircraft replaced out older Hornets and will provide air combat capability well into the coming decades. To support all the aircraft, the continued procurement of tanker assets was continued. Additional AEW&C aircraft and the Global Hawk UAV were purchased to round out the surveillance and monitoring capability.

In the information arena, the continued development and refinement of command and control was realized with the integration of a single command headquarters. The communications and support systems continue to evolve to support critical functions.

During this epoch, Australia's involvement in a RIMPAC type exercise was proven to be more capable with its offerings of destroyer class vessels instead of frigate size vessels as in the first epoch. Nevertheless, in spite of providing bigger maritime vessels, Australia's force projection capability to the outer arc is still limited and there is no provision for providing air assets. Australia continues to rely on cooperation with regional powers like Japan and the US to ensure security in the outer arc.

For operations within the inner arc, a comparison between an Indonesia and Australian force highlights certain Indonesian maritime weaknesses with respect to anti-air and anti-submarine capabilities. With the procurement of more capable Spruance DDGs and F/A-18E/F Hornet fighters, Australia is poised to take advantage of these weaknesses and comprehensively exploit them. The main shortfall of the Australian force is the lack of an amphibious force designed to effectively neutralize enemy coastal defenses. Even if the full complement of Australian land forces could somehow be landed, the Indonesian troops still possess an overwhelming numerical advantage.

However, with the emphasis on better training and utilization of technology, it is believed that the Australian forces can provide sufficient kill factor to counter Indonesia's numerical advantage. When compared to the last epoch, Australia's ability to win in a conflict with

Indonesia is significantly improved.

In this epoch, Australia's R&D focused on the development of space launching capability and energy resources. The initial investment in space launching infrastructure in Cape York, Melville Island and Christmas Island was completed in 2008 with the commencement of commercial launching projects. Concurrently, continued R&D into electro-magnetic assisted launch proceeded. R&D into remote sensing resulted in the ability of imaging offshore oil reserves. This capability, coupled with the lower cost of deep sea drilling and the consistently high price of oil (US$30 a barrel) gave rise to aggressive export of oil to Japan, China and other Asian countries. Australia also realized a breakthrough in photovoltics technology enabling a shift in the internal energy requirement of Australia from less than 10% solar energy to 50% solar energy. Breakthroughs in fluidized bed technology for coal burning results in aggressive interest in coal as a source of energy. High-density LNG transportation allows yet another alternate energy resource for export. Forward looking, Australia also continued R&D into energy storage and supplies such as quartz technology, fuel cells and photovoltics.

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C. Epoch Three (2011-2015)

1. Australian Security Environment in the Year 2015

Since the last update to the Defense White Paper in 2010 there has not been substantial change to the basic goals, policies and structures of the Australian Defense Force. It is prudent however to take stock of global events those have unfolded, weigh their effects on our future as a nation, and make the appropriate mid-course corrections to the ADF's direction.

a. Globalization

Globalization was noted in both the Defense White Paper of 2000 and the addendum in 2010 as the most dominant factor shaping the Pacific Rim. The benefits of economic cooperation have lead to unprecedented economic growth in the region. While this has provided many nations with the wealth necessary to establish themselves as viable members of the international community, it has also created a state of international interdependency that has set the stage for small disagreements on trade issues to potentially flare into conflict. On the positive side, Australia sees less reason for nations to resort to conflict when most disputes are more advantageously resolved (for both nations) in regional or diplomatic forums. In short, the nature of the global economy is both a positive and a negative from the standpoint of probability of war.

Perhaps tipping the scale in the direction of insecurity was the growing rift in nations fuel requirements versus their available resources. Many nations of the Asia Pacific Rim were limited in their ability to grow as the result of constrained energy resources. This has actually been positive for Australia, as our natural resources have begun to meet world demand for energy. This contributed to the growth in GDP and spurred foreign investment in Australia.

b. Australian Strategic Interests and Objectives

The core priorities for Australia's defense have not been altered significantly in this epoch. The only major change is the recognition of the role that the global economy plays in national and international security. Although Australia is somewhat immune from international economic disturbances due to an abundance of natural resources and isolated geographic location, significant interruption in trade would have dire consequences to our economy. For this reason the Defense Ministry has decided to include the facilitation of free trade as a core interest. This interest could be affected by a maritime strategy designed to control key sea lines of communication (SLOC). Examples of these key routes include the Straits of Malacca and the routes between Darwin, Indonesia and Papua New Guinea.

In 2000, the ADF leadership undertook difficult steps to secure a credible force into the 21st century. These changes were predicated by adjusting the allocations of defense dollars. Long-ranging external operational commitments were skewed in favor of a reapportionment of assets into the procurement of future capabilities. This reduction in the current capabilities was undertaken with careful studies of the near-term impact and probability of war. The essentially secure geographical nature of our country, combined with a lack of credible threat in the region, made this course of action best suited for our long-range goals. The absence of a major conflict in the last decade has supported the wisdom of this decision. Several large leaps in capability were made in this epoch and will be in detail in the force structure section. The period 2010 to 2015 witnessed an ADF that had grown in size and subsequently required more investment in current operations. The changes in these budgetary allotments can be seen in the following table.

	2000	Epoch 1	Epoch 2	Epoch 3
Current Capabilities	57.930%	52.00%	51%	56%
Future Capabilities	29.320%	33.72%	33%	28%
Research	1.955%	2.95%	3%	4%
Personal Services	7.463%	7.46%	10%	9%
Resource Administration	3.332%	3.33%	3%	3%

Table 8. Broad Functions

c. Examining the Regional Powers

(1). The United States

The United States today has military capability and strategic influence that is still unparalleled. However, the past decade has shown a narrowing of the gap. Australia believes that US strength supports a generally stable global environment. The primacy of the US is built on the strength of its economy, the quality of its technology, the willingness of US governments and voters to accept the costs and burdens of global power, and the acknowledgement by most countries that US primacy serves their interests. There has been some evidence that the US has begun to retreat inwards in recent years however. A slowdown of the mighty economic machine from its growth rates of the 1990's was expected by most. The domestic reaction of its slowing of growth has been towards a more isolationist stance with respect to Asia. There is evidence of a slowdown of naval deployments as well as the continued troop withdrawals from the unifying Korea.

The Australian Government believes that US presence in the region will ultimately promote economic, social and political developments that align with our interests and values. To this end, an aggressive diplomatic campaign to the US government has been undertaken which features increased US basing privileges and calls for increased US/Australian joint and combined exercises. The gradual withdrawal of US troops from Korea has left a noticeable gap in military presence in the region. The investment undertaken to develop the port of Darwin aims to provide not only a comfortable port for Australian vessels but also as a base for US and other fleets. We believe that the combination of our forces will achieve our joint objectives in spite of the lessened US presence in the theater. Other nations such as Japan have also shown an interest in joining the alliance. Abroad, no country in the world will have the military or economic power to challenge the combined US, Australian and Japanese forces over the next few decades.

(2). Indonesia

Indonesia has been a key area of concern for Australia for the past several years. Its relative proximity to our shores and the instability that has erupted has caused great concern in the world community. In late 2014, Irian Jaya became the second major state to declare its independence from Indonesia in the past fifteen years. Despite the implicit support for their sovereignty by the government of Indonesia, the breakaway caused problems almost immediately. The Indonesian military establishment, which had already been openly critical of the civilian power struggle, took this opportunity to capitalize on nationalistic sentiment to initiate a coup d'etat. After the takeover and firm establishment of power in Jakarta, a state of martial law was declared in Irian Jaya. A mass influx of regular troops into the nation set off alarms in the international community. Worried that the troops could spread to adjoining Papua New Guinea, the UN Security Council issued a resolution condemning the invasion of Irian Jaya and formally recognizing it as a nation. Australia was appointed as lead nation of the UN task force that was sent to the area. This force remains in place in 2015.

One of the primary concerns with the invasion of an Indonesian state was the importance of the shipping lines around the island nation to the international economic infrastructure, particularly oil shipments. Maritime support from the United States in the form of an Aircraft Carrier Battle Group (CVBG) and minesweeping helicopters was provided. The Japanese Self-Defense Force (JSDF) has also become involved with the operation as their energy supply lines have been threatened. Maintaining the SLOCs open through the Indonesian archipelago remains the top priority of the ADF as of this writing.

2. Economic Development and Defense Spending

Australia's economy has experienced sustained upward momentum for the last 15 years. In the period 2010 to 2015, the GDP grew at an average annual rate of 4.36%. This growth rate resulted in the GDP increasing from US$523 billion to US$595 billion by the end of the decade. While the size of the economy continued to increase, the percentage allocated to defense remained relatively constant at 2.4% of GDP. The growth rate of the economy and the percentage spent on national defense is represented in Figure (23). This growth was driven by a variety of factors including both domestic policy and technology based productivity gains.

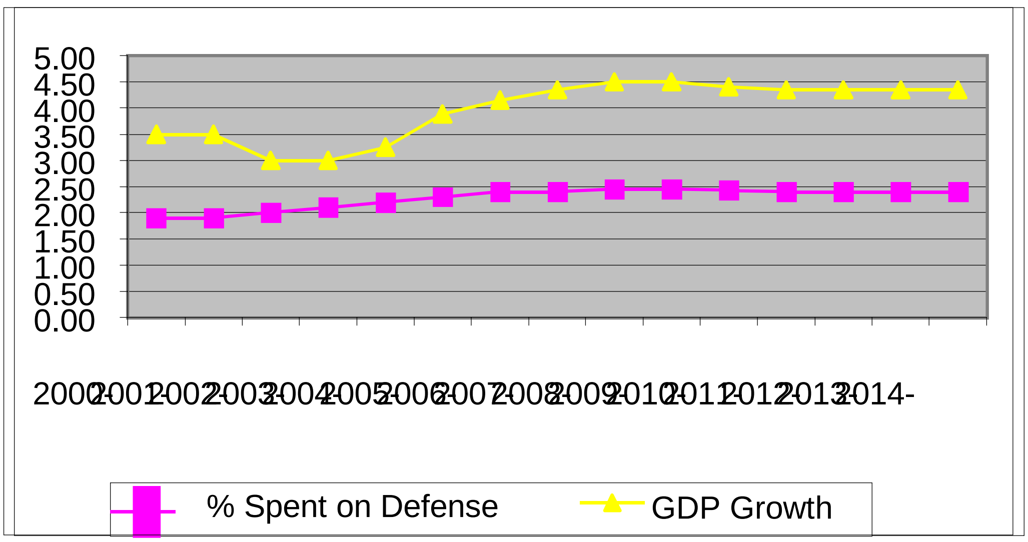

Figure 23. GDP Growth and % Spent on Defense

Australia embarked on a comprehensive economic vision in the year 2000. This integrated strategy contained three main thrusts. The monetary and fiscal policy measures instituted were designed to facilitate sustainable growth with minimal inflation. Immigration policy was changed so that key labor shortfalls could be eliminated. Diplomatic measures sought to open trade boundaries in both the Pacific Rim and internationally. The results of these policies were evident in the sustained growth despite some negative international trends.

The notable shift away from a liberal entitlement policy initiated in 2008 was designed to empower Australians to invest wisely for their retirement rather than purely relying on social security. The ageing demography of Australia has been a concern for the government for many years. In 1999, 42% of the federal budget was taken up by entitlements. It was recognized early that as our population aged, this would become a heavy burden on other governmental sectors. Tax measures designed as incentives to personal investment for retirement were initiated despite many internal debates on the subject. Additionally, wealthy Australians were given estate tax benefits for forgoing their entitlements. These changes, coupled with the growth rate of the economy, resulted in the percentage of entitlement spending remaining relatively constant as the population aged.

The fiscal policy measures initiated in 2008 and designed to spur investment in the capital markets had the effect of creating a boom in the stock markets and a subsequent “wealth effect”. Additionally the increased GDP allowed federal investment in a variety of projects, which had the effect of increasing productivity across the board.

Monetarily, the government took steps to mitigate the risk of inflation by adjusting short-term interest rates in response to early indicators of inflation. The money supply was also closely monitored to fine tune short-range growth forecasts. Employment rates went up dramatically towards the end of the epoch as a result of opening markets and the capital influx. The services sector grew at the fastest rate followed closely by the energy, technology and research areas.

As Australia’s economy expanded over the last 15 years and new market areas opened, the rate of unemployment drastically fell. The demand for highly skilled workers was the fastest growing sector of the labor market while an increase in the service and other sectors was also noted. The government has reacted to this employment crunch by adjusting its immigration policy to reduce key shortages. Measures to speed the approval of visas for skilled and technology workers were introduced. As a result immigration from the nations of India, China, Indonesia and Malaysia increased. These increases were initially rejected by some portions of the Australian populace but were embraced by most as a step towards increased productivity and a shift toward key industries. These policies have begun to alleviate some of the rising labor costs that have begun to hamper growth and indicate signs of increasing inflation. This pressure remains one of the Economic Ministry's highest priorities. In addition to the continued use of focused immigration policy, substantial investment in education and training will need to be made to fully take advantage of our diverse culture to maintain growth.

Diplomatically, Australia continued to seek to build relationships with the key nations of the Pacific Rim and with Non-Governmental Organizations (NGOs). These alliances were based not only on mutually beneficial economic arrangements but also on the premise that countries that have mutual interests have less impetus to go to war. Australia continued its close relationship with the United States during the last five years and intends to do so in the future. Key agreements with several US companies lead to the opening of plants in the manufacturing, energy, semi-conductors, fiber optics and aircraft sectors. These mutually beneficial arrangements resulted in not only in a substantial boost to the economy but also to key transfer of knowledge in these areas and building of new industrial bases.

Australia also opened up new channels with Japan. After experiencing a prolonged recession in the 1990's and the early 2000's, the island nation undertook some painful but necessary reforms. The protective measures that Japan had traditionally clung to were eased in order to realize the synergies of globalization. Japan's lack of internal energy resources led to trade agreements with Australia to develop our abundant natural resources. Significant capital inflows to the Australian energy industry by both foreign and domestic sources have begun to build a substantial infrastructure that, coupled with our technology leaps in this area, should position us to be an international leader in the energy market.

Arrangements with the Association of South East Asian Nations (ASEAN) were successfully pursued during this epoch. Australia's status as a key consultant to the organization was elevated in 2006 when appointed chief of the ASEAN Regional Forum. Australia used this position to shore up their position in key markets and national security arrangements.

Australia continued to undertake efforts with China in the areas of trade and security in the past five years. While Chinese human rights problems have continued to plague the nation on the international front, it's rapidly developing economy and increased status, as a regional power could not be ignored. Australia's diplomatic arrangements with China has thus far been perfunctory and designed primarily to keep channels open.

Australia intends to continue work closely with the regional power entities into the next epoch to facilitate a stable international economy and mutually beneficial security arrangements. While competition among the nations of the Pacific Rim is inevitable, it does not have to be a source of conflict if the correct arrangements are stuck.

The economic policies pursued in the period from 2010 to 2015 have resulted in assisting the economy in its growth. The productivity benefits reaped from information technology were significant facilitators of this growth. Evidence does however; exist that these benefits may be approaching the limits of their continued ability to provide huge gains. Fortunately, the opening of new markets such as energy, space and other technologies has contributed greatly the overall growth of the economy during this epoch. The expectation is for this trend to continue.

3. Australian Force Structure 2015

The development of the force structure for the ADF during the third epoch was the result of a review of the vulnerabilities and weaknesses of the 2010 force structure and issues stemming from the 2010 net assessment scenarios. Additionally, the national and military strategies and the ability of the military forces to carry out these strategies were evaluated.

a. The Royal Australian Navy (RAN)

For the RAN, the vulnerabilities identified during the second epoch are as follows:

(1). Limited long range air defense capability

(2). Improving replenishment capability

(3). Improving amphibious lift capability

In the first two epochs, the lack of long-range air defense in our surface ships was a recognized vulnerability. The previous upgrades to the guided missile and ANZAC frigates served to mitigate this vulnerability, but did not eliminate it. As a result, the RAN embarked on a plan to indigenously produce an air defense ship. The result of this project is the introduction of the Howard-class Aegis destroyer (DDG). This class of ships was produced in Australia with the assistance of the United States. The United States provided the latest Aegis weapons system at a significant cost savings. The construction of larger hull forms, such as the Multi-Role Auxiliary (MRA), served as the model for the construction of the Howard DDG. The process and lessons learned during this construction process greatly facilitated the construction of the new class of DDGs. Due to the continuing construction of the MRA ships during this epoch, construction of this new DDG was limited to one hull in this epoch.

The Navy force structure for 2015 is provided below.

(1). Surface Combatants

(a). 6 FFG

(b). 14 ANZAC FF

(c). 4 Spruance DDG

(d). 1 Aegis DDG

(e). 8 High-speed catamarans

(f). 30 Patrol Boats (PB)

(g). 5 Multi-Role Auxiliary (MRA)

(h). 2 Amphibious Lift (LPA)

(i). 15 Landing Craft Medium (LCM)

(j). 6 Landing Craft Heavy (LCH)

(2). Mine Warfare

(a). 2 Inshore MCM

(b). 12 Huon-class MCM

(c). 4 Dive teams

(3). Submarine Force

(a). 8 Collins SS

(4). Navy Air

(a). 16 Sea Hawk helicopters

(b). 7 Sea King helicopters

(c). 40 Super Sea Sprite helicopters

(d). 19 P-3C Orion MPA

(e). 10 LAMPS Mk-III helicopters

The major addition to the Navy inventory was the Howard Aegis air-defense ship. This ship provides the RAN with the beginnings of a maritime air defense capability. This capability will be instrumental in providing protection to RAN and coalition assets against modern air-launched weaponry. Construction of two, and possibly three, additional hulls will continue into the next epoch. The RAN feels the continuation of this construction program is absolutely necessary in furthering the capability of the naval forces.

Four additional high-speed catamarans were purchased during this epoch to augment the lift and amphibious capability. Given the fact that Australia's forces are small and primarily equipped with light weapons, the catamarans are an ideal vessel to rapidly reposition forces. These high-speed catamarans have proven their worth in operations throughout the region during this epoch.

Three additional MRAs were added to the naval forces inventory. One of these ships replaced the remaining oiler/replenishment ship. The other two ships were constructed as replacements for the Landing Platform Auxiliaries (LPA). The LPAs will reach their end of life and will be decommissioned in the fourth epoch. The fifth MRA hull was constructed with a well deck configuration to allow the launching and recovery of amphibious craft. Future MRA ships, if constructed, will also have well decks. The remainder of the naval force structure remains the same from the second epoch.

A careful review of the worldwide situation by the Australian government during this epoch has revealed some potentialities with respect to the United States. A combination of factors has the potential of forcing the United States to remove its troops and naval presence from its traditional Western Pacific bastions in Japan, Korea, and Okinawa. If the United States desires to keep these forces in the Western Pacific, it must find new ports and facilities with sufficient size and infrastructure to base them. As a result of this potentiality, Australia developed the naval facilities in the northern port of Darwin into world-class facilities during this epoch.

The Darwin naval base of 2010 was only capable of supporting minor surface combatants on two piers and hardstand dock facilities. These facilities were unable to support large, deep draft warships and other major combatants.[10] Accordingly, in an effort to provide an enticing basing alternative to the US government and military, a significant investment and construction process was started. This construction expanded the existing naval facilities to support additional minor combatants and developed a new facility capable of handling major combatants. This facility, located near the East Arm Port commercial facility, was constructed to serve primarily as a naval base, but also had the attributes of a commercial facility should the United States decide not to base its fleet there. Accordingly, the facility is capable of supporting ships up to 100,000 tons at a minimum draft of 46 feet. Support of deeper draft ships is possible with dredging should the need arise. Much like the East Arm Port, this facility has adequate fuel storage and logistics capability and is linked to the overland routes via the Northern Territory railway system.[11] Since its completion in 2010, the East Arm Port commercial facility has proven to be a successful endeavor and the lessons learned during that construction and subsequent operations have been applied to the expansion of the naval facilities. Australia feels this new naval facility will be of sufficient size and scope to support the United States military forces in the future as a new homeport for the US 7th fleet.

As a result of the 2015 force structure, the RAN is still faced with a moderate air defense

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[10] Parliamentary Standing Committee on Public Works, Commonwealth of Australia, *Darwin Naval Base Redevelopment*, September 2, 1999.
[11] The information on the East Arm Port commercial facility was derived from the following web site: http://www.nt.gov.au/dpa/eastarm/index.html (home page).

capability, but significant improvement was made with the introduction of the Howard Aegis DDG. Construction of future hulls will continue the positive trend in this area. The oldest Knox class FFGs and the two LPAs will be decommissioned during the next epoch. The decommissioning of these vessels will decrease the total ship inventory, but the addition of modern warships such as the Spruance and Aegis DDGs and the MRAs offset these impending losses to the inventory. The most pressing issue facing the navy force planners in the next epoch is the one of its anti-submarine warfare and surveillance aircraft. The navy's P-3 fleet is ageing and faces retirement or an airframe extension in the coming years. Australia must decide on whether to replace the aircraft with a similar airframe and capability or to adjust its surveillance capability, possibly with unmanned aircraft.

b. The Australian Army

For the Australian Army, the vulnerabilities identified during the second epoch are as follows:

(1). Remains a light fighting force with limited heavy equipment and armament

(2). No amphibious capability

In 2010, it was noted that Australia's army is small, lightly equipped, and expected to remain so during the third epoch given the range of expected operations. The technology advances and the superior weaponry purchased during the second epoch made up for the shortfall in actual troop numbers. However, the net assessment against Indonesia highlighted the fact that while technically superior, the Australian Army did not possess the means to conduct an opposed amphibious landing.

The Army force structure for 2015 is provided below.

(1). Special Forces (2 regiments SAS/2 Commando regiments)

(2). Mechanized Force (1 brigade)

(3). Light Infantry Force (1 brigade)

(4). Motorized Infantry Force (1 brigade)

(5). Marine Amphibious Force (2 brigades) (150 AAAVs)

(6). Army Aviation Force

(7). Ground-based Air Defense

(8). Army Reserve Force

(9). Army Aviation (helicopters)

  (a). 36 S-70A Black Hawk

  (b). 6 CH-47D Chinook

  (c). 24 Apache Armed Reconnaissance

  (d). 12 Troop Lift

  (e). 20 V-22 Osprey

(10). Ground Based Air Defense

  (a). 12 RBS-70 laser guided units

  (b). 10 Patriot firing units

  (c). 12 Patriot PAC-3 firing units

(11). Army Reserve

  (a). 11^{th} Brigade (North & Central Queensland)

  (b). 4^{th} Brigade (Victoria)

  (c). 8^{th} Brigade (NSW)

(12). Reserve Surveillance Units

  (a). Northwest Mobile Force (NORFORCE)

(b). Pilbara Regiment (WA)

(c). Far North Queensland Regiment

As a result of the major deficiency identified during the 2010 net assessment process, the army embarked on a campaign to develop an amphibious capability. As a result, the major change to the ground capabilities of the army was the creation of two marine amphibious brigades. Recognizing the magnitude of this effort, this capability and the formation of these units were conceived in close cooperation with the United States Marine Corps (USMC). Operational doctrine, normally developed over decades, was developed during this epoch as a direct result of this cooperation. Extensive operations and training under the guidance of USMC observers established the operational basis for these units. As part of the overall force, these units also have 150 Advanced Amphibious Assault Vehicles (AAAV) to support their operations. The addition of an amphibious troop capability allows the Australian military to conduct an opposed beach landing of forces should the need arise.

Army aviation saw the addition of the V-22 Osprey tilt rotor aircraft to the inventory to support the newly formed Marine brigades. The technical and mechanical difficulties experienced in the Osprey program in the early part of this century were overcome and the aircraft has proven to be reliable and effective. The V-22 and the MRAs provide the capability to deploy troops over land and over the sea as the opportunity dictates. The V-22 also serves as a long-range replacement aircraft for the aging CH-46 helicopter fleet. As the Marine amphibious capabilities expand, additional V-22 Ospreys will be added to the inventory in future epochs.

Australia's reserve components remained unchanged from the last epoch. The reserve forces have continued to train, supplement, and in some cases, deploy in place of regular troops.

The army of 2015 looks much like that of 2010. The army remains a light fighting force with limited heavy equipment and armament. The additional of dedicated marine amphibious brigades have bolstered the overall capabilities force, but it still remains a small and light fighting force. Australia feels this is a satisfactory force structure given the range of future conflicts.

c. The Royal Australian Air Force (RAAF)

For the RAAF, the vulnerabilities identified during the second epoch are as follows:

(1). Air combat capability with respect to regional defense forces (modernization issue)

(2). Loss of air strike capability with the retirement of the F-111

During the second epoch, the RAAF began the combat aircraft procurement plan to address the modernization issues of the air combat fleet. This plan resulted in the purchase of F/A-18 E/F Hornet aircraft to replace the older A/B models. The RAAF also faced the retirement the F-111 and the loss of air strike capability.

The RAAF force structure for 2015 is provided below.

(1). 80 F/A-18 E/F Hornet

(2). 35 F-111

  (a). 21 C, 14 G

(3). 24 C-130J Hercules

(4). 14 C-27J Spartan

(5). 7 AEW&C Boeing 737-700

(6). 8 Boeing 767 Tankers

(7). EWSP upgrades for all air platforms

(8). 50 Global Hawk UAV

During this epoch, the F/A-18 A/B models were completely phased out with the purchase of forty additional E/F models. The procurement of this aircraft and its modern weaponry gives Australia one of the most capable air combat fleets in the region.

Thirty additional Global Hawk Unmanned Air Vehicles (UAV) were added to the inventory to bolster the surveillance capability of the force. These unmanned aircraft may be the replacement for the P-3 surveillance capability in the future epochs.

The RAAF in 2015 is ready for operations throughout the region. The biggest vulnerability faced in the near future is the retirement of the F-111 aircraft and the loss of long-range air strike capability. However, the maritime forces and their Tomahawk cruise missiles, along with the UAVs for surveillance, have replaced the strike capability of the F-111.

d. Information Capability

In the area of information, the vulnerability identified during the second epoch was the issue of how to maintain pace with changing information technology. The issue is how incorporate emerging technology without having to make wholesale changes to the information capability of the nation with each new release or new technology. Accordingly, Australia developed a carefully planned and executed modernization program to maintain pace with changing information technology while maintaining robust information systems.

The Information Capability force structure for 2015 is provided below.

(1). Operational Command

(a). Single Joint Headquarters

(b). Deployable HQ (two)

(c). Communications (SATCOM, HF, Networks)

(d). Command and Information Management Systems

(2). Strategic Intelligence

(3). Strategic Surveillance

(4). Geospatial Information

(5). Hydrographic Survey Force

In 2015, the information capability of the ADF remains largely unchanged. The modernization program resulted in an information capability superior to other countries in the region. Additionally, the functionality of the system enables the ADF to seamlessly integrate with other advanced nations during coalition operations.

In the future, Australia must still carefully weigh the cost versus benefit aspects of any prospective information technology. Also, Australia faces the challenge of integrating multiple surveillance capabilities – from airborne aircraft and unmanned vehicles to surface ships and submarines.

4. Scenarios for Static Net Assessment

a. Scenario 1: Protection of Sea Lines of Communications (SLOCs)

The fastest trade route from the West to Asia is via the Straits of Malacca and the South China Sea (SCS) as shown in the following diagram. With Chinese forces increasingly exerting military influence in the SCS, the result is the transformation of the area into a "bath tub", potentially restricting commercial vessel passage. In essence, this fast trade route comes under the direct threat of Chinese military dominance in the region.

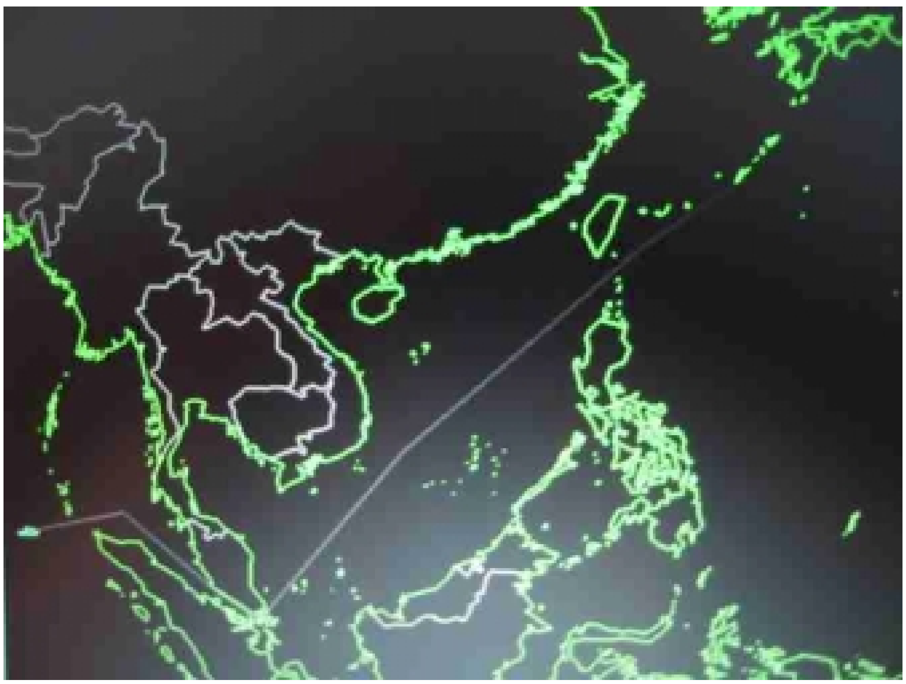

Figure 24. Main SLOC in Southeast Asia via Malacca Straits

An alternative trade route could be devised as shown in the following diagram. This trade route bypasses the treacherous SCS, goes south of Indonesia, and uses Darwin as a transit center. By going northwards towards Japan, the route transits through the Indonesian archipelago, a potential hotspot in view of the instability of the regime after a recent military coup. Nevertheless, the kind of threats faced in the Indonesian passage is likely to be low level, restricted to piracy, or rogue troops firing shoulder launched weapons at merchant vessels. Threats by the conventional Indonesian military elements are unlikely, as this will constitute an act of war.

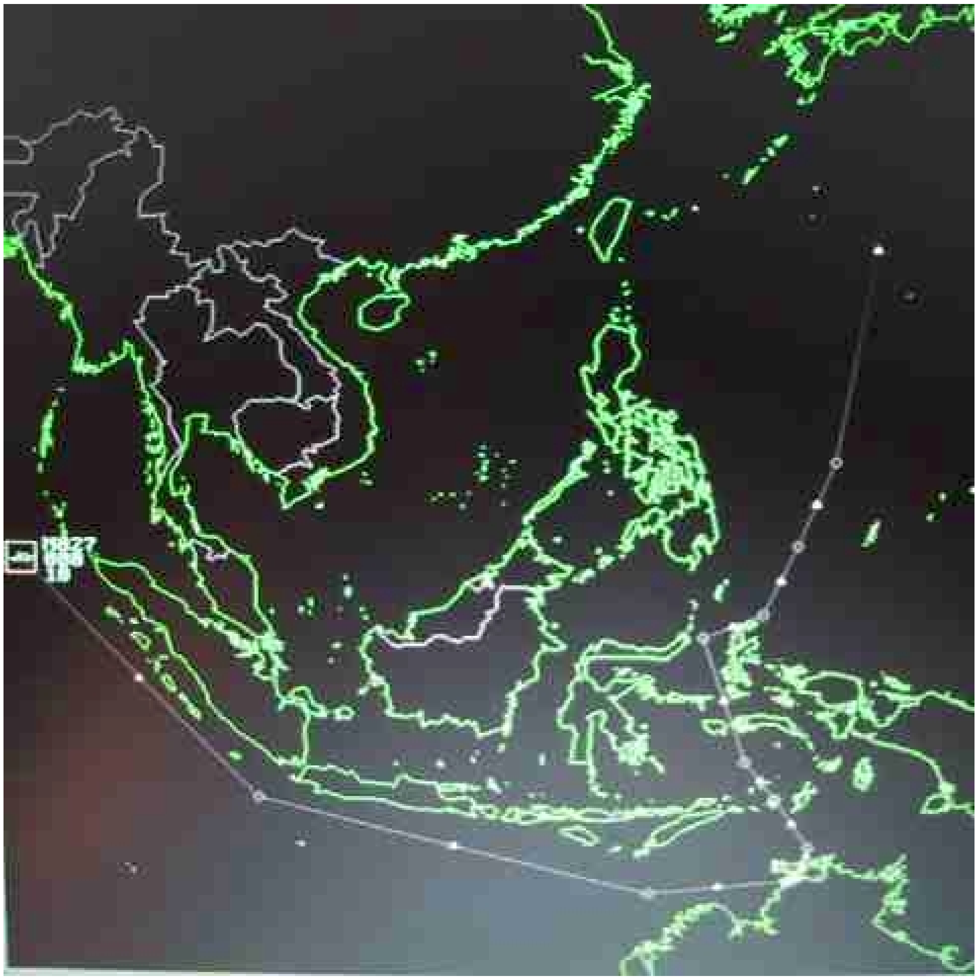

Figure 25. Alternate SLOC via Darwin

To ensure even better protection from potential harm, a third trade route could be established as shown in the following diagram. This trade route via Melbourne bypasses Indonesia and SCS completely. By transiting through Papua New Guinea, a friendly nation, Australia can ensure the safety of merchant shipping in this area.

Figure 26. Alternate SLOC via Melbourne

There are severe tradeoffs in the usage of the safer routes. A typical supertanker cruising at about 10 knots can transit from Sumatra to Japan via Singapore in about 15 days. If Darwin is made the transit center, the transit time increases to 24 days. Should Melbourne be used as the transit center, a transit time of 38 days is required. If the Chinese military threat in SCS is imminent, forsaking the shortest trade route may be a necessary option. In this case, the use of Darwin as a transit center is feasible in terms of the relative risk involved and the time compromise. Australia can offer its service as the regional policeman by ensuring the security of this trade route, especially through Indonesian waters.

There are a number of threats to the SLOCs in the form of:

(1). Land based attacks by terrorists

(2). Mine warfare

(3). Surface vessels or piracy

(4). Submarine attack

(5). Air attack.

Land-based attacks by terrorists may be conducted using low-tech infantry anti-tank weapons like the Carl Gustav 84mm recoilless rifles. Though effective against land-based targets, it may not be very effective against commercial shipping. Certainly, with ships transiting more than a nautical mile (NM) from shore, the effectiveness of such a weapon is greatly reduced. This threat, though highly likely, does not present itself as credible enough to consider here.

The use of asymmetrical weapons like mines poses enormous problems for Australia's maintenance of a security region. This weapon is cheap, easy to implement, and very difficult to neutralize. It is a problem the ADF needs to carefully examine for future solutions. However, mines are non-discriminatory and would cause great damage to the Indonesian coastal trade if deployed.

Piracy in the SCS region has long been rampant and with the influx of Chinese military vessels, pirates could well be forced out of their territory into the southern waters of the Philippines and Indonesia. This is a likely threat that will impact the security of the region tremendously.

The submarine and air threats are deemed to be unlikely, as these actions will require the conventional Indonesian military elements to execute in any significant quantity. Should such actions occur, it will almost certainly cause an international outcry and Indonesia will be faced with the consequences of starting a war. Nevertheless, with the military leaders now in control of the country, any scenario is plausible and Australia must be ready for these contingencies.

b. Scenario 1: Provision of Maritime Action Group (MAG)

Australia will introduce a MAG in the region to ensure that the possible threats to commercial shipping are addressed. The responsibilities of SLOC protection by Australia must be developed in close cooperation with regional powers like the US, Japan, and India. Australia can provide protection from southern Sumatra through to Darwin and the channels leading north of Darwin through western Irian Jaya. The responsibilities for protection of shipping west of Sumatra can be negotiated with the US naval assets in the Indian Ocean and the Indian Navy. For the waters north of Indonesia, the US and the Japanese Navy can play a role to ensure safe transit by commercial vessels. Australia should limit its responsibilities so as not to unduly overstretch its military assets.

In providing a static net assessment on the abilities of the Australian MAG, the questions "How Much?", "How Far?", and "How Fast?" will be addressed.

c. Scenario 1: How Much?

The MAG composition will be as follows:

(1). 1 x MRA supply ship

(2). 4 x ANZAC FFGs

(3). 4 x Huon MCM

(4). 2 x Collins SS

(5). 8 x UAV (Global Hawk) on patrol at any time

(6). 2 x P-3C Orion on standby at Tindal AFB

(7). 2 x AEW&C aircraft on patrol

(8). 1 x F/A-18 squadron on standby at Tindal AFB

The MRA supply ship is capable of sustaining the surface vessels operating at the Indonesian channel north of Darwin (the ANZAC frigates and the Huon MCM). The ANZAC FFGs provide anti-surface capabilities with search and detection of such threats provided by the UAVs. The Collins submarines offer anti-submarine capabilities in conjunction with the P-3C Orion aircraft. The newly acquired F/A-18 E/F Hornet fighters provide anti-air capabilities should the need arise. The MAG will operate from Darwin Naval Base and Tindal Airbase.

d. Scenario 1: How Far?

The aim of the MAG is to provide a security zone up to 1,000 NM from the northern coastline of Australia. With provisioning from the MRA supply ship, the ANZAC FFGs, the Collins submarines, and the Huon MCM can comfortably cover the required distance. The Global Hawk UAV has an endurance of 46 hours flight time cruising at 300 knots. The entire security zone can be searched by a single UAV without refueling with detection by an Electro-optic/infrared sensor up to 60 NM range and Synthetic Aperture Radar (SAR) radar up to 100 NM range.

The range extension of air force fighters to 1,000 NM will require the use of air-to-air refueling, now available to the ADF. Without air-to-air refueling, the operating range of the F/A-18E/F (with anti-air weapon configuration) extends to a maximum of 600 NM from the coastline.

e. Scenario 1: How Fast?

The search pattern of the UAVs is as shown in the following diagram. A single UAV can cover the entire search route in 40 hours (traveling at 300 knots). The use of eight UAVs will ensure that every single spot is searched once every five hours. This will allow the MAG to map every single surface vessel in the region and classify them accordingly, assuming they can discriminate the threats from the traffic.

Figure 27. UAV Air Search Pattern

Should hostile activities be determined, the FFGs (deployed as shown in the following diagram) will be able to react within four hours along the SLOC. As the surface threats are defined to be mainly low level with piracy being the major culprit, the FFG should be adequate to counter this threat. Should military vessels from the TNI (Indonesian Armed Forces) be involved, then backup vessels like the Spruance or Howard DDGs will have to be summoned. This is unlikely, as Indonesia has no reason to provoke military confrontation with its neighbors. It has enough internal strife as it is.

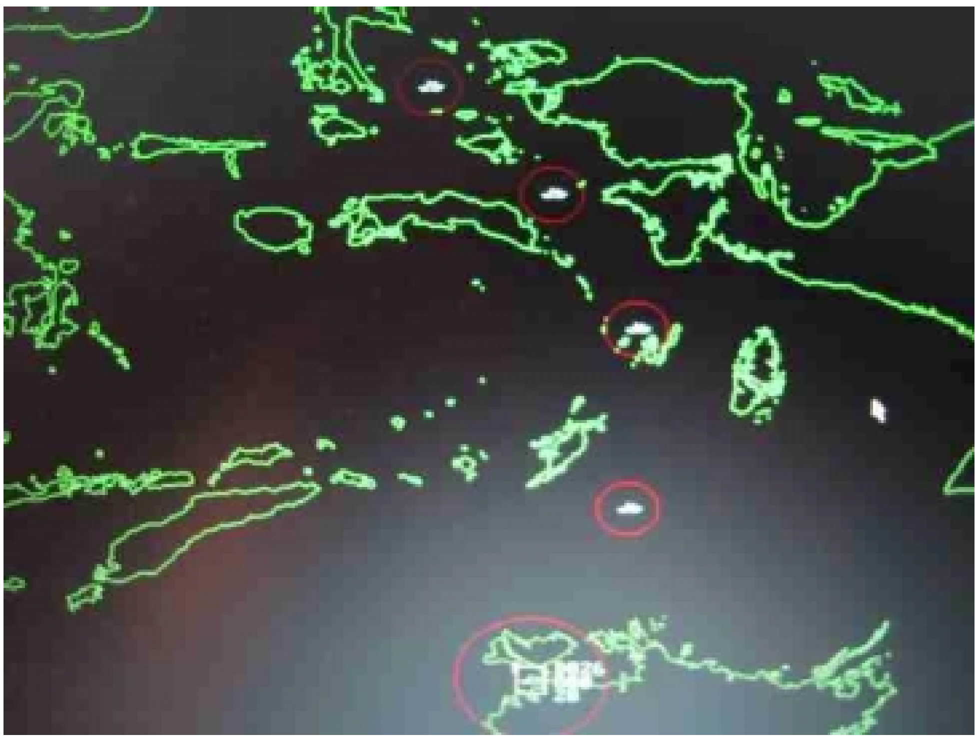

Figure 28. Alternate SLOC Protection with MAG (FFG Disposition)

If mines are detected along any of the routes, the Huon MCMs will immediately be dispatched from Darwin to execute mine clearing operations. The operational speed of such vessels is at about five knots while clearing. To clear a mine-safe route from Darwin out from Indonesia (as shown in the following diagram) will take at least eight days for a single minesweeper. With the use of four Huon MCM vessels, the channel could perhaps be opened within perhaps two days.

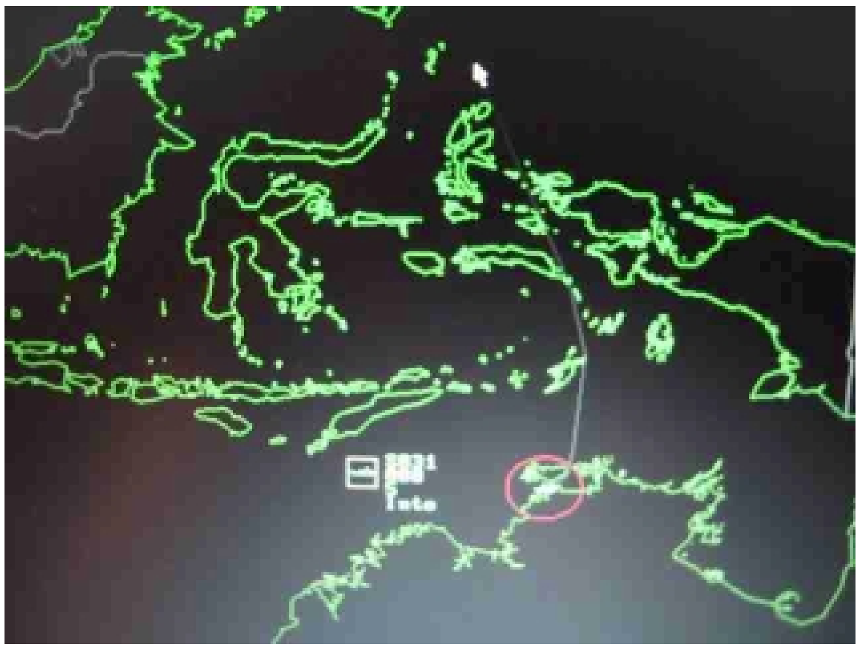

Figure 29. Mine Clearance Path from Darwin

If the scenario of submarines threatening merchant vessels should materialize, then the activation of the Collins submarines to react along the SLOC can occur within 10 hours. More rapid reaction can be through air means with the P-3C Orion operating from Tindal to anywhere along the SLOC in less than four hours. The deployment of the Collins submarines are as shown in the following diagram.

Figure 30. Deployment of Submarine along SLOC

The F/A-18 Hornet fighters can react to enemy air threat within two hours if the threat is less than 600 NM from the coastline, and three hours if the threat is up to 1,000 NM. This delay is to meet the requirement for air-to-air refueling to extend the range of the fighters. The detection of hostile enemy air threats is provided by the Jindalee over-the-horizon radars (able to cover up to 1,000 NM from northern coastline) and the employment of the Airborne Early Warning and Control (AEW&C) aircraft, which has a 350 NM air search radar. The endurance range of the fighter jets is shown in the following diagram. It should be stressed that although the submarine and air threats are viewed as improbable, the setup of the MAG is designed to counter such threats should the improbable scenario occur.

Figure 31. Aircraft Range with and without Air-to-Air Refueling

f. Scenario 1: Summary for SLOC Protection Scenario

The SLOC protection effort by the ADF through the provision of a Maritime Action Group demonstrated a force able to deal with the various possible threats faced by commercial shipping. The surface threats are adequately neutralized by the use of patrols along the SLOCs with detection provided by the UAV.

The problem of mines is less adequately addressed as it is difficult and slow to ensure a mine safe SLOC. Even the optimistic reaction time of two days can be quite hampering to commercial shipping and this can be a potent weapon for the adversaries to exploit.

Submarine and air threats, though unlikely, can certainly occur should the Indonesian government become desperate. Under such a scenario, the MAG is adequately setup to react competently. Nevertheless, the further problem of imminent war will have to be addressed, as the opponent will clearly have signaled a desire to elevate conflict.

g. Scenario 2: Invasion of East Timor/Irian Jaya

The declaration of independence of Irian Jaya will pose similar problems for this province as it did for its predecessor, East Timor. With the military coup, it is envisioned that the Indonesian military government may attempt to retake Irian Jaya by force. The task force used to counter such a threat will be similar to that used on the East Timor invasion scenario discussed in the second epoch.

Geographically, East Timor and Irian Jaya are situated at about 500-600 NM from Darwin. Some of the main weaknesses of trying to retake East Timor are the numerical inferiority of the ADF task force and the severe lack of amphibious assets to mount an amphibious assault. The task force has demonstrated a capability to achieve maritime superiority over the Indonesian maritime force in the last epoch. In this epoch, with the economic and political problems faced by Indonesia, it is predicted that many of its modernization efforts for its military are stalled. Therefore, a weak maritime force struggling to operate old equipment in the region is presented in this scenario. Further, Indonesia is unlikely to possess the military might to simultaneously retake East Timor and Irian Jaya in view of the political turmoil the country is undergoing. Much of the military assets will be used to quell the civilian unrest. With this setting in mind, the answers to the questions "How Much?", "How Far?", and "How Fast?" are attempted.

h. Scenario 2: How Much?

The Indonesian force for this scenario is the same as that described in the second epoch.

The Australia task force will be comprised of the same force in the last epoch with an additional Howard DDG with the following configuration:

(1). 1 x Howard Class DDG

(a). 6 x Mk-50 ASW torpedoes

(b). 8 x Harpoon anti-ship missiles

(c). 90 x RIM-161A SM-3 missiles

(d). 90 x Tomahawk missiles

The Howard DDG is the equivalent of the US Arleigh Burke DDG. This ship offers superior anti-air capabilities with the SM-3 missiles having an extended range to up to 200 NM.

To boost the shortcomings of the land forces, two Marine brigades were raised in this epoch to provide the capability to mount an amphibious assault. In addition, the numerical ground troop comparison is much more favorable with the Australian troop numbers actually surpassing their Indonesian counterparts. The lift assets for the additional Marine brigades are as listed:

(1). 2 x Marine Bdes for Amphibious Assault

(a). 1st Bde - 2 x MRAs (30 AAAV, 1800 personnel), 2 MRA (rest of personnel and equipment)

(b). 2nd Bde - 6 x Catamarans (personnel), 2 x LPAs (equipment)

(2). 2 x Infantry Bdes for Follow-on Land Campaign

(a). 1st Bde - 19 x C-130J (Light Bde)

(b). 2nd Bde - 6 x Catamarans, 2 x LPAs

i. Scenario 2: How Far?

The Australian maritime assets are expected to provide maritime security for up to 600

NM from Darwin to East Timor or Irian Jaya. Once the air and surface threats had been countered, the lift assets can project land forces to East Timor or Irian Jaya.

k. Scenario 2: How Fast?

The time for projection of land forces to deploy to retake Irian Jaya or East Timor by force is as listed:

(1). 1st Marine brigade to land in 30 hours (based on amphibious ship speed of 15 kts)

(2). 2nd Marine brigade in 40 hours

(3). 1st Infantry brigade by second day

(4). 2nd Infantry brigade by third day

The stated time does not include mobilization period for reserves to cover the active personnel. The time assumes the task force is already concentrated at staging area (Darwin).

l. Scenario 2: Summary for East Timor/Irian Jaya Invasion Scenario

For this epoch, the ADF has developed a much more capable land force to support a forcible invasion of either East Timor or Irian Jaya. The benefits of this new land force include the amphibious fighting capabilities and more troops (12,000 Australian soldiers versus 10,000 Indonesian troops). Further, the investment in a 21st Century Soldier concept in the first epoch had developed a soldier with enhanced body armor protection, integrated command and control systems for each soldier through enhanced communications devices, and better weapons that can provide anti-armor capabilities. In terms of soldier performance, the Australian soldier is definitely superior to their Indonesian counterpart.

The maritime assets of the TNI have not been upgraded significantly in view of the economic problems of the country. Operating with aging equipment and having to deal with turmoil in the country, the military is under tremendous pressure and their commitment in countering any possible East Timor or Irian Jaya invasion will be very limited in view of the other problems This therefore results in a maritime force which is not improved in capability compared to the one in the last epoch, so the Australian task force can easily gain an upper hand in the maritime arena.

In conclusion, the ADF had geared itself over the last two epochs to become a much more capable and all-rounded force to deal with a potentially serious conflict they might face. The maritime assets control the sea and air channels, and the land forces are capable of launching amphibious assaults and possess a numerical advantage over their Indonesian counterparts. The ADF is now capable of handling this scenario as long as it doesn’t deteriorate into a drawn out campaign against a large fraction of the total Indonesian forces.

5. Technology Niches and R&D Report

a. Introduction

In epoch three, electro-magnetic assisted launch capability materialized resulting in significantly reduced per launch cost when coupled with power supplied by solar energy. Energy R&D breakthroughs in quartz technology allowed high-energy density storage in compact size enabling the powering of small commercial and military equipment. Increased efficiency in fuel cells also led to their widespread use in automobiles and miniature airframes in the future.

With electro-magnetic assisted launching capability achieved, quartz energy storage, and efficient fuel cells becoming available in 2015, the main R&D focus in the next epoch will be shifted to R&D into military application of these high-density energy storage and supplies (quartz technology).

The investment into electro-magnetic assisted launching infrastructure totaled US$500 million with industry and private collaboration. In addition, R&D into military applications of quartz technology undertaken by DSTO cost US$200 million.

b. Economic Benefits

(1). Space Launching Service

The demand for space launching service will depend heavily on the elasticity of demand and the availability and quality of supply. In 2000, the cost of launching various payloads into space varied between US$4000 and US$10000 per pound. Based on the extrapolation of the technologies available for space launching, it is possible to reduce this cost to approximately US$500 by the year 2015. This is an eight-fold decrease in cost, which could conservatively lead to an estimated increase in demand of at least ten fold. In the area of supply, Australia envisions that, based on the investment and the inherent advantages of our large landmass and geographical location, it will be able to capture at least 10% of the launch industry by 2015.

(2). Energy Export

The percentage of GDP generated by the energy export is based on a figure of 10% of the net profit margin generated by the five largest oil companies; this would generally take into account the expenses, investment as well as operating cost involved.

(3). Impact on GDP

The economic benefits derived in this epoch from the space industries amounted to an increase of 0.75% in GDP. Energy export continues to contribute 1.5% in GDP during this epoch. With the export of oil constant with respect to the previous epoch at 1.5 million barrels per day, approximately 5% of OPEC combined oil production, total revenue is about US$16 billion (@US$30 a barrel). The amount of coal exported remained at 300 Mmst, which is worth US$9 billion (@ US$30 a ton). Finally, LNG export remains at 90 Tcf, which provides US$3 billion. These figures are essentially constant with respect to the last epoch, but reflect a two-fold increase in oil, LNG and coal export as compared to 1999. This change is due substantially to the rapid technology breakthroughs and aggressive investment into energy infrastructure and exploration.

In addition, new niche markets in miniature high-density energy storage devices and fuel cells contribute an average of 0.25% to the GDP during this epoch.

6. Summary

Epoch three was punctuated by several major events that had repercussions for Australian security. The trend of economic globalization, which has produced a vast array of international interdependencies, has continued. While the increased wealth has generally raised the standard of living in Australia and elsewhere in the Pacific Rim, clouds on the international relations horizon have cast a pall. The peaceful reunification of Taiwan with China in 2008 was not as calamitous as many had predicted. It did however have significant effects on the world order. The increasingly forward deployment of Chinese forces in Taiwan and recent indications of a stepped up presence in the Philippines has many worried. The relationship of China to both Korea and Japan will be key in ascertaining whether or not the trade routes that have produced such wealth for Australia will be threatened.

Australia has continued to closely ally itself with the regional powers for this and other reasons. The recent hollowing of the US military presence in the region, due to both domestic and diplomatic reasons, has shifted the Australian force planners away from dependence on this global power. Since the US has lost bases in both Okinawa and Korea and the potential of their basing in the Philippines gone with new Chinese presence there, Australia has undertaken a program to fill this void with a base and port facility in Darwin. This investment will hopefully further improve Australia's ability to operate with allies and maintain free SLOCs in the region.

The economic picture for Australia during this time period remained bright. The full impact of the increased export of energy and iron ore was realized in this epoch. Along with efficient economic policies, growing market efficiencies dominated the business terrain. The GDP grew at a mean annual rate of 4.35%. The program of sacrificing the military's operating budget for future procurement was nearing its end. The operational demands of new systems and personnel demanded more resources. The emerging friction of regional nations in this time period also required a slightly higher state of readiness.

In this epoch, the ADF embarked on an ambitious expansion of military forces and capability. Significant allocation of resources resulted in a vastly improved overall force structure.

In the navy, the continued lack of long-range air defense capability was addressed. The first indigenously produced Aegis destroyer joined the fleet, providing the much needed maritime air defense and surveillance capability. The Multi-Role Auxiliary (MRA) and high-speed catamaran continue to contribute to a wide range of lift and sustainment operations.

In the army, lessons learned from the 2010 net assessment process revealed the offensive amphibious capability of the ADF to be lacking. In close cooperation with the United States, the army developed and fielded two amphibious marine brigades in five short years during this epoch. This massive undertaking could not have been done without the support and cooperation of the United States Marine Corps. Advanced Amphibious Assault Vehicles (AAAV) and the next generation tilt rotor aircraft were procured as part of this development.

The air force continued the retirement and replacement of its combat aircraft throughout the epoch and eventually replaced all the older aircraft. Additional Global Hawk UAVs were added to the inventory to boost and compliment the surveillance capability.

Political developments throughout the Asia Pacific region highlighted the potential for United States troop withdrawals from the Korean Peninsula and Japan. Recognizing this situation and the importance of the northern port of Darwin to the ADF and its allies prompted Australia to modernize and expand the military infrastructure in and around that city. Expansion of ship berthing and the addition of deep draft facilities made Darwin a very attractive alternative homeport and base for US ships and troops currently based in Japan.

This epoch's net assessment process focused on issues within the inner arc. The Indonesian SLOC protection effort by the ADF through the provision of a Maritime Action Group demonstrated a capable force in dealing with the various possible threats faced by commercial shipping. The surface threats are adequately neutralized by the use of patrols along the SLOCs with detection provided by the UAV. The problem of mines is less adequately addressed as it is difficult and slow to ensure a mine safe SLOC. Even a reaction time of two days can be quite hampering to commercial shipping. This can be a potent weapon for the adversaries to exploit.

Submarine and air threats, though unlikely, can certainly occur should the Indonesian government become desperate. Under such a scenario, the MAG is adequately setup to react competently. Nevertheless, the further problem of imminent war will have to be resolved, as the opponent will clearly have signaled a desire to escalate the conflict.

For this epoch, the ADF has developed a much more capable land force to support an operation to liberate either East Timor or Irian Jaya. The benefits of this new land force include the amphibious fighting capabilities and more troops. Furthermore, the investment in a 21st Century Soldier concept in the first epoch developed a soldier with enhanced body armor protection, integrated command and control systems for individual soldiers through enhanced communications devices, and better weapons that can provide anti-armor capabilities. In terms of soldier performance, the Australian soldier during this epoch is definitely superior to their Indonesian counterpart.

The maritime assets of the TNI have not been upgraded significantly in view of the economic problems of the country. Operating with aging equipment and having to deal with turmoil in the country, the military is under tremendous pressure and their commitment in countering any possible East Timor or Irian Jaya invasion will be very limited in view of the other problems. This resulted in a maritime force that is not improved in capability compared to the one in the last epoch, so the Australian task force can easily gain an upper hand in the maritime arena.

In the third epoch, Australia realized the electro-magnetic assisted launch capability resulting in a significantly reduced per launch cost with the power being supplied by solar energy. This capability significantly offsets the initial investment into electro-magnetic assisted launching infrastructure. Energy R&D breakthroughs in quartz technology enables high energy density storage in compact sizes, thus providing the ability to power small commercial and military equipment. Increased efficiency in fuel cells also led to widespread use in automobiles and miniature airframes. With these breakthroughs, Australia then embarked on R&D into military application of such high-density energy storage and supplies.

D. Epoch Four (2016-2020)

1. Australian Security Environment in the Year 2020

The dominant trend of globalization has been discussed at length by the ADF as a primary driver of the security environment. This factor once again played an important role in defining the region in which we reside and trade in during the period 2015 to 2020. Many Asia Pacific Rim nations were hampered by the supply of energy in this epoch. This has actually been positive for Australia, as the enormous natural resources of our nation have been tapped to meet this demand for energy. This has contributed to the overall gross domestic product and has spurred foreign investment in Australia. The importance of regional trade routes has increased as a result of this new market. Security of these routes is a crucial factor towards a stable regional and domestic economy.

While the core priorities for Australia's defense have again remained relatively static, the core mission of keeping the SLOCs open has been added as a primary objective. The key routes of between Darwin, Indonesia and Papua New Guinea along are the highest priority for our maritime forces but we may be asked to participate in coalition or allied operations as far north as the South China Sea or the Sea of Japan.

a. The Regional Powers

(1). The United States

During the third epoch Australia took steps to fill the void caused by a hollowing of the US presence in the Pacific Rim. The reunification of Korea and the subsequent removal of American troops stationed there and in Okinawa left a power vacuum that Australia felt was not in our interest or that of our neighbors. For this reason, we undertook a program to build a base facility in Darwin, which would be extremely attractive to the global power. The substantial investment required to develop this base was justified by the importance of our trade routes and the force multiplying effect of having allied troops based there. We have continued to work closely with the United States to further joint interests and have developed an outstanding operational and diplomatic relationship with them. Australia continues to believe that the US strength supports a generally stable global strategic environment.

(2). Indonesia

Indonesia has been a key area of concern for Australia for the past several years. Its relative proximity to our shores and the continued instability has caused great concern for our nation because of the aforementioned importance of the surrounding SLOCs. Recent overtures by China to the beleaguered Indonesian government have demonstrated that nation's intention to extend their influence as a regional hegemon. This remains a situation that is possibly destabilizing and threatening to regional trade.

(3). Japan

As previously mentioned Australia and Japan share mutual interest of stability in the Asia Pacific region. Unencumbered transit of the sea is required by Japan to obtain the necessary raw materials to fuel their now powerful economy. Supply chain disruption of fuel or iron ore provided by Australia would be disastrous to Japan's ability to continue to grow. Japan has recognized this situation and has assisted in Australia and the United States in patrolling key SLOCs with maritime and surveillance assets. The diplomatic and operational arrangements our nations have allowed distribution of key intelligence and military tasking when called for in exercises and everyday surveillance.

Net assessments scenarios have shown that joint and combined forces can control the key choke points and communications routes. Future cooperation with both Japan and the United States coupled with diplomatic arrangements with other nations and NGOs should contribute to maintaining continued security in the region.

2. Economic Development and Defense Spending

Australia's economy has experienced sustained upward momentum for the last two decades. Between 2015 and 2020, the GDP grew at an average annual rate of 3.78%, slightly less than the previous five-year period. The Australian Economic Ministry does not see this as a significant downward trend but rather a healthy shift to a sustainable rate of growth given the current international and domestic trade environment. The overall increase in trade has resulted in the GDP rising from US$618 billion to US$690 billion by the end of the decade. While the size of the economy continued to increase, the percentage allocated to defense has remained relatively constant at 2.4% of GDP. The growth rate of the economy and the percentage spent on national defense is graphically represented in Figure (32). This growth was driven by a variety of factors including both domestic policy and technology-based productivity gains and the opening of new markets to Australia.

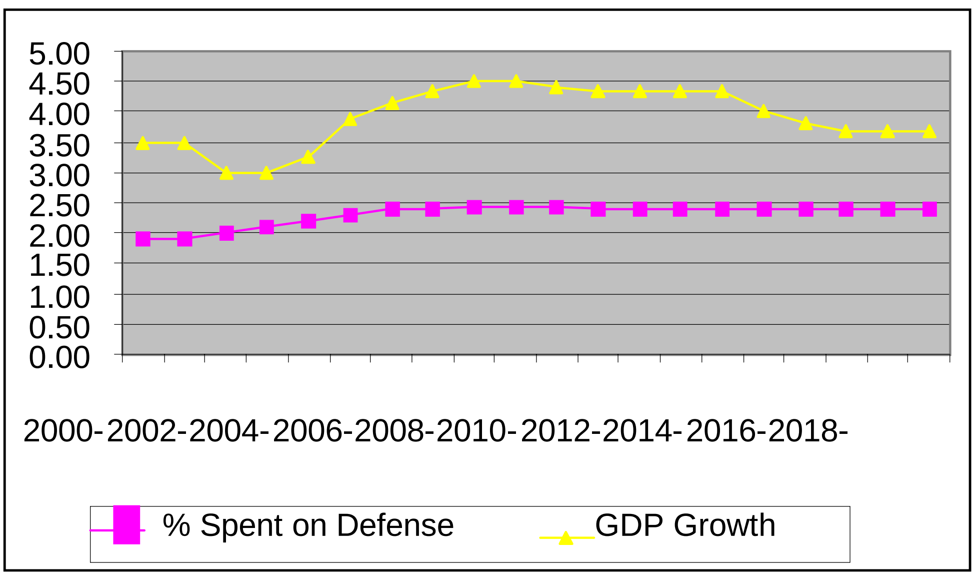

Figure 32. GDP Growth and % Spent on Defense

3. Australian Force Structure 2020

The development of the force structure for the Australian Defense Force during the fourth epoch was the result of a review of the vulnerabilities and weaknesses of the 2015 force structure and issues stemming from the 2015 net assessment scenarios. The national and military strategies and the ability of the military forces to carry out these strategies were evaluated as part of the process. Finally, world events and the possible actions of China and the United States in the region were evaluated. The combination of these three reviews yielded the following forces structure and rationale for that structure.

a. The Royal Australian Navy (RAN)

For the RAN, the vulnerabilities identified during the third epoch are as follows:

(1). Improving long range air defense capability

(2). Impending loss of some FFGs

(3). Impending loss of LPAs

(4). Replacement aircraft for the P-3C or a replacement of its capability?

During the last epoch, the issue of maritime long-range air defense capability was addressed through the introduction of the Howard-class Aegis DDG. This ship, indigenously produced in Australia, provided a significant improvement to the maritime air defense capability. During this epoch, this construction program continued and three additional Aegis ships were delivered.

The loss of some ships due to retirement is inevitable in any naval force. The retirement of four of the older Knox-class FFGs was recognized and the capability of these ships was replaced with the more capable Spruance and Aegis DDGs in earlier epochs. The Multi-Role Auxiliary (MRA) construction program offset the loss of the amphibious capability previously provided by the Landing Platform Auxiliaries (LPA).

During this epoch, the future of the ageing P-3C Orion aircraft fleet was addressed. It was recognized that these aircraft provide two vital functions. They provide a primary role of anti-submarine warfare (ASW) and the secondary role of maritime surveillance. A careful review of the possible platforms to replace these capabilities was conducted. It was found that the Global Hawk Unmanned Aerial Vehicle (UAV) was a viable platform to assume the maritime surveillance role, but did not satisfy the ASW role. Since a suitable replacement aircraft or airframe was not available, it was decided that the P-3C aircraft would be refurbished to extend the airframes and improve the capabilities with the latest generation Synthetic Aperture Radars (SAR). This refurbishment program resulted in service life extensions of the airframes.

The Navy force structure for 2020 is provided below.

(1). Surface Combatants

- (a). 2 FFG
- (b). 20 ANZAC FF
- (c). 4 Spruance DDG
- (d). 4 Aegis DDG
- (e). 11 High-speed catamarans
- (f). 30 Patrol Boats (PB)
- (g). 6 Multi-Role Auxiliary (MRA)
- (h). 15 Landing Craft Medium (LCM)
- (i). 6 Landing Craft Heavy (LCH)

(2). Mine Warfare

- (a). 2 Inshore MCM

(b). 12 Huon MCM

(c). 4 Dive Teams

(3). Submarine Force

(a). 8 Collins SS

(4). Navy Air

(a). 16 Sea Hawk helicopters

(b). 7 Sea King helicopters

(c). 40 Super Sea Sprite helicopters

(d). 19 P-3C Orion (refurbished and improved) MPA

(e). 10 LAMPS Mk-III helicopters

The 2020 Navy force structure shows the decommissioning of four Knox class FFGs. These ships were retired at the end of their 35-year useful life.

Given the strong possibility that the RAN will be called upon to maintain the SLOCs, the loss of the FFGs was viewed as a serious issue. To offset the FFGs and to bolster maritime capability, the ANZAC shipbuilding project was restarted. The modular construction technique of these ships and the maintenance of the knowledge base allowed this program to be rapidly redeveloped. The project added six ships to the naval inventory. Each of these ships was fitted with the latest in sensor and weapon technology.

Three additional Howard-class Aegis DDGs were constructed. The three new DDGs, along with the original ship of the class, were back fitted with a laser anti-ship missile system (IOC 2020). This system provided a quantum leap in the missile defense capability of the RAN. The Australian advance in energy storage was the enabler of this technology.

The last of the class of the MRAs was completed. This ship, like the fifth hull, was constructed and configured with a well deck to allow the loading and offloading of amphibious vehicles.

The high-speed catamarans have proven to be viable and valuable additions to the RAN. Three additional ships were added to the inventory. These ships will be instrumental in proving a rapid response capability to any area within the inner arc region.

The remainder of the naval force structure remains the same from the third epoch.

The expansion of the Darwin Naval Base (DNB) during the third epoch has proven to be a worthwhile investment. The base provided support to RAN ships as well as ships from other nations in the region and the United States. It has served as the hub for operations in the region and will provide key military infrastructure and support in the future.

b. The Australian Army

For the Australian Army, the vulnerability identified during the third epoch was that it remains a light fighting force with limited heavy equipment and armament. This fact will remain true during the fourth epoch. Given the range of excepted operations in the future, military planners determined light, highly mobile troops were more advantageous that heavy armored troops. To counter for its lack of size, the army has embraced technology advances and superior weaponry to make their small force lethal and able to handle a variety of missions.

The Army force structure for 2020 is provided below.

(1). Special Forces (2 regiments SAS/2 Commando regiments)

(2). Mechanized Force (1 brigade)

(3). Light Infantry Force (3 brigades)

(4). Motorized Infantry Force (1 brigade)

(5). Marine Amphibious Force (2 brigades) (150 AAAVs)

(6). Army Aviation Force

(7). Ground-Based Air Defense

(8). Army Reserve Force

(9). Army Aviation (helicopters)

 (a). 36 S-70A Black Hawk

 (b). 6 CH-47D Chinook

 (c). 24 Apache Armed Reconnaissance

 (d). 12 Troop Lift

 (e). 60 V-22 Osprey

(10). Air Defense

 (a). 12 RBS-70 laser guided units

 (b). 10 Patriot firing units

 (c). 12 Patriot PAC-3 firing units

 (d). High Energy Laser air defense system

(11). Army Reserve

 (a). 11th Brigade (North & Central Queensland)

 (b). 4th Brigade (Victoria)

 (c). 8th Brigade (NSW)

(12). Reserve Surveillance Units

 (a). Northwest Mobile Force (NORFORCE)

 (b). Pilbara Regiment (WA)

 (c). Far North Queensland Regiment

For 2020, the biggest change in the structure of the land forces was the addition of two light infantry brigades. The addition of these troops was a result of Australia's operations in Irian Jaya during the third epoch. These lightly equipped troops are suited to serve as long-term occupation forces in Irian Jaya. The Irian Jaya operation proved that additional troop structure was warranted and required.

To ensure all the land forces deployed with modern equipment in sufficient numbers, an ongoing modernization program was developed to purchase additional and replacement vehicles. Infantry Mobility Vehicle (IMV), Australian Light Armored Vehicle (ASLAV), and Armored Personnel Carriers (APC) were upgraded or purchased to support the land forces.

In the aviation branch, forty additional V-22 Ospreys were purchased to support troop transport and amphibious operations. These aircraft operate from the MRA ships as well as from land bases to perform its mission. The aircraft has proven its worth in operations in the region.

In the air defense capability, a High Energy Laser (HEL) air defense system was developed and deployed to support the defense of Darwin. This system was developed and deployed as a cooperative effort with the United States and Israel. This system supplements the air defense system surrounding Darwin and provides a quantum leap in the engagement capability.

Australia's Army reserve components remained unchanged from the last epoch. The reserve forces have continued to train, supplement, and in some cases, deploy in place of regular troops.

c. The Royal Australian Air Force (RAAF)

For the RAAF, the vulnerability identified during the third epoch was the fact that the F-111 would be retired during the fourth epoch. This loss was recognized and planned for in earlier epochs. The strike capability provided by the F-111 was replaced by the DDGs of the maritime forces. Sufficient lead-time was provided to the maritime forces to develop the capability and operational doctrine to support long-range strike. While the loss of an air delivered strike capability may be an issue for some operations, the lack of a suitable replacement aircraft forced the ADF to shift this capability to another branch of the service.

