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U.S. AND SOVIET STRATEGIC COMMAND AND CONTROL: IMPLICATIONS FOR A PROTRACTED NUCLEAR WAR

by

Kirk S. Lippold

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This thesis will address the relative ability of the command and control systems of the ited States and Soviet Union to support a protracted nuclear war. It covers the development d structure of the command and control organizations used to support the respective tional Command Authorities. In discussing these organizations, the various systems pporting the command and control apparatus will also be covered. This includes the threat rning and attack assessment equipment used to determine strategic and tactical warning and e communications equipment used to alert forces of increased readiness and the conduct of lear strikes if required. The technical factors associated with the performance of C3 in uclear environment will also be covered. The result is a net assessment of the two mand and control systems that highlights the strengths and weaknesses inherent in each. commendations to help enhance the United States' position regarding this national security sue are also developed.

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U.S. and Soviet Strategic Command and Control: Implications for a Protracted Nuclear War

by

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March 1989

ABSTRACT

This thesis will address the relative ability of the command and control systems of the United States and Soviet Union to support a protracted nuclear war. It will address the organizations as well as the various systems used to support the respective National Command Authorities. This includes the threat warning and attack assessment equipment used to determine strategic and tactical warning, the communications equipment used to alert forces of increased readiness and the contribution of these systems in the conduct of nuclear strikes, if required. It also includes a review of the technical factors associated with the performance of C^3 in a nuclear environment. The result is a net assessment of the two command and control systems that highlights the strengths and weaknesses inherent in each. Specific recommendations, such as better aircraft support schemes and more robust command and control systems, are developed to help enhance the United States' position regarding this vital national security issue.

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I. INTRODUCTION

Today, the United States and Soviet Union each possess extensive strategic command and control organizations. Both however, have evolved differently and each country's system has distinct advantages and disadvantages. These differences must be considered in the context of how the military is organized and what procedures guide nuclear weapons control functions.

The Soviet Union has very precisely defined concepts of command and control which focus on a wartime environment. It utilizes a rigorous design process when creating a command and control system, and by having a specific focus for its military, the supporting systems can be much easier to build and implement. Each component is built to suit a specific purpose and contributes to the overall mission of the system whether it is for tactical forces or strategic command and control of nuclear forces. The emphasis is on cooordinated and large scale use of conventional forces in any nuclear conflict, and it has adapted the command and control systems to be able to execute nuclear operations if required.

The United States, on the other hand, tends to have a more loosely defined concept of command and control and places greater emphasis on the capabilities of available technology. The strategic systems currently in place have usually evolved due to a recurring deficiency in their operational use rather than from planning the system from the top down. This chapter will cover the command and control organizations in the United States and Soviet Union and will set the stage for analysis of current systems and and net assessment in Chapters III, IV, and VI.

A. U.S. COMMAND AND CONTROL

With the development and use of the first atomic device, the United States found itself in a unique military and political position. With a weapon of this power, the requirement for a strict and clearly defined command and control organization had to be formulated. Over the ensuing years, this requirement has manifested itself in a strategic command, control, communications, and intelligence (C^3I) structure that has evolved into a system designed to support current political doctrine.

Although considered by the Soviet Union for years in the design of their systems, the United States has only recently begun to develop C^3I systems which address the aspect of survivability in the context of maintaining a sustained warfighting capability in a nuclear confrontation. Presidential Directive (PD) 59 and National Security Decision Directive (NSDD) 13 have set the stage for the United States to place its nuclear forces and their supporting command and control structures in a position where they have the capability to carry out a protracted nuclear conflict and "win" by denying the Soviet Union its war aims.[1]

The current command and control system is still in a state of evolution. The changes occurring within the field of C^3 are both technically challenging and based on the drive to provide a strategic command and control system still containing the important aspects of flexibility, redundancy, endurance, reliability, security, and, most important, survivability.

The United States' strategic command and control network is organized in a manner which allows for close control over the employment of nuclear weapons. The system utilized for exercising this control is the World Wide Military Command and Control System (WWMCCS). It is designed to support the National Command Authority (NCA) during either a nuclear or conventional conflict. It operates through and serves the Joint Chiefs of Staff (JCS), while subordinate command organizations support the Unified and Specified Commanders and their Service component commanders.[2]

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[1]Paul Bracken, The Command and Control of Nuclear Forces (New Haven: Yale University, 1983), p. 88.

[2]Kenneth L. Moll, Strategic Command and Control (Washington, D.C.: Library of Congress, Congressional Research Service, 19 November 1980), p. 6.

In carrying out the mission of maintaining a viable command and control network, the United States utilizes a complex command and control architecture. The equipment supporting it includes fixed sight radars, a variety of communications equipment designed to employ the entire electromagnetic spectrum, and intelligence gathering systems to provide the NCA with processed information capable of supporting real-time decisionmaking. One aspect of command and control which should be addressed is its contribution to maintaining deterrence.

A robust command and control system is often seen as a prime ingredient in the deterrent equation. By maintaining a C^3I system capable of functioning in a nuclear environment, the desire for either the United States or the Soviet Union to initiate an attack is hopefully decreased since the chances of successfully executing a decapitating strike are diminished. Deterrence could be assumed to flow from the fact that the system, if exercised in a conflict, could properly function, and continuity of control could be maintained. This point is emphasized by Blair in his book Strategic Command and Control:

> Deficiencies in command performance could be cause for serious concern regardless of the resilience of the forces and the strategy to which they are subordinated. If command and control fails, nothing else matters.[3]

---

[3]Bruce G. Blair, Strategic Command and Control, Redefining the Nuclear Threat (Washington, D.C.: The Brookings Institution, 1985), p. 4.

Also, with a survivable command and control system, the ability to communicate intentions and actions contributes to maintaining a stable relationship between the countries.

It has been noted that the desire for deterrence also stems from sound military theory. The view which holds that deterrence is a function of mutual societal vulnerability addresses the possibility that command instability may result in unintended conflict or an uncontrolled escalation of a conflict in progress. The opposite tack which holds that deterrence flows from the promise of proficient military conduct fails to take into account that if command instability occurs, the conflict cannot be fought in any militarily intelligent fashion.[4] The important intertwining of an enduring command and control system and crisis stability has been addressed by Steinbruner:

> The most severe problems with the concept of stability result from the fact that its technical definition has not included a critical dimension of strategic capability: namely the physical and organizational arrangements for exercising deliberate command of strategic forces.[5]

Although the United States has chosen the strategic path of developing an enduring and survivable C^3I system for strategic forces, this utilization of resources has been claimed by some to be an inefficient use of resources.

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[4]Colin S. Gray, Nuclear Strategy and National Style (Lanham: Hamilton Press, 1986), p. 153.

[5]John Steinbruner, "National Security and the Concept of Strategic Stability," Journal of Conflict Resolution 22, no. 3 (September 1978): p. 413.

By seeking to field this type of system, the United States is investing funding and resources that may be better spent in preparing for a short nuclear war. The critical aspects concerning the much needed hardening of ICBM and national command authority bunkers is frequently brought up. Also, the ability to maintain forces at higher generated alert postures than may occur in a crisis can put a severe strain on logistics requirements.[6] These concerns are valid, but the requirement to plan for a worst case scenario--a protracted nuclear war--must be strived toward. By expending resources in this manner, many of the concerns about resource utilization will be taken care of as updated and new systems become operational.

B. SOVIET COMMAND AND CONTROL

The Soviet Union approaches the command and control of its nuclear forces in a manner quite different from the United States. The leadership of the Soviet Armed Forces is vested in the Defense Council. The Defense Council is set up in peacetime to facilitate any possible transition to war that may be required, hence, it is generally viewed as a wartime organization. The daily peacetime activities of the military are controlled by the Ministry of Defense which has eleven deputy ministers, five of which control the main

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[6]Colin S. Gray, <u>Nuclear Planning and Strategic Planning</u> Philadelphia Policy Papers (Philadelphia: Foreign Policy Research Institute, 1984), p. 24.

bulwark of the Soviet defenses. The five main services are the Strategic Rocket Forces, Ground Forces, Navy, Air Defense Forces, and Air Forces. The remaining six deputy defense ministers oversee civil defense, rear services, the main inspectorate, construction and billeting, personnel, and armaments.[7]

As with the United States, the Soviet Union realizes and stresses the important aspects required in any command and control system. There are, however, some important differences. The Soviet Union places more importance on viewing the C^3I process as a system which serves as a "force multiplier".[8] The concept of force multiplier gives a commander in the field or country an added advantage against the enemy by allowing him to employ better data processing techniques, communications, and decisionmaking tools, giving them the overall qualitative edge needed for victory. They also place an increased emphasis on the survivability of their strategic systems designed to support a nuclear conflict. This emphasis on survivability has been the driving force behind the demand for leadership survival and a capability to continue a nuclear confrontation while maintaining political control of their nuclear forces.

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[7]Department of Defense, Soviet Military Power: An Assessment of the Threat 1988 (Washington D.C.: U.S. Government Printing Office, 1988), p. 13.

[8]James G. Taylor, "Cybernetic Concepts and Troop Control," unpublished paper (Monterey: Naval Postgraduate School, 1987), p. 4.

In the event of a crisis, the Soviet Union's political and military organizations would undergo slight modifications. The Defense Council will be modified to resemble the World War II State Defense Council, or VGK Stavka, and will be responsible for the planning of strategic operations and overseeing the wartime development of the armed forces. The control of the strategic nuclear forces will be directly controlled by them and assigned strike missions as required.[9]

To support this effort, the Soviet Union has built an extensive array of command and control facilities that are designed to support the nation's political and military leadership. Communications are carried out by a variety of means including land-lines, radiotelephone, microwaves, and satellites. These facilities all incorporate a degree of survivability through physical hardening, EMP hardening, or redundancy. There is also a program of deep underground shelters designed to protect the leadership and provide them with a degree of survivability allowing conduct of a protracted conflict.[10] When viewed within the concept of Soviet military strategy and their "vitally important" strategic missions that must be performed, these developments make much more sense. The Soviets believe that

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[9]Department of Defense, Soviet Military Power 1988, p. 16-17.

[10]Department of Defense, Soviet Military Power 1988, p. 59-60.

strategic offense and defense must be simultaneously executed in modern warfare in order to achieve its strategic goals.[11]

C. SURVIVABILITY

In considering both the United State's and Soviet Union's command and control structures for controlling nuclear forces, it is apparent that both are deeply concerned with their ability to maintain a robust system capable of surviving a dedicated nuclear attack and continuing the fight for a period of days, weeks, and possibly months. The Soviet Union has made tremendous progress in this area, as seen in their reliance on leadership bunkers, communication techniques, and in wargame scenarios where communication breakdowns are part of the exercise. The United States, on the other hand, has only recently begun to appreciate the value of being able to support the C^3 requirements necessary for a protracted nuclear conflict. Started during the Carter administration, the drive toward attaining the command and control facilities capable of waging this type of conflict has been continued by the Reagan Administration.

Although much has been done to reduce and eliminate the command and control system vulnerabilities inherent in a

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[11]James G. Taylor, "Soviet Perspective on Military Affairs and Deterrence," unpublished paper (Monterey: Naval Postgraduate School, 1989), p. 19.

nuclear conflict, the United States is still falling short of attaining this illusive goal. The thrust of this thesis is to discuss the C^3I systems currently in use by the United States and Soviet Union, the nuclear effects and technical considerations impacting a command and control system, a net assessment of where the United States and Soviet Union systems' stand in achieving this goal, and a set of recommendations listing what the United State still requires to fully attain this capability. If the United States achieves this ability, it will then have the option to negotiate a termination to the conflict and possibly arrange for the reconstitution of the government and society.

II. UNITED STATES' AND SOVIET UNION COMMAND AND CONTROL

The importance of command and control is not lost on either the United States or the Soviet Union. Both realize it is a critical facet of their ability to execute combat operations, including a nuclear strike. As stated by Esposito and Schear:

> Of all the factors shaping East-West strategic relations in the 1980's, none is potentially more important than Command, Control, Communications and Intelligence (C^3I). The sensors, communications systems, operational procedures, and command organizations that comprise, in effect, the central nervous systems of the U.S. and Soviet defense establishments play a critical role in security: they determine the responsiveness of nuclear forces to each other--and to their respective national authorities--in peacetime, in crises, and in conflict.[12]

It is this fact that will be addressed in this chapter and chapters III and IV.

A. U.S. STRATEGIC C^3 DEVELOPMENT

The requirement and concept for an integrated and robust command and control system began with the decision in the late 1940's to continue production of more atomic weapons for military use. With the advent of the Atomic Energy Commission in 1946, President Truman was able to maintain tight control over the warheads. In the event of a

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[12]Lori Esposito and James A. Schear, The Command and Control of Nuclear Weapons (Queenstown: The Aspen Institute for Humanistic Studies, 1985), p. 1.

military crisis where possible use of nuclear weapons was foreseen, the Commission would turn the warheads over to the military for mating to appropriate delivery vehicles.[13] This decision to maintain a direct and responsive political link between political requirements and military action has continued to provide the United States with a strategic decisionmaking process requiring effective and efficient flow of communications.

With the explosion of a nuclear bomb by the Soviet Union on August 29, 1949, the Cold War and the nuclear arms race began in earnest. As the Soviets increased their capability to use nuclear weapons in a conflict, the time line necessary for providing an adequate defense of Europe began to shrink. It became apparent that the U.S. military would require direct access to the nations' stockpile of nuclear weapons in order to employ them in the defense of the country and its interests. This policy change was implemented in 1951 when the military first began receiving weapons. By 1956, the weapons were turned directly over to the military both within the United States and at overseas bases.[14]

Throughout this time period and until the early 1960's, the strategic C^3 system did not require much flexibility.

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[13] Paul Bracken, The Command and Control of Nuclear Forces (New Haven: Yale University, 1983), p. 180.

[14] Bracken, The Command and Control of Nuclear Forces, p. 181-182.

Since nuclear weapons could only be delivered via the bomber force, and the nuclear strategy of the time dictated a massive response against the Soviet Union, a long time line was inherent in the system. The United States was shocked into action regarding the use of missile technology when the Soviet Union launched Sputnik I on October 4, 1957, and by April 18, 1961 it had put Yuri Gagarin into space. These two accomplishments, especially Sputnik I, made the United States realize that the Soviet Union was quickly developing the necessary technology base required to place nuclear warheads on missiles and launch them at the United States with little or no warning.

The United States was quick to respond and began programs to build ICBM and SLBM missile systems. With their development and deployment, the United States managed to maintain their dominance regarding nuclear weaponry. The changes within the command and control structure began to undergo some revisions to accommodate this new technology and the philosophy still in vogue, Massive Retaliation.

With the doctrine of Massive Retaliation, which called for unconstrained all-out attacks, three requirements were laid upon the command and control structure:

1. a large nuclear force, capable of inflicting a devastating first strike;

2. an excellent warning system, both tactical and strategic. It must be capable of providing as much advanced warning as possible; and

3. a streamlined command and control structure capable of quickly and efficiently relaying the President's orders to go to war.[15]

The vehicle for carrying out these requirements was the Department of Defense Reorganization Act of 1958. It excluded the service secretaries in the combat chain of command and designated the President and Secretary of Defense as the National Command Authority.[16]

With the development of the ballistic missile, the time line under which a C^3 system would be required to function became even shorter. By the mid-1960's, it was estimated that the NCA would have about 25 to 30 minutes from launch detection to impact in which to decide on an appropriate response. Since its inception in the 1970's, WWMCCS has served as a focal point for communication and information links with the Department of Defense. With this system the NCA was able to exercise more responsive control over deployed U.S. conventional and nuclear forces. A more detailed discussion covering the evolution of the system will be covered in Chapter IV.

As the United States' nuclear forces and related technology expanded, the nuclear doctrine of the 1960's and early 1970's was centered around the philosophy of Mutual

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[15]Bracken, The Command and Control of Nuclear Forces, p. 183-184.

[16]Bruce G. Blair, Strategic Command and Control, Redefining the Nuclear Threat (Washington, D.C.: The Brookings Institution, 1985), p. 52.

Assured Destruction (MAD). To support the NCA in the decision to employ nuclear weapons, the communications system design was centered on the ability of the equipment to respond with little notice and accurately deliver the Emergency Action Message (EAM) to the subordinate nuclear commanders for action. The system had little need for survivability since a nuclear war was expected to consist of a single spasm attack with no thought given to a second strike or the support of a nuclear reserve force for war termination and negotiation. This type of policy remained in effect until 1974 when Secretary of Defense Schlesinger redefined the role of the U.S. nuclear forces and their supporting command and control systems.

With National Security Decision Memorandum (NSDM) 242, the United States began a shift in its nuclear weapon employment policy by specifying that Soviet command and control facilities would be among those military installations to be targeted in a nuclear exchange.[17] This key shift in policy now recognized the criticality of command and control facilities in the effective conduct of a nuclear war.

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[17]Desmond Ball, "Counterforce Targeting: How New? How Viable?", Arms Control Today, 11, February 1985, p. 1-9, and Congress, Senate, Committee on Armed Services, FY 1978 Authorization for Military Procurement, Research and Development: Hearing before the Committee on Armed Services, p. 556, as cited in Blair, Strategic Command and Control, p. 25.

The concern with targeting command and control facilities was continued during the Carter administration with the issuance in 1980 of Presidential Directive (PD) 59. Presidential Directive 59 not only continued with the "Schlesinger doctrine", it also reportedly added the constituent elements of escalation control, explicit countercommand targeting, and preparedness for protracted war.[18] This shift is also significant, in that it specifies the requirement for being able to conduct a protracted nuclear exchange. This new demand on the U.S. command and control network required a revisitation to the C^3 survivability aspects that had previously been dismissed as unnecessary and destabilizing.

In 1982 the Reagan Administration adopted the basic tenets set forth in PD 59 including the requirement to develop and maintain an ability to fight a protracted nuclear conflict. The directive addressed the issues involved in such an undertaking including the supporting C^3 structure and equipment that would be required if the U.S. expected to conduct a nuclear exchange over a period of days, weeks or possibly even months. It emphasized the communications systems needed to support reconstitution and

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[18]Stephen J. Cimbala Nuclear War and Nuclear Strategy, Unfinished Business (Westport: Greenwood Press, 1987), p. 52.

execution of strategic nuclear reserve forces, specifically full communications with ballistic missile submarines.[19]

This policy has set the standard for the U.S. goal of attaining the communication architecture and equipment necessary to support a protracted conflict. Also, the administration felt it needed to justify the expense involved in putting forth the new requirement calling for any current or planned strategic system to have a C^3 system capable of supporting it under all conditions of use, including nuclear war. These developments set the stage for U.S. progress towards developing a survivable and enduring C^3 system capable of withstanding the rigors of a protracted nuclear conflict.

B. U.S. STRATEGIC C^3 ORGANIZATION

The U.S. command structure is comprised of several organizations which serve as the focal point for decisionmaking in the event of a nuclear conflict. At the NCA level, there are actually two chains of succession. Presidential succession is provided for in the Constitution and is in accordance with public law (Title 3, U.S. Code, Section 19). The order of ranking is by order of creation of each department:

1. President

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[19]Richard Halloran, "Pentagon Draws Up First Strategy For Fighting a Long Nuclear War," New York Times, 30 May 1982, p. 1, 3, 4.

2. Vice President
3. Speaker of the House
4. President Pro Tempore of the Senate
5. Secretary of State
6. Secretary of the Treasury
7. Secretary of Defense
8. Attorney General
9. Secretary of the Interior
10. Secretary of Agriculture
11. Secretary of Commerce
12. Secretary of Labor
13. Secretary of Health and Human Services
14. Secretary of Housing and Urban Development
15. Secretary of Transportation
16. Secretary of Energy
17. Secretary of Education[20]

The Secretary of Defense or his successor has the authority to order retaliation in the event the President or his successor could not be located:

1. Secretary of Defense
2. Secretary of the Army
3. Secretary of the Navy
4. Secretary of the Air Force

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[20] Congress, House of Representatives, Committee on Government Operations, Our Nation's Nuclear Warning System: Will It Work If We Need It?: Hearing before the Committee on Government Operations. 99th Cong., 1st sess., 26 September 1985, p. 111-112.

5. Undersecretary of Defense for Policy

6. Undersecretary of Defense of Research and Engineering

7. Eight Assistant Secretaries of Defense and the General Counsel to DoD

8. Undersecretaries of the Army, Navy, and Air Force

9. Ten Assistant Secretaries of the Army, Navy, and Air Force[21]

To carry out the assigned missions, the NCA relies on the Unified and Specified Commanders who have direct access to the nation's nuclear stockpile. These commanders consist of the Commander in Chief Strategic Air Command (CINCSAC), Commander in Chief Pacific Command (CINCPAC), Commander in Chief Atlantic Command (CINCLANT), and U.S. Commander in Chief European Command (USCINCEUR). These commands were established by the President under section 124, title 10, United States Code, and given responsibility for the nuclear combatant forces of the United States, and assigned distinctive military missions.[22] In addition, there are other organizations in which the U.S. has a participating nuclear force role. These are Commander in Chief Channel Command (CINCHAN), Supreme Allied Commander Europe (SACEUR),

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[21]Barry R. Schneider, "Invitation to a Nuclear Beheading," <u>The Nuclear Reader: Strategy, Weapons, War</u>. eds. Charles W. Kegley, Jr. and Eugene R. Wittkopf (New York: St. Martin's Press, Inc., 1985), p. 280.

[22]Russell E. Dougherty, "The Psychological Climate of Nuclear Command," <u>Managing Nuclear Operations</u>, eds. Ashton B. Carter, John B. Steinbruner, and Charles A. Zraket (Washington, D.C.: The Brookings Institution, 1987), p. 409-410.

Commander in Chief Europe (CINCEUR), and Commander in Chief North American Aerospace Defense Command (CINCNORAD).

If a nuclear attack is detected, the NCA, in consonance with the commanders of the National Military Command Center (NMCC) located in the Pentagon, the Alternate National Military Command Center (ANMCC) located at Fort Ritchie, Maryland, SAC, and NORAD will convene a threat assessment conference to determine the validity of the attack and determine an option to be executed for the Single Integrated Operational Plan, called the SIOP. To carry out this difficult and time sensitive operation, the U.S. utilizes an integrated system of radars, communication systems, and satellite support systems. The SIOP will be addressed in detail in Chapter VI, and these facilities will be addressed in detail in Chapter IV.

Under the Specified and Unified Commanders, the nuclear forces form a triad comprised of bombers, intercontinental ballistic missiles (ICBM's), and submarine launched ballistic missiles (SLBM's). Current forces consist of 1000 ICBM's-950 Minuteman II and III and 50 Peacekeeper missiles, 28 Poseidon and eight Trident ballistic missile submarines, 167 B-52G, 96 B-52H, 61 FB-111 and 97 B-1B bombers.[23]

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[23]Department of Defense, United States Military Posture FY 89, Joint Chiefs of Staff (Washington, D.C.: U.S. Government Printing Office, 1988), p. 39.

C. SOVIET TROOP CONTROL AND STRATEGIC C^3 DEVELOPMENT

The Soviet Union has always endeavored to maintain a military structure with foundations that were easily understood and whose format was straightforward and explicit. Their current approach to strategic command and control has attempted to adhere to this standard. In the broad perspective, the Soviets have attempted to integrate the facets of political leadership, military power, technological capability, and rigorous procedures to define their approach to the task of controlling their nuclear weapon forces. They view their strategic C^3 systems as one of the keys to their victory in any protracted nuclear conflict with the West since it will enable them to reconstitute and carry on the fight. In this light, the Soviet command and control process is a powerful system that has been developed over many years incorporating the lessons of history.

With the experiences of World War II serving as a foundation of knowledge, the Soviet Union has attempted to maintain a cohesive and balanced approach to the problems of command and control. They have undergone several shifts in their approach to the use of nuclear weapons in conducting military policy. The first phase commenced in 1949 when the Soviet Union detonated their first nuclear weapon. Although they realized this new weapon had enormous power and potential, they did not foresee a viable military purpose behind its use. During this first phase, lasting from 1946 until 1953 and Stalin's death, the Soviets denegrated the significance of nuclear weapons.

With the ascendency of Nikita Khrushchev to power, the Soviet Union ushered in a second phase in nuclear weapons doctrine. From 1953-1956 the Soviets sought to rapidly expand their fledgling nuclear arsenal to a point where they could go nuclear as quickly and as broadly as possible.

In the third phase from 1957-1964, the Soviets based their defense posture on the foundation of nuclear weapons and especially on the hopes for the rapid deployment of strategic missiles. In 1959 the Soviets created the Strategic Rocket Forces (SRF). A "revolution in military affairs" was said to have occurred and commencing in 1965, the Soviet Union began a fourth phase by embracing a warfighting posture capable of supporting conventional and strategic forces in an all-out nuclear warfighting scenario.[24] This phase also adopted, for the first time, the possibility of fighting a protracted conflict in a nuclear environment. With this new Soviet doctrine, a requirement for survivable and enduring command and control systems allowing for continuing control of nuclear forces became a key factor in maintaining a warfighting capability.

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[24]Robbin F. Laird and Dale R. Herspring, The Soviet Union and Strategic Arms (Boulder: Westview Press, 1984), p. 9.

In the fifth and most current phase, the Soviet Union still postulates a conflict involving conventional and nuclear means. Realizing that an all-out nuclear exchange would leave the United States and the Soviet Union devastated, it has again invested in bolstering conventional forces while also modernizing their strategic nuclear force and the supporting command and control stucture.[25] As part of their modernization effort, they have placed considerable effort towards protecting the political and military leadership.

As the Soviet Union continues its nuclear force modernization efforts, it is also upgrading the supporting command and control architecture and systems to support the doctrine they espouse. The strong desire to maintain political control of the nuclear weapons command and control process still exists today. The latest policies reflect three significant aspects that should be considered when interpreting the latest doctrine:

1. the CPSU's preeminent role in the formulation of military doctrine is still emphasized

2. the Soviet have consistently made it clear that Soviet military doctrine is time limited and that nothing is immutable in military affairs, and

3. military doctrine in the Soviet perspective represents essentially a set of guidelines for force development. In the event of a war, military doctrine is expected

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[25]Laird and Herspring, <u>The Soviet Union and Strategic Arms</u>, p. 9.

> to recede, giving way to the dictates of military strategy.[26]

The current trend toward more integrated and combined force operations reflects this policy.

The critical nature of command and control has not been lost on the Soviet Union in its planning for nuclear war. In 1967 Marshall of the Soviet Union, V.D. Sokolovoskiy, wrote that in order to incapacitate the enemy, "a simultaneous rocket strike against the vital centers and means of armed combat of an enemy country is the quickest and most reliable way of achieving victory in modern war".[27] Destruction of the U.S. nuclear arsenal remains one of their top priorities. The target base for disruption of the enemy's capability for attack includes a myriad of important sites and installations. According to the previous commander of the Strategic Rocket Forces, Marshall M. Krylov, the principal targets of the SRF would be the enemy's delivery systems, weapons storage and fabrication sites, military installations, military industries, and center of politico-military adminstration, command and

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[26]Phillip A. Petersen and Notra Trulock III, "A 'New' Soviet Military Doctrine: Origins and Implications," Strategic Review (Summer 1988): p. 10-11.