The RAAF force structure for 2020 is provided below.

(1). 80 F/A-18 E/F Hornet

(2). 24 C-130J Hercules

(3). 14 C-27J Spartan

(4). 7 AEW&C Boeing 737-700

(5). 8 Boeing 767 Tankers

(6). 50 Global Hawk UAV

In 2020, the main thrust of the air force combat capability will rely on the F/A-18 E/F Hornet aircraft. These aircraft have proven to be capable in a variety of missions.

The Global Hawk Unmanned Aerial Vehicles (UAV), along with the Airborne Early Warning & Control (AEW&C) aircraft, provides a surveillance capability unmatched by regional forces. The long loiter time of the UAVs and the command and control capability of the AEW&C aircraft simplify the surveillance of the SLOCs and the surrounding region. These capabilities serve to reduce the vulnerabilities facing Australia in the region.

d. Information Capability

The Information Capability force structure for 2020 is provided below.

(1). Operational Command

(a). Single Joint Headquarters

(b). Deployable HQ (two)

(c). Communications (SATCOM, HF, Networks)

(d). Command and Information Management Systems

(2). Strategic Intelligence

(3). Strategic Surveillance

(4). Geospatial Information

(5). Hydrographic Survey Force

In 2020, the information capabilities of the ADF remain largely unchanged from the last epoch. A robust C4ISR system links varied forces throughout the region and provides for rapid dissemination of information and intelligence.

4. Scenarios for Static Net Assessment

a. Scenario 1: Protection of Sea Lines of Communications (SLOCs)

During this epoch, the protection of SLOC becomes an even more important issue. China's rapid military expansion in the South China Sea (SCS) region affects regional stability and threatens the transit of merchant vessels along the traditional SLOCs. As in the last epoch, Australia will continue to provide a MAG to provide security for the SLOC. The MAG had been significantly strengthened for this epoch and the composition will be as follows:

(1). 2 x MRA supply ship

(2). 2 x Spruance DDG

(3). 2 x Howard DDG

(4). 4 x ANZAC FFGs

(5). 4 x Huon MCM

(6). 4 x Collins SS

(7). 4 x UAV (Global Hawk) on patrol at any time

(8). 2 x P-3C Orion on standby

(9). 2 x AEW&C aircraft on patrol

(10). 1 x F/A-18 Hornet squadron on standby

The main enhancement is the provision of the Howard DDG, which would enhance the overall air-defense capabilities of the MAG.

The MAG will be divided into four Task Groups (TG) to patrol each area. Each TG composition is as follows:

(1). 1 x Howard/Spruance DDG

(2). 1 x Collins SS

(3). 1 x ANZAC FFG

(4). 1 x UAV (Global Hawk)

b. Scenario 1: Dynamic Net Assessment Analysis - Submarine Detection in SLOC

In this epoch, Australia examined the effect of the submarine threat in more detail by applying a dynamic net assessment. Submarine threats are much more difficult to neutralize as detection is a crucial problem. Even with the substantial naval assets patrolling the respective patrol zones, it is difficult to detect a submarine. However, once a submarine is detected, it can be neutralized with much higher confidence with the available assets. The detection of submarines will primarily be through:

(1). Visual/Radar: the submarine will have to snorkel or be traveling in very shallow water for detection to be possible via this means.

(2). Passive Sonar: with the amount of traffic anticipated in the SLOC, detection by this method is very difficult.

(3). Active Sonar: this method is dangerous to adopt for our forces as it immediately provides the locality of our forces to the enemy.

The UAV surveillance capabilities rely on its SAR (up to 100 NM) and IR imaging (up to 60 NM). Searching for submarines with the UAV yields low probability of success. The use of P3-Cs or the Sea Hawk helicopter may provide more effective submarine detection capability. However, the search area is huge and employment of such assets to scour the entire SLOC is inefficient and costly.

Employment of active sonar techniques will threaten our surface vessels with attacks and is a risk that should only be considered when all other options fail. This method will serve to deter potential hostile submarines from having free reign in the area of operations although it may also force them to attack our assets.

The safest compromise is through the use of passive sonar techniques to detect submarines in the SLOC. The dynamic net assessment is attempted to provide information on the probability of detecting a hostile submarine based on the available assets.

c. Scenario 1: Potential Submarine Threats

In a scenario with the Indonesian government favoring the Chinese military expansionism provides Indonesia opportunity to align with a powerful ally. The issue of racial animosity has been discarded in favor of possible economic development and military ties. In this scenario, threats in the SLOCs may come from both Chinese and Indonesian sources. The Chinese advanced submarines are the Han SSNs and the Kilo Type 636 advanced diesel variants. The Indonesian government had modernized its submarine fleet to include five new Type-206A diesel submarines from Germany that are quieter and more capable than the previous Type-209 submarines. The sonar emission signatures by these submarines are shown in the following table (Passive Sonar Cross Section (PSCS)):

Submarine Type	**Front (dB)**	**Side (dB)**	**Rear (dB)**
Han Class SSN	100	101	102
Kilo Class SS	85	86	87
Type 206A SS	85	86	87

Table 9. Passive Sonar Cross Section of Various Submarine Types[12]

[12] Figures derived from Harpoon 2 computer simulation software.

The Han SSN measures over 100 meters in length and has a displacement in excess of 4,000 tons. Its PSCS figures are naturally significantly higher than the smaller diesel submarines. With its nuclear power plant, it also emits a stronger signature than the others. In other words, it is significantly easier to detect a nuclear submarine than the more advanced diesel submarines. Note that the Han SSN is China's first attempt at building an indigenous nuclear attack submarine and is not on a par with its western counterparts. If it does not improve in terms of passive sonar emission, then it is not a formidable foe.

Annex E describes the details of calculations to derive the conditions for detection based on passive sonar techniques. A submarine route is plotted as shown in the following diagram to determine the effectiveness of the passive sonar detection capabilities.

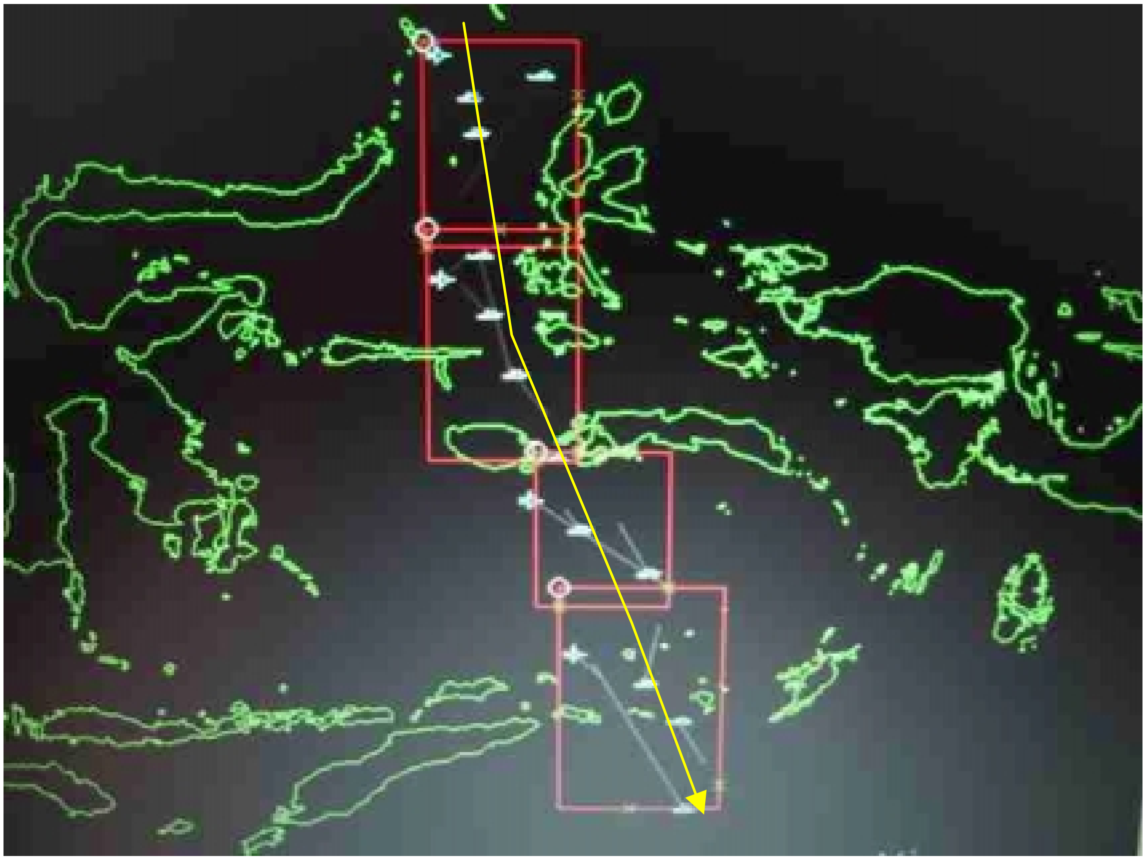

Figure 33. Simulated Submarine Route through SLOC

The figure shows a yellow arrow indicating a simulated path of a submarine transiting through the SLOC with the patrols in place. A simulation program called Harpoon 2[13] was used to determine the effective detection capability of the patrols in place to detect a submarine in the SLOC. A number of Monte Carlo style trials were put into the program whereby three slightly different paths were taken by each submarine through the SLOC. The patrols in place only use passive sonar for detection. Annex E describes in detail on how the Harpoon 2 software calculates when detection will take place based on a set of mathematical rules. The results of the trials are summarized in the following table:

Trial	**1**	**2**	**3**
Han	42 hrs	22 hrs	34 hrs
Kilo	36 hrs	Not Detected	42 hrs
Type 206A	110 hrs	Not Detected	62 hrs

Table 10. Experimental Results for Submarine Detection

The results show the possibility of detecting an SSN to be significantly higher than the diesel variants. Detection of diesel submarines is very difficult and there is a good chance that a diesel submarine may bypass detection completely. This will pose a significant threat for the MAG to ensure SLOC protection when a submarine threat is imminent.

However, if the submarines are detected, then the activation of the Collins submarines to react along the SLOC can occur within six hours. Surface vessels can react within four hours and more rapid reaction can be by the P-3C Orions operating from Tindal to anywhere along the SLOC in less than four hours.

d. Scenario 1: Summary for SLOC Protection Scenario

The SLOC protection by a Maritime Action Group is capable of dealing with the various

[13] Harpoon 2 is a computer based war-gaming software used to simulate world conflicts with realistic algorithms to determine the results of maritime engagements. The software was originally created by Larry Bond and was published in 1995 by *360 Software (Inc)*.

possible threats faced by commercial shipping. The surface threats are adequately neutralized by the use of patrols along the SLOC with detection provided by the UAVs.

The problem of mines is less adequately addressed, as it is difficult and slow to ensure a mine-safe SLOC. Even the optimistic reaction time of two days can be quite hampering to commercial shipping and this can be a potent weapon for the adversaries to exploit.

Submarine and air threats, though unlikely, can certainly occur should the Indonesian government become desperate. Under such a scenario, the MAG is adequately setup to react competently against an air threat. The problem of defeating a submarine threat is mainly a detection problem. It is shown that detection of diesel submarines is extremely difficult. It should be stressed that although the submarine and air threats are viewed as improbable, the setup of the MAG is designed to counter such threats should the improbable scenario occurs.

e. Scenario 2: Invasion of East Timor/Irian Jaya

For this epoch, the Australian Defense Force has developed a much more capable land force to support a forcible invasion of either East Timor or Irian Jaya. Raising two additional infantry brigades to further beef up our land force capabilities does this. The benefits of this new land force include the amphibious fighting capabilities and 18,000 Australian soldiers (with total of six brigades) versus 10,000 Indonesian troops (still at one infantry division size). Further, the investment in a 21st Century Soldier concept in the first epoch had developed a soldier with enhanced body armor protection, integrated command and control systems for each soldier through enhanced communications devices, and better weapons that can provide anti-armor capabilities. In terms of soldier performance, the Australian soldier is definitely superior to their Indonesian counterpart.

The maritime assets of the TNI have not been upgraded significantly in view of the economic problems of the country. Operating with aging equipment and having to deal with turmoil in the country, the military is under tremendous pressure and their commitment in any possible East Timor or Irian Jaya invasion will be very limited in view of the other problems they are handling, particularly civilian unrest. This therefore results in an Indonesian maritime force that is no better in capability than the one in the last epoch. The Australian task force can easily gain an upper hand in the maritime arena.

In conclusion, the ADF had geared itself over the twenty years to become a much more capable and all-rounded force to deal with a hostile Indonesia, a potentially serious conflict. The maritime assets control the sea and air channels and the land forces are capable of launching amphibious assaults while possessing a numerical advantage over their Indonesian counterparts. The ADF is now capable of handling this scenario.

5. Technology Niches and R&D Report

In this epoch Australia's R&D is manifested in three key defense projects. The first is a High-Energy Laser (HEL) missile defense system for Darwin. The second is a technology concept study into Theater Ballistic Missile (TBM) defense and the third is a ship-based anti-ship missile laser defense system.

a. High Energy Laser

The first key project is a High-Energy Laser (HEL) missile defense system. The project, code named DPAMDS (Darwin Port Anti-Missile Defense System), is essentially a two-tier system consisting of an upgraded version of the HEL currently available in the US at White Sands. Australia's upgraded version of the HEL incorporates the new niche results in energy storage and supply technology. The system will incorporate enhanced range (up to 20km) and has the capability of targeting and destroying cruise missiles. The project will commence in 2015 with the first tier IOC in 2020. The ADF will invest US$1.5 billion into the system R&D, integration and deployment for Darwin.

The second tier is a Tactical High Energy Laser (THEL) missile defense system consisting of a upgraded version of the THEL current in operation with the Israel defense force, which was jointly develop with US. The upgraded version of the THEL also incorporates the new niche results in energy storage and supply technology. The system will incorporate enhanced range (up to 5 km), while at the same time being more compact and mobile. This system serves as a quantum leap in air defense capability against short and intermediate range surface-to-surface missiles as well as aircraft. The project will commence in 2015 with the first tier IOC in 2018. The ADF will invest US$500 million into the system R&D, integration and deployment for Darwin.

The broad system specifications for DPAMDS are provided below.

(1). Deuterium Fluoride Chemical Laser, Mega-Watt (MW) class

(2). Wavelength: 3-5 microns (visible – near IR)

(3). Aperture diameter: 1-2 m

(4). Range: THEL (up to 5 km), HEL (up to 20 km)

(5). IR search and track Radar (8-12 microns, 3-5 microns)

(6). Incorporate adaptive optics to reduce thermal blooming and diffraction

The following figures depict various portions of Project DPAMDS.

Figure 34. Beam Director for the HEL

Figure 35. Above ground HEL Installation

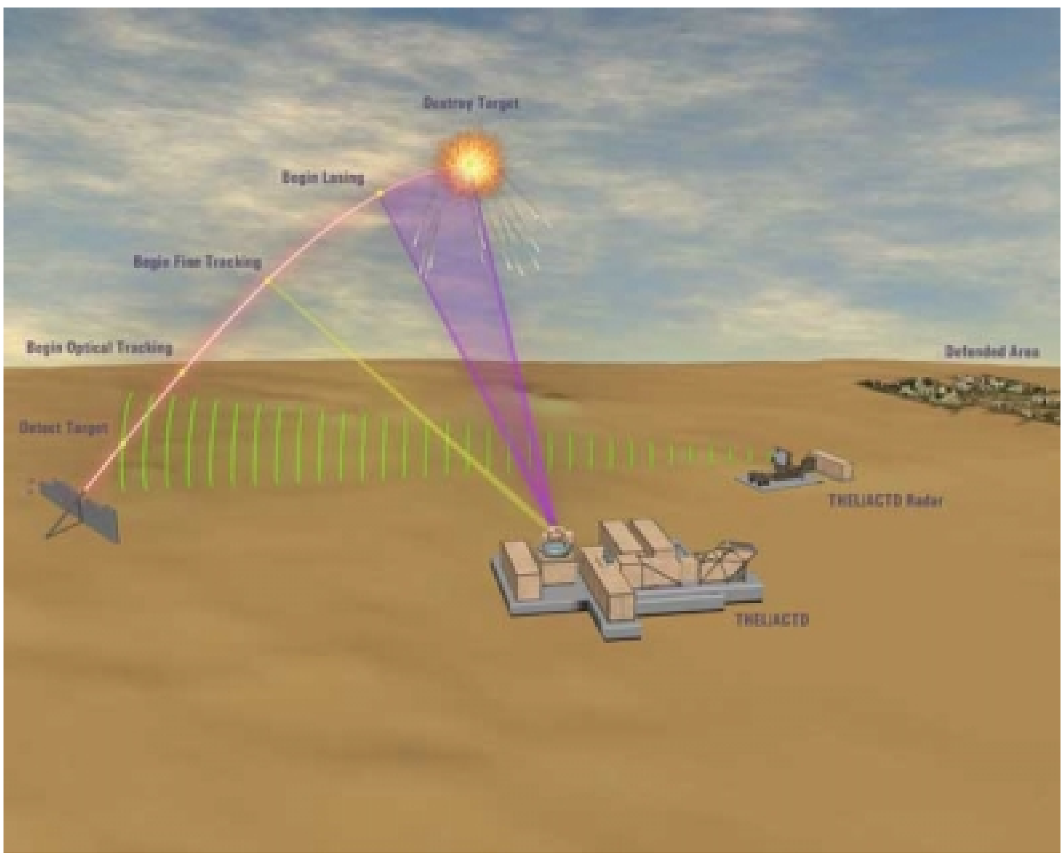

Figure 36. Schematic Diagram of the Engagement Scenario[14]

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[14] Figures obtained from TRW website http://www.trw.com.

b. TBM Defense Concept Studies

The second project is an R&D effort code named BOLDEAGLE. This is a technology R&D project to acquire technology for developing a TBM defense system possibly using airborne lasers and ground Free Electron Lasers (FEL). The investment in this R&D will cost US$50 million per year and will be conducted in collaboration with the US and Japan.

c. Ship-Based Laser Anti-Ship Missile Defense System

The third key project undertaken by the ADF is the installation of a diode-pumped solid-state laser anti-ship missile defense system into the existing fleet of frigates and destroyers. This project is code named STINGRAY. It is based on the concept of "unlimited" and low cost per shot defense against anti-ship missiles. The project commences in 2015 with IOC in 2020. The initial investment into the R&D and prototypes cost US$500 million and the integration cost is US$100 million per ship. Besides giving the Navy a quantum leap in anti-missile defense, the project introduces the ADF to fighting with directed energy weapons (DEW). This would allow doctrine and tactics to be developed and operationalized for future operations using DEW.

Project STINGRAY also includes the option of upgrading to an efficient MW-class FEL DEW system for satisfying shipboard self-defense requirements on future generations of Navy vessels. The FEL technology is expected to become feasible in 2020 and beyond. FEL is chosen because of the potential for high-power operation and the accessibility to all IR wavelengths.

d. R&D 2020 and Beyond

Australia is well posed to embark on a wide variety of future developments. In the non-defense realm, Australia sees the possibility of synthetic fuel being available in 2020 and beyond. The initial feasibility studies into nanotechnology also allow Australia to embark on the sintering of advance smart materials.

In the defense realm, the advancements in energy storage and supplies would likely make miniature UAVs and Unmanned Underwater Vehicles (UUV) a reality in the near future. Laser weapons would also be widely used giving rise to the concept of unmanned laser weapons platform operating from a “mother” platform. Portable DEW could also materialize as part of the weapons arsenal for ground troops. Finally, with the issue of energy supply worked out, it may be possible to artificially enhance the capability of our solders using biomechanical means.

6. Summary

Several events of the past epoch and, indeed of the past several years, have produced an environment in which Australia has become aware of its new role of security in the Pacific Rim. The spreading influence of China and the continuing instability in the Indonesian archipelago during this period have presented an environment fraught with potential conflict. Exports to Japan and other Asian nations have increasingly become a larger portion of the Australian GDP and a vital and safely diversified source of energy and iron ore stores for these nations. For these reasons, the maintenance of the SLOCs in this region has become a paramount security concern. The continued bitterness from the troubled Indonesian government in Irian Jaya and recent indications that the PRC has made some inroads towards securing some influence and possible military presence in Indonesia have caused Australia, Japan and the United States to reexamine the strategy to maintain maritime security in the region. The force structure developed in the previous epochs has allowed a certain degree of freedom given our expanded capability and reach. Australia still must solicit the participation of allies to effectively patrol the vast areas.

It was with this aim that the substantial investment in the port of Darwin was justified. The attractiveness of this port to the United States was predicated on the relatively short steaming time to key points in both the Pacific Rim and the Middle East. Additional investment in this facility by the United States has helped reduce its vulnerabilities to hostile attack. Diplomatic arrangements with the Japan have secured porting rights for the Japanese Maritime Self Defense Force (JMSDF). The military arrangements were solidified during this epoch by a series of exercises designed to demonstrate the interoperability of these combined allied forces and dissuade aggressive hegemonic aims of the PRC.

Economically, the GDP growth continued although at a slightly lesser rate. The slight decrease in the rate of growth from the 4.5% during the previous epoch to the mean of 3.78% this epoch is not considered serious by the Economic Ministry but rather a damped version of the business cycle. The effect of a slowdown in trade to our Asian partners is one factor that could potentially seriously wound both the Australian and global economy. It is for this reason that Australia values the security of the trade routes so highly.

The force structure developed during this epoch focused on expanding the existing force and introducing new, available, and cost effective technology innovations.

The navy completed the procurement of the Howard Aegis DDG and added a total of three ships to the inventory. The ANZAC frigate construction program was restarted in order to counter the decommissioning of older frigates. Maritime surveillance was enhanced through the improvement and refurbishment of the P-3C Orion aircraft. A suitable replacement aircraft capable of anti-submarine warfare was not available forcing the ADF to refurbish the older aircraft. This program was effectively a service lift extension similar to that performed on ships.

In the army, the addition of two light infantry brigades and the replacement of infantry vehicles maintained this branch of the ADF ready to support operations throughout the region. To support these additional troops and the amphibious forces, the air force saw an increase in the number of next generation tactical tilt rotor aircraft.

The largest technological advance in the ADF was the introduction of laser-based weapons systems. These systems, based on the Howard Aegis DDG at the end of the epoch and in the air defense system surrounding Darwin, will provide anti-ship missile defense and air defense and provide a quantum leap in the missile defense capability in the ADF. The land-based system utilizes a high-energy laser capable of intercepting short and intermediate range surface-to-surface missiles, cruise missiles, and aircraft.

In this epoch, the ADF continues to provide a Maritime Action Group that has demonstrated to be a capable force in dealing with the various possible threats faced by commercial shipping. The surface threats are adequately neutralized by the use of patrols along the SLOCs with detection provided by the UAVs. The availability of Howard destroyers meant a more capable MAG with better firepower and anti-air capabilities.

Additionally, the ADF has developed a much more capable land force to support a forced invasion of either East Timor or Irian Jaya. The benefits of this new land force include the amphibious fighting capabilities and more troops. Further, the investment in a 21st Century Soldier concept in the first epoch developed a soldier with enhanced body armor protection, integrated command and control systems for each soldier through enhanced communications devices, and better weapons with anti-armor capabilities. In terms of soldier performance, the Australian soldier is definitely superior to their Indonesian counterpart.

In conclusion, the ADF had geared itself over the last two epochs to become a much more capable and rounded force to deal with a range of conflicts. The maritime assets control the sea and air channels, and the land forces are capable of launching amphibious assaults and possess a numerical advantage over their Indonesian counterparts. The ADF is now capable of handling a land force invasion of Indonesia.

In the fourth epoch, Australia's R&D effects was manifested in three key defense projects. The first is a High Energy Laser (HEL) missile defense system code named DPAMDS (Darwin Port Anti-Missile Defense System). It is a two-tier system consisting of the upgraded version of the HEL and Tactical HEL, currently available in the US and Israel respectively. This upgraded version incorporates the new niche in energy storage and supplies technology and enhances the effective weapons range. The second key military project is Project BOLDEAGLE which is a technology R&D to acquire the capability of developing a TBM defense system possibly using airborne lasers and ground FELs. The third key project undertaken by the ADF is the integration of a diode pumped solid-state laser anti-ship missile defense system on the existing fleet of frigates and destroyers. This project is code named STINGRAY. It is based on the concept of “unlimited” and low cost per shot defense against anti-ship missiles. Besides giving the Navy a quantum leap in anti-ship missile defense, the project also serve to operationalize the ADF in fighting with directed energy weapons.

Annex A

Note: The background information for Team Australia is closely associated with and in many ways identical to the Australian Defense White Paper published in December of 2000. This annex provides background information and can be considered an abstract of the Defense White Paper.

Security and The Role of Australia's Armed Forces

1. Force in International Affairs

The Australian Government has considered the future role of force in international affairs, including the argument that changes in the structure of the international system will reduce the importance of force in relations between nations over the coming years. The Government does not dismiss these views, and indeed it places a high priority on working with others, at both the regional and global level, to further minimize, and if possible to eliminate, the risk of war. The continuing threat of proliferation of weapons of mass destruction makes those efforts all the more important.

Resort to force will continue to be constrained by many aspects of the international system, and armed conflict between states will remain less common than in earlier centuries. But there remains a risk that circumstances may still arise in which these constraints are not effective. That risk is as high in the Asia Pacific region as it is elsewhere in the world. It is best minimized by realism about the challenges still to be faced in strengthening peace in our region, and a commitment to work with others, both locally and globally, to build a more robust and resilient international system. This requires strategic policy, which is integrated with wider diplomatic and political policies. But it also means we need to maintain a capable defense force, that is trained and equipped to meet the demands of conventional wars between states.

2. New Military Tasks

a. Military Operations Other than War (MOOTW):

Australia has been engaged in only one conventional conflict since the Vietnam War, and that was the Gulf War of 1990-91. But our armed forces have been busier over the last decade, and especially the past two years, than at any time since our involvement in Vietnam. This reflects a worldwide trend.

It is clear that various forms of military operations other than conventional war are becoming more common. Since the end of the Cold War, there has been a worldwide upsurge in intra-state conflicts. These disputes have accounted for the vast majority of armed conflicts, and have placed new demands on the armed forces of many countries, including humanitarian relief, evacuations, peacekeeping and peace-enforcement.

The Australian Defense Force (ADF) is no exception. Over the past decade we have deployed the ADF to places as diverse as Namibia, Somalia, Western Sahara and Rwanda in Africa; the Gulf and elsewhere in the Middle East; and Cambodia, the Solomon Islands, Papua New Guinea (Bougainville), Indonesia (drought relief in Irian Jaya) and East Timor in our nearer region. In these places, the ADF has undertaken tasks from famine and disaster relief to peacekeeping and humanitarian assistance.

The Australian Government believes that this is an important and lasting trend, with significant implications for the ADF. Over the next 10 years the ADF will continue to undertake a range of operations other than conventional war, both in our own region and beyond. Preparing the ADF for such operations will therefore take a more prominent place in our defense planning than it has in the past.

In many cases, especially at the lower end of the spectrum of intensity, we are likely to need to deploy quickly and operate effectively in dangerous and uncertain situations that may not necessarily require the use of force. Our tasks might include distribution of relief supplies, evacuation of civilians, providing medical help or monitoring a peace agreement.

But often these operations will be more demanding. The boundary between a benign situation and open conflict, either against local irregulars or more capable armed forces, can become blurred. Participation in peacekeeping operations, particularly in the region, is strongly supported as being in Australia's interest. Even in benign situations, an evident capability to use force can help to keep things peaceful. The capabilities we need for MOOTW have a lot in common with those we develop for conventional conflicts.

b. Non-Military Security Issues

Australia faces many security concerns other than those involving military force. These include the potential for non-military threats, such as cyber attack, organized crime and terrorism. They also include concerns over illegal immigration, the drug trade, illegal fishing, piracy and quarantine infringements.

Many of these problems, such as illegal immigration, involve the challenge of effective surveillance, patrolling and policing of our maritime approaches. Illegal incursions into our Exclusive Economic Zone and territorial waters, and onto our territory, constitute an on-going problem for Australia. Given the size of our maritime jurisdiction, this is a significant challenge.

The Government has recently undertaken a major review of our coastal surveillance and enforcement activities, including the significant contribution made by Defense to these efforts. That review proposed important enhancements, including improved surveillance capacity through the acquisition of two extra aircraft, and the establishment of an integrated surveillance center.

The ADF will continue to have a major part to play in these activities. Our patrol boats, maritime surveillance aircraft and intelligence capabilities are fully engaged in the day to day monitoring and policing of our maritime approaches, and their efforts are closely integrated with other agencies.

New defense capabilities have the potential to make an even bigger contribution to coastal surveillance in the future. Within a few years, the ADF's wide area surveillance system will provide the potential for continuous real-time coverage of our northern air and sea approaches. This system will be fully integrated with other national coastal surveillance capabilities, to provide a comprehensive coverage of ships and aircraft approaching our shores.

The ADF maintains counter terrorist capabilities for resolving situations that are beyond the capacity of our police forces. It also helps in sea search and rescue and special circumstances such as the Olympics, firefighting, and in responding to other types of natural disaster.

Defense will also be among the key contributors to the Government's efforts to develop responses to cyber attack on Australia's critical information infrastructure.

3. Australia's Strategic Environment

This section outlines those aspects of Australia's strategic environment that will influence the overall direction of our strategic policy and force development over the next 10 to 20 years.

a. Our Strategic Setting: The Global Context

At the global level, two interrelated trends are likely to shape our strategic environment - globalization and the primacy of the United States. The trends of globalization especially in trade, investment and communications are increasing cross-border integration and interdependence around the world. Overall, globalization looks likely to be good for security because it strengthens the stake that governments and people have in the smooth working of the international system. For example, increased international flows of trade, investment and technology increase the benefits of a stable international environment and the costs of any disruption. However, the security benefits of globalization are limited by countervailing pressures. First, nation-states remain the most important strategic actors. Moreover, nationalism in various forms remains potent and in some areas is an increasingly powerful motivator. Second, globalizing trends are being accompanied by growing regionalism, especially in the field of security, where the end of the Cold War has moved attention from the global power balance to a series of regional strategic systems -including the Asia Pacific. Third, the integrative trends of globalization themselves are not irreversible and could be especially vulnerable to a deteriorating security environment.

(1). US Primacy

The United States today has a preponderance of military capability and strategic influence that is unique in modern history. That preponderance supports a generally stable global strategic environment. The primacy of the United States is built on the strength of its economy, the quality of its technology, the willingness of US governments and voters to accept the costs and burdens of global power, and the acknowledgement by most countries that US primacy serves their interests. All these factors are likely to endure.

However, we should be careful not to take US primacy for granted. Over the coming years the US global role may come under pressure, both from within the United States and from other countries. Domestically, the United States will continue to accept the human and material costs of supporting causes that directly touch its vital interests. But the willingness of the United States to bear the burden of its global role where its interests are less direct could be eroded, especially if it faces protracted commitments, heavy casualties or international criticism. The incoming administration of President George W. Bush has expressed reluctance to continue involving US forces in remote areas where the risk is high and direct US interests are not involved. While the Bush Administration has voiced this concern the Australian government does not see a quantum change in US policy for the next decade.

(2). The Role of the United Nations

A third significant global trend has been the evolution of the United Nations. Over the past decade the UN has become more active and effective. In doing so it has broadened the range of its activities and responsibilities in the security area. The UN has grappled with internal problems and crises from the Balkans to Rwanda, Cambodia and East Timor, responding to a widespread recognition that international security can be affected by problems within, as well as between, states.

b. Areas of Potential Conflict Outside the Asia Pacific

Outside the Asia Pacific region, strategic problems continue to be most likely in the Middle East, and potentially also in Central Asia. Primarily NATO and European security structures will manage European security problems, such as those in the Balkans.

Russia's future place in the European and global strategic environment remains unclear. Security and stability in Europe will continue to depend on the maintenance of an effective working relationship between Russia, and the United States and its European allies.

c. The Asia Pacific Region

Although there remains a risk of localized or more widespread economic downturn from time to time, the Asia Pacific is set to be the most dynamic region in the world over the next few decades. Economic growth should help build stability. But it will also put strains on old relationships, raise new expectations and perhaps offer new temptations. The most critical issue for the security of the entire region is the nature of the relationships between the region's major powers - China, Japan, India, Russia and the United States.

The United States is central to the Asia Pacific security system, and its role will be critical in maintaining security over the coming decades. It will be in Asia that the United States is likely to face the toughest issues in shaping its future strategic role - especially in its relationship with China.

(1). China, Japan and the United States

The trilateral relationship between China, Japan and the United States will define the East Asian strategic framework. Both Beijing and Washington clearly understand the importance of managing the US-China relationship effectively, and recognize the costs to both of them - and to the rest of the region - if they fail to do so. The benefits of a stable and cooperative relationship would be very great. Important steps have been made, for example in progress towards China's accession to the World Trade Organization, but significant problems remain in the relationship - especially concerning the issue of Taiwan. It is therefore possible that US- China relations may be a significant source of tension in the region in coming years. This could be important to Australia's security.

(2). US-Japan

The US-Japan relationship is the key pillar of US strategic engagement in Asia. The strength of US security commitments to Japan, and the scale of US military deployments in Northeast Asia, which the US-Japan relationship facilitates, is critical to maintaining strategic stability in the whole region. The US-Japan relationship has great depth and resilience, and both sides have worked effectively in recent years to overcome problems and adapt to new conditions. This has provided a welcome framework in which Japan has been able to take a larger role in regional and global security issues. Without the reassurance provided by the US relationship, Japan would face difficult strategic choices with security consequences for other countries in the region.

(3). North and South Korea

The Korean Peninsula is clearly a key dynamic factor in the Northeast Asian strategic balance. Reconciliation between North and South Korea, leading to a reduced level of military confrontation, seems closer now than for many years. But it could also introduce new pressures – including over the future of US forces in Korea - which would need careful management.

(4). India

India's economic growth is enhancing its strategic potential and influence in the region. Its nuclear tests, and the development of an operational nuclear capability, have made the regional nuclear balance more complex. There are elements of strategic competition between China and India that have been amplified by the development of India's nuclear capability. The future of this relationship will be important for the security of the whole region. The risk of war - and even of nuclear war - between India and Pakistan remains significant and disturbing, but it is India's growing role in the wider Asia Pacific strategic system that will have more influence on Australia's security.

(5). Conclusion

In general, we believe the forces for peace and stability in the Asia Pacific region are strong, helped by the growth of regional multilateral structures and frameworks. The likelihood is that over the coming decades the region will enjoy growing economic integration and political cooperation. But there will inevitably be tensions between the major powers of Asia over the next 20 years, and their relationships may change significantly. There is a small but still significant possibility of growing and sustained confrontation between the major powers in Asia, and even of outright conflict. Australia's interests could be deeply engaged in such a conflict, especially if it involved the United States, or if it intruded into our nearer region.

d. The Nearer Region and Immediate Neighborhood

The security of the nearer regions: Southeast Asia and the Southwest Pacific - could be affected directly by instability and conflict among the region's major powers, but countries of the nearer region also face major challenges of their own.

Overall, Southeast Asia remains an area of great promise. Economic liberalization and institutional reform provide hope that in many countries a return to high growth rates can be sustained over the longer term. Political and social evolution is strengthening the robustness, legitimacy and resilience of the political systems in many ways. Despite the strains of economic crisis and rapid enlargement of its membership, ASEAN continues to provide a focus for the sense of shared interests and common goals, which has been so important to Southeast Asia over recent decades. There remain a number of security issues, such as conflicting claims in the South China Sea, which will need to be handled carefully if regional security is to be maintained.

The countries of our immediate neighborhood - Indonesia, East Timor, Papua New Guinea, and the island states of the Southwest Pacific - face large economic and structural challenges.

(1). Indonesia

Indonesia is at a critical point in its history. The political evolution of the past few years has seen a vibrant democracy emerge with unexpected speed. The successful conduct of elections throughout the country in June 1999 and the subsequent installation of a democratic government have been an historic achievement for the people of Indonesia. Since May 1998, they have shown a determination to make democracy work. This is a major cause for optimism about Indonesia's future.

But at the same time there are challenges ahead. Three issues in particular stand out. The first is the challenge of political evolution through democratization and decentralization. The second is the need for wide-ranging economic reforms to put Indonesia back on the path to sustainable growth. The third is the resolution of religious, separatist and other challenges to the cohesion and stability of Indonesia.

The Government believes the interests of Indonesia's neighbors, and of the Indonesian people themselves, will best be served by a country that is united, stable and democratic; well-governed and prosperous; cohesive and peaceful at home; and responsible and respected abroad.

Indonesia's size, its huge potential, and its traditional leadership role in Southeast Asia mean that adverse developments there could affect the security of the whole of our nearer region, and beyond.

(2). East Timor

East Timor's emergence as an independent state is a new factor in our security environment. The willingness of Presidents Habibie and Wahid to facilitate East Timor's transition, and to build a friendly bilateral relationship between Indonesia and East Timor, are most welcome. But important security issues remain, which may not be resolved by the time the UN- sponsored transition to independence is completed, probably by the end of 2001.

There is a significant risk of continued security challenges from armed militias opposed to independence. It is clearly important that East Timor should be allowed to develop in peace, without the threat of intimidation or violence. East Timor, for its part, will need to establish a national approach to security and defense issues that serves it well while maintaining ties to Indonesia.

(3). Papua New Guinea

Twenty-five years after independence from Australia, Papua New Guinea has maintained many of the key foundations of progress and prosperity, including an active democracy, free press, and an independent judiciary. Abundant mineral resources exemplify its economic potential.

But as its leaders have acknowledged, Papua New Guinea has made little progress over the past few years, and in important respects has slipped backwards. Economic growth has been slow, corruption has afflicted public life, social progress in areas like education and health has been limited, and law and order have deteriorated Papua New Guinea faces a long and uncertain road to prosperity and stability. Without progress, important problems that have significance for security and stability beyond its borders will remain. One is the threat to national cohesion from secession movements, most particularly in Bougainville. Another is the potential for threats to the security of legitimate government from unlawful and violent challenge, including by elements within the armed forces.

(4). Southwest Pacific

Australia, New Zealand and Papua New Guinea share the Southwest Pacific with 13 other countries. They are all unique, with different histories; cultures, institutions, opportunities and problems, but they have some things in common. These include the inherent problems of national development for small and isolated nations, many with an unsustainable relationship between population and resources.

Current problems in Fiji and the Solomon Islands provide important evidence of deep-seated ethnic and political problems that pose threats to law and order, legitimate government and even national cohesion in some Pacific Island states. In others, such as the small states of Polynesia and Micronesia, economic and environmental challenges are uppermost.

Pacific Island leaders are well aware of many of these problems, and are taking steps to different degrees to address them. Even so, the stability, cohesion and viability of some of these nations will remain under significant pressure over the years ahead. Their resulting vulnerability will continue to be a strategic concern for Australia.

e. An Attack on Australia?

Australia today is a secure country, thanks to our geography, good relations with neighbors, a region where the prospect of inter-state conflict is low, our strong armed forces and a close alliance with the United States. Of these positive factors, only the benefits of our strategic geography are immutable. But the chances of an attack on Australia remain low.

A full-scale invasion of Australia, aimed at the seizure of our country and the erasure or subjugation of our national polity, is the least likely military contingency Australia might face. No country has either the intent or the ability to undertake such a massive task. The region's major powers could conceivably develop the capabilities to undertake an invasion of the continent, but none has anything like that level of capability at present, and it would take many years of major effort to develop. They would also need to establish major bases near Australia. Such developments are not credible unless there were to be major changes in the region's security environment.

A major attack on Australia, aimed at seizing and holding Australian territory, or inflicting major damage on our population, infrastructure or economy, remains only a remote possibility. The capabilities to undertake such an attack would be easier to develop than those needed for an invasion, especially if bases near Australia were accessible. Such developments are highly unlikely in our current strategic environment, but our defense planning cannot altogether dismiss the possibility that they might occur. Some countries have weapons of mass destruction - nuclear, biological or chemical weapons - which, delivered by long-range ballistic missiles, could reach Australia. But it is very unlikely that any of those countries would see advantage in attacking Australia with such weapons, not least because of our alliance with the United States.

Minor attacks on Australia, aimed at harassing or embarrassing Australia, or putting pressure on our policies, would be possible with the sorts of capabilities already in service or being developed by many regional countries. But such attacks would become credible only if there were a major dispute. Even then, it would be most unlikely that another government would miscalculate so badly as to think that it would gain by attempts at military intimidation. Nonetheless such miscalculations do occur, and sometimes with little warning.

f. The Development of Military Capabilities

A key factor in the evolution of Australia's strategic environment is the development of military capabilities in the Asia Pacific region. This will influence the relationships between countries in the region, and it is a critical issue to consider in deciding Australia's own future capability needs. In recent times the Asia Pacific has seen the fastest growth of military capabilities in the world. There have been four factors underpinning that trend: economic growth, development of managerial and technical skills, changing strategic perceptions and priorities, and access to technology. All of these factors seem likely to endure over the next two decades. Our defense planning therefore needs to take account of the likelihood that capabilities in our region will continue to show substantial and sustained growth, in ways which are important to Australia's military situation.

(1). Air Combat Capabilities

Over the last 10 to 15 years, a number of regional defense forces have begun to develop sophisticated air combat capabilities. They have introduced new-generation fighters with the weapons and sensor systems for Beyond Visual Range (BVR) air combat which means the ability to detect and attack hostile aircraft from ranges of up to 60 or 70 nautical miles. Until the mid-1990s Australia was one of very few countries in the Asia Pacific region with BVR capabilities. By 2005, at least nine regional countries, apart from the United States and Australia, will have developed these capabilities, and some will have built up substantial numbers of BVR-capable fighter aircraft.

In a parallel development, some countries in the region are expected to acquire Airborne Early Warning and Control aircraft over the coming decade. These aircraft provide a key edge in air combat, because they allow earlier detection of hostile forces, and more effective deployment of aircraft in action. They also contribute critically to maritime and strike operations. By 2010, some seven regional countries apart from the United States and Australia are expected to have acquired various levels of AEW&C capability.

These developments, and others including air-to-air refueling and relatively low-cost stealth modifications to make aircraft harder to detect, will mean that across the region – including in some countries of Southeast Asia - there are likely to be significant increases in air-combat capability over the coming decade.

(2). Naval Forces

Naval forces will become more capable over the coming decade as a result of a number of well- established trends. One is the proliferation of high-capability anti-ship missiles such as Harpoon, Exocet and their Russian equivalents. Over the past decade a number of regional countries have acquired more sophisticated anti-ship missiles with longer range, better guidance, and more capable systems which allow several missiles to be launched at a target simultaneously from different directions. The number of types of platform that can launch these missiles has also increased to include not just ships but submarines and several types of aircraft. These trends are expected to continue over the current decade. For example we expect to see supersonic anti-ship missiles enter service in several countries in the region over that time and the capability to target ships at long range will improve. Regional navies will also deploy improved defenses against these missiles on their ships.

Another key development is the expansion of submarine capability in the region. Over the coming decade it is likely that the capabilities of submarines being operated by regional navies will improve significantly, and a number of navies will acquire submarines for the first time. Anti-submarine warfare capabilities will also improve.

(3). Strike Forces

Strike capabilities will continue to improve in the region with the introduction of more capable aircraft, supported by air-to-air refueling in some cases, and able to be fitted with longer range standoff weapons. Ships and submarines in some regional navies may also develop enhanced strike capabilities, as they acquire long-range cruise missiles and shorter-range standoff weapons. Such weapons will carry increasingly sophisticated guidance systems and warheads and will be supported by more advanced reconnaissance and targeting systems. Defenses against strike will also improve, with better air combat capabilities and more advanced surface-to-air missiles coming into service in the region.

(4). Land Forces

Most land forces throughout the region already have a numerical advantage in troop numbers over Australia's. Land forces in the region will become more sophisticated, with the wider introduction of important technologies such as night-vision equipment, unmanned aerial vehicles for reconnaissance and improved communications. Firepower and mobility will be enhanced in many armies by acquisition of more helicopters, including reconnaissance and fire-support helicopters, and new types of armored vehicles.

At lower levels of technology, but still very important in many types of operation, we expect to see a wide range of non-state actors, including criminals and insurgents, continuing to gain access to modern, sophisticated weaponry. The proliferation of light guided weapons such as shoulder-fired anti-aircraft missiles is likely to continue.

(5). Information Capabilities

Developments in information technology, and the rapid changes they are bringing to the nature of warfare, will enhance the operational effectiveness of armed forces over the coming decade. Intelligence, surveillance, communications, command and control capabilities, and the whole spectrum of information warfare, will expand significantly. To take one example, the increased availability of high-quality satellite imagery from commercial sources will significantly enhance the information-gathering capabilities of many countries.

(6). Weapons of Mass Destruction

Weapons of mass destruction remain a concern for the region's strategic stability. Nuclear, chemical and biological weapons, and their chief means of delivery - ballistic missiles - are all aspects of weapons of mass destruction over which we need to remain vigilant. The trend towards proliferation of weapons of mass destruction globally will require our continued focus.

4. Australia's Strategic Interests and Objectives

This section explains the Government's decisions about Australia's broad strategic policy: our strategic interests, objectives and priorities. At its most basic, Australia's strategic policy aims to prevent or defeat any armed attack on Australia. This is the bedrock of our security, and the most fundamental responsibility of government. But there is more we can do to prevent attack on our territory than building armed forces, and our armed forces need to be able to do more than simply defend our coastline. We are a major trading nation, with our prosperity dependent on our engagement with other countries. Australia therefore cannot be secure in an insecure region, and as a middle-size power, there is much we can and should do to help to keep our region secure, and support global stability.

a. Ensure the Defense of Australia and its Direct Approaches

Australia's most important long-term strategic objective is to be able to defend our territory from direct military attack. We therefore have an overriding strategic interest in being able to protect our direct maritime approaches from intrusion by hostile forces. As previously mentioned a major attack on Australia is not at all likely in current circumstances, and even minor attacks are improbable. But we do not rule out the possibility, especially over the longer term that circumstances might change in ways that make the prospect less unlikely. Even if the risk of an attack on Australia were low, the consequences would be so serious that it must be addressed.

b. Foster the Security of our Immediate Neighborhood

Our second strategic objective is to help foster the stability, integrity and cohesion of our immediate neighborhood, which we share with Indonesia, New Zealand, Papua New Guinea, East Timor and the island countries of the Southwest Pacific. We would be concerned about major internal challenges that threatened the stability and cohesion of any of these countries. We would also be concerned about any threat of outside aggression against them.

c. Promote Stability and Cooperation in Southeast Asia

Our third strategic objective is to work with others in Southeast Asia to preserve the stability and cooperation that has been such a notable achievement over the past few decades. Our key strategic interest is to maintain a resilient regional community that can cooperate to prevent the intrusion of potentially hostile external powers and resolve peacefully any problems that may arise between countries in the region. We would be concerned about any major external threat to the territorial integrity of the nations in our nearer region, especially in maritime Southeast Asia, whether that threat came from outside or inside the region.

d. Support Strategic Stability in the Wider Asia Pacific Region

Our fourth strategic objective is to contribute in appropriate ways to maintaining strategic stability in the Asia Pacific region as a whole, and to help contribute to building a stronger sense of shared strategic interests.

e. Support Global Security

Our fifth strategic objective is to contribute to the efforts of the international community, especially the United Nations, to uphold global security. The success of the UN in nurturing the principle that armed aggression by one state against another is not to be tolerated, and the effectiveness of its mechanisms in marshalling an international response when the principle is flouted, are important Australian strategic interests. That is a key reason why Australia is among the UN's most consistent supporters. We will also continue to support the United States in the major role it plays in maintaining and strengthening the global security order.

Australia also has an interest in preventing the spread of weapons of mass destruction (WMD). This interest has both a humanitarian and a strategic aspect. We have an interest in helping to ensure that no one should experience the horrors of nuclear, chemical or biological warfare. We have a strategic interest in minimizing the risk that WMD might one day be used or threatened against us. Effective global non-proliferation regimes are vital to limit the spread of

WMD in our region.

5. Australia's Military Strategy

This section explains the tasks of Australia's armed forces in achieving our strategic objectives, the consequent priorities for the development of our military capabilities and the principles underpinning our force-development priorities.

The strategic tasks for the ADF are:

a. Defending Australia

The Government has reaffirmed that the primary priority for the ADF is to maintain the capability to defend Australian territory from any credible attack, without relying on help from the combat forces of any other country. The Government's approach to this task is shaped by the following principles.

(1). Self-Reliance

Our armed forces need to be able to defend Australia without relying on the combat forces of other countries. This principle of self-reliance reflects, fundamentally, our sense of ourselves as a nation. As we made clear in discussing our US alliance in Chapter Five, the Government's commitment to self-reliance does not reflect any lack of confidence in our allies. Nor does it suggest that we would not seek and expect help from our allies and friends in time of need. It simply means that we should not rely on others having either the capacity or the willingness to defend our country especially if we have not taken the effort to provide effectively for our own defense

(2). A Maritime Strategy

The key to defending Australia is to control the air and sea approaches to our continent, so as to deny them to hostile ships and aircraft, and provide maximum freedom of action for our forces. The nature of our air and sea approaches is such that a maritime strategy includes a vital and central role for land forces. They would assist air and naval forces to control those approaches and would be needed to defeat any incursions onto our territory. A key role would be to ensure the security of the bases from which our air and naval forces operate.

(3). Proactive Operations

Australia's strategic posture is defensive in the most fundamental sense. We would not initiate the threat or the use of force, and our objectives in conflict would be to terminate hostile operations against us as quickly as possible, and to our maximum benefit, at minimum cost in lives and resources. But that does not mean that our approach would be operationally defensive. On the contrary, if attacked, Australia would take a highly proactive approach in order to secure a rapid and favorable end to hostilities.

b. Contributing to the Security of our Immediate Neighborhood

Our second priority is to have defense forces able to make a major contribution to the security of our immediate neighborhood. This might require the ADF to contribute to regional peacekeeping and humanitarian relief operations and help evacuate Australians and others from regional trouble spots. We should be prepared to be the largest force contributor to such operations. Our planning needs to acknowledge that we could be called upon to undertake several operations simultaneously, as we are at present in East Timor, Bougainville and the Solomon Islands.

(1). Resisting Aggression

In the highly unlikely event of unprovoked armed aggression against any of our immediate neighbors, Australia would want to be in a position, if asked and if we concluded that the scale of our interests and the seriousness of the situation warranted such action, to help our neighbors defend themselves. The capability to provide such help would be drawn from the forces we have developed for the defense of Australia. Fortunately the strategic geography of our neighborhood makes this feasible. The air and naval capabilities we develop for the defense of Australia would be able to make a valuable contribution to this task. Land forces would also be important for securing bases, and providing specific contributions such as Special Forces.

(2). Lower-Level Operations

Lower-level operations, such as evacuations, disaster relief and peacekeeping operations of different sorts are the most likely types of operation that we might need to undertake in our immediate neighborhood. The ADF needs to be prepared and equipped to undertake such operations should it be required to do so.

In general, the capabilities we develop in the ADF for defending Australia provide forces appropriate for these tasks. However, the experiences of East Timor, Bougainville, Cambodia and elsewhere have taught us important lessons about the use of forces in lower level contingencies. Such operations have specific characteristics that place strong demands on some elements of the ADF, especially our land forces, logistics capacity and deployment capabilities. Key lessons and their implications for our forces include the following:

Training: Operations like INTERFET and the Peace Monitoring Group on Bougainville place great demands on the training and personal quality of the men and women of the ADF. In sometimes dangerous and ambiguous situations, they can be called upon to make snap judgments that can have life and death significance. Often junior personnel who must have the training, preparation and personal qualities to handle such situations must make these decisions on the spot.

Readiness and Sustainment: The need for operations such as evacuations or support for a legitimate government can arise quickly and with little warning, so forces need to be available at high levels of readiness. Some kinds of operations, such as peacekeeping, can require a relatively large presence on the ground, so significant numbers of personnel might need to be deployed and supported. And while some types of operations such as evacuations are over quickly, others, such as some types of peacekeeping, can last for months or even years. So it is important that forces are sized and structured to allow sustainment and rotation.

Deployment and Support: Forces may need to be inserted, and evacuees extracted, sometimes in dangerous circumstances, so substantial military air and sealift must be available. Forces must be supported and provided with a wide range of services in difficult conditions. There is often a need to provide relief services to local populations as well. We therefore need adequate logistics and support capabilities, including deployable medical facilities; cargo-handling systems, water and fuel supply facilities, and engineering capabilities.

Firepower and mobility: Success in pacifying an unstable situation often depends on a demonstrated ability and willingness to use preponderant force swiftly in response to any violence, so forces need to have ample firepower. While such operations might typically involve lightly armed adversaries, there can be potential for escalation by intervention of well-armed conventional forces. We need to have capabilities available to deter or, if need be, respond to such escalation. This would often involve not just land force capabilities but also air and naval forces to protect force elements as they deploy, maintain lines of supply and provide additional firepower.

Command and Communications: The task of leading such operations places additional demands on the ADF for command, communications, intelligence and other facilities.

The Government intends that, within the capabilities we develop for the defense of

Australia, we will make sure that we have sufficient forces to meet these demands, so that we are well prepared to respond to credible contingencies in our immediate neighborhood.

At the same time, it is important that we recognize the limits to Australia's ability to influence and help in major crises, even in our immediate neighborhood. Relatively small crisis situations can require very high levels of resources to manage and control. For example, even if we had had much larger forces than we have today, Australia could not have undertaken to restore peace and security in East Timor under INTERFET except with the help of a large number of coalition partners and the cooperation of the Indonesian authorities. Australia would contemplate contributing with armed forces to an international response our immediate region only if it had the support of our neighbors, and of other countries from the region and beyond.

c. Supporting Wider Interests

The third priority for Australia's forces is to be able to contribute effectively to international coalitions of forces to meet crises beyond our immediate neighborhood where our interests are engaged. Such coalitions might involve operations ranging from peacekeeping and disaster relief to relatively high-intensity conflict. In general, the closer a crisis to Australia, the larger the contribution we would want to be able to provide.

We do not envisage that Australia would commit forces to operations beyond our immediate neighborhood except as part of a multinational coalition. The scale of our contribution would depend on a wide range of factors, but in general we would expect to make a greater contribution to coalition operations closer to home, where our interests and responsibilities are greater. In Southeast Asia we would want to be able to make a substantial contribution to any regional coalition that we decided to support - especially if it involved our undertakings under the FPDA. In the wider Asia Pacific region we would want to have the capacity to make a significant contribution to any coalition we thought it appropriate to join. In most cases the United States would lead such a coalition, and we would expect our forces to operate closely with US forces. Beyond the Asia Pacific region we would normally consider only a relatively modest contribution to any wider UN or US-led coalition, proportionate to our interests and the commitments of contributors from elsewhere in the world.

We would be most unlikely to contemplate the leadership of any coalition operations that were focused beyond Southeast Asia or the South Pacific.

We would expect to be able to provide the forces needed to contribute to coalition operations from within the capabilities we develop for the defense of Australia and for operations within our immediate region. The key requirements of such forces would be that they should be able to succeed with an acceptable level of risk in the operational environment expected, taking into account the levels of adversary forces and capabilities that they might encounter. They should also be capable of operating adequately with the other coalition members.

In broad terms, these conditions suggest that a major Australian contribution to a coalition for higher intensity operations would more likely involve air or naval forces than land forces. The air and naval forces we develop for the defense of Australia will provide the Government with a range of options to contribute to coalitions in higher intensity operations against well-armed adversaries. Our land forces would be ideally suited to provide contributions to lower intensity operations including peace-enforcement, peacekeeping and many types of humanitarian operations. Such operations are much more likely than high intensity operations and would emphasize mobility and the levels of protection and firepower appropriate for our own environment, rather than the kinds of heavy armored capabilities needed for high intensity continental warfare.

d. Peacetime National Tasks

In addition to these core tasks in support of Australia's strategic objectives, the ADF will also be called upon to undertake a number of regular or occasional tasks in support of wider national interests. These include specific and ongoing commitments to coastal surveillance and emergency management, as well as ad hoc support to wider community needs.

One of the most important of these is the critical contribution that the ADF makes to the security of our coastline from illegal immigration, smuggling, quarantine evasion and other intrusions on our sovereignty.

Other peacetime national tasks include counter-terrorist response, maritime search and rescue, and natural disaster relief.

(1). ADF Special Forces maintain a highly respected capacity for counter-terrorist operations, which is among the most sophisticated in the world;

(2). Emergency Management Australia provides training, national policy coordination and coordinated responses for civil emergencies;

(3). The ADF's long-range air and naval capabilities assist maritime search and rescue, undertake navigational and hydrographic work, and also support fisheries management;

(4). Major contributions are made to other events, such as the Sydney 2000 Olympic Games and the coming Centenary of Federation celebrations; and

(5). ADF units, including Reserve units, make a major contribution to disaster relief in Australia and our immediate neighborhood.

6. Australian Force Structure 2000

As stated in the 2000 Defense White Paper, Australia outlines its strategic interests and objectives as follows:

(1). Defense of Australia and its direct approaches

(2). Foster the security of our immediate neighborhood

(3). Promote stability and cooperation in Southeast Asia in a collaborative effort

(4). Contribute in appropriate ways to maintaining strategic stability in the wider Asia Pacific region

(5). Contribute to the efforts of the international community, especially the United Nations, to uphold global security.

These national strategic interests and objectives directly shape the military strategy of Australia.

To achieve these key tasks, the ADF will maintain and further develop an integrated and balanced joint force that can provide capabilities appropriate to the two highest tasks identified above. First, Australia will maintain maritime capabilities - mostly air and naval forces - that can defend Australia by denying our air and sea approaches to any credible hostile forces. Second, Australia will maintain land forces - including the air and naval assets needed to deploy and protect them - that can operate as part of a joint force to control the approaches to Australia and respond effectively to any armed incursion onto Australian soil. Both those sets of capabilities would also be able to support the security of our immediate neighborhood and contribute to coalition operations.

In order to meet the military strategies dictated and strategic objectives above, the ADF leadership and the government have embarked on a new approach to capability planning by preparing a detailed, costed plan for the ADF over the next 10 years. The plan provides the ADF with clear long-term goals for its development and the funding needed to achieve those goals.

The acquisition procurement changes will focus on the life cycle costs of the systems and include not only the initial capital investment required, but also personnel, operating, support and upgrade costs over a 20 year nominal operating cycle. The acquisition plan will be revised annually, within the 10-year budget constraint, to take account of changing strategic circumstances, new technologies and changed priorities.

a. The Royal Australian Navy (RAN)

Australia's force for maritime operations provides the ability to deny an opponent the use of the maritime approaches and ensures the freedom to operate at sea. This ability to deny opponent operations while allowing the operation of ADF maritime forces at sea is critical to the defense of Australia and highlights the capacity to provide security to the immediate region. Additionally, Australia’s maritime forces must be able to integrate and operate with coalition forces seamlessly.

Australia's maritime forces consist of the surface fleet, which includes major combatants, helicopters and support ships, submarines, maritime patrol aircraft, mine hunters, and patrol boats.

The capability goal of the maritime forces is maintain an assured capability to detect and attack any major surface ships, and to impose substantial constraints on hostile submarine operations, in our extended maritime approaches. Also, the maritime forces must be able to support Australian forces deployed offshore, to contribute to maritime security in our wider region, to protect Australian ports from sea mines, and to support civil law enforcement and coastal surveillance operations. Additionally, the force must be able to operate effectively with those of the United States and to contribute to regional coalition operations. The submarines must be able to operate effectively in high capability operational environments in the Asia

Pacific region. Maritime patrol aircraft must have the capacity to operate throughout the region, with high-quality sensors and weapons for attacks on surface ships and submarines. The patrol boats must be able to make a cost-effective and sustained contribution to civil coastal enforcement and surveillance operations.

(1). Major Issues

(a). Surface Fleet

Australia's surface fleet consists of two classes of major warship. The first of those is the six guided missile frigates (FFGs) that entered service between 1980 and 1993. The second class is the eight ANZAC ships that have or will enter the service between 1996 and 2004.

These ships have three potential shortfalls that must be considered. The first is the adequacy of ships' defenses against the more capable anti-ship missiles. Without adequate defenses, these ships are limited in their ability to operate against capable regional navies and within range of hostile air forces. A project now under way will provide such defenses for the FFGs, but the ANZACs do not have adequate defenses and have other significant deficiencies in their combat capabilities.

The second is the requirement for a long-range air-defense capacity in the fleet. Without such capability, the ships are more vulnerable to air attack, less capable of defending forces deployed offshore and less capable of contributing effectively to coalition naval operations.

The third is the future replenishment capability. A robust replenishment capability increases the maritime capability by allowing the ships to operate at sea for longer periods of time and at greater ranges from port. One of the support ships, the HMAS Westralia, will reach its end of life in 2009 and the other in 2015. The future procurement plan must address the replacement of these ships

To address these issues, the ADF developed the following plan. First, the ANZAC ships will be upgraded to provide a reasonable level of anti-ship missile defenses and other enhancements of their combat capabilities, including the fitting of Harpoon anti-ship missiles. This project is scheduled to start in 2001 with upgraded ships in service by 2007.

Second, the FFGs will be replaced upon decommissioning in 2013 by a new class of at least three air-defense capable ships. It is expected that these ships will be significantly larger and more capable than the FFGs. The project is scheduled to commence in 2005-06. The government desires to build these ships in Australia, which will provide significant work for Australia's shipbuilding industry.

Third, the ADF plans to replace HMAS Westralia, which is a converted commercial tanker, with a purpose-built support ship upon decommissioning. The second ship, the HMAS Success will be replaced, with another ship of the same class upon decommissioning in 2015. As before, the government desires to build these ships in Australia. The project to replace HMAS Westralia is planned to start around 2004-05.

(b). Submarines

The government plans to bring all of the Collins class submarines to a high level of capability by major improvements to both the platform and combat systems. Modifications already under way to some boats have resulted in major improvements in the acoustic performance of the boats and in the reliability of a number of the ship systems. Interim modifications to the combat system have improved performance. All boats will now be modified for better acoustic performance and reliability and a new combat system will be introduced.

In addition, a project is also scheduled to commence in 2002-03 to address the replacement of the current heavyweight torpedo with a new and more capable weapon. The first new torpedoes are planned to enter service around 2006.

(c). Maritime Patrol Aircraft

Australia's fleet of 19 P-3C Orion maritime patrol aircraft will undergo a major refurbishment and capability upgrade over coming years. The P-3Cs will reach the end of their current planned life in around 2015. Unless new technology emerges that can replace the P-3C's roles, the aircraft will be refurbished to allow operation past that date. This refurbishment plan would start in 2007. Capability upgrades planned for the future are the fitting of new electro-optical sensors to improve capacity to detect ships under difficult circumstances, starting around 2004-05, and the acquisition of a new lightweight torpedo to improve the P-3C's critical submarine-killing capabilities, starting around 2002. A remaining shortfall is self-protection for the aircraft from missiles if they were to be deployed in medium or high threat environments.

(d). Patrol Boats

The 15 Fremantle class Patrol Boats are close to the end of their service life. These boats provide the critical function of coastal surveillance and enforcement and are therefore a high priority for replacement. The ADF will embark on a project in 2001 to replace the patrol boats with a new class of patrol boat as the older ones are decommissioned. The new boats will preferably be built in Australia and are expected to enter service from 2004-05.

(2). Navy Force Structure 2000

The Navy force structure for 2000 is provided below.

(a). Surface Combatants

i. 1 DDG

ii. 6 FFG

iii. 2 ANZAC FF

iv. 1 High Speed Catamaran (leased)

v. 15 Patrol Boats (PB)

vi. 2 oiler/replenishment ships

vii. 1 Heavy Amphibious Lift Ship (HLAS)

viii. 2 Amphibious Lift (LPA)

ix. 15 Landing Craft Medium (LCM)

x. 6 Landing Craft Heavy (LCH)

(b). Mine Warfare

i. 2 Inshore Mine Countermeasures (MCM)

ii. 3 Huon MCM

iii. 2 Dive Teams

(c). Submarine Force

i. 1 Oberon SS

ii. 3 Collins SS

(d). Navy Air

i. 16 Sea Hawk (anti-submarine/surveillance) helicopters

ii. 7 Sea King (utility/transport) helicopters

iii. 6 Squirrel (light utility) helicopters

iv. 5 Kiowa (light utility/training) helicopters

v. 10 Super Sea Sprite helicopters

vi. 19 P-3C Orion MPA

b. The Australian Army

The land force capability grouping includes all elements of the Army, and those elements of Navy and Air Force whose principle task is to deploy them.

The capability goal of the land forces and its supporting elements is to provide land forces that can respond swiftly and effectively to any credible armed conflict on Australian territory. Additionally, the land forces must be able to conduct the more likely types of operations in the immediate region i.e., MOOTW.

The ADF has also decided against the development of additional heavy armored forces suitable for contributions to coalition forces in high intensity conflicts. These forces would be cost prohibited and would most likely not be needed in the defense of Australia or in our immediate region. Some level of armor capability will remain in place.

The ADF will implement these broad goals under four headings: Ready Frontline Forces; Sustainment and Rotation; Combat Weight; and Deployment, Support and Command, Control, Communication and Intelligence (C3I).

(1). Ready Frontline Forces

The Army will be structured to ensure the ability to sustain a brigade deployed on operations for extended periods, and at the same time maintain at least a battalion group available for deployment elsewhere. To achieve this, they will retain on a permanent basis the increased numbers of land force units that have been brought to high readiness over the last two years. This is an expansion in the number of infantry battalions at high readiness from four to six. Under this plan six battalion groups, each of around 1,000 personnel, will be held at no more than 90 days notice to move, and most at 30 days or less. They include a parachute battalion, two light infantry air-mobile battalions, a motorized battalion, a mechanized battalion, and a commando battalion. In addition, the current SAS Regiment of 700 personnel will be maintained at high readiness.

The above forces will be organized in three brigades and the Special Operations Group as at present. The brigades, each of around 3,000 personnel, will include, in addition to the infantry battalions, a range of specialized combat units such as armor, artillery, aviation, combat engineers, and logistics and support units.

(2). Sustainment and Rotation

Special attention will be paid to the capacity of our land forces to sustain operations once deployed. This has been a significant weakness of the land forces in the past. Accordingly, service personnel will not serve on operations for longer than six to 12 months at a time followed by a substantial period of recuperation before being deployed again. Recent operations in East Timor highlighted the limited sustained deployment capability of the ADF.

The key to the land force sustainment capability will come from the reserve forces. In line with the new emphasis on a small, high-readiness army ready for deployment, the role of the reserve forces will undergo a major transition. In the past, the partially trained reserve forces were to be used to supplement and expand the Army for major land operations in some future crisis. This action did not take proper advantage of the skills available in the Reserves. As a result, the priority of the future for the reserve force will be to provide fully trained personnel to our ready frontline forces deployed on operations. This will greatly enhance the capacity to sustain forces on operations for extended periods.

(3). Combat Weight

The ADF believes that land forces should have sufficient firepower, protection and mobility to provide clear advantage in any likely operations in defense of Australia or in our immediate region. To support these goals, a program of rapid enhancement of a range of combat capabilities for our land forces will be undertaken. The key elements of this program are as follows:

(1). Two squadrons (around 20-24 aircraft) of Armed Reconnaissance Helicopters planned to enter service from 2004-05.

(2). An additional squadron (about 12 aircraft) of troop-lift helicopters to provide extra mobility for forces on operations.

(3). Major upgrade of 350 of the M113 Armored Personnel Carrier fleet, with the upgraded vehicles planned to enter service from around 2005.

(a). A new shoulder-fired guided weapon for key elements of the force to attack armored vehicles, bunkers and buildings. This weapon is planned to enter service around 2005.

(b). Improved body armor, weapons, and night vision equipment and communications systems for all soldiers in deployable land forces. New equipment should begin to enter service from around 2003.

(c). New air defense missile systems to supplement the existing RBS-70 and replace the existing Rapier systems, giving comprehensive ground-based air defense coverage to deployed forces. These systems are planned to enter service from around 2005 and 2009 respectively.

(d). Twenty new 120mm mortar systems mounted in light armored vehicles to improve mobile firepower planned to enter service in 2006.

(e). A new thermal surveillance system and tactical uninhabited aerial vehicle (UAV) to provide surveillance for deployed forces, planned to enter service from around 2003 and 2007 respectively.

Additionally, sustained investment will be made in maintaining or enhancing current land force capabilities such as the 105mm and 155mm field artillery.

(4). Deployment, Support and C3I

The recent operations in East Timor and as the leader of the United Nations follow-on operations, Australia recognized a deficiency in the capacity to deploy forces on operations and support them while deployed.

The major weakness in these operations was the ability to conduct amphibious lift. This capability was substantially increased by the introduction into service of amphibious support ships, HMAS Manoora and Kanimbla, after the lease of the catamaran HMAS Jervis Bay expires. The heavy lift Landing Ship HMAS Tobruk will be replaced when it reaches the end of its service life in 2010, and a program to replace of Manoora and Kanimbla in 2015 will be implemented. The result is that Australia's recently expanded amphibious lift capability will be retained at its present level of three major ships. In addition, we plan to replace the fleet of 15 medium landing craft and six heavy landing craft, and study options to retain access to the unique capabilities of catamarans such as Jervis Bay.

The airlift capabilities will be enhanced by the acquisition of new aircraft to replace the Caribou from 2010, and by the refurbishment of our 12 C130H aircraft by about 2008. We plan to undertake a major program to provide better electronic warfare self-protection of our transport aircraft and helicopters from missiles by around 2004.

The Logistics Support Force will be enhanced by increasing the preparedness of individual units thus providing improved support to deployed forces and an enhanced ability to rotate forces.

(5). Army Force Structure 2000

The Army force structure for 2000 is provided below.

(a). Special Forces (1 regiment SASR/1 regiment Commando)

(b). Mechanized Force (1 brigade)

(c). Light Infantry Force (1 brigade)

(d). Motorized Infantry Force (1 brigade)

(e). Army Aviation Force

(f). Ground Based Air Defense

(g). Combat & Logistics Support

(h). Army Reserve Force

(i). Army Aviation (helicopters)

- i. 36 S-70A Black Hawk
- ii. 4 CH-47D Chinook
- iii. 25 UH-1H Iroquois
- iv. 43 Kiowa Light Observation
- v. AS350BA Squirrel

(j). Air Defense

- i. 12 RBS-70 laser guided firing units
- ii. 12 Rapier radar tracking units

(k). Reserve Units

- i. 11th Brigade (North & Central Queensland)
- ii. 4th Brigade (Victoria)
- iii. 5th Brigade (NSW)
- iv. 8th Brigade (NSW)
- v. 9th Brigade (SA & Tasmania)

vi. 13th Brigade (WA)

(l). Reserve Surveillance Units

i. Northwest Mobile Force (NORFORCE)

ii. Pilbara Regiment (WA)

iii. Far North Queensland Regiment

c. The Royal Australian Air Force (RAAF)

(1). Air Combat

Air combat is the most important single capability for the defense of Australia, because control of the air over the territory and maritime approaches is critical to all other types of operation in the defense of Australia.

Australia's air-combat capability is based on its fleet of 71 F/A-18 aircraft with its sensor systems and missiles, supported by other systems including air-to-air refueling (AAR), and an integrated command and communications system, including surveillance and battle space management systems in the Air Defense Ground Environment.

The capability goal of air combat is to ensure the ability to protect itself from air attack, and control the air approaches to ensure that we can operate effectively against any hostile forces approaching Australia. The air combat capability must be maintained at a level at least comparable qualitatively to any in the region, and with a sufficient margin of superiority to provide an acceptable likelihood of success in combat. These forces must be large enough to provide a high level of confidence that they could defeat any credible air attack on Australia or in our approaches, and capable enough to provide options to deploy an air-combat capability to support a regional coalition. They will also have the capacity to provide air-defense and support for deployed ground and maritime forces in our immediate region.

Given this capability goal, the major challenges to achieving this goal are three-fold. First, the air-combat capabilities of a number of defense forces throughout the region have grown steadily in recent years, and are expected to continue to do so. As a result, it is anticipated that the capabilities of the F/A-18 aircraft will be out of date with respect to a number of regional air forces.

Second, the air-to-air refueling (AAR) aircraft - four Boeing 707 aircraft - are close to the end of their effective life. Over the next few years they will need to be substantially refurbished or replaced in order to maintain an AAR capability. AAR is crucial to the effectiveness of the air combat element as it extends the range and endurance of the fighters. This is critical for covering our extended air approaches, including offshore territories and for providing air support to surface ship deployments including amphibious task forces and land forces deployed in the immediate region.

Third, future air combat needs to be addressed before the F/A-18 aircraft reach the end of their service life between 2012 and 2015.

Given the above challenges, the ADF developed a four-pronged plan in response. First, the current upgrade program for the F/A-18 aircraft will continue. Significant phases are already underway; including the installation of new and significantly improved radar, and the acquisition of new advanced air-to-air missiles. Additional phases have been scheduled to provide the fighter force with a range of upgrades. This program of upgrades is planned to be completed by 2007 and includes:

(a). Advanced tactical data links to allow the aircraft to exchange combat information instantly with other units, allowing better cooperative tactics

(b). A new helmet-mounted missile cueing system to get the best out of new short-range air-to-air missiles

(c). Structural improvements to extend the life of the airframe and reduce its detectability by enemy radars

(d). Some initial improvements to electronic warfare self-protection

Second, the acquisition of four Airborne Early Warning and Control (AEW&C) aircraft, with the possibility of acquiring a further three aircraft later in the decade will be a reality. The AEW&C will make a major contribution to many aspects of air combat capability, significantly multiplying the combat power of the upgraded F/A-18 fleet. These aircraft will improve command and control, improve capacity for air defense of surface ships, and enhance our strike capability. The aircraft are planned to start entering service around 2006.

Third, a firm schedule for a major project to replace and upgrade the AAR capability. This project will acquire up to five new-generation AAR aircraft, which would have the capacity to refuel not only our F/A-18 aircraft but also our F-111 and AEW&C aircraft over a wide area of operations. These aircraft will also provide a substantial air cargo capability, and are planned to enter service around 2006.

Fourth, the ADF will examine options for acquiring new combat aircraft to follow the F/A-18, and potentially also the F-111. Provision has been made in the Defense Capability Plan for a project to acquire up to 100 new combat aircraft to replace both the F/A-18 and F-111 fleets. Acquisition is planned to start in 2006-07, with the first aircraft entering service in 2012.

(2). Strike

The strike capability focuses on the forces that enable Australia to attack hostile forces in the territory of an adversary, in forward operating bases, and in transit to Australia. This capability is viewed as very important to the government. Strike capability allows Australia more scope to determine the pace and location of hostilities and would impose major defensive costs on an adversary contemplating hostile action. Additionally, strike forces provide support to Australian forces deployed abroad and may contribute to regional coalitions.

Strike operations can be conducted by F/A-18s and other platforms equipped with the appropriate weapons. The F-111 long-range bombers, however, provide the bulk of the strike capability.

The capability goal of the strike capability is to ensure the capability to contribute to the defense of Australia by attacking military targets within a wide radius of Australia, against credible levels of air defenses, at an acceptably low level of risk to aircraft and crew. Australia does not desire a strike capability large enough to conduct sustained attack on an adversary's wider civil infrastructure, but does require a capability able to attack those militarily significant targets that might be used to mount or support an attack on Australia. The country does not, however, require sufficient capacity to mount sustained strike campaigns against a significant number of such targets. The government expects that the strike capabilities developed for the defense of Australia would provide options to contribute to regional coalitions against more capable adversaries at acceptable levels of risk to crew and aircraft.

The ADF has considered three key issues in relation to the F-111 strike capability. First, the capacity of the F-111s to overcome improving air defenses has been enhanced recently by improvements to the electronic warfare self-protection (EWSP) systems and by the acquisition of standoff weapons, allowing aircraft to launch attacks from outside the range of some air defense systems. However, the ADF recognizes that over the coming decade further improvements will be required in both areas. Accordingly, further EWSP upgrades and acquisition of additional types of stand-off weapons with longer range and with different guidance and targeting systems to provide more alternative attack options and better capability against hardened and area targets will be required.

Second, the decision to acquire AEW&C aircraft and enhance the AAR capability will also contribute significantly to strike capability. For the first time, air-to-air refueling of the F-111s will be able to be conducted, increasing the range, payload and tactical options. The expansion of the AAR capability will also benefit the capacity of the F/A-18s to undertake strike missions at longer range with greater weapons loads. AEW&C aircraft will help the strike force penetrate air defenses and avoid hostile forces. In-flight refueling for our AEW&C aircraft will increase their capacity to support strike missions.

Third, the future of the strike capability after the F-111 leaves service, expected to be between 2015 and 2020, must be considered. It is unlikely that there will be any comparable specialized strike aircraft suited to the needs of the ADF at that time. A range of alternatives may be available by then, including the much greater use of long-range missiles fired from large transport aircraft, naval platforms, or even unmanned combat aerial vehicles. Alternatively, the best option may be specialized strike variants of air-combat aircraft. This would allow the replacement of the F-111 by the same type of aircraft that is bought to replace the F/A-18, which would result in large savings in operating costs.

(3). RAAF Force Structure 2000

The Air Force force structure for the year 2000 is provided below.

(a). 71 F/A-18 Hornet

i. 53 A, 18 B

(b). 35 F-111

i. 21 C, 14 G

(c). 24 C-130 Hercules

i. 12 E, 12 H

(d). 14 DHC-4 Caribou

(e). 5 Boeing 707 Tankers

(f). EWSP upgrades for all air platforms

(g). Trainer Fleet

d. Information Capability

Effective use of information is at the heart of Australia's defense capability. This trend is a reflection of the dominant theme in the evolution of the modern military force. As information technology matures, its place in the every day operations of a military force will be critical. This trend is more significant to Australia than to many other countries. The strategic circumstances of Australia mean that innovative applications of different aspects of information technology offer Australia unique advantages.

Major advances in surveillance technology will allow the detection of hostile forces far from the shore. Faster secure communications and data links between tactical units enable these units to cooperate in combat with unprecedented speed and ease. This will multiply the effectiveness of each platform significantly.

The Information Capability grouping covers intelligence and surveillance capabilities, communications, information warfare, command and headquarters systems, and logistics and business applications.

The capability goals for Information Capabilities are to position the ADF to harness advances in information technology in ways that ensure that the ADF has timely, accurate and secure information to exploit fully individual and unit combat capabilities, and allow their employment in more flexible ways. Our specific objectives include:

(1). Maintaining first-rate intelligence capabilities

(2). Developing a comprehensive surveillance system providing continuous coverage of our extended air and sea approaches

(3). Developing an integrated command system covering operations at all levels and in all environments

(4). Providing communication capabilities that can support Australian operations throughout our territory and our immediate region, with increased capacity to support a range of new information systems

(5). Maximizing the efficiency and effectiveness of our logistics systems and management processes by cost-effective investment in information technology applications

(6). Ensuring these systems are managed effectively, secure against information warfare attack and able to achieve a high level of interoperability with our allies and partners.

(7). Major Issues

(a). Intelligence

Good intelligence will remain critical to Australia's strategic posture in a complex and fluid environment. The intelligence organization and infrastructure must be able to monitor comprehensively several crises at the same time and provide effective operational support to deployed forces. New technologies offer new opportunities for collection, analysis and distribution of intelligence. The future development plan incorporates substantial and sustained investment in enhanced intelligence capabilities, including:

i. Enhanced signals intelligence and imagery collection capabilities

ii. Enhanced geospatial information systems

iii. Improved intelligence processing and dissemination systems

iv. Deeper levels of cooperation with the United States in some key systems

(b). Surveillance

Recent technology developments have expanded significantly the potential for sustained, 24-hour surveillance of the northern approaches, particularly by the Jindalee Operational Radar Network (JORN) and other systems. The ADF plans to exploit these developments by undertaking a sustained program of enhancement to the JORN over the horizon radar system. An improved capability to fuse data from JORN and other sensor systems to provide an integrated national surveillance picture will be undertaken.

(c). Communications

Sustained investment in communications capability will be necessary to support the application of information technology innovations, especially for deployed forces. Key enhancements planned include the fixed network within Australia, long-range communications to deployed forces, networked communications systems throughout an area of operations, tactical communications for combat units, and improved communications network management systems. Specific projects will include higher capacity satellite communications based on a commercial provider, enhanced broadband communications with ships at sea, and improved battle space communications for air and land force elements.

(d). Command, Logistics and Business Systems

Investment in systems to improve the efficiency and effectiveness of command and management functions in the ADF is a high priority. Improved command arrangements and systems are essential to our ability to deploy and operate effectively in complex environments at short notice. Better logistics and business systems will increase combat power in the field and save money. The key investments planned over the coming decade are the establishment of a single collocated Theatre Headquarters, and the development of two deployable headquarters to provide on the spot command for two deployed forces simultaneously; a single integrated command support system linking all ADF elements; and an integrated personnel, logistics and financial system based on e-business principles.

(8). Information Capability Force Structure 2000

The Information Capability force structure and capabilities are provided below.

(a). Operational Command

i. Deployable HQ (one)

(b). Communications (SATCOM, HF, Networks)

(c). Command and Information Management Systems

(d). Strategic Intelligence

(e). Strategic Surveillance

(f). Geospatial Information

(g). Hydrographic Survey Force

Annex A

The information presented in Annex A was derived from the following sources. In some cases, entire sections of the source documents were cited; therefore, footnotes were not used.

Commonwealth of Australia, *Defence 2000, Our Future Defence Force*, December 2000

Department of Defence, Commonwealth of Australia, *Defence Review 2000 - Our Future Defence Force, A Public Discussion Paper*, June 2000

Department of Defence, Commonwealth of Australia, *The Australian Defence Force, Capability Fact Book*, June 2000

SEI Team Australia Economic Model Navigation Table of Contents

This spreadsheet represents the economic model and assumptions used by derive future growth and budgetary constraints for this study. Initial parameters were derived from a variety of Australian government sources including the Defense Discussion Paper and the Australian Bureau of Statistics.

GDP and Defense Spending

Epoch	Year	GDP (Aus B $)	% Spent on Defense	Economic Growth	Defense Expenditure (In Billions of Aus $)	GDP (US B $) Us Dollar Conversion 1.8287 $aus/$us	Defense Budget
Epoch 1	2000-2001	684	1.90%	3.50%	13	374.151324	7.108875157
	2001-2002	708.2	1.90%	3.50%	13.455	387.24662	7.357685788
	2002-2003	729.4	2.00%	3.00%	14.588	398.864019	7.97728038
	2003-2004	751.3	2.10%	3.00%	15.777	410.82994	8.627428731
	2004-2005	775.7	2.20%	3.25%	17.065	424.181913	9.332002078
Epoch 2	2005-2006	805.9	2.30%	3.89%	18.535	440.682589	10.13569955
	2006-2007	839.3	2.40%	4.15%	20.144	458.970916	11.015302
	2007-2008	877.1	2.40%	4.35%	21.050	479.624608	11.51099059
	2008-2009	916.6	2.45%	4.50%	22.456	501.207715	12.27958902
	2009-2010	916.6	2.45%	4.50%	22.456	501.207715	12.27958902
Epoch 3	2010-2011	956.9	2.43%	4.40%	23.252	523.260855	12.71523876
	2011-2012	998.5	2.40%	4.35%	23.964	546.022702	13.10454484
	2012-2013	1041.9	2.40%	4.35%	25.007	569.774689	13.67459254
	2013-2014	1087.3	2.40%	4.35%	26.095	594.559888	14.26943732
	2014-2015	1087.3	2.40%	4.35%	26.095	594.559888	14.26943732

Epoch 4	2015-2016	1130.8	2.40%	4.00%	27.138	618.342284	14.84021481
	2016-2017	1173.7	2.40%	3.80%	28.170	641.839291	15.40414297
	2017-2018	1217.2	2.40%	3.70%	29.212	665.587344	15.97409626
	2018-2019	1262.2	2.40%	3.70%	30.293	690.214076	16.56513782
	2019-2020	1262.2	2.40%	3.70%	30.293	690.214076	16.56513782
					Total Defense Expenditure for 20 yr period		**245.0064228**

This model assumes the Australian dollar remains constant at the current exchange rate of 1.87 Australian dollars per US dollar. A substantial amount of signifigant digits have been maintained to most accurately account for future growth.

Annex B

Population and GDP per Capita

		0.51 US $ GDP (US B $)	(Million People) Population	Per Capita GDP (US$)
Base Line	2000-2001	374.15	19.169083	19518.48
Epoch I	2004-2005	424.18	21	20199.14
Epoch II	2009-2010	501.21	21.7	23097.13
Epoch III	2014-2015	594.56	23	25850.43
Epoch IV	2019-2020	690.21	24.5	28172.00

Broad Function Budget Allocation

Epoch 1

Defense Budget Broad Function	1999 % of Total	Epoch 1 % of Total	2005-2006 Defense Budget	Defense Expenditure
Current Capabilities	57.930	52.00%	40.40	21.01
Future Capabilities	29.320	33.72%	40.40	13.62
Research	1.955	2.95%	40.40	1.191
Personal Services	7.463	7.46%	40.40	3.01
Resource Administration	3.332	3.33%	40.40	1.34
Total				

Epoch 2:

Defense Budget Broad Function	2009-2010 % of Total	End of Epoch Defense Expenditure
Current Capabilities	51%	29.1822
Future Capabilities	33%	18.8826
Research	3%	1.7166
Personal Services	10%	5.7220
Resource Administration	3%	1.7166
Total	100%	

Epoch 3:

Defense Budget Broad Function	2010-2015 % of Total	2010-2015 Defense Budget	End of Epoch Defense Expenditure
Current Capabilities	56%	68.03	38.0986
Future Capabilities	28%	68.03	19.0493
Research	4%	68.03	2.7213
Personal Services	9%	68.03	6.1230
Resource Administration	3%	68.03	2.0410
Total	100%		

Epoch 4:

Defense Budget Broad Function	2015-2020 % of Total	2015-2020 Defense Budget	End of Epoch Defense Expenditure
Current Capabilities	60%	79.35	47.6092
Future Capabilities	25%	79.35	19.8372
Research	3%	79.35	2.3805
Personal Services	9%	79.35	7.1414
Resource Administration	3%	79.35	2.3805

All dollar amounts
Are in US B $

Summary

	2000	Epoch 1	Epoch 2	Epoch 3	Epoch 4
Current Capabilities	57.93 %	52.00%	51%	56%	60%
Future Capabilities	29.32 %	33.72%	33%	28%	25%
Research	1.95 %	2.95%	3%	4%	3%
Personal Services	7.46 %	7.46%	10%	9%	9%
Resource Administration	3.33 %	3.33%	3%	3%	3%

Epoch 1 Budget

						Budgeted an
Budget for Epoch I						13.62411
	Platforms	# bought	Current Inv	Unit Cost	Total in 2005	
Ships	Huon	4	2	0.3000	6	1.2
	Anzac FFG	6	2	0.3333	8	2
Subs	Collins Class	3	3	0.4667	6	1.4
	Torpedo Upgrade (MK-48/50)	Total Fleet			Fleet outfitted	0.5
Aircraft	F-111 Upgrade**	Total Fleet				0.5
	F/A-18 Capability Upgrade	Total Fleet			Fleet outfitted	0.5
	EWSP	Total Fleet			Fleet outfitted	0.3
	AEW&C	4		0.3750	4	1.5
	Advanced Tanker Aircraft	5		0.0650	5	0.325
	Armed Recon Helos (Apache	24	0	0.0208	24	0.5
Ground Forces	LSLAV	80		0.0050	80	0.4
	Bushranger IMV	150		0.0017	150	0.255
	APC Upgrade	Total Fleet			Fleet outfitted	0.255
	Comm	Total Fleet			Fleet outfitted	0.2
	NVG	Total Fleet			Fleet outfitted	0.1
	Shoulder Fired Weapon	Total Fleet			Fleet outfitted	0.05
	21 st Century Soldier	Total Fleet			Fleet outfitted	0.1
Weapons	Air Defense (Patriot)	10	0	0.1000	10	1
	Improved Harpoon	250		0.0012		0.3
	Paveway 1 & 2 Kits	20000		0.0000		0.2
	AAMRM	300		0.0027		0.8
					Total Expenditu	12.385
					Total Remainin	1.239105

Epoch 2 Budget

Epoch 2	**Defense Procurement Budget**					
						Budgeted
						18.8826
	Platforms	# bought	Current Inv	Unit Cost	Total in 2010	
Ships	Huon	6	6	0.2	12	1.2
	Anzac FFG	6	8	0.25	14	1.5
	Spruance Class DDG	4		0.5	4	2
	Catarmarans	4		0.25	4	1
	Patrol Boats (Freman	30		0.05	30	1.5
	MRA	2		0.5	1	1
Subs	Collins Class	2	6	0.25	8	0.5
Aircraft	F/A18 E/F	40		0.125	40	5
	Lamps Mk III	10		0.025	10	0.25
	Sea Sprite	30		0.018	30	0.54
	C-130 Replacement	12	12	0.083	24	1
	C-27J	14		0.016	14	0.228
	Advanced Tanker Airc	3		0.065	5	0.195
	AEW&C	3		0.333	7	1
	Global Hawk	20		0.013	20	0.25
Ground Forces	Air Defense (Patriot F	12	0	0.042	12	0.5
Weapons	JSOW	300		0.000667	300	0.2
Information Warfare and C4I Protective measures						0.6
					Total Expenditure	18.463
					Total Remaining	0.4196 <=

Epoch 3 Budget

Budget for Epoch 3		Budgeted amount (US Dolla		Budget Outlay
				19.04931022
		Total in 2015	Unit Cost	Program Cost
Ships				
High Speed Catamarans		4	0.25	1
MRA		3	0.667	2
Howard Class Aegis Ship		1	1.5	1.5
Huon Class detection systems				0.5
Aircraft				
UAV		30	0.0167	0.5
V-22		20	0.065	1.3
F/A-18 E/F		40	0.125	5
Military Facility				
Darwin				2
Ground Forces				
AAAV		150	0.00267	0.4
Marine Amphibious Brigades		2	4	8
				22.2
				-3.150689782

Epoch 4 Budget

				Budgeted
Budget for Epoch IV				19.83718
	# bought	Total in 2020	Unit Cost	Program Cost
Ships				
MRA	1	6	0.8	0.8
Howard Class DDG	3	4	1	3
Improved Anzac FFG	6	20	0.5	3
High Speed Catamarans	3	11	0.25	0.75
FEL weapons on DDG	Entire Fleet			0.5
Aircraft				
P-3C upgrade	Entire fleet			0.3
V-22	40	60	0.065	2.6
Ground Forces				
Infantry BG	2		2.5	5
IMV	150		0.002	0.3
APC	100		0.0025	0.25
ASLAV	100		0.005	0.5
THEL Air Defense				1.5
		Total Expenditure		18.5
		Total Remaining		1.337182

Annex C

Summary of Australia Study

Area of Concern	2000-2005	2006-2010	2011-2015	2016-2020
Geopolitical Situation	•Partnering with US, Japan and other regional powers •Increase in MOOTW •Increase in UN/Coalition Operations	•US partnership despite slight pullback in the region •MOOTW continue to grow •Continued reliance on coalitions •Peaceful transfer of power between Taiwan and China	•US pullback leading nations to pursue other alternatives •Continued unification efforts in Korea	•China making overtures to Philippines and Indonesia •Darwin increasing in importance as a regional base/port
Themes	•Globalization •US Strategic Primacy	•Globalization increases and spreads interdependencies •Energy resources increasingly important	•Globalization continues •Energy resources scarce for many •Concern for secure SLOCs	•Australia increasingly important as exporter of energy and iron ore. •SLOC security becomes a paramount interest for nations of the region.
Interests and Objectives	•Ensure defense of Australia and its direct approaches. •Foster security in the immediate neighborhood. •Work with other nations to promote security in Southeast Asia •Contribute in appropriate ways to maintaining strategic stability in the wider Asia Pacific Region •Contribute to the efforts of the international community (United Nations)	•Ensure defense of Australia and its direct approaches. •Foster security in the immediate neighborhood. •Work with other nations to promote security in Southeast Asia •Contribute in appropriate ways to maintaining strategic stability in the wider Asia Pacific Region •Contribute to the efforts of the international community (United Nations)	•Ensure defense of Australia and its direct approaches. •Foster security in the immediate neighborhood. •Work with other nations to promote security in Southeast Asia •Contribute in appropriate ways to maintaining strategic stability in the wider Asia Pacific Region •Facilitate free trade in the Pacific Rim •Contribute to the efforts of the international community (United Nations)	•Ensure defense of Australia and its direct approaches. •Foster security in the immediate neighborhood. •Work with other nations to promote security in Southeast Asia •Contribute in appropriate ways to maintaining strategic stability in the wider Asia Pacific Region •Facilitate free trade in the Pacific Rim •Contribute to the efforts of the international community (United Nations)
Strategic Priorities	•Defense of Australia •Self Reliant •Control air and sea approaches •Attack hostile forces as far away from shore as possible • Contribute to the security of immediate neighborhood •Support Australia's interests and objectives by contributing to international coalitions	•Defense of Australia •Self Reliant •Control air and sea approaches •Attack hostile forces as far away from shore as possible • Contribute to the security of immediate neighborhood • Support Australia's interests and objectives by contributing to international coalitions	•Defense of Australia •Self Reliant •Control air and sea approaches •Attack hostile forces as far away from shore as possible • Contribute to the security of immediate neighborhood • Support Australia's interests and objectives by contributing to international coalitions	•Defense of Australia •Self Reliant •Control air and sea approaches •Attack hostile forces as far away from shore as possible • Contribute to the security of immediate neighborhood • Support Australia's interests and objectives by contributing to international coalitions

Annex C

Economy (GDP) **GDP/Capita (US$)**	• 1995.274 Billion US $ • $20,200/capita	• 2381.694 Billion US $ • $23,097/capita	• 2828.178 Billion US $ • $25,850/capita	• 3306.20 Billion US $ • $28172/capita
Defense Budget (US$) **%GDP**	• 40.40 Billion US $ • 1.9-2.2%	• 57.22 Billion US $ • 2.3-2.45%	• 68.03 Billion US $ • 2.4-2.45%	• 79.35 Billion US $ • 2.4%
Broad Functions **Current Capabilities**	52%	51%	56%	60%
Future Capabilities (Procurement and Modernization)	33.72%	33%	28%	25%
Defense Research (Basic and experimental development)	2.95%	3%	4%	3%
Personal Services	7.46%	10%	9%	9%
Resource Administration	3.33%	3%	3%	3%

Force Structure **Navy**	• Surface Combatants: 6 FFG, 8 ANZAC FF, 15 Patrol Boats (PB), 2 oilers, 3 LPAs, 15 Landing Craft Medium (LCM), 6 Landing Craft Heavy (LCH) • Mine Warfare: 2 Inshore Mine CM (MCM), 6 Huon MCM, 2 Dive Teams • Submarines: 6 Collins SS • Navy Air: 16 Sea Hawk, 7 Sea King, 11 Super Seasprite, 19 P-3C Orion	• Surface: 6 FFG, 14 ANZAC FF, 4 Spruance DDG (VLS), 4 catamarans, 30 PB, 2 Multi Role Auxiliary (MRA), 1 oiler, 2 LPAs, 15 LCM, 6 LCH • Mine Warfare: 2 Inshore MCM, 12 Huon MCM, 4 Dive Teams • Submarines: 8 Collins SS • Navy Air: 16 Sea Hawk, 7 Sea King, 11 Super Seasprite, 19 P-3C Orion, 10 LAMPS Mk-III	• Surface: 6 FFG, 14 ANZAC FF, 4 Spruance DDG (VLS), 1 Aegis DDG, 8 catamarans, 30 PB, 5 MRA, 2 LPAs, 15 LCM, 6 LCH • Mine Warfare: 2 Inshore MCM, 12 Huon MCM, 4 Dive Teams • Submarines: 8 Collins SS • Navy Air: 16 Sea Hawk, 7 Sea King, 11 Super Seasprite, 19 P-3C Orion, 10 LAMPS Mk-III	• Surface: 2 FFG, 20 ANZAC FF, 4 Spruance DDG (VLS), 4 Aegis DDG, 11 catamarans, 30 PB, 6 MRA, 15 LCM, 6 LCH • Mine Warfare: 2 Inshore MCM, 12 Huon MCM, 4 Dive Teams • Submarines: 8 Collins SS • Navy Air: 16 Sea Hawk, 7 Sea King, 11 Super Seasprite, 19 P-3C Orion (refurbished SLEP), 10 LAMPS Mk-III
Army	• Special Forces (1 reg; 1 bn; 1res) • Mechanized Force (1 armor; 1 calvary; 2 mech infantry; 2 artillery) • Light Infantry Force (2 infantry bn; 1 calvary; 2 paratroopers) • Motorized Infantry Force (3 infantry; 2 mech transport) • Army Aviation Force (130 helos) • Ground Based Air Defense (12 Rapier; 12 RBS-70) • Combat & Logistics Support • Army Reserve Force (6 infantry brigades; 3 surveillance units)	• Special Forces (2 reg; 2 bn) • Mechanized Force • Light Infantry Force • Motorized Infantry Force • Aviation Force (78 helos) • Ground Based Air Defense (12 RBS-70; 10 Patriot; 12 PAC-3) • Combat & Logistics Support • Army Reserve Force (3 inf brigades; 3 surveillance units)	• Special Forces (2 reg; 2 bn) • Mechanized Force • Light Infantry Force • Motorized Infantry Force • Marine amphibious force (2 brigades w/150 AAAVs) • Aviation (78 helos, 20 V-22) • Ground Based Air Defense (12 RBS-70; 10 Patriot; 12 PAC-3) • Army Reserve Force (3 inf brigades; 3 surveillance units)	• Special Forces (2 reg; 2 bn) • Mechanized Force • Light Infantry Force • Motorized Infantry Force • Marine amphibious force (2 brigades w/150 AAAVs) • Aviation (78 helos, 60 V-22) • Ground Based Air Defense (12 RBS-70; 10 Patriot; 12 PAC-3, laser based system) • Army Reserve Force (3 inf brigades; 3 surveillance units)
Air Force	• 71 F/A-18 A/B (57 A, 18 B), 35 F-111 (21 C, 14 G), 24 C-130 Hercules (12 H, 12 J), 14 DHC-4 Caribou, 4 AEW&C Boeing 737-700, 5 Boeing 767 Tankers, 59 PC9 Trainer, 25 BAe Hawk Fighter Trainer	• 50 F/A-18 A/B (32 A, 18 B), 40 F/A-18 E/F, 35 F-111 (21 C, 14 G), 24 C-130J Hercules, 14 C-27J Spartan, 7 AEW&C Boeing 737-700, 8 Boeing 767 Tankers	• 80 F/A-18 E/F, 35 F-111 (21 C, 14 G), 24 C-130J Hercules, 14 C-27J Spartan, 7 AEW&C Boeing 737-700, 8 Boeing 767 Tankers	• 80 F/A-18 E/F, 24 C-130J Hercules, 14 C-27J Spartan, 7 AEW&C Boeing 737-700, 8 Boeing 767 Tankers
C4ISR	• Operational Command • Strategic Intelligence • Strategic Surveillance • Geospatial Information • Hydrographic Survey Force	• Operational Command • Strategic Intelligence • Strategic Surveillance • Geospatial Information • Hydrographic Survey Force	• Operational Command • Strategic Intelligence • Strategic Surveillance • Geospatial Information • Hydrographic Survey Force	• Operational Command • Strategic Intelligence • Strategic Surveillance • Geospatial Information • Hydrographic Survey Force

Force Structure Vulnerabilities				
Navy	• Anti-ship missile defense for ANZACs • Long range air defense capability • Limited replenishment capability • SS platform and combat systems • Patrol craft are aging • Limited amphibious lift capability	• Long range air defense capability • Improving replenishment capability • Improving amphibious lift capability	• Improving long range air defense capability • Impending loss of some FFGs • Impending loss of LPAs (older amphibious ships) • Replacement aircraft for the P-3C or replacement for its capability?	Issues for 2021 and beyond • ADF remains small but has modern equipment and capability • All services can be easily overextended if conducting multiple operations in different and widely separated theaters • Will remain reliant on allies to conduct operations outside of the inner arc against an overwhelming force
Army	• Army's small size • No heavy armored force • Smaller reserve force	• Remains a light fighting force with limited heavy equipment and armor	• Remains a light fighting force with limited heavy equipment and armor	
Air Force	• Limited air combat capability wrt regional defense forces (modernization issue) • Air-to-air refueling capability aging • Long term replacement of F/A-18 and F-111	• Improving air combat capability wrt regional defense forces • Facing loss of air strike capability with the retirement of the F-111	• Facing loss of air strike capability with the retirement of the F-111	
C4ISR	• Limited indigenous intelligence capability • Communications • Command & Control	• Maintain pace with changing technology	• Maintain pace with changing technology • Integration of multiple surveillance capabilities	

<u>Net Assessment</u> **Indonesia** **SCS** **Philippine Sea**	• Ability to project force and control maritime area of ops • Difficult to succeed at any land campaigns due to limited land forces and amphibious lift • Without external intervention, a drawn out war can be disastrous • Contribution is significant • Due to distance, it may be difficult to attain air parity	• Weak Indonesian anti-air & anti-submarine capabilities • Superior air assets for Australia against Indonesia • Inferior land troop numbers vs Indonesian Army • Technology advantage for Australian soldiers • Credible contribution of forces by Australia for Coalition Force in numerical terms • Limited air-defense capabilities of Australian vessels (FF)	<u>Invasion of East Timor/ Irian Jaya</u> • Weak Indonesian Maritime assets (lack of economic progress result in limited upgrades) • Superior air assets for Australia against Indonesia • Superior land assets for Australia through addition of Marine Bdes • Technology advantage for Australian soldiers <u>SLOC Protection</u> • Requires alliance with other regional powers • Adequate protection against surface threats • Slow reaction to mine warfare threats • Submarine and air threats unlikely	<u>Invasion of East Timor/Irian Jaya</u> • Weak Indonesian Maritime assets (lack of economic progress result in limited upgrades) • Superior air assets for Australia against Indonesia • Better land assets for Australia through addition of Marine Bdes • Technology advantage for Australian soldiers <u>SLOC Protection</u> • Ability to counter surface threats easily • Mine clearance capability tedious but possible • Submarine: uncertainty in detection; nevertheless can provide deterrence
Expected Defense Trends	• Growth of fighter aircraft with Beyond Visual Range targeting capability. • More highly capable anti-ship missiles • Increasingly significant strike and land forces	• Proliferation of Cyberwar, WMD • Increasing presence of highly capable AAW/ASuW ship platforms • Emergence of UAVs	• Proliferation of Cyberwar, WMD • AAW/ASuW ship platforms • Surveillance assets keep movement difficult to conceal from most nations	• Theater Missile Defense • Asymmetric tactics • Area denial solutions vary

Technology Focus	• Space launch capability and related areas of technology development • Nanotechnology in the specific area of sintering advance smart materials • High density energy storage and supplies	• Expensive (US$30/Barrel Crude) • Generally manageable and not a significant drag on Australia as a result of significant internal energy resources • Increasing emphasis on the use of control devices and advanced materials to lessen energy use. (A major benefit of Information Age technologies). • All countries with the wherewithal to do so have taken strong and effective steps to diversify their energy sources. • New fuel types, as well as oil and natural gas at inconvenient locations • Increased emphasis on dirty fuels such as coal (with new pollution controls)	•Electro-magnetic assisted launch capability significantly reduces per launch cost. •Energy R&D breakthrough in quartz technology allows high energy density storage in compact size. •Increase efficiency in fuel cell leads to widespread use in automobiles, miniature airframes etc. •R&D into military application of high-density energy storage and supplies (quartz technology) •Electro-magnetic assisted launching infrastructure – US$500 million (Industry and private collaboration) •R&D into military applications of quartz technology (DSTO – US$200 million)	PROJECT DPAMDS • Two tier – anti-missile defense system. • First tier – includes the development and deployment of a HEL missile defense system. • Based on concept of HEL for medium-range missile defense (up to 20km). • Second tier – THEL for short-range missile defense (up to 5km). PROJECT BOLDEAGLE • R&D in collaboration with US and Japan developing the technology of a TBM defense using airborne laser and ground FEL. • Serve as a technology capability that can be employed should the treat arises. PROJECT STINGRAY • Integration of Diode Pumped Solid State Laser anti-ship missile defense on FFGs and DDGs. • Based on the concept of "unlimited" and low cost shots for defense against anti-ship missiles. • Option for upgrading to FEL when the technology becomes feasible.

Australia's Technology Research and Development Framework

	Epoch 1	Epoch 2	Epoch 3	Epoch 4
Main R&D Efforts & Breakthroughs	• Initial technology feasibility studies into the following, 1. Nanotechnology (customizing of advance smart materials). 2. Space launching technology (electromagnetic launch, trans-atmospheric flight, and laser propulsion). 3. High-density energy storage and supplies technology (silica gel energy storage, new generation fuel cell etc). 4. New energy resource technology (remote sensing, deep sea drilling, photovoltics, 'clean' burning of coal, high density transportation of LNG etc) • Results from feasibility studies drives the focus of technology effort in two areas, 1. Space launching capability (commercial space launch facilities) 2. Energy R&D (R&D into new energy resource technology, high-density energy and supplies).	• Investment in space launching infrastructure in Cape York, Melville Island and Christmas Island. • Infrastructure completed in 2008 with the commencement of commercial launching projects. • Continued R&D into Electro-magnetic assisted launch feasibility. • R&D into remote sensing results in advancement in the ability of discovering off-shore oil reserve, coupled with the lower cost of deep sea drilling and the consistence US$30 a barrel price for oil give rise to aggressive export of oil to Japan, China and other Asian countries. • Breakthrough in photovoltics technology causes a shift in the internal energy requirement of Australia. (less than 10% solar energy to 50% solar energy). Thus increasing Australia export of energy resources to other countries. • Breakthrough in fluidized bed technology for coal burning results in increased and aggressive interest in coal as a source of energy. (Australia has the 4th largest coal reserve and is the large	• Electro-magnetic assisted launch capability significantly reduces per launch cost. Power supplied by solar energy. • Energy R&D breakthrough in quartz technology allows high energy density storage in compact size. Ability to power small commercial and military equipment. • Increase efficiency in fuel cell leads to widespread use in automobiles, miniature airframes etc. • R&D into military applications of high-density energy storage and supplies (quartz technology).	PROJECT DPAMDS • Two tier – anti-missile defense system. • First tier – includes the development and deployment of a HEL missile defense system for Darwin. • Based on concept of HEL for medium-range missile defense (up to 20km). • Second tier – THEL for short-range missile defense (up to 5km). PROJECT BOLDEAGLE • R&D in collaboration with US and Japan developing the technology of a TBM defense using airborne laser and ground FEL. • Serve as a technology capability that can be employed should the threat arise. PROJECT STINGRAY • Integration of Diode Pumped Solid State Laser anti-ship missile defense on FFGs and DDGs. • Based on the concept of "unlimited" and low-cost shots for defense against anti-ship missiles. • Option for upgrading to FEL when the technology becomes feasible.

		coal exporter) • High-density LNG transportation allows yet another alternate energy resource for export. • Continue R&D into energy storage and supplies in the following areas, 1. Quartz technology (silica gel) – miniature energy storage. 2. Fuel cell (methane) 3. Photovoltics		
Timeframe	• Initial feasibility studies 2000 – 2002 (2 years) • Detail studies 2003 – 2005 (3 years)	• Space launching capabilities available starting 2008. • Breakthrough in technology in remote sensing, deep sea drilling, coal burning, LNG storage and transportation, photovoltics resulting in very attractive export of energy resources during this epoch.	• Electro-magnetic assisted launching capability achieved in 2015. • Quartz energy storage and efficient fuel cells available in 2015.	PROJECT DPAMDS • First-tier commence 2015 with IOC 2020 • Second-tier commence 2015 with IOC 2018 PROJECT BOLDEAGLE • R&D gives Australia the capability of TBM defense should the treat arise. PROJECT STINGRAY • Integration commences beginning of epoch 4 and IOC 2020.

Investment ($ US)	• Initial feasibility study - 500 million (DSTO – 100 million, Industry – 150 million, Private collaboration – 250 million) • Space launching capability – 500 million (DSTO - 100 million, Industry and private collaboration – 400 million) • Energy R&D – 250 million (DSTO – 100 million, industry and private collaboration – 150 million)	• Space launching infrastructure – 1 billion (Industry and private collaboration). • R&D into Electro-magnetic assisted launch – 500 million (Industry and private collaboration) • Continued energy R&D – 100 million (DSTO – 50 million, Industry – 50 million)	• Electro-magnetic assisted launching infrastructure – 500 million (Industry and private collaboration). • R&D into military applications of quartz technology (DSTO – 200 million)	PROJECT DPAMDS • Medium-range HEL missile defense system investment – US$1.5 billion (project). • Short-range THEL missile defense system investment – US$500 million (project). PROJECT BOLDEAGLE • Airborne and FEL TMD investment – US$50 million (per year). PROJECT STINGRAY • Ship board Diode Pumped Solid State Laser project investment – US$500 million. • Integration cost – US$100 million (per ship).
Possible Collaborations	1. US, Japan 2. US, France, Japan, China, Germany 3. Japan, US, China 4. Japan, China, US	1. Commercial space launching projects with Japan, Germany, US, Russia, China and other Asian countries. 2. Energy R&D - Japan, US.	1. Commercial space launching projects with Japan, Germany, US, Russia, China and other Asian countries. 2. Energy R&D - Japan, US.	PROJECT DPAMDS • HEL – US and Japan • THEL – US, Israel and Japan PROJECT BOLDEAGLE • TMD –US and Japan PROJECT STINGRAY • Shipboard Laser missile defense system – US
Economic Benefits		• Space industries contribute an increase of 0.5% of GDP during this epoch • Energy export contributes an increase of 1% of GDP during this epoch (oil 1.5 million barrels per day, coal 300 Mmst, LNG 90 Tcf)	• Space industries contribute an increase of 0.75% of GDP during this epoch. • Energy export continues to contribute and increase of 1.5% of GDP during this epoch. • New niche market in miniature high-density energy storage device and fuel cell contributes an increase of 0.25% of GDP during this epoch.	• Space industries contribute an increase of 0.75% of GDP during this epoch. • Energy export continues to contribute and increase of 1.5% of GDP during this epoch. • New niche market in miniature high-density energy storage device and fuel cell contributes an increase of 0.25% of GDP during this epoch.

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Annex E

Mathematical Model for Passive Sonar Detection (based on Harpoon II simulation software)

Introduction

This appendix shows how the passive sonar submarine detection capability of the various Royal Australian Navy (RAN) vessels in the SLOC protection scenario described in epoch 4's net assessment section. The following model is used by the Harpoon II simulation software to generate detection of submarines in the SLOC (refer to Figure 33, page 4-158) by the RAN maritime patrols. This model is extracted from "Harpoon II Sonar Model" explanation (http://www.stud.tu-muenchen.de/~oliver.einhaeuser/sonarmod.htm) written by Oliver Einhaeuser.

Target Noise

Every seaborne object (ship, submarine, torpedo) in Harpoon II has a basis sonar cross-section giving the emitted noise level at ultraquiet speed (<=5kts). Depending on its speed, it emits sound to each of the three frequency bands at the noise level L_t:

$$L_t = PSCS + (m_{v,t} * v_{t,eff} + G_v) \quad [dB]$$

PSCS : target passive sonar cross-section from the HII database

$v_{t,eff}$: effective target speed

$v_t <= 5$ kts : $v_{t,eff} = 0$ $\quad$ $v_t > 5$ kts : $v_{t,eff} = v_t - 5$ kt

$m_{v,t}$: target noise increase with speed

$v_t < 20$kts : $m_{v,t} = 1.30$ dB/kts $\quad$ $v_t >= 20$kts : $m_{v,t} = 0.65$ dB/kts

G_v : basis noise level increase for high speeds

$v_t < 20$kts : $G_v = 0$ $\quad$ $v_t >= 20$kts : $G_v = (20 - 5) * (1.30 - 0.65) = 9.75$ dB

The engine type and the HII Shrouded Propulsor and Advanced Propulsor flags for submarines do not have any effect on the target noise.

Ambient Noise

The ambient noise level L_a is:

$$L_a = L_{a,0} + m_{w,p} * ssl \quad [dB]$$

$L_{a,0}$: ambient noise basis level

LF : $L_{a,0} = 95$ dB $\quad$ MF : $L_{a,0} = 89$ dB $\quad$ HF : $L_{a,0} = 89$ dB

$m_{w,p}$: noise increase by weather

$m_{w,p}$ = 5 dB/(sea state level)

ssl : sea state level

It is assumed that the ambient noise level does not vary with depth.

Sensor Background Noise (Passive)

The passive sonar also receives noise from its own platform. The intensity L_r is:

L_r = PSCS + $m_{v,r}$ * v_r [dB]

PSCS : receiver passive sonar cross-section from the HII database

$m_{v,r}$: receiver noise increase by speed

LF : $m_{v,r}$ = 3.6 dB/kts MF : $m_{v,r}$ = 4.2 dB/kts HF : $m_{v,r}$ = 5.5 dB/kts

v_r : receiver speed

It is assumed that cavitation at high speeds has no effect on L_r.

The total intensity $L_{b,p}$ is normally equal the ambient noise level L_a. When L_r is close to or even higher than the ambient noise level, the sensor background noise then is:

L_b = 10 * $\log_{10}$[10^(L_r / 10) + 10^(L_a / 10)] [dB]

G_b = (L_b - L_a) / m_b [dB]

$L_{b,p}$ = L_a + G_b [dB]

m_b : background noise reduction factor

LF : m_b = 2.5 MF : m_b = 2.9 HF : m_b = 3.7

The logarithmic addition of L_r and L_a can easily be done with the table below.

L_r - L_a	SUM(L_r, L_a) [dB]
> 9	L_r
9	L_r + 0.5

8	$L_r + 0.6$
7	$L_r + 0.8$
6	$L_r + 1.0$
5	$L_r + 1.2$
4	$L_r + 1.5$
3	$L_r + 1.8$
2	$L_r + 2.1$
1	$L_r + 2.5$
0	$L_r + 3.0$
-1	$L_a + 2.5$
-2	$L_a + 2.1$
-3	$L_a + 1.8$
-4	$L_a + 1.5$
-5	$L_a + 1.2$
-6	$L_a + 1.0$
-7	$L_a + 0.8$
-8	$L_a + 0.6$
-9	$L_a + 0.5$
< -9	L_a

Condition for Passive Detection

A target is detected by passive sonar at the range R with:

$$L_t - \{ 20 * \log_{10}(R) + m_d * R \} - L_{b,p} >= G_{s,p}$$

m_d : dispersion factor

LF: m_d = 0.17 dB/nm MF: m_d = 1.1 dB/nm HF: m_d = 3.8 dB/nm

$G_{s,p}$: sensor Passive Sensitivity from the database

Depth differences between target and receiver do no have any effects on the detection range (no thermal layer). At convergence zones the target noise which reaches the receiver is slightly increased (ca. 3-5 dB). With

$$20 * \log_{10}(R) + m_d * R = G_d(R)$$

and the table below the detection range can be quickly estimated.

R [nm]	LF: $G_d(R)$	MF: $G_d(R)$	HF: $G_d(R)$
2	6.4	8.2	13.6
3	10.1	12.8	20.9
4	12.7	16.4	27.2
5	14.8	19.5	33.0
6	16.6	22.2	38.4
7	18.1	24.6	43.5
8	19.4	26.9	48.5
9	20.6	29.0	53.3
10	21.7	31.0	58.0

11	22.7	32.9	62.6
12	23.6	34.8	67.2
13	24.5	36.6	71.7
14	25.3	38.3	76.1
15	26.1	40.0	80.5
16	26.8	41.7	84.9
17	27.5	43.3	89.2
18	28.2	44.9	93.5
19	28.8	46.5	97.8
20	29.4	48.0	102.0
21	30.1	49.5	106.2
22	30.6	51.0	110.4
23	31.1	52.5	114.6
24	31.7	54.0	118.8
25	32.2	55.5	123.0
26	32.7	56.9	127.1
27	33.2	58.3	131.2
28	33.7	59.7	135.3
29	34.2	61.1	139.4
30	34.6	62.5	143.5
31	35.1	63.9	147.6

32	35.5	65.3	151.7
33	36.0	66.7	155.8

Annex F

List of Acronyms

AAAV	Advanced Amphibious Assault Vehicle
AAR	Air-to-Air Refueling
AAW	Anti-aircraft Weapon
AB	Airbase
ABARE	Australian Bureau of Agricultural and Resource Economics
ACRES	Australian Center for Remote Sensing
ADCAP	Advanced Capability Torpedo
ADF	Australian Defense Force
AEW&C	Airborne Early Warning and Control
AMRAAM	Advance Medium Range Anti-Aircraft Missile
APC	Armored Personnel Carrier
ASEAN	Association of South East Asian Nations
ASLAV	Australian Light Armored Vehicle
ASW	Anti-Submarine Warfare
ASuW	Anti-Surface Warfare
Bde	Brigade
Bst	Billion Short Tons
BVR	Beyond Visual Range
C4ISR	Command, Control, Communications, and Computers Intelligence, Reconnaissance and Surveillance
CSIRO	Commonwealth Scientific and Industrial Research Organization
CVBG	Carrier Battle Group
CVN	Aircraft Carrier (Nuclear)
dB	Decibel
DC	Direct Current
DDG	Guided Missile Destroyer
DEW	Directed Energy Weapon
Div	Division
DNB	Darwin Naval Base
DPAMDS	Darwin Port Anti-Missile Defense System
DSTO	Defense Science and Technology Organization
EEZ	Exclusive Economic Zone
EO	Electronic Optic
ESSM	Evolved Sea Sparrow Missile
EWSP	Electronic Warfare Self Protection
FEL	Free Electron Laser
FFG	Guided Missile Frigate
FPDA	Five Power Defense Agreement
GDP	Gross Domestic Product
HALS	Heavy Amphibious Lift Ship
HEL	High Energy Laser
HF	High Frequency
HQ	Headquarters
IMV	Infantry Mobility Vehicle

Inf	Infantry
INTERFET	International Force East Timor
IOC	Initial Operating Capability
IR	Infrared
IT	Information Technology
JMSDF	Japanese Maritime Self Defense Force
JORN	Jindalee Operational Radar Network
JSDF	Japanese Self-Defense Force
LCH	Landing Craft Heavy
LCM	Landing Craft Medium
LNG	Liquefied Natural Gas
LPA	Landing Platform Auxiliary
MAG	Maritime Action Group
MCM	Mine Countermeasure ship
Mmst	Million Short Tons
MOOTW	Military Operations Other Than War
MPA	Maritime Patrol Aircraft
MRA	Multi-Role Auxiliary
MW	Mega-watt
NGO	Non-Governmental Organization
NM	Nautical Mile
NORFORCE	Northwest Mobile Force
NSW	New South Wales
OTH	Over-the-Horizon
PB	Patrol Boats
PRC	People’s Republic of China
PSCS	Passive Sonar Cross Section
R&D	Research and Development
RAAF	Royal Australian Air Force
RAN	Royal Australian Navy
RIMPAC	Rim of the Pacific
SA	South Australia
SAM	Surface to Air Missile
SAR	Synthetic Aperture Radar
SAS	Special Air Service
SASR	Special Air Service Regiment
SATCOM	Satellite Communications
SCS	South China Sea
SLOC	Sea Lines of Communication
SNA	Static Net Assessment
SS	Attack Submarine (Conventional)
SSN	Attack Submarine (Nuclear)
TBM	Theater Ballistic Missile
Tcf	Trillion Cubic Feet
TG	Task Group
THEL	Tactical High Energy Laser

TMD	Theater Ballistic Missile Defense
TNI	Indonesian Defense Force
UAV	Unmanned Aerial Vehicle
UN	United Nations
USMC	United States Marine Corps
UUV	Unmanned Underwater Vehicle
WA	Western Australia
WMD	Weapons of Mass Destruction
WTO	World Trade Organization

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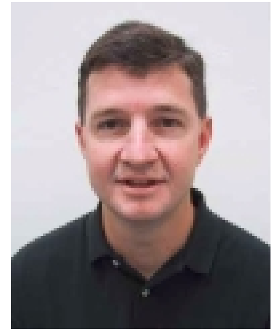
Annex G
Biographies



Commander Timothy S. Luffy
United States Navy

Commander Timothy S. Luffy was born in Phoenix, Arizona. He graduated from Coronado High School in Scottsdale, Arizona in 1978. While in high school, he was a member of the National Honor Society and the varsity wrestling team. CDR Luffy graduated with merit from the United States Naval Academy in 1983, earning a Bachelor of Science Degree in Aerospace Engineering. Following commissioning, he attended Nuclear Power School in Orlando, Florida and then reported for prototype training in Idaho Falls, Idaho.

After completion of basic submarine training in February 1985, CDR Luffy reported to his first sea duty assignment onboard USS GURNARD (SSN 662) homeported in San Diego, California. The ship completed a regular overhaul at Puget Sound Naval Shipyard, post overhaul certifications and training, and a Western Pacific deployment. He served as the Reactor Controls Assistant, Damage Control Assistant, and Communicator. He transferred to the staff of Commander, Submarine Force, U. S. Pacific Fleet in November 1988 where he served as a Command Center Watch Officer and the Hawaii Area Local Operations Officer.

In January 1991, CDR Luffy reported to his next submarine assignment as Engineer Officer onboard USS SAM HOUSTON (SSN 609) homeported in Pearl Harbor, Hawaii. The ship completed an Operational Reactor Safeguards Examination and was subsequently transferred to Puget Sound Naval Shipyard for decommissioning. Following advanced submarine training, he returned to Pearl Harbor as Navigator and Operations Officer onboard USS TUNNY (SSN 682). During this tour, the ship completed several Eastern Pacific and two extended Western Pacific deployments. Following his second department head tour, CDR Luffy returned to the staff of Commander, Submarine Force, U. S. Pacific Fleet in November 1994 where he served as the Special Projects Officer. In this capacity, CDR Luffy exercised operational oversight of several highly specialized submarine operations, the Navy’s deep submergence and submarine rescue operations, and naval special warfare assets.

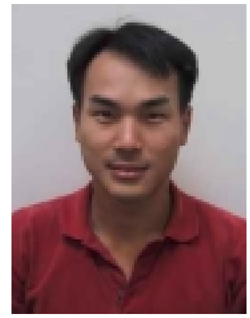
Following Prospective Executive Officer training, CDR Luffy reported as Executive Officer of USS MARYLAND (SSBN 738) (BLUE) in King's Bay, Georgia in May 1997. He completed three strategic deterrent patrols in support of the nation’s strategic deterrence mission.

CDR Luffy reported to the Naval Postgraduate School in April 1999 for advanced education. He graduated from the Systems Engineering and Integration curriculum in March 2001 with a Masters of Science degree in Systems Integration.

CDR Luffy's personal awards include the Meritorious Service Medal, the Navy/Marine Corps Commendation Medal (four awards), the Navy/Marine Corps Achievement Medal, the Battle Efficiency "E" (three awards), the Navy Expeditionary Medal, the National Defense Service Medal (two awards), and the Sea Service Deployment Ribbon (two awards).

CDR Luffy is married to the former Elizabeth Higgins of Atlanta, Georgia. They have three children, Samantha, Scott, and Sean.

Annex G



Major Mark Teo
Singapore Army

Major Mark Teo is a graduate of the prestigious Australian Defense Force Academy (ADFA), class of 1993. He attended ADFA as a winner of the Singapore Armed Forces (SAF) Overseas Training Award in 1990. Major Teo graduated from ADFA with a Bachelors of Science degree majoring in Computer Science with First Class Honors. He subsequently attended the Royal Military College, Duntroon (Australia), to undergo officer cadet training and graduated in 1994 as a Lieutenant in the Singapore Army.

On return to Singapore from his studies, Major Teo was promoted to the rank of Captain and held command of a Division Signal Platoon specializing in advanced military wide-area communications network. After his ground tour, he was reassigned to the Signal Formation Headquarters as a Staff Officer. During this tour, Major Teo was instrumental in the success of numerous Army C4I acquisition projects. He received a formation level commendation award for his outstanding contribution to the Signal Formation in 1998.

Major Teo assumed command of the Signal Company in the 4^{th} Singapore Armored Regiment in 1998 and had gained much operational experience in armored fighting concepts and provision of communications support for a rapid movement force. Major Teo was promoted to his current rank in 1999. On completion of his command tour, he was awarded the coveted SAF Postgraduate Award and selected to attend the Naval Postgraduate School (NPS) in Monterey, California, USA.

Major Teo graduated from NPS in 2001 with a Masters of Science degree in Systems Integration. He returned to Singapore to serve as a Weapons Staff Officer in the Ministry of Defense Headquarters.

Annex G

Lieutenant Gerald R. McMurray
United States Navy

Lieutenant McMurray was raised in Alexandria, Virginia and graduated from the United States Naval Academy in 1992 with a Bachelors of Science in Economics. While at the academy, he was a member of the Brigade Boxing Team and the Honor Council. After a brief assignment at the Pentagon, he reported to Pensacola, Florida for flight training. He received his Naval Flight Officer wings in August of 1994 and was assigned to the *Shamrocks* of VS-41 for fleet replacement training in the S-3B Viking. Upon completion he received orders to the VS-29 *Dragonfires* and deployed to the Western Pacific aboard the USS KITTY HAWK in 1996. During his second deployment on the USS CARL VINSON (CVN-70) he participated in Operation Desert Fox and Southern Watch. While with the *Dragonfires*, LT McMurray earned qualifications as Air Wing Strike Lead, Mission Commander, Staff TAO, NATOPS, and Instrument Instructor. He held the positions of NATOPS, SUW/Conventional Weapons, Training and Readiness, Information Systems and Division Officer.

He reported to the Naval Postgraduate School in June of 1999 where he is currently completing a double masters degree program in Systems Engineering and Integration (SEI) and Financial Management. He is currently slated to report to CINCPACFLT in Hawaii to become a Tomahawk Planning Officer.

Lieutenant McMurray has accumulated over 1200 flight hours, over 350 carrier landings and over 700 parachute jumps. LT McMurray's awards and decorations include the Navy Achievement Medal (two awards) and various unit and service awards.

LT McMurray is married to the former Andrea Renny of Rio De Janeiro, Brazil who is currently the Assistant Civil Engineer for the City of Monterey.

Annex G

Captain Jason Boon Hwa Lee
Singapore Army

CPT Lee joined the Singapore Armed Forces in December 1989. He was commissioned as an officer in December 1990 after graduating from the Officer Cadet School. In December 1990, he attended the Armour Infantry Officer Course, after which he assumed his duties at the School of Armour as an instructor for a period of 6 months. In 1991, he was awarded the SAF Academic Training Award (LTA) to further his education at the National University of Singapore, graduating with a Bachelors degree in Mechanical Engineering (First Class Honors).

In June 1995, CPT Lee reported back to active duty at the 46th Battalion, Singapore Armoured Regiment to assume the appointment as a Platoon commander where he served for one year. In 1996, CPT Lee attended Company Tactics Course (CTC) and Basic Airborne Course (BAC) before being assigned to the HQ Armour as a Staff Officer in the Weapons Staff branch.

In 1998, CPT Lee attended the Armour Officer Advance Course (AOAC) before serving his Officer Commanding tour in the 42nd Battalion, Singapore Armoured Regiment.

In September 1999, CPT Lee was awarded the Specialist Postgraduate Scholarship, he attended the Naval Postgraduate School in Monterey, California, USA, where he received a Master of Science in Systems Integration. Upon graduation, CPT Lee was reassigned to the Headquarters Ministry of Defense, Singapore where he will serve as an Army Weapons Staff Officer.

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CHAPTER 5 – JAPAN

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Defense of Japan

Executive Summary

Diplomatic relations in East Asia during the past twenty years (2001-2021) evolved from individual hedging strategies for an uncertain future to a triangular balance of power involving China, Japan, and the United States. The relative influence of the three powers shifted during the century. The declining role of America and the gradual ascension of both China and Japan have yet to force other Asian states to choose sides among the three. However these three states are each beginning to assert pressure on others to shift the balance in their own favor.

In Japan the economic reforms instituted by the new Progressive Political Party in 2001 resulted in drastic restructuring that thoroughly changed its economy. These reforms produced Japan's trade and financial resurgence. In 2006 the rejection of Japan's attempt to gain a permanent UN Security Council seat perpetuated Japanese domestic opinion that it could no longer rely on economics alone as a means to gain international prestige. Additionally, the draw down of US forces in Korea in 2006 caused Japan to question the nature of America's commitment to Japanese defense resulting in increased efforts to attain military autonomy. The peaceful reconciliation of Taiwan with the PRC in 2008 accomplished one of China's primary national objectives, the reintegration of all former Chinese lands (Hong Kong, Macao, and Taiwan). This reunification allowed China to become more assertive in the South China Sea presenting increased threats to Japanese security. Korean reunification in 2016 and subsequent reduction of US troops in Japan beginning in 2020 has caused Japanese force planners to temper efforts toward

military autonomy via the maintenance of the US-Japan security agreement as a hedge against alarming Japan's neighbors.

Domestically, the institutional reforms mentioned above resulted in significant short-term pain but long-term dividends as Japan's GDP maintained positive growth from 2006 onward. Japanese producers increased automation and advanced capital-intensive means of production. Concurrently the government encouraged more women to join the labor force and prolonged the participation of older workers. Government promotion of spending on education, training, and research and development also contributed to the positive economic climate. Japan continued to diversify its sources of energy during the twenty-year period. Dependence on oil imports decreased by nearly 12% from 2010 levels and by 20% since 2000. Domestic generation and cooperative endeavors with Russia and Australia has lessened oil dependence to 1/3 of Japan's total. While not fully self-reliant for energy production, Japan has limited vulnerabilities by both diversifying fossil fuel suppliers and promoting means of internal generation.

Japan's defense strategy hinged on self-reliance throughout the scenario. Driven by the geopolitical situation outlined above, Japan's strategic vision became the twin pillars of defense and deterrence. Under the pillar of defense, Japan sought a force capable of responding to the full spectrum of warfare. The JSDF also implemented a long-term plan to indigenously manufacture and field large numbers of long-range conventional missiles to fulfill the role of deterrence. Japan continued to adhere to the US-Japan Security Arrangements. These agreements were continuously re-evaluated due to realignments in the regional power structure but remained integral to Japan's defense strategy.

Force structure implementations resulted in a Japanese military in 2020 that is self-sufficient for homeland defense, has an advanced and comprehensive C4ISR system, and has state-of-the-art weapon systems produced indigenously (including a large conventional missile force). The JSDF at 2020 also has several weaknesses: the lack of a nuclear deterrent, comprehensive missile defense, and robust ASW solutions. To limit its strategic vulnerabilities, Japan must address these deficiencies, further diversify energy sources and strive for continued self-sufficiency in all three components of national power: economic, military, and political.

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A. Epoch 1 (2001 ~ 2005)

1. Foreign Policy

The Asia-Pacific region is subject to uncertainties and surprises in the post-Cold War era as demonstrated by the nuclear tests by India and Pakistan and the missile launch over Japan by North Korea. Given this security environment, Japan embraces a three-pronged security policy: firmly maintaining the Japan-U.S. security arrangements, building Japan's defenses, and making diplomatic efforts towards international peace and security.

Under our Constitution, Japan has built its defense in accordance with the principles of an exclusively defense-oriented policy, not becoming a military power posing a threat to other countries. With ever-increasing interdependence, the stability and prosperity of Japan is inevitably linked to the peace and prosperity of the Asia-Pacific region and of the world. Efforts must be made at various levels while maintaining the U.S. military presence, namely: (1) resolution of individual conflicts and confrontations; (2) bilateral and multilateral dialogues and cooperation toward regional stability; (3) political and security-related dialogues and cooperation toward increasing the policy transparency of the Asia-Pacific countries and building confidence among them; and (4) the achievement of greater regional political stability through support and cooperation in the economic development of countries in the region.[1]

The Guidelines for Japan-U.S. Defense Cooperation, released in September 1997, created a solid basis for more effective and credible Japan-U.S. cooperation under normal circumstances and during contingencies. In addition, ensuring the effectiveness of the

Guidelines and effectively advancing Japan-U.S. defense cooperation under the Guidelines will foreshadow bilateral defense planning in case of an armed attack against Japan and mutual cooperation planning for areas surrounding Japan. Further development of defense technology exchanges between Japan and the United States occur within the Japan-U.S. Security Arrangements. Since the end of the Cold War, weapons of mass destruction and ballistic missiles have proliferated, and ballistic missile defense (BMD) has become an important task in Japan's defenses.

Japan has developed closer intra-regional dialogues through sustained summit diplomacy with the major regional powers and also worked on building intra-regional confidence through the ASEAN Regional Forum (ARF) for region-wide political and security-related dialogues and cooperation in the Asia-Pacific. Further, Japan has recently been promoting security- and defense-related dialogues with countries such as the People's Republic of China, Indonesia and Thailand, with the first-ever security dialogue with the Republic of Korea. Other forms of multilateral cooperation in the region include cooperation spearheaded by Japan, the United States and the ROK to contain North Korean nuclear weapon development and the Four-Party Meeting, with members ROK, the US, the PRC and North Korea.[2]

2. The International Military Situation - Overview

More than a decade has passed since the end of the Cold War, yet we seem no closer to the emergence of a stable international order. Rather, the combinations of

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[1] http://www.mofa.go.jp/policy/other/bluebook/1999/index.html (1999 Japanese Diplomatic Blue Book)
[2] ibid.

political, economic, military, and social factors that have undermined stability during much of the 1990s remain at play. The most important of these include:

a. Significant continuing uncertainties, especially regarding the future of Russia, China, Indonesia, the Middle East, and the Korean peninsula**.**

b. Rogue states, groups, and individuals are willing to engage in violence to improve their position and undermine order.

c. Rapid technological development (particularly in the areas of information processing, biotechnology, communications, nanotechnology, and weapons) enables groups to exert inordinate influence relative to their economic and military clout.

d. Global defense spending continues to decline. Nations (including Japan) are not keeping pace with the US military in technology. This has spurred some toward asymmetric options, widened the gap between US and Japanese forces, reduced the number of allied redundant systems, and increased Japanese demand on unique US force capabilities such as satellites, JSTARS, AWACS etc.

e. Pressures continue to result from unfavorable demographic developments. By 2020, developing world population will increase some 25% while Japan's declines. Meanwhile, some 20-30 million of the world's poorest people move into urban areas each year. These trends will continue to stress the resources, infrastructure, and leadership of states throughout Africa, Asia, and Latin America.

f. Growing disparities in global wealth and resource distribution continue to exacerbate north-south and inter-regional tensions. One quarter of the world's population (the developed world) controls nearly 80% of today's wealth and consumes the great majority of the world's resources. The numbers will probably get worse (from the developing world's perspective) during the next 15 years.

g. The changing structure, role, adaptability, and influence of familiar Cold War entities – the UN, NATO, the nation state, – and the increasing presence and impact of NGOs, brings greater uncertainty to the way policy is made and implemented in the post-Cold War era.

h. Many individuals, groups, and states fear the global expansion and perceived dominance of Western (especially US) values, ideals, culture, and institutions. Efforts to resist, halt, or undo this trend will spur anti-Western sentiments and behavior.

i. International drug cultivation, production, transport, and use will remain a major source of instability, both within drug producing, transit, and target countries, and between trafficking and consumer nations.

j. Ethnic, religious, and cultural divisions will remain a motivation for and source of conflict in much of the world. As the situation in Kosovo demonstrated, ethnic-based conflict is often brutal and intractable.

k. A combination of factors – many of those listed above, plus inadequate infrastructure and health facilities, resource shortages, natural disasters, epidemics, and insufficient local, regional, and global response capabilities – have combined to increase the numbers of people requiring international humanitarian assistance. According to UN assessments, some 35-40 million people worldwide needed aid each year during the 1990s, compared to slightly more than 20 million in 1985. Likewise, the number, size, cost, and duration of UN and other 'peace operations' have risen significantly since the late 1980s.[3]

These factors create the conditions in which threats and challenges emerge, and define the context in which Japanese strategy, interests, and forces operate. Collectively, they foster a complex, dynamic, and dangerous global security environment. No power, condition, or circumstance is likely to emerge during the next 10 years capable of transcending this general instability and imposing a new global order. Accordingly, we can expect the global dynamic will continue to spur numerous crises, hotspots, and issues that will directly affect Japanese policy and interests.

3. The International Military Situation – Specific Nations

a. The Koreas

It is expected that the Korean peninsula will be undergoing reunification within the next two decades. If the reunification process goes according to South Korea's plans, the economies of the current two states will be kept separate initially and then merged slowly over a period of perhaps 10 years. The South Koreans want to avoid the problems that Germany has encountered in reunifying quickly. If this is so, North Korea will continue to be a source of short-term weapon proliferation. Once reunification begins, the capabilities of both states will be merged and the balance of power in East Asia will likely shift.[4]

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[3] Vice Admiral Thomas R. Wilson (Director, Defense Intelligence Agency), Statement Before The Senate Select Committee on Intelligence. Military Threats and Security Challenges Through 2015. February 2, 2000.

[4] http://www.fas.org/spp/starwars/advocate/ifpa/index.html. Institute for Foreign Policy Analysis, April 1997.

In the near-term, North Korea poses a clear proliferation threat. It has developed an independent nuclear production cycle, an estimated 1-5 nuclear weapons, biological weapons, and a huge stockpile of toxic materials. In addition, North Korea is developing an indigenous missile industry aided by funding from Iran, Chinese training of hundreds of North Koreans in missile technologies, imported Russian nuclear and missile technicians, and access to other Russian expertise via electronic mail. Since North Korea began full missile production runs in 1987, it is believed to have produced 80-120 *Scud* B/C missiles per year. Current *Scud* production is thought to be only *Scud* C models, which have a range of 500-600 km.[5]

As for the new and more complex *Nodong*-1 missiles, it is estimated that North Korea could generate an annual output of 30-50 units if *Scud* production were halted. The *Nodong-1* is a based on *Scud* technology but incorporating a longer fuel tank and using a cluster of four engines to give it a range of 1000-1300 km carrying a warhead payload of 700-1000 kg. From North Korea, the *Nodong's* range arc covers most of Japan. Looking to the future, North Korea's test firing of its next-generation missile system, the *Taepo Dong*[6] (TD) in 1998, is obviously targeted at Japan. Although these missile systems remain in their infancy, reports indicate that the TD-1 is an 18-meter-long missile with a range of 1500-2000 km. It is believed that the TD-2 version will be constructed by adding a 14-meter-long thruster on top of a *Taepo Dong*- 1 body to create a two-stage system. Although there is some controversy concerning the expected range of the TD-2, it seems likely that the missile will have a range arc that lies in the 4000-6000 km band while

[5] Ibid

[6] This refers to the same missile as Korean's *Daepo-dong* missile.

carrying a 1000 kg warhead[7]. Intelligence indicates that the TD-2 is currently ready for initial deployment (2005).