[27]V.D. Sokolovskiy, Soviet Military Strategy, ed. Harriet Fast Scott (New York: Crane, Russak and Company, Inc., 1967), p. 276.

control.[28] In summary the essense of current Soviet concepts are outlined below:

1. Soviets appreciate scope of devastation in the event a nuclear war occurred.

2. Soviets seek to deter a nuclear war by two means:

   a. political--promote relaxation of tensions, and
   b. military--develop means of militarily defeating any adversary.

3. Should deterrence fail, Soviets will seek to limit damage to their homeland through a combination of four ways:

   a. attempted preemption
   b. offensive superiority
   c. strategic defense, and
   d. conventional counterstrikes.

4. Soviets place a high priority on limiting damage, and the ability to preempt places a high demand on C^3I systems.

D. SOVIET STRATEGIC C^2 ORGANIZATION

The critical nature of command and control has become so ingrained into the Soviet Union's policies and doctrine for a nuclear conflict that it now considers destruction of the United States' nuclear arsenal and its supporting command and control facilities among one of its top priorities. Utilizing an effective C^3I system, a preemptive attack would depend on effective coordination of Soviet strike

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[28]Marshall N. Krylov, <u>Nedeliia</u> (Week), no. 36 (September 1967), cited in William T. Lee, "Soviet Nuclear Targeting Strategy," in <u>Strategic Nuclear Targeting</u>, eds. Desmond Ball and Jeffrey Richelson (Ithaca: Cornell University Press, 1986), p. 86.

capabilities and accurate intelligence of enemy intentions.[29] According to Ball:

> Command-and-control systems are inherently relatively vulnerable, and concerted attacks on them would very rapidly destroy them, or at least render them inoperable. Despite the increased resources that the U.S. is currently devoting to improving the survivability and endurance of command-and-control systems, the extent of their relative vulnerability remains enormous. The Soviet Union would need to expend thousands of warheads in any comprehensive counterforce attacks against U.S. ICBM silo, bomber bases and FBM submarine facilities, and even then hundreds if not thousands of U.S. warheads would still survive. On the other hand, if would require only about 50-100 warheads to destroy the fixed facilities of the national command system or to effectively impair the communication links between the National Command Authorities and the strategic forces.[30]

The Soviet Union has a very extensive network of C^3I systems for its strategic nuclear forces. The principal components of this system are:

1. the Soviet national command authorities (NCA)
2. the network of early warning and attack assessment systems, and
3. the systems for communicating early warning and attack assessment intelligence to the Soviet NCA and for communicating attack commands from them to the strategic forces.[31]

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[29] Daniel J. Marcus, "Soviet Power Today," Signal 41, no. 4 (December 1986), p. 23.

[30] Desmond Ball, "Can Nuclear War Be Controlled?," Adelphi Papers Number One Hundred and Sixty-Nine (London: The International Institute for Strategic Studies, Autumn 1981), p. 19.

[31] Desmond Ball, "The Soviet Strategic C^3I System," C3I Handbook, 1st ed., ed. Defense Electronics (Palo Alto: EW Communications, Inc., 1986), p. 206.

To provide a focal point for this type of strategic decisionmaking, the Soviets are expected to implement the framework of a highly successful planning and execution organization utilized in World War II--the General Headquarters (Stavka) of the Supreme High Command, Verkhovnaye Glavnokomandovaniye or VGK. The Stavka is the highest leadership body for the armed forces in wartime. It is responsible for planning strategic operations, as well as nuclear operations, and overseeing the wartime development of the armed forces.[32]

The leadership of the Soviet Armed Forces is vested in the Politburo and the Defense Council. Under the Defense Council, direct control and administration of the daily activities of the armed forces is entrusted to the Ministry of Defense. Party control of the armed forces is assured by its decisionmaking power, its control over personnel appointments, and by the KGB's Third Chief Directorate.[33] Also, within the Ministry of Defense are the three first deputy defense ministers and the eleven deputy ministers.

Five of the eleven deputy ministers are Commanders in Chief (CINC's) of the five services - Strategic Rocket Forces, Ground Forces, Navy, Air Defense Forces, and Air

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[32]Department of Defense, Soviet Military Power: An Assessment of the Threat 1988 (Washington, D.C.: U.S. Government Printing Office, 1988), p. 16.

[33]Department of Defense, Soviet Military Power 1988, p. 13.

Force. The five service CINC's are responsible for peacetime force administration, management, and training. The remaining six deputy defense ministers oversee civil defense, rear services, the main inspectorate, construction and billeting, personnel, and armaments.[34]

Within the Ministry of Defense, the Soviet armed forces are controlled by the General Staff. This staff conducts peacetime and wartime force management and control. Under the General Staff are the sixteen Military Districts which comprise the highest military-administrative level of military units, training institutions, military establishments of the various Services, and local military registration disposed within a particular area.[35] These peacetime Military Districts do not turn into fronts in a conflict, but rather, the command and staff functions of a front are very likely to be already "embedded" in the headquarters of the Military Districts and the various Groups of Forces.[36]

Also subsumed within the General Staff's areas on control are the five Theaters of Military Operations

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[34]Department of Defense, Soviet Military Power 1988, p. 13.

[35]John Hemsley, Soviet Troop Control: The Role of Command Technology in the Soviet Military System (New York: Brassey's Publisher Limited, 1982), p. 254.

[36]John G. Hines and Phillip A Petersen, "Changing the Soviet System of Control," International Defense Review 9, no. 3. (March 1986): p. 287.

(TVD's). The TVD's are geographical entities in which a High Command of Forces (HCOF) is placed. They are the theaters in which the main strategic groupings of belligerent powers are deployed and operating, both as a result of an emerging international arrangement of forces and by virtue of prevailing economic, military, political, and geographic conditions. The main military-political and strategic goals in the armed conflict are attained in the main theater of military operations.[37]

There are currently five TVD's, four of which are permanent regional high commands (denoted by (*)):

1. Northwestern TVD (*)
2. Western TVD (*)
3. Southwestern TVD (*)
4. Southern TVD (*), and the
5. Far East TVD.[38]

In a time of crisis or conflict, the TVD commander will have responsibility for several fronts, and, using forces generated by the military districts under him, will direct their actions.[39] Figure 2-1 shows the Soviet wartime command and TVD structure.

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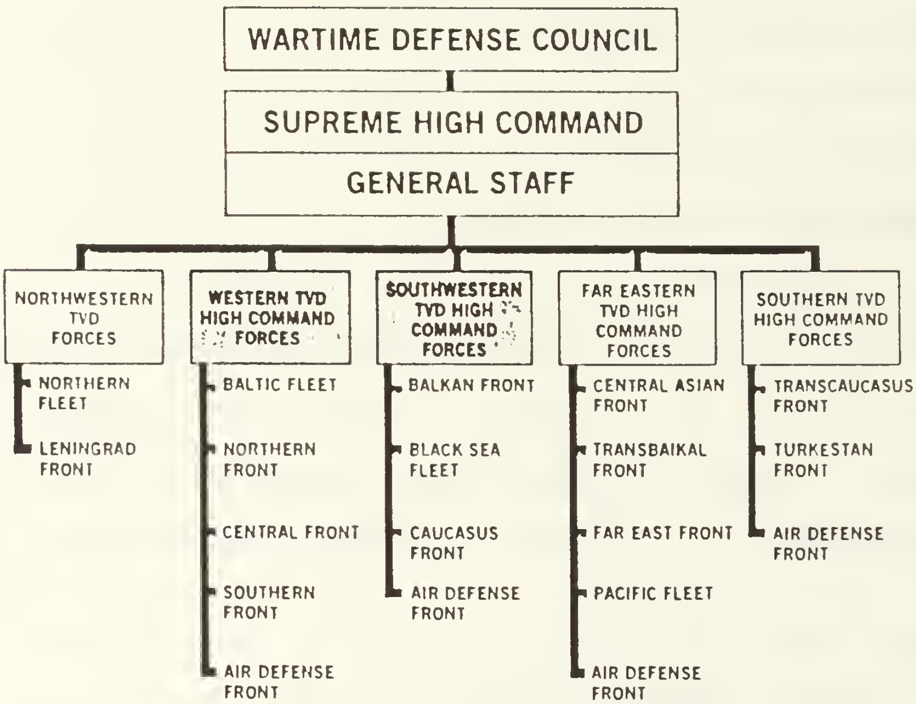
[37]Hemsley, Soviet Troop Control, p. 268.

[38]Department of Defense, Soviet Military Power 1988, p. 13-15.

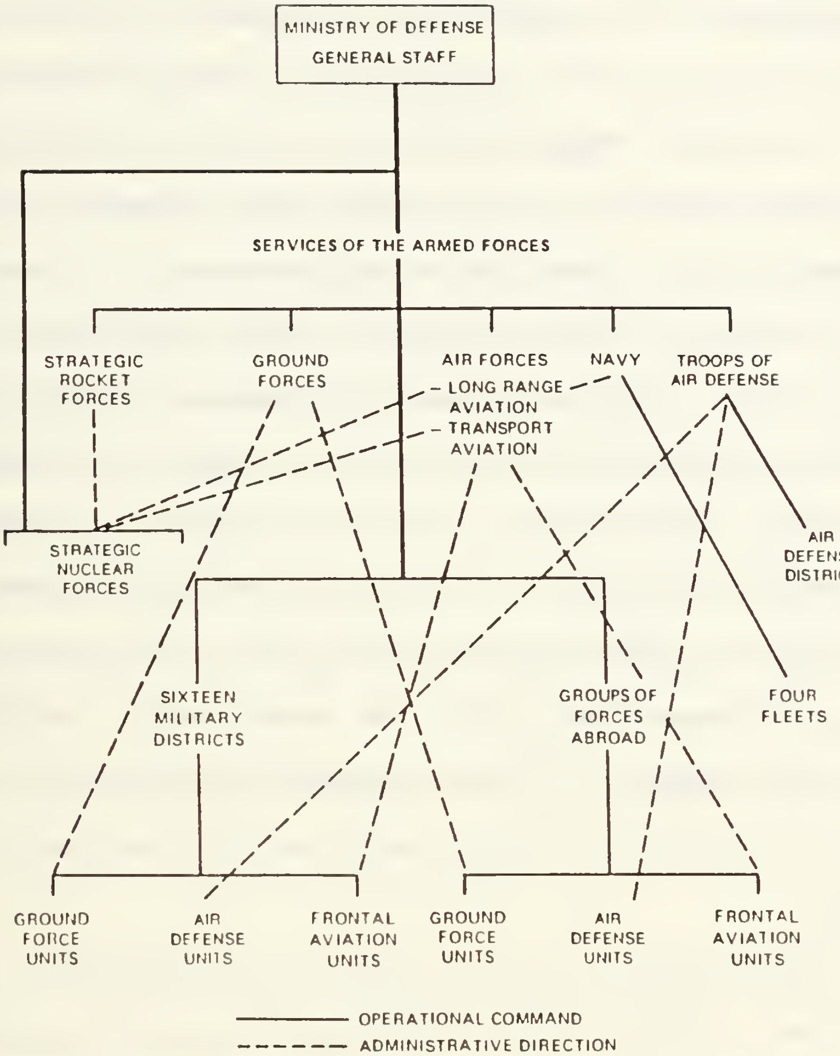
[39]Harriet Fast Scott and William F. Scott, The Soviet Control Structure: Capabilities for Wartime Survival (New York: National Strategy Information Center, Inc., 1983), p. 70.

This command organization, from the General Secretary down to the TVD commanders, is designed to provide the Soviets with the much required flexibility when fighting a nuclear war. The overriding priority to maintain political control of nuclear weapons and their release criteria are strictly maintained and the Soviet NCA has at its disposal the broad spectrum of information from which to support and decide on a course of action. Figure 2-2 provides a complete diagram of these organizations and their relation to each other.



The Soviet wartime coalitional command structure. Note: Shaded areas indicate those commands that include East European forces.

Figure 2-1. Soviet Wartime Command and TVD Structure



SOURCES. *SOVETSKOYE ADMINISTRATIVNOYE PRAVO* [SOVIET ADMINISTRATIVE LAW] (MOSCOW JURIDICAL LITERATURE, 1982), P 246. S S MAKSIMOV, *OSNOVY SOVETSKOGO VOYENNOGO ZAKONODATEL STVA* [THE FUNDAMENTALS OF SOVIET MILITARY LEGISLATION] (MOSCOW VOYENIZDAT, 1978), PP 52-55

Figure 2-2. Operational Structure of the Soviet Armed Forces

E. CONCLUSIONS

The United States and the Soviet Union have each established and developed a unique command and control system that fully integrates those political and military features required for effective nuclear weapons control. Both nations have strict guidelines to be followed in the event of a nuclear confrontation. The United States plans to follow well-established and publicized lines of authority and succession in the chains of command. There is a distinct dividing line between the political and military portions of the nuclear equation whereas in the Soviet Union, that dividing line is not so easily defined. The goals of the Soviet Union lie in its desire to eventually achieve world domination. The ties and supports between the military and political organizations is much closer than in the U.S. Consequently, in the event of a crisis that threatens the fabric of the Soviet Union, the military would most likely play a much more decisive and politically active role.

With both nations, the C^3 structure required to support the doctrines calling for a protracted nuclear exchange is challenging and has been approached in different ways. To a much greater extent than the United States, the Soviet Union has sought to integrate strategic offense and defense in its military strategy and have accordingly integrated the various strategic systems. To this end, the Soviets have invested heavily for many years in leadership and military survival facilities whereas the United States has only recently placed a heightened interest on those types of systems capable of supporting sustained nuclear operations. The specific systems for each nation will be addressed in Chapters III and IV.