Obviously, missile sales could provide North Korea with desperately needed foreign exchange, oil, or food aid. Moreover, there are reports that North Korea is transferring technology on chemical and biological weapons, with Iran, Iraq, Syria, and Libya being specifically cited as recipient nations. As North Korea is already believed to have the ability to manufacture bomblet technology for its ballistic missile warheads, it seems likely that it has developed submunition packaging for CW and BW agents.

In the short term, South Korea is understandably concerned about the North's nuclear, missile, and military capabilities in general, but long-term, it is more worried about Japan's nuclear and missile potential. In a sense, however, these concerns complement and reinforce South Korea's growing desire to see a united Korean peninsula play an influential role in East Asia during the next century--an era that many in the Asian community believe will become known as "the Asian century."

South Korea has an extensive nuclear power industry that includes 11 atomic power plants. Moreover, the work that was done during the 1970s on developing a nuclear weapon reportedly reached the point where it was about 95 percent complete before pressure from the United States halted its development[8]. Essentially, South Korea has the knowledge and skills to become a nuclear power very rapidly if it so chooses. Since its nuclear industry is under IAEA safeguards, its biggest obstacle to becoming a nuclear power is access to weapons-grade material. This obstacle could be overcome if South Korea gained access to Russian fissile material or was able to circumvent IAEA

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[7] ibid

safeguards. There have been a few reports that indicate that South Korea may have been the intended destination for some intercepted weapons-grade fissile material that was being smuggled out of Russia[9]. When these reports are linked to other reports that indicate that South Korea is pursuing the development or acquisition of dual-use technology that would allow it to develop nuclear weapons, it seems to show a circumstantial pattern of activity which indicates that South Korea may either be planning to develop a nuclear weapon or is taking precautionary action to ensure that it could assemble a nuclear arsenal within a short period of time.

As for delivery systems, South Korea has been pursuing missile technology. Although hampered by a 1979 bilateral US-ROK accord (reaffirmed in 1990) which limited its right to develop ballistic missiles to those with a range of 180 km or less, South Korea is working to abolish this accord and join the missile technology control regime (MTCR) which would limit its military missile development to 300 km, but allow it to pursue space-launch vehicle development. By 2015, South Korea has ambitions of having 19 space satellites in geosynchronous orbit (using its own launch vehicles). Studies have shown that space launch capabilities are not commercially viable since excess capacity exists among the established launch providers and there are suspicions that South Korea is interested in developing it as a hedge against needing its own missile force.

Upon reunification, South Korea will gain access to the missile capabilities being developed by North Korea. As such, North Korea's CW, BW, and nuclear weapons and technology are likely to be joined to South Korea's advanced technological capabilities.

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[8] ibid

South Korea is believed to have conducted research on CW and BW. Consequently, a united Korea could well become a nuclear, chemical, and biologically armed power with IRBM or ICBM delivery capabilities sometime shortly after reunification. Of course, how the reality of this potential capability plays out is highly dependent on the political moves and events that unfold during the next 10 or so years.

South Korean officials, looking beyond reunification, are focusing on the role that a reunified Korean peninsula will likely play in East Asia. They seem to believe that Korea will be able to leverage its peninsular geographic position and its military power in ways that will allow it to play an influential role in the region. Many Koreans claim that a reunified Korea will be the France of East Asia--an ally of the United States, but one that charts its own independent course. Within the new regional order, Korea sees for itself the role of mediator between Washington and Beijing. Within the new envisioned era, they seem to believe that China is a state with which Korea can deal. As one ranking Korean official noted, China is "a benign giant" that could cause pain if he "accidentally stepped on you while walking through the neighborhood," but was unlikely--in the Korean experience--to strike out intentionally[10]. According to this official, there are other smaller countries [implying Japan] that have more often acted like deliberate predators. As is repeated often in Seoul, Korea has had 5000 years of experience in handling its larger neighbor, all of which gives Seoul a more balanced perspective on the China threat than that being voiced in Tokyo or Washington. It seems clear that Korean policy makers expect a united Korea to have close and friendly relations with China.

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[9] ibid
[10] ibid

As for its future relations with Russia, Korean thinkers still seem somewhat wary of the Bear, yet there does not seem to be much fear that an adversarial relationship might develop between the two countries. Rather, it is its historic enemy, Japan, which most concerns many Koreans. It is understood that relations between Japan and Korea may again turn hostile as the new regional order in East Asia evolves. In the event that Japan finds itself at odds with the Koreans, the United States could be placed in the role of playing peacemaker or be forced to choose sides. In short, Japan (and possibly the United States) might find itself facing a difficult situation in Northeast Asia if Korea, Russia, and China form a de facto alliance against Japan.

b. China

Modern China is very patriotic, imbued with a collective sense of 5000 years of glorious history, a history blotted by 140 years of humiliation by the Western imperialistic powers during the 19th and early 20th centuries. Unfortunately, this sense of humiliation still irritates China's national psyche and colors its policy development. Any Chinese leader who appears to bow to Western pressure on issues involving China's rights as a sovereign nation stands in danger of being purged. For practical purposes, this means that the Western tendency to conduct confrontational diplomacy via the news media puts Chinese leaders in the position of having to oppose Western initiatives for fear that acquiescence would appear as yielding to Western imperialistic power.

China's political leadership has been weakened with Deng Xiao Ping's passing. This weakness has allowed the People's Liberation Army (PLA) to increase its influence in China's political decision-making process. Deng, with his credentials as one of the old revolutionary leaders, was in a position to deal with pressure from the West in a fairly pragmatic manner, secure from charges that he was unwilling to stand up to the Western imperialists. The current leadership, lacking the stature bequeathed on their predecessors by their participation in China's revolution, has much less flexibility in handling international issues. The possibility that a Western power could try to pressure Chinese policy publicly and inadvertently trigger a military confrontation is increased by China's internal political weakness.

China's prickly national sensitivity toward sovereignty issues is coupled to a national legacy of Confucian values in which the world is viewed in terms of an absolute hierarchy. Within this philosophy, the idea of a relationship between sovereign equals is a foreign concept. In practical terms, as the Chinese view themselves as being the world's greatest civilization, the Confucian philosophy imbues this ancient civilization with a cultural orientation that suggests that China should lead the world. Thus, as China continues to grow in economic and military might, it should be expected that the country would exercise its power and become more assertive in international affairs. This could result in tense relations with Japan and the United States, especially as China sees the status of Taiwan as being its number one national sovereignty issue. It is questionable, however, if China will be able to integrate itself into the current U.S.-led international system without creating significant levels of turmoil. Complicating the process is the fact that China's leaders distrust the West. This distrust stems from three primary factors. The first is leaders who are provincial in their thought processes and have little understanding of the West. Second, these leaders feel personally threatened by Western talk of a "peaceful democratic evolution" of China's government, an evolution that would displace them personally from power. And lastly, the lessons of China's history over the past two centuries argue against being too trusting of the West, conditioning Chinese leaders to view the international system in terms of *realpolitik.*

Against this backdrop of distrust and fear, the Chinese view the United States as having vast powers that enable it to manipulate events--a situation that possibly carries the seeds for future misinterpretations and confrontations. For example, in the event that China is set back in its quest to modernize its economy and expand its global presence, it may well hold the United States responsible for its failures, believing that the U.S. interfered with China's economic development for the purpose of eliminating its potential rival, China, from the contest for future global leadership.

Within this evolving situation, the question is now, "How will China use its future military capabilities in pursuit of its national interests?" Historically, China has not been viewed as an expansionistic nation. The South Koreans see China as a benign giant that would not deliberately inflict harm. On the other hand, China has used force offensively on a number of occasions during the latter half of the 20th century: China forcibly colonized Tibet in the 1950s, attacked India in 1962 and Vietnam in 1979. More recently, it used military force to press its territorial claims in the South China Sea, to the consternation of the ASEAN nations. Likewise, China demonstrated disregard for its economic interests with Taiwan when it attempted to use military intimidation to influence Taiwan's March 1996 presidential elections. These two events seem to indicate that China may not be much dissuaded by economic considerations in cases where it believes key national interests are at stake and the use of military force is judged to be a viable option. At the same time, there are many in China who are hesitant to see the country become too strong militarily because they fear it will antagonize China's neighbors and could affect commercial interests.

It is difficult to define China's national objectives. Analysis of reports, leadership statements, and Chinese activities, taken together, provide sufficient insight to make an informed assessment. China's key objectives seem to be to develop China's economic and technological potential under the continued leadership of the Chinese Communist Party (CCP), to secure future energy supplies (South China Sea, Central Asia, and the Middle East), and to reunify all Chinese lands by 2010 (Hong Kong, Macao, and Taiwan).

China, and particularly the members of the CCP, believes that the future fate of the country and of the party is, to a large extent, dependent upon sustained economic growth rates in the vicinity of 10 percent per year. If economic growth declined to 6-7 percent, China could have difficulty creating the 10 million or so jobs it needs each year to keep pace with its growing population. For China's leadership, economic growth is seen as necessary to validate the legitimacy of the government. Until recently, China's political leadership has allowed economic growth to occur with little direction. China now hopes to change this situation.

Japan taught the world that it was not necessary to reinvent the economic wheel--a country can buy new technology and leapfrog into the future. The Chinese hope to use Japan's example and develop a more disciplined economic policy that will allow them to catch up to the developed world in 15-20 years (Japan took 30 years from 1950 to 1980). China hopes to re-centralize some of its economic planning activities and has tasked the State Planning Commission to define China's economic trajectory for the rest of the decade and beyond. Apparently, China hopes to adopt an industrial policy for its commercial firms based on the Japanese model of grouping its industries and linking customer firms with captive supplier companies (*keiretsu* groupings). For China's defense industries, however, Chinese officials seem to believe that the United States' defense industrial policy provides the better model for China to emulate.

As economies develop around the globe, the demand for oil will also increase. China only has about 2.4 percent of the world's total oil and gas reserves. Future sources of energy supplies are going to be a key factor in its continued ability to sustain economic development as it feeds and supports 1.2 billion people, as it experiences the automotive revolution, as it meets the demand for expanded air travel, and as it engages in energy-intensive manufacturing. According to recent estimates, China's net external requirement for oil imports is expected to rise from the current daily level of one million to three million by 2010, and seven million barrels per day by 2015. During the next 15 years, East Asian oil imports from the Middle East could easily triple. In the face of the expected demand, China is interested in securing its future supplies.

China's concerns regarding its future energy supplies are also influencing many of its foreign policy decisions. For example, in 1992 it claimed about 80 percent of the South China Sea and its use of military force to reinforce that claim is clearly aimed at securing oil and gas. Although the dispute over the Spratley Island area seems to be cooling somewhat (due to drilling technology limitations in deep waters), this region still holds the potential for conflict if oil supplies tighten during the next century and drilling technology advances sufficiently to make feasible the extraction of these deposits.

China's interest in Iran and Iraq (which together contain 20 percent of the world's proven oil reserves) seems clearly linked to its concern over future oil supplies, while this same issue might also be coloring China's policy toward the states of Central Asia, states that hold the world's second largest reserves of oil.

Another national objective is the consolidation of perceived Chinese lands under centralized Chinese control. The existence of these areas, independent of China's control, is a constant reminder of China's humiliation during its 140 years of weakness. While the issue of Hong Kong and Macao are settled, the reintegration of Taiwan by 2010 is, of course, much more problematic. Taiwan's movement toward successful implementation of democratic rule undermines the efforts of the Chinese Communist Party (CCP) on the mainland to reestablish its legitimacy as the ruling party in China. Under Confucian-based nationalism, the CCP can justify its rule as being good for China, with the Confucian philosophy justifying the CCP's hierarchical, authoritarian rule. In contrast, an economically successful Taiwan under a democratic government would demonstrate that there is a possible alternative to CCP governance.

On the opposite side of the ledger, however, Taiwan offers China an opportunity (in business terms) to engage in a non-hostile takeover of one of the economic crown jewels of East Asia. Taiwan also has a very advanced electronics industry that would greatly benefit China as it enters the information era, especially in light of China's weakness in advanced electronics. In essence, the challenges and potential benefits that Taiwan presents to China ensure that Chinese-Taiwanese relations will remain a tense political issue until the reunification issue is resolved.

Along with the issue of reunification is the problem of securing China's geostrategic periphery. Almost 70 percent of China's 21,656 kilometer-long border and 66 percent of its over 3 million square kilometers of territorial waters face some level of external threat. In addition, some of the threat cited is a result of disputed territorial claims for islands in the China Sea. The countries with which China has disagreements over islands include Japan plus six other nations involved in the separate Spratley Islands' dispute (separate from a Japanese-Chinese dispute).

China believes in the value of military power, the greater one's military capabilities, the greater the awesomeness of the state, and the more likely one is to determine conflict outcomes to one's advantage. Nevertheless, the advantages that China might be able to gain from such capabilities are about two decades from realization. Consequently, the Chinese can be expected to use diplomacy where possible to achieve their national objectives.

China's basic use-of-force philosophy is neither to seek conflict nor to avoid it. China's viewpoint that the United States is its most likely long-term security threat has been reinforced by the growing U.S. public discussions regarding the need to limit or partially "contain" China. The subsequent dispatch of two U.S. carrier battlegroups to the vicinity of Taiwan in March 1996 apparently has been interpreted by the Chinese as affirming their fear that the United States is adopting a containment strategy for dealing with China. China considers Japan, its number two security threat, to be the most likely to cause it difficulty in East Asia. As such, at least during the near-term, China seems to accept continued U.S. involvement with Japan as a means of reassuring Japan and of limiting its inclination to establish a formidable military capability of its own. Although apparently ranked as China's number three threat, China sees Russia primarily as a source of technology. It also views Russia as useful in helping to limit the United States' international role. Both China and Russia are irritated with U.S. actions; therefore, each country gains mutual support from the other as they cooperate against their mutual adversary. In the December 1996 Chinese-Russian summit, both countries made it clear that they oppose a unipolar world. It is likely that China wants all U.S. forces off the Korean peninsula once reunification occurs. Obviously, continued presence of U.S. forces in Korea after reunification would potentially limit Chinese influence in the peninsula. Those forces would also be useful to the United States in any effort to contain China. At a minimum, China needs the Korean peninsula to be neutral, but preferably allied with China.

c. Russia

As Russia is currently preoccupied with its internal affairs, it is difficult to enumerate Russia's official national objectives. Russia has not yet developed a coherent foreign policy. Nevertheless, a careful review of the comments and writings of Russia's political elite provides some recurring patterns of thought from which insights can be derived. Russia seeks its former level of international status to include a larger share of global markets and greater influence in the international decision-making process.
One of the main irritations expressed by Russia's political community is frustration over its diminished international stature in the post-Cold War order. Moreover, there is a high degree of anger over the decline in Russia's share of the international arms market[11]. Russians look at the increase in U.S. arms market share and complain that the United States is trying to destroy Russia's defense industries and gain a monopoly for its own industries. As a result, Russia's political community is becoming much more adamant

regarding Russia' right to sell arms to whomever it wishes. Further, Russia wants to encourage a military balance in East Asia. Its historic fear of Japan is again becoming evident. Russia's policy community believes that a withdrawal of U.S. forces from East Asia would undoubtedly result in a rearming of Japan--a possibility most Russians fear. Thus, the majority believes that a limited U.S. presence in East Asia (one sufficient to reassure Japan but limited enough to be kept in check by the other states) would be beneficial to Russia's national interests and contribute to a stable East Asian balance of power. Within a new power alignment, many Russians believe that a reunified Korea would prove to be the natural ally of Russia--thus Russia is actively courting both North and South Korea. With regard to China, there seems to be divided opinion. There are those in the Russian policy community who believe that a more capable China would tend to expand its interests toward the South, which would pose problems for the United States and divert U.S. attention away from Russian affairs.

Regardless, the fact remains that Russia and China are growing closer together in the face of U.S. policies that are displeasing to both countries. The conservative estimate is that at least 1000 Russian technicians are working in China's nuclear and rocket programs. In the early 1990's, China is estimated to have purchased between $4.5 and $6 billion worth of weapons and military equipment from Russia. Included in this trade are advanced military aircraft, *Kilo* submarines, defense manufacturing facilities, defensive missile systems, and reportedly, key ICBM missile components and possibly missile manufacturing information. For Russia, China is a source of inexpensive consumer goods and provides an easily accessible market for its defense production. In addition, the

[11] ibid

possible option of using China as Russia's "China card" to help maintain a check on U.S. behavior may well become part of Russia's national security game plan. Thus, the future Russian-Chinese relationship will be a key factor in Japan’s future security equation. Russia plans to exercise hegemony over Central Asia and ensure that the region does not threaten Russian security. This region contains the world's second largest reserves of petroleum, is rich in natural resources and raw materials, contains a majority of the 20 million ethnic Russians who live outside of Russia's borders. As a result, many in Russia's policy-making community deeply regret Russia's loss of direct control over the region and are actively working to maintain indirect control. As an exacerbating factor, the area's dominant Islamic and Turkic religious and ethnic roots are viewed as potential avenues for exploitation by Turkey and Iran.

4. Internal Environment

a. Domestic Political Evolution

The bubble Japanese economy of the 1990s collapsed towards the end of the century and Japan suffered a sustained period of stagnant economic growth. In 1997, the Government outlined six areas of structural reform, but the Japanese people only saw some improvements in the education system, in social security, in the health insurance system. Deregulation proceeded in finance, telecommunications, distribution, electricity, transportation, among other sectors. But the heart of the reform – total deregulation, real changes in the corporate governance and tax systems, and sweeping changes to the pension fund system – these proceeded very slowly or never really happened. With no confidence that things were going to get better and no clear direction of progress in the near or long term, a bleak economic future embraced Japan in the new millennium.

Dissatisfied and convinced that the incumbent leadership was not capable of effectively implementing any mid-term to long-term economic recovery plan, the Japanese people got impatient and desperately wanted an alternative.

Wide spread protests occurred in major Japanese cities and a vote of no confidence forced the incumbent Prime Minister to resign in May 2001. In the July elections, the electorate made a never-seen-before turn-out of 80%. And even more surprising were the results of the election. The new political party that advocated honest reforms won a surprising land-slide victory. This party was founded by a young, more liberal and progressive leader, one who was genuinely committed to political and economic reforms for Japan, one who was against the "keiretsu" ways of doing business in Japan.

Drastic restructuring followed after the new leader was sworn in. The Japanese Cabinet was revamped and the new Diet immediately passed an emergency financial bill targeted at "Short-Term Pain for Long-Term Gain"[12], calling for thorough and systematic changes to Japan's financial and business way of life. The government took the lead by taking a hefty 25% cut in the entire civil service. The government made major reforms to the Japanese economic infrastructure (i.e. tax system, monetary and fiscal policies) and revamped the "inefficient" Japanese economic model. The massive Japanese ¥38,390[13] trillion in foreign reserves was drawn on initially as the new government increased

[12] Based on *Scenario 2: Crash and Rebirth* from http://www.gbn.org/scenarios/japan.
[13] US$349 trillion based on US$1=¥110. This is a real figure, accurate as of 29 September 2000 from the following http://www.mof.go.jp.

spending to try to sustain the economy. At the same time, a demand-based economic recovery plan was being developed in order to sustain the economy in the longer term.

b. Economic Response

The economy responded negatively, but not unexpectedly, as it took a massive downturn registering a negative 8% GDP[14] growth for the year 2001, the worst performance by the modern Japanese economy. Miraculously, the Japanese people showed confidence in the plan and the government this time. Believing in the new leader, the Japanese people showed great tenacity and demonstrated a strong national will to endure the short-term pain for long-term gain. This time, the Japanese economy demonstrated strong resilience and the economy improved in 2002 through 2005. Although the annual average GDP growth was a negative 3.59%, this five-year epoch ended on a high note for the Japanese economy, as it registered a positive half percentage point for the year 2005. Although meager, this was widely regarded by the Japanese public as good performance by the new government and signs of better days to come in the future, which won the new party further endorsement. Over the five-year period, the Japanese economy turned in an average annual GDP of ¥426.6 trillion, a drastic decline from the ¥497 trillion GDP of 2000.

With the recovery plan widely supported and underway, the early signs of recovery gave confidence of better economic performance in the future.

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[14] Although it is high improbable that Japan will turn in such a poor economic performance, it is possible that such a dire outcome could occur. The purpose of such a drastic change is to paint a scenario that the party time is over for Japan and for major and drastic changes to be implemented so as to “restart” the Japanese economy.

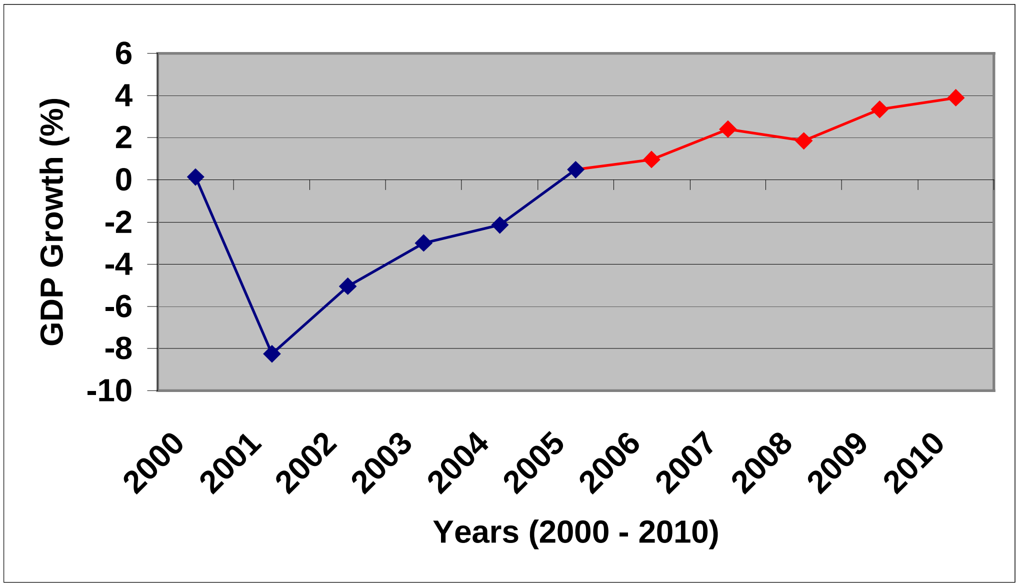

Chart 5-1 - GDP Growth from 2000 to 2005 and Projected GDP for 2006 to 2010.

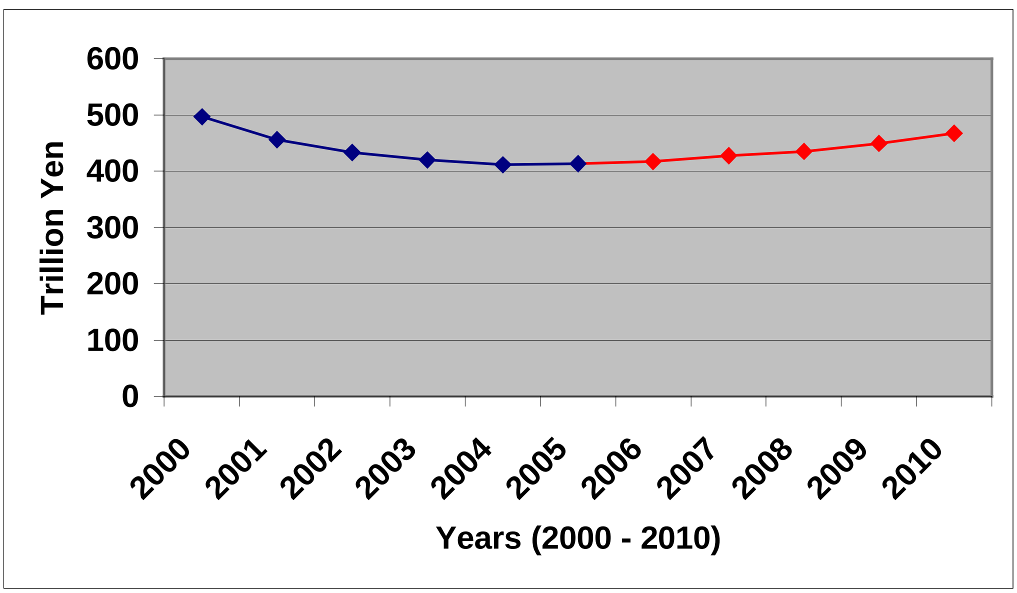

Chart 5-2 - Absolute GDP for the 2000 to 2005 and Projected GDP for 2006 to 2010.

c. Defense Spending

Despite the unfavorable economic situation, the new government strongly emphasized that a strong domestic and political environment was necessary for political and economic restructuring. It strongly believed that the presence of a credible and more self-reliant Japanese military was a critical pre-requisite for guaranteeing the stability needed to rebuild the economy and to sustain its growth in the long-term. There was therefore renewed emphasis on the Japanese Maritime Self-Defense Force. In order to assure effective maintenance, modernization and build-up of the Japanese military defense spending was pegged very close to 1% of GDP although the Diet was not constitutionally bound to spend 1% for defense. The result was a total of ¥21.30 trillion spend on defense for the epoch, or an average annual spending of ¥4.26 trillion. Although a consistent ratio of the GDP, compared to the 2000 defense spending, this was a significant 8% absolute reduction.

d. Demographics

Japan’s population experienced its most rapid period of aging towards the end of the last century. By the end of 2005 almost one-fifth of the Japanese population was over the age of 65, making Japan one of the oldest nations in world. The situation was worsened by the average fertility rate of 1.4 children per woman, well below the desired 2 or more required to replace the aging population. Although aging, the population remained relatively constant at 128 million. This was primarily due to better health service that resulted in a very high life expectancy of 80 years. This is a worrisome demographic picture.

Demographics had two major implications for the Japanese economy. Firstly, the aging population had resulted in decline of the national labor force of the country from 86 million in 2000 to 84 million in 2005. Secondly, the lack of adequate national pension schemes and retirement homes in Japan resulted in a rise in the welfare and social burden for the shrinking working population. The aging population also caused a decline in Japan's household savings.

The diminishing of the national labor force left the new leadership with few alternatives but to leverage technology and move towards a capital-intensive Japanese economy. The government encouraged more women to join the work force and continued import of skilled and unskilled workers. At the same time, the Diet raised the retirement age from 65 to 70 years old. In order to keep the aging population relevant in skill and knowledge, a comprehensive education and training system was developed. The government also planned to invest in information technology and productivity efforts in order to make up for the diminishing labor force.

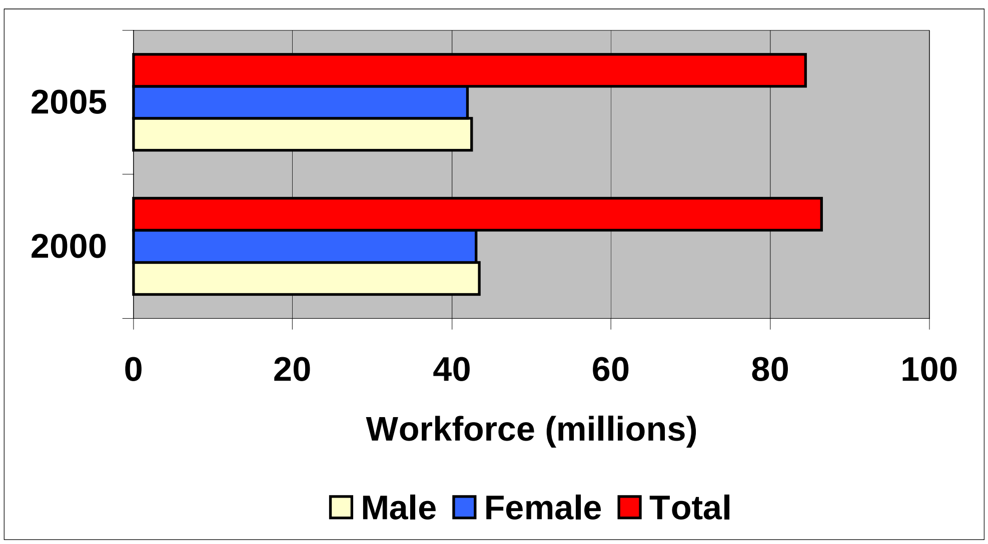

Chart 5-3 – 2000 and 2005 Comparison of National Labor Force

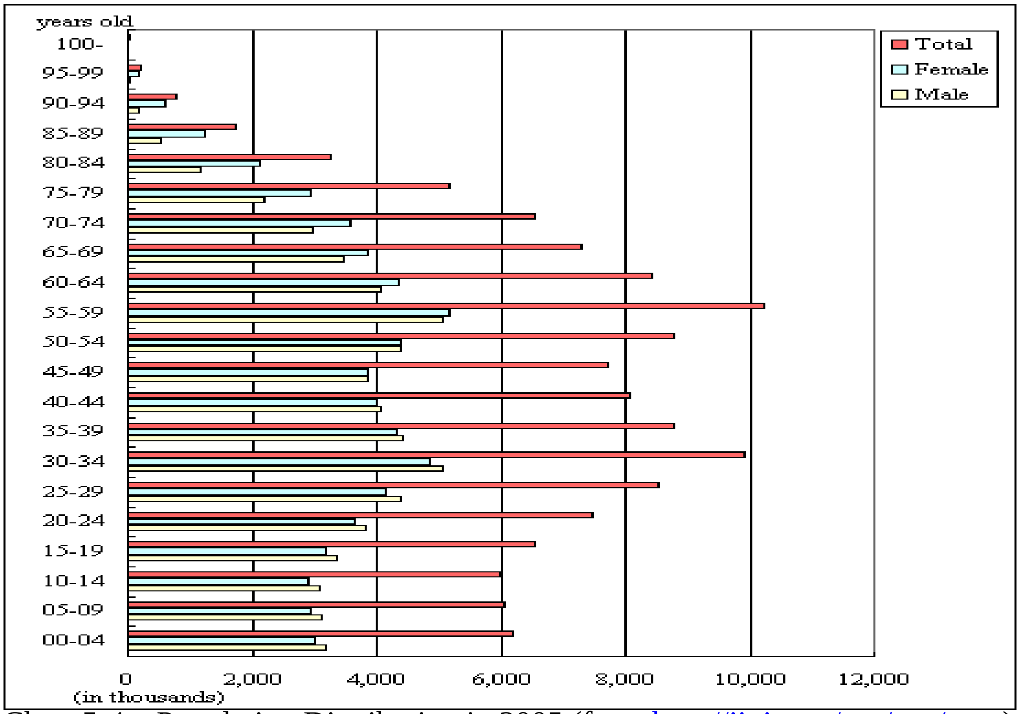

Chart 5-4 – Population Distribution in 2005 (from http://jinjapan/org/stat/stats)

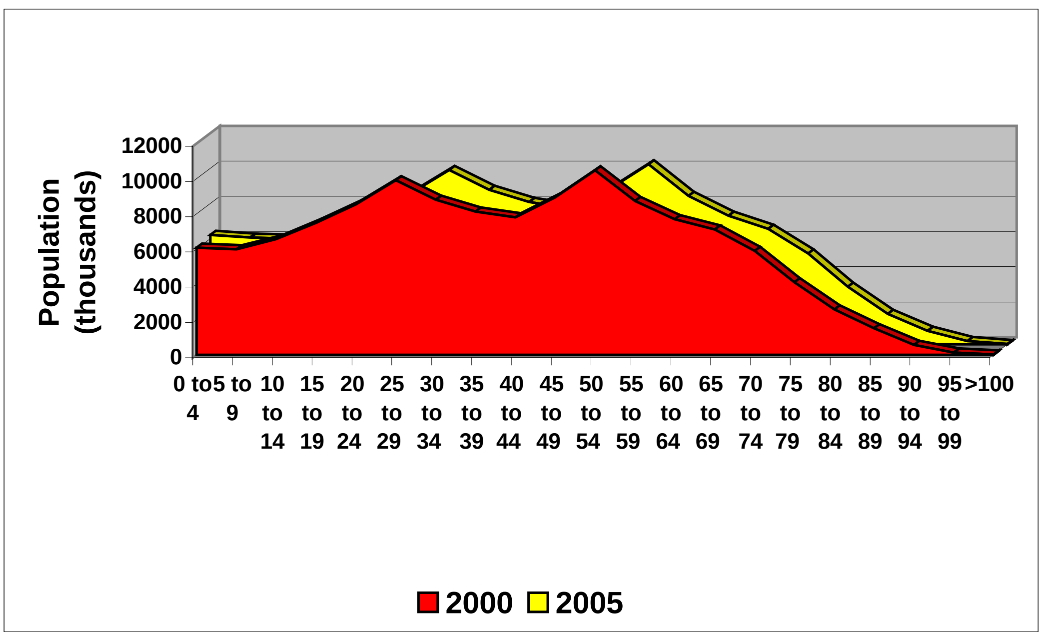

Chart 5-5- Population Distribution Trend

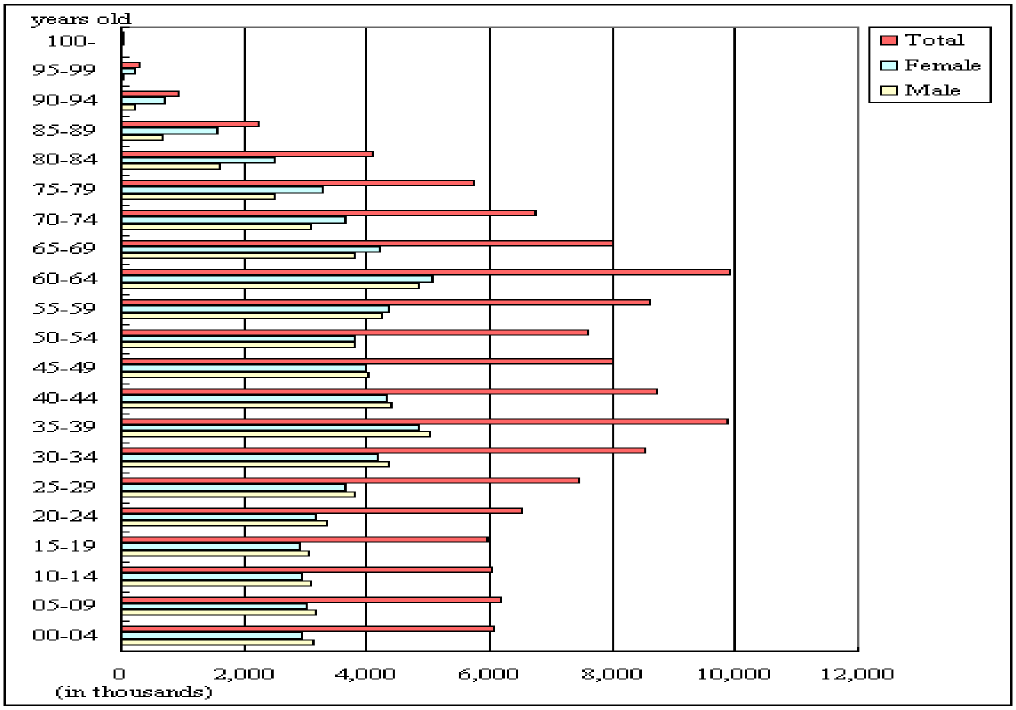

Chart 5-6 – Projected Population Distribution in 2010 (from http://jinjapan/org/stat/stats)

e. Energy Supplies

Japan lacked significant domestic sources of energy and continued to be one of the largest energy importers of crude oil, natural gas and other energy. At the turn of the century, Japan had to import over 80 percent of its total demand for energy. To move away from such strong reliance on the import of energy sources, Japan's energy policy focused on the 3 Es[15] :

(1) Economic Growth

(2) Energy security; and

(3) Environmental protection

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[15] http://jin.jcic.or.jp/access/energy/warming.html

In June 1996, the Diet enacted the Law Concerning Promotion of the Use of New Energy sources, like the sun, wind, heat produced by waste incinerators, etc. The *raison d'etre* was to have renewable energy sources that have few negative impacts on the environment and assure adequate energy. In 2000, new energy sources (excluding geothermal energy) provided 2% of the domestic energy supply and this was projected to increase to 3% in 2005-2010.

The last of the WW II generation of Japanese had passed, and together with them went the nuclear-allergy that had plagued Japan. Japan eyes nuclear power as its principal long-term solution for achieving a significant degree of energy independence. In 2000, nuclear energy supplied 12% of the total primary energy needs and the Japan Atomic Energy Research Institute (JAERI) has confidence that it will increase to 16% in 2010. Nuclear power not only assured Japan of a significant degree of energy independence, but it also contributed to a drastic reduction in Japan's carbon dioxide emissions in accordance with the Kyoto global warming agreement.

Japan was and will continue to be the world's largest importer of steam coal for power generation and of coking coal for steel making. Japan accounts for about 28% of the total world coal imports. Despite this, Japan will continue to rely on oil imports from the Middle East via long transit across the Indian Ocean. In order to diversify its energy supplies, alternative oil fields for exploration were sought in Alaska, Tarim Basin, Siberia, Sakhalin, East China Sea and the much conflicted South China Sea. Japan embarked on a joint venture with the People's Republic of China and the two Koreas for an overland oil and gas pipeline linking Central Asia (the Irkutsk Region), past

Ulaanbaatar, across Mongolia and northern China to Beijing, into the Korean Peninsular and via a subsea route into Japan.

Environmentally, LNG is more attractive than oil and Japan plans to build an effective and comprehensive internal gas transmission and distribution network. In addition, changes will be made to the physical infrastructure and market organization to increase the use of LNG for electric generation.

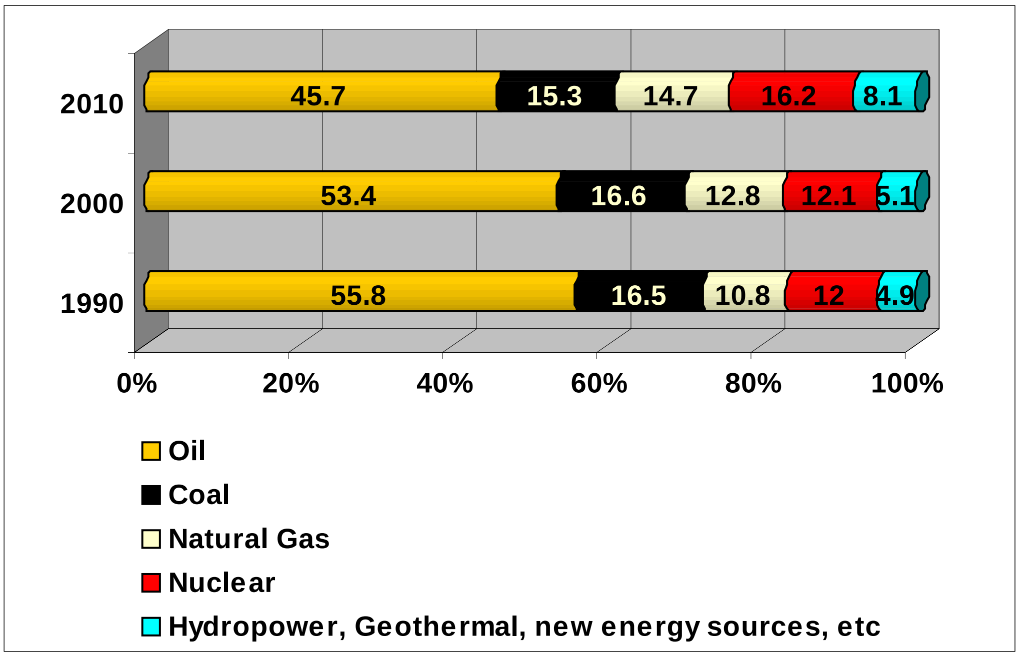

Chart 5-7 – Primary Energy Supply Sources (1990 and 2000 data from http://jin.jcic.or.jp/access/energy/profile.html)

5. Japan Self-Defense Force

a. Introduction

The geopolitical situation, coupled with the changing domestic policies in the Japan political arena, clearly influenced the way the Japan Self-Defense Force (JSDF) poised itself.

The key event that has had strong bearing on the military was the launch of Taepo Dong I ballistic missile by North Korea on 31 August 1998. The missile flew across the Sea of Japan, over the Honshu Island, and fell into the Pacific Ocean off the Sanriku coast of Japan – flying for nearly 1000 miles.

The key needs for the military were as follows:

1) Improve current C4ISR; and

2) Pursue a ballistic missile defense system.

The details of these efforts will be discussed in the subsequent sections.

b. Three Principal Considerations for Force Planning

First and foremost, Japan must be militarily self-reliant in its homeland defense. Although in general, Article 9 renounced war as a sovereign right of Japan, it was interpreted that Japan will never start a war against another country. Furthermore, the right to self-defense dictates that Japan must be able to defend itself against any hostile invasion – whether the attack comes in the form of amphibious landing or a ballistic missile attack[16]. Hence, if the sovereignty of the homeland is threatened, the use of proportionate force is considered legitimate.

Secondly, to be a credible force, the military must be prepared for the full spectrum of warfare. As Japan is constantly besieged with natural disasters, like earthquakes, the military must also respond with civil disaster relief efforts and other peacetime roles, like participation in UN missions.

[16] Defense of Japan, 1999 white paper

Lastly, the US-Japan Security Arrangement will still be in place. Japan welcomes the stationing of troops in the Korea peninsula and in Okinawa as a stabilizing factor in the region. Coupled with a strong US naval presence, it also serves to control expansion of China and ensure the freedom of seas in the region. The US-Japan Security Arrangement also provided a nuclear umbrella over Japan and many numerous opportunities for technological cooperation.

c. Japan Defense Strategy

With the three considerations in mind, we review the defense strategies that were adopted in the first epoch.

First, the cornerstone of Japan's military self-reliance is defense and deterrent. By defense, Japan strives to nullify any attempt to bring hostility to itself – either through a conventional engagement or a ballistic missile attacks. On the need for a ballistic missile defense system, Japan was working closely with US for the Navy Theater Wide Defense (NTWD) system and the land-based Theater High Attitude Area Defense (THAAD) system. All the Kongo-class (similar to the US Aegis destroyer) destroyers in the fleet have been retrofitted with the Navy Area Defense (NAD) capability. Similarly the Patriot PAC-2 systems are in the progress of upgrading to PAC-3 capability. Both the NAD and PAC-3 are capable of intercepting missiles up to a height of 25 km. However, in the last five years, despite committing substantial amount of money in R & D, there was no significant breakthrough in the development of THAAD and NTWD.

As a deterrent, Japan strives to possess a credible force that would make an adversary to think again before considering hostile actions against Japan. Hence, Japan invested heavily in expanding its C4ISR and cruise missile technology.

The second strategy is for the JSDF to maintain a full spectrum of military options so that a proportional retaliation could be mounted against any aggressors.

The third strategy involves the development of Japan's own defense industry. Whenever possible, Japan strives to produce her own indigenous weapon systems through her own R&D in cutting edge technologies. Otherwise, industry engages in partnerships with other countries for cooperative technological research and development. The end is an efficient industrial base reducing reliance on arms imports. In the times of dwindling manpower, the military will have to leverage technology.

d. Defense Policy

Japan's Defense Policy[17] for the years 2001 through 2005 is discussed in the seven paragraphs below:

<u>Promotion of efforts for peace and stability through CBMs and ODAs</u>. The foremost policy statement is the promotion of peace and stability through Confidence Building Measures (CBMs), for example, engaging in multi-lateral dialogues and joint training, and providing Overseas Development Assistance (ODA) to other nations.

<u>Development of defense capability (especially in JBMD and C4ISR)</u>. The thrust of the military focus was the development of Japan Ballistic Missile Defense (JBMD)

[17] Defense of Japan 1999, Urban Connection.

system & enhancing the C4ISR for surveillance so that sufficient early warning can be provided.

Adherence to the US-Japan Security Arrangement. Japan will not employ her military as the first option to resolve any conflicts. US aid will be sought first if the need arises. Nonetheless, in the spirit of self-defense, proportional retaliation can be expected from the JSDF.

Exclusively defense-oriented policy. Force may not be employed unless and until an attack is mounted on Japan by another country, and the use of these forces is kept to a minimum necessary for self-defense.

Not becoming a military power. Japan does not intent to be a dominant military power in the East Asian region.

Adherence to the three non-nuclear principles. Japan will not possess, produce, nor permit the introduction of nuclear weapons.

Ensuring civilian control of the military. The precedence of the democratic political control over the military will be maintained.

e. Defense Expenditure

With the implementation of the short-term pain, long-term gain policy, there was a crunch in the budget for defense expenditure. The JSDF adopted various measures to ensure that military expenses stayed within 1% of the GDP. Table 3-1 shows the major components of the defense budget. The 2000 figures were included for comparison. Refer to Annex 5A for the detailed expenditure spreadsheets. Most of the mission areas suffered a cut in their budget. The restructuring of the two Combined Arms Divisions

(CAD) created some savings in the categories of Personnel and Provision, and in Maintenance. Equipment acquisition was purposely slowed down. The available resources were generally channeled to a few key programs like the acquisition of the Type-03 SSM, F-2 fighters and some vessels like the Kongo-class destroyers and the Osumi-class LSTs. The construction of a National Command and Control System (NCCS) was also a priority item.

	Item	Year 2000 (Billion ¥)	Epoch 1 Total (Billion ¥)	%	Yearly Average (Billion ¥)	% Change (cf: 2000)
1	Personnel & Provision	2,203.4	10,350.0	48.5%	2,070.0	-6.1%
2	Maintenance	890.6	4,154.0	19.5%	830.8	-6.7%
3	Facilities	168.7	850.0	4.0%	170.0	0.8%
4	**R&D**	**120.5**	**615.0**	**2.9%**	**123.0**	**2.1%**
5	**Equipment Acquisition**	**914.1**	**2,458.0**	**11.5%**	**491.6**	**-46.2%**
6	Others	638.4	2,900.0	13.6%	580.0	-9.1%
	Total	**4,935.7**	**21,327.0**	**100%**	**4,265.4**	**-13.6%**

Table 5-1: Defense expenditure for 2001 to 2005.

Knowing the importance of R&D to pursuit of cutting-edge weapon systems, Japan increased R & D expenditures. Key R & D expenditures were for the development of JBMD, the Type-03 SSM and the Unmanned Aerial Vehicles (UAVs).

f. Defense Industry

At the turn of the century, Japan was efficient in long production runs, but relatively inefficient in short productions runs. Many military items, which were few in quantity, remained relatively expensive. Fortunately, the joint impacts of the economic reform and procurement reforms were able to transform the situation.

g. Defense Research & Development Efforts

Japan has always been a big investor in R&D – about 3 to 5% of its GDP[18] annually over the past 25 years. It has long realized that the most effective way to solve the aging population and increasing energy demand is through better technology.

Every five years, the National Institute of Science and Technology Policy (NISTEP) would conduct a technological survey, using the Delphi survey method, for the next 30 years. The coverage is very comprehensive.

Although defense-related R&D (about 0.3%) is very small, Japan could leverage dual-use commercial technologies to build better and cheaper military equipment. Japan also maintains bi-lateral or multi-lateral cooperation with other countries in the regime of technological exploration, especially the US.

h. Defense Research & Development Programs (2001 to 2005)

A total of ¥123 billion was spent over the last five years on R & D. Table 5-2 shows the major R&D programs for the JSDF. Many of the items are related to the missile defense programs, a total of ¥160 billion. Almost ¥75 billion was spent to speed up the development of the Type-03 deterrent cruise missile. Also, a total of ¥100 billion was spent to expand C4ISR.

[18] "1999 Survey of Research and Development", http://www.stat.go.jp/english/1531.htm.

S/No	Item	Amount (Million ¥)	Remarks
1	Type-03 SSM	75,000	Completed, production began in 2003.
2	Patriot PAC-3	50,000	Completed, upgrading began in 2002.
3	Ballistic Missile Defense System	75,000	In progress.
4	SM3 Missile for NTWD	25,000	In progress.
4	BMC3I	10,000	In progress.
5	National C2 System	20,000	In progress.
6	EU-1 (low observable UAV)	25,000	Completed, production began in 2004.
7	EU-2 (HAE UAV)	25,000	In progress.
	Total	305,000	
8.	Others	310,000	
	Grand Total	615,000	

Table 5-2: Main R & D Programs.

i. Japan’s R&D and Procurement Priorities

Japan’s priorities for military R&D and procurement for the next epoch will be as follows: (1) to find a cost-effective solution to defend Japan against long-range ballistic missiles and cruise missiles; (2) to expand JSDF’s Type 3 TEL missile force to provide a massive conventional strike and deterrent capabilities that will also enhance area denial capabilities for the waters surrounding Japan; (3) to improve JSDF’s C4ISR to enhance the mission effectiveness and to enable the conduct of long-range land-attack and anti-ship strike missions; and (4) to invest R&D resources in unmanned platforms.

6. Key Defense Systems in 2001 to 2005

In this section, we examine some of the key defense systems that came into being during the period from 2001 to 2005.

a. Japan Ballistic Missile Defense (JBMD) System

As part of the defense strategy, the development of a credible ballistic missile defense system was deemed critical to the safety of the Japan homeland. First was the Japan Ballistic Missile Defense (JBMD) system. A total of ¥160 billion was invested in R & D effort in conjunction with the US. The NAD and PAC-3 programs were successful. The existing fleet of Patriot PAC-2 is in the progress of upgrading and the Kongo-class destroyers are also equipped with the NAD capability. The NAD employs the 2-stage SM2 missiles, which could intercept up to 100,000 ft. The Patriot PAC-3 systems could only intercept the missile within the atmosphere (endo-atmospheric).

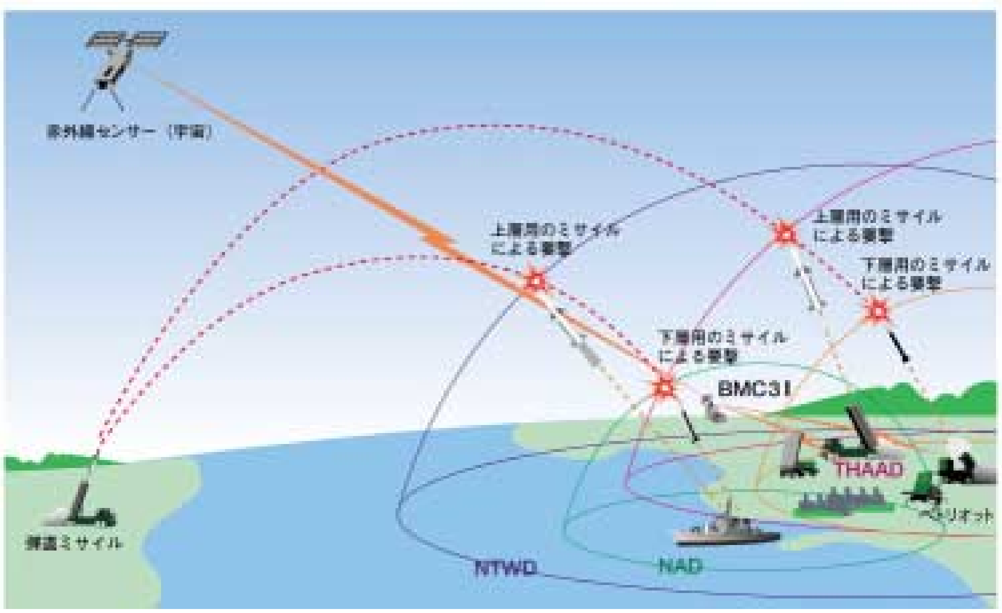

Figure 5-1: JBMD Major Components.

However, both the NTWD and THAAD system, which are supposed to intercept the missile in the exo-atmosphere, did not demonstrate promising advancement. Nonetheless, Japan is willing to further invest in the development of these two systems.

b. EU-1 Low Observable UAV.

	• Endurance: >8 hours @500nm • Cruise Speed: 250 kts • Payload: 1000 lbs • Altitude: 45 kft • Sensors: LPI SAR, EO, SIGINT

Figure 5-2: EU-1

As part of the effort to expand the C4ISR capabilities, Japan embarked on several UAV programs. EU-1, a low observable UAV, is the first in the series. Japan approached the US to revive their previously cancelled Dark Star project. The first EU-1 (the specifications are similar to Dark Star), at a cost of ¥2 billion per aircraft, was rolled out in 2004. A total of seven EU-1s were acquired over the last 2 years.

c. Type-03 SSM.

Type-03 SSM is a long-range (about 1000 nm) sub-sonic cruise missile for surface targets. The design is largely based on the Tomahawk missile but re-designed and produced by Mitsubishi Heavy Industry. Each launcher cost ¥1.2 billion and each missile cost ¥100 million. The missile is modular; hence it can be easily configured for either land-attack or anti-ship roles. Every missile carries a 1000 lb warhead.

	• Range: 1000 nm • Length: 6.25 m • Weight: 1,440 Kg • Diameter: 51.8 cm • Standard VLS cell; or 21" Torpedo tube • Warhead: 1000 lb

Figure 5-3: Type-03 SSM

d. Information Gathering Satellite (IGS) System.

	• Orbit: 500 km (LEO) • Sensors: EO • Resolution: 1 m • Total Satellites: 4

Figure 5-4: Information Gathering Satellite

The purpose of introducing the information-gathering satellites is to prevent threats and crises. In 2003, Mitsubishi Electric Corp developed and launched a total of four satellites at a cost of ¥1700 billion. These LEO satellites orbit at 500 km above the Earth to get images of required regions regularly and reveal those factors that could become a threat. The satellites carry optical sensors that are able to resolve images as small as one square meter – such as ballistic missiles and combat aircraft.

As the satellite program comes under the purview of the National Space Development Agency (NASDA) of Japan, the cost did not appear in JSDF's budget. Japan also established a MOU with the US to share satellite imageries.

7. National Defense Program Outline

The National Defense Program Outline[19] (NDPO) spelled out the desired end-state of the JSDF. The NDPO was drafted and approved in 1995. It was reviewed again in the late 2001. Table 5-3 shows the current NDPO and the corresponding order of battle in the JSDF.

Classification		2001 NDPO	At End of Revised Mid-Term Defense Program (2005)
Manpower	GSDF (Regular)	145,000	Approx. 158,000
	GSDF (Reserve)	25,000	Approx. 10,000
	MSDF	50,000	Approx. 46,500
	ASDF	50,000	Approx. 48,300
	Joint Staff	2,000	Approx. 1,600
	Total (Active)	247,000	Approx. 254,400
	Grand Total	272,000	Approx. 264,400
GSDF	Division	8 Infantry Division 1 Armored Division	10 Infantry Division 1 Armored Division
	Brigade	6 Infantry Brigade 1 Airborne Brigade 1 Helicopter Brigade 1 Amphibious Brigade	3 Infantry Brigade 1 Airborne Brigade 1 Helicopter Brigade 1 Amphibious Brigade
	Tank	Approx 1000	Approx 1030
	Artillery	Approx 1000	Approx 1000
MSDF	Destroyer	60	57
	Submarine	20	19
	Combat Aircraft	200	Approx 210
ASDF	Fighter	400	Approx 330
	UAV	Approx 50	7

Table 5-3: National Defense Program Outline

[19] Defense of Japan 1999, Urban Connection

The North Korean missile firing made the Japanese government realize that it is very weak in the area of missile defense. In view of the uncertainty in the BMD technology, there is also a need to enhance the deterrence capability. Furthermore, the numerous incidents of intrusion by "suspicious boats" also prompted the JDA to review its intelligence collection and early warning capabilities. Hence, there was a need to expand both the maritime and the air force capabilities.

The force structure of the GSDF was also reviewed. It was ascertained that at the end-state, a total of nine divisions (8 Infantry and 1 Armoured), together with nine brigades (6 Infantry, 1 Amphibious, 1 Airborne, and 1 Heliborne) is sufficient to fulfill its mission. Furthermore, part of the active force was converted to reserve appointment. At the end of 2005, there are a total of approximately 254,400 active personnel. This figure will be trimmed to 247,000 active personnel. The cut in the active posts in the GSDF will be used to fund the increase in the ASDF and MSDF.

The subsequent sections will describe the changes to the various services. Main missile systems and C4ISR systems are discussed separately.

a. Ground Self Defense Force (GSDF)

			Epoch 1 (2001 ~ 2005)			
S/No	**Item**	**2000 Qty (Start)**	**Acquire/ Build-up**	**Upgrade**	**Retire/ Close down**	**2005 Qty**
1	Infantry/Combined Div	12			2	10
2	Infantry Bde	2	2			4
3	Armored Div	1				1
4	Heliborne Bde	1				1
5	Airborne Bde	1				1
6	Amphibious Bde	0	1			1
7	Tanks	1,135		50		1,135
8	APC	770	25	50		795
9	Artillery (155mm SP)	831				831
10	MLRS	128	50			178
11	Attack Helicopters	88	5		5	88
12	Other Helicopters	424	5		5	424

Table 5-4: Major GSDF Order of Battle

Over the last five years, there was quite a change in the GSDF order of battle. The two Combined Arms Divisions were closed down. At the same time, two infantry brigades and one amphibious brigade were raised. The saving of manpower was also reflected in the lower expenses in Personnel and Provision. There is an on-going program to modernize and upgrade the tanks and APCs, but there is minimal fluctuation in the quantity. As part of the efforts to reduce the reliance on manpower, more MLRSs were being purchased. The intention is to replace the 155 mm SP artillery in the near future.

b. Maritime Self Defense Force (MSDF)

			Epoch 1 (2001 ~ 2005)			
S/No	**Item**	**2000 Qty (Start)**	**Acquire/ Build-up**	**Upgrade**	**Retire/ Close down**	**2005 Qty**
1	Kongo & DD21	4	3	4		7
2	Other DDs	53			3	50
3	Submarine (SS)	18	2		1	19
4	Mine warfare ship (MSC)	37	2		1	38
5	Landing Ship (LST)	11	3			14
6	P3C (Fixed wing patrol)	100		15		100
7	HSS-2B (Patrol)	36				36
8	MH-53E (Mine sweeping)	10				10
9	SM3 Missile (NTWD)	0				0
10	SH-60J (anti-sub)	78	2		2	78

Table 5-5: Major MSDF Order of Battle

The MSDF continued its modernization of the fleet. While the maritime force acquired 3 new Kongo-class destroyers, it also retired the three oldest destroyers. Four of the Kongo-class destroyers were also upgraded with the new NAD capability. Two more submarines and mine warfare ships were acquired, while one each was retired respectively. The fleet of Osumi-class LSTs was also expanded so as to support the amphibious brigade. Also 15 of the 100 P3Cs were upgraded to extend their service life.

c. Air Self-Defense Force (ASDF)

			Epoch 1 (2001 ~ 2005)			
S/No	**Item**	**2000 Qty (Start)**	**Acquire/ Build-up**	**Upgrade**	**Retire/ Close down**	**2005 Qty**
1	F-15 (J/DJ)	203				203
2	F-22	0				0
3	F-1	52				52
4	F-2	45	30			75
5	F-4/RF-4 (E/EJ)	133				133
6	C-1	28				28
7	C-130H	16				16
8	CH-47J (Transport)	19	10			29
9	KC-135	0	5			5

Table 5-6: Major ASDF Order of Battle

The major change in the ASDF is the procurement of 30 new F-2s bringing the total to 75 fighters. The F-2 is meant to replace the F-15 in the near future. Also 10 new CH-47 transport helicopters were added to its inventory to improve its airlift capability. In order to extent the operating range of its aircrafts, the ASDF also began to equip itself with KC-135 refueling tankers.

d. Major Missile Systems

			Epoch 1 (2001 ~ 2005)			
S/No	**Item**	**2000 Qty (Start)**	**Acquire/ Build-up**	**Upgrade**	**Retire/ Close down**	**2005 Qty**
1	Patriot PAC-3 FU Upgrading	120		20		120
2	I-HAWK Upgrading (in group)	192		2		192
3	Type-88 TEL (c/w 6 missile ea)	68	12			80
4	Type-03 TEL (6 missile ea)	0	100			100
5	Type-03 Missile	0	1,000			1,000

Table 5-7: Major Missile Systems

A significant amount of the expenditure was spent on missiles system upgrading and procurement. This is the high growth area because missiles offer high lethality, long range and low manpower requirement.

Specifically, Japan invested in cruise missiles because of the difficulty in detection and counter-measures. Twelve more Type-88 TELs were procured. The objective was to build a deterrence capability using a large array of missiles, especially cruise missiles. When the R & D in Type-03 cruise proved successful, procurement was switched to the new Type-03 SSM and 100 TELs were procured, together with 1000 missiles.

Japan also embarked on the upgrading programs for its Patriot PAC-2 to PAC-3 and the I-Hawk systems. The upgrading of the Patriot and I-Hawk system is expected to take the next 10 to 15 years.

e. Major C4ISR Systems

			Epoch 1 (2001 ~ 2005)			
S/No	**Item**	**2000 Qty (Start)**	**Acquire/ Build-up**	**Upgrade**	**Retire/ Close down**	**2005 Qty**
1	EU-1 (Low observable) [05]	0	7			7
2	E-2C	13				13
3	E-767	4				4
4	Info Gathering Satellite	0	4			4
5	National C2 System	0	1			1
6	IW Platoon (30-men)	0	1			1

Table 5-8: Major C4ISR Systems

The JSDF also established the National Command and Control Systems (NCCS) for command and control, sensor fusion and distribution of cueing and targeting information. Continuous R & D effort is expected so as to improve the system using the best technologies available.

There is a heavy investment in UAVs so as to enhance the surveillance and targeting capabilities. Through the revival of the US Darkstar project, the EU-1 was rolled out. It was hoped that this would mark the beginning of a series of UAVs that were indigenously manufactured in Japan.

In addition, Japan will also have four information gathering satellites that would orbit at 500 km above the Earth. These are being developed and launched by Mitsubishi Electric Corporation.

Realizing the importance of information warfare, the JSDF also trained and configured one platoon of IW warriors every five years. These IW platoons will report directly to the Joint Chiefs of Staff.

8. Static Net Assessment - Japan Versus North Korea

In this section, the static assessment of a confrontation between Japan's forces and North Korean forces is presented. Details of Japan's forces can be found in the previous chapter. Refer to the Korean chapter for details of North Korea Force Structure for 2005. The data presented in this section has been reorganized and aggregated to provide a more focused comparison.

a. Manpower

Japan	North Korea
Joint : 1,600 Army : 168,000 (10 Div, 4 Bde, 1 Armored Div, 1 Airborne Bde, 1 Heli Bde, 1 Amphibious Bde) Navy : 46,500 Air Force : 48,300	Army : 1,140,000 + 600,000 Reserves Navy : 46,000 + 65,000 Reserves Air Force : 86,000
Total : 264,400	**Total : 1,937,000**

The total JSDF manpower is one order of magnitude smaller than that of North Korea. Due to economic and demographic reasons, it is not possible for Japan to significantly increase the manpower of its armed forces.

b. Air Force

Japan	North Korea
203 F15 52 F1 75 F2 133 F4/RF4 28 C1 16 C130 29 CH47 5 KC135 AAR	35 MiG 29 206 Lower-end Fighters 80 Bomber 334 Attack 304 Fixed-wing Transport 292 Helicopters

North Korean's Air Force mainly comprises lower-end[1] or older aircraft. The only significant force in their inventory is the 35 MiG29s. But this should not pose much problem to Japan's 200 F15s. Hence, JASDF should not face much opposition when operating outside the coverage of North Korean's land-based SAM systems, including the airspace over the Sea of Japan.

c. Navy

	Japan	**North Korea**
Surface Combatants	7 Kongo DDGs 50 Other DDGs 3 Missile Patrol Craft Maritime Safety Agency: 13/46 Lg/Med Patrol Vessel 38 Patrol Craft 81 Coastal Patrol Craft 180 Coastal/Rescue Craft	48 Missile Armed Ships (3 FF, 45 PC) 403 Other small non-missile armed ships
Submarines	19 SS	10 Romeo Class 71 Other lower-end boats
Mine Warfare	38	24
Amphibious	14 LSTs	35 LSTs 231 Others (LCPs etc)
Aircraft	100 P3C 78 ASW Helicopters 46 Others	10 ASW Helicopters

North Korea's surface fleet consists mainly of lower-end frigates and missile crafts, each with two to four missiles. It is clear from the above table that the North Korean Navy is no match for the modern Japanese Navy in a force-on-force confrontation in open waters. The inclusion of air power considerations only serves to exacerbate the imbalance.

d. Army

	Japan	North Korea
Tanks	1135 MBTs	3500 Tanks
APC	795	2500
Artillery	831	8200
MLRS	178	2300
Attack Helicopters	88	50

While numerically superior, North Korean equipment is mostly a generation or two behind the modern equipment of the Japanese army. But regardless of the relative combat power of the land forces, without the support of sea and air power, it is highly unlikely that the North Korean army can attack Japan in significant numbers.

e. Missiles

	Japan	North Korea
Strike	100 Type 03 TELs (6 missiles per TEL) 80 Type 88 TELs (6 missiles per TEL)	100 Scud B 150 Hwasong 5 250 Hwasong 6 80 Nodong 1/2 25 Taepo Dong 1/2
Air Defense	120 Patriot FU (100 PAC2 and 20 PAC3) 192 I-HAWK FU	5,500 SAMs

The majority of North Korean missiles do not have the range to hit Japan. Of concern is North Korean's development of long-range ballistic missiles, such as the Taepo Dong. While the quantity and accuracy of these missiles may not pose a serious threat to Japan's military, it may be used as a weapon of terror against the Japanese population. The Japanese Type 3 missiles have the range to hit anywhere in North Korea. Hence, they serve as a conventional deterrent as well as to provide, if necessary, a first-strike capability to remove the Taepo Dong threat on the ground.

f. C4ISR

Japan	North Korea
4 IMINT Satellites 30-person Computer Warfare Team 7 EU-1 13 E2C 4 E767 National C2 System	Unknown

Details of the North Korean C4ISR capabilities are not known but are assumed not to be technologically advanced. However, it is assumed that they have the means to procure commercially available services such as satellite images, satellite communications etc.

g. Summary (Japan versus North Korea)

Overall, given North Korean's inability to project large-scale forces across the Sea of Japan, it does not pose a military threat to Japan. The only significant capability is North Korean's R&D efforts into long-range ballistic missiles with possible WMD capabilities. Japan will commit resources in future epochs to find a cost-effective solution to this threat.

9. Static Net Assessment - Japan Versus China

In this section, the static assessment between Japan's forces and China's forces is presented. Details of Japan's forces can be found in the previous chapter. The data presented has been reorganized and aggregated to provide a meaningful comparison.

Defense of Japan 2005

a. Manpower

Japan	China
Joint : 1,600 Army : 168,000 (10 Div, 4 Bde, 1 Armoured Div, 1 Airborne Bde, 1 Heli Bde, 1 Amphibious Bde) Navy : 46,500 Air Force : 48,300	PLA : 1,928,000 Rapid Reaction : 55,000 Navy : 280,000 Marines : 10,000 Special Forces : 7,000 Intelligence : 3,000
Total : 264,400	**Total : 2,283,000**

The total JSDF manpower is one order of magnitude smaller than that of China. Due to economic and demographic reasons, it is not possible for Japan to significantly increase the manpower of its armed forces.

Operationally, as shall be seen in the air and naval orders of battle, China's sealift capability is assessed able to project no more than 20,000 troops and their airlift capability no more than 6,000, a small fraction of the total PLA order of battle.

Qualitatively, although PLA personnel are generally well trained in basic skills, their leadership, training in combined operations and morale is low. Most soldiers are poorly educated and one-third leave active duty each year. There is also no professional NCO corps.

b. Air Force

Japan	China
203 F15 52 F1 75 F2 133 F4/RF4 28 C1 16 C130 29 CH47 5 KC135 AAR	200 MiG31 298 J11 100 J10 2253 Lower-end fighters/attack 235 Long-range Bombers 58 Heavy/Medium Lift FW Transport 264 Light FW Transport 10 IL78 AAR 224 Helicopters

The majority of China's over 2000 fighters are lower-end aircraft. But with the inclusion of MiG31s and J11s in the last 5 years, China has finally caught up with Japan's F15s qualitatively and has quantitatively surpassed JASDF's fleet of current generation fighters. But the actual outcome of an air war would depend very much on the training and competency of the pilots as well as its C4 capabilities. Both are reportedly deficient for China's Air Force. Hence the result of the battle for air superiority over East China Sea is uncertain.

c. Navy

	Japan	**China**
Surface Combatants	7 Kongo DDGs 50 Other Destroyers 3 Missile Patrol Craft Maritime Safety Agency: 13/46 Lg/Med Patrol Vessel 38 Patrol Craft 81 Coastal Patrol Craft 180 Coastal/Rescue Craft	27 Destroyers 41 Frigates 149 other Missile Craft 70 Torpedo Craft 30 Speed Boats
Submarines	19 SS	63 SS 5 SSN 1 SSBN
Mine Warfare	38	83
Amphibious	14 LSTs	26 LSTs 66 Others
Aircraft	100 P3C 78 ASW Helicopters 46 Others	See "Air Force"

China's surface fleet consists mainly of lower end destroyers, frigates and missile crafts, each with four to eight SSMs and up to eight SAMs. The total missile capacity of all surface combatants is estimated to be about 1112 SSMs and 424 SAMs spread over 217 ships, or about seven missiles per ship. In contrast, while the Japanese surface fleet is numerically inferior, it is technologically modern and carries missiles of far longer range. For example, a Kongo-class DDG carries 90 VLS cells and eight Harpoon missiles. Furthermore, the surface fleet is supported by a large fleet of surveillance and ASW aircraft. Overall, JMSDF has the edge in surface warfare.

Of the 63 China SS, only the six Song-class and eight Kilo-class are of more recent design. These, together with the five SSN provide China with a more superior sub-surface capability. However, with the 19 modern SS and ASW capabilities of its destroyers and aircraft, JMSDF should be able to maintain a very slight edge in an open-ocean naval battle.

d. Missiles

	Japan	**China**
Strike	100 Type 03 TELs (6 missiles per TEL) 80 Type 88 TELs (6 missiles per TEL)	900 SRBM 60 MRBM 90 IRBM 45 ICBM 84 SLBM (with 1 SSBN) 5700 ASCM 500 Tomahawk Equivalent 1700 other LACM
Air Defense	120 Patriot FU (100 PAC2 and 20 PAC3) 192 I-HAWK FU	25 Long Range SAM Bns 20 Short Range SAM Bns

Although China has a large ballistic and cruise missile inventory, the majority are SRBMs and shorter-range cruise missiles, which do not have the range to reach Japan when fired from the mainland. Only 695 land-based missiles have the range to overfly the East China Sea, comparable in number to Japan's 600 Type 3 missiles. However, this missile, presently equipped only with conventional warhead, does not constitute a deterrent to China's nuclear weapons.

The 100 mobile land-based Type 3 TELs will play a big role in the defense against a scenario of a China large-scale invasion. With no clear winners in the comparison between air and naval combatants, Type 3 missiles will provide the additional firepower necessary to tilt the balance in JSDF's favor in a defensive scenario. However, should China conduct an all-out invasion, a larger Type 3 TEL fleet will be required to ensure a complete destruction of all the forces afloat.

e. C4ISR

Japan	China
4 IMINT Satellites 30-person Computer Warfare Team 7 EU-1 13 E2C 4 E767 National C2 System	14 IMINT Satellites 16 AEWCC

Details of China's spy satellite capability are not available and hence a comparison cannot be made. Japan's Airborne Early Warning fleet of E2Cs and E767s are assessed to be technologically superior as compared to China's Y8s and A50s.

f. Summary (Japan versus China)

Numerically, Japan lags far behind in most areas and this gap can never be bridged due to demographic and economic reasons. Japan will therefore have to leverage advanced technology to overcome China's numerical advantage; in short, to overcome quantity with quality. With a smaller defense budget, Japan cannot afford to compete in all capability areas, and must therefore be very selective in its military investment to achieve its defense objectives. These include capabilities to counter a large-scale China invasion, as well as cost-effective solutions to counter China's nuclear and missile capabilities.

10. Epoch 1 Summary

More than a decade passed since the end of the Cold War, yet no new stable international order appeared from 2001-2005. Rather, the combination of political, economic, military, and social factors that have undermined stability during much of the 1990s remained at play. Given this security environment, Japan embraced a three-pronged security policy of firmly maintaining the Japan-U.S. security arrangements, building up Japan's defense capability, and making active diplomatic efforts to ensure international peace and security. Japan moderately built up its defense capability during this period in accordance with the fundamental principles of maintaining an exclusively defense-oriented policy while not becoming a military power that might pose a threat to other countries. Japan remained concerned with growing regional threats to our security. Specific concerns included, North Korea’s possession of weapons of mass destruction and the means to deliver them, the possibility of a more assertive China as a result of its growing economic and military might, and an unpredictable Russia that retains possession of a vast nuclear and conventional arms stockpile.

Domestically, a progressive political movement gained popular support as a result of its reform based platform. The new party dominated the elections resulting in its members gaining majority of the seats in the Diet and occupying the seat of Prime Minister. This movement instituted drastic restructuring programs that overhauled the Cabinet and immediately passed an emergency financial bill targeted at “Short-Term Pain for Long-Term Gain”, calling for thorough and systematic changes to Japan’s economic infrastructure. The economy responded with a massive downturn, registering negative 8% GDP growth for the year closing December 2001. Despite an average GDP growth of negative 3.59%, the progressive movement maintained support, bolstered in 2005 by the government's positive growth projections for the upcoming three years.

Even though the economic situation was unfavorable, the new government strongly emphasized a credible and more self-reliant military as being critical to the successful implementation of its reforms. As a result, defense spending was maintained in the vicinity of 1% of GDP.

The new regime understood that Japan's security was being compromised by our reliance on energy import and sought to rectify the situation by focusing on economic growth, energy security, and environmental protection. The use of new energy sources was stressed and with the gradual disappearance of the nuclear allergy, renewed emphasis was placed on nuclear energy as a possible long-term solution to energy independence. Additional measures undertaken included the diversification of fossil fuel suppliers and the expanded use of liquid natural gas.

Movements toward self-reliance were also evident in the Japan Self Defense Force (JSDF). Japan developed a strategic vision encapsulated by the twin pillars of defense and deterrence. Under the pillar of defense, Japan sought to develop a force capable of responding to the full spectrum of warfare. Under this guideline, Japan continued our collaborative efforts with the US to develop ballistic missile defenses. Japan's Kongo-class destroyed fleet was retrofitted with the Navy Area Defense (NAD) capability and our Patriot PAC-2 systems are being upgraded to PAC-3 as a result of these efforts. The JSDF also developed a long-term plan to indigenously manufacture and field large numbers of long-range conventional missiles to fulfill the role of deterrence.

Japan continued to adhere to the US-Japan Security Arrangements. These agreements remained the cornerstone of Japan's defense due to both political realities and our inability to project significant levels of power. In a similar vein, Japan's defense policies remained exclusively defense oriented and adhered to the three non-nuclear principles (Japan will not possess, produce, or permit the introduction of nuclear weapons). The dismal economic climate and subsequent lower levels of defense allocation predicated the prioritization of areas for defense expenditure. The available resources were channeled to acquire more Type-03 SSMs, F-2 fighters, Kongo-class DDGs, and Osumi-class LSTs. The construction of a National Command and Control System (NCCS) also received significant funding. Research and Development expenditures were increased however, and resources were allocated toward the development of JBMD, the Type-03 SSM and unmanned aerial vehicles.

The JSDF conducted two military net assessments against North Korea and China during this epoch in order to illuminate weaknesses in our force structure. Upon examination North Korea is quantitatively superior in nearly all areas: manpower, number of air and maritime craft, armor, and missiles. When examining qualitatively a different picture emerged. Our modern aircraft and "blue water" naval fleet would preclude North Korea's ability to gain air or sea dominance over the Sea of Japan. While numerically superior, North Korean equipment was a generation or two behind that of the Japanese army. Regardless of the relative combat power of the land forces, without the support of sea and air power it is highly unlikely that the North Korean army could have attacked Japan in significant numbers during this time period. Given North Korean's inability to project large-scale forces across the Sea of Japan, it did not possess the capability to threaten the Japanese mainland by conventional means. The one area of concern was North Korean's R&D efforts into long-range ballistic missiles with possible WMD capabilities. Japan evaluated this as a weakness in our force structure and committed resources in future epochs to find a cost effective solution to this threat.

Similar to the North Korean comparison, China has far more military assets than Japan. What differs is the quality of China's high-end fighters, submarines, long-range missiles (nuclear and conventional), and C4ISR capabilities. The acquisition of MiG31s and J11s has enabled China to match Japan qualitatively and has quantitatively surpassed JASDF's fleet of current generation fighters. The actual outcome of an air war would depend on the training and competency of the pilots as well as its C4 capabilities. Both are reportedly deficient for China's Air Force and therefore the result of the battle for air superiority over East China Sea is uncertain.

The evaluation of an undersea war also proved inconclusive. Of the 63 China SS, only the six Song class and eight Kilo class are recent designs. These modern diesels and China's five SSN provide a formidable sub-surface capability. Japan also has a formidable diesel fleet and other modern ASW platforms; therefore the outcome of a sub-surface battle with China is unknown.

Although China has a large ballistic and cruise missile inventory, the majority are SRBMs and shorter-range cruise missiles, which do not have the range to reach Japan when fired from the mainland. Only 695 land-based missiles have the range to over-fly the East China Sea, comparable in number to Japan's 600 Type 3 missiles. However, this missile, presently equipped only with conventional warhead, does not constitute a deterrent to China's nuclear weapons.

Details of China's spy satellite capability are not available and hence a C4ISR comparison cannot be made. Japan's Airborne Early Warning fleet of E2Cs and E767s are assessed to be technologically superior when compared to China's Y8s and A50s.

Numerically, Japan lags far behind China in most areas and this gap will remain for the foreseeable future due to demographic and economic reasons. Japan will therefore have to leverage advanced technology to overcome China's numerical advantage to overcome quantity with quality. Japan's smaller defense budget precludes competition in all areas, therefore we must be very selective in our military investment to achieve its defense objectives. These investments must include capabilities to counter a large-scale China invasion, and cost-effective solutions to counter China's nuclear and missile capabilities.

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B. Epoch 2 (2006 ~ 2010)

1. Foreign Policy

During the past five years (2005-2010) the static security environment in East Asia has evolved into new patterns of intra-Asian and trans-Pacific relations. These relations have been driven by “reconciliation” of Taiwan and the People’s Republic of China (PRC), the growing move toward Korean reunification, and the subsequent draw down of US troops on the Korean Peninsula. The geostrategic patterns in the Asia-Pacific region remain defined by sophisticated hedging strategies on the part of the major powers in the Pacific. However, this fluid security environment is likely to congeal as uncertainty over the reunification of Korea and PRC/Taiwan consolidation has diminished.

As the region’s security picture has become more lucid, Japan has reevaluated its three-pronged security policy: firmly maintaining the Japan-U.S. security arrangements, building up Japan's defense capability, and making diplomatic efforts to ensure international peace and security. Of particular concern is the lack of sustained American focus on the region and a renewed American Eurocentrism manifested in NATO expansion and long-term obligations in Europe. While Japan acknowledges US pre-eminence, it is concerned that the US is driven more by narrow domestic interests and ideological imperatives than common goals or evident strategy. Realizing that there is no viable alternative to counter-balance Chinese power, Japan must pursue its own identity as a major power by playing more of a leadership role in the region and by relying on the U.S. security presence for stability in the short term.

The result of the evaporation of the top-down US-Japan command relationship has caused Japan to seek a more equal partnership with America. The gradual extraction of US troops from Korea in combination with the American economic slowdown has caused Japan to question the nature of American commitment to Japanese defense. The lack of American resolve in the region has forced Japan to increase its military autonomy, including clandestine efforts to develop its own nuclear umbrella.

Concurrently, Japan's assertive diplomacy must counter the declining U.S. political/military involvement in East Asia. The rejection of Japan's bid for a permanent seat on the United Nations Security Council, a pillar of its foreign policy for more than a decade, has further cemented Japanese resolve to rely on both military and economic means as springboards to international prestige. The significant domestic support for the Security Council seat provided the impetus to reinterpret Article 9 of the Japanese Constitution that prevented intervention into civil wars overseas. The removal of this constraint enabled Japan to play a more active role in international affairs.

Future Japanese policy must be made with China in mind. Particular importance must be placed on the continuation of efforts toward a Japanese-Korean rapprochement and partnership with Moscow. In the case of Korea, Japan must seek to influence the future geopolitical direction Korea pursues. With regards to relations with Russia, a range of cooperative endeavors regarding oil and gas from Sakhalin and also eventually from Irkutsk, offers Russia alternatives to strategic cooperation with China. Japan's Russia policy is part of a larger "Eurasian diplomacy" extended to Central Asia with oil and gas resources as much the objective as geopolitical positioning.

2. The International Military Situation – Overview

See section 2 page 5-5 – no significant change

3. The International Military Situation – Specific Nations

a. The Koreas

The gradual move toward Korean reunification and subsequent pressure applied by North Korea on the South for US troop withdrawals is of obvious strategic importance to Japan. American acquiescence has necessitated an American examination of other basing options in the region for the formerly Korean-based troops. Japanese domestic opinion on the current level of American troops based in Japan (10,000 troops in 2010) is fragile. American overtures toward Japanese basing options, and subsequent Japanese rejections of such proposals, have further fractured the increasingly tenuous alliance. As America examines its regional basing options, the possibility of a significant reduction of permanently based US troops in the region has forced Japan to accelerate its efforts toward military autonomy. Regardless of US military reactions to a unified Korea, Japan must evaluate the possible regional security posture of a future unified Korean state. Possible outcomes include: neutrality along Swiss lines; strategic independence; Sino-Korean alignment or continued alliance with the United States. The most likely mid-term outcome is a reconfigured US-Korean agreement with emphasis on access, logistic support, prepositioned equipment and joint training and exercising. The definitely diminished permanent presence of the US in the region validates earlier Japanese hedging strategies and facilitates Japanese reevaluation of its strategic partnership with the US.

b. China

Two decades of high levels of growth have moved China closer to its primary national goal: economic modernization. This objective is the foundation of its 21st century version of the slogan: Rich Country, Strong Army. Beijing's long-term objective is to lay the foundation for becoming a multi-dimensional great power by attaining a new level of "comprehensive national strength" – the sum of economic, technological and military power which together define a country's international standing (in their view). The peaceful reconciliation of Taiwan and the PRC will further enable the technological maturation of the Chinese economy and its military industrial complex. China's military modernization program will undoubtedly accelerate as a result of access to Taiwan's burgeoning electronics industry. The attainment of one of China's primary national objectives, the reintegration of all former Chinese lands (Hong Kong, Macao, and now Taiwan) may cause China to become more assertive in the South China Sea, eliminating what it views as one of the barriers erected by the US to contain China.

To balance its near-term economic goals and longer-term security agenda, China has evolved its own hedging strategy, one beginning with efforts to neutralize potential threats along its enormous borders. China has crafted a diplomatic strategy designed to solidify ties with its neighbors as a result of the Tiananmen tragedy and US battlegroup intervention into the Taiwan Straits. Specifically, China has normalized relations with Singapore and Indonesia, cultivated ties to other ASEAN nations (particularly to Thailand, Malaysia and Burma) and enhanced political and military/technical ties to Russia.

In light of possible Chinese expansionism in the South China Sea and definite diplomatic attempts to neutralize threats along China's borders, Japan must be doubly wary of being strategically isolated in the region. Japan must continue to cultivate positive relationships with the nations of ASEAN, Korea, and Russia and develop the appropriate military capabilities and partnerships to deal with threats to its national interests.

c. Russia

The Russia of 2010 remains in relative turmoil but is gradually recovering from its post-Soviet decline. Russian policy-makers continue to have global ambitions, but are constrained by a lack of means. This realization has caused Russia to focus primarily on regional security issues. Russia remains encircled by strategic concerns: the possible inclusion of Former Soviet Union (FSU) republics into NATO in the West; the possible expansion of Turkish influence and Islamic fundamentalism in the South; and China, Korea, and Japan in the East. The lack of inclusion into the European Union combined with the gradual withdrawal of permanent American forces from East Asia is viewed as destabilizing and has caused Russia to play regional actors against one another as a means of stabilization.

Russia's "chronic crisis" of the past twenty years (1990-2010) has brought neither a full collapse nor any real progress, but instead gridlock and a continued muddling along. Japan does not view these developments as enduring and foresees an eventually successful integration of Russia into the new international world order in the long-term. During this integration Japan foresees stable relations among the former Soviet republics and a future territorial settlement with Japan, bringing investment and trade opportunities. Russia is viewed as a possible future strategic partner for Japan, enabling Japan to check Chinese expansionism in the region and granting access to Russian natural resources.

Japan must continue to pursue policies that are favorable to both Russia and Japan to prevent the possibility of Russian alliance with either China or Korea or both.

d. United States

The period of 2005-2010 was characterized by reversal of focus by all the major regional powers. China and Japan began to contemplate external ambitions, while the United States began to focus on domestic concerns. The America of 2010 no longer has a relatively free hand to conduct international affairs. Internal pressures, namely the competition between entitlements and defense for government dollars, coupled with competing international demands has resulted in American overextension. While much continues to be made of the growing weakness of the United States, we must not exaggerate the supposed marginalization of America. There has been a clear shift in the power equilibrium, especially when compared with the last 25 to 30 years (1980-2010), when the United States was certainly the first among equals. What has happened since then is not so much that the United States has weakened but that others have grown in power. The United States is still the most powerful country in the world, and while it cannot do everything everywhere, it still maintains the capabilities to project power at places of its own choosing.

As previously stated, the gradual withdrawal of American troops from Korea and rebuffed attempts to relocate these troops in Japan have caused Japan to reevaluate its security tenets. While Japan is concerned about the lack of American resolve, we do not foresee the complete removal of American forces from the region in the near term due to American economic and security interests in the region. This being said, we must build up our military forces as a hedge against the possible security vacuum caused by US troop reductions.

4. Internal Environment

a. Domestic Political Situation

As described in Epoch 1, the Japanese people took a hard but correct (if only from hind sight) decision when they decided that the party was over and it was time to put the Japanese economy in gear again. The political evolution that took place in 2001, and the subsequent major changes that were made to the political and economic infrastructures, drastically changed the Japanese business way-of-life. Although times were hard for some years, the endurance and persistence paid dividends as the Japanese economy showed positive growth in 2005. Growth was sustained for the last five years from 2006 to 2010. The reforms and restructuring efforts addressed the roots of the economic problems and were given credit for saving and redeeming the Japanese economy from the four-year recession from 2001 to 2004.

The “Short-Term Pain for Long-Term Gain” strategy adopted by the government paid dividends as the resilient Japanese economy rebounded from the previous years of negative growth to register six straight years of positive and unprecedented sustained growth. Such a prompt recovery, although not without pain, gave the Japanese people renewed confidence in the government, and endorsed and reaffirmed its stewardship for the longer term.

Deregulation in the finance, telecommunications, distribution, electricity, and transportation sectors were accepted and formed the baseline for the new economic boom for Japan. The new economic infrastructures improved the efficiency of the Japanese economy and re-generated private-demand within the domestic market that was critical to the sustenance of longer-term economic growth. The success of the economic reforms renewed foreign confidence and interest in Japan again. New businesses and capital began pouring into Japan once more. These further boosted private demand and the government was now able to move away from using public spending to maintain the economy.

Succumbing to unification pressures by North Korea on South Korea to ask the United States to withdraw its forces from the Korean Peninsular, the United States announced in 2006 that it would reduce forces to 50% of the pre-existing levels by 2015. Although there were pressures by the United States for Japan to allow and indeed pay for basing the troops withdrawn from South Korean to be re-located in Okinawa, strong domestic political objections in Japan and the poor economic situation of the last five years did not allow acceptance by the Japanese government. With subsequent slowdown in growth and strong competition for resources at home, the United States slowly began relocating these troops back to the United States.

The Japanese government projected that one day in the near future, the United States would eventually withdraw its forces from Japan and thereby leave Japan to fend for itself militarily. The developments on the Korean Peninsula provided the catalyst for the Japanese to begin re-interpreting Article 9 of the Japanese Constitution, and re-examining Japanese options for increasing its autonomous military capabilities for the defense of the Japanese homeland, as well as the protection of the Sea Lines Of Communications (SLOCs). At the same time, Japanese concerns for North Korea's ballistic missile capability and nuclear programs, coupled with the possible integration of launching technology from South Korea in the event of a Korean unification prompted renewed debates on Japan's adherence to the three non-nuclear principles.

b. Economic Performance

After nearly five years of contraction in Epoch 1, the Japanese economy finally pulled itself out and recorded its highest growth in the new millennium, averaging an annual positive 5.2% growth from 2006 to 2010. This translated into an average annual GDP of ¥479 trillion, and an average per capita GDP of ¥3.74 million, with the highest growth of 8.1% recorded for the year closing December 2008. Although substantial, this high annual average was still below the ¥497 trillion GDP of 2000. In effect, the recession early in the millennium has set the Japanese back almost a decade, and it was only in 2009 that the Japanese surpassed the 2000 GDP level.

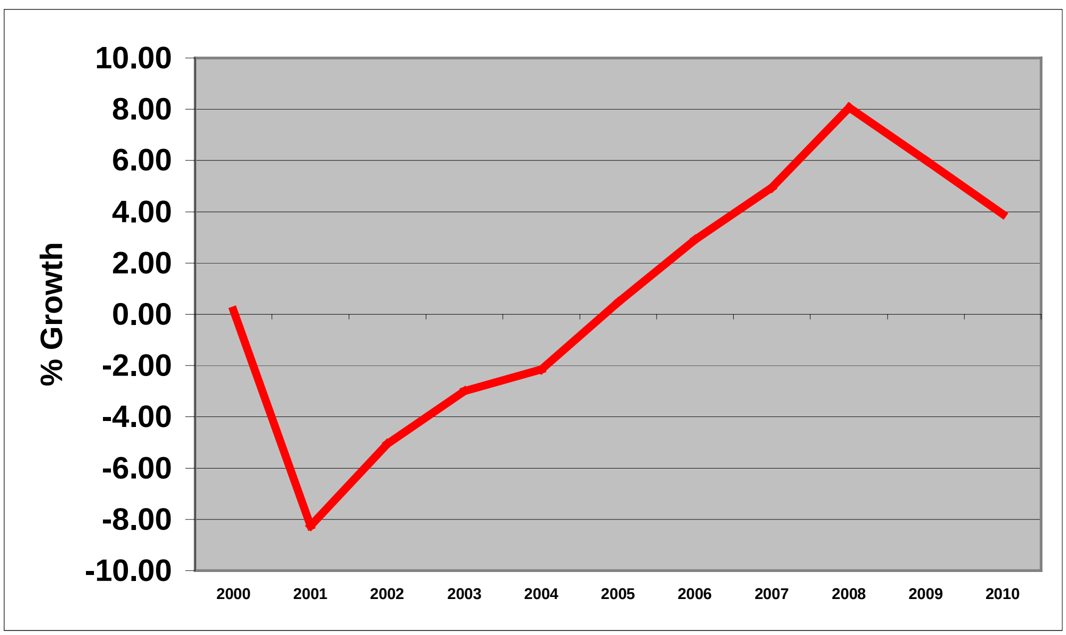

Chart 5-8: GDP Growth from 2000 to 2010

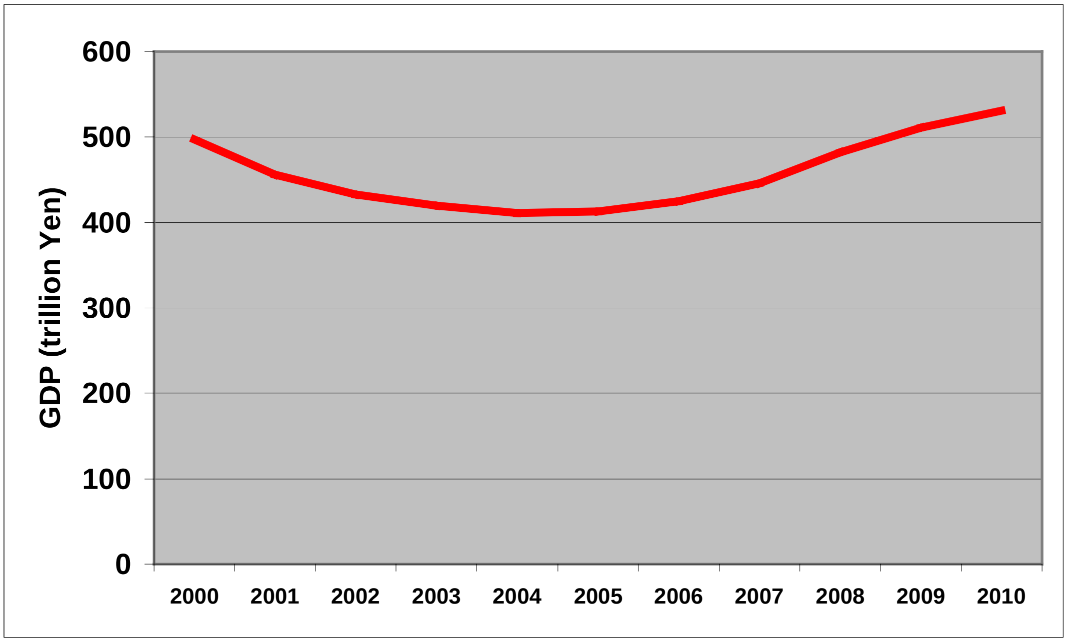

Chart 5-9: Absolute GDP for the 2000 to 2010

c. Defense Spending

With mixed signals by the United States in South Korea, the Japanese government continued its emphasis on defense and advocated the idea of a more autonomous Japanese military capability. Although the economy recovered from recession and enjoyed six years of positive growth, the defense spending continued to be pegged very close to 1% GDP for each of the five years. The result was a total of ¥23.91 trillion spent on defense for the five years, or an average annual spending of ¥4.78 trillion, representing a 12% average increase over the last five years. Although a substantial increase, this was still below the ¥4.92 trillion spent on defense in 2000.

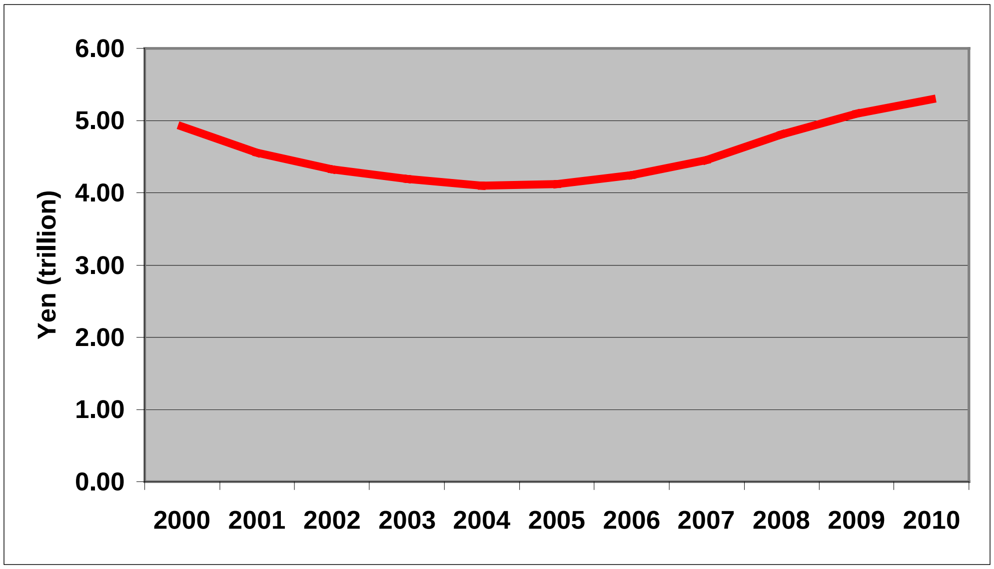

Chart 5-10: Absolute Defense Expenditure from 2000 to 2010

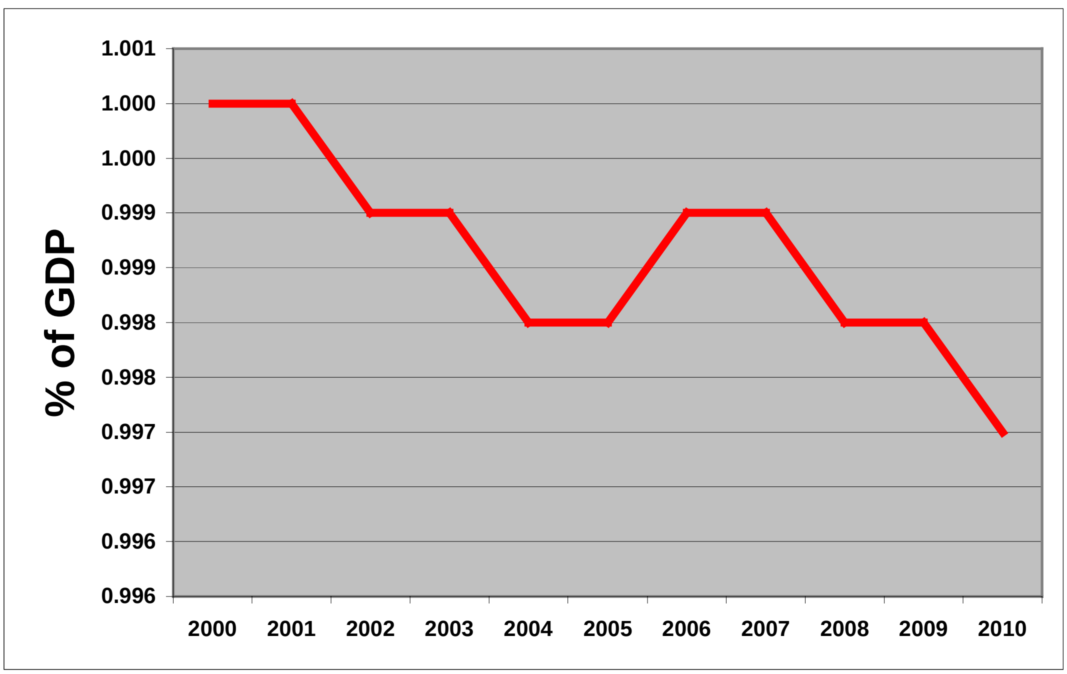

Chart 5-11: Defense Expenditure as a Ratio of GDP from 2000 to 2010

d. Demographics

The aging population problem continued to plaque Japan. The government continued to leverage technology towards a capital-intensive Japanese economy. While continuing the controlled import of skilled and unskilled workers, the government raised the retirement age from 65 to 70 years old, bringing the total workforce in 2010 from 81 million to 89 million. This was only an interim measure as the population continued to age.

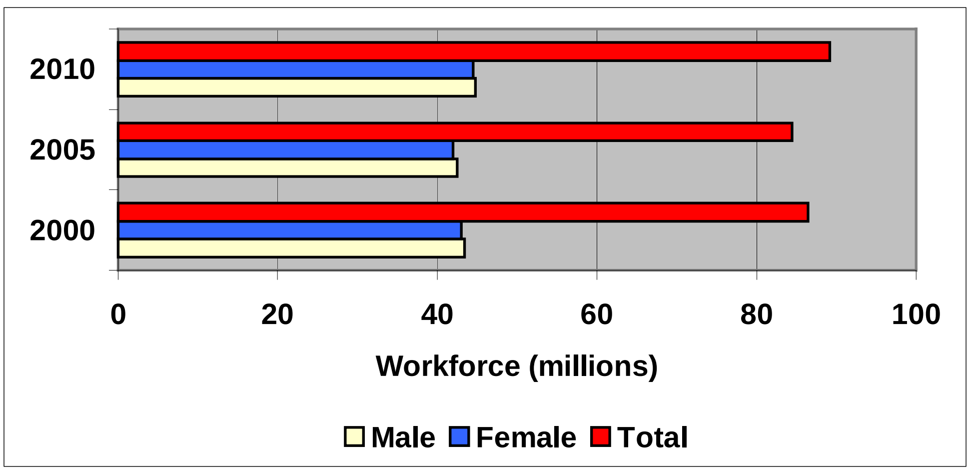

Chart 5-12: Comparison of National Labor Force for 2000, 2005 and 2010

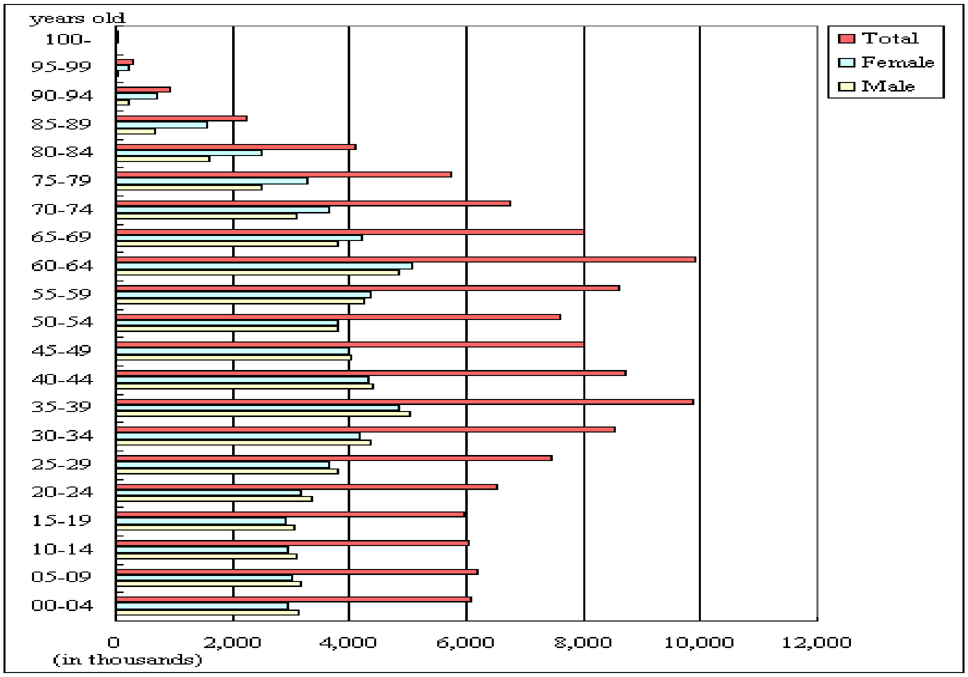

Chart 5-13: Population Distribution in 2010 (Chart obtained from

http://jinjapan/org/stat/stats)

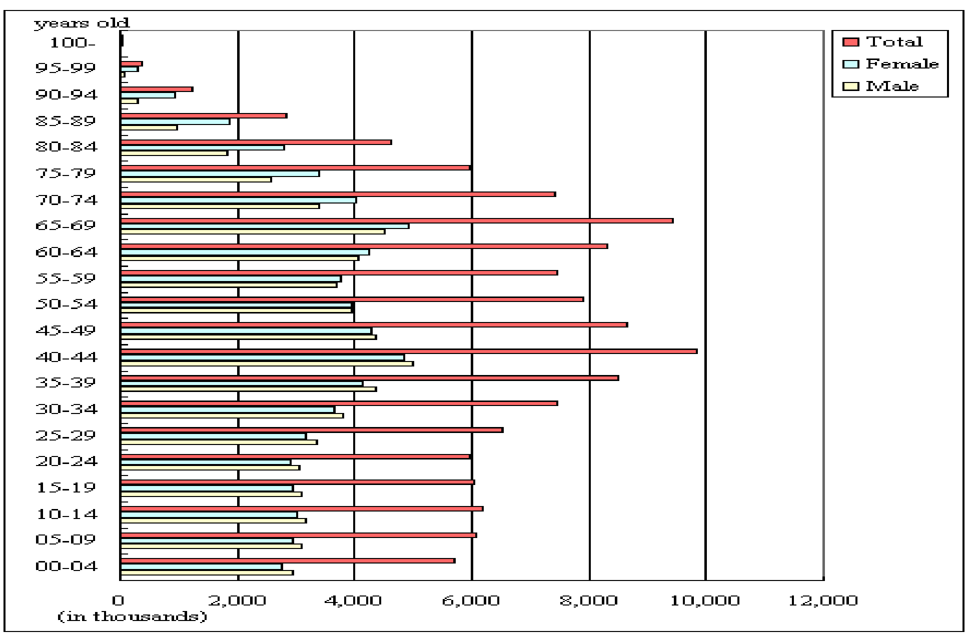

Chart 5-14: Population Distribution Trend

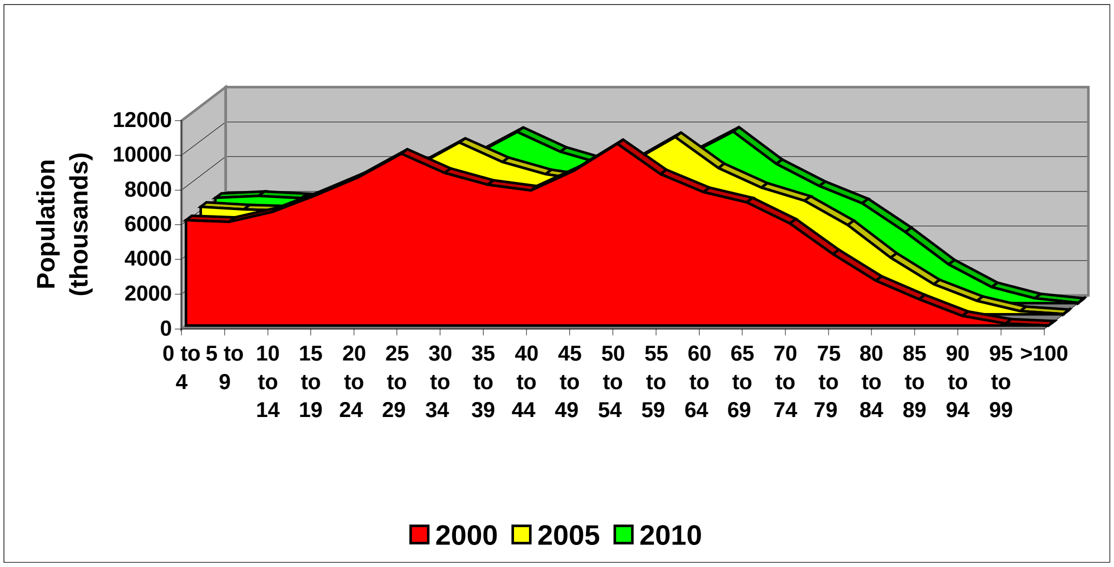

Chart 5-15: Projected Population Distribution in 2010 (Chart obtained from http://jinjapan/org/stat/stats)

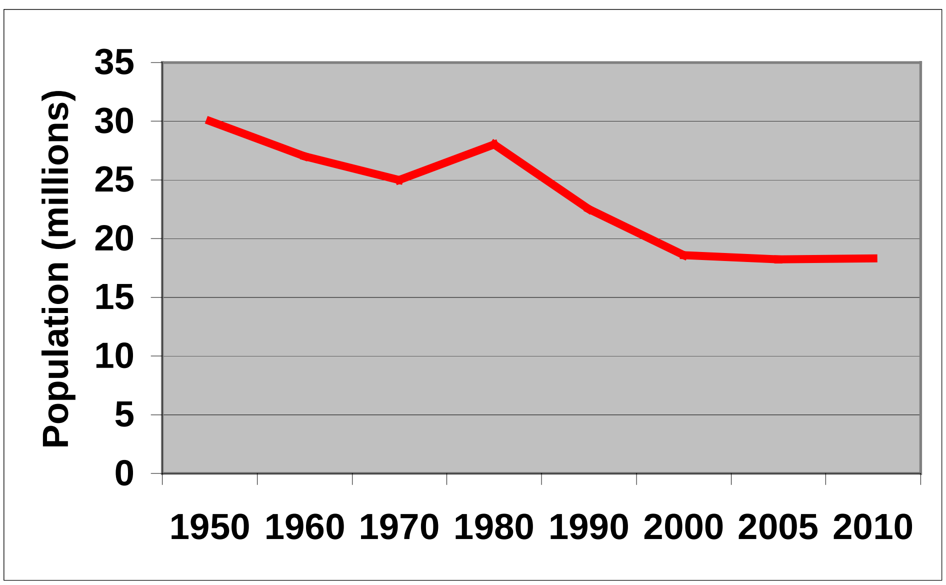

Chart 5-16: Children Population from 1950 to 2010

e. Energy Supplies

Japan's lack of significant domestic sources of energy continued to be a challenge especially now that the economy has picked up. The focus on adapting the Japanese economic, industrial and domestic infrastructures of the past ten years has begun to show effects on Japan's energy consumption patterns. In terms of the breakdown in consumption of energy, about half of Japan's total energy was used by industry, while about a quarter was used for the purposes of transportation and the rest by the residential, agricultural and service sectors. Japan continued to consume about 5.5[1] billion barrels a day, with most of its imports coming from the Middle East. Japan has diversified its dependence on crude oil import from its major sources[2] (United Arab Emirates, Saudi Arabia, Kuwait, Iran, Qatar and Indonesia) to other oil fields in Central Asia, Alaska, the South China Sea and even Australia. These are viable alternative sources of energy, but the Japanese economy remained vulnerable to the global competition for these resources. . Therefore Japan continued its quest to move away from the strong reliance on the import of energy sources, aiming for zero-growth in Japan's energy consumption by 2020.

The overland (oil and gas) pipeline from Central Asia (the Irkutsk Region), past Ulaanbaatar, across Mongolia and northern China to Beijing, into the Korean Peninsular and via a subsea route into Japan, provided an alternative supply to Japan. Phase I of the efforts to restructure its industrial and economic infrastructures for energy conservation

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[1] Provided by the Energy Information Administration (http://www.eia.doe.gov/emeu/cabs/japan.html). This was the 1999 estimation for Japan's energy consumption. Based on the economic downturn early in the millennium which reduced Japan's consumption of energy, as well as the results of Japan's investment in adapting and restructuring its economic, industrial and residential infrastructures for new energy sources,

and for use of new energy sources[3] was also completed in 2007, substantially contributing to the reduction in Japan's dependence on the import of oil.

Back in 1998, Japan already had thirty-six operating nuclear reactors, providing the installed capacity for the generation of 44 gigawatts of energy, ranking Japan third in the world behind the United States and France[4]. However, in terms of percentage of nuclear power used in the generation of electricity for domestic use, nuclear power contributed only 20%[5] of the total electricity capacity of Japan. This is comparable to the United States 19% but is small compared to the 77% in France. With the passing of the last of the WW II generation of Japanese and the nuclear-allergy that had plagued Japan for a long time, Japan plans to construct another 15 more nuclear reactors. The Japan Atomic Energy Research Institute (JAERI) proposed the development of a self-sustaining plutonium-based nuclear power industry that includes breeder[6] reactors and a complete plutonium fuel-cycle processing capability. It is expected that the result of such an activity will create a large stockpile of refined plutonium, a stockpile that is expected to amount to 45-90 tons[7].

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this figure remained a good estimate for the consumption of energy for 2010, after the economy has recovered.

[2] http://www.eia.doe.gov/emeu/cabs/japan.html

[3] New energy sources refer to sources like solar power, hydropower, geothermal power, wind power, etc.

[4] http://www.iea.org/statist/keyworld/p_0106.htm

[5] These are 1999 figures obtained from http://www.icc.ru/fed/kovykt.html. The rest of the electricity being generated by: LNG-22%, coal-10%, oil-27%, and hydro-21%.

[6] A breeder reactor is a fast neutron reactor that is capable of producing more plutonium fuel than the uranium fuel it burns. The process involves the burning of the U-235 in electric power producing reactor, reprocessing the spent fuel to recover the residual U-235 and Pu-239 for use in subsequent reactors, Essentially, it converts waste U-235 into Pu-239. This implies that 100-times as much energy can be obtained from the same amount of raw fuel. Source – The Changing Need for a Nuclear Reactor by Richard Wilson (http://www.uilondon.org/uilondon/uilondon/sym/1999/wilson.htm)

[7] http://www.fas.org/spp/starwars/advocate/ifpa/report696_ch3.htm

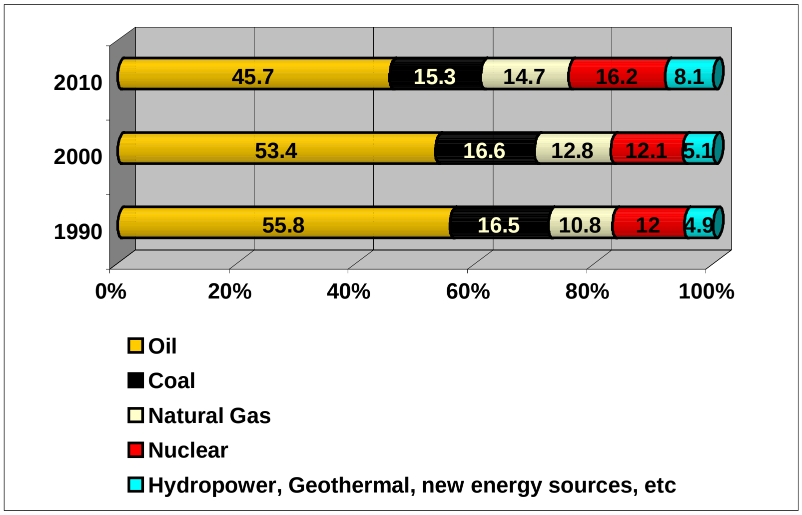

Chart 5-17: Primary Energy Supply Sources (1990 and 2000 data from http://jin.jcic.or.jp/access/energy/profile.html)

Primary Fuel Types	Major Importing Countries
Oil	United Arab Emirates, Saudi Arabia, Kuwait, Qatar and China
Natural Gas	Southeast Asia (mainly Indonesia and Malaysia)
Coal	Australia, South Africa, United States and China

Table 5-9: Major Importing Countries for Japan's Primary Energy Supplies (http://www.eia.doe.gov/emeu/cabs/japan.html)

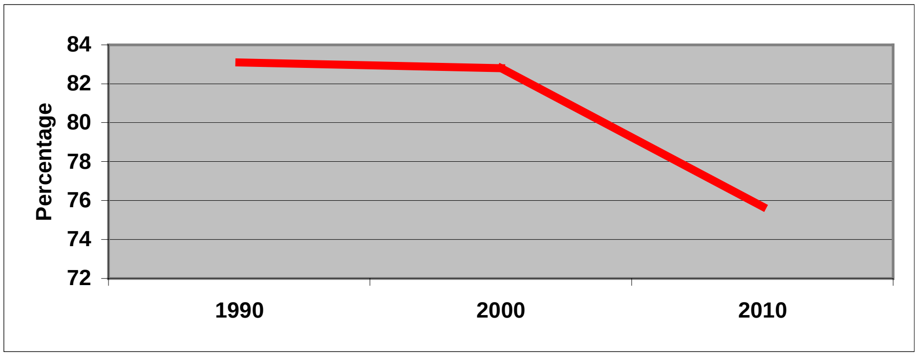

Chart 5-18: Import of Energy for 1990, 2000 and 2010

5. Japan Self-Defense Force

a. Introduction

The call for unification in the Korea Peninsula warranted the withdrawal of US troops in South Korea. Although the number of troops trimmed by the US was not very significant over the last five years, nonetheless, it cast some doubts as to the US commitment in the Pacific Rim in the near future. This prompted Japan to begin to think about self-sufficiency rather reliance on the US for its security.

b. Principal Considerations for Force Planning

The principal considerations remained the same as the first epoch. Internally, the Japan Self-Defense Force had begun reviewing the scope of the US-Japan Security Arrangement for potential amendments.

c. Japan Defense Strategy & Policy

There was no change to the Defense Strategy and Policy. However, the lack of significant progress in the development of NTWD and THAAD systems shifted the emphasis to deterrence rather than defensive capabilities.

d. Defense Expenditure

As the Japan economy was recovering from the short-term pain, long-term gain policy, there was a consequent increase of 12.4% in military expenditure as compared to the first epoch. There was a sharp drop in R&D as Japan reviewed its commitment to the

BMD research with the US. Much of the funding was channeled to equipment acquisition that now totaled 17% of military expenditure.

S/No	Item	Epoch 1 Average (Billion ¥)	Epoch 2 Total (Billion ¥)	%	Yearly Average (Billion ¥)	% Change (cf: Epoch 1)
1	Personnel & Provision	2,070.0	10,878.0	45.4%	2,175.6	5.1%
2	Maintenance	830.8	4,298.0	17.9%	859.6	3.5%
3	Facilities	170.0	913.0	3.8%	182.6	7.4%
4	**R&D**	**123.0**	**525.0**	**2.2%**	**105.0**	**-14.6%**
5	**Equipment Acquisition**	**491.6**	**4,075.0**	**17.0%**	**815.0**	**65.8%**
6	Others	580.0	3,260.0	13.6%	652.0	12.4%
	Total	**4,265.4**	**23,949.0**	**100.0%**	**4,789.8**	**12.3%**

Table 5-10: Defense expenditure for 2006 to 2010

e. Defense Research & Development Programs

A total of ¥525 billion was spent over the last 5 years on R & D. Table 5-11 shows the major R&D programs for the JSDF. The commitment to missile defense programs R&D was about ¥50 billion. The EU-2, the second in the series of UAV was completed and production started in 2007. Meanwhile, Japan embarked on a program for a strike UAV and ICBM. We were also pursuing a more advanced seeker for missiles so as to home on the new-generation stealth ship.

S/No	Item	Amount (Million ¥)	Remarks
1	Type-XX ICBM	20,000	In progress.
2	Ballistic Missile Defense System	30,000	In progress.
3	SM3 Missile for NTWD	10,000	In progress.
4	BMC3I	10,000	In progress.
5	National C2 System	20,000	Upgrading.
6	UF-3X	30,000	In progress.
7	EU-2 (HAE UAV)	25,000	Completed, production in 2007.
	Total	145,000	
8	Others	380,000	
	Grand Total	525,000	

Table 5-11: Main R & D Programs

f. Key Defense Systems

In this epoch, the only new weapon system that was phased into operation was the EU-2.

The EU-2 was designed as a high altitude and long endurance UAV. It was indigenously manufactured by Fuji Heavy Industries. It essentially functioned as a pseudo satellite that cost about ¥ 6 billion a copy. Speeding across the airspace at 300 knots and with an endurance of 60 hours, the EU-1 could operate as far out as 5,000 nm and still had an on station time in excess of one day. Flying at an altitude of 100,000 ft, EU-2’s sensors would have an operating range of at least 300 nm. Another key mission for EU-2 would be to serve as communication relay for the ships or aircrafts (e.g. EU-1). This was important so that all the essential information would be able to pipe back to the NCCS for a consistent battlefield picture.

<table>
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- Endurance: 60hrs
- Cruise Speed: 300kts
- Payload: 3000lbs
- Power: 80kW
- Altitude: 100kft
- C4ISR:
    - Electro-Optics
    - SIGINT
    - SAR
    - Air Search Radar
    - Comms relay
    - Pseudo Satellite

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Figure 5-5: EU-2

g. National Defense Program Outline

The National Defense Program Outline (NDPO) that laid out the long-term, steady state order of battle for the various Services was last reviewed in 2001. The end-state, at the end of another five-year mid-term review at 2010, was shown in Table 5-12.

Classification		2001 NDPO	At End of Revised Mid-Term Defense Program (2010)
Manpower	GSDF (Regular)	145,000	Approx. 150,000
	GSDF (Reserve)	25,000	Approx. 20,000
	MSDF	50,000	Approx. 47,500
	ASDF	50,000	Approx. 48,900
	Joint Staff	2,000	Approx. 1,800
	Total (Active)	247,000	Approx. 248,200
	Grand Total	272,000	Approx. 268,200
GSDF	Division	8 Infantry Division 1 Armored Division	9 Infantry Division 1 Armored Division
	Brigade	6 Infantry Brigade 1 Airborne Brigade 1 Helicopter Brigade 1 Amphibious Brigade	6 Infantry Brigade 1 Airborne Brigade 1 Helicopter Brigade 1 Amphibious Brigade
	Tank	Approx 1000	Approx 1030
	Artillery	Approx 1000	Approx 1000
MSDF	Destroyer	60	57
	Submarine	20	19
	Combat Aircraft	200	Approx 210
ASDF	Fighter	400	Approx 330
	UAV	Approx 50	7

Table 5-12: 2010 Mid-Term Review of Defense Program

Within the JSDF, there was a flow of active manpower posts from the ground forces to the other services. The GSDF continued to downsize its active forces and increase its reserve order of battle. The rest of the Services saw little change.

The subsequent sections will describe the changes to the various Services. Main missile systems and C4ISR systems are discussed separately.

h. Ground Self Defense Force (GSDF)

			Epoch 2 (2006 ~ 2010)			
S/No	**Item**	**2005 Qty**	**Acquire/ Build-up**	**Upgrade**	**Retire/ Close down**	**2010 Qty**
1	Infantry/Combined Div	10			1	9
2	Infantry Bde	4	2			6
3	Armored Div	1				1
4	Heliborne Bde	1				1
5	Airborne Bde	1				1
6	Amphibious Bde	1				1
7	Tanks	1,135		100		1,135
8	APC	795	25	100		820
9	Artillery (155mm SP)	831			100	731
10	MLRS	178	100			278
11	Attack Helicopters	88	5		5	88
12	Other Helicopters	424	5		5	424

Table 5-13: Major GSDF Order of Battle

The major change was in the GSDF was the restructuring of another infantry division to form two more independent brigades. There was also an on-going digitization program and replacement of the 155mm artillery with MLRS.

i. Maritime Self Defense Force (MSDF)

			Epoch 2 (2006 ~ 2010)			
S/No	**Item**	**2005 Qty**	**Acquire/ Build-up**	**Upgrade**	**Retire/ Close down**	**2010 Qty**
1	Kongo & DD21	4	6			13
2	Other DDs	53			3	47
3	Submarine (SS)	18	2		1	20
4	Mine warfare ship (MSC)	37	2		1	39
5	Landing Ship (LST)	11	3			17
6	P3C (Fixed wing patrol)	100		15	15	85
7	HSS-2B (Patrol)	36				36
8	MH-53E (Mine sweeping)	10				10
9	SM3 Missile (NTWD)	0				0
10	SH-60J (anti-sub)	78	3		2	79

Table 5-14: Major MSDF Order of Battle

The MSDF continued its modernization effort of the fleet. It now had 13 Kongo-class destroyers and 20 submarines. The P3C was starting to be phased out and was being replaced by UAVs.

j. Air Self-Defense Force (ASDF)

			Epoch 2 (2006 ~ 2010)			
S/No	**Item**	**2005 Qty**	**Acquire/ Build-up**	**Upgrade**	**Retire/ Close down**	**2010 Qty**
1	F-15 (J/DJ)	203				203
2	F-22	0	50			50
3	F-1	52			17	35
4	F-2	75	25			100
5	F-4/RF-4 (E/EJ)	133			50	83
6	C-1	28				28
7	C-130H	16				16
8	CH-47J (Transport)	29	10			39
9	KC-135	5	5			10

Table 5-15: Major ASDF Order of Battle

There were significant changes in the ASDF. We brought in the new F-22 fighters with the intention to phase out the F-15 later. We also increased the fleet of F-2 to 100 and downsized the F/RF-4 squadrons. The CH-47 was increased to 39 as the main provider of airlift capabilities. To extent the reach of the fighters, more KC-135 were also being procured.

k. Major Missile Systems

			Epoch 2 (2006 ~ 2010)			
S/No	**Item**	**2005 Qty**	**Acquire/ Build-up**	**Upgrade**	**Retire/ Close down**	**2010 Qty**
1	Patriot PAC-3 FU Upgrading	120		60		120
2	I-HAWK Upgrading (in group)	192		2		192
3	Type-88 TEL (c/w 6 missile ea)	80				80
4	Type-03 TEL (6 missile ea)	100	450			550
5	Type-03 Missile	1,000	4,500			5,500

Table 5-16: Major Missile Systems

The upgrading programs for Patriot and I-Hawk continued from the last epoch. The shift towards a more aggressive deterrent capability was visible through the procurement of additional 450 Type-03 TELs. Japan would have a total of 5,500 Type-03 missiles in inventory. There would be more growth in this area.

l. Major C4ISR Systems

			Epoch 2 (2006 ~ 2010)			
S/No	**Item**	**2005 Qty**	**Acquire/ Build-up**	**Upgrade**	**Retire/ Close down**	**2010 Qty**
1	EU-1 (Low observable)	7	15			22
2	EU-2 (HAE)	0	18			18
3	E-2C	13				13
4	E-767	4				4
5	Info Gathering Satellite	4	6		2	8
6	IW Platoon (30-men)	1	1			2

Table 5-17: Major C4ISR Systems

Japan continued to enlarge its fleet of UAVs. The new EU-2 was rolled out in 2007 and 18 aircrafts were procured. We also acquired 15 more EU-1. The number of spy satellites was also doubled to eight. The intention was to bring the number to 16 so that the revisit time of any particular spot of the earth could be reduced to one day.

6. Static Net Assessment - Japan Versus North Korea

In this section, the static assessment between Japan's forces and North Korean forces is presented. Details of Japan's forces can be found in the previous chapter. Refer to the Korean Team's submission for details of North Korea Force Structure for 2010. The data presented in this section has been reorganized and aggregated to provide a more focused comparison.

a. Manpower

Japan	North Korea
Joint: 1,800 (1,600) Army: 170,000 (168,000) Navy: 47,500 (46,500) Air Force: 48,900 (48,300)	No reliable figures available for 2010 Army: (1,140,000 + 600,000 Reserves) Navy: (46,000 + 65,000 Reserves) Air Force: (86,000)
Total: 268,200 (264,400)	**Total: (1,937,000)**

(Figures in parenthesis denote figures for previous epoch)

Over the last five years, the North Korean military underwent drastic cuts in manpower. While reliable figures are not available, our intelligence was able to determine that the North Korean army demobilized 20 of its 117 divisions. Even so, the total JSDF manpower remains one order of magnitude smaller than that of North Korea. Due to economic and demographic reasons, it is not possible for Japan to significantly increase the manpower of its armed forces.

b. Air Force

Japan	North Korea
203 (203) F15 50 (0) F22 35 (52) F1 100 (75) F2 83 (133) F4/RF4 28 (28) C1 16 (16) C130 39 (29) CH47 10 (5) KC135 AAR	35 (35) MiG 29 206 (206) Lower-end Fighters 80 (80) Bomber 321 (321) Attack 304 (304) Fixed Wing Transport 275 (275) Helicopters

There has been no significant change to the North Korean Air Force and it mainly comprises lower-end[8] or older aircraft. The only modern fighter in their inventory is the 35 MiG29s. This should not pose much problem to Japan's 50 F22s and 203 F15s. In short, the capability gap between the two Korean Air Forces has actually increased over the last five years. Hence, JASDF should not face much opposition when operating outside the coverage of North Korean's land-based SAM systems, including the airspace over the Sea of Japan.

[8] In this section, "lower-end" is used to refer to military equipment with a capability (for which they have been designed) that is at the lower end of the spectrum. This term is relative and time sensitive. For example, a fighter aircraft that is considered state-of-the-art in 1960 would have become obsolete by 1990 and hence referred to as a "low-end" fighter in 1990.

c. Navy

	Japan	North Korea
Surface Combatants	13 (7) Kongo 47 (50) Other DDGs 3 Missile Patrol Craft Maritime Safety Agency: 13/46 Lg/Med Patrol Vessel 38 Patrol Craft 81 Coastal Patrol Craft 180 Coastal/Rescue Craft	48 (48) Missile Armed Ships (3 FF, 45 PC) 403 (403) Other small non-missile armed ships
Submarines	20 (19) SS	2 (0) Kilo Class 21 (21) Romeo Class 67 (71) Other lower end boats
Mine Warfare	39 (38)	24 (24)
Amphibious	17 (14) LSTs	35 (35) LSTs 231 (231) Others (LCPs etc)
Aircraft	85 (100) P3C 79 (78) ASW Helicopters 46 (46) Others	12 (12) Maritime Patrol Aircraft 10 (10) ASW Helicopters

Over the last five years, the only addition to the North Korean Navy is the acquisition of the two Kilo-class submarines. North Korea's surface fleet consists mainly of lower-end frigates and missile crafts, each with two to four missiles. It is clear from the above table that the North Korean Navy is no match for the modern Japanese Navy in a force-on-force confrontation in open waters. The inclusion of air power into consideration only serves to exacerbate the imbalance.

d. Army

	Japan	North Korea
Tanks	1135 (1135) MBTs	2800 (3500) Tanks
APC	820 (795)	2000 (2500)
Artillery	731 (831)	7325 (8200)
MLRS	278 (178)	2000 (2300)
Attack Helicopters	88 (88)	40 (50)

Over the last five years, no new equipment has been acquired. Instead, a substantial amount has been decommissioned. While still numerically superior, North Korean equipment is mostly a generation or two behind the modern equipment of the Japanese army. But regardless of the relative combat power of the land forces, without the support of sea and air power, it is highly unlikely that the North Korean ground force can attack Japan in significant numbers. Nor does Japan's policy of deterrence require invasion of North Korea

e. Missiles

	Japan	North Korea
Strike	550 (100) Type 03 TELs (6 missiles per TEL) 80 (80) Type 88 TELs (6 missiles per TEL)	100 Scud B 150 (150) Hwasong 5 250 (250) Hwasong 6 120 (80) Nodong 1/2 50 (25) Taepo Dong 1/2 may have 3 to 6 nuclear weapons
Air Defense	120 (120) Patriot FU (40 PAC2 and 80 PAC3) 192 (192) I-HAWK FU	3,000 (5,500) SAMs

The majority of North Korean missiles do not have the range to hit Japan. Of concern is North Korean's deployment of long-range ballistic missiles, such as the Nodong and Taepo Dong. While the quantity and accuracy of these missiles may not pose a serious threat to Japan's military, it may be used as a weapon of terror against the Japanese population. In addition, it is now known that they have enough plutonium to built three to six nuclear weapons. The Japanese Type 3 missiles have the range to hit anywhere in North Korea. While they are presently equipped only with conventional warhead and are not a direct deterrent to the North Korean nuclear weapons, they serve as a pre-emptive strike capability to remove the Nodong and Taepo Dong threat on the ground.

f. C4ISR

Japan	**North Korea**
8 (4) IMINT Satellites 60 (30)-person Computer Warfare Team 22 (7) EU-1 18 (0) EU-2 13 (13) E2C 4 (4) E767 National C2 System	No AEW No MPA

Details of the North Korean C4ISR capabilities are not known. However, the reader could assume that they were not technologically advanced. However, it is assumed that they have the means to procure commercially available services such as satellite images, satellite communications etc.

g. Summary (Japan versus North Korea)

The relative military strengths of the two countries have not changed significantly over the five years. Overall, given North Korean's inability to project large forces across the Sea of Japan, it does not pose a conventional military threat to Japan. The only significant capability is North Korean's investment in long-range ballistic missiles with WMD capabilities. Japan will commit resources in future epochs to find a cost-effective solution to this threat.

7. Static Net Assessment - Japan Versus China

In this section, the static assessment between Japan's forces and China's forces is presented. Details of Japan's forces can be found in the previous chapter. The data presented has been reorganized and aggregated to provide a meaningful comparison.

a. Manpower

Japan	**China**
Joint: 1,800 (1,600) Army: 170,000 (168,000) Navy: 47,500 (46,500) Air Force: 48,900 (48,300)	PLA: 1,780,000 (1,928,000) Rapid Reaction: 70,000 (55,000) Navy: 300,000 (280,000) Marines: 13,000 (10,000) Special Forces: 12,000 (7,000) Intelligence: 4,000 (3,000)
Total: 268,200 (264,400)	**Total: 2,179,000 (2,283,000)**

Over the last five years, while China has made cuts in the overall manpower requirements, the numbers of the rapid reaction force, marines and special forces has increased. The total JSDF manpower is one order of magnitude smaller than that of China. Due to economic and demographic reasons, it is not possible for Japan to significantly increase the manpower of its armed forces.

Operationally, (as shall be seen in the air and naval order of battle), Chinese sealift capability has not increased significantly over the last five years, and is assessed able to project no more than 20,000 troops and their airlift capability no more than 12,000[9], a small fraction of the total PLA order of battle.

Qualitatively, although PLA personnel are generally well trained in basic skills, their leadership, training in combined operations and morale is low. Most soldiers are poorly educated and one-third leave active duty each year. There is also no professional NCO corps[10].

b. Air Force

Japan	China
203 (203) F15	10 (0) J12
50 (0) F22	300 (200) MiG31
35 (52) F1	335 (298) J11
100 (75) F2	200 (100) J10
83 (133) F4/RF4	1500 (2253) Lower-end fighters/attack
28 (28) C1	120 (235) Long-range Bombers
16 (16) C130	68 (58) Heavy/Medium Lift FW Transport
39 (29) CH47	155 (264) Light FW Transport
10 (5) KC135 AAR	10 (10) AAR
	316 (224) Helicopters

The majority of China's over 2000 fighters are lower-end aircraft. But with the inclusion of MiG31s and J11s in the last 10 years, China has caught up with Japan's F15s qualitatively and has quantitatively surpassed JASDF's fleet of current generation fighters. In terms of advanced fighters, JASDF's F22 fleet is significantly larger than that of China's J12 fleet. But the actual outcome of an air war would depend very much on the training and competency of the pilots as well as its C4 capabilities. Both are

[9] Extrapolated based on assessment by http://www.brookings.edu/views/articles/ohanlon/2000fall_IS.pdf.
[10] http://www.fas.org/nuke/guide/china/agency/pla-intro.htm

reportedly deficient for China's Air Force[11]. Hence the result of the battle for air superiority over East China Sea is uncertain.

c. Navy

	Japan	China
Surface Combatants	13 (7) Kongo DDGs 47 (50) Other Destroyers 3 Missile Patrol Craft Maritime Safety Agency: 13/46 Lg/Med Patrol Vessel 38 Patrol Craft 81 Coastal Patrol Craft 180 Coastal/Rescue Craft	35 (27) Destroyers 46 (41) Frigates 166 (149) other lower end Missile Craft 60 (70) Torpedo Craft 30 (30) Speed Boats
Submarines	20 (19) SS	63 (63) SS 5 (5) SSN 2 (1) SSBN
Mine Warfare	39 (38)	83 (83)
Amphibious	17 (14) LSTs	26 (26) LSTs 66 (66) lower capacity craft
Aircraft	85 (100) P3C 79 (78) ASW Helicopters 46 (46) Others	See "Air Force"

China's surface fleet consists mainly of lower end destroyers, frigates and missile crafts, each with four to eight SSMs and up to eight SAMs. The total missile capacity of all surface combatants is estimated to be about 1,408 SSMs and 480 SAMs spread over 247 ships, or about 7.6 missiles per ship. In contrast, while the Japanese surface fleet is numerically inferior, it is technologically modern and carries missiles of far longer range. For example, the 13 Kongo-class DDGs have a total missile capacity of 1,274, a number comparable to the missile capacity of the entire China's surface fleet. Furthermore, the

[11] http://www.rand.org/publications/MR/MR580/mr580.html

Japan surface fleet is supported by a large number of surveillance and ASW aircraft. Overall, JMSDF has the edge in surface warfare.

Of the 63 China SS, only the 10 Song-class and 10 Kilo-class are of more recent designs. These, together with the five SSN provide China with a more superior sub-surface capability. However, with the 20 modern SS and ASW capabilities of its destroyers and aircraft, JMSDF should be able to maintain a very slight edge in an open-ocean naval battle.

d. Missiles

	Japan	**China**
Strike	550 (100) Type 03 TELs (6 missiles per TEL) 80 (80) Type 88 TELs (6 missiles per TEL)	980 (900) SRBM 90 (60) MRBM 65 (90) IRBM 62 (45) ICBM 110 (84) SLBM (with 2 SSBN) 5805 (5700) ASCM 800 (500) Tomahawk Equivalent 2200 (1700) other shorter range LACM
Air Defense	120 (120) Patriot FU (40 PAC2 and 80 PAC3) 192 (192) I-HAWK FU	46 (25) Long Range SAM Bns 45 (20) Short Range SAM Bns

Although China has a large ballistic and cruise missile inventory, the majority are SRBMs and shorter-range cruise missiles, which do not have the range to reach Japan when fired from the mainland. Only 1017 land-based missiles have the range to overfly the East China Sea. While Japan also has long-range cruise missiles, these are presently equipped only with conventional warhead and hence do not directly constitute a deterrent to China's nuclear weapons.

In the last five years, Japan has vastly increased its Type 3 TEL fleet. The 550 mobile land-based Type 3 TELs will play a big role in the defense against a scenario of a China large-scale invasion. With no clear winners in the comparison between air and naval combatants, the Type 3 missiles will provide the additional firepower necessary to tilt the balance in JSDF's favor in a defensive scenario. Should China conduct an all-out invasion, a large Type 3 TEL fleet will ensure a complete destruction of all the forces afloat.

e. C4ISR

Japan	**China**
8 (4) IMINT Satellites 60 (30)-person Computer Warfare Team 22 (7) EU-1 18 (0) EU-2 13 (13) E2C 4 (4) E767 National C2 System	16 (14) IMINT/EW Satellites 16 (16) AEWCC

Details of China's spy satellite capability are not available and hence a comparison cannot be made. Japan's Airborne Early Warning fleet of E2Cs and E767s are assessed to be technologically superior as compared to China's Y8s and A50s. In addition, Japan has invested heavily on unmanned platform and has thus far deployed 40 C4ISR UAVs.

f. Summary (Japan versus China)

In the last five years both sides have continued to increase their inventories of modern military equipment. Numerically, Japan continues to lag far behind in most areas and this gap can never be bridged due to demographic and economic reasons. Japan will therefore have to leverage advanced technology to overcome China's numerical advantage; in short, to overcome quantity with quality. With a smaller defense budget, Japan cannot afford to compete in all capability areas, and must therefore be very selective in its military investment to achieve its defense objectives. These include capabilities to counter a large-scale China invasion, as well as possible cost-effective solutions to counter China's nuclear and missile capabilities.

8. Japan's R&D and Procurement Priorities

Japan's priorities for military R&D and procurement for the next epoch will be as follows: (1) to find a cost-effective solution to defend Japan against long-range ballistic missile and cruise missiles; (2) given that both China and North Korea are equipped with nuclear weapons, the Japan Atomic Energy Agency will undertake a secret program to develop nuclear weapons. The declaration and deployment of the nuclear weapons will be determined at a later date; (3) to expand on JSDF's Type 3 TEL missile force to provide a massive conventional strike and deterrent capabilities. This will also enhance our area denial capabilities for the waters surrounding Japan; (4) to improve JSDF's C4ISR capabilities to enhance the mission effectiveness of JSDF and to enable the conduct of long-range land-attack and anti-ship strike missions; and lastly (5) to invest R&D resources in unmanned platforms.

9. Epoch 2 Summary

This epoch saw East Asia evolving into new patterns of intra-Asian and trans-Pacific relations. As the region's security picture has become more lucid, Japan has reevaluated its three-pronged security policy: firmly maintaining the Japan-U.S. security arrangements, building up Japan's defense capability, and making diplomatic efforts to ensure international peace and security. Of particular concern is the lack of sustained American focus on the region. Realizing that there is no viable alternative to counter-balance Chinese power, Japan must pursue its own identity as a major power by playing more of a leadership role in the region and by relying on the U.S. security presence for stability in the short term.