The concern now facing the United States is the fact that the Soviets have commenced on a modernization program for their strategic forces, including the C^3I systems, to allow them to achieve an authoritative lead in integrated and automated systems.[40] Technologically, the United States will probably maintain superiority, but the Soviet Union has the rigorous command structure and control procedures in place and is working diligently to fill in the gaps where they are lacking. Both countries possess formidable command and control structures, but like any large system, their ability to adapt to the strains of a nuclear conflict remain to be seen.

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[40]Department of Defense, Soviet Military Power 1988, p. 8-17.

III. U.S. COMMAND AND CONTROL SYSTEMS

The Joint Chiefs of Staff Publication No. 1 provides the following definition of command and control:

> The exercise of authority and direction by a properly designated commander over assigned forces in the accomplishment of the mission. Command and control functions are performed through an arrangement of personnel, equipment, communications, facilities, and procedures employed by a commander in planning, directing, coordinating, and controlling forces and operations in the accomplishment of the mission.[41]

This statement is supposed to be the guiding principle for United States' command and control functions. To support this statement in a strategic sense, the United States has developed a vast network of warning and intelligence equipment and procedures. This system is designed to provide the NCA with the support required for control of military forces.

In this chapter, the functions of the components which comprise the strategic command and control system will be addressed. These systems include the World Wide Military Command Control System (WWMCCS), the warning and attack assessment systems, the command and control facilities, and the communications equipment in use. The end goal of the system is to support the NCA in the execution of the Single

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[41]Department of Defense, Dictionary of Military and Associated Terms, Joint Chiefs of Staff Publication 1 (Washington, D.C.: U.S. Government Printing Office, 1984), p. 76-77.

Integrated Operational Plan (SIOP). For execution of the SIOP as well as other time sensititve operations, the chain of command is from the NCA through the chairman of the Joint Chiefs to the commanders of the forces.[42]

A. C^3 SYSTEM OVERVIEW AND PROCEDURES

As previously mentioned, the NCA is comprised of the President and Secretary of Defense and their respective chains of succession. The National Military Command System (NMCS) provides the required connectivity between the NCA, Joint Chiefs, and the various CINC's. Before breaking WWMCCS into its components, the subject of predelegated authority and preplanned responses should be mentioned since they can perform a vital function in support of national strategy.

The planning for delegation of authority and the issuance of preplanned response options in the event of a nuclear conflict is essential to ensuring the survival of the United States. Through continuity of government and appropriate military actions the United States should be able to sustain a warfighting effort in a protracted war. The command and control structure currently supporting this

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[42]Department of Defense, Department of Defense Directive 5100.30, World-wide Military Command and Control System (WWMCCS) (Washington, D.C.: Department of Defense, December 2, 1971), p. 1-2, as cited in Albert E. Babbitt, "Command Centers," Managing Nuclear Operations, eds. Ashton B. Carter, John D. Steinbruner, Charles A. Zraket (Washington, D.C.: The Brookings Institution, 1987), p. 322-323.

doctrine is comprised of many facets, some of which are undergoing significant changes and upgrades as a result of PD 59 and NSDD 13 which called for strengthening C^3I facilities and hardware.

Although the Constitution clearly states that Congress is responsible for declaring war, the requirement in the nuclear age calling for predelegation of authority, from a president to a military commander, ordering the use of nuclear weapons, naturally raises some very sensitive Constitutional issues as well as concerns about how to effectively integrate a control mechanism for nuclear weapons into a democratic form of government.[43] Hopefully, the predelegation of basic authority to order the use of nuclear weapons facilitates the exercise of positive control in the event of NCA or NMCS incapacitation. This action will presumably weaken the enemy's motivation to attack the U.S. in the first place, thereby contributing to deterrence.[44]

In support of strategic nuclear missions and to aid in the direct Presidential control of nuclear weapons, the United States employs a C^3 system with three distinct areas of responsibility:

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[43]Paul Bracken, The Command and Control of Nuclear Forces (New Haven: Yale University Press, 1983), p. 200.

[44]Bruce G. Blair, Strategic Command and Control, Redefining the Nuclear Threat, (Washington, D.C.: The Brookings Institution, 1985), p. 113.

1. warning and intelligence assessment
2. command and control capability
3. communications systems

Together, these three areas combine to form the WWMCCS. Although WWMCCS took shape nearly 20 years ago, it has only recently begun to synthesize the piecemeal combination of systems that formed the basis of the United States' deterrent nuclear posture. Today, the systems that comprise WWMCCS and the WWMCCS Information system (WIS) are in an evolutionary maturation process as new technology is applied in an effort to meet the "survivable and endurable" requirement established for them.

B. WWMCCS/WIS

Created in 1971 by Department of Defense Directive 5100.30, today, WWMCCS is a combination of about 60 communications systems and 30 command centers dispersed worldwide. The system is designed to link key government and military decision makers with the nation's defense structure. It is the backbone of the NCA and strategic forces' connectivity. The system is capable of transmitting and receiving voice, data and video, and during a nuclear conflict, would provide the NCA with the required information and communications capability to allow proper execution of the SIOP.[45]

Because of the critical nature of the missions involved, the system has been designed to provide as much real time information as possible. Keeping pace with technology advances and with the demands placed on it, which have increased in both quantity and complexity, the creation of the WWMCCS Information System (WIS) came about to standardize the processing of data.[46]

The system of WWMCCS is intended to support four basic functional categories of higher echelon military command and control. These categories, or functional families, were defined by a concept of operations and general requirements for post-1985 as:

1. Nuclear planning and execution (NPE)
2. Threat warning and attack assessment (TW/AA)
3. Resource and unit monitoring (RUM), and
4. Conventional planning and execution (CPE)

Although all four categories comprise WWMCCS, improvements sought to the automated data component of WIS do not extend to the NPE and TW/AA categories.[47]

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[45]Defense Electronics, C3I Handbook, 1st ed., ed. Defense Electronics (Palo Alto: EW Communications, Inc., 1986), p. 122.

[46]Defense Electronics, C3I Handbook, 1st ed., p. 122.

[47]Defense Electronics, C3I Handbook, 2d ed., ed. Defense Electronics (Palo Alto: EW Communications, Inc., 1987), p. 56.

NPE is evolving along two significant programmatic lines. One is the automated data processing (ADP) portion, and the second is the engineering of what was called the minimum essential emergency communications network. The TW/AA portion is responsible for monitoring three types of strategic threats against the United States: missile attacks, attacks by atmospheric threats such as bombers and cruise missiles, and, lastly, threats against U.S. space assets such as communications and sensor satellites.[48]

Although still in an evolutionary process, WWMCCS is becoming a component of WIS. With the emphasis on joint service ventures being stressed, the system is being continually adapted to various needs. However, technological challenges such as multi-level security, data standardization, and the use of local area networks (LAN's) are hampering the integration of the process.[49] As the system becomes more streamlined, it will continue to provide the NCA and strategic forces with a viable command and control network capable of both peacetime, crisis, and wartime operations.

C. WARNING AND INTELLIGENCE ASSESSMENT

The main purpose of warning and intelligence assessment facilities and equipment is to provide a means of gauging

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[48]Defense Electronics, C3I Handbook, 2d ed., p. 56.

[49]Defense Electronics, C3I Handbook, 2d ed., p. 59.

and determining the validity of a nuclear strike against the United States. The system consists of dedicated and adapted satellites and a variety of radar facilities providing coverage over different areas and threats. The various systems are described below:

1. Satellite Systems

a. Satellite Early Warning System (SEWS)

The SEWS is designed to provide tactical warning of a ballistic missile attack by using infrared sensing of missile exhaust gases. It consists of three satellites positioned in a geosynchronous orbit over the Pacific, Atlantic, and Indian oceans. Coverage extends from 81° north and south and across 162° of longitude. Besides providing attack confirmation, these satellites can also provide critical information about the nature and size of the attack, allowing for an appropriate response.[50] Warning information is transmitted from the satellite to various ground stations which relay the information to SAC, NMCC, and NORAD for evaluation.[51] Figure 1 shows approximate satellite positions.[52]

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[50]Paul B. Stares, "Nuclear Operations and Antisatellites," Managing Nuclear Operations, p. 681-685.

[51]Bracken, Command and Control of Nuclear Forces, p. 36.

[52]Stares, "Nuclear Operations and Antisatellites," p. 685.

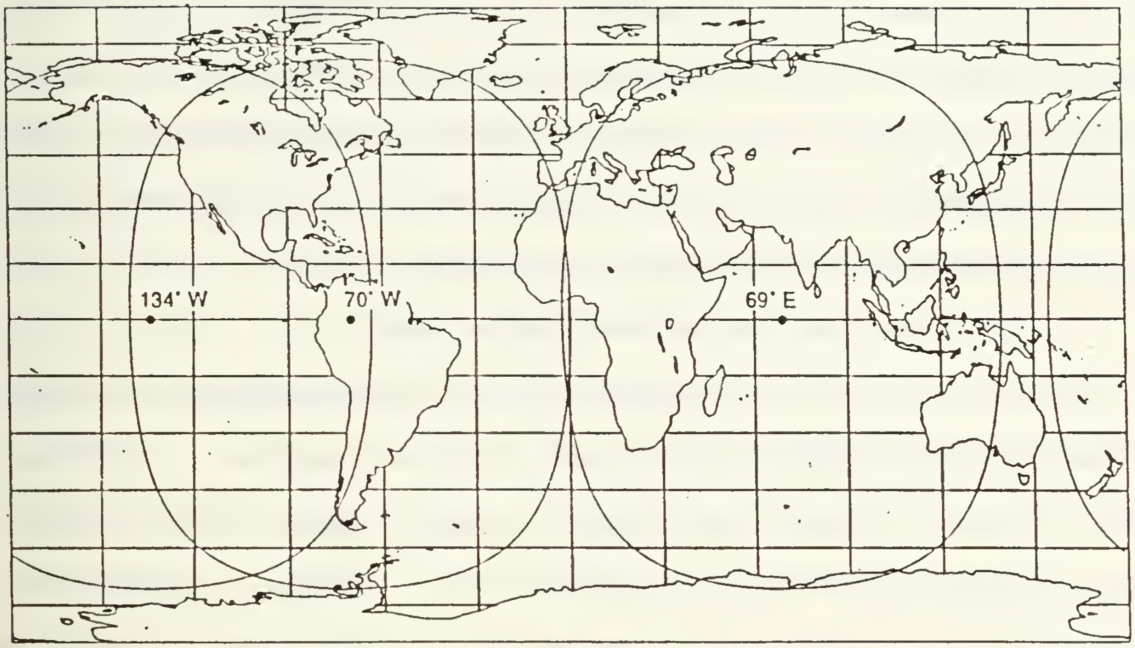

Figure 3-1. Approximate SEWS Earth Coverage[53]

b. Navigation Satellite Timing and Ranging (NAVSTAR)

NAVSTAR global positioning system (GPS) is a space-based radio navigation system designed to allow users to passively receive precise position, velocity, and time information anywhere on or above the earth's surface. It is accurate in distance to within 16 meters spherical error probable, velocity 0.10 meters per second, and time within 100 nanoseconds. It utilizes spread spectrum signals of 1575.2 MHz and 1227.6 MHz modulated onto a carrier frequency of 10.23 Mbps. System design has incorporated several

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[53]Anthony Kenden, "U.S. Military Satellites, 1983," Journal of the British Interplanetary Society 38, February 1985, p. 63.

survival mechanisms including 18 satellites in operation with three backup satellites in orbit, physical hardening against antisatellite weapons, sabotage or jamming attacks on the control facilities, and jamming or electromagnetic pulse disruption of the user equipment.[54]

c. Nuclear Detection System (NDS)

The NDS is deployed as a supplementary package onboard the NAVSTAR GPS system, NDS is designed to detect the flash, X-rays, and electromagnetic pulse from nuclear explosions anywhere in the world. Initial operational capability is anticipated to begin in 1991, and it will be capable of determining weapons yield and having an accuracy to within 100 meters. Data from NDS will be transmitted to all principal command centers, both fixed and airborne.[55] In the context of a protracted nuclear conflict, NDS will be the primary source of information capable of providing the NCA with postattack assessments and follow-on attack planning.[56]

d. Defense Meteorological Support Program (DMSP)

Consisting of two satellites in near-polar orbits, each one is capable of viewing the entire earth's

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[54]Defense Electronics, The C3I Handbook, 2d ed., p. 68-70.

[55]Stares, "Nuclear Operations and Antisatellites," p. 690.

[56]Congress, Senate, Committee on Armed Services, Department of Defense Authorization for Appropriation for Fiscal Year 1983: Hearing before the Committee on Armed Services, 97th Cong., 2d sess., 16 March 1982, p. 4624-4625.

surface in twelve hours. System is designed to provide meteorological data in support of military operations and utilized visual and infrared sensors to determine weather patterns and storm information. An infrared temperature and moisture sounder and a microwave temperature sounder is also used to allow forecasters to plot curves of atmospheric temperature and water vapor as a function of altitude. To determine the effect of the aurora on communications and radar systems operating in the northern latitudes, it is also equipped with a precipitating electron spectrometer. Current survivability enhancements include hardening against laser radiation and electromagnetic pulse.[57] Additionally, data provided by meteorological satellites has a direct application to missile targeting, since the accuracy of ballistic missiles is greatly affected by prevailing wind conditions and the moisture-content of clouds.[58]

e. Reconnaissance and Surveillance Satellites

These satellite systems provide a variety of critical information related to electronic intelligence (ELINT), communications intelligence (COMINT) signal

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[57]Defense Electronics, The C3I Handbook, 2d ed., p. 66-67.