The quest for a seat in the United Nations' Security Council and the beginning of the withdrawal of United States forces from South Korea precipitated the reconsideration of the United States commitment in the region, especially that of the defense of the Japanese homeland. These developments provided the catalyst for the Japanese to begin re-interpreting Article 9 of the Japanese Constitution, and re-examining Japanese options for increasing its autonomous military capabilities for the defense of the Japanese homeland, as well as the protection of the SLOCs.

Domestically, the political and economic measures taken during the first two epochs resulted in drastic changes in the Japanese business way of life. But the endurance and persistence paid dividends as the Japanese economy showed positive signs of growth in 2005, and this was sustained for these last five years from 2006 to 2010.

Riding on the recovering economy, the JSDF took steps to bolster its defense capabilities with new acquisition and R&D programs. The missile, naval, air and C4ISR capabilities were significantly enhanced with the procurement of state-of-the-art systems. But there is as yet no cost-effective solution to comprehensive missile defense system. Realizing its limitations in manpower and defense budget, especially when compared to China, JSDF will continue to be very selective in its military investments. Key areas of focus in the next epoch will include finding cost-effective solutions to defend Japan against missile attacks and a large-scale invasion.

C. Epoch 3 (2011 ~ 2015)

1. Foreign Policy

During the past five years (2010-2015) the patterns of intra-Asian and trans-Pacific relations that developed during the previous epoch have evolved into a more discernable triangular balance of power in the region involving the US, China, and Japan. This tripartite balance of power has resulted in the emergence of more predictable and sometimes constructive patterns of relations between the three regional powers. The gradual erosion of the unipolar world order has forced Asian states to fundamentally re-orientate and re-examine their security policies. In light of this, the Asian states from 2010 to 2015 were preoccupied with positioning for the regional power realignment. While no clear client-state relationships have developed, the seeds for this type of alignment have been sown.

Against this backdrop, Japan continues to reevaluate our three-pronged security policy: firmly maintaining the Japan-U.S. security arrangements, building up Japan's defense capability, and making diplomatic efforts to ensure international peace and security. The continued deterioration of American regional commitment and the emergence of an expansive China places increased importance on the further development of Japanese strategic independence. However, given the persistent historic perception of Japan as an aggressor in the Asia-Pacific, we must continue to maintain remnants of the US-Japan security treaty to pacify our neighbors for the short term. Until Japanese forces can fully evolve to meet the new security requirements, the aforementioned treaty provides an anchor to manage the destabilizing effects of conflicts in the region. Thus, the treaty continues to provide a useful framework for the development of balanced ties between Japan and the US in the context of growing interdependence on the one hand, and uncertainty on the other.

The United States remains the leading power in the region and world, but due to its evolving Asian force structure, America is more dependent than ever on Japan for forward basing. This presents American policy-makers with being dependent on Japan for bases in Asia while Japanese domestic debate rages over the disposition of American forces inside its borders. The American dilemma, coupled with the very real possibility of forward-based Chinese forces in the Philippines, presents Japan with heightened security concerns. Japan must play a larger political and military role in the region to ensure our national security. We must also assure our neighbors that our resurgence does not threaten their interests. We must continue to conduct joint military exercises as both a means of reassurance to our friends and as a demonstration of resolve to our enemies. Japan's growing military power must be couched in terms of Japanese "burden sharing" in the context of American "burden shedding" as countries in the region continue to view the US-Japanese strategic partnership as the linchpin for regional stability.

2. The International Military Situation – Overview

The international military situation remains similar to the overview given in section 2 page 5-5, with the exception of the rise of multi-polarity. While a multi-polar world has yet to fully take hold, it is evident that the increasing influence of both India and China present new challenges to Japanese security and that of our allies.

3. The International Military Situation – Specific Nations

a. The Koreas

The Korean reunification scheduled for early in 2016 has drastically altered the Japanese security picture. Concerns over the decreased American presence in the region and Korea's strategic direction have forced Japan to vigilantly monitor the integration of North and South Korea. We assess the former military forces of the North and South as acting independently on operational and tactical levels, but pursuing a unified strategy as crafted by a coherent senior military leadership. While Japan views this as an exploitable command and control weakness, we are careful not to underestimate the formidable arsenals now combined as a result of reunification.

The details of the impending reunification remain unclear, but it is apparent that a reconfigured US-Korean agreement with emphasis on access, logistic support, pre-positioned equipment and joint training and exercising is emerging. Japan must continue efforts to cultivate a positive economic climate with the Koreas and continue to monitor Korean relations with China and Russia to assure that Japan does not become threatened by three nuclear states.

b. China

China expects to become the dominant power in East Asia. It has evolved into the world's second most powerful nation (as defined by its own terms of comprehensive national strength: economic, military, and technology) and believes that in due course it will surpass the U.S. economy in total size. These objectives will likely remain out of reach as China has yet to integrate Taiwanese business models or deal with overpopulation, both huge obstacles to modernity which continue to drag China down despite its economic progress. China does represent a significant challenge to Japanese security. Our goals of economic and diplomatic engagement with China have been diluted by Chinese military activities in the South China Sea. We must now attempt to contain Chinese influence in the region.

Military modernization and the conduct of naval exercises in the vicinity of the Philippines pose threats to Japanese regional trade routes. Russian arms sales and Taiwanese electronics expertise has begun to add technical depth to the vast human resources possessed by the Chinese armed forces. Taiwanese forces have been dubbed the Eastern Sea Protection Force (ESPF), however their operational doctrine remains in doubt. While the PRC claims these forces will only be used for regional defense, the PLA undoubtedly has long-term plans for military integration. China’s economic ties with ASEAN nations during the previous epoch resulted in a positive economic and political climate that has enabled China to conduct military exercises with relatively little diplomatic protests from her neighbors to the south. Reports of discussions between the Philippines and China regarding possible Chinese basing in Subic Bay also presents an increased threat to Japanese security.

c. Russia

The Russia of 2015 has yet to fully emerge from its post-Soviet decline but remains in control of a vast military stockpile that includes nuclear weapons. Russia remains encircled by strategic concerns, but has developed mutually beneficial relationships with both China and Japan. The sale of Russian arms to the Chinese and

Indians continue to bring in much needed revenue, as has Japanese access to the natural resources of Siberia. Siberian development was made possible by the settlement of the Kuril Islands dispute and by other bilateral agreements.

Russia's economic situation has brightened somewhat, but not enough to discontinue its policy of "limited globalism" in which Russia engages the world and the Asia-Pacific region on a selective basis. Present economic resurgence aside, Russia still does not posses the means for wide-ranging global aspirations and is likely to continue its present policy. Continued economic cooperation with Russia remains essential to Japanese security due to our needs for the diversification of energy sources and to counteract Chinese economic ties brought about by Russian military sales.

d. United States

America has yet to fully emerge from its earlier financial difficulties in this decade. The USFK force reductions and Korean unification have alarmed Japan causing the present debate over what to do with American forces in Okinawa and Kadina. Australia and Vietnam are being examined as possible US basing options if forces are withdrawn from Japan. Internal pressures continue to compete for government dollars. Reliance on energy from the Middle East plagues America's ability to commit resources for Japanese defense. While the United States is providing security insurance to Japan under the US-Japan Security Arrangement, Japan must begin to rely on our own means to counter threats to our security.

4. Japan Domestic Situation

a. Japan Economy

The institutional reforms implemented in epoch 1 (2000-2005) continued to pay significant dividends as Japan's GDP maintained levels of 4-6% GDP growth from 2010-2015. The slowdown in labor force of 2010 exacerbated labor scarcity and caused labor costs to rise further. Japanese producers reacted by increasing automation and advancing less capital-intensive means of production. The government also encouraged more women to join the labor force and prolonged the participation of older workers. Government promotion of spending on education, training, and research and development also contributed to our positive economic climate.

The structural and banking problems that plagued Japan were overhauled by adjusting the whole Japanese system: business, taxation, administration, legal/judicial, political/election, technological, and educational. Additional amelioration came from the allocation of economic resources to areas where Japan maintained competitiveness (automobile manufacturing, telecommunication, computer, internet, financial and other service industries) and where Japanese products set de facto global standards (fax machines, photo-copying machines, animation, and factory management).

Goods, services, labor, real estate, and financial markets were deregulated enabling Japan to best utilize its limited human resources, land resources, domestic purchasing power, and vast household savings. These deregulations encouraged venture businesses and foreign subsidiaries, created new jobs, raised efficiency and reduced domestic price levels.

b. Nuclear Debate

In spite of the nuclear allergy, Japanese leaders have for 30 years maintained that Japan must retain the option to develop nuclear weapons. Japanese law and policy reveal two significant gaps: the discrepancy between the public's perception of anti-nuclear statutes and their actual meanings; and more importantly, the gulf between the government's stated policy and our actions regarding nuclear weapons.

Most Japanese believe our constitution explicitly prohibits nuclear weapons, but the government has stated repeatedly and consistently that the constitution does not prohibit them. Article 9, which renounces Japan's right to make war and to possess 'armed forces,' has no explicit provision against nuclear weapons. Post-war cabinets have consistently maintained that the Constitution does not necessarily prohibit the possession of nuclear weapons if they are kept to the minimum required for self-defense. As Japan reevaluates the provisions in Article 9, we must realize that the Constitution does not serve as a deterrent to nuclear armament regardless of our previously stated policies.

Japan's other anti-nuclear barricades are equally porous. We have ignored indications that the United States was routinely bringing nuclear weapons into Japanese ports, an action interpreted by American military planners as tacit permission to carry nuclear weapons into our harbors. We believe American aircraft carriers home-ported in Yokohama routinely brought nuclear weapons into the port. Additionally, our participation in joint military exercises in which U.S. forces simulated the use of nuclear weapons also underline the dichotomy between our government's policies and its actions regarding nuclear weapons. The Three Non-Nuclear Principles were established as national policy more than 40 years ago, but are not stipulated by law. We have ruled out the need for specific legislation because the principles are already well known both at home and abroad. A more binding constraint is the Japanese law governing nuclear energy, which strictly limits its use to peaceful purposes. Nonetheless, our present Japanese government must either change the law or choose to ignore it, as earlier governments have disregarded the three non-nuclear principles.

International agreements prove more formidable because Japan cannot change them unilaterally. The NPT and bilateral nuclear cooperation agreements are two notable examples. Japan is a member of the NPT, but the treaty does not provide for any sanctions or punitive measures against members who violate treaty obligations. Any member is allowed to withdraw from the treaty with a three-month notice to the U.N. Security Council if "extraordinary events have jeopardized its supreme interests”. Japan maintains unilateral nuclear agreements with six countries – the United States, Britain, France, Canada, Australia, and China. Each of these agreements excepting the one with China stipulates that everything Japan has imported from these countries must be used only for non-military purposes. If Japan were to use its civilian nuclear program for military purposes, a set of stringent sanctions could be imposed, including the immediate return of all imported materials and equipment to the original exporting country. The likelihood of sanctions actually being imposed is another matter. The history of American foreign relations suggests that sanctions are rarely the case, particularly when a major economic partner is involved.

c. Energy

Our diversification of energy import routes (natural gas and oil shipments from Russian Far East) have lessened heavy reliance on the Persian Gulf and provided Japan with the supplements for internal generation. Natural gas resources of the Sakhalin Islands compare favorably with other substantial regional natural gas suppliers. Estimates indicate that Sakhalin proven and probable gas reserves are as high as 50 to 65 trillion cubic feet (TCF). By comparison, Indonesia, the world's largest LNG exporter, has proven reserves of around 82 TCF. Sales from Sakhalin, either by pipeline or LNG carrier, have a substantial cost advantage over most suppliers. Sakhalin gas is the most economical by pipeline, reaching Japan for the equivalent cost of $2.00 to $2.80 per million BTU (million British Thermal Unit) as compared to Yakutia gas at $2.50 to $3.70 per MMBTU or Irkutsk gas at $2.30 to $3.60 per MMBTU. Sakhalin LNG costs are equally competitive at $1.90 per MMBTU, about equal to the equivalent capital costs for shipment from Botang LNG in Indonesia and slightly cheaper than the $2.15 per MMBTU for shipments from Australia's Northwest shelf.

To facilitate higher natural gas imports, Japan must resolve issues that block the construction of a national transmission grid. Greater use of natural gas has more domestic support than nuclear power and oil imports because Japan has never experienced a major accident or disruption of its natural gas imports. Moreover, its 22 natural gas receiving terminals are no more subject to military attack than its 51 nuclear facilities. There are several groups with conflicting interests that make up the Japanese natural gas and electricity sectors. Some of these important players have entrenched positions for status quo policies. But end-users are unlikely to continue to tolerate automatic expensive pass-on of costs, creating some momentum for change in the system.

Demand for change exists also in the electricity market of Japan. Currently, this market is heavily regulated, with the MITI agency in the center of pricing, entry and planning decisions. Electricity prices are very high by world standards (more than twice as high as in the U.S. or U.K. for example) but also do a poor job of signaling the real costs of electricity. A major obstacle to reform is that private companies own most of the facilities, and deregulation may erode their profits. This may also explain why proposed reforms have focused so far on the retail segment of the market. Most of the gains from reform of electricity supply in other countries have arisen from exploiting technological changes that have allowed wholesale electricity markets to become more competitive. By delaying the adoption of measures in line with world best practice, Japan has foregone the large efficiency gains that are benefiting the economies of other countries.

Successful deregulation requires an understanding of the sources of monopoly power in the industry, separation of competitive from natural monopoly elements, and a compensation package to the industry for losses expected during a transition period. Partial reforms that relax controls in the retail market while leaving monopolies in generation and transmission in place may be more harmful than beneficial. In order to institute positive changes in the energy market within Japan, MITI would need to garner the support of the relevant industries to engineer the necessary reforms.

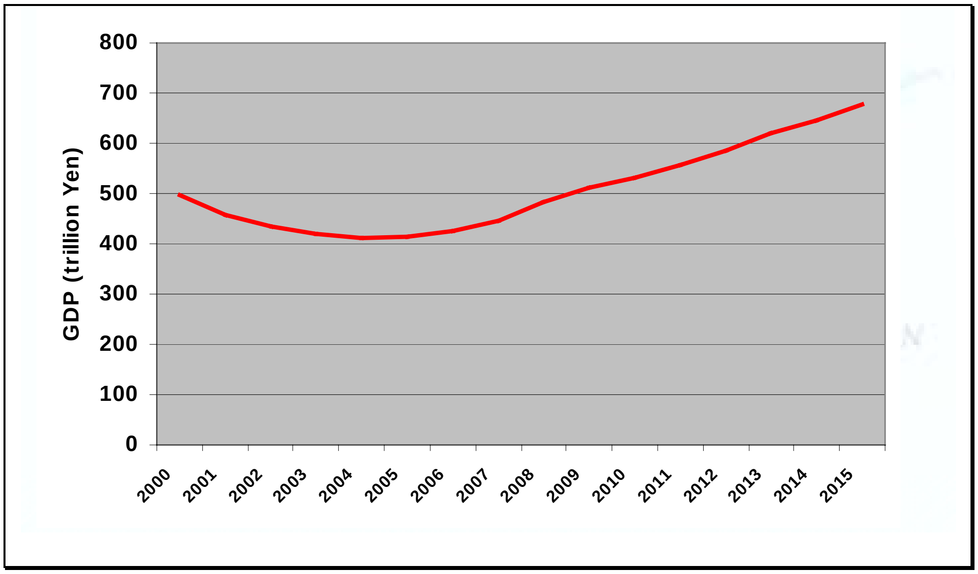

Chart 5-19: Economic Overview (GDP Growth)

Japan's GDP has sustained significant positive growth from 2010 to 2015. The economic difficulties resulting from reforms instituted earlier this century began to pay dividends in 2009 when GDP attained its former levels in year 2000. As is evident from the chart, GDP has grown over 30 percent since 2009. Per capita GDP in 2015 is about US$44K.

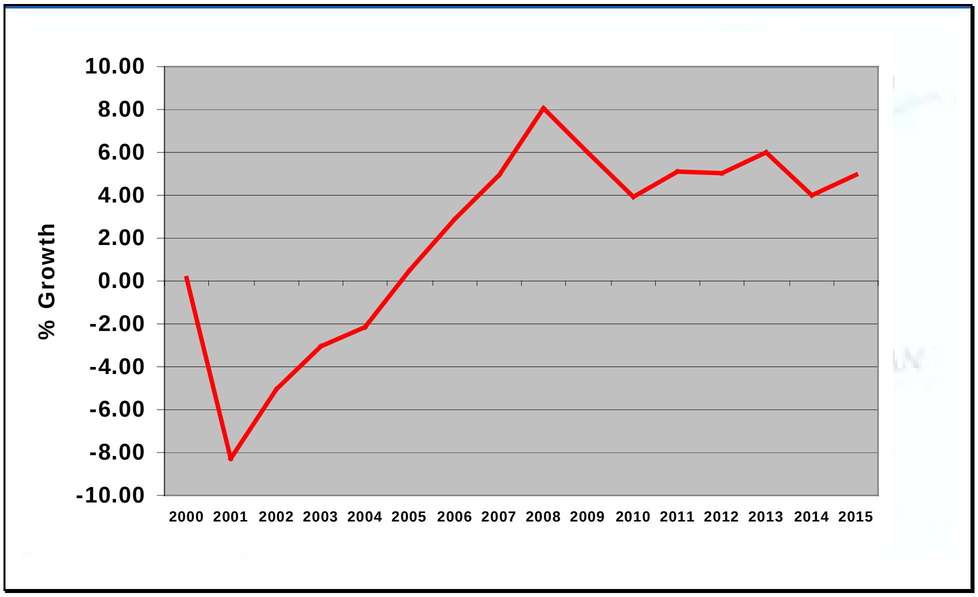

Chart 5-20: Economic Overview (GDP Performance)

This chart represents GDP performance by percentage from 2000-2015. The slow down in economic growth experienced 2008-2010 leveled off and Japan experienced sustained levels of 4-6% growth during 2010-2015.

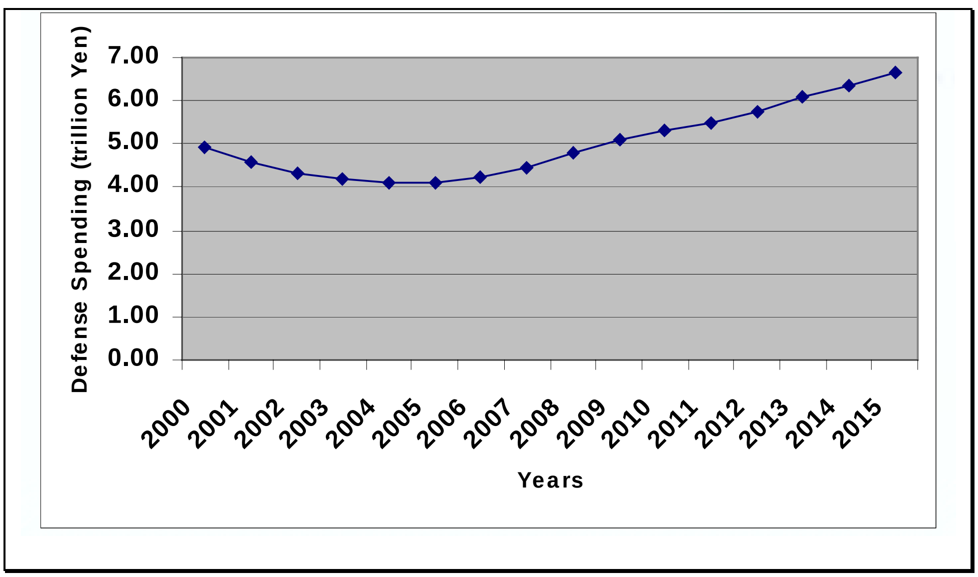

Chart 5-21: Defense Spending (2000 ~ 2015)

Japan's total expenditure on defense has increased from 5 trillion yen in 2010 to nearly 7 trillion at 2015. While this is a significant increase, spending as percentage of GDP has remained at a nearly constant rate of 1 percent.

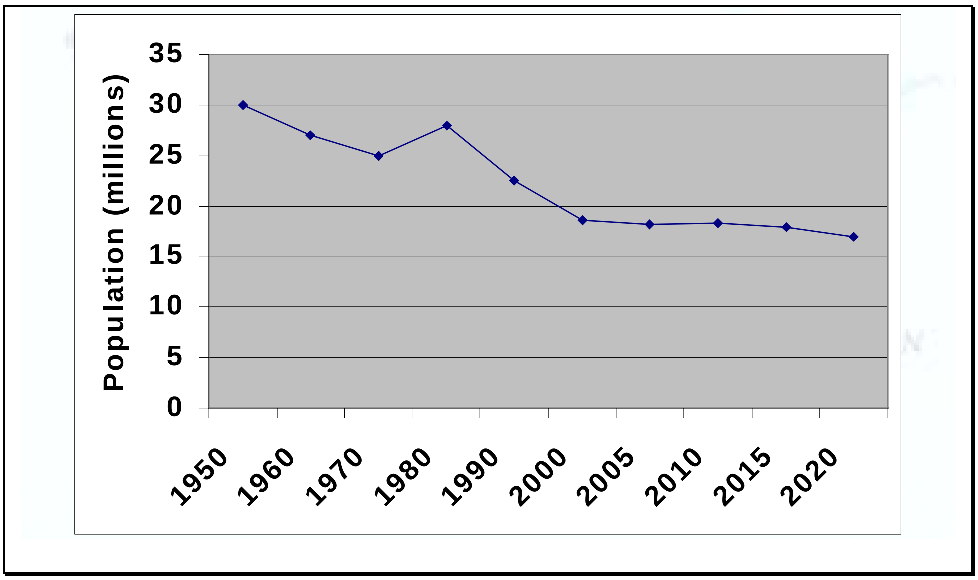

Chart 5-22: Demographics

Japan's population continued to gradually decline during this epoch, however over the past 15 years (2000-2015) population growth remained relatively constant. The 2015-2020 projection demonstrates a continuation of this trend.

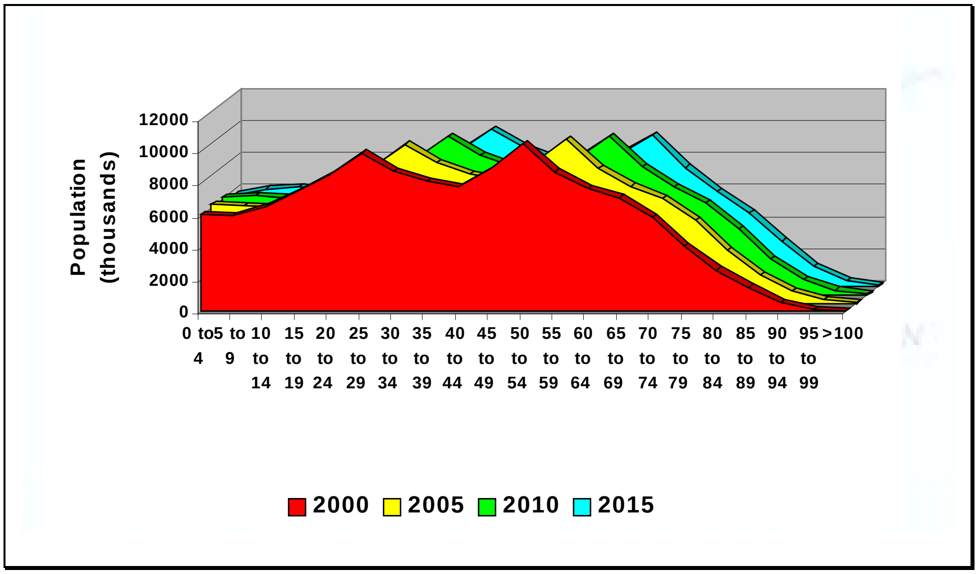

Chart 5-23: Demographics Shift

As is evident by the peak shifts on this chart Japan's population continues to age.

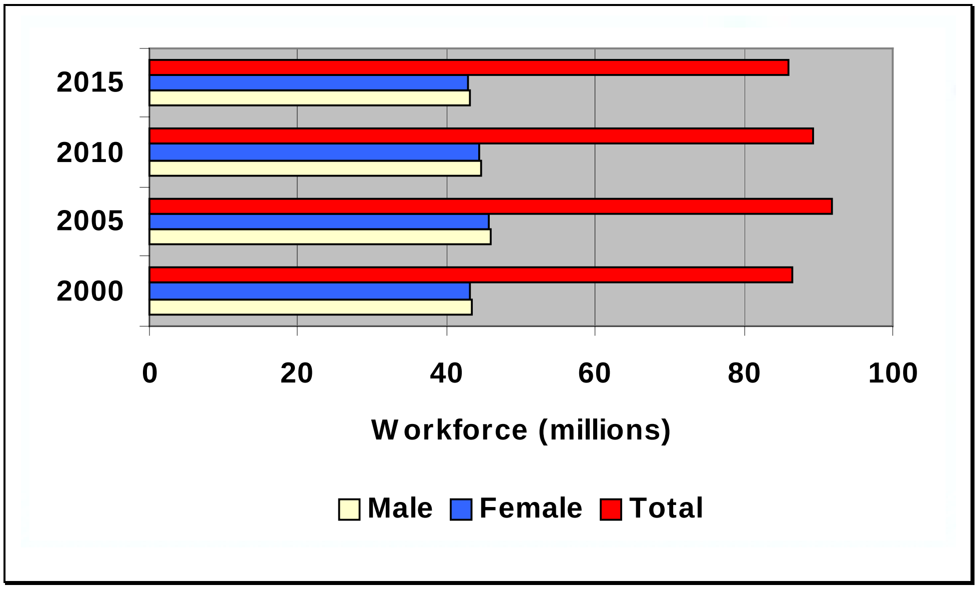

Chart 5-24: Demographics (Workforce)

The total workforce has not decreased significantly during this epoch, however the short- term solution of an increased retirement age has begun to show decreased dividends.

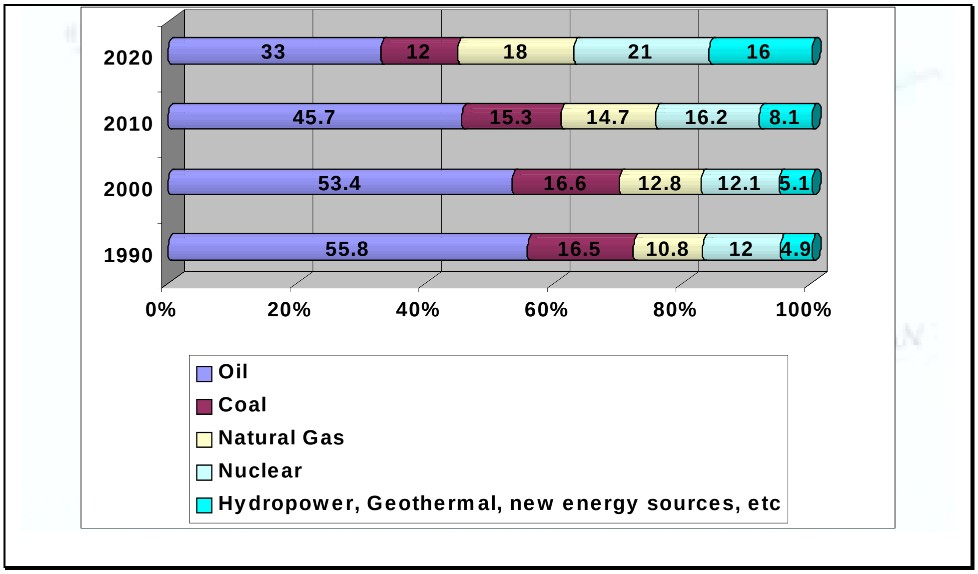

Chart 5-25: Energy Sources

Japan continues to diversify sources of energy. Our dependence on oil imports is projected to decrease in 2020 by nearly 12% from 2010 levels. Due to domestic generation and cooperative endeavors with Russia, we project that oil dependence will lessen to 1/3 of the total. While we are not fully self-reliant for energy production, we have limited vulnerabilities by both diversifying fossil fuel suppliers and means of internal generation.

5. Japan Self-Defense Force

The third epoch saw Japan at the crossroads, apprehensive about the events that evolved in the region.

First and foremost, there was a diminishing US presence in the East Asia. US troops had already begun withdrawing from the Korea Peninsula and 50% of the forces were out by 2015. The peaceful unification of the Koreas would dictate that the rapid reaction forces being stationed in Okinawa could be recalled in the near future. The economic reality of the first decade of the new millennium and the negative feeling of the Japanese towards the US military in Okinawa dictated recall or repositioning in Australia. US DoD was also in the process of downsizing the Pacific fleet as part of the effort to scale down US military deployments overseas.

Secondly, the unification of North and South Koreas, may not signal the beginning of a new era of peace in East Asia. The combined Koreas' military arsenal was definitely a sizeable force.

Lastly, China's expansion in the South China Sea was also worrisome. China had been conducting large-scale exercises in the South China Sea in recent years. Occasionally, China had forced the re-routing of Japan shipping around East Philippines. Furthermore, China had also acquired some US military technologies through the unification with Taiwan.

These events had strong implications for the Japan military. Firstly, would the US still have the will and capability to shield Japan from an invasion, bearing in mind that there might not be any permanent stationing of US troops in Japan? What would the scope of the US-Japan Security Arrangement be in the near future? Secondly, was our homeland defense system sufficient to counter any invasion from China or Korea? If not, what were the alternatives? Thirdly, could we protect our critical SLOC through the South China Sea so that Japan economy and energy supplies would not be threatened? Lastly, how can we defend, counter or deter the long-range missile and nuclear threats from both China and Korea? The Sea of Japan might be too narrow a space to give Japan the sufficient and necessary time to react and respond to a missile attack from either Korea or China.

Despite jubilation over unifications of the Korea Peninsula and China-Taiwan, some in Japan could not applaud. Since World War II, Japan had been a passive country in the geopolitical arena – mainly reacting to events that happened and the posture adopted by the US. For better or worse, that was changing. The new generations of Japanese (and thus the military leadership) preferred a take-charge attitude.. As the public debated over a long-term vision for Japan, the JSDF was undergoing a revolution in military affairs. The thought of creating a nuclear force was no longer an objectionable endeavor.

a. Defense Strategy and Policy

There was no change to the Defense Strategy and Policy in this epoch. The third epoch was really a time of reflection for the military – there were numerous discussions and deliberations on what would be the best direction for the JSDF to be charted. The gist of the arguments centered on these four topics: (1) how self-reliant do we become? (2) what would be the scope of the US-Japan Security Arrangement? (3) would a cost-effective comprehensive missile defense system be feasible? (4) or would adopting a nuclear strategy be a better deterrent measure?

b. Defense Expenditure

S/No	Item	Epoch 2 Average (Billion ¥)	Epoch 3 Total (Billion ¥)	%	Yearly Average (Billion ¥)	% Change (cf: Epoch 2)
1	Personnel & Provision	2,175.6	12,000.0	39.3%	2,400.0	10.3%
2	Maintenance	859.6	4,500.0	14.8%	900.0	4.7%
3	Facilities	182.6	1,920.0	6.3%	384.0	110.3%
4	R&D	105.0	560.0	1.8%	112.0	6.7%
5	Equipment Acquisition	815.0	8,225.0	27.0%	1,645.0	101.8%
6	Others	652.0	3,300.0	10.8%	660.0	1.2%
7	**Total**	**4,789.8**	**30,505.0**	**100%**	**6,101.0**	**27.4%**

Table 5-18: Defense expenditure for 2011 to 2015.

In the third epoch, there was a substantial increase in absolute terms for defense spending. The money for equipment acquisition was doubled and the military was able to acquire those systems that it had shelved during the period of economic recovery. Nonetheless, the total expenditure averaged only 0.99 % of the total GDP.

One of the key projects was to enhance infrastructures survivability under the program National Survivability and Enhancement Project (NSEP). That was a ¥2 trillion, 10-year program beginning in 2011. The objective was to harden key military installation like airbases, naval bases and C4 assets. Redundancy was also built through additional runways, alternative C2 headquarters, etc. By 2015, phase I (which comprised priority-one military installations) had been completed.

c. Defense Research & Development Programs

A total of ¥560 billion was spent over the last five years on R & D. There was an increase of 6.7% over the second epoch. Table 5-19 shows the major R&D programs for the JSDF. The commitment to missile defense programs R&D was about ¥70 billion. The SM3 missile was ready for fielding on the Kongo-class destroyer. The interceptor could engage incoming ballistic missiles that had a velocity of five km/s or less. The R&D on ICBM was also completed and initial deployment started in 2012. The UF-3, the third in the series of UAV was completed and production started in 2014. Meanwhile, Japan secretly embarked on a black program for a nuclear warhead[1], in cooperation with Japan Atomic Energy Research Institute (JAERI). We also invested heavily on unmanned underwater vessels and ship-based and land-based laser targeting systems. R&D with France & Russia on nuclear propulsion system was also in the pipeline.

S/No	Item	Amount (Million ¥)	Remarks
1	Type-12 ICBM	10,000	Completed, production in 2012.
2	Ballistic Missile Defense System	35,000	In progress.
3	SM3 Missile for NTWD	10,000	Upgraded Kongo DD for NTWD.
4	BMC3I	25,000	In progress.
5	National C2 System	30,000	Upgrading in progress.
6	UF-3 (Strike & F/R)	45,000	Completed, production in 2014.
7	Nuclear Warhead	25,000	In progress.
8	UUV & Laser Systems	30,000	In progress.
	Total	210,000	
9.	Others	350,000	
	Grand Total	560,000	

Table 5-19: Main R & D Programs

[1] For more details on Japan nuclear capability, refer to Public Education Center: “Thinking the Unthinkable: Will Japan deploy the Bomb?” at http://www.publicedcenter.org/japan.html.

d. Future R&D and Procurement Priorities

Japan’s priorities for military R&D and procurement for the next epoch are as followed: (1) to find a cost-effective solution to defend Japan against long-range ballistic missile and cruise missiles; (2) to increase the size of the JMSDF so as to improve the SLOC protection role; (3) to further develop the Ryukyu Islands to support extended operations to the south of Japan; (4) to improve the survivability of key military installation and facilities on the Japanese homeland; (5) to increase the number of Type 3 TEL missiles in order to provide a more massive and survivable conventional strike and deterrent capability. This will also enhance our area denial capabilities for the waters surrounding Japan; (6) to improve JSDF’s C4ISR; and (7) to invest R&D resources in unmanned platforms.

e. Key Defense Systems

1) Missile Defense System

By the end of 2015, the capability of our missile defense system was still not comprehensive.

Upgrading of the Patriot system to PAC-3 capability has been completed. Japan had 24 batteries of Patriot of five missile launchers each. The Patriot batteries were then able to fire both the PAC-2 (two out of the five missile launchers) and PAC-3 missiles, providing air defenses against aircrafts, and cruise missiles, and ballistic missiles in the exo-atmosphere. The I-Hawk upgrading program was also completed. There were 32 batteries of I-Hawk with six launchers each.

All the existing Kongo-class destroyers were also upgraded with NTWD capabilities (against ballistic missile of speed five km/s or less) and carried the necessary SM-3 missiles.

2) UF-3 (Strike & Fighter Recce UAV)

	• Max Speed: Mach 2.0 • Cruise Speed: Mach 1.2 • Payload: 12,000 Lbs • Altitude: 65,000 Ft • Range: 1,200 nm

Figure 5-36: UF-3

UF-3 was a low observable unmanned combat aerial vehicle (UCAV) that was a follow-on development of US X-36[2] program. The project was co-developed by Mitsubishi Heavy Industries and Boeing Co. It had an operating range of 1,200 nm while cruising at Mach 1.2. This system would substantially enhance our strike and fighter recce capability without increasing the demand for pilots.

[2] Ref : Boeing Co. - http://www.boeing.com/defense-space/military/x36/x36.htm

Like EU-1, command and control of UF-3 would be very versatile. Depending on the mission needs, the C2 could originate from (1) the NCCS for specific Joint mission; (2) a destroyer, e.g. Kongo, for extended range of operation; or (3) a manned fighter, e.g. F-22, controlling a fleet of four UF-3 for strike mission.

The operating range of UF-3 could be easily extended, for example, by operating in tandem with the EU-2 (a pseudo-satellite) that provided the communication relays.

3) Type-12 Intercontinental Ballistic Missile (ICBM)

	• Power Plant: 3 solid-propellant rocket motors • Speed: 15,000 mph at burnout (7 km/s) • Range: 5,218 nm • Ceiling: 700 miles • Payload: 2,640 lb • Length: 59.9 ft • Weight: 79,423 lb • Diameter: 5.5 ft

Figure 5-37: Type-12 ICBM

Type-12 ICBM was designed and built by Mitsubishi Heavy Industries in 2012. It was equivalent to a US Minuteman III[3]. It employed three solid-propellant rockets motors to deliver ordnance more than 5000 nautical miles. In this epoch, only two ICBMs were deployed.

f. National Defense Program Outline

Amidst all the deliberations, JSDF reviewed its National Defense Program Outline (NDPO) again in 2012. The NDPO spelled out the long-term plan for the military.

Classification		**2001 NDPO**	**2012 NDPO**
Manpower	GSDF (Regular)	145,000	Approx. 120,000
	GSDF (Reserve)	25,000	Approx. 50,000
	MSDF	50,000	Approx. 60,000
	ASDF	50,000	Approx. 55,000
	Joint Staff	2,000	Approx. 12,000
	Total (Active)	247,000	Approx. 247,000
	Grand Total	272,000	Approx. 297,000
GSDF	Division	8 Infantry Division 1 Armored Division	8 Infantry Division 1 Armored Division
	Brigade	6 Infantry Brigade 1 Airborne Brigade 1 Helicopter Brigade 1 Amphibious Brigade	6 Infantry Brigade 1 Airborne Brigade 1 Helicopter Brigade 1 Amphibious Brigade
	Tank	Approx 1000	Approx 1140
	Artillery	Approx 1000	Approx 1020
MSDF	Destroyer	60	70
	Submarine	20	22
	Combat Aircraft	200	200
ASDF	Fighter	400	450
	UAV	Approx 50	300

Table 5-20: Comparison of NDPO 2001 & 2012

[3] Ref : FAS US Minuteman III - http://www.fas.org/nuke/guide/usa/icbm/lgm-30_3.htm.

In essence, the plan was to gradually downsize the active component of the GSDF and transfer the posts to the other services. Nonetheless, the capability of the GSDF would be maintained by expanding the reserve units. The MSDF was expanded so as to accommodate the need for a larger SLOC protection role. The Joint Services had been restructured to create a unified missile command to include the Type-03 missiles and the newly added ICBMs. At the end state, there was no net increase in the active personnel.

Classification		**2012 NDPO**	**At End of Revised Mid-Term Defense Program (2015)**
Manpower	GSDF (Regular)	Approx. 120,000	Approx. 134,000
	GSDF (Reserve)	Approx. 50,000	Approx. 35,000
	MSDF	Approx. 60,000	Approx. 53,600
	ASDF	Approx. 55,000	Approx. 51,200
	Joint Staff	Approx. 12,000	Approx. 8,400
	Total (Active)	Approx. 247,000	Approx. 247,200
	Grand Total	Approx. 297,000	Approx. 282,200
GSDF	Division	8 Infantry Division 1 Armored Division	8 Infantry Division 1 Armored Division
	Brigade	6 Infantry Brigade 1 Airborne Brigade 1 Helicopter Brigade 1 Amphibious Brigade	6 Infantry Brigade 1 Airborne Brigade 1 Helicopter Brigade 1 Amphibious Brigade
	Tank	Approx 1140	Approx 1,130
	Artillery	Approx 1020	Approx 920
MSDF	Destroyer	70	60
	Submarine	22	21
	Combat Aircraft	200	Approx 200
ASDF	Fighter	600	480
	UAV	300	137

Table 5-21: 2015 Mid-term Review of Defense Program

Table 5-21 compares the order of battle at 2015 versus the latest NDPO that was established in 2012.

g. Ground Self-Defense Force (GSDF)

			Epoch 3 (2011 ~ 2015)			
S/No	**Item**	**2010 Qty**	**Acquire/ Build-up**	**Upgrade**	**Retire/ Close down**	**2015 Qty**
1	Infantry/Combined Div	9			1	8
2	Infantry Bde	6				6
3	Armored Div	1				1
4	Heliborne Bde	1				1
5	Airborne Bde	1				1
6	Amphibious Bde	1				1
7	Tanks	1,135		300		1,135
8	APC	820	100	300		920
9	Artillery (155mm SP)	731			100	631
10	MLRS	278	150			428
11	Attack Helicopters	88	20		5	103
12	Other Helicopters	424	30		5	449

Table 5-22: Major GSDF Order of Battle

The restructuring of the divisions and brigades had been completed. The GSDF now comprised eight Infantry Divisions, one Armored Division, and six Infantry Brigades. In addition, it also had three brigades with special roles.

h. Maritime Self-Defense Force (MSDF)

			Epoch 3 (2011 ~ 2015)			
S/No	**Item**	**2010 Qty**	**Acquire/ Build-up**	**Upgrade**	**Retire/ Close down**	**2015 Qty**
1	Kongo & DD21	13	15	20		28
2	Other DDs	47			15	32
3	Submarine (SS)	20	6		5	21
4	Mine warfare ship (MSC)	39	5		2	42
5	Landing Ship (LST)	17	10			27
6	P3C (Fixed wing patrol)	85		15	15	70
7	HSS-2B (Patrol)	36				36
8	MH-53E (Mine sweeping)	10				10
9	SM3 Missile (NTWD)	0	200			200
10	SH-60J (anti-sub)	79	10		2	87

Table 5-23: Major MSDF Order of Battle

The MSDF began another era of rapid expansion. Another 15 Kongo-class destroyers were acquired, partly to replace the older destroyer fleet. All the Kongo-class destroyers were upgraded to NTWD capability and 200 SM3 missiles were purchased from the US.

i. Air Self-Defense Force (ASDF)

			Epoch 3 (2011 ~ 2015)			
S/No	**Item**	**2010 Qty**	**Acquire/ Build-up**	**Upgrade**	**Retire/ Close down**	**2015 Qty**
1	F-15 (J/DJ)	203			101	102
2	F-22	50	200			250
3	F-1	35			17	18
4	F-2	100	25			125
5	F-4/RF-4 (E/EJ)	83			50	33
6	C-1	28				28
7	C-130H	16				16
8	CH-47J (Transport)	39	20			59
9	KC-135	10	20			30

Table 5-24: Major ASDF Order of Battle

ASDF also embarked on a rapid modernization program, following the economic recovery. We brought in another 200 F-22 fighters while phasing out the 101 F-15. We also increased the fleet of F-2 to 125 but downsized the F-1 and F/RF-4 squadrons. We also acquired another 20 CH-47 and 20 KC-135 refueling tankers.

j. Major Missile Systems

			Epoch 3 (2011 ~ 2015)			
S/No	**Item**	**2010 Qty**	**Acquire/ Build-up**	**Upgrade**	**Retire/ Close down**	**2015 Qty**
1	Patriot PAC-3 FU Upgrading	120		40		120
2	I-HAWK Upgrading (in group)	192		0.25 gp		192
3	Type-12 ICBM	0	2			2
4	Type-88 TEL (c/w 6 missile ea)	80				80
5	Type-03 TEL (6 missile ea)	550	750			1,300
6	Type-03 Missile	5,500	7,500			13,000

Table 5-25: Major Missile Systems

The upgrading programs for Patriot and I-Hawk were completed in this epoch. All the Patriot batteries were now able to fire both the PAC-2 and PAC-3 missiles. We continued to field another 750 Type-03 TELs. A new addition to the inventory was the Type-12 ICBM.

k. Major C4ISR System

			Epoch 3 (2011 ~ 2015)			
S/No	**Item**	**2010 Qty**	**Acquire/ Build-up**	**Upgrade**	**Retire/ Close down**	**2015 Qty**
1	EU-1 (Low observable)	22	35			57
2	EU-2 (HAE)	18	37			55
3	UF-3 (Strike & F/R)	0	25			25
4	E-2C	13				13
5	E-767	4				4
6	Info Gathering Satellite	8	6	4	4	10
7	IW Platoon (30-men)	2	1			3

Table 5-X: Major C4ISR Systems

Finally, with the inclusion of 25 UF-3, the overall UAV fleet had increased to 137 unmanned aircraft. There was a net increase of two spy satellites. The Ballistic Missile C^3I (BMC^3I) system was also fully integrated into the NCCS.

6. Static Net Assessment - Japan Versus China

In this section, the static assessment between Japan's forces and China's forces is presented. Details of Japan's forces can be found in the previous section. The data presented has been reorganized and aggregated to provide a meaningful comparison.

a. Manpower

Japan	China
Joint: 8,400 (1,800) Army: 169,000 (170,000) Navy: 53,600 (47,500) Air Force: 51,200 (48,900)	PLA: 1,600,000 (1,780,000) Rapid Reaction: 90,000 (70,000) Navy: 310,000 (300,000) Marines: 15,000 (13,000) Special Forces: 14,000 (12,000) Intelligence: 5,000 (4,000)
Total: 282,200 (268,200)	**Total: 2,034,000 (2,179,000)**

(Figures in parenthesis denote figures for previous epoch)

Over the last five years, China has continued to make cuts in overall military manpower. At the same time, the buildup of the rapid reaction force, Marines and Special Forces has persisted. The total JSDF manpower remains an order of magnitude smaller than that of China. Due to economic and demographic reasons, it is not possible for us to significantly increase the manpower of our armed forces.

Operationally, (as shall be seen in the air and naval orders of battle), China's air and sealift capability have improved, and is assessed to be capable of projecting an estimated 19,000 troops by fixed-wing transport aircraft and 27,000 troops by sea. But this is only a small fraction of the total PLA order of battle.

Qualitatively, although PLA personnel are generally well trained in basic skills, their leadership, training in combined operations and morale is low. Most soldiers are poorly educated and one-third leave active duty each year. There is also no professional NCO corps[4].

b. Air Force

Japan	China
250(50) F22	20(10) J12
102(203) F15	400(300) MiG31
125(100) F2	375(335) J11
18(35) F1	285(200) J10
25 (0) UF3	700(1500) Lower end fighters/attack
33(83) F4/RF4	50(120) Long Range Bombers
28 (28) C1	100(68) Heavy/Medium Lift FW Transport
16 (16) C130	100(155) Light FW Transport
59(39) CH47	13 (10) AAR
30(10) KC135 AAR	397(316) Helicopters

The modernization of China's Air Force continues unabated. The last five years saw further procurement of current generation fighters, such as the MiG31s and J11s, while trimming its large fleet of older generation aircraft. Over the last 15 years, China has effectively caught up with our F15s qualitatively and has quantitatively surpassed our fleet of current generation fighters

However, we have previously decided to maximize our limited pool of pilots by providing them with the best fighters money can buy. Hence, we have pushed ahead with the replacement of our fleet of fighters with F22s. In so doing, China's main fighter fleet is once again a generation behind that of Japan.

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[4] http://www.fas.org/nuke/guide/china/agency/pla-intro.htm

The actual outcome of an air war would depend very much on the training and competency of the pilots as well as its C4 capabilities. Both are reportedly deficient for China's Air Force[5]. This is assessed to be the main reason for China's decision to invest in current generation fighters rather than acquiring larger quantities of the technologically superior J12s. Overall, it is assessed that China is very unlikely to prevail in the battle for air superiority over East China Sea.

c. Navy

	Japan	**China**
Surface Combatants	28(13) Kongo DDGs 32(47) Other Destroyers 3 Missile Patrol Craft Maritime Safety Agency: 13/46 Lg/Med Patrol Vessel 38 Patrol Craft 81 Coastal Patrol Craft 180 Coastal/Rescue Craft	35(35) Destroyers 52(46) Frigates 179(166) other lower end Missile Craft 50(60) Torpedo Craft 30(30) Speed Boats
Submarines	21(20) SS	55(63) SS 5(5) SSN 3(2) SSBN
Mine Warfare	39(38)	83(83)
Amphibious	27(17) LSTs	43(26) LSTs 66(66) lower capacity craft
Aircraft	70(85) P3C 87(79) ASW Helicopters 46(46) Others	See "Air Force"

Over the last five years, the only significant additions to China's surface fleet are the two DDGX and six FFX. But the majority of the surface fleet comprises lower-end destroyers, frigates and missile crafts, each with four to eight SSMs and up to eight

[5] http://www.rand.org/publications/MR/MR580/mr580.html

SAMs. The total missile capacity of China's surface fleet has improved and is now estimated to be about 1612 SSMs and 496 SAMs. This represents an increase of 12% over the last epoch. Spread over 267 missile armed ships, the average is about 7.9 missiles per ship.

In contrast, while our surface fleet is numerically inferior, it is technologically modern and carries missiles of far longer range. We have invested heavily on our surface fleet, with the procurement of an additional 15 modern DDGs to replace the older destroyers. This fleet of 28 Kongo DDGs, each carrying 90 VLS Cells and 8 Harpoon missiles, has a total missile capacity that exceeds the entire China's Navy. Furthermore, our surface fleet is supported by a large number of surveillance and ASW aircraft. Overall, our Navy has a definite edge in surface warfare.

China continues to modernize its submarine fleet with the procurement of 3 Song-class, three Kilo- class and three SSX Class submarines, bringing their total number of modern diesel electric submarines to 29. These, together with the five SSN provide China with a superior sub-surface capability. However, with our 21 modern SS and ASW capabilities of our destroyers and aircraft, our Navy should be able to maintain a slight edge in an open-ocean naval battle.

d. Missiles

	Japan	China
Strike	1300(550) Type 03 TELs (6 missiles per TEL) (Missiles: 13,000) 80(80) Type 88 TELs (6 missiles per TEL) 2 Type 12 ICBMs	1125(980) SRBM 90(90) MRBM 32(65) IRBM 113(62) ICBM 155(110) SLBM (with 3 SSBN) 7640(5805) ASCM 2500(800) Tomahawk equivalent 5300(2200) other shorter range LACM
Air Defense	120(120) Patriot FU 192(192) I-HAWK FU	90(46) LR SAM Bns 100(45) SR SAM Bns

Although China has a large ballistic and cruise missile inventory, the majority are SRBMs and shorter-range cruise missiles, which do not have the range to reach Japan when fired from the mainland. But over the last five years, China has acquired more missiles, bringing the total number of land-based missiles having the range to fly over the East China Sea to 2,736. While we have also have substantial number of Type 3 missiles, these are presently equipped only with conventional warhead and hence do not directly constitute a deterrent to China's nuclear weapons.

In the last five years, we have vastly increased our Type 3 TEL fleet and Type 3 missiles. The 1300 mobile land-based Type 3 TELs will play a big role in the defense against a scenario of a China large-scale invasion. The Type 3 TEL fleet will provide the additional firepower necessary to decisively tilt the balance in our favor in a defensive scenario. Should China conduct an all out invasion, a large Type 3 TEL fleet will ensure a complete destruction of all the forces afloat.

To date, while we have acquired an initial ballistic missile defense capability in our Kongo Class NTWD ships and Patriot PAC3 missiles, we are still unable to defend against ballistic missiles of velocity greater than five km/s.

e. C4ISR

Japan	**China**
10(8) IMINT Satellites 90(60)-person Computer Warfare Team 57(22) EU-1 55(18) EU-2 13 (13) E2C 4 (4) E767 National C2 System	28(16) IMINT/EW Satellites 15(16) AEWCC

Details of China's spy satellite capability are not available and hence a comparison cannot be made. Over the last five years, we have improved our C4ISR capability substantially with the acquisition of more EU1s and EU2s. Together with our AEW fleet of E2Cs and E767s, our airborne C4ISR capabilities are assessed to be technologically superior as compared to China's Y8s and A50s.

f. Summary (Japan versus China)

In the last five years both sides have continued to increase their inventory of modern military equipment. Numerically, we continue to lag far behind in most areas and this gap can never be bridged due to demographic and economic reasons. We will therefore have to leverage advanced technology to overcome China's numerical advantage; in short, to overcome quantity with quality. Examples of this include our acquisition of F22s and Kongo DDGs. With a smaller defense budget, Japan cannot afford to compete in all capability areas, and must therefore be very selective in its military investment to achieve its defense objectives. These include capabilities to counter a large-scale China invasion, as well as cost-effective solution to counter China's nuclear and missile capabilities.

7. Static Net Assessment - Japan Versus Korean Federation

In this section, the static assessment of Japan's order of battle against that of the combined order of battle of both the Republic of Korea (ROK) and the Democratic People's Republic of Korea (DPRK) is conducted. The reason for the conduct of such an assessment being that the impending unification on the Korean Peninsular aroused worries and concerns in Japan. As such, the Japanese military needed to examine its military capabilities against such a rising threat from a unified Korea.

A few assumptions are taken with regards to the combined forces of the ROK and DPRK: (1) all forces in the ROK and the DPRK are integrated and jointly under the command and control of one Unified Korean Commander; (2) any issues pertaining to the C4ISR, training, and equipment interoperability at the different levels of command of the ROK and DPRK have been resolved; and (3) the minimum effective strength of the military is assumed to be at least the sum of the two military forces combined. For the purpose of the assessment, it is taken to be simply the sum of the two, although the above assumption could take a long time to resolve in reality.

The orders of battle have intentionally been reorganized and aggregated to provide a meaningful evaluation and comparison. Details of Japan's order of battle can be found in the section above and details of the ROK and DPRK were attained from interactions with the Korean team. Some epoch 3 Korean figures were projected from epoch 2 due to the unavailability of data.

a. Economy

	Japan	**ROK**	**DPRK**
Average Annual GDP Growth	5.1%	5.9%	12%
Average Annual GDP	¥617.8 trillion = US$5.616 trillion	US$663 billion	US$17.7 billion plus US$13 billion in aid package
Average Annual Per Capita GDP	¥4.86 million = US$44,000	US$14,000	US$816
Average Annual Spending on Defense as Ratio of GDP	0.99%	3.5%	27%
Average Annual Spending on Defense	¥5.9 trillion = US$54 billion	US$23.2 billion	US$4.8 billion

In terms of percentage of GDP spent on defense, DPRK's spending was one order of magnitude higher than that of Japan's, whilst the ROK's was three times higher. Although the total of these two percentages was much higher than that of Japan, their combined total in dollar terms was only half that of Japan's because Japan had a much higher GDP than the two Koreas combined. Japan spent about 30% of its defense expenditure on new equipment acquisition, old equipment upgrade and replacement. Both the ROK and the DPRK spent a comparable 30% on their equivalent force improvement programs. However, it is assessed that the DPRK's expenditure was for the replacement and modernization of a technologically much older order of battle. Therefore, the existing technological gap between the two forces is assessed to remain.

b. Manpower

Japan	ROK	DPRK
Joint: 8,400 Army: 169,000 (8 Div, 6 Bde, 1 Armored Div, 1 Airborne Bde, 1 Heli Bde, 1 Amphibious Bde) Navy: 53,600 Air Force: 51,200	Army: 560,000 (23 Active Div and 23 Reserve Div) Navy: 67,000 Air Force: 63,000	Army: 607,000 (50 Active Div and 17 Reserve Div) Navy: 46,000 + 65,000 Reserves Air Force: 86,000
Total: 282,200	**Total: 690,000**	**Total: 804,000**

(Note: The ROK Navy and Air Force figures were 2000 figures obtained from http://www.fas.org/irp/world/rok/nis-docs/defense08.htm, whilst the DPRK figures were from 2005, as no reliable figures were available.)

In terms of manpower, the JSDF is one order of magnitude smaller compared to those of the ROK and the DPRK combined. In view of its demographic and economic considerations, it is assessed that Japan's investment in better training and more technologically advanced combat systems make up for this numerical disadvantage.

c. Navy

	Japan	ROK	DPRK
Surface Combatants	28 (13) Kongo 32 (47) other destroyers	30 Missile Armed Ships (6 DD, 24 FS) 13 DD, 91 PB	48 Missile Armed Ships (3 FF, 39 PB) 5 FS 297 PB
Submarines	21 (20) SS	9 Type 209 (Chang Bogo) 6 Type 214	4 Kilo 14 Romeo 51 Others
Mine Warfare	42 (39)	15	24
Amphibious	27 (17) LSTs	33	223
Aircraft	70 (85) P3C 87 (79) ASW Helicopters 36 Others	28 P3C 20 Super Lynx	12 MPA

There are more missile-armed ships from the two Koreas combined than that in the Japanese fleet. But in terms of missile counts, Japan is comparable. The DPRK's missile-armed crafts comprise lower-end frigates and a sizeable number of patrol boats, each with two to four missiles. Those from the ROK are slightly more comparable to the Japanese, with 19 Aegis KDX series destroyers, six of which are armed with eight Harpoons, and some equipped with the SM-2 missiles. However, these are few in numbers compared to those of Japan's more modern Kongos, which are equipped with two squads of Harpoon SSMs. However, the Korean acquisitions of additional Kilo-class and Type 214 diesel submarines are a concern to the Japanese military. All in all, it is assessed that the combined surface fleets of the ROK and DPRK is no match for the more modern Japanese Navy.

d. Air Force

Japan	ROK	DPRK
250 (50) F22 102 (203) F15 125 (100) F2 18 (35) F1 25 UF 3 33 (83) F4/RF4 28 C1 16 C130 59 (39) CH47 30 (10) KC135 AAR	65 FXxx 160 F16 C/D 95 F5E 5 UCAV 160 Attack 10 RF 4/5 62 Fixed Wing Transport 30 Helicopters 5 KCxxx	35 MiG 29 206 other fighters 80 bomber 214 ground attack 118 fixed wing transport 275 helicopters

Comparing current generation fighters, Japan has slightly more F15s and F2s compared with the ROK and DPRK's F16s and MiG 29 respectively, although the ROK's F-16 and F5 fleets have been U.S. built, trained and supported. More importantly, Japan has significant numerical advantage in terms of advanced fighters with its fleet of

250 F22s versus the ROK's fleet of 65 FX fighters. The other fighters in the DPRK air force are lower-end ones comprising MiG 23s and MiG 21s and are assessed incomparable to the modern Japanese fighters.

e. Army

	Japan	ROK	DPRK
Tanks	1135 MBTs	2300	3875 Medium Tanks 1000 Light Tanks
APC	920	2500	2700
Artillery	631	4050 Gun Arty	6450 Gun Arty
MLRS	428	180	1700
Attack Helicopters	103	146	78

The ROK's equipment alone is numerically superior to those in the Japanese inventory. This gap is further expanded with the inclusion of the even higher numbers from the DPRK. However, the latter's equipment is assessed to be at least a generation or two behind the modern equipment of the Japanese army. Although this is a serious threat, it is assessed to be remote unless significant numbers of these can be brought to bear on Japanese soil, which in reality would require the support of their air forces and navies combined.

f. Missiles

	Japan	ROK/DPRK
Attack	1300 (550) Type 03 TELs (6 msl per TEL) 80 (80) Type 88 TELs (6 msl per TEL) 2 Type 12 ICBM	300 Scud B 150 Hwasong 5 250 Hwasong 6 120 Nodong 1/2 60 Taepo Dong 1 60 Taepo Dong 2 (may have 3 to 6 nuclear weapons) 25 KSR 1180
Air Defense	120 Patriot FU 192 I-HAWK FU	1024 SAMs (6100 ADA)

The close proximity of Japan to the Korean Peninsular and DPRK's possession of 240 Nodong 1/2 and Taepo Dong 1/2 ballistic missiles, means that the ROK and DPRK has the capability to bridge the Sea of Japan and readily hit all major cities in Japan, even though Japan has a sufficient number of SAM firing units. In return, Japan has 7800 Type 3 TEL land-based missiles that can hit any part of both the ROK and the DPRK – the Koreas only have about 1500 SAM firing units combined. Although Japan has twice as many SAM firing units than the number of offensive missile that the two Koreas have, Japan has the additional handicap of having to spread its firing units over a wide area while the attacker has the choice to dictate its targets. It is assessed that Japan may have difficulty in effectively defending itself against massive missile attack from the two Koreas if such an attack could be mounted. An additional concern is the potential use of these missiles for the delivery of weapons of mass destruction in acts of terror against Japanese cities and its population.

g. Summary (Japan versus ROK and DPRK Combined)

In summary, the combined total of the two Korean's military forces may have been numerically higher than that of Japan's but it is still not a serious threat. The large armies of the two Koreas appear formidable but their inability to effectively be projected onto Japanese soil makes this threat remote. However, of concern is the DPRK's possession of ballistic missiles and WMD capabilities that may potentially be used as a weapon of terror against Japanese cities and its population. Japan shall continue to commit resources in the future to find a cost-effective solution to this threat.

8. Dynamic Assessment Scenario 1 – Defense Against Amphibious Operation

This scenario is set in the East China Sea in 2016, whereby China decides to conduct a large-scale amphibious operation onto the west coast of Kyushu. The amphibious task force comprises 80% of their surface combatants, or 214 missile-armed ships, and 80% of their sealift capability, or 87 transport ships.

Our primary strategic intelligence collection and early warning capabilities include our human intelligence network and our 10 spy satellites providing imagery intelligence updates of any part of the world at a rate of once in 1.5 days. This will be supplemented by information obtained through our intelligence exchange agreement with USA. The agreement stipulates that the USA will provide any information that pertains to threats to Japan, and vice versa. With these in place, it is assumed that there will be no strategic surprise, and that any invasion by China will be preceded by a discernable period of tension. Our forces will be on alert, and will be deployed or dispersed in accordance with doctrine and operational requirements.

Our normal peacetime surveillance requirements include round-the-clock air and maritime surveillance by EU2s and ground-based radar stations. During this period of tension, an additional three EU2 stations west of Kyushu will provide persistent coverage over the area. This will be supported by P3Cs and EU1s for shadowing and investigation.

Forward imagery intelligence and electronic reconnaissance missions will be carried out by our stealthy EU1s and UF3s. The targets-of-interest includes key air and naval bases, key missile sites, likely troop concentration areas, as well as other early warning indicators of an impending attack.

China is likely to precede the amphibious operations with a massive missile strike on our air and naval bases. We will retaliate with Type 3 missile strikes on their key airbases and ships in port. In addition, we will also strike key military targets such as C4 facilities, missile sites, power plants etc. Given the completion of Phase I of our improvement in survivability and repair and recovery capabilities, our airbases should be able to recover in four to eight hours. Since the East China Sea is more than 400nm wide, China's amphibious task force should still be more than 200nm away.

a. Concept of Operation

We will adopt a layered defense against the amphibious task force (ATF). The concept of operations will be as follows:

Maritime Defense Zone 1 (less than 500nm) – We will attack the ATF with up to 5000 Type 3 missiles. Surveillance and targeting information will be provided by EU1s and EU2. On a worst-case assumption, the ATF carries 500 SAMs, and that each SAM successfully engage one of our Type 3 missiles. That will leave 4500 missiles, or 15 anti-ship missiles for every one of the 300 ships in the ATF. With no SAM remaining, it is unlikely that any ship will survive this attack. However, should the ATF somehow manage to survive, we will proceed to the next defense zone.

Maritime Defense Zone 2 (less than 200nm) – We will attack the ATF, which by now would have expended all their air defense missiles, with our submarines, destroyers and aircraft. China's Air Force is unlikely to achieve air superiority in this area more than

200nm off its shores given our superior fighter fleet of F22s and our highly capable ship-based air defense. With our ships and continuous waves of air attacks, none of the ships in the ATF is likely to survive. However, should the ATF somehow managed to survive the attacks in Zone 1 and 2, we still have a third and fourth line of defense.

Maritime Defense Zone 3 & 4 (less than 60nm) – These lines of defense are based on our shorter-range anti-ship missiles (Type 88 and Type 96 missiles) and the tanks, artillery and other weapons of the army inventory. At this point, the Japan Air Force will also be able to attack the ATF with impunity. We should be able muster two Div++ for defense. Hence, on the assumption of 4:1 force ratio, China will need at least 10 to 11 divisions for a successful amphibious operation. This is not possible since the total sealift capability is less than three divisions.

b. Conclusion

From the analysis, it is clear that at 2016, China will not be able to successfully conduct an amphibious operation against Japan. Their amphibious task force stands little chance of surviving the transit across the East China Sea. This is due to the following reasons: (1) China’s inability to shut down the Japan Air Force due to the high survivability and repair and recovery capabilities of our upgraded airbases. China was also not able to shut down our Type 3 TELs due to their mobility and dispersion; (2) China’s surface fleet’s ship-based air defense is inadequate and hence could be easily overwhelmed by our massive anti-ship missile strike; and (3) China’s Air Force is not able to achieve air superiority over East China Sea.

Even beyond these reasons we will have a robust ground and air defense if the amphibious force lands.

9. Dynamic Assessment Scenario 2 – SLOC Protection

This scenario is set in the South China Sea, where Chinese naval military forces are conducting extended maritime exercises in the seas between Guangzhou and islands in the Philippines. The PLAN Task Force comprises 40 missile-armed ships (8 destroyers, 12 frigates and 20 other missile armed craft), an SSN, MPA support and a whole host of auxiliary support ships. These ships number 1/5 of China's operationally available major surface combatants (assuming that a Chinese operational availability of two-thirds of the total force). Japan's main source of oil imports from the Middle East and trade from South East Asia transits through the Indian Ocean and the South China Sea SLOC. As part of the exercise, the PLAN task force, citing missile-firing exercises as the reasons, occasionally closes the SLOC. This interrupts the inflow of trade, energy and other critical resources into Japan. There is a subsequent fall in confidence with regards to the safety of shipping plying the seas in this area. This frustrates the Japanese leaders, as shipping to and from Japan declines. Japan begins to feel the "strangulating effects" of the PLAN's maritime exercise.

In order to ensure the safety of its shipping, as well as to restore confidence for the inflow of trade and other critical resources, a Japanese SLOC-Protection task force, comprising five Kongos, five DDs and round-the -clock surveillance from the EU-2s, is quickly dispatched to the area to enforce the freedom of navigation through the South China Sea and to deter and protect any Japan bound shipping from potential harassment.

The table below is a summary of the major combatants from the two navies.

	Japan	**China**
Missile Armed Ships	5 Kongo DDG 5 Asagiri DD	8 Luhu/Soveremenny/Luda/DDGX DDs 12 Jiangwei/Jianghu/FFX FFs 20 (Huan/Houxin/Huangfeng/Hega/PCMX)
Submarines	-	1 Han class SSN
Others	EU-2	MPA

a. Assessment

A static assessment of the major combatants between these two task forces has been conducted and the findings are summarized in the paragraphs below.

The PLAN task force is numerically superior to that of the Japanese task force.

In terms of surface action, the Japanese Task Force (JTF) is slightly inferior as there is eight SSMs per ship (total 80 missiles) versus 240 SSM spread over 40 ships (six per ship) for the PLAN Task Force. However, the Japanese Harpoon (and the SM-2/3) SSMs are also qualitatively superior to the PLAN's mixed bag of C-801/802/201 SSMs, except for the 250 km SSN 22 (Sunburn) SSM on the Soveremenny-class DDG.

In terms of air defense between the surface combatants, the JTF is superior with its ships' 90 cell VLS configured for AAW, as compared to the PLAN's mixed bag of SAN-7s and HQ-7s. Although large in numbers, the Japanese Task Force may not be able to sustain any prolonged battle because the close proximity of the southern coast of China subjects the Japanese ships to constant land-based fighter and missile attacks as well. On the other hand, the massive numbers of Japanese Type 3 TEL missiles and its large numbers of fighters and bombers are of no use because the long distances put the Type 3 missiles at the rim of their effective range. Also the nearest Japanese airbase is further than the combat radius of its fighters and bombers.

The threat from the single SSN is of some concern as there is no solution for tracking it, except for “flaming datum”. Japan will continue to look for an effective solution for this.

b. Conclusion (Japan SLOC-Protection)

We could draw the following conclusions from this scenario assessment. First of all, Japan needs to increase the size of its SLOC-Protection force to match that of the PLAN task Force. The vulnerability of the SLOC-Protection task force against land-based missile and fighter attacks is a big problem that will reduce the survivability of the ships significantly. Hence, more anti-air capability is needed for the SLOC-Protection task force to ensure its survivability. Lastly, there is no effective solution to counter the SSN threat.

For remedial actions, Japan may need to turn to several alternatives as the way ahead. We can seek assistance from the United States, although this may not be a reliable option. At the same time, we can also adopt a diplomatic strategy of getting more of the countries in the region (countries like the ASEAN, Australia, India, Russia, etc) involved in order to garner more strength. Domestically, we can route Japanese shipping to the east of the Philippines, or into the Pacific so as to stretch the reach of the PLAN forces.

10. Epoch 3 Summary

This epoch saw a more discernable triangular balance of power in the region involving the US, China, and Japan. Japan continued to reevaluate our three-pronged security policy: firmly maintaining the Japan-U.S. security arrangements, building up Japan's defense capability, and making active diplomatic efforts to ensure international peace and security. At the same time, the regional countries poised themselves for the impending unification of the Koreas.

Domestically, the long-term dividends for the drastic economic measures taken in 2001 were reaped as Japan enjoyed a decade of sustained positive growth since 2005. Japan’s efforts to sustain the national workforce level remained intact, though they were beginning to show diminishing dividends. Domestic reliance on imported energy continued to decline.

On the military front, there was substantial increase in absolute terms for defense spending; for example, the amount of money was doubled for equipment acquisition. The National Survivability and Enhancement Project was also initiated. With regard to technology, the US-derivative BMD system had matured by 2015 for field deployment. Meanwhile, we embarked on a black program for a nuclear warhead.

The static net assessment analysis against a potential unified Korean military showed that although quantitatively Japan’s military was one order of magnitude lower, its more modern equipment and better training and C4I capabilities put the Japanese military qualitatively ahead of the unified Korea and only their missiles remain a serious threat.

On the other hand, the static net assessment analysis against China showed that we continued to lag far behind in most areas and this gap can never be bridged due to demographic and economic reasons. We would therefore have to leverage advanced technology to overcome China's numerical advantage. A separate scenario study on China's capability to invade Japan clearly demonstrated that at 2016, China would not be able to successfully conduct an amphibious operation against Japan. This was because their amphibious task force was unlikely to survive the transit across East China Sea against our layered defenses.

Lastly, a separate analysis of our SLOC protection capabilities highlighted some areas of concerns, which would require remedial actions in the near future.

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D. Epoch 4 (2015 ~ 2020)

1. Geopolitical Arena

Diplomatic relations in East Asia during the past five years (2015-2020) have largely been an extension of the patterns developed during the beginning of the decade. The regional triangular balance of power remains but the relative influence of each of the respective powers continues to shift. The declining role of America and the gradual ascension of both China and Japan has yet to force Asian states to choose sides between the three, however these three states are beginning to assert pressure on their neighbors in order to shift the balance in their favor. The gradual emergence of the new regional order continues to force Asian states to re-examine their security policies. The indicators of this new regional alignment have been abundant and most Asian strategic planners have anticipated a gradual realignment. What most did not plan for though, is the roll back of American presence. In light of this rollback nations are beginning to feel compelled to align with either China or Japan.

Japan continues to reevaluate its three-pronged security policy: firmly maintaining the Japan-U.S. security arrangements, building up Japan's defense capability, and making diplomatic efforts to ensure international peace and security. The continued deterioration of American regional commitment and the emergence of an expansive and globally significant China places increased importance on the further development of Japanese strategic independence. However, given the persistent historic perception of Japan as an aggressor in the Asia-Pacific, Japan must continue to maintain some remnants of the US-Japan security treaty to pacify its neighbors at least for the short term. Until Japanese forces can fully mobilize to meet the security requirements in the new era, the aforementioned security treaty provides an anchor to contain and manage the destabilizing effects of conflicts in the region. Thus, the treaty continues to provide a useful framework for the development of balanced ties between Japan and the US in the context of growing interdependence on the one hand, and uncertainty on the other.

The United States remains the leading world power, but Japan must continue to strive for self-sufficient means of assuring its security. The American dilemma, coupled with the ongoing possibility of Chinese forces based in the Philippines, presents Japan with heightened security concerns. Japan must continue to play a larger political and military role in the region to ensure its national security while also assuring its neighbors that its resurgence does not threaten their interests. Japan continues to conduct joint military exercises as both a means of reassurance to its friends and as a demonstration of resolve to its enemies. Japan's growing military power must be couched in terms of Japanese "burden sharing" in the context of American "burden shedding" as countries in the region continue to view the US-Japanese strategic partnership as the linchpin for regional stability.

a. The Koreas

Korean reunification early in 2016 and the nearly complete withdrawal of American troops from the Korean Peninsula continue to concern Japan. Japan remains unsure of the status of military integration but still assesses the former military forces of the North and South as acting independently on operational and tactical levels, but pursuing a unified strategy as crafted by a coherent senior military leadership. Japan also remains concerned regarding the closer ties between Korea and China. Japan must continue efforts to cultivate a positive economic climate with the Koreas and continue to monitor Korean relations with China and Russia to ensure that Japan does not become surrounded by three nuclear states.

b. China

China expects to become the dominant power in East Asia. It aspires to replace the United States at the top of the world hierarchy of power. Its power continues to grow, however institutional reforms have been slow in coming and continue to hold China back from achieving its full potential. China does represent a significant challenge to Japanese security and Japan must pursue the best course of action to secure its interests. Japanese goals of economic and diplomatic engagement with China have been diluted by Chinese military activities in the South China Sea, and it must now attempt to contain Chinese influence in the region.

China's military modernization and conduct of naval exercises in the vicinity of the Philippines pose threats to vital Japanese regional trade routes. Russian arms sales and Taiwanese electronics expertise have begun to add technical depth to the vast human resources possessed by the Chinese armed forces. Reports of discussions between the Philippines and China regarding possible Chinese basing in Subic Bay also presents an increased threat to Japanese security.

c. Russia

In 2020, Russian remains in control of a vast military stockpile, including nuclear weapons. Russia remains encircled by strategic concerns, but has developed mutually beneficial relationships with both China and Japan. The sale of Russian arms to the Chinese and Indians continue to bring in much needed revenue, as has Japanese access to the natural resources of Siberia.

Russia continues its policy of "limited globalism" in which Russia engages the world and the Asia-Pacific region on a selective basis. Russia still does not posses the means for wide-ranging global aspirations and is likely to continue its present conflicted foreign policy. Continued economic cooperation with Russia remains essential to Japanese security due its needs for the diversification of energy sources and to counteract Chinese economic ties brought about by Russian military sales.

d. The United States

America continues its rollback from East Asia including the withdrawal of all US forces in Japan aside from one carrier battle group in Yokosuka. The US has shifted its forces to Darwin enabling America to project significant power into East Asia but on a decelerated timeline. Japan must maintain positive relations with the US while at the same time developing internal means to counter threats independently or until American forces arrive. Internal US pressures continue to compete for government dollars and reliance on energy from the Middle East plagues America's ability to commit resources for Japanese defense.

2. Domestic Situation

The institutional reforms implemented in epoch 1 (2000-2005) continued to pay significant dividends as Japan's GDP grew between 2-5% from 2015-2020. The government has continued to encourage women to join the labor force and for older workers to continue to participate in the economy. These measures are showing decreasing utility and are not providing enough workers. Japan must seek new ways to either decrease its reliance on labor or bring in workers from outside Japan.

The successes of deregulation during the previous epoch continued to encourage venture businesses and foreign subsidiaries, created new jobs, raised efficiency and reduced domestic price levels. Japan maintained competitiveness in automobile manufacturing, telecommunication, computer, plus Internet, financial and other service industries. The deregulation of goods, services, labor, real estate, and financial markets enabled Japan to best utilize its limited human resources, land resources, domestic purchasing power, and vast household savings.

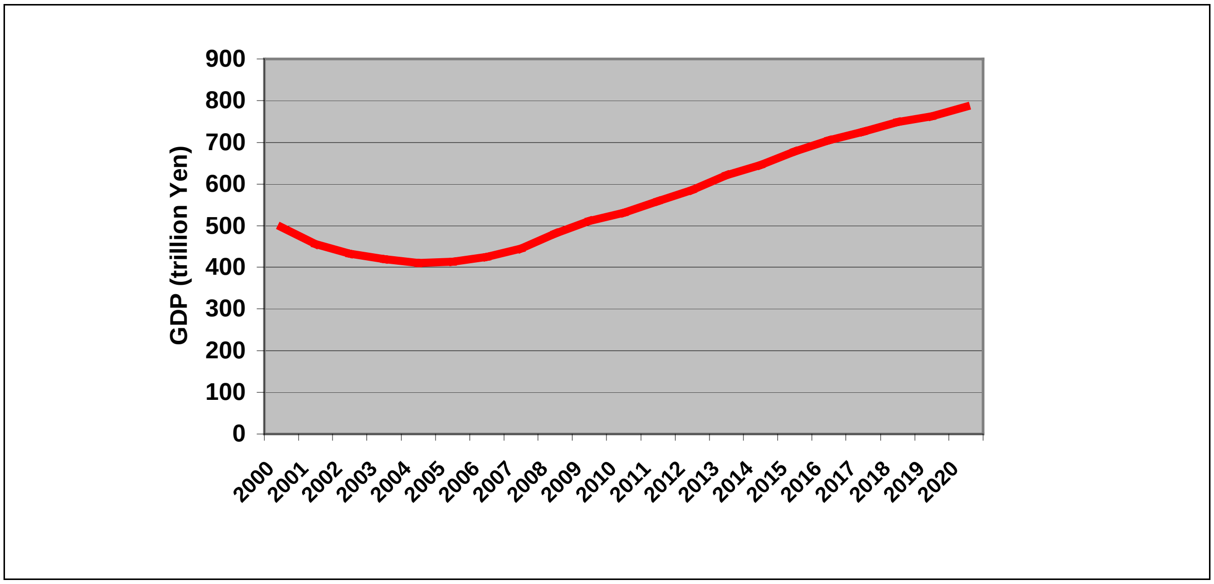


Chart 5-26: GDP Growth (2000 to 2020)

Japan’s GDP has sustained significant positive growth from 2015 to 2020. The economic difficulties resulting from reforms instituted earlier this century began to pay dividends in 2009 when GDP attained its former levels in year 2000. As is evident from the chart, GDP has grown nearly 60% since 2009. Per capita GDP in 2020 is US$51K.

Chart 5-27 represents GDP performance by percentage from 2015-2020. Economic growth has slowly decreased since 2010 but remains healthy.

Japan's total expenditure on defense has increased by nearly 1 trillion yen from 2015 to 2020. While this is a significant increase, spending as percentage of GDP has remained at a nearly constant rate of 1 percent.

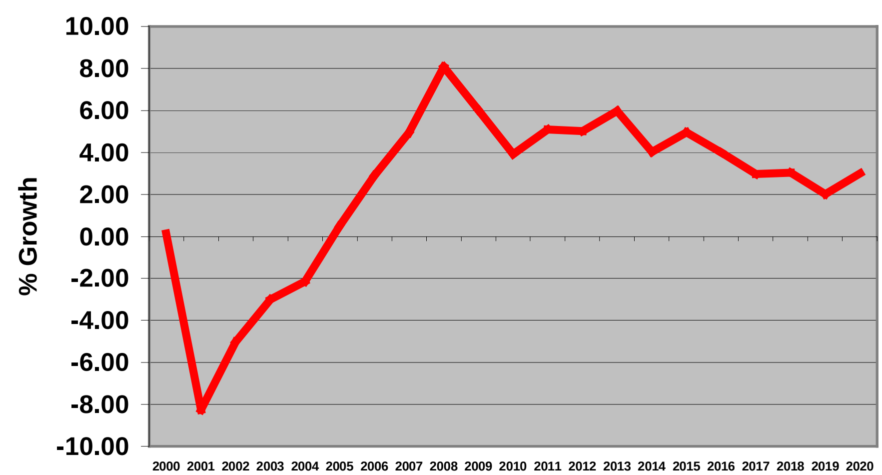


Chart 5-27: Economic Overview (GDP Performance)

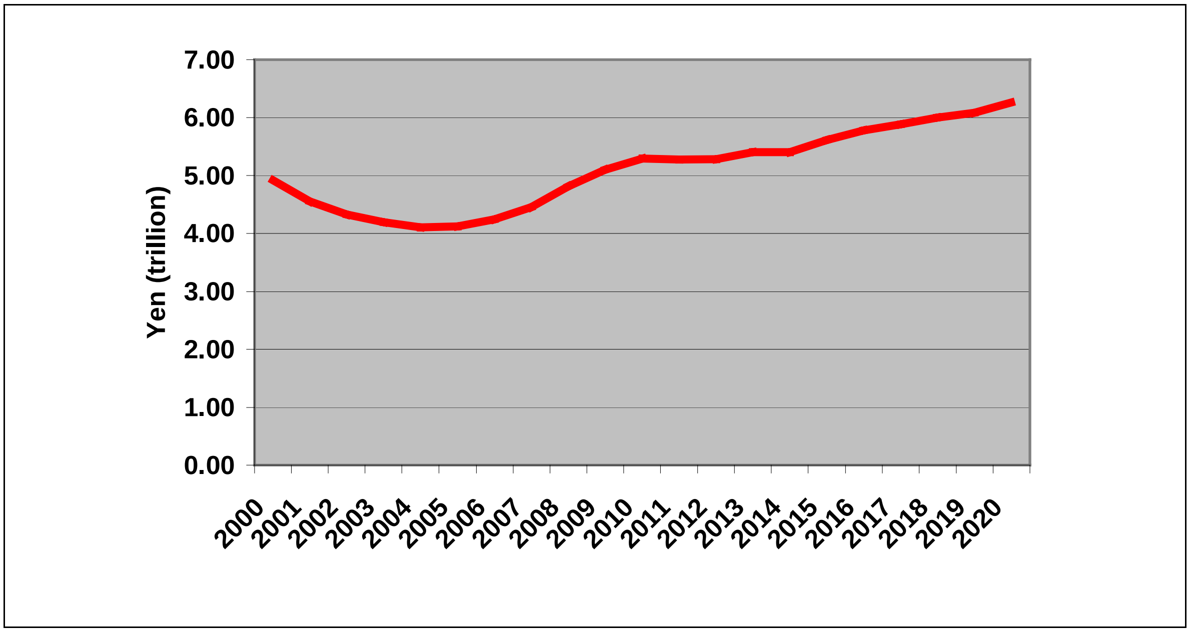


Chart 5-28: Defense Spending (2000 to 2020)

a. Nuclear Debate

In spite of the nuclear allergy, Japanese leaders have maintained that Japan must retain the option to develop nuclear weapons. Many believe the Japanese constitution explicitly prohibits nuclear weapons, but the government has stated repeatedly and consistently that the Japanese Constitution does not prohibit them. Article 9, which renounces Japan's right to make war and to possess ‘armed forces,’ has no explicit provision against nuclear weapons. As Japan reevaluates the provisions in Article 9, it must realize that the Constitution does not serve as a deterrent to nuclear armament regardless of its previously stated policies.

The Three Non-Nuclear Principles were established as national policy more than 40 years ago, but are not stipulated by law. Japan has ruled out the need for specific legislation because the principles are already well known both at home and abroad. A more binding constraint is the Japanese law governing nuclear energy, which strictly limits its use to peaceful purposes. Nonetheless, the present determined Japanese government must either change the law or choose to ignore it, as earlier governments have disregarded the three non-nuclear principles.

International agreements prove more formidable because Japan cannot change them unilaterally. The NPT and bilateral nuclear cooperation agreements are two notable examples. Japan is a member of the NPT, but the treaty does not provide for any sanctions or punitive measures against members who violate treaty obligations. Any member is allowed to withdraw from the treaty with a three-month notice to the U.N. Security Council if "extraordinary events have jeopardized its supreme interests".

b. Energy

Japan's diversification of energy import routes, adding natural gas and oil shipments from the Russian Far East, has lessened heavy reliance on the Persian Gulf and provided Japan with supplements to internal generation. Japan must continue to import natural gas resources from the Sakhalin Islands during the short term as they compare favorably with other substantial regional natural gas suppliers. Greater use of natural gas has more domestic support than nuclear power and oil imports because Japan has never experienced a major accident or disruption of its natural gas imports.

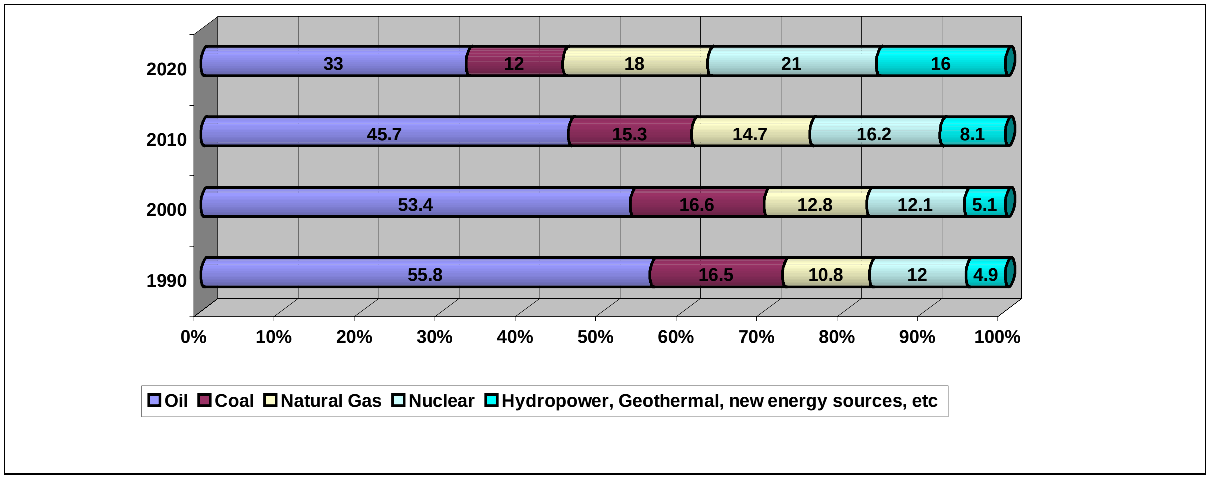


Chart 5-29: Primary Energy Sources

Japan continues to diversify energy sources. Its dependence on oil imports decreased in 2020 by nearly 12% from 2010 levels. Due to domestic generation and its cooperative endeavors with Russia, oil dependence will lessen to 1/3 of the total. While not fully self-reliant for energy production, Japan has limited vulnerabilities by diversifying both fossil fuel suppliers and means of internal generation.

c. Demographics

The total workforce has begun to decrease. Japan must continue to examine means to reduce its dependency on labor.

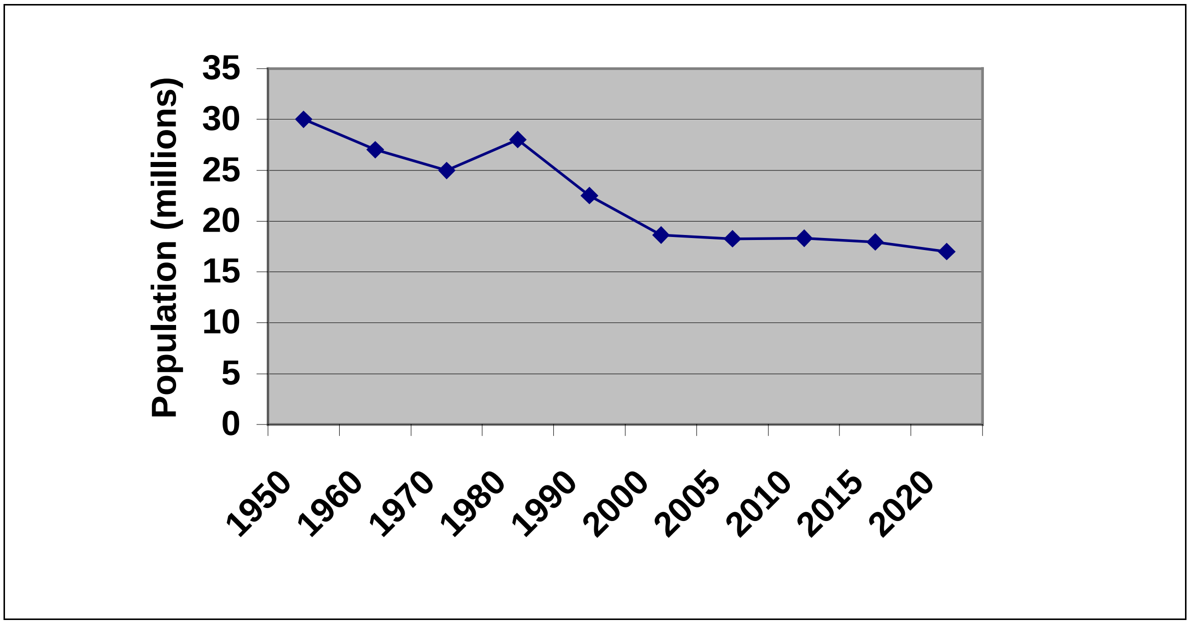


Chart 5-30: Children Population (1950 to 2020)

Japan's population continued to age gradually during this epoch, however over the past 20 years (2000-2020) population growth rates remained relatively constant.

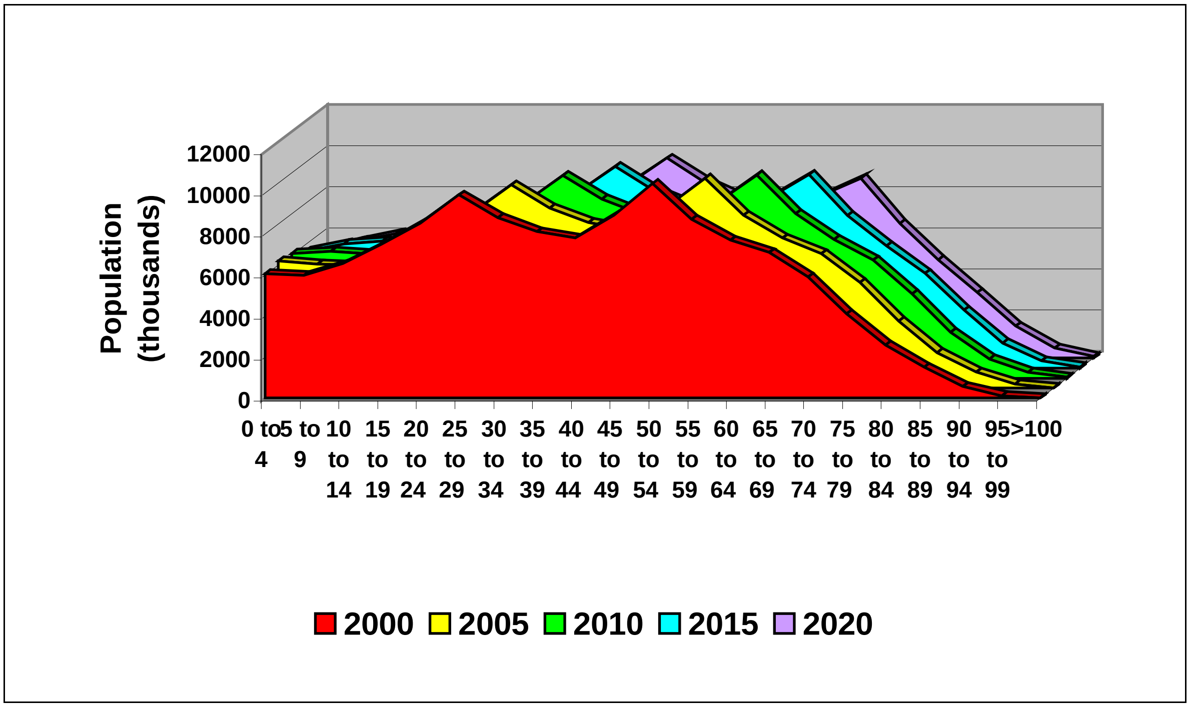


Chart 5-31: Aging Population Trend

As is evident by the shifting peak on this chart Japan's population continues to age.

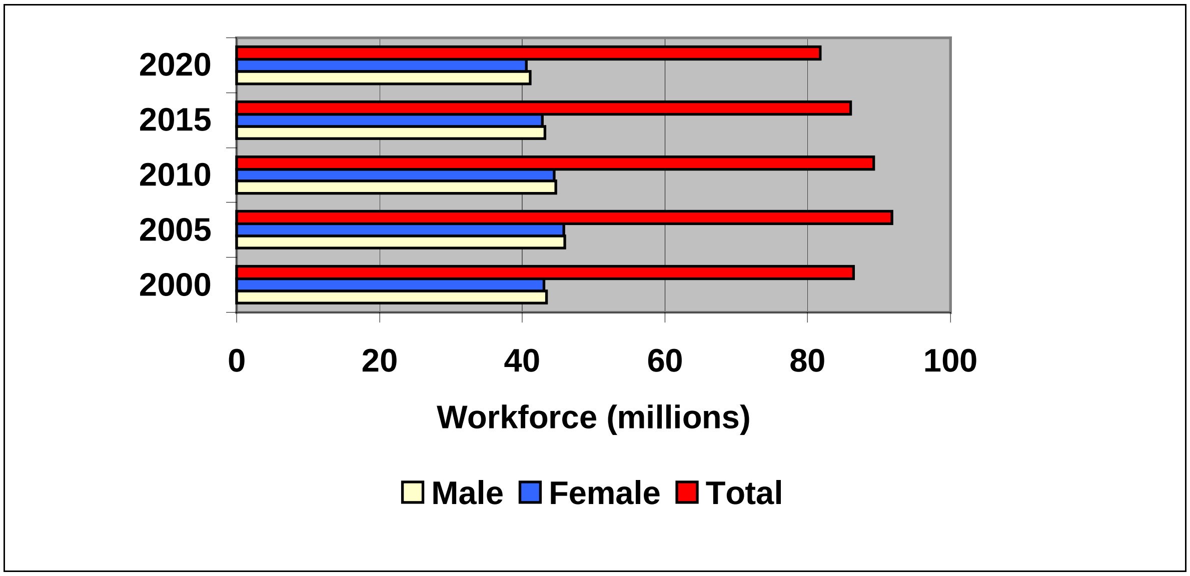


Chart 5-32: Japanese Workforce

3. Japan Self-Defense Force

In the last five years, the US forces had almost completed its withdrawal from the Korea Peninsula. By 2020, token US forces had started leaving Okinawa. The tentative plan was to reposition those US troops in Darwin, Australia. In the near future, there would be a sizable decrease of US presence in this region. For the moment, the US-Japan Security Arrangement was still in place and the US had reiterated its support for the NPT. Even though North Koreas had disarmed their nuclear weapons, Japan remains wary of the fact that they did possess the technological know-how. Furthermore, China had been expanding their military rapidly in the recent years and their nuclear missiles could easily threaten Japan.

a. Principal Considerations

First and foremost, Japan must be militarily self-sufficient in its homeland defense. Having no land border would imply that any invasion would come via the sea or air. The massive withdrawal of US troops from the region compelled Japan to rethink how it could ensure its sovereignty. The right to self-defense dictates that Japan must be able to defense itself against any hostile invasion. Secondly, to be a credible force, the military must be prepared for the full spectrum of warfare. As Japan is constantly besieged with natural disasters, like earthquakes, the military must also respond civil disaster relief efforts and other peacetime roles, like participation in UN missions. Thirdly, with the limited manpower due to demographic and economic reasons, Japan needs to overcome its numerical disadvantages by leveraging technology and high-quality training. Lastly, Japan depends on external resources. Hence, it needs to protect these critical lifelines.

b. Defense Strategy and Policy

For the past 20 years, Japan's defense strategy had remained essentially the same. The primary focus was the twin pillars of defense and deterrent.

By defense, Japan strived to nullify any attempt to bring hostility to itself – either through a conventional engagement or by air/missile attacks. Therefore, Japan had increased its Patriot batteries and equipped its Sapporo and Kongo-class destroyers with NTWD (Navy Theatre Wide Defense) capability.

By deterrent, Japan strives to possess a credible force that would cause any adversary to think again before considering hostile actions against Japan. Hence, Japan invested heavily in expanding its C4ISR capabilities for early warning and cruise missile technology for retaliation.

As with the Defense Strategy, there was no amendment to the Defense Policy. Japan had not deployed any nuclear weapons although it does possess the necessary materials and technical know-how to put existing fission materials onto a Type-03 SSM warhead.

c. Defense Expenditure

S/No	Item	Epoch 3 Average (Billion ¥)	Epoch 4 Total (Billion ¥)	%	Yearly Average (Billion ¥)	% Change (cf: Epoch 3)
1	Personnel & Provision	2,400.0	14,534.0	39.8%	2,906.8	21.1%
2	Maintenance	900.0	4,512.0	12.4%	902.4	0.3%
3	Facilities	384.0	2,000.0	5.5%	400.0	4.2%
4	R&D	112.0	770.0	2.1%	154.0	37.5%
5	Equipment Acquisition	1,645.0	11,216.0	30.7%	2,243.2	36.4%
6	Others	660.0	3,500.0	9.6%	700.0	6.1%
7	Total	6,101.0	36,532.0	100%	7,306.4	19.8%

Table 5-27: Defense Expenditure from 2016 to 2020

The ten-year defense survivability program was successfully completed. All the key military installations were hardened. In some cases, redundancy was built – for example, alternate runways, etc. Repair and recovery facilities were also enhanced. There was also a major salary revision in 2018. All military personnel would see an average increase of 8% in pay. Overall, the defense expenditures averaged about 0.98% of the GDP.

At the beginning of the decade, when the national economy took a downward turn, the military felt the squeeze as it strived to maintain total expenditures within 1% of the GDP. Hence, there was a significant reduction in equipment acquisitions and many on-going programs were either reprioritized or cancelled. Nonetheless, this trend was reversed in the second decade as the economy picked up, as reflected below.

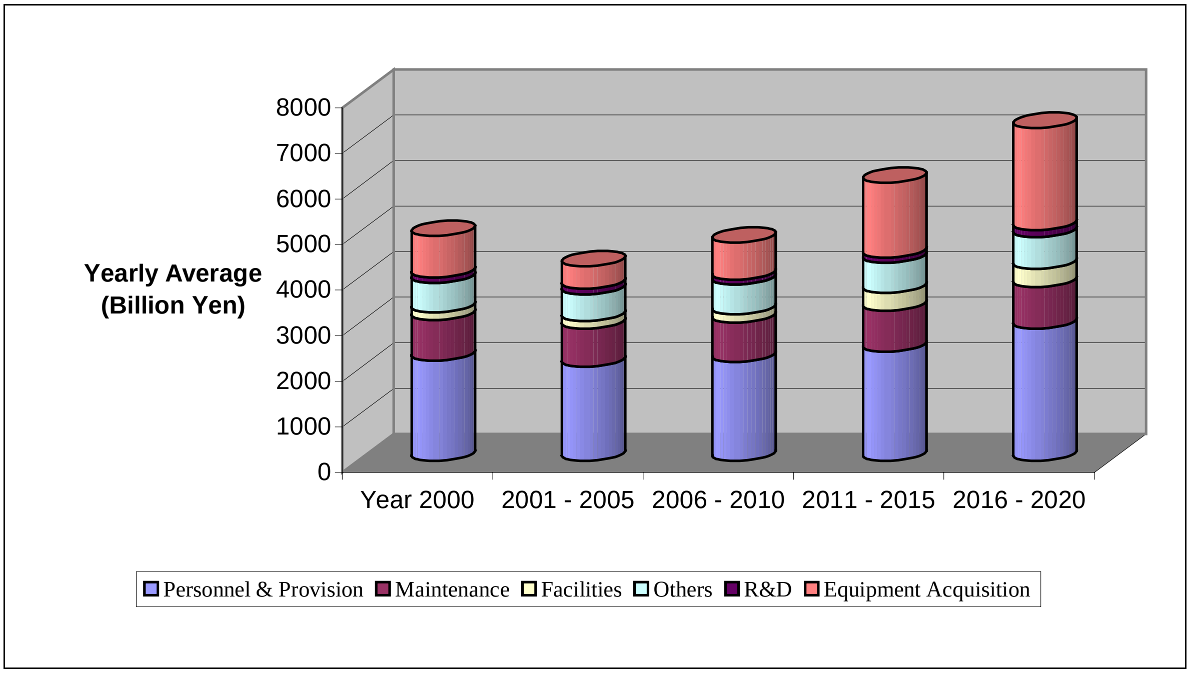


Chart 5-32: Defense Expenditure Trend from 2000 to 2020

d. Defense Research and Development Programs

The nuclear warhead development program was essentially completed. However, there was no physical deployment by 2020. But Japan had increased the stock of weapon-grade plutonium. The JAMSTEC UUV and the High Energy Laser Systems (HELS) were on-going R&D programs. Refer to Annex 5B for a brief description of all the systems that were fielded over the twenty years. Believing that hedging with technology could compensate forany numerical disadvantage facing the JASF , Japan was relentless in research and development investments, both as a national policy and in the military. Over the twenty-year period, the main defense research and development programs are as listed below:

S/No	Item	Amount (Billion ¥)	Remarks
1	Nuclear Submarine	160	Production by 2025.
2	JAMSTEC UUV	55	3 prototypes fielded.
3	Ballistic Missile Defense	160	NTWD, PAC-3, BMC3I.
4	Type-12 ICBM	30	10 ICBM deployed.
5	Type-03 SSM	75	2000 TELs deployed.
6	200 KT Nuclear device	50	Completed.
7	High Energy Laser systems	45	3 prototypes fielded.
8	UAV (EU-1, EU-2 & UF-3)	150	300 UAVs fielded.
9	National Command and Control System	120	All services C4ISR fully integrated.

Table 5-28: Main Defense Research and Development Programs from 2000 to 2020

e. National Defense Program Outline

By 2020, the JSDF force structure had almost approached the desired end-state as spelled out in the 2012 NDPO. For the last 10 years, the number of active personnel in the entire JSDF had remained relatively constant.

Classification		2012 NDPO	At End of Revised Mid-Term Defense Program (2020)
Manpower	GSDF (Regular)	Approx. 120,000	Approx. 121,000
	GSDF (Reserve)	Approx. 50,000	Approx. 49,000
	MSDF	Approx. 60,000	Approx. 60,500
	ASDF	Approx. 55,000	Approx. 54,500
	Joint Staff	Approx. 12,000	Approx. 11,500
	Total (Active)	Approx. 247,000	Approx. 247,500
	Grand Total	Approx. 297,000	Approx. 296,500
GSDF	Division	8 Infantry Division 1 Armored Division	8 Infantry Division 1 Armored Division
	Brigade	6 Infantry Brigade 1 Airborne Brigade 1 Helicopter Brigade 1 Amphibious Brigade	6 Infantry Brigade 1 Airborne Brigade 1 Helicopter Brigade 1 Amphibious Brigade
	Tanks	Approx 1140	1,135
	Artillery	Approx 1020	1059
MSDF	Destroyer	70	65
	Submarine	22	22
	Combat Aircraft	200	Approx 200
ASDF	Fighter	600	600
	UAV	300	300

Table 5-29: 2020 Mid-Term Review of Defense Program

The table above compares the order of battle at 2020 versus the latest NDPO that was established in 2012.

f. Ground Self-Defense Force (GSDF)

			Epoch 4 (2016 ~ 2020)			
S/No	**Item**	**2015 Qty**	**Acquire/ Build-up**	**Upgrade**	**Retire/ Close down**	**2020 Qty**
1	Infantry/Combined Div	8			1	8
2	Infantry Bde	6				6
3	Armored Div	1				1
4	Heliborne Bde	1				1
5	Airborne Bde	1				1
6	Amphibious Bde	1				1
7	Tanks	1,135		**300**		**1,135**
8	APC	920	**100**	**300**		**1,020**
9	Artillery (155mm SP)	631			**400**	**231**
10	MLRS	428	**400**			**828**
11	Attack Helicopters	103	**30**		**5**	**128**
12	Other Helicopters	449	**45**		**5**	**489**

Table 5-30: Major GSDF Order Of Battle

The main procurement in the last five years was the MLRS. To-date, the ratio of MLRS to 155 mm SP artillery is about 4:1. The Army digitization effort was also completed. Their C4I systems had also been effectively integrated into the National Command and Control System (NCCS).

g. Maritime Self-Defense Force (MSDF)

			Epoch 4 (2016 ~ 2020)			
S/No	**Item**	**2015 Qty**	**Acquire/ Build-up**	**Upgrade**	**Retire/ Close down**	**2020 Qty**
1	Kongo Destroyer	28				28
2	SM3 Missile (NTWD)	200	800			1,000
3	Sapporo DDGs	0	20			20
4	Other DDs	32			15	17
5	Submarine (SS)	21	2		6	17
6	Meiji SSN (Akula-class)	0	5			5
7	Mine warfare ship (MSC)	42	8		3	47
8	Landing Ship (LST)	27	15			42
9	P3C (Fixed wing patrol)	70		15	15	55
10	HSS-2B (Patrol)	36				36
11	MH-53E (Mine sweeping)	10				10
12	SH-60J (anti-sub)	87	20		2	105
13	JAMSTEC UUV	0	3			3

Table 5-31: Major MSDF Order Of Battle

The Maritime force acquired 20 new Sapporo DDGs (US DD21 variant that has ASW capabilities) instead of the Kongo destroyers. In total, there were 48 modern and high-tech destroyers, which required less manning and maintenance. Japan also bought five new Meiji-class submarine – these were the Akula[1] class nuclear submarines from Russia. Japan also spent about ¥160 billion yen to acquire an additional Akula-class submarine for reverse engineering. It was desired that by 2025, Japan would be able to manufacture nuclear submarines.

[1] FAS Russia Akula-class Nuclear Submarine - http://www.fas.org/man/dod-101/sys/ship/row/rus/971.htm.

h. Air Self-Defense Force (ASDF)

			Epoch 4 (2016 ~ 2020)			
S/No	**Item**	**2015 Qty**	**Acquire/ Build-up**	**Upgrade**	**Retire/ Close down**	**2020 Qty**
1	F-15 (J/DJ)	102			102	0
2	F-22	250	200			450
3	F-1	18			18	0
4	F-2	125	25			150
5	F-4/RF-4 (E/EJ)	33			33	0
6	C-1	28				28
7	C-130H	16				16
8	CH-47J (Transport)	59	30			89
9	KC-135R	30	30			60

Table 5-32: Major ASDF Order Of Battle

The ASDF had completed its modernization programs. The 450 F-22 would completely replace the F-15 and the F-2 was meant to replace the F-1 and F/RF-4. That would greatly streamline the logistics facilities in the Japan Air Force. The fleet of KC-135R refueling tankers was also expanded to 60 in number.

i. Major Missile Systems

			Epoch 4 (2016 ~ 2020)			
S/No	**Item**	**2015 Qty**	**Acquire/ Build-up**	**Upgrade**	**Retire/ Close down**	**2020 Qty**
1	Patriot PAC-3 FU Upgrading	120	120			240
2	Type-12 ICBM	2	8			10
3	Type-88 TEL (c/w 6 missile ea)	80			80	0
4	Type-03 TEL (6 missile ea)	1,300	700			2,000
5	Type-03 Missile	13,000	7,000			20,000
6	High Energy Laser System	0	3			3

Table 5-33: Major Missile Systems

Japan fielded another 120 Patriot firing units to provide air-defense for some of the key national installations that were identified in the national survivability study. The

Type-88 was phased out. However, the Type-03 TEL force was expanded to 20,000 missiles. Eight more ICBMs were also deployed.

j. Major C4ISR Systems

			Epoch 4 (2016 ~ 2020)			
S/No	**Item**	**2015 Qty**	**Acquire/ Build-up**	**Upgrade**	**Retire/ Close down**	**2020 Qty**
1	EU-1 (Low observable)	57	**43**			**100**
2	EU-2 (HAE)	55	**45**			**100**
3	UF-3 (Strike & F/R)	25	**75**			**100**
4	E-2C	13				**13**
5	E-767	4				**4**
6	Info Gathering Satellite	10	**8**	**6**	**2**	**16**
7	IW Platoon (30-men)	3	1			4

Table 5-34: Major C4ISR Systems

By 2020, Japan would have fielded a total of 300 UAVs, 100 each of EU-1, EU-2 and UF-3. There was also a total of 16 Information Gathering Satellites (IGS), thus Japan would have a revisit rate of once daily over any region. Their resolution was also enhanced to 30 cm.

4. Static Net Assessment

a. Japan Versus Unified Korea

In this section, the static assessment of Japan's order of battle against that of the new Unified Korea is conducted. The following assumptions are taken with regards to the military forces of a Unified Korea:

(1) There is a Unified Korean Commander who has overall command and control of the military forces, which are essentially the combined forces of the ROK and DPRK prior to unification.

(2) Any issues pertaining to the C4ISR, training, and equipment interoperability at the different levels of command have been resolved, although these normally can take a long time to resolve.

The orders of battle have intentionally been reorganized and aggregated to provide a meaningful evaluation and comparison. Details of Japan's order of battle can be found in the section above, while details of the Unified Korea are referred from the Korean chapter, with some numbers inferred from Epoch 3 as data for Epoch 4 is not available.

1) Economy

	Japan	**Unified Korea**
Average Annual GDP Growth	3%	K(N) - 12-7.2 % tapering off K(S) - 5.9 %
Average Annual GDP	¥745.6 trillion = US$6.778 trillion	K(N) - US$33.1 billion K(S) - US$884.7 billion
Average Annual Per Capita GDP	¥5.87 million = US$53,000	K(N) - US$1,525 K(S) - US$18,600
Defense as Ratio of GDP	0.98%	K(N) - 27 % K(S) - 3.5 %
Average Annual Spending on Defense	¥7.4 trillion = US$67 billion	K(N) - US$8.9 billion K(S) – US$31.0 billion

Table 5-35: Economic Comparison Between Japan and Unified Korea

Although the average annual GDP of Unified Korea was one-seventh that of Japan’s ¥745.6 trillion, its defense spending is two-thirds that of Japan’s. The high defense spending as a ratio of its GDP is the result of the North’s continued spending on its huge military force. However, both countries spent an equivalent 30% of their defense monies on force improvement programs like new equipment acquisition, old equipment upgrade and replacement.

2) Manpower

Japan	Unified Korea
Joint: 11,500 (8,400)[2] Army 170,000 (169,000) Navy 60,500 (53,600) Air Force: 54,500 (51,200)	Army: 863,000 Navy[3]: 113,000 + 65,000 Reserves Air Force: 126,000
Total: 296,500 (282,200)	**Total: 1,167,000**

Table 5-36: Manpower Comparison Between Japan and Unified Korea

With the unification of the ROK and the DPRK, there was a general effort to reduce the size of both militaries, especially those of the armies. Even with such efforts, the Unified Korea military continues to be an order of magnitude higher than that of Japan. Therefore, Japan continues to invest in better training and more technologically advanced combat systems to make up for this superior numerical disadvantage.

3) Navy

	Japan	Unified Korea
Surface Combatants	20 (0) Sapporo 28 (28) Kongo 17 (32) other destroyers	25 (19) KDX destroyers 334 (382) PBs (39 missile armed)
Submarines	5 (0) SSN 17 (21) SS	10 Type 214 9 Type 209 4 Kilo 10 Upgraded Romeo
Mine Warfare	47 (42)	42 (39)
Amphibious	42 (27) LSTs	98 (256)
Aircraft	55 (70) P3C 105 (87) ASW Helicopters 36 (36) Others	60 (40) MPA 30 ASW Helicopters

Table 5-37: Navy Comparison Between Japan and Unified Korea

[2] Figures in parenthesis denote figures for previous epoch.
[3] The Unified Korean Navy and Air Force figures are 2015 figures as no reliable figures were available.

Comparing the fleets, the combatant of significance is the introduction of 20 Sapporo DDGs into the Japan's, replacing some of the older DDs, as compared to the 25 KDX destroyers of the Unified Korea, only six of which are equipped with the Harpoon and the Aegis system. The Unified Korea continues to maintain the former DPRK's substantial fleet of small and old patrol boats, 39 of which are armed with two to four missiles. In terms of total missile capacity, the 20 Sapporos exceed that of the entire Unified Korean Navy. The introduction of the 5 Meiji-class SSNs into Japan's existing fleet of diesel submarines gives it a qualitative edge over the Unified Korea's fleet of 33 diesel submarines. Whilst the overall naval numbers may be comparable, Japan operates a more modern fleet and therefore is assessed to have the qualitative advantage over the Unified Korea.

4) Air Force

Japan	**Unified Korea**
450 (250) F22 150 (125) F2 100 (25) UF 3 28 (28) C1 16 (16) C130H 89 (59) CH47 60 (30) KC135 AAR	468 (566) fighters [133 FXxx, 55 UCAV, 140 F16 C/D, 20 MiG 29, 20 MiG 23, 100 MiG 21] 336 (374) Ground Attack 10 (5) RF 4/5 188 (180) Fixed Wing Transport 305 Helicopters 10 (5) KCxxx

Table 5-38: Air Force Comparison Between Japan and Unified Korea

There was no significant change to the air force of the Unified Korea as it continues to maintain the same fleets from the former ROK and DPRK. On the other hand, Japan continues with its modernization efforts with the procurement of more advanced fighters while retiring the old. Therefore, Japan continues to enjoy its numerical superiority in its advanced fighter fleet with the additional purchase of 200 F22s to replace the F15s, as compared to the 133 FX fighters of Unified Korea, an increase of 68 from the former ROK's fleet of 65. The aging F1s and F4/RF4 were also retired, as Japan modernizes its air force. On the other side, the Unified Korea increased its fleet of UCAVs from five to a substantial force of 55. In terms of current generation fighters, these are comparable for both countries.The Unified Korea continues to maintain the remainder of its lower-end fighters, MiG 23s and MiG 21s. With higher quality training, better C4 capabilities and more modern aircraft, it is assessed that the Japanese air force also enjoys a qualitative advantage over the Unified Korea.

5) Army

	Japan	**Unified Korea**
Troops	8 (8) Div, 6 (6) Bde, 1 (1) Armored Div, 1 (1) Airborne Bde, 1(1) Heliborne Bde, 1 (1) Amphibious Bde	53 (73) Div
Tanks	1135 (1135) MBTs	2880 (4300)
APC	1,020 (920)	3040 (4040)
Artillery	231 (631)	8250 (10500) Gun Arty
MLRS	828 (428)	1380 (1880)
Attack Helicopters	128 (103)	386 (242)

Table 5-39: Army Comparison Between Japan and Unified Korea

The Unified Korea has reduced the size of its army, although it continues to maintain a sizable force for domestic and economic reasons. Even with this reduction, the Unified Korea Army is still numerically larger than Japan's. Japan has one airborne brigade, one heliborne brigade and one amphibious, but these are not large enough to effectively take over anything on the mainland of Unified Korea. On the other hand, the Unified Korea may have a large army, but it has limited lift capability, and therefore chances that such a huge force can be brought to bear on the Japanese homeland is highly remote, and will require the support of its air force and navy which face heavy qualitative and quantitative handicaps when operating away from the homeland.

6) Missiles

	Japan	**Unified Korea**
Attack	2000 (1300) Type 03 TELs (6 msl per TEL) 10 (2) Type 12 ICBM	60 (40) KSR 1[4] 25 (0) Hyon Mu[5] 100 (150) Hwasong 5[6] 250 (250) Hwasong 6[7] 296 (216) Nodong 1/2[8] 135 (105) Taepo Dong 1[9] 85 (55) Taepo Dong 2[10] (may have 3 to 6 nuclear weapons)
Air Defense	240 (120) Patriot PAC-3 FU 192 (192) I-HAWK FU	1138 (1524) SAM 1100 (3100) ADA

Table 5-40: Missile Comparison Between Japan and Unified Korea

The Unified Korea has increased its numbers of ballistic missiles from 376 to 516, almost a 40% increase. These are missiles that can hit the Japanese cities. To counter these, Japan has doubled its Patriots to 240 FUs, and maintaining its 192 I-Hawks FUs. Japan also has a fleet of 48 NTWD DDG that has an initial ballistic missile defense capability with the Patriot PAC3[11] missile. These are assessed to be insufficient to defend against any massive missile attacks from the Unified Korea. It is assessed that to increase the number of SAMs is a not a cost-effective way to counter such a threat. On the other hand, Japan increased its Type 3 missiles to 2000 units, or a total of 12,000 missiles. This is one order of

[4] Range of 180km.
[5] Range of 300km.
[6] Range of 330km.
[7] Range of 500km.
[8] Range of 1300km.
[9] Range of 2000km.
[10] Range of 6000km.
[11] The PAC3 missiles are still not able to intercept ballistic missile re-entering the atmosphere at velocities higher than 5 km/sec.

magnitude higher than the 1100 SAM units in the Unified Korea. It is intended that this ability to retaliate can be deterring and is the more cost-effective answer to the Unified Korea's increasing ballistic missile inventory.

7) Summary (Japan Versus Unified Korea)

In summary, despite its smaller GDP, the Unified Korea continues to spend a substantial portion of its GDP on defense, to improve and replace its old and obsolete equipment. This amount is comparable to Japan's 1% GDP spending in dollar terms. Although the Unified Korea continues to reduce its military, especially its army, it is still numerically larger than that of Japan. But it does not pose a serious threat to Japan. However, Japan continues to leverage quality training and advanced technology to maintain a advanced military force. The Unified Korea's force of ballistic missiles and its possession of WMD capabilities continue to worry Japan. Japan must find cost-effective solutions to these threats. Japan shall continue to commit resources in this area.

b. Japan Versus China

In this section, the static assessment between Japan's forces and China's forces is presented. Details of Japan's forces can be found in the previous chapter. The data presented has been reorganized and aggregated to provide a meaningful comparison.

1) Manpower

Japan	China
Joint: 11,500(8,400) Army: 170,000(169,000) Navy: 60,500(53,600) Air Force: 54,500(51,200)	PLA: 1,500,000(1,600,000) Rapid Reaction: 100,000(90,000) Navy: 310,000(310,000) Marines: 15,000(15,000) Special Forces: 14,000(14,000) Intelligence: 10,000(5,000)
Total: 296,500(282,200)	Total: 1,949,000(2,034,000)

Table 5-41: Manpower Comparison Between Japan and China

Over the last 5 years, China has continued to downsize its overall military manpower. At the same time, the buildup of the rapid reaction force has persisted. The total JSDF manpower remains an order of magnitude smaller than that of China. Due to economic and demographic reasons, it is not possible for Japan to significantly increase the manpower of JSDF. Operationally, (as shall be seen in the air and naval order of battle), China's air and sealift capability have improved, and is assessed to be capable of projecting an estimated 22,000 troops by fixed wing transport aircraft and 36,000 troops by sea. But this constitutes only a small fraction of the total PLA order of battle

Qualitatively, although PLA personnel are generally well trained in basic skills, their leadership, training in combined operations and morale is low. Most soldiers are poorly educated and one-third leave active duty each year. There is also no professional NCO corps[12].

[12] http://www.fas.org/nuke/guide/china/agency/pla-intro.htm

2) Air Force

Japan	China
450(250) F22 150(125) F2 100(25) UF3 28 (28) C1 16 (16) C130 89(59) CH47 60(30) KC135R AAR	120(20) J12 350(400) MiG31 362(375) J11 285(285) J10 580(700) Lower end fighters/attack 112(100) Heavy/Medium Lift FW Transport 100(100) Light FW Transport 16(13) AAR 439(397) Helicopters

Table 5-42: Air Force Comparison Between Japan and China

The modernization of China's Air Force continues unabated. The main acquisition for China over the last 5 years is the 100 of fifth-generation J12s. At the same time, they continue to phase out their large fleet of older aircraft. China's ORBAT of fourth-generation fighters have remained stagnant, indicating that their future procurement will probably be focused on fifth- generation fighters. However, JASDF has previously decided to maximize the limited pool of pilots by providing them with the best fighters money can buy. Hence, Japan pushed ahead with the replacement of the fleet of fighters with 450 F22s. In so doing, JASDF has now commanded a definite qualitative edge over the PLAAF.

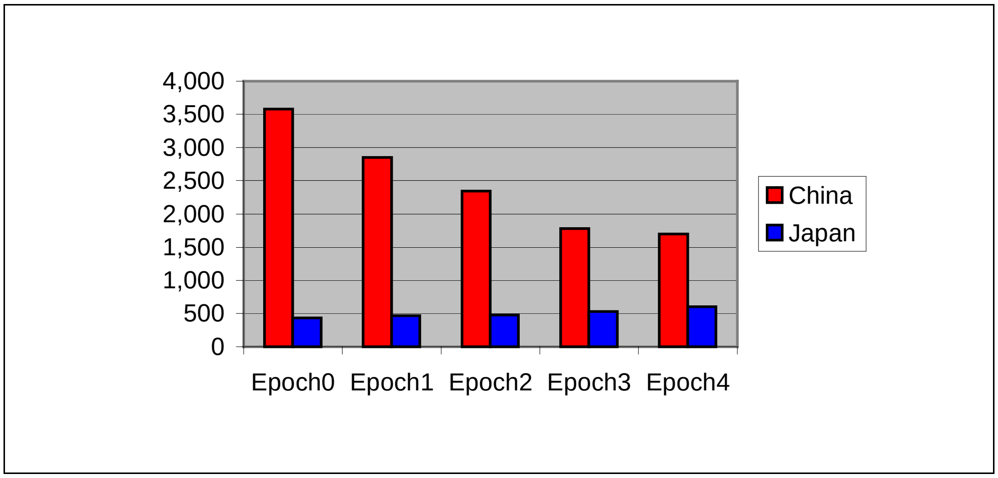
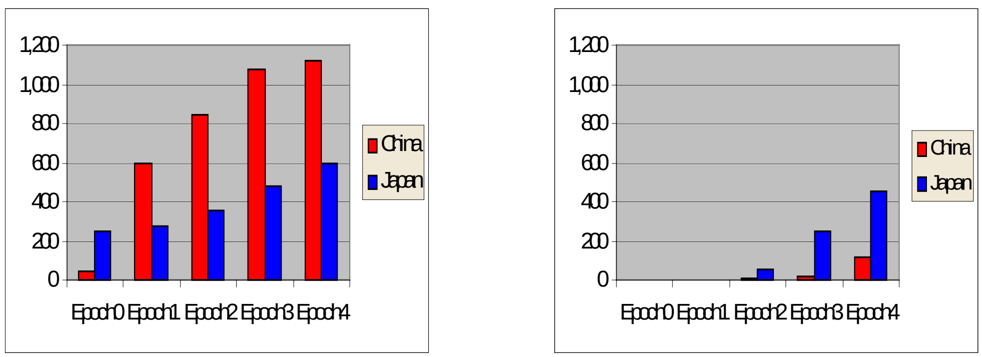


Chart 5-34: Numerical Comparison of Fighter Fleets over 20 Years

The chart above presents a numerical comparison of the two fighter fleets over the 20-year period.



4th + 5th Generation Fighters   5th Generation Fighters

Chart 5-35: Fighter Comparison by Generations

If the fighters were to be compared qualitatively, the picture shifts in favor of Japan. From the trends, it is assessed that the ability for China to institute advanced fighters is about 7 to 10 years behind that of Japan. The actual outcome of an air war would depend very much on the training and competency of the pilots as well as its C4 capabilities. Both are reportedly deficient for China's Air Force[13]. This is assessed to be the main reason for China's decision to delay large-scale procurement of fifth-generation fighters until now. Overall, it is assessed that China is very unlikely to prevail in the battle for air superiority over East China Sea.

3) Navy

	Japan	**China**
Surface Combatants	28(28) Kongo DDGs 20 Sapporo DDGs 17(32) Other Destroyers 3 Missile Patrol Craft Maritime Safety Agency: 13/46 Lg/Med Patrol Vessel 38 Patrol Craft 81 Coastal Patrol Craft 180 Coastal/Rescue Craft	41(36) Destroyers 58(52) Frigates 197(179) other lower end Missile Craft 50(50) Torpedo Craft 30(30) Speed Boats
Submarines	17(21) SS 5 SSN	57(55) SS 7(5) SSN 8(3) SSBN
Mine Warfare	47(42)	83(83)
Amphibious	42(27) LSTs	63(43) LSTs 66(66) lower capacity craft
Aircraft	55(70) P3C 105(87) ASW Helicopters 46(46) Others	See "Air Force"

Table 5-34: Navy Comparison Between Japan and China

Over the last five years, the only significant additions to China's surface fleet are the five DDGX and four FFX. But the majority of the surface fleet comprises lower-end destroyers, frigates and missile crafts, each with four to eight SSMs and up to eight SAMs. The total missile capacity of China's surface fleet has improved and is now estimated to be about 1908

13 http://www.rand.org/publications/MR/MR580/mr580.html

SSMs and 512 SAMs. This represents an increase of 15% over the last epoch. Spread over 296 missile armed ships, the average is about 8.2 missiles per ship.

In contrast, while the Japanese Navy surface fleet is numerically inferior, it is technologically modern and carries missiles of far longer range. Japan has invested heavily on the surface fleet, with the procurement of 20 Sapporo to replace the older destroyers. The fleet of 28 Kongo DDGs and 20 Sapporo has a total missile capacity that exceeds that of the entire China Navy. Furthermore, Japan's surface fleet is supported by a large number of surveillance and ASW aircraft. Overall, JMSDF has a definite edge in surface warfare.

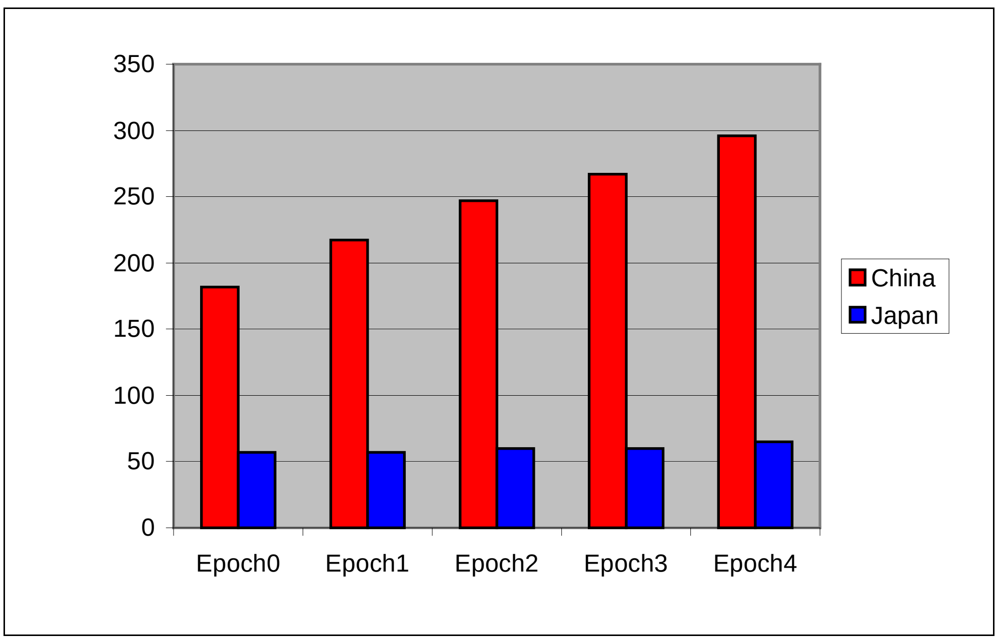


Chart 5-36: Comparison of Missile Ships

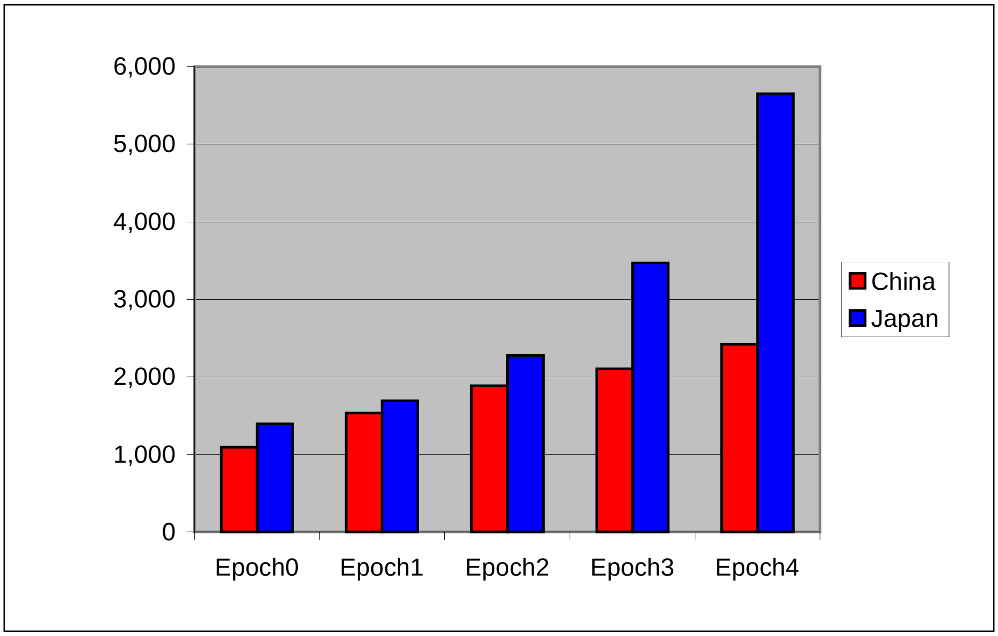


Chart 5-37: Comparison of Missile Capacity

The two charts above compare the number of missile platforms and missile capacities of both fleets. They clearly indicate a differing philosophy of building a surface fleet. China has built its surface fleet more for littoral waters while Japan focuses on building an ocean-going navy.

With a fleet of modern and highly capable destroyers, supported by a large number of UAVs, MPAs and ASW aircraft, Japan should be able to defeat China in a naval engagement over the open waters of East China Sea. Japan has made inroads into nuclear propulsion with the procurement of five Meiji-class (Akula-class) SSNs. On the other hand, China continues to modernize its submarine fleet with the procurement of two Song-class, one Kilo-class and six SSX-class submarines, bringing their total number of modern diesel electric submarines to 38. They have also acquired two SSNX, bringing their total number of nuclear attack submarines to 7.

These provide China with a superior sub-surface capability. But with Japan's ASW capabilities of the destroyers and aircraft, JMSDF should be able to maintain a slight edge in an open-ocean naval battle.

4) Missiles

	Japan	**China**
Strike	2000(1300) Type 03 TELs (6 missiles per TEL) (Missiles: 20,000) 10 Type 12 ICBMs	1150(1125) SRBM 95(90) MRBM 20(32) IRBM 155(113) ICBM 183(155) SLBM (with 8 SSBN) 8340(7640) ASCM 4000(2500) Tomahawk Equivalent 8050(5300) other shorter range LACM
Air Defense	240(120) Patriot FU 192(192) I-HAWK FU	120(90) LR SAM Bns 150(100) SR SAM Bns

Table 5-44: Missile Comparison Between Japan and China

Although China has a large ballistic and cruise missile inventory, the majority are SRBMs and shorter-range cruise missiles, which do not have the range to reach Japan when fired from the mainland. But over the last 10 years, China has acquired more missiles, bringing the total number of land-based missiles having the range to over-fly the East China Sea to 4270 missiles. While Japan's Type 3 missiles outnumber those of China by better than 4:1, these are presently equipped only with conventional warhead and hence do not directly constitute a deterrent to China's nuclear weapons.

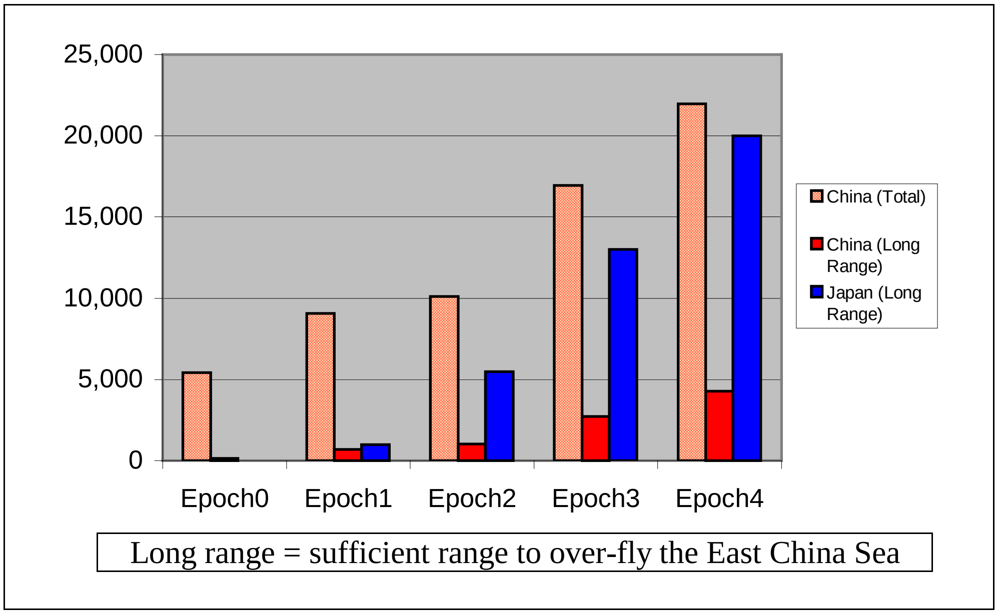


Chart 5-38: Numerical Comparison of Missile Stockpile

In the last 5 years, Japan has vastly increased the Type 3 TEL fleet and Type 3 missiles. The 2000 mobile land-based Type 3 TELs will play a big role in the defense against a scenario of a China large-scale invasion. The Type 3 TEL fleet will provide the additional firepower necessary to decisively tilt the balance in Japan's favor in a defensive scenario. Should China conduct an all-out invasion, a large Type 3 TEL fleet will ensure destruction of all the forces afloat.

To date, while Japan has acquired an initial ballistic missile defense capability in the Kongo and Sapporo NTWD ships and Patriot PAC3 missiles, it is still unable to defend against ballistic missile of velocity greater than five km/s.

5) C4ISR

Japan	China
16(10) IMINT Satellites 120(90)-person Computer Warfare Team 100(57) EU-1 100(55) EU-2 13(13) E2C 4(4) E767 National C2 System	42(28) IMINT/EW Satellites 16(15) AEWCC

Table 5-45: C4ISR Comparison Between Japan and China

Details of China's spy satellite capability are not available and hence a comparison cannot be made. Over the last five years, Japan has improved the C4ISR capability substantially with the acquisition of more EU1s and EU2s. Together with the Airborne Early Warning (AEW) fleet of E2Cs and E767s, JSDF's airborne C4ISR capabilities are assessed to be technologically superior as compared to China's AEWCC aircraft.

6) Summary (Japan Versus China)

In the last five years both sides have continued to increase their inventories of modern military equipment. Numerically, Japan continues to lag far behind in most areas and this gap can never be bridged due to demographic and economic reasons. Japan will therefore have to leverage advanced technology to overcome China's numerical advantage; in short, to overcome quantity with quality. Examples of this include the acquisition of F22s and Sapporos. With a smaller defense budget, Japan cannot afford to compete in all capability areas, and must therefore be very selective in its military investment. These include capabilities to counter a large-scale China invasion, a cost-effective solution to counter China's nuclear and missile capabilities, as well as capabilities to protect its SLOCs.

5. Dynamic Net Assessment

a. Scenario 1 – Nuclear Counter-Strike

As of 2020, Japan does not possess any nuclear weapons. The reasons are mainly political and not technical, as explained in previous chapters. Over the last ten years, Japan has secretly committed R&D and other resources to successfully develop (though not fully test) a 200kt nuclear warhead that can be delivered by the Type 3 SSM and Type 12 ICBM. Japan has also collected sufficient weapon-grade nuclear materials for the production of 200 warheads. Upon receiving the approval from the political leadership, Japan should be able to rapidly deploy up to 200 nuclear weapons. This scenario is constructed to analyze Japan's nuclear counter-strike capability against China, should this capability be realized in the near future.

The nuclear warheads will serve as Japan's main strategic deterrent capability. Against China, the weapons will be employed in the form of a limited "Mutual Assured Destruction". The warheads will be mounted on the Type 3 SSMs and be launched from any of the land-based Type 3 TELs, Kongo/Sapporo or submarines. The nuclear Type 3 missiles will externally resemble the conventional missiles. Pre-launch survivability will therefore be dependent on platform quantity (2000 TELs, 48 ships and 22 submarines) and mobility.

As shall be seen in subsequent scenarios, Type 3 missiles will also play a key role in conventional defense. However, at any point in time, 2000 missiles (including the 200 nuclear missiles) will be reserved as the Nuclear Counter-Strike (NCS) force.

Figure 5-8: Range Envelope of Type 3 Missile

The map above shows the key China cities that are within striking distance of the Type 3 missiles. 20 of the largest cities, including Beijing, Shanghai, Hong Kong, Taipei, Guangzhou etc, will be targeted in the nuclear counter-strike. Each city will be attacked with a single salvo of 90 conventional missiles and 10 nuclear missiles. This salvo is assessed to be more than sufficient to overwhelm any cruise missile defense within the city's locality. As the missiles are externally similar, it will not be possible for China's defenses to pick out the nuclear missiles from the conventional ones.

b. Scenario 2 – Defense Against Airborne and Amphibious Operations

This scenario is set in East China Sea in 2020, whereby China has decided to conduct a large-scale airborne and amphibious invasion onto the western coast of Kyushu, perhaps as intimidation against nuclear arming by Japan. It is not the principal objective of this section to examine why China would decide to conduct the invasion, but to examine how the scenario would unfold should the invasion take place.

It is assumed that that the entire scenario does not involve the use of non-conventional weapons. If nuclear, biological or chemical weapons are used, then Japan will retaliate using the nuclear weapons in accordance with Scenario 1.

Japan's primary strategic intelligence collection and early warning capabilities include the human intelligence network and the 16 spy satellites (providing imagery intelligence update of any part of the world at a rate of once a day). These will be supplemented by information obtained through Japan's intelligence exchange agreement with USA. The agreement stipulates that USA will provide any information that pertains to threat to Japan, and vice versa. With these in place, it is assumed that there will be no strategic surprise, and that any invasion by China will be preceded by a discernable period of tension. Japan's forces will be on alert, and will be deployed or dispersed in accordance to established doctrine and operational requirements. There will also be an increase in the levels of surveillance and intelligence collection activities.

Japan's normal peacetime surveillance requirements include round-the-clock air and maritime surveillance by EU2s and ground-based radar stations. During this period of tension, an additional three EU2 stations will be set up west of Kyushu to provide persistent coverage over the area. These will be supported by P3Cs and EU1s for close-in shadowing and investigation.

Forward imagery intelligence and electronic reconnaissance missions will be carried out by the stealthy EU1s and UF3s. The targets-of-interest includes key air and naval bases, key missile sites, likely troop concentration areas, as well as other early warning indicators of an impending attack. By this time, Japan will also have inserted specialforces for reconnaissance and real time reporting of significant enemy activities.

1) Airborne Assault Operations

China's airborne assault force is assumed to comprise 80% of their fighter and fixed-wing transport fleet, or 894 fighters and 170 transport aircraft. In this scenario, JASDF's fighter fleet will play a pivotal role in defense. Hence, the biggest threat would be a massive cruise-missile strike by China in an attempt to shut down Japan's airbases and disrupting its ability to launch the fighters. But given the estimated 450nm distance, China's sub-sonic cruise missiles would take more than 50 minutes to reach their targets in Kyushu. Tactical early warning of missile launch is therefore vital to Japan's ability to successfully launch enough fighters for air defense.

Given the short reaction time, Japan will pre-configure the fighters for maximum endurance in air-to-air missions. Upon detection of enemy preparatory activities, such as massive arming, fueling, troop embarkation etc, 100 F22s will be placed on 15 minute alert and another 150 on 30 minute alert.