[58]Desmond Ball, "Can Nuclear War Be Controlled," Adelphi Papers Number One Hundred and Sixty-Nine (London: The International Institute for Strategic Studies, Autumn 1981), p. 19.

intelligence (SIGINT), radar imaging intelligence, and photo-reconnaissance intelligence. Together these systems form the basis of our technical intelligence (TECHINT) resources.[59] These systems all combine to support three key roles in supporting national security: (1) provide information on foreign weapons, industrial productivity, agricultural output, and the status of forces related to their defense posture; (2) monitors the military forces and their readiness postures, thereby decreasing the possibility of a surprise attack and contributing to escalation control; and (3) provides data pertaining to verification of arms control agreements and the adherence to its provisions.[60] Stemming in part from the second role, the possibility exists for using these systems to provide post-attack damage assessment and status of the enemies reconstituted forces should they survive a nuclear conflict.

2. Radar Systems

a. North Warning System (NWS)

The NWS is an evolutionary system; it was originally started as the Pinetree Line then the Distance Early Warning (DEW) Line. Currently in the process of upgrades starting in 1986, the system will be completely

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[59]William E. Burrows, Deep Black: Space Espionage and National Security (New York: Random House, 1986), p. 17-24.

[60]Burrows, Deep Black, p. 1-7.

operational by 1992. The system is designed to have thirteen large attended radars interspersed with thirty-nine short-range unattended "gap fillers" across northern Alaska and Canada.[61] It provides SAC and NORAD with timely tactical warning of an impending Soviet air-breather attack. Survivability enhancements include massive use of solid-state electronics as well as sophisticated communications links and automated computerized control.[62] (Fig. 3-2)

b. Over The Horizon Backscatter (OTH-B)

The OTH-B radar system will become the principal ground based atmospheric surveillance sensor. It is designed to provide long range detection and early warning of manned bomber, air-to-surface missile and cruise missile attack against the continental United States. Operating at 5 to 28 MHz, it has 100 megawatts of radiated power. Beam-width is 7.5° and can be electronically "steered" to radiate desired areas of coverage. It operates by transmitting high frequency (HF) signals and bouncing them off the ionosphere. The system's receive antenna arrays pick up the re-refracted signal (backscatter) and through signal processing; the desired target echoes are separated from the clutter of land and sea returns and are displayed. Four areas of coverage

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[61]John C. Toomay, "Warning and Assessment Sensors," Managing Nuclear Operations, p. 292-293.

[62]Toomay, "Warning and Assessment Sensors," p. 293.

are planned in twelve sectors. The three east coast sectors are completed with the west coast, Alaskan, and gulf port sectors scheduled to be in operation in the late 1980's and early 1990's. Due to effects by aurora borealis interference, the system is ineffective toward the north, hence the requirement for the North Warning System. (Fig. 3-2)

Source: "USAF Hones Air Defense Capabilities," *Aviation Week and Space Technology*, vol. 120 (March 19, 1984), p. 85.

Figure 3-2. Planned Atmospheric Coverage of the United States and Canada, Showing Over The Horizon Backscatter (OTH-B) Coverage Sectors and North Warning System (NWS)

c. Ballistic Missile Early Warning System (BMEWS)

The BMEW system is designed to provide warning of an ICBM attack from the Soviet Union or China. Consisting of three sites with varying degrees of coverage, they are located at Clear, Alaska with 170° azimuthal coverage, Thule, Greenland with 200° coverage, and Fylingdales, England with 180° coverage. It is capable of detection ranges of 4000 km on a target of 0.1 m^2 radar cross section; however, resolution between a group of closely spaced weapons is poor, and they cannot differentiate between them. It is also not accurate enough to project target impact points or pinpoint launch locations in a useful manner. Future plans call for upgrading the facilites by replacing them with PAVE PAWS radars.[63] (Fig. 3-3)

d. Perimeter Acquisition Radar Attack Characterization System (PARCS)

The PARCS radar was originally part of the Safeguard Anti-Ballistic Missile (ABM) system, and is the only component of the system still in service. It is a large phased array radar whose purpose is to provide accurate assessment of inbound reentry vehicles to the ICBM fields in the central United States. PARCS is capable of providing a raid count, an impact profile, and a target class summary (number of weapons expected to land on cities,

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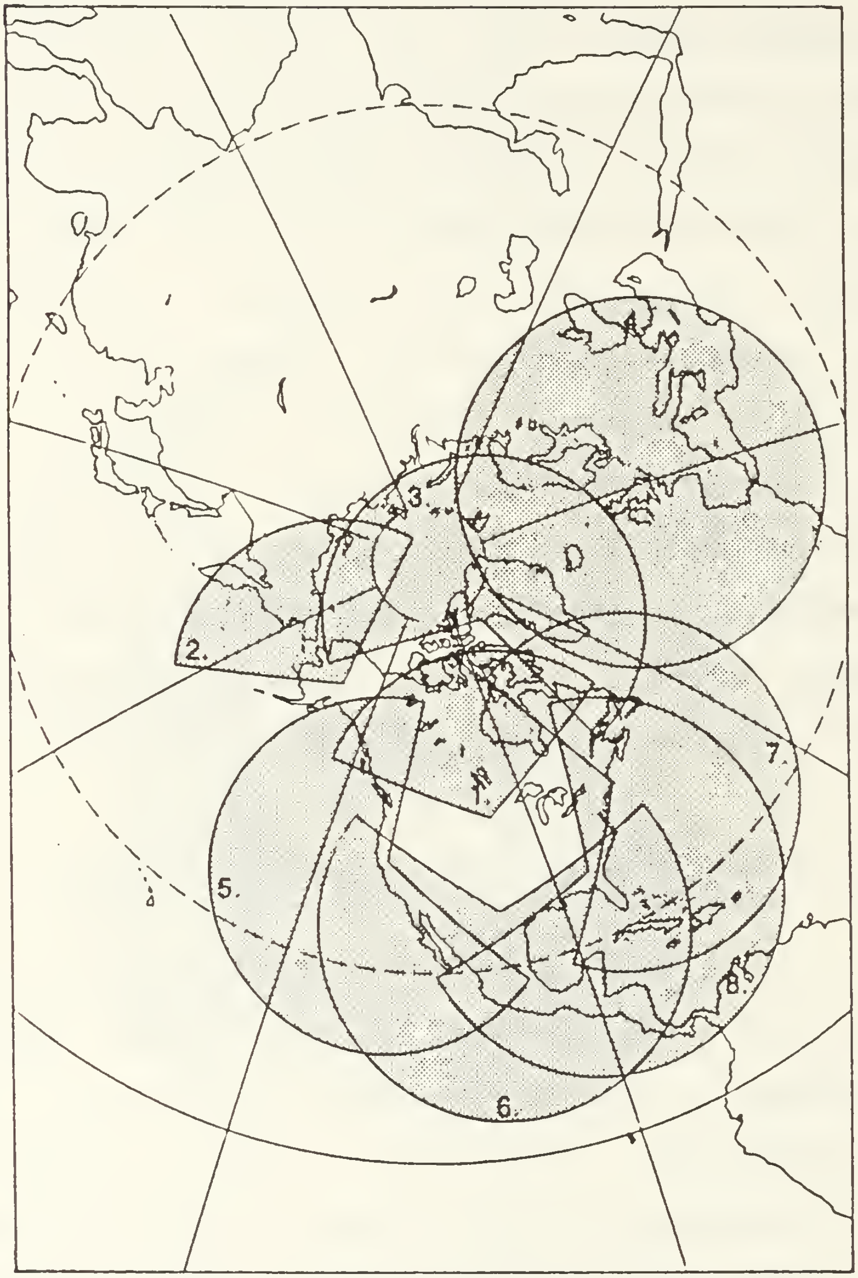
[63]Toomay, "Warning and Assessment Sensors," p. 293-296.

missile fields, bomber or tanker fields, command and control centers, and Washington, D.C.)[64] (Fig. 3-2)



a 1 PARCS; 2 BMEWS, Clear, Alaska, 3. BMEWS, Thule, Greenland, 4 BMEWS. Fylingdales. England; 5. PAVE PAWS. Beale AFB. California; 6. PAVE PAWS, Goodfellow AFB, Texas; 7. PAVE PAWS, Cape Cod AFS, Massachussetts; 8. PAVE PAWS Robins AFB, Georgia. Figure shows 1,000-km altitude detection contours.

Figure 3-3. Missile Warning Radar Coverage, 1990's

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[64]Aviation Week and Space Technology, "Improved U.S. Warning Net Spurred," Aviation Week and Space Technology 112, no. 25, June 23, 1980, p. 38, 44.

e. Perimeter Acquisition of Vehicle Entry Phased-Array Warning System (PAVE PAWS)

These facilities consist of four large phased array radar facilities located at Cape Cod Air Force Station in Massachusetts; Beale Air Force Base, California; Robins Air Force Base, Georgia; and Goodfellow Air Force Base, Texas.[65] They are designed to detect and track SLBM attacks. Upgrades in power and data processing capability are in progress to give them greater tracking capacity and the discrimination necessary for accurately counting MIRV's and predicting their impacts. They replaced the older FSS-7 and FPS-85 radars.[66] (Fig. 3-3)

f. Cobra Dane

Cobra Dane is a large ground-based radar on Shemya Island, Alaska. It became operational in 1977 for the purpose of monitoring Soviet tests of MIRV's. It can track dozens of targets simultaneously and provide information on the size and shape of reentry vehicles launched in the Soviet Pacific Ocean test range.[67]

D. COMMAND AND CONTROL CAPABILITY

In order to effectively conduct a nuclear exchange, especially a protracted conflict, the NCA must have the capability of receiving accurate and timely processed

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[65]Toomay, "Warning and Assessment Sensors," p. 306.

[66]Blair, Strategic Command and Control, p. 224.

[67]Bracken, Command and Control of Nuclear Forces, p. 37.

information, making a decision on a response, and issuing the necessary orders to have it carried out. The mechanism to support this requirement is based on a number of fixed and airborne command posts. Currently, the National Military Command System (NMCS) has three command centers: the National Military Command Center (NMCC), its alternate, and an airborne command post. Each is capable of executing SIOP options and maintaining direct connectivity with the JCS and the CINC's. Additionally, the individual CINC's have their own airborne command posts for maintaining a link to ensure direct control over assigned nuclear forces. The details of each facility are addressed below.

1. Fixed-Site Facilities

a. National Military Command Center (NMCC)

Located in the Pentagon, it is designed to provide the NCA with the capability to assemble the commanders of the NMCC, ANMCC, SAC, and NORAD together in the event of a nuclear conflict or national emergency. It has the facilities for intelligence activities, conferencing, logistics support, computers, programming support, and vital communications equipment. It also contains back-up primary power, consumables, and life-support equipment. It is a soft target since there has been no attempt to harden it.[68]

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[68]Babbitt, "Command Centers," p. 323, 336-337.

b. Alternate National Military Command Center (ANMCC)

The ANMCC is the back-up facility to the NMCC and is located underground at Ft. Ritchie, Maryland. The facility receives the same warning and intelligence data as NMCC. It can also effect a smooth transition of power to/from the NMCC and NEACP.[69] The facility was rated as "moderately hard" but recently downgraded due to increased Soviet ICBM and SLBM accuracy and yield.[70]

c. Strategic Air Command (SAC) Command Post

The SAC command post is located at SAC headquarters at Offut AFB, Nebraska. It is an underground facility that has recently undergone significant modernization upgrades to intelligence and warning inputs and communications equipment. Although located underground, it is not considered a hardened facility. It is designed to control the strategic bomber and ICBM forces.[71]

d. North American Aerospace Defense Command (NORAD)

Located in Cheyenne Mountain outside Colorado Springs, Colorado, it is a separate organization from SAC. It is operated in conjunction with the Canadian Defense Force (CDF) and is tied into the resources provided to NMCC,

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[69]Blair, Strategic Command and Control, p. 108-109.

[70]Blair, Strategic Command and Control, p. 108-109, 139.

[71]Bracken, Command and Control of Nuclear Forces, p. 186-188.

ANMCC, and SAC. It is a hardened facility but cannot withstand a dedicated attack.

e. CINCPAC, CINCLANT, CINCEUR Headquarters

These command centers are located in Honolulu, Hawaii, Norfolk, Virginia, and Stuttgart, Germany respectively. They are designed to control the nuclear forces within their theaters, including SSBN's. Facilities are above ground and are not hardened.[72]

f. Federal Emergency Management Agency (FEMA)

The FEMA is responsible for coodinating civil emergency preparedness for nuclear attack, planning to ensure continuity of government and coordinating mobilization of resources during national security emergencies.[73] To support these activities, FEMA maintains a national underground command center, the Alternate Emergency Information and Coordinating Center, and ten regional centers. At least six of these are underground.[74]

2. Mobile Sites

a. National Emergency Airborne Command Post (NEACP)

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[72]N.L. Flacco, "Command and Control Survivability: Has The Reagan Administration Given Up?," unpub. paper (Monterey: Naval Postgraduate School, 1987), p. 12.

[73]Federal Emergency Management Agency, <u>This Is The Federal Emergency Management Agency</u>, (Washington, D.C.: U.S. Government Printing Office, 1987), p. 2.

[74]Robert G. Leahy, <u>The Mechanisms of War Termination</u>, (Washington, D.C.: Institute for Foreign Policy Analysis, 1986) 23, as cited in Flacco, <u>Command and Control Survivability</u>, p. 12.

Now located at Grissom Air Force Base, Indiana, it is a modified Boeing 747, designated an E-4B, that has been EMP hardened from the design stage. It too has the same capabilities as the NMCC and ANMCC and can be scrambled and prestaged as necessary for the President and his staff in the event of a crisis. It is considered the most survivable of the command and control platforms and facilities. CINCPAC and CINCLANT have the same specially fitted aircraft available to them and can scramble them as required.[75] (Fig. 3-4)

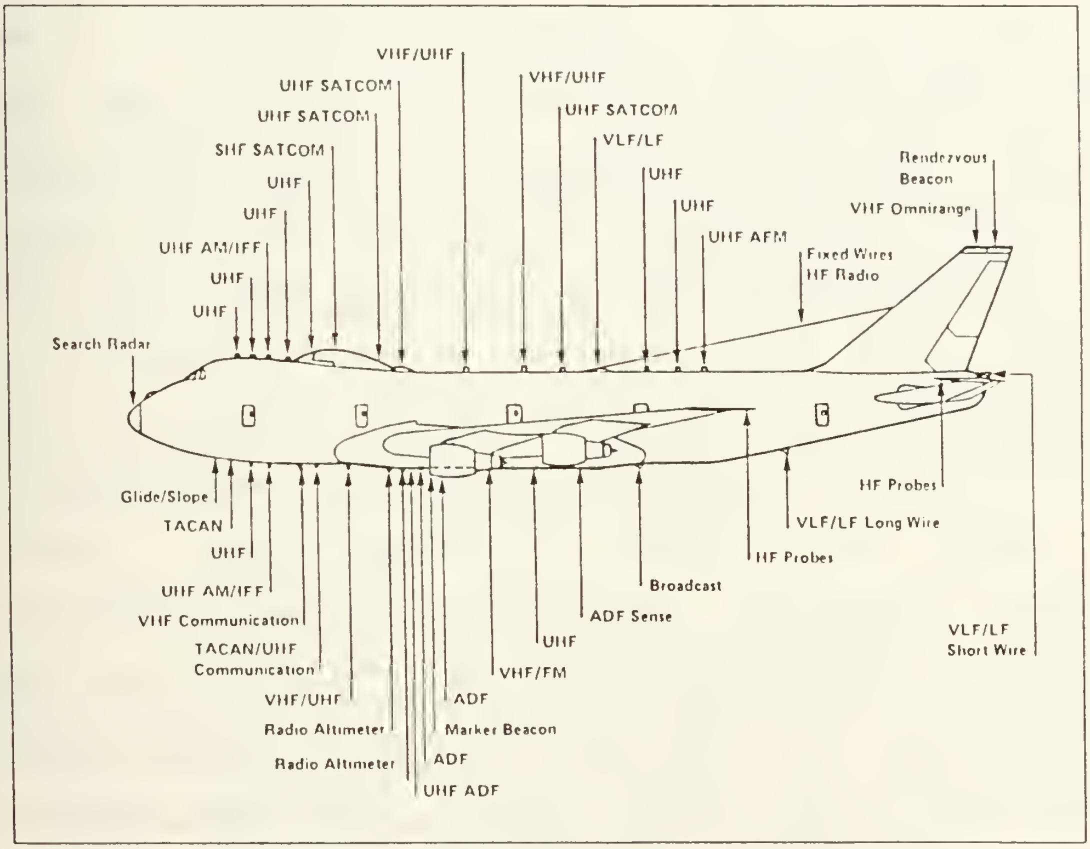

Figure 3-4. National Emergency Airborne Command Post

[75]Blair, Strategic Command and Control, p. 189.

b. Looking Glass

Looking Glass is a modified Boeing 707, designated an EC-135, that serves as the alternate command post for SAC. There has been aircraft airborne since the program's inception February 3, 1961. It is designed to carry out the same functions as SAC in a nuclear conflict.

E. COMMUNICATIONS SYSTEMS

Considered by many to be "the tie that binds", communications and data processing is a fundamental underpinning for effective command and control. Although C^3I has received great emphasis in recent years, it has been communications equipment and systems that have received the majority of emphasis and funding priorities. The special problems posed by the requirement of enduring and survivable communications has posed special technical problems that have required extensive rethinking of communications architecture and design, especially in the areas of physical hardening, EMP hardening, and the ability to operate in a damaged or degraded state. Despite budgetary constraints, communications upgrades to WWMCCS are expected to continue dependent on the availability of launch vehicles and the requirement to maintain communications capability at the present level. The three types of systems-ground based, air based, and satellites--currently in use and those expected to become operational within the next few years are addressed below:

1. Ground Based

a. Primary Alerting System (PAS)

PAS is a dedicated landline circuit, which has been upgraded with additional cable and microwaves. It serves as the primary means of strategic voice communications for SAC and runs from SAC to the numbered Air Force headquarters in the United States, the Minuteman and Peacekeeper Launch Control Centers (LCC's), wing command posts at primary SAC bomber bases, and other units at home and abroad.[76]

b. Scope Signal

Scope Signal is an HF communications system that replaces Giant Talk. It is tasked with providing connectivity between SAC headquarters and SAC's globally deployed forces. It consists of three stations within the U.S. and six overseas stations. The three stations within the U.S. will be capable of "seizing" all stations located worldwide within 30 seconds. EAM's can then be transmitted by the NCA to all SAC airborne forces.[77]

c. Green Pine

The Green Pine system is a group of forward area UHF ground radio stations located on an arc between Alaska's Aleutian Islands and Iceland. Its purpose is to communicate with bombers enroute to their targets.

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[76]Blair, Strategic Command and Control, p. 54-55, 103.

[77]Defense Electronics, C3I Handbook, 1st ed., p. 139.

d. Ground Wave Emergency Network (GWEN)

GWEN is a strategic communications system operating over the low frequency (LF) groundwave (150-175 KHz) band. E-4B and EC-135 aircraft will be equipped with GWEN terminals linking them with the system.[78] The system has completed initial operational testing and will become fully operational with a 56-node network by the end of 1989. There are 40 more nodes scheduled to be built to give remote SAC bases connectivity. The full system should be operational by 1993.[79] (Fig. 3-5)

e. Very Low Frequency (VLF) System

The VLF communications systems are used to communicate with U.S. submarine forces at sea. The range of this system is reputed to be about 10,000 km. The antenna sights are operated by the U.S. Navy and have been located throughout the U.S. and abroad. The submarine message broadcast system is sent utilizing this system. In order for submarines to copy it they must trail a long wire behind the submarine for good reception, and, although water penetration is possible, it is only for a few meters. VLF is somewhat difficult to operate it is considered excellent for operation in a nuclear environment due to its relative

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[78] Defense Electronics, C3I Handbook, 1st ed., p. 85.

[79] Department of Defense, Report of the Secretary of Defense to the Congress on the FY 1990/FY 1991 Biennial Budget and FY 1990-1994 Defense Programs (Washington, D.C.: U.S. Government Printing Office, 1989), p. 192.

immunity to nuclear bursts. It is also a very reliable system.[80]

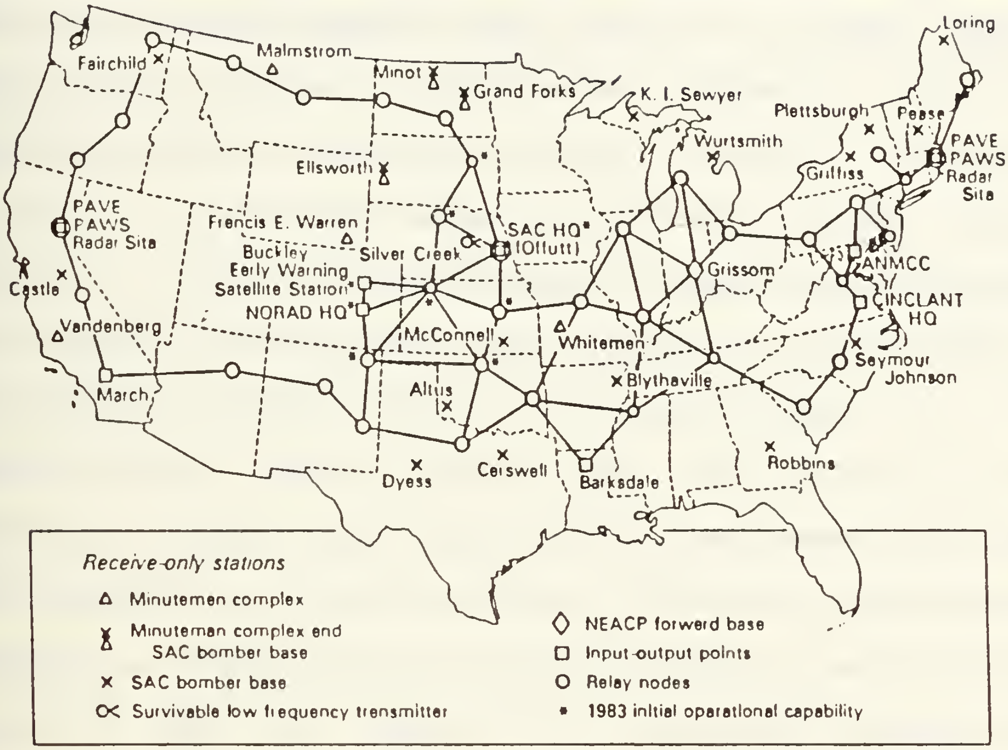

Figure 3-5. Ground Wave Emergency Network (GWEN) Thin-Line System

f. Extremely Low Frequency (ELF) System

The system originally planned, called Sanguine, was designed to transmit ELF signals to SSBN's at sea and had the additional benefit of being EMP and physically hardened to withstand a nuclear blast. As the system evolved, however, the hardening portion fell by the wayside, but the EMP hardening remained intact. The current system,

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[80]Ashton B. Carter, "Communications Technologies and Vulnerabilities, Managing Nuclear Operations, p. 236-239.

called Seafarer, is now operational. There are two sites located at Clam Lake, Wisconsin, and one on Michigan's Upper Peninsula near K.I. Sawyer AFB. Radiated power is two to eight watts, and the transmitters operate in electrical sychronism to increase signal strength. Although the data rate is slow, it serves as more than a "bell ringing" system and can transmit a considerable amount of information using Navy coding techniques and preformatted messages.[81]

g. Rapid Execution and Combat Targeting (REACT)

With the high alert rates and reliable supporting communications for the ICBM force, the REACT programs have recently been instituted to enhance the present system characteristics and upgrade the message-handling capabilities and computer systems of launch facilities. This will allow ICBM's to be retargeted rapidly in order to strike newly emergent targets.[82]

2. Airborne Systems

a. Emergency Rocket Communications System (ERCS)

These selected Minuteman silos are located at Whiteman AFB, Missiouri and house missiles equipped with a tape recorder and a UHF radio package instead of a warhead. It is designed to transmit an EAM with the launch authorization provided from the NCA. The system has the

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[81]Defense Electronics, C3I Handbook, 2d ed., p. 79-80.

[82]Department of Defense, Report of the Secretary of Defense on the FY 1990/FY 1991 Biennial Budget, p. 185.

capability to receive a launch order from Looking Glass or other LCC's, play it back to permit launch crews to check it for accuracy and completeness, and upon launch, broadcast the message during a flight along either a northwest or northeast trajectory.[83]

b. Post Attack Command and Control System (PACCS)

PACCS is an airborne strategic network designed to control bomber and ICBM forces in the event its underground command centers, alternate command, or ground-based communications are destroyed. PACCS includes Looking Glass, the East and West Auxiliary Command Posts, the three Airborne Launch Control Centers and the two Radio Relay aircraft. PACCS' mission unlike NEACP's, whose mission is to direct the full range of U.S. strategic forces, is to command and control SAC's nuclear assets and maintain connectivity between these forces.[84] (Fig. 3-6)

c. Take Charge And Move Out (TACAMO)

TACAMO is a Navy airborne radio relay system that serves as the survivable communications link between the NCA and SSBN's on alert at sea. The aircraft is a modified EC-130 that transmits very low frequency (VLF) signals via a six-mile-long trailing wire antenna. It uses spread spectrum technology and receives uplink messages from shore

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[83]Blair, Strategic Command and Control, p. 166.

[84]Defense Electronics, C3I Handbook, 1st ed., p. 117-118.

stations and the E-4B NEACP aircraft. It can also line with the AFSATCOM and FLTSATCOM systems as well as the ERCS. Upgrades in aircraft and equipment, with the introduction of the E-6A, commenced in 1988.[85]

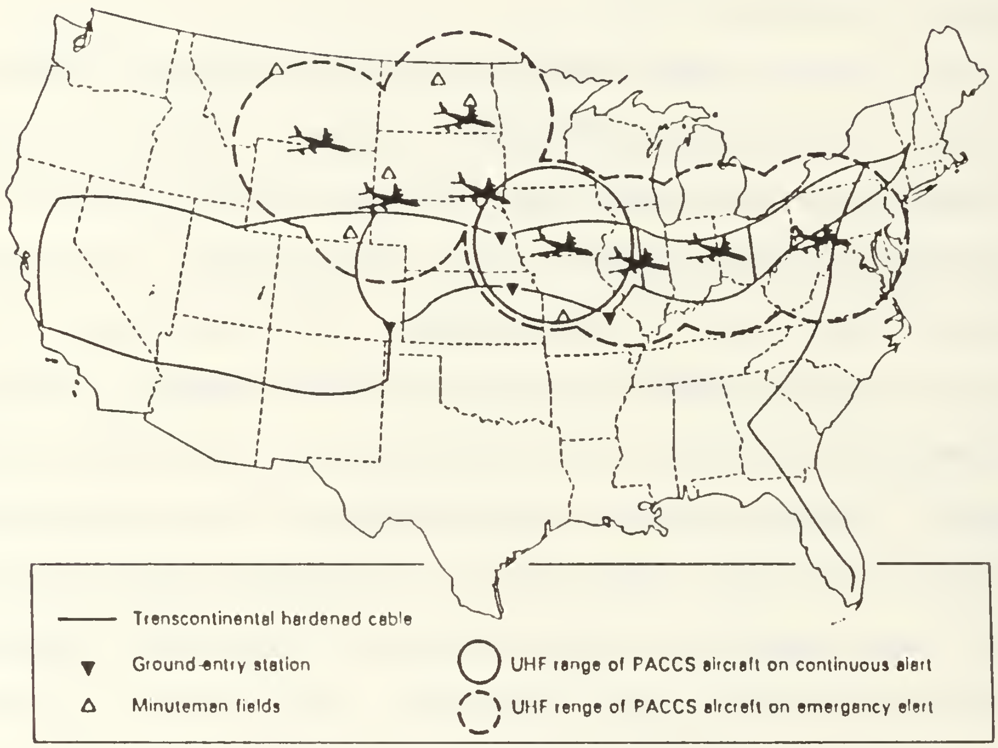

Figure 3-6. PACCS Airborne UHF Communications Network

d. Miniature Receive Terminal (MRT)

The system is a VLF/LF terminal which permits bombers to receive messages in flight at much greater distances that the UHF line-of-sight communications. Messages can be received from airborne command posts and it is much less susceptible to nuclear effects and jamming,

[85]Defense Electronics, C3I Handbook, 1st ed., p. 89-90.

making it a key control factor in issuing orders at the "fail-safe" point. It will reach initial operational capability on the B-1B bombers in 1991 and should be fully deployed on B-52H bombers by the mid-1990's.[86]

3. Satellites

a. Fleet Satellite Communications System (FLTSATCOM)

This satellite system provides UHF voice and data communications among U.S. naval aircraft, ships, submarines; strategic C^3 networks, and SAC forces. It operates on 23 channels in the 244-400 Mhz range with one 500 KHz wideband channel reserved for use by the NCA. It is scheduled to be replaced by MILSTAR in the 1990's.[87]

b. Defense Satellite Communications System (DSCS) III

The system is used to provide long-haul communications for worldwide military command and control, crisis management, intelligence dissemination and administrative services. It has 23 channels: 10 for Navy use, 12 for strategic capable forces and one wideband channel for use by the NCA. It is jam resistant and has a single channel transponder and two UHF antennas for use by

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[86]Department of Defense, Report of the Secretary of Defense on the FY 1990/FY 1991 Biennial Budget, p. 193.