Upon detection of massive missile strike, the F22s will be upgraded in readiness and/or scrambled accordingly[14]. At the same time, Japan will retaliate with Type 3 missile strikes on China's airbases, missile sites and C4 facilities. Having maximum endurance on the F22s allows time for Japan's Type 3 missiles to shut down China's airfields. The external fuel tanks would of course be jettisoned prior to engaging the enemy. Should China's missile strikes continue, Japan would further retaliate by striking China's ships, naval bases, power plants and other military targets.

It is assumed that 50% of China's airborne task force managed to take off before their airfield is closed, or 447 fighters and 85 transport aircraft. JASDF will have 250 F22s airborne to intercept the task force. Given these forces, JASDF will require a fighter exchange ratio of 2:1 or better to emerge victorious.

Extensive computer simulations conducted by British Aerospace and the British Defense Research Agency shows that the kill ratio between F22s and Su35s (a representative of a Russian fourth-generation fighter) is 10:1[15]. In addition, JASDF has better trained pilots and better C4ISR

[14] JASDF has completed the survivability enhancement program, which includes the building of alternate runways. On a conservative assumption of 5 airbases with 3 runways each, pair take-off, 2 minutes apart, 250 aircraft can be launched in less than 20 minutes.

[15] http://www.fas.org/man/dod-101/sys/ac/docs/98-111.pdf. This study was conducted before either aircraft was put into operational service. By 2020, JASDF would have operated the F22s for about 10 years. During this time, JASDF have also upgraded the associated air defense C4I systems to maximize the capabilities of the fleet of advanced fighters. Hence it is assumed that the kill ratio would remain essentially the same as at 2020.

support for air operations. With the F22s capitalizing on stealth to avoid the sweepers and engage the transports, it is highly likely that JASDF will succeed in defeating the airborne assault force. Any “leakages” will be dealt with by Japan’s capable ship-based (Kongo DDGs and Sapporo) and land-based air defenses (Patriots, I-HAWKs and other SHORADS).

Even if any troops managed to land on Japan, they will be effectively cut-off from support and further reinforcement from China. With the heavy investment in survivability and repair and recovery capabilities, Japan would be able to launch fighters within four hours and establish air superiority over the landing zone. Japan will also be able to augment the defenses by redeploying the appropriate ship-based and land-based SAM units. The enemy’s sea lines-of-communications will also be cut-off by JMSDF and the Type 3 TEL fleet.

2) Amphibious Operations

The amphibious task force is assumed to comprise 80% of China’s surface combatants, or 237 missile-armed ships, and 80% of their sealift capability, or 103 transport ships.

China is likely to precede the amphibious operations with a massive missile strike on Japanese air and naval bases. Japan will retaliate with Type 3 missile strikes on their key airbases and ships in port. In addition, Japan will also strike key military targets such as C4ISR facilities, missile sites, power plants etc. Given the completion of Japan’s efforts to enhance survivability and repair and recovery capabilities, the airbases should be able to recover within four hours. Since East China Sea is more than 400nm wide, China's amphibious task force should still be more than 200nm away.

Japan will adopt a layered defense against the amphibious task force (ATF). The concept of operations will be as follows:

1 Maritime Defense Zone 1 (less than 500nm) – Japan will attack the ATF with up to 7000 Type 3 missiles. Surveillance and targeting information will be provided by EU1s and EU2. On a worst-case assumption, the ATF carries 500 SAMs, and each SAM successfully engages one of the Type 3 missiles. That will leave 6500 missiles, or 19 anti-ship missiles for every one of the 340 ships in the ATF. With no SAMs remaining, it is unlikely that any ship will survive this attack.

2 Maritime Defense Zone 2 (less than 200nm) – Japan will attack the ATF, which by now would have expended most of their air defense missiles, with submarines, destroyers and aircraft. China Air Force is unlikely to achieve air superiority at this area, which is more than 200nm off their shores, given JSDF's superior fighter fleet of F22s and highly capable ship-based air defense. With the ships and continuous waves of air attacks, none of the ships in the ATF are likely to survive. However, should both highly unlikely events happen in quick succession (that is, the ATF somehow managed to survive the attacks in Zone 1 and 2), there is a third line of defense.

3 Maritime Defense Zone 3 (less than 15nm) – This line of defense is based on the shorter-range Type 96 anti-ship missiles and the tanks, artillery and other weapons of the army inventory. At this point, JASDF will also be able to attack the ATF with impunity. Japan should be able muster two Div++ for defense. Hence, on an assumption of 4:1 force ratio[16], China will need at least 10 to 11 divisions for a successful amphibious operation. This is not possible since the total sealift capability is less than three divisions.

3) Conclusion for Scenario 2

From the analysis, it is clear that in 2020, China will not be able to successfully conduct an amphibious operation against Japan. Their airborne and amphibious task forces stand little chance of surviving the transit across East China Sea. This is due to the following reasons: (1) China's inability to shut down JASFD due to the high survivability and repair and recovery capabilities of the airbases. China is also not able to shut down Japan's Type 3 TELs due to their mobility and dispersion; (2) China's ship-based air defense is inadequate and hence could be easily overwhelmed by Japan's massive anti-ship missile strike; and (3) China's Air Force is not able to achieve air superiority over the East China Sea.

[16] This is a conservative estimate. Some experts have estimated this ratio to be as high as 10:1.

Early warning of incoming missiles is vital to Japan's success in the air defense scenario. Japan will therefore continue to invest heavily to develop this capability domain.

c. Scenario 3 – SLOC Protection

Rather than relying on sheer terror and intimidation associated with the conduct of a massive invasion to seize Japan, the PRC can use its military force in a more limited but coercive manner by interdicting Japanese commercial vessels plying to and from Japanese ports. Such an action is deemed to be more troubling and coercive to Japan than the former as it takes advantage of the following facts:

1 Japan is more vulnerable to any disruptions to the SLOCs than the PRC because the former has fewer natural resources and has no other way to import or export except through the sea or the air.

2 Japan's foreign trade[17] accounts for 20% percent of its GDP (in contrast, this is only 10% for the PRC).

3 The sea routes in and out of Japan's four major commercial seaports, though numerous, are predictable.

[17] Regional trading contribution to Japan's total foreign trade (1999 data from http://www.jin.jcic.or.jp):

	Asia	Europe	N. America	S. America	Africa	Oceania
Exports	40%	20%	36%	1%	1%	2%
Imports	49%	17%	25%	2%	1%	6%

1) PRC Strangulation Strategy

Therefore, the PRC's strategy is strangulation of the Japanese economy for an indefinite period of time. If the PRC can sink sufficient commercial ships to scare others, it can convince most commercial shippers not to risk sea-borne trade with Japan.

The PRC attempts to introduce a significant risk factor into all maritime voyages in and out of Japan by occasionally sinking a cargo ship. This can be done using one or a combination of the following PRC assets: (1) 296 missile-armed-ships; (2) 1117 fighters; (3) numerous mines; (4) 57 diesel submarines; and (5) 7 nuclear submarines.

The use of missile-armed ships and fighters are considered too overt and easily attributable and are therefore likely to escalate the situation into hot war. It would be rather easy for the Japanese military to retaliate, considering the qualitative superiority of the Japanese air force and navy.

The PRC's mines can pose a problem too. Each of the PRC's submarines usually carry two to three dozen of these, so half of its diesel submarine fleet will be able to carry about 1,000 mines. If they are able to place mines near major Japanese harbors they may cause attrition rates of a few percent each time commercial or military ships try to enter or leave Japanese ports or naval bases until the mines are swept

As for using submarines, each of the PRC's diesel submarines may be able to sink one or two cargo vessels before the flaming datum draws substantial Japanese counter attacks from the surface, air and subsurface units assure that the attacking PRC diesel submarine is destroyed The Chinese diesel submarines have limited endurance and require charging of batteries every so many days. The comprehensive surveillance capabilities of Japan are likely to be able to detect and destroy the subs, sometimes even before they are able to destroy any shipping. However, considering the large numbers of diesel submarines in the PLAN, this can pose a serious concern to Japan.

For the PRC, the least risky and most effective asset for the conduct of such SLOC disruption operations shall be its fleet of seven SSNs. Unlike the diesel submarines, these have long endurances when submerged (approximately 100[18] days) and much higher speeds than the diesels. They will be elusive against any Japanese anti-submarine efforts except against Japan's fleet of five newly-acquired SSNs.

2) Japan's SLOC Protection Strategy

What kind of SLOC protection strategy shall Japan adopt and what kinds of military options does it have? Japan can take a number of steps to break such a PRC SLOC disruption strategy and to mitigate any effects it may have.

Firstly, cargo ships can be routed east to the Pacific Ocean and then south and east of the Philippines, through the Indonesian Archipelago thereby

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[18] This is limited by the amount of provisions that can be carried onboard.

avoiding the South China Sea totally. This will force the PRC to attempt attacks in the open ocean far from its territory. Such an approach will add a few thousand miles and modest cost to the merchant ships' journey. Such an approach allows Japan's anti-submarine surface ships to operate either within cover of land-based Japanese air power or out of range of most of the PRC's combat planes. Japanese air power will be well positioned to defend ships to the east of Japan from any PRC aircraft that might pursue them.

Secondly, Japan can use its surface fleet to accompany convoys of merchant ships, though this is harder to do for ships approaching Japan than for ships leaving its harbors because those that approach come from many different places. If they assemble east of Japan to wait for escorts, they will be vulnerable at that point. PRC submarines lying quietly in wait in the right places can hear approaching convoys before they themselves are detected, making it very likely for them to get in the first shot. The outcome of such a struggle is very hard to predict.

And finally, Japan can maintain presence and deterrence through the deployment of five groups of naval ships at critical points along the SLOCs. If there are any attacks on Japanese commercial shipping, these ships could prosecute the aggressors.

3) Concept of Operation

The following assumptions are taken with regards to the concept of operation for the maintenance of presence and deterrence through the deployment of five TGs of naval ships at critical points along the SLOCs: (1) there will be no strategic surprise; (2) the United States Navy continues to maintain freedom of navigation of the seas; (3) the PRC is unable to threaten trans-Pacific shipping; (4) based on the possibility of SLOC disruption, Japan has secured special arrangements with the United States for oil and other critical supplies to be directly shipped to Japan, and also to trans-ship European or Middle East supplies through the United States; and (5) a period of up to three months is required for diplomatic resolution of the situation.

Japan will maintain sea control out to 200nm, with a continuous sea situation picture provided by EU1s and EU2s. Surface combatants will be employed to enforce sea control, supplemented by fighters and land-based anti-ship missiles if the need arises. In the waters between Japan and the Singapore Straits, five Task Groups (TGs), each comprised of two Sapporo, two Kongo DDs, one Meiji SSN and one minesweeper, will patrol critical areas, as a show of presence and to deter any disruption to Japanese shipping. Each TG will also be assigned a permanent presence of one EU 1 or EU 2 station for the maintenance of SSP. All Japan-bound ships will also be electronically tracked through the use of transponders via the EU 1 and EU2 or through Japanese satellites. If any PRC submarine makes an attack on any Japanese commercial shipping, a "flaming datum" is established, and all commercial vessels shall be routed away, while the nearest on-scene TG prosecutes the aggressor.

4) Analysis

Given the Japanese naval order of battle, it will be able to sustain the five TGs for such an operation over an extended period of up to three months. Although Japan has a comprehensive suite of surveillance capability and a modern surface fleet, it still does not have a robust solution for the continuous tracking of the PRC's SSNs. However, considering the limited numbers of PRC SSNs, Japan is willing to accept the sinking of one commercial vessel to establish a datum (called "flaming datum") to the subsequent prosecution by the nearest on-scene TG. Once the datum has been established, with a sizable force of four ships all carrying ASW capable helicopters, and the Meiji SSN, it is assessed that the TG has a very good probability of localizing, targeting and eventually destroying the aggressor submarine.

5) Conclusion for Scenario 3

In conclusion, the PRC's fleet of seven SSNs is a serious threat to Japan as it can be effectively deployed to sink sufficient Japanese shipping to scare off any subsequent sea-borne trade with Japan. While the JMSDF is able to maintain a substantial presence at critical points along SLOC to deter any such attacks, it still does not have a capability to shadow and track the SSNs continuously. The introduction of the five Meiji SSNs into the JMSDF has improved the TGs capability against the SSN threat. Also, Japan will continue to diversify its supplies through other SLOCs so as to increase its resilience against the PRC’s attempt to disrupt Japanese sea-borne trade in the South China Sea. Lastly, Japan may need to turn to the following alternatives as the way out: (1) to seek assistance from the United States, although this may not be a reliable option; and (2) to adopt a diplomatic strategy of getting more countries in the region (countries like the ASEAN, Australia, India, Russia etc) involved in order to garner more strength against an ever more muscular China.

6. 2020 and Beyond

a. JSDF at 2020

After twenty years of evolution and modernization, the JSDF has the following major strengths at 2020: (1) it is self-sufficient in terms of its abilities to defend the Japanese homeland from any attacks; (2) it has developed and fielded an advanced and comprehensive C4ISR network that is critical for the forewarning of any hostilities on Japan; (3) it has fielded a massive conventional missile force in its 20,000 Type 3 SSMs that can be launched from the 2,000 Type 3 TELs, the 48 DDGs, and the 22 submarines; (4) it has modernized and maintained a state-of-the-art inventory of weapons systems; and (5) Japan has developed and established an indigenous defense industry to support the JSDF's efforts to be more self-reliant.

Despite its many strengths at 2020, the JSDF is also conscious and aware of the following key weaknesses: (1) it does not possess any nuclear weapons in its inventory and therefore is not able to provide a visible nuclear deterrent; (2) it does not have comprehensive capabilities to defend against massive missile attacks on its homeland; (3) it lacks robust continuous tracking and shadowing of enemy submarines.

b. 2021 and Beyond

For 2021 and beyond, the following are few issues of consideration for Japan to progress from 2021 and beyond: (1) strive for self-determination not only economically, but also politically and militarily; (2) further diversify its energy sources so that there is lesser reliance on the SLOC for imports; (3) re-examine the provisions in the U.S.-Japan Security Arrangement; (4) remove the nuclear allergy completely; (5) strive to increase its capabilities while maintaining zero-manpower growth, or even a manpower reduction in view of Japan’s aging population; (6) look towards the establishment of coalitions with its regional allies to ensure freedom of navigation of the SLOCs; (7) examine and explore the concept and viability of forward defense; (8) find cost-effective solutions to the missile and nuclear threats (through the deployment of a nuclear-deterrent capability, investments in research and development in comprehensive missile defense capability, and improvements in early warning and intelligence collection capabilities); (9) find cost effective solutions to the submarine threat (through the development and deployment of a comprehensive underwater surveillance network around Japan, and around the Ryukyu Islands, investment in research and development in air-independent-propulsion, and development in unmanned submarine capability; and finally (10) improve capabilities on unmanned platforms.

7. Epoch 4 Summary

The regional triangular balance of power in the region remained but the relative weight of each of the respective powers continued to shift in this epoch. The declining role of the U.S. and the gradual ascension of China forced Japan to continue reevaluating its three-pronged security policy: firmly maintaining the Japan-U.S. security arrangements, building Japan's defense capability, and making diplomatic efforts to ensure international peace and security. Despite the nuclear allergy, Japan leaders maintained that it must retain the option to develop nuclear weapons. To this extent, Japan began re-evaluating the provisions in Article 9 of the Constitution and debated on its adherence to the Three Non-Nuclear Principles.

By 2020, the withdrawal of U.S. forces from the Korean Peninsular was almost completed and token U.S. forces had begun to leave Okinawa. While the U.S.-Japan Security Arrangement remained intact, Japanese leaders continued to project that the U.S. would one day be gone from Japan, and may not fulfill its military commitments to defend Japan. Therefore Japan continued to develop a credible force for deterrence. As of 2020, Japan does not possess any nuclear weapons. However, Japan has the all the resources necessary for two hundred 200kt nuclear warheads that can be delivered by its huge Type 3 SSM fleet and 12 ICBMs.

The institutional reforms implemented in the first epoch continued to pay significant dividends as Japan’s sustained 15 years of positive economic growth. It continued to spend only 1% of its GDP on defense. Earlier efforts to sustain the national workforce remained intact but were beginning to show diminishing dividends as the

Japanese population continues to age. Domestic reliance on imported energy sources continued to decline.

Japan continues to lag behind the PRC as the latter maintained its military modernization efforts. However, Japan's dynamic net assessments concluded that the PRC is still not able to successfully conduct a massive airborne or amphibious assault on Japan. In another assessment on SLOC protection, Japan does not have the capability to continuously shadow and track the PRC's SSNs deployed for SLOC disruption operations. For the final scenario, it was assessed that Japan would possess a credible nuclear counter-strike capability against 20 PRC cities with 90 conventional and 10 nuclear missiles each if the nuclear warheads were to be produced and tested.

Annex 5A : Japan Defense Expenditure

					Epoch 1 (2001 ~ 2005)					
S/No	**Item**	**2000 Qty (Start)**	**Unit $$ (Mil Yen)**	**Upgrade $$ (Mil Yen)**	**R & D $$ (Mil Yen)**	**Acquire**	**Upgrade**	**Retire**	**Acq Cost (Mil Yen)**	**2005 Qty**
	Grand Total				**615,000**				**2,457,740**	
1	**GSDF**									
2	Infantry/Combined Div	12	0					2	0	10
3	Infantry Bde	2	0			2			0	4
4	Armoured Div	1							0	1
5	Heliborne Bde	1	0						0	1
6	Airborne Bde	1	0						0	1
7	Amphibious Bde	0	0			1			0	1
8	Tanks	1,135	861	50			50		2,500	1,135
9	APC	770	182	50		25	50		7,050	795
10	Artillery (155mm SP)	831	1,040						0	831
11	MLRS	128	1,840			50			92,000	178
12	Attack Helicopters	88	4,500			5		5	22,500	88
13	Other Helicopters	424	2,935			5		5	14,675	424
14	Other Equipments				47,500				95,000	0
15										
16	**MSDF**									
17	Kongo DDG (DD51 variant)	4	110,000	5,000		3	4		350,000	7
18	Sapporo DDG (DD21 variant)	0	125,000						0	0
19	Other DDs	53	64,071					3	0	50
20	Submarine (SS)	18	46,394			2		1	92,788	19
21	Meiji SSN (Akula class)	0	160,000						0	0
22	Mine warfare ship (MSC)	37	14,745			2		1	29,490	38
23	Landing Ship (LST)	11	37,286			3			111,858	14
24	P3C (Fixed wing patrol)	100		500			15		7,500	100
25	HSS-2B (Patrol)	36							0	36
26	MH-53E (Mine sweeping)	10							0	10
27	SM3 Missile (NTWD)	0	100		25,000				0	0
28	SH-60J (anti-sub)	78	5,075			2		2	10,150	78
29	UUV	0	30,000						0	0
30	Other Equipments				100,000				245,000	0
31										

Annex 5A : Japan Defense Expenditure

					Epoch 1 (2001 ~ 2005)					
S/No	**Item**	**2000 Qty (Start)**	**Unit $$ (Mil Yen)**	**Upgrade $$ (Mil Yen)**	**R & D $$ (Mil Yen)**	**Acquire**	**Upgrade**	**Retire**	**Acq Cost (Mil Yen)**	**2005 Qty**
32	**ASDF**									
33	F-15 (J/DJ)	203							0	203
34	F-22	0	8,800						0	0
35	F-1	52							0	52
36	F-2	45	11,830			30			354,900	75
37	F-4/RF-4 (E/EJ)	133							0	133
38	C-1	28							0	28
39	C-130H	16							0	16
40	CH-47J (Transport)	19	4,457			10			44,570	29
41	KC-135R	0	6,000			5			30,000	5
42	Other Equipments				110,000				220,000	0
43										
44	**Missile Systems**									
45	Patriot PAC-3 FU	120	2,000	2,000	50,000		20		40,000	120
46	Patriot Ops/Maintenance								99,815	0
47	I-HAWK Upgrading (in group)	192		52,188			2		104,376	192
48	Type-12 SSM (ICBM)	0	1,000						0	0
49	Type-88 TEL (c/w 6 missile ea)	68	1,214			12			14,568	80
50	Type-03 TEL (6 missile ea)	0	1,200		75,000	100			120,000	100
51	Type-03 Missile	0	100			1,000			100,000	1,000
52	200 KT Nuclear Warhead	0							0	0
53	Missile Defense (include BMD)	0	0		75,000				0	0
54	High Energy Laser System	0	50,000						0	0
55	Other Equipments				32,500				65,000	0
56										
57	**Major C4I System**									
58	EU-1 (Low observable) [2005]	0	2,000		25,000	7			14,000	7
59	EU-2 (HAE) [2007]	0	6,000		25,000				0	0
60	UF-3 (fast; strike) [2014]	0	3,500						0	0
61	E-2C	13							0	13
62	E-767	4							0	4
63	Info Gathering Satellite	0				4			0	4
64	National C2 System	0	150,000		20,000	1			150,000	1
65	BMC3I (Missile Defense)	0			10,000				0	0
66	IW Platoon (30-men)	0	5,000			1			5,000	1
67	Other Equipments				20,000				15,000	0

Annex 5A : Japan Defense Expenditure

					Epoch 2 (2006 ~ 2010)					
S/No	**Item**	**2000 Qty (Start)**	**Unit $$ (Mil Yen)**	**Upgrade $$ (Mil Yen)**	**R & D $$ (Mil Yen)**	**Acquire**	**Upgrade**	**Retire**	**Acq Cost (Mil Yen)**	**2010 Qty**
	Grand Total				**525,000**				**4,075,097**	
1	**GSDF**									
2	Infantry/Combined Div	12	0					1	0	9
3	Infantry Bde	2	0			2			0	6
4	Armoured Div	1							0	1
5	Heliborne Bde	1	0						0	1
6	Airborne Bde	1	0						0	1
7	Amphibious Bde	0	0						0	1
8	Tanks	1,135	861	50			100		5,000	1,135
9	APC	770	182	50		25	100		9,550	820
10	Artillery (155mm SP)	831	1,040					100	0	731
11	MLRS	128	1,840			100			184,000	278
12	Attack Helicopters	88	4,500			5		5	22,500	88
13	Other Helicopters	424	2,935			5		5	14,675	424
14	Other Equipments				60,000				95,000	0
15										
16	**MSDF**									
17	Kongo DDG (DD51 variant)	4	110,000	5,000		6			660,000	13
18	Sapporo DDG (DD21 variant)	0	125,000						0	0
19	Other DDs	53	64,071					3	0	47
20	Submarine (SS)	18	46,394			2		1	92,788	20
21	Meiji SSN (Akula class)	0	160,000						0	0
22	Mine warfare ship (MSC)	37	14,745			2		1	29,490	39
23	Landing Ship (LST)	11	37,286			3			111,858	17
24	P3C (Fixed wing patrol)	100		500			15	15	7,500	85
25	HSS-2B (Patrol)	36							0	36
26	MH-53E (Mine sweeping)	10							0	10
27	SM3 Missile (NTWD)	0	100		10,000				0	0
28	SH-60J (anti-sub)	78	5,075			3		2	15,225	79
29	UUV	0	30,000						0	0
30	Other Equipments				110,000				245,000	0
31										

Annex 5A : Japan Defense Expenditure

					Epoch 2 (2006 ~ 2010)					
S/No	**Item**	**2000 Qty (Start)**	**Unit $$ (Mil Yen)**	**Upgrade $$ (Mil Yen)**	**R & D $$ (Mil Yen)**	**Acquire**	**Upgrade**	**Retire**	**Acq Cost (Mil Yen)**	**2010 Qty**
32	**ASDF**									
33	F-15 (J/DJ)	203							0	203
34	F-22	0	8,800			50			440,000	50
35	F-1	52						17	0	35
36	F-2	45	11,830			25			295,750	100
37	F-4/RF-4 (E/EJ)	133						50	0	83
38	C-1	28							0	28
39	C-130H	16							0	16
40	CH-47J (Transport)	19	4,457			10			44,570	39
41	KC-135R	0	6,000			5			30,000	10
42	Other Equipments				115,000				220,000	0
43										
44	**Missile Systems**									
45	Patriot PAC-3 FU	120	2,000	2,000			60		120,000	120
46	Patriot Ops/Maintenance								99,815	0
47	I-HAWK Upgrading (in group)	192		52,188			2		104,376	192
48	Type-12 SSM (ICBM)	0	1,000		20,000				0	0
49	Type-88 TEL (c/w 6 missile ea)	68	1,214						0	80
50	Type-03 TEL (6 missile ea)	0	1,200			450			540,000	550
51	Type-03 Missile	0	100			4,500			450,000	5,500
52	200 KT Nuclear Warhead	0							0	0
53	Missile Defense (include BMD)	0	0		30,000				0	0
54	High Energy Laser System	0	50,000						0	0
55	Other Equipments				65,000				65,000	0
56										
57	**Major C4I System**									
58	EU-1 (Low observable) [2005]	0	2,000			15			30,000	22
59	EU-2 (HAE) [2007]	0	6,000		25,000	18			108,000	18
60	UF-3 (fast; strike) [2014]	0	3,500		30,000				0	0
61	E-2C	13							0	13
62	E-767	4							0	4
63	Info Gathering Satellite	0				6		2	0	8
64	National C2 System	0	150,000		20,000				0	1
65	BMC3I (Missile Defense)	0			10,000				0	0
66	IW Platoon (30-men)	0	5,000			1			5,000	2
67	Other Equipments				30,000				30,000	0

Annex 5A : Japan Defense Expenditure

					Epoch 3 (2011 ~ 2015)					
S/No	**Item**	**2000 Qty (Start)**	**Unit $$ (Mil Yen)**	**Upgrade $$ (Mil Yen)**	**R & D $$ (Mil Yen)**	**Acquire**	**Upgrade**	**Retire**	**Acq Cost (Mil Yen)**	**2015 Qty**
	Grand Total				**560,000**				**8,224,701**	
1	**GSDF**									
2	Infantry/Combined Div	12	0					1	0	8
3	Infantry Bde	2	0						0	6
4	Armoured Div	1							0	1
5	Heliborne Bde	1	0						0	1
6	Airborne Bde	1	0						0	1
7	Amphibious Bde	0	0						0	1
8	Tanks	1,135	861	50			300		15,000	1,135
9	APC	770	182	50		100	300		33,200	920
10	Artillery (155mm SP)	831	1,040					100	0	631
11	MLRS	128	1,840			150			276,000	428
12	Attack Helicopters	88	4,500			20		5	90,000	103
13	Other Helicopters	424	2,935			30		5	88,050	449
14	Other Equipments				60,000				95,000	0
15										
16	**MSDF**									
17	Kongo DDG (DD51 variant)	4	110,000	5,000		15	20		1,750,000	28
18	Sapporo DDG (DD21 variant)	0	125,000						0	0
19	Other DDs	53	64,071					15	0	32
20	Submarine (SS)	18	46,394			6		5	278,364	21
21	Meiji SSN (Akula class)	0	160,000						0	0
22	Mine warfare ship (MSC)	37	14,745			5		2	73,725	42
23	Landing Ship (LST)	11	37,286			10			372,860	27
24	P3C (Fixed wing patrol)	100		500			15	15	7,500	70
25	HSS-2B (Patrol)	36							0	36
26	MH-53E (Mine sweeping)	10							0	10
27	SM3 Missile (NTWD)	0	100		10,000	200			20,000	200
28	SH-60J (anti-sub)	78	5,075			10		2	50,750	87
29	UUV	0	30,000		15,000				0	0
30	Other Equipments				122,500				245,000	0
31										

Annex 5A : Japan Defense Expenditure

					Epoch 3 (2011 ~ 2015)					
S/No	Item	2000 Qty (Start)	Unit $$ (Mil Yen)	Upgrade $$ (Mil Yen)	R & D $$ (Mil Yen)	Acquire	Upgrade	Retire	Acq Cost (Mil Yen)	2015 Qty
32	**ASDF**									
33	F-15 (J/DJ)	203						101	0	102
34	F-22	0	8,800			200			1,760,000	250
35	F-1	52						17	0	18
36	F-2	45	11,830			25			295,750	125
37	F-4/RF-4 (E/EJ)	133						50	0	33
38	C-1	28							0	28
39	C-130H	16							0	16
40	CH-47J (Transport)	19	4,457			20			89,140	59
41	KC-135R	0	6,000			20			120,000	30
42	Other Equipments				110,000				220,000	0
43										
44	**Missile Systems**									
45	Patriot PAC-3 FU	120	2,000	2,000			40		80,000	120
46	Patriot Ops/Maintenance								99,815	0
47	I-HAWK Upgrading (in group)	192		52,188			0		13,047	192
48	Type-12 SSM (ICBM)	0	1,000		10,000	2			2,000	2
49	Type-88 TEL (c/w 6 missile ea)	68	1,214						0	80
50	Type-03 TEL (6 missile ea)	0	1,200			750			900,000	1,300
51	Type-03 Missile	0	100			7,500			750,000	13,000
52	200 KT Nuclear Warhead	0			25,000				0	0
53	Missile Defense (include BMD)	0	0		35,000				0	0
54	High Energy Laser System	0	50,000		15,000				0	0
55	Other Equipments				32,500				65,000	0
56										
57	**Major C4I System**									
58	EU-1 (Low observable) [2005]	0	2,000			35			70,000	57
59	EU-2 (HAE) [2007]	0	6,000			37			222,000	55
60	UF-3 (fast; strike) [2014]	0	3,500		45,000	25			87,500	25
61	E-2C	13							0	13
62	E-767	4							0	4
63	Info Gathering Satellite	0				6	4	4	0	10
64	National C2 System	0	150,000		30,000				0	1
65	BMC3I (Missile Defense)	0			25,000				0	0
66	IW Platoon (30-men)	0	5,000			1			5,000	3
67	Other Equipments				25,000				50,000	0

Annex 5A : Japan Defense Expenditure

					Epoch 4 (2016 ~ 2020)					
S/No	**Item**	**2000 Qty (Start)**	**Unit $$ (Mil Yen)**	**Upgrade $$ (Mil Yen)**	**R & D $$ (Mil Yen)**	**Acquire**	**Upgrade**	**Retire**	**Acq Cost (Mil Yen)**	**2020 Qty**
	Grand Total				**770,000**				**11,216,088**	
1	**GSDF**									
2	Infantry/Combined Div	12	0						0	8
3	Infantry Bde	2	0						0	6
4	Armoured Div	1							0	1
5	Heliborne Bde	1	0						0	1
6	Airborne Bde	1	0						0	1
7	Amphibious Bde	0	0						0	1
8	Tanks	1,135	861	50			300		15,000	1,135
9	APC	770	182	50		100	300		33,200	1,020
10	Artillery (155mm SP)	831	1,040					400	0	231
11	MLRS	128	1,840			400			736,000	828
12	Attack Helicopters	88	4,500			30		5	135,000	128
13	Other Helicopters	424	2,935			45		5	132,075	489
14	Other Equipments				80,000				110,000	0
15										
16	**MSDF**									
17	Kongo DDG (DD51 variant)	4	110,000	5,000					0	28
18	Sapporo DDG (DD21 variant)	0	125,000			20			2,500,000	20
19	Other DDs	53	64,071					15	0	17
20	Submarine (SS)	18	46,394			2		6	92,788	17
21	Meiji SSN (Akula class)	0	160,000		160,000	5			800,000	5
22	Mine warfare ship (MSC)	37	14,745			8		3	117,960	47
23	Landing Ship (LST)	11	37,286			15			559,290	42
24	P3C (Fixed wing patrol)	100		500			15	15	7,500	55
25	HSS-2B (Patrol)	36							0	36
26	MH-53E (Mine sweeping)	10							0	10
27	SM3 Missile (NTWD)	0	100			800			80,000	1,000
28	SH-60J (anti-sub)	78	5,075			20		2	101,500	105
29	UUV	0	30,000		40,000	3			90,000	3
30	Other Equipments				130,000				260,000	0
31										

Annex 5A : Japan Defense Expenditure

					Epoch 4 (2016 ~ 2020)					
S/No	**Item**	**2000 Qty (Start)**	**Unit $$ (Mil Yen)**	**Upgrade $$ (Mil Yen)**	**R & D $$ (Mil Yen)**	**Acquire**	**Upgrade**	**Retire**	**Acq Cost (Mil Yen)**	**2020 Qty**
32	**ASDF**									
33	F-15 (J/DJ)	203						102	0	0
34	F-22	0	8,800			200			1,760,000	450
35	F-1	52						18	0	0
36	F-2	45	11,830			25			295,750	150
37	F-4/RF-4 (E/EJ)	133						33	0	0
38	C-1	28							0	28
39	C-130H	16							0	16
40	CH-47J (Transport)	19	4,457			30			133,710	89
41	KC-135R	0	6,000			30			180,000	60
42	Other Equipments				120,000				240,000	0
43										
44	**Missile Systems**									
45	Patriot PAC-3 FU	120	2,000	2,000		120			240,000	240
46	Patriot Ops/Maintenance								99,815	0
47	I-HAWK Upgrading (in group)	192		52,188					0	192
48	Type-12 SSM (ICBM)	0	1,000			8			8,000	10
49	Type-88 TEL (c/w 6 missile ea)	68	1,214					80	0	0
50	Type-03 TEL (6 missile ea)	0	1,200			700			840,000	2,000
51	Type-03 Missile	0	100			7,000			700,000	20,000
52	200 KT Nuclear Warhead	0			25,000				0	0
53	Missile Defense (include BMD)	0	0		25,000				0	0
54	High Energy Laser System	0	50,000		30,000	3			150,000	3
55	Other Equipments				50,000				100,000	0
56										
57	**Major C4I System**									
58	EU-1 (Low observable) [2005]	0	2,000			43			86,000	100
59	EU-2 (HAE) [2007]	0	6,000			45			270,000	100
60	UF-3 (fast; strike) [2014]	0	3,500			75			262,500	100
61	E-2C	13							0	13
62	E-767	4							0	4
63	Info Gathering Satellite	0				8	6	2	0	16
64	National C2 System	0	150,000		50,000				0	1
65	BMC3I (Missile Defense)	0			10,000				0	0
66	IW Platoon (30-men)	0	5,000			1			5,000	4
67	Other Equipments				50,000				75,000	0

Annex 5A : Japan Defense Expenditure

					Summary (2001 ~ 2020)					
S/No	**Item**	**2000 Qty (Start)**	**Unit $$ (Mil Yen)**	**Upgrade $$ (Mil Yen)**	**R & D $$ (Mil Yen)**	**Acquire**	**Upgrade**	**Retire**	**Acq Cost (Mil Yen)**	**2020 Qty**
	Grand Total				**2,470,000**				**25,973,626**	
1	**GSDF**									
2	Infantry/Combined Div	12	0		0	0	0	4	0	8
3	Infantry Bde	2	0		0	4	0	0	0	6
4	Armoured Div	1			0	0	0	0	0	1
5	Heliborne Bde	1	0		0	0	0	0	0	1
6	Airborne Bde	1	0		0	0	0	0	0	1
7	Amphibious Bde	0	0		0	1	0	0	0	1
8	Tanks	1,135	861	50	0	0	750	0	37,500	1,135
9	APC	770	182	50	0	250	750	0	83,000	1,020
10	Artillery (155mm SP)	831	1,040		0	0	0	600	0	231
11	MLRS	128	1,840		0	700	0	0	1,288,000	828
12	Attack Helicopters	88	4,500		0	60	0	20	270,000	128
13	Other Helicopters	424	2,935		0	85	0	20	249,475	489
14	Other Equipments				247,500	0	0	0	395,000	0
15										
16	**MSDF**									
17	Kongo DDG (DD51 variant)	4	110,000	5,000	0	24	24	0	2,760,000	28
18	Sapporo DDG (DD21 variant)	0	125,000		0	20	0	0	2,500,000	20
19	Other DDs	53	64,071		0	0	0	36	0	17
20	Submarine (SS)	18	46,394		0	12	0	13	556,728	17
21	Meiji SSN (Akula class)	0	160,000		160,000	5	0	0	800,000	5
22	Mine warfare ship (MSC)	37	14,745		0	17	0	7	250,665	47
23	Landing Ship (LST)	11	37,286		0	31	0	0	1,155,866	42
24	P3C (Fixed wing patrol)	100		500	0	0	60	45	30,000	55
25	HSS-2B (Patrol)	36			0	0	0	0	0	36
26	MH-53E (Mine sweeping)	10			0	0	0	0	0	10
27	SM3 Missile (NTWD)	0	100		45,000	1,000	0	0	100,000	1,000
28	SH-60J (anti-sub)	78	5,075		0	35	0	8	177,625	105
29	UUV	0	30,000		55,000	3	0	0	90,000	3
30	Other Equipments				462,500	0	0	0	995,000	0
31										

Annex 5A : Japan Defense Expenditure

					Summary (2001 ~ 2020)					
S/No	**Item**	**2000 Qty (Start)**	**Unit $$ (Mil Yen)**	**Upgrade $$ (Mil Yen)**	**R & D $$ (Mil Yen)**	**Acquire**	**Upgrade**	**Retire**	**Acq Cost (Mil Yen)**	**2020 Qty**
32	**ASDF**									
33	F-15 (J/DJ)	203			0	0	0	203	0	0
34	F-22	0	8,800		0	450	0	0	3,960,000	450
35	F-1	52			0	0	0	52	0	0
36	F-2	45	11,830		0	105	0	0	1,242,150	150
37	F-4/RF-4 (E/EJ)	133			0	0	0	133	0	0
38	C-1	28			0	0	0	0	0	28
39	C-130H	16			0	0	0	0	0	16
40	CH-47J (Transport)	19	4,457		0	70	0	0	311,990	89
41	KC-135R	0	6,000		0	60	0	0	360,000	60
42	Other Equipments				455,000	0	0	0	900,000	0
43										
44	**Missile Systems**									
45	Patriot PAC-3 FU	120	2,000	2,000	50,000	120	120	0	480,000	240
46	Patriot Ops/Maintenance				0	0	0	0	399,260	0
47	I-HAWK Upgrading (in group)	192		52,188	0	0	4	0	221,799	192
48	Type-12 SSM (ICBM)	0	1,000		30,000	10	0	0	10,000	10
49	Type-88 TEL (c/w 6 missile ea)	68	1,214		0	12	0	80	14,568	0
50	Type-03 TEL (6 missile ea)	0	1,200		75,000	2,000	0	0	2,400,000	2,000
51	Type-03 Missile	0	100		0	20,000	0	0	2,000,000	20,000
52	200 KT Nuclear Warhead	0			50,000	0	0	0	0	0
53	Missile Defense (include BMD)	0	0		165,000	0	0	0	0	0
54	High Energy Laser System	0	50,000		45,000	3	0	0	150,000	3
55	Other Equipments				180,000	0	0	0	295,000	0
56										
57	**Major C4I System**									
58	EU-1 (Low observable) [2005]	0	2,000		25,000	100	0	0	200,000	100
59	EU-2 (HAE) [2007]	0	6,000		50,000	100	0	0	600,000	100
60	UF-3 (fast; strike) [2014]	0	3,500		75,000	100	0	0	350,000	100
61	E-2C	13			0	0	0	0	0	13
62	E-767	4			0	0	0	0	0	4
63	Info Gathering Satellite	0			0	24	10	8	0	16
64	National C2 System	0	150,000		120,000	1	0	0	150,000	1
65	BMC3I (Missile Defense)	0			55,000	0	0	0	0	0
66	IW Platoon (30-men)	0	5,000		0	4	0	0	20,000	4
67	Other Equipments				125,000	0	0	0	170,000	0

Annex 5A : Japan Defense Expenditure

S/No	Item	2000 Qty (Start)	Unit $$ (Mil Yen)	Upgrade $$ (Mil Yen)	Remarks
	Grand Total				
1	**GSDF**				
2	Infantry/Combined Div	12	0		The 2 CADs will be restructured first.
3	Infantry Bde	2	0		
4	Armoured Div	1			
5	Heliborne Bde	1	0		
6	Airborne Bde	1	0		
7	Amphibious Bde	0	0		
8	Tanks	1,135	861	50	Type-90 Tank
9	APC	770	182	50	Buy 10% of Type-89 and 90% of Type-96
10	Artillery (155mm SP)	831	1,040		
11	MLRS	128	1,840		
12	Attack Helicopters	88	4,500		Price assumed
13	Other Helicopters	424	2,935		Average cost of OH-1, UH-60JA, UH-1J, & CH-47A
14	Other Equipments				
15					
16	**MSDF**				
17	Kongo DDG (DD51 variant)	4	110,000	5,000	Price assumed; NO Aegis NTWD upgrade till 3rd epic; upgraded to NAD initially
18	Sapporo DDG (DD21 variant)	0	125,000		Price assumed
19	Other DDs	53	64,071		To retire gradually
20	Submarine (SS)	18	46,394		
21	Meiji SSN (Akula class)	0	160,000		Price assumed; buy one for reverse engineering.
22	Mine warfare ship (MSC)	37	14,745		
23	Landing Ship (LST)	11	37,286		3 Osumi class LST by 1999
24	P3C (Fixed wing patrol)	100		500	
25	HSS-2B (Patrol)	36			
26	MH-53E (Mine sweeping)	10			
27	SM3 Missile (NTWD)	0	100		Price provided by SMCB.
28	SH-60J (anti-sub)	78	5,075		
29	UUV	0	30,000		Prototyping (with JAMSTEC)
30	Other Equipments				
31					

Annex 5A : Japan Defense Expenditure

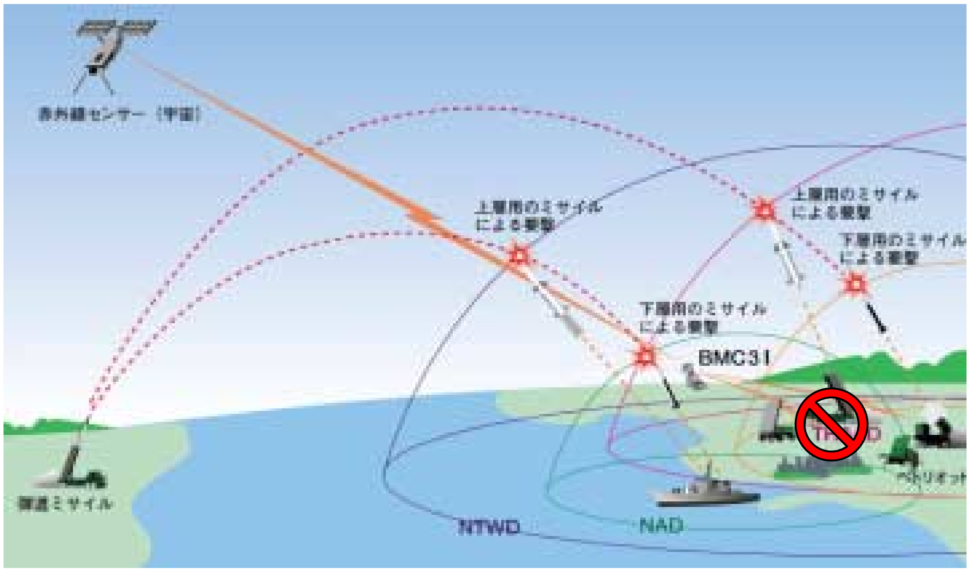
S/No	Item	2000 Qty (Start)	Unit $$ (Mil Yen)	Upgrade $$ (Mil Yen)	Remarks
32	**ASDF**				
33	F-15 (J/DJ)	203			
34	F-22	0	8,800		To replace F-15
35	F-1	52			
36	F-2	45	11,830		To replace F-1 and F/RF-4
37	F-4/RF-4 (E/EJ)	133			
38	C-1	28			
39	C-130H	16			
40	CH-47J (Transport)	19	4,457		
41	KC-135R	0	6,000		The new R variant of KC-135
42	Other Equipments				
43					
44	**Missile Systems**				
45	Patriot PAC-3 FU	120	2,000	2,000	Upgrading to fire PAC-3
46	Patriot Ops/Maintenance				8 groups
47	I-HAWK Upgrading (in group)	192		52,188	Upgrade program (6 groups); 1.75 gp upgraded before 2001
48	Type-12 SSM (ICBM)	0	1,000		Matured tech for Japan
49	Type-88 TEL (c/w 6 missile ea)	68	1,214		To phase out in epoch 4.
50	Type-03 TEL (6 missile ea)	0	1,200		
51	Type-03 Missile	0	100		
52	200 KT Nuclear Warhead	0			Ready for deployment by 2020.
53	Missile Defense (include BMD)	0	0		
54	High Energy Laser System	0	50,000		Prototyping
55	Other Equipments				
56					
57	**Major C4I System**				
58	EU-1 (Low observable) [2005]	0	2,000		Advance HAE, Surveillance UAV with C4ISR capabilities
59	EU-2 (HAE) [2007]	0	6,000		US Darkstar equivalence
60	UF-3 (fast; strike) [2014]	0	3,500		US X-36 equivalence
61	E-2C	13			
62	E-767	4			
63	Info Gathering Satellite	0			Treaty with US to share imagery
64	National C2 System	0	150,000		Continuous R&D to upgrade
65	BMC3I (Missile Defense)	0			
66	IW Platoon (30-men)	0	5,000		
67	Other Equipments				

Annex B: JSDF New Weapon Systems

The following is a list of new weapon systems that were created during the period from 2001 till 2020.

1. Air/Missile Defense System
2. EU-1 (Low Observable UAV)
3. EU-2 (HAE UAV)
4. UF-3 (Strike & Fighter Recce UAV)
5. Type-03 SSM
6. Type-12 ICBM
7. Information Gathering Satellite (IGS)
8. JAMSTEC UUV (Prototype)
9. High Energy Laser Systems (Prototype)

Air/Missile Defense System



As part of the defense strategy, the development of a comprehensive air/missile defense system is deemed critical to the safety of the Japan homeland. By 2020, the state-of-the-art technology for the Japan missile defense system was as follows:

(a) The entire fleet of 28 Kongo class destroyers and the newer 20 DD21 were retrofitted with both the Navy Area Defense (NAD) and Navy Theater Wide Defense (NTWD) systems. The NAD and NTWD were able to intercept ballistic missiles in the endo-atmospheric and exo-atmospheric altitudes respectively. However, the NTWD was able to engage incoming ballistic missile of speed 5 km/s or less.

(b) There was no procurement of the THAAD system as it was deemed that the more mobile and versatile NTWD system on the destroyers was more cost effective.

(c) All the Patriot batteries were upgraded to be able to fire PAC-3 interceptors. There were a total of 48 batteries of five launchers each capable of firing 4 missiles. As a norm, two of the five launchers were configured to fire PAC-3 interceptor. The Patriot batteries were able to provide air and missiles defenses against aircrafts, cruise missiles, and ballistic missiles in the exo-atmosphere.

(d) All the 32 batteries of I-Hawk were also upgraded.

(e) The ballistic missile (BM) C3I system was also fully integrated into Japan National Command and Control System (NCCS).

The total cost of investment (in million yen) was as follows:

	Item	R&D	Upgrading/ Procurement	Remarks
a.	PAC-3	50,000	480,000	Upgrading PAC-2 to PAC-3
b.	NTWD	45,000	100,000	200 SM3 missiles
c.	I-Hawk	-	221,799	
d.	BMC3I	55,000	-	Subsequently integrated into NCCS.
e.	BMD (Misc)	165,000	-	
	Total	**315,000**	**801,799**	

References:

- Patriot PAC-3: FAS - http://www.fas.org/spp/starwars/program/patriot.htm
- Patriot PAC-3: DefenseLink - http://www.freerepublic.com/forum/a36efead7561b.htm
- BMD: DOT&E FY'99 Annual Report - http://sun00781.dn.net/spp/starwars/program/dote99/

EU-1 (Low Observable UAV)

- Endurance: >8 hours @500nm
- Cruise Speed: 250 kts
- Payload: 1000 lbs
- Altitude: 45,000 ft
- Sensors: LPI SAR, EO, SIGINT
- Cost: ¥2 Billion
- Quantity: 100

As part of the effort to expand the C4ISR capabilities, Japan embarked on a few UAV programs. EU-1, a low observable UAV, is the first in the series. Japan approached the US to revive their previously cancelled Dark Star project. The first EU-1 (the specifications were similar to the US Dark Star project), at a cost of ¥2 billion per aircraft, was rolled out in 2004. A total of 100 EU-1 was acquired over the last 20 years.

The command and control of the EU-1 could either originate from the National Command and Control System (NCCS) Center or from a DD21 and Kongo destroyer. Communication between the UAV and the Ground Control System (GCS) could be relay via ship-based SATCOM, or other UAV.

Reference:

- FAS DarkStar (LO HAE UAV) Program - http://www.fas.org/irp/agency/daro/uav96/22-23.html.

EU-2

- Endurance: 60 hrs
- Cruise Speed: 300 knots
- Payload: 3000 lbs
- Power: 80 kW
- Altitude: 100,000 ft
- C4ISR:
  - Electro-Optics
  - SIGINT
  - SAR
  - Air Search Radar
  - Comms relay
  - Pseudo Satellite
- Cost: ¥6 Billion
- Quantity: 100

EU-2, a high altitude and long endurance UAV, was indigenously manufactured by Fuji Heavy Industries.

It was essentially a pseudo satellite that cost about ¥6 billion a copy. Speeding across the airspace at 300 knots and with an endurance of 60 hours, the EU-1 could operate as far out as 5,000 nm and still had an on station time in excess of one day (note: 10,000 nm/300 kts = 26.7 hrs).

Flying at an altitude of 100,000 ft, EU-2's sensors would have an operating range of at least 300 nm. Furthermore, another key mission for EU-2 would be communication relay for the ships or aircrafts (e.g. EU-1). This was important so that all the essential information would be able to be piped back to the NCCS for a consistent battlefield picture.

UF-3

	• Max Speed: Mach 2.0 • Cruise Speed: Mach 1.2 • Payload: 12,000 Lbs • Altitude: 65,000 Ft • Range: 1,200 nm • Cost: ¥3.5 Billion • Quantity: 100

UF-3 was a low observable unmanned combat aerial vehicle (UCAV) that was a follow-on development of US X-36 program[1]. The project was co-developed by Mitsubishi Heavy Industries and Boeing Co. It had an operating range of 1,200 nm while cruising at Mach 1.2. This system would substantially enhance our strike and fighter recce capability without increasing the demand for pilots.

Like EU-1, command and control of UF-3 would be very versatile. Depending on the mission needs, the C2 could originate from

a. the NCCS for specific Joint mission;

b. a Destroyer, e.g. Kongo, for extended range of operation; or

c. a manned fighter, e.g. F-22, controlling a fleet of four UF-3 for strike mission.

d. on Autonomous mission – the EU-2 could be preprogrammed with routes to attack fixed land targets using JDAM or JSOW, or preprogrammed for fighter and/or electronic recce.

The operating range of UF-3 could be easily extended, for example, by operating in tandem with the EU-2 (a pseudo-satellite) that provided the communication relays.

Reference:

- Boeing Co. - http://www.boeing.com/defense-space/military/x36/x36.htm

[1] Due to the lack of information, performance specifications are the team's assessment and not based on any authoritative reference on the X-36 project.

Type-03 SSM

- Range: 1,500 nm
- Length: 6.25 m
- Weight: 1,440 Kg
- Diameter: 51.8 cm
- Standard VLS cell; or 21” Torpedo tube
- Warhead: 1000 lb
- Nuclear: 200 kt (possible)
- TEL Cost: ¥3.5 Billion
- TEL Quantity: 2,000
- Missile Cost: ¥100 Million
- Missile Quantity: 20,000

Type-03 SSM was a long-range sub-sonic cruise missile for surface target. The design was largely based on the Tomahawk Missile but re-designed and produced by Mitsubishi Heavy Industry. Each launcher cost ¥1.2 billion and each missile cost ¥100 million. The missile was modular; hence it can be easily configured for either land attack or anti-ship roles. It can be mounted on a standard VLS cell or 21” torpedo tube. It could carry a 1000 lb conventional warhead or a 200 kt nuclear device. A total of 2000 TELs and 20,000 missiles were procured.

Reference:

- FAS BGM-109 Tomahawk Missile - http://www.fas.org/man/dod-101/sys/smart/bgm-109.htm.

Type-12 ICBM

	• Power Plant: 3 solid-propellant rocket motors • Speed: 15,000 mph at burnout (7 km/s) • Range: 5,218 nm • Ceiling: 700 miles • Payload: 2,640 lb • Length: 59.9 ft • Weight: 79,423 lb • Diameter: 5.5 ft • Cost: ¥1 Billion • Quantity: 10

Type-12 ICBM was designed and built by Mitsubishi Heavy Industries in 2012. It was equivalent to a US Minuteman III. It employed 3 solid-propellant rockets motors to deliver ordnance more than 5,000 nautical miles. A total of 10 ICBMs were deployed.

Reference:

- FAS US Minuteman III - http://www.fas.org/nuke/guide/usa/icbm/lgm-30_3.htm.

Information Gathering Satellite (IGS)

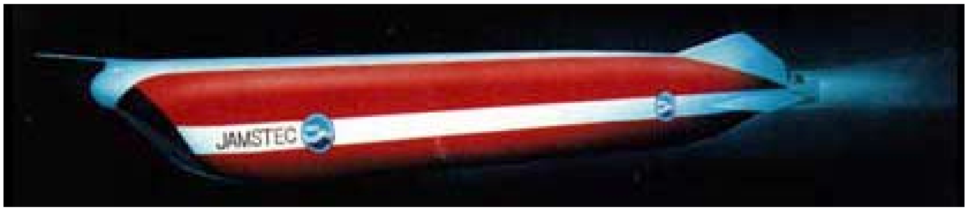
	• Orbit: 500 km (LEO) • Sensors: EO • Resolution: 30 cm • Managed by NASDA • Cost: ~ ¥450 Million • Total Satellites: 16

The purpose of introducing the information-gathering satellites was to provide surveillance and early warning so as to identify arising threats and crises. In 2003, Mitsubishi Electric Corp developed and launched a total of 4 satellites at a cost of ¥1,700 billion. These LEO satellites that orbit at 500 km above the Earth and acquired images of required regions regularly and revealed those factors that could become a threat. The satellites carried optical sensors that were able to resolve images as small as one square meter – such as ballistic missiles and combat aircraft. By 2010, the resolution was further enhanced to 30 cm. As the satellite program came under the purview of the National Space Development Agency (NASDA) of Japan, the cost did not appear in JSDF's budget. As a contingency, Japan also established a MOU with the US to share satellite imageries.

Reference:

- BBC Online Network – http://news.bbc.co.uk/hi/english/world/asia-pacific/newsid_204000/204700.stm.

JAMSTEC UUV



- Cruising Distance: 2,000 km
- Cruising Speed: 20 kt (30 kt max)
- Depth: 5,000 ft
- Weight in Air: 10 tons.
- Power Source: Fuel Cell (Nuclear ?)
- Guidance: Pre-programmed, Autonomous navigation, Acoustic remote control & UROV modes.
- Navigation: INS combining ring-laser gyro and Doppler sonar, and acoustic-homing, obstacle avoidance, expendable optical fiber cable remote control.
- Sensors: CTDO, Multi Sea Beam, Water Sampler (200 samples), a digital camera.
- Can be enhanced to carry 4 x MK-112 torpedoes.

Concept Of Operations (Draft)

For An Unmanned Underwater Vehicle With Nuclear Cruise Missiles

Peacetime Roles: Geological Research, Real-time seafloor seismic observation, Deep sea floor topography, Search and Rescue mission, & Communications relay.
Defense Roles: Monitor and track surface ship activities, Monitor and track submarines activities, Mine neutralization, Anti-ship & ASW capabilities.

The following addresses methods of basing, communications and positive control for an unmanned underwater vehicle carrying nuclear-armed cruise missiles (TLAM-N equivalents).

1. BASING: intended to provide a secure second-strike capability against a few dozen warheads in a surprise or accidental attack in peacetime and against several hundred warheads during an acute crisis.

a. *Peacetime:* The majority of the vehicles are kept in port, but ready to launch if the proper messages are passed. A small number are kept at sea, some armed and some not. While at sea, they could be tethered to buoys for part of their time at sea and transiting the rest. The locations themselves would be connected with command authorities and would be one means of passing strike messages to attached underwater vehicles.

b. *Crisis:* The bulk of the force is at sea, and armed. While still tied to the buoy system, they would spend a larger fraction of their time in transit.

2. COMMUNICATIONS MEANS: VLF communication will be used, if a suitable transmitter site is found. Underwater sound transmitters can be used in the Inland Sea, as this might be simply a means of notifying the vehicles that an important message is coming. Alternative is the space-based lasers (blue-green?). The vehicles would place themselves at an appropriate depth and location for message reception at preprogrammed times.

3. POSITIVE CONTROL, for both the missile and the warhead. An authenticated launch message is needed to launch the missiles. Likewise, the proper code is needed to arm the warheads. The warheads would be equipped with something like the US PAL. The warheads themselves would have built-in means to disable themselves in response to detected tampering attempts – electronic or physical.

Japanese planning allows for a significant percentage of warheads unavailable because of failure to receive or properly respond to launch messages.

By 2020, three UUVs were field for prototyping.

Cost per system: ¥30 billion (estimate)

Quantity: 3 (for prototyping)

R&D effort: ¥55 billion

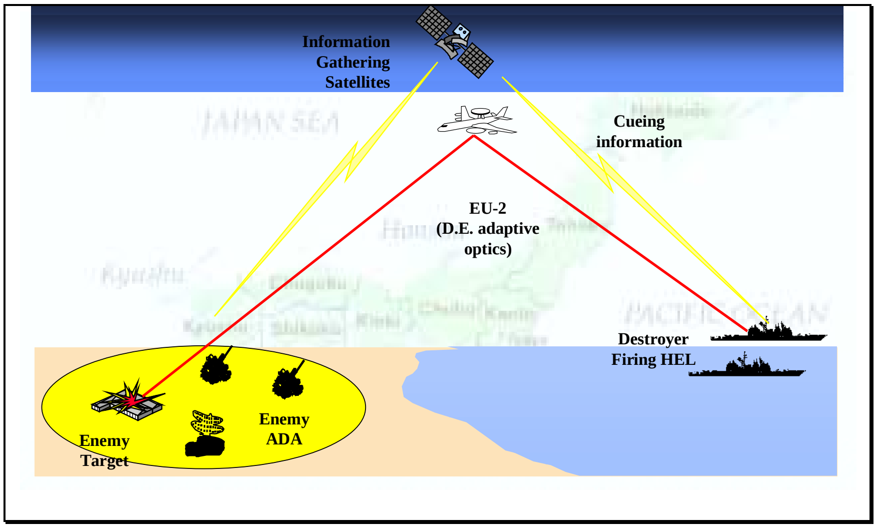
Acknowledgement:

- The team would like to thank Prof. Franck for his guidance on scripting the concept of operation for the UUV.

Reference:

- JAMSTEC Marine Technology Department - http://www.jamstec.go.jp/jamstec-e/tech/now.html

High Energy Laser (HEL)



The High Energy Laser (HEL) program was an on-going R&D effort that was started in 2012. The HEL was designed to be compact and mountable either on a land-based platform or on a destroyer. The laser-firing unit can be used in conjunction with an EU-2 that had an adaptive optics to reflect and focus the laser energy on over the horizon target. The HEL was designed to engage a wide array of targets:

(a) Against ballistic missile (engaging in the re-entry phase)
(b) Air defense against aircraft/cruise missile
(c) Surface targets: Anti-ship & Land targets (missile silo, C2 HQ, ADA, etc)
(d) Anti-satellite (LEO)

By 2020, three systems were fielded for prototyping – two ship-based and one land-based.

Cost per system: ¥50 billion (estimate)
Quantity: 3 (for prototyping)
R&D effort: ¥45 billion

Reference:

- Rockwell Team ABL Homepage - http://sun00781.dn.net/spp/starwars/program/abl/rockwell/

Annex C: Epoch by Epoch at a Glance

Epoch	I	II	III	IV
Period	**2001-2005**	**2006-2010**	**2011-2015**	**2016-2020**
Geopolitics	▪ Maintenance of US-Japan security relationship.	▪ Commencement of US troop withdrawal from ROK. ▪ Reunification of the PRC and Taiwan. ▪ Rejection of bid for seat in UN Security Council.	▪ Battle for influence over Korea's strategic direction.	▪ Korean reunification. ▪ Minimal US forces in Korea. ▪ US troops withdrawing from Japan. ▪ Gradual ascension of the PRC.
Domestic Situation	▪ Diet passed economic policy aimed at "short term pain for long term gain". ▪ Japan entered into recession.	▪ "Long term" dividends enjoyed as economy recovered. ▪ Re-evaluation of 3 pronged security policy. ▪ Re-interpretation of Article 9.	▪ Positive economic climate. ▪ Medication of Japan's nuclear allergy. ▪ Re-evaluation of US-Japan Security Arrangement.	▪ Re-evaluation of provisions in Article 9. ▪ Debates on adherence to 3 Non-Nuclear Principles.
Annual Average GDP	¥426.6 trillion	¥479.0 trillion	¥617.8 trillion	¥745.6 trillion
Annual Average Growth	-3.6%	5.2%	5.0%	3%
Per Capita GDP	¥3.34 million	¥3.75 million	¥4.89 million	¥6.01 million
Annual Average Defense Spending	¥4.26 billion	¥4.78 billion	¥6.1 billion	¥7.3 billion
Introduction of New Key Weapon Systems	▪ NAD and Patriot PAC-3. ▪ Type-03 SSM. ▪ EU-1 (low observable UAV). ▪ Information Gathering Satellite. ▪ IW platoon.	▪ EU-2 high altitude, long endurance UAV.	▪ Type-12 ICBM. ▪ UF-3 low observable UCAV. ▪ F-22 fighter. ▪ NTWD capability against ballistic missile (speed less than 5km/sec).	▪ Meiji SSN. ▪ Sapporo DDG. ▪ JAMSTEC UUV. ▪ HEL system. ▪ Completion of nuclear warhead program (short of deployment).

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Annex D: List of Acronyms

Acronym	Description
AAR	Air-to-Air Refueling
ADA	Air Defense Artillery
AEWCC	Air Early Warning Command and Control
AIP	Air Independent Propulsion
APC	Armored Personnel Carrier
ARF	ASEAN Regional Forum
Arty	Artillery
ASCM	Anti-Ship Cruise Missile
ASEAN	Association of South East Asian Nations
ASW	Anti-Submarine Warfare
ATF	Amphibious Task Force
BAe	British Aerospace Engineering
Bde	Brigade
BDRA	British Defense Research Agency
BMC3I	Ballistic Missile Command, Control, Communications and Intelligence
BMD	Ballistic Missile Defense
Bn	Battalions
BW	Biologic Weapons
C2	Command and Control
C4	Command, Control, Communications and Computers
C4I	Command, Control, Communications, Computers and Intelligence

Acronym	Description
C4ISR	Command, Control, Communications, Computers, Intelligence, Surveillance and Reconnaissance
CAD	Combined Arms Division
CBM	Confidence Building Measure
CCP	Chinese Communist Party
CW	Chemical Weapons
DD	Destroyer
DDG	Guided Missile Destroyer
Div	Division
DPRK	Democratic People's Republic of Korea
EO	Electro Optic
ESPF	Eastern Sea Protection Force
EW	Electronic Warfare
FU	Firing Unit
GCS	Ground Control System
GDP	Gross Domestic Product
HAE UAV	High Altitude, Long Endurance Unmanned Aerial Vehicle
HAWK	Home All the Way Killer
HEL	High Energy Laser
IAEA	International Atomic Energy Agency
ICBM	Inter-Continental Ballistic Missile
IGS	Information Gathering Satellite

Defense of Japan (Acronym)

Acronym	Description
IFV	Infantry Fighting Vehicle
IMINT	Imagery Intelligence
IRBM	Intermediate Range Ballistic Missile
IW	Information Warfare
JAERI	Japan Atomic and Energy Research Institute
JBMD	Japan Ballistic Missile Defense
JDA	Japanese Defense Agency
JDAM	Joint Direct Attack Munition
JSDF	Japan Self-Defense Force
(J)ASDF	(Japan) Air Self-Defense Force
(J)GSDF	(Japan) Ground Self-Defense Force
(J)MSDF	(Japan) Maritime Self-Defense Force
JSOW	Joint Stand-Off Weapon
JTF	Japanese Task Force
LACM	Land-Attack Cruise Missile
LEO	Low Earth Orbit
LNG	Liquefied Natural Gas
LPI	Low Probability Intercept
LR	Long Range
LST	Landing Ship Tank

Acronym	Description
MBT	Main Battle Tank
MDZ	Maritime Defense Zone
MLRS	Multiple Launcher Rocket System
MOU	Memorandum of Understanding
MPA	Maritime Patrol Aircraft
MRBM	Medium Range Ballistic Missile
MTCR	Missile Technology Control Regime
NAD	Navy Area Defense
NASDA	National Space Development Agency
NCCS	National Command and Control System
NCO	Non-Commissioned Officer
NCS	Nuclear Counter Strike
NDPO	National Defense Program Outline
NISTEP	National Institute of Science and Technology
NPT	Nuclear Non-Proliferation Treaty
NTWD	Navy Theatre Wide Defense
NSEP	National Survivability and Enhancement Project
ODA	Overseas Development Assistance
OPEC	Organization of Petroleum Exporting Countries
ORBAT	Order of Battle
PAC	Patriot Advanced Capability

Defense of Japan (Acronym)

Acronym	Description
PB	Patrol Boats
PLA	People's Liberation Army
PLAAF	People's Liberation Army Air Force
PLAN	People's Liberation Army Navy
PRC	People's Republic of China
R & D	Research and Development
ROK	Republic of Korea
RRF	Rapid Reaction Force
SAM	Surface-to-Air Missile
SAR	Synthetic Aperture Radar
SATCOM	Satellite Communication
SHORAD	Short Range Air Defense
SIGINT	Signal Intelligence
SLBM	Submarine Launched Cruise Missile
SLOC	Sea Lines Of Communication
SM	Standard Missile
SP	Self-Propelled
SR	Short Range
SRBM	Short Range Ballistic Missile
SS	Ship Submersible – Diesel Submarine
SSBN	Ship Submersible Ballistic Nuclear – Ballistic Missile Submarine (Nuclear Propulsion)

Acronym	Description
SSM	Surface-to-Surface Missile
SSN	Ship Submersible Nuclear – Attack Submarine (Nuclear Propulsion)
SSP	Sea Situation Picture
TD	Taepo Dong
TEL	Transportable Erector Launcher
TF	Task Force
TG	Task Group
THAAD	Theatre High Altitude Area Defense
THAWK	Tomahawk
TLAM	Tomahawk Land-Attack Missile
TLAM-N	Tomahawk Land-Attack Missile Nuclear
UAV	Unmanned Air Vehicles
UCAV	Unmanned Combat Aerial Vehicle
UN	United Nations
US	United States
USFK	United States Forces in Korea
UUV	Unmanned Underwater Vehicle
VLF	Very Low Frequency
VLS	Vertical Launch System
WMD	Weapon of Mass Destruction
WW II	World War II

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Annex F: Biography

1. Lieutenant Colonel Nee Bor Wei was enlisted in the Singapore Armed Forces in Dec 1984. He was awarded the Overseas Training Award to study Engineering Science in Oxford University (United Kingdom) the following year. After graduating in 1988, he joined the Republic of Singapore Air Force as an Air Operations and Communications Officer. He subsequently served as a Branch Head in HQ RSAF. After graduating from the Singapore Command and Staff Course, he was assigned to the Joint Staff. In 1999, he was selected to attend the Systems Engineering/Integration curriculum in Naval Postgraduate School.

2. Major Chiu Eng Tatt, of the Republic of Singapore Navy (RSN), was enlisted in 1986 and graduated from the Britannia Royal Naval College (UK) in 1987. He obtained his Bachelor of Engineering (Honours) in Electrical and Electronics Engineering, from the University of Birmingham (UK) in 1990, under the Singapore Armed Forces (SAF) Overseas Training Scholarship, and completed the Singapore Command and Staff Course in 1997. He has served onboard most classes of ships in the RSN, his last appointment being the Commanding Officer of a Missile Corvette. He has also done a staff tour as a force plans officer in the Navy Headquarters. For three years, he served as an Honorary Aide-De-Camp to the President of the Republic of Singapore. In 1999, he was awarded the SAF Postgraduate Scholarship to study the first System Engineering Integration (SEI) course at the Naval Postgraduate School (USA). Major Chiu is married with a three-year-old daughter.

3. Major Lye King Siong, of the Singapore Army, was enlisted in 1989. He graduated from National University of Singapore in 1994 with a Bachelor of Science (Hons, 2nd Upper) in Computer Science (Information Technology). He joined the Signals Formation in 1995 and had since held several staff appointment in HQ Signals and HQ Engineers. His last appointment was OC, Trunk Communication Company in a CAD Signal Battalion. In 1999, he was awarded the SAF Postgraduate Scholarship to study the System Engineering Integration course at the Naval Postgraduate School. He is married with 2 Cavalier King Charles Spaniels.

4. Lieutenant McCullough is a native of Birmingham, Alabama. After graduating from the U.S. Naval Academy in May 1995, he reported to his initial assignment in USS MERRILL (DD 976) where he served as Anti-Submarine Warfare Officer and Public Affairs Officer. His next assignment began in August 1998 where he served as Fire Control Officer and Ship's Material Maintenance Officer in USS Lake Champlain (CG-57). In September 1999 he was ordered to the Naval Postgraduate School where he completed Joint Professional Military Education Phase I and earned a Masters of Science Degree in Systems Integration (C4I). His personal awards include the Navy Commendation Medal and the Navy and Marine Corps Achievement Medal.