[87]Defense Electronics, C3I Handbook, 1st ed., p. 71-71.

the AFSATCOM as a wartime backup C^3 system for strategic forces.[88]

c. Air Force Satellite Communications System (AFSATCOM)

The strategic portion of the FLTSATCOM is the AFSATSOM and is used for communications between nuclear missile command posts, strategic bombers, and other facilities harboring nuclear weapons. The system is fully operational with 550 terminals in use.[89]

d. Military Strategic and Tactical Relay System (MILSTAR)

A new generation satellite system to be fielded in the 1990's, it will utilize EHF communications, spread spectrum techniques, fast frequency hopping and the ability to operate autonomously for as long as six months without ground support. Physical as well as extensive EMP hardening are also built in. The planned configuration calls for eight geosychronous satellites, four in equatorial positions, four at higher and lower latitudes for polar coverage and one orbital spare.[90]

F. SUMMARY

As shown, the command and control system which makes up the United States' C^3I system is complicated and diverse.

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[88]Defense Electronics, C3I Handbook, 2d ed., p. 63-64.

[89]Defense Electronics, C3I Handbook, 1st ed., p. 171.

[90]Defense Electronics, C3I Handbook, 2d ed., p. 61-62.

No one area can stand alone and function without the support of the others. The challenges presented by operating a system like WWMCCS/WIS, capable of continuous peacetime operations and quickly adapting to the harsh standards demanded in a nuclear conflict are very demanding. Exhibiting the qualities inherent in any functional command and control system--flexibility, redundancy, reliability, accuracy, security, etc.--WWMCCS/WIS provides a tool through which the NCA can carry out required missions with strategic nuclear forces. Figure 3-7 shows a breakdown of the information flow within the United States' strategic forces.

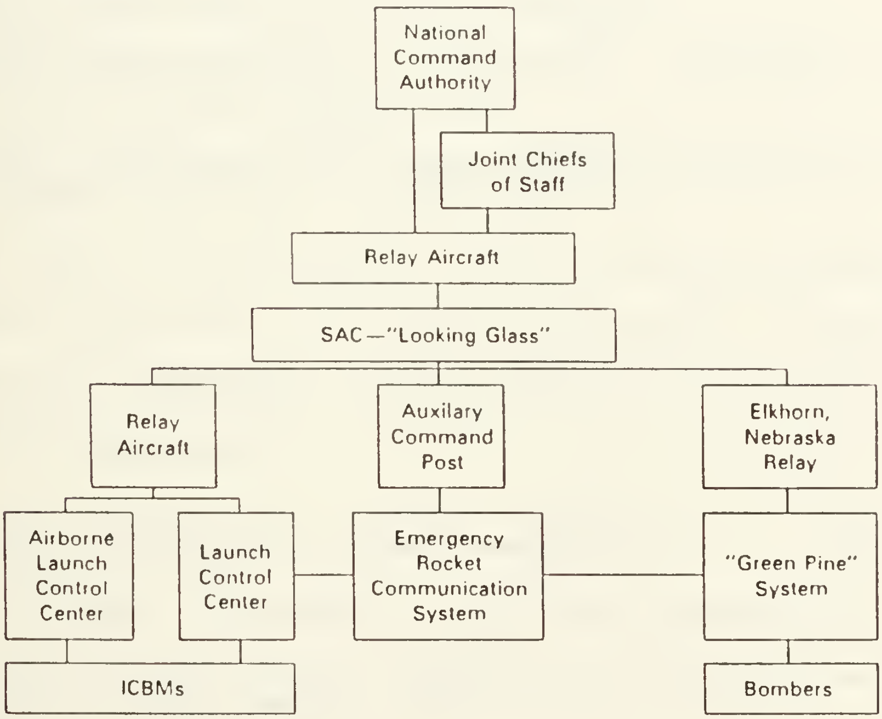

Figure 3-7. U.S. Command and Control Diagram for Control of Strategic Nuclear Forces

With the commencement of the Strategic Modernization Program under the Reagan administration, C^3I has received a top priority for system upgrades and enhancements. These improvements are designed to provide the United States with a responsive and integrated command and control structure capable of retaliating to a nuclear stike, reorganizing and reconstituting the remaining strategic forces and then continuing the fight in a protracted conflict if required.

IV. SOVIET COMMAND AND CONTROL

In discussing the concepts involved in Soviet command and control, it is apparent they are extremely concerned with the degree of control they exercise over their society and the military. This Soviet preoccupation pervades every aspect of Soviet society, most especially military affairs, in which the Soviets have perceived a major revolution to have occurred. This revolution, which came to fruition in the 1960's, is composed of three relatively independent phases:

1. the development of nuclear weapons
2. the development of long-range missiles to deliver these nuclear weapons, and
3. the development of comprehensive automation of the forces and means of waging war.[91]

In additions to these phases, Soviet military analysts have suggested four primary military-technological trends as also creating the conditions for the emerging "revolutionary turn in military affairs":

1. the accumulation, further development and qualitative modernization of nuclear weapons
2. the rapid development of military electronics
3. the significant qualitative modernization of conventional weapons, and

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[91]James G. Taylor, "Cybernetic Concepts and Troop Control," unpublished report (Monterey: Naval Postgraduate School, 1987), p. 15.

4. the development of weapons systems based on new physical principles.[92]

The Soviets postulate that the technologies involved in these trends could increase the controllability of both weapons systems and force operations.[93] In order to control its nuclear arsenal effectively, the Soviet Union has developed a comprehensive and integrated C^3I structure to support a sustained nuclear warfighting capability.

To better appreciate how the Soviets developed their C^3I system, it would help to know how it uses different terms to express its definition of strategic command and control. Soviet military writers use the expression "command, control, and communications" only when discussing Western forces. In discussing their own strategic requirements, they use the terms troop control (upravleniye voyskami) and strategic leadership (strategicheskoye rukovodstvo).[94] The definitions of troop control and strategic leadership are best summarized as follows:

1. Troop control is the constant control on the part of commanders and staffs of all phases of activity of subordinated troops directed toward fulfillment of assigned missions. The basic requirements of troop

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[92]Phillip A. Petersen and Notra Trulock III, "A 'New' Soviet Military Doctrine: Origins and Implications," Strategic Review 16, no. 3. (Summer 1988): p. 12.

[93]Petersen and Trulock, "A 'New' Soviet Military Doctrine: Origins and Implications," p. 12.

[94]Stephen M. Meyer, "Soviet Nuclear Operations," Managing Nuclear Operations, eds. Ashton B. Carter, John D. Steinbruner, and Charles A. Zraket (Washington, D.C.: The Brookings Institution, 1987), p. 474.

command are: continuity, firmness, flexibility, and quickness of reaction to changes in the situation.[95]

2. Strategic leadership is concerned with decisionmaking and political oversight by the highest political military authorities.[96]

By providing a rigid and distinct definition for the two aspects of command and control, it feels it has better defined the roles that members of the military and political chain of authority operate under, thereby providing a better forum for force employment and execution.

Although little information exists in hard facts about the Soviet approach to nuclear war, current military writings postulate three primary avenues from which a nuclear conflict could occur:

1. escalation to global war from peacetime

2. global nuclear war arising from an extended superpower confrontation or crisis, or

3. a nuclear escalation in the course of a major conventional war with the West.[97]

Soviet military specialists have also mentioned two other possible scenarios:

1. an accident that precipitates nuclear war, or

2. an escalation to nuclear war from a local war

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[95]John Hemsley, Soviet Troop Control: The Role of Command Technology in the Soviet Military System (New York: Brassey's Publishers Limited, 1982), p. 269.

[96]Meyer, "Soviet Nuclear Operations," p. 474.

[97]Meyer, "Soviet Nuclear Operations," p. 471.

The only other nuclear war contingency that might occur, and one which is not mentioned by the Soviets, is the possibility of a surprise first-strike by the Soviets intended to disarm the United States.[98]

Today, the Soviet Union has a very extensive network of C^3I systems for supporting its strategic nuclear forces. The principal components of this system are:

1. the Soviet national command authorities (NCA)
2. the network of early warning and attack assessment systems, and
3. the systems for communicating early warning and attack assessment intelligence to the Soviet NCA and for communicating attack commands from them to the strategic forces.[99]

Additionally, the Soviet Union has built an extensive network of command and control bunkers from which a war effort could be directed. This capability will be addressed further in Chapter VII.

A. WARNING AND ATTACK ASSESSMENT SYSTEMS

The Soviet Union maintains an extensive array of warning systems to provide them with both strategic warning of a nuclear attack as well as the tactical facilities to characterize and determine the extent of an attack underway. Currently, they rely on intelligence supplied

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[98]Meyer, "Soviet Nuclear Operations," p. 471.

[99]Desmond Ball, "The Soviet Strategic C^3I System," C3I Handbook, 1st ed., ed. Defense Electronics (Palo Alto: EW Communications, Inc., 1986), p. 206.

through SIGINT, COMINT, ELINT, and photoreconnaissance intelligence (PHOTINT) to provide strategic warning. Warning of an inbound attack is gleaned from various radars, including OTH-B and phased array, and satellite systems.

1. Satellite Systems

a. Infrared Detection

Similar in nature to the United States' DSP and NDS systems, these satellites comprise a ballistic missile launch detection network. The constellation in place now consists of infrared telescope-carrying satellites which are reportedly capable of providing about 30 minutes warning of a U.S. ICBM launch and of determining the general area from which the attack was launched.[100] This system has not achieved the success reported in the DSP program and, consequently, full time coverage of U.S. ICBM fields has not been achieved.[101] (Fig 4-1)

b. Radar Ocean Reconnaissance Satellite (RORSAT)

RORSAT is a radar imaging satellite designed to detect, locate and target enemy naval forces. They are part of the Soviet's strategic defensive system and comprise the first layer of the Soviet Ocean Surveillance System (SOSS)

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[100]Department of Defense, Soviet Military Power 1985, (Washington D.C.: U.S. Government Printing Office, 1985), p. 45.

[101]Ball, "The Soviet Strategic C^3I System," p. 210.

Also, they are nuclear powered which gives them a much extended service life.[102]

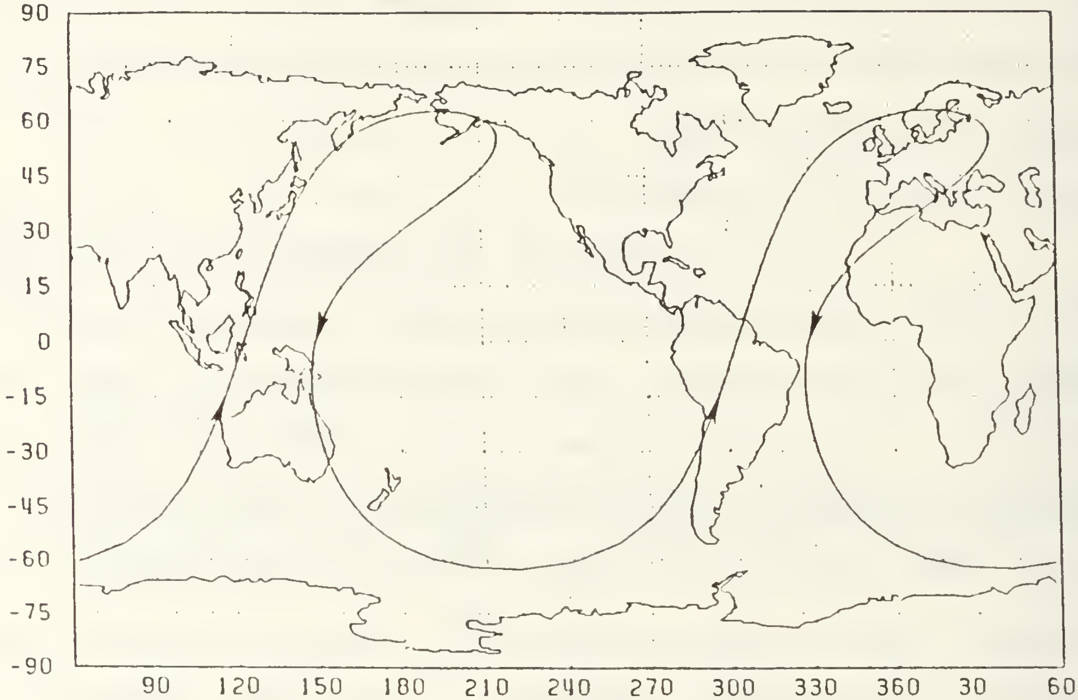

Figure 4-1. Estimated Ground Path for Soviet Early Warning Satellite

c. Electronic Intelligence Satellites (ELINT)

The ELINT satellites comprise a system of at least six satellites designed to operate in cooperation with the RORSAT satellite system. This is the second portion of the SOSS system and is called ELINT Ocean Reconnaissance Satellite (EORSAT). It provides worldwide coverage and monitors the electromagnetic spectrum from ELF to UHF. Due

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[102]Nicholas L. Johnson, "C^3 in Space: The Soviet Approach," Soviet C3, ed. Stephen J. Cimbala, (Washington, D.C.: AFCEA International Press, 1987), p. 347.

to their limited capabilities in EHF, this system is given little credibility to operate effectively in this region.[103] A new system began to be fielded in 1984, and by 1985 a more capable system was operational. The new system can effectively operate with only four satellites in orbit.[104]

d. GLONASS

GLONASS is a global navigation system similar in nature to the soon-to-be-deployed U.S. NAVSTAR GPS system. The system is capable of providing locating data for both strategic and tactical systems; however Soviet SSBN's would probably not rely on it too heavily since they would reportedly be "bastioned" close to the homeland in time of crisis or war and support could be provided by other means.[105]

e. Signals Intelligence (SIGINT)

Although a SIGINT system has been fielded, it reportedly lacks the sophistication of current U.S. systems. It requires a much larger number of operational satellites which are deployed in a configuration permitting accurate direction finding of the source of signal transmissions. The information provided by these systems comprise the bulk

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[103] Ball, "The Soviet Strategic C^3I System," p. 210.

[104] Johnson, "C^3 in Space: The Soviet Approach," p. 347-348.

[105] Stares, "Nuclear Operations and Antisatellites," p. 689.

of Soviet strategic warning of impending U.S. preparations for a nuclear strike.[106]

2. Radars

a. Over The Horizon Backscatter (OTH-B)

Code named "Steel Work", there are three radar sites operational--one near Nikolayevsk-na-Amure in the extreme eastern Soviet Union; one near Gomel, about 175 miles southeast of Minsk; and a third near Nikolayev in the Caucasus Mountains. The first two are positioned for detection of ICBM's launched from U.S. ICBM fields, and the last site is trained toward Chinese ICBM fields. As with U.S. OTH-B radars, these too are very powerful and work within the HF spectrum.[107] The radars can be used in either beam steering mode or wide-angle steering; and, given an azimuth of anticipated attack, they can provide SLBM detection as well.[108]

b. Hen House

The system currently consists of nine radar sites located on the periphery of the Soviet Union. They confirm an attack and provide missile tracking information.[109] There are six site locations: Sary Shagan;

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[106]Bracken, Command and Control of Nuclear Forces, p. 46-47.

[107]Ball, "The Soviet Strategic C^3I System," p. 210.

[108]Ball, "The Soviet Strategic C^3I System," p. 210.

[109]Department of Defense, Soviet Military Power 1988, p. 45.

Olenogorsk (on the Kola Peninsula); Skrudna, Latvia; Nikolayev, in the Caucasus Mountains; Angarsk (Mishelevka) near Irkutsk; and Kamchatka. They are similar in performance to the U.S. BMEW System with detection ranges in the vicinity of 6000 km.[110] These radars are designed as a secondary layer of radar confirmation to supplement satellite and OTH-B systems and provide data on the scale of an attack. They also provide target-tracking data in support of the Soviet anti-ballistic missile (ABM) program.[111] These radars will be replaced by the new phased array radars by the mid-1990's. (Figure 4-2)

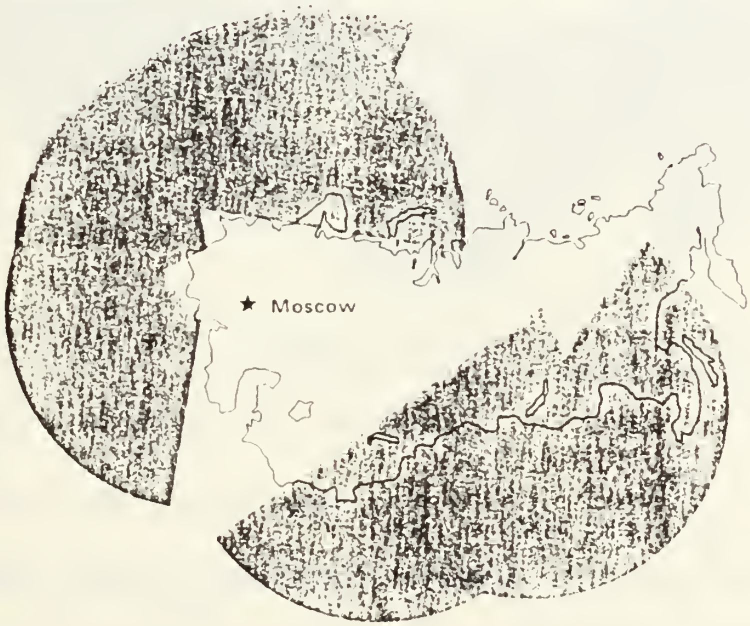

Figure 4-2. Hen House Radar System Coverage

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[110]Ball, "The Soviet Strategic C^3I System," p. 211.

[111]Department of Defense, Soviet Military Power 1985, p. 45.

c. Cat House and Dog House Large Phased Array Radars (LPARS)

These radars, located south of Moscow, are designed to provide intermediate range target-tracking information to supplement the ABM system deployed around Moscow.[112] The systems both operate in the VHF band around 100 MHz with a range of about 2800 km.[113] (Fig. 4-3)

d. Pill Box Large Phased Array Radars (LPARS)

This is a network of nine radars located around the Soviet Union designed to ascertain the general direction of an attack and provide up to 30 minutes warning. Each building has four radar faces, giving each facility 360° coverage. Although construction is not expected to be complete until the mid-1990's, the the ability to integrate target tracking and ABM intercepts gives them a true battle management capability.[114] Their locations have been tentatively identified: Pushkino, northeast of Moscow; Pechora; Lyaki, near the Caspian Sea; Olenogorsk, on the Kola Peninsula; Sary Shagan; Mishelevka,

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112 Department of Defense, <u>Soviet Military Power 1985</u>, p. 47-48.

113 Cecil Brownlow and Barry Miller, "The Growing Threat: Soviets Closing Gap in Avionics, Computer Science Military Development," <u>Aviation Week and Space Technology</u> 95, no. 14, 25 Oct 1971, p. 40-46.

114 Department of Defense, <u>Soviet Military Power 1988</u>, p. 44-45, 56-57.

near Irkutsk; Abalakova, north of Krasnoyarsk; and on the Kamchatka Peninsula.[115] (Fig. 4-3)

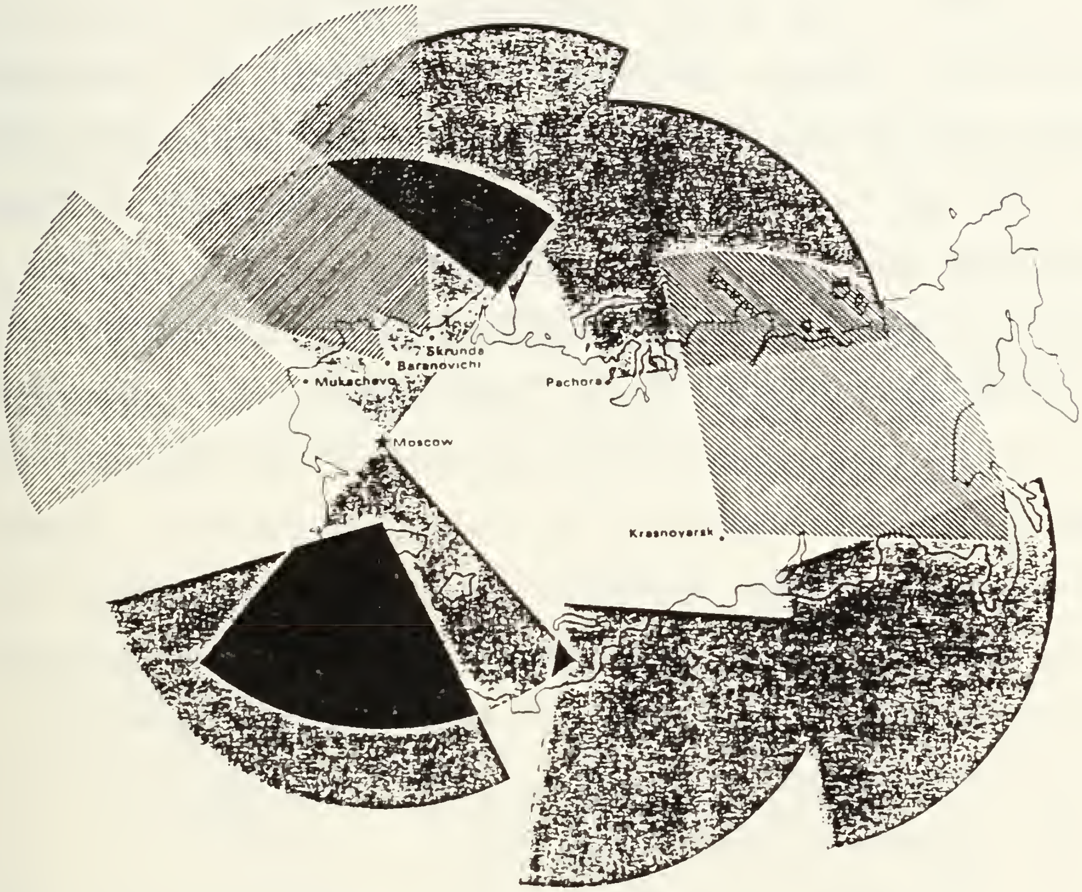

Figure 4-3. Coverage Sectors of Dog and Cat House Radars and Pill Box Large Phased Array Radars

C. STRATEGIC COMMUNICATIONS

The Soviets have typically relied heavily on their long haul HF communications capability. With the vast distances involved in maintaining connectivity across their country, the Soviets used to placed great emphasis on this form of

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[115]Ball, "The Soviet Strategic C^3I System," p. 211, and Department of Defense, Soviet Military Power 1988, p. 14-15.

communication. Recently, however, the Soviet Union has become very dependent on satellite communications. Starting in the 1970's, the Soviet Union began to field a variety of satellite systems designed to support a worldwide communications capability. This effort has continued today, and, of all satellites launched, communications-related satellites now account for the second largest portion of launches next to photoreconnaissance satellites[116].

Although little exact information is available concerning their land based communications network and operating characteristics, there are several sources concerning satellite communications. The Soviets rely on a three tier system of satellites located in low altitude, highly elliptical (Molniya), and geosynchronous orbits.

1. Satellites

a. Low Altitude

There are two sets of constellations, both serving near real-time needs of military forces across the Soviet Union. They are deployed in 74° inclination orbits to permit coverage across extreme northern and southern latitudes.[117]

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[116]Nicholas L. Johnson, Soviet Space Programs 1980-1985 66 (San Diego: Univelt, Inc., 1987), p. 56.

[117]Johnson, Soviet Space Programs 1980-1985, p. 56.

b. Highly Elliptical (Molniya)

Two constellations of these satellites serve Soviet communication requirements. Eight Molniya-1 satellites are flown in eight orbital planes spaced 45° apart with each satellite tracing the same ground path over the Earth every three hours. Four Molniya-3 satellites are in orbital planes spaced 90° apart to reduce tracking requirements.[118] Until recently, one of the Molniya-3 satellites served as the Soviet contribution in the Moscow-Washington "hot line".[119] (Fig. 4-4)

Figure 4-4. Coverage Area As Observed From A Satellite In A Molniya Orbit

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[118]Johnson, <u>Soviet Space Programs 1980-1985</u>, p. 58-59.

[119]Ball, "The Soviet Strategic C^3I System," p. 213.

c. Geosynchronous

This type of orbital pattern was not fully adopted by the Soviets until the late 1970's and early 1980's. This was due in part to the fact that although these satellites have very high orbits, their coverage cannot reach all parts of the Soviet Union at once--requiring additional satellites. Four systems currently exist: Raduga, which primarily provides domestic and international communications service in the 4-6 GHz range; Ekran, which provides television broadcast services to Siberia, the Far East, and Extreme North; Gorizont, which provides television service to the western portion of the Soviet Union and the Warsaw Pact countries; and the Kosmos system which provides for other missions including test and evaluation of new systems and equipment.[120] (Fig 4-5)

2. Land-Sea-and Air-Based Assets

The Soviet Union currently possesses an extensive network of HF and VHF radio, land-lines, and microwave communications links. These systems have been the mainstay of Soviet strategic communications for years. Although they have begun to rely upon satellites for their communication needs more than ever, these older systems are still relied on to provide connectivity in a protracted conflict.[121]

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[120]Johnson, Soviet Space Programs 1980-1985, p. 65-73, and Ball, "The Soviet Strategic C^3I System," p. 213.

[121]Ball, "The Soviet Strategic C^3I System," p. 212.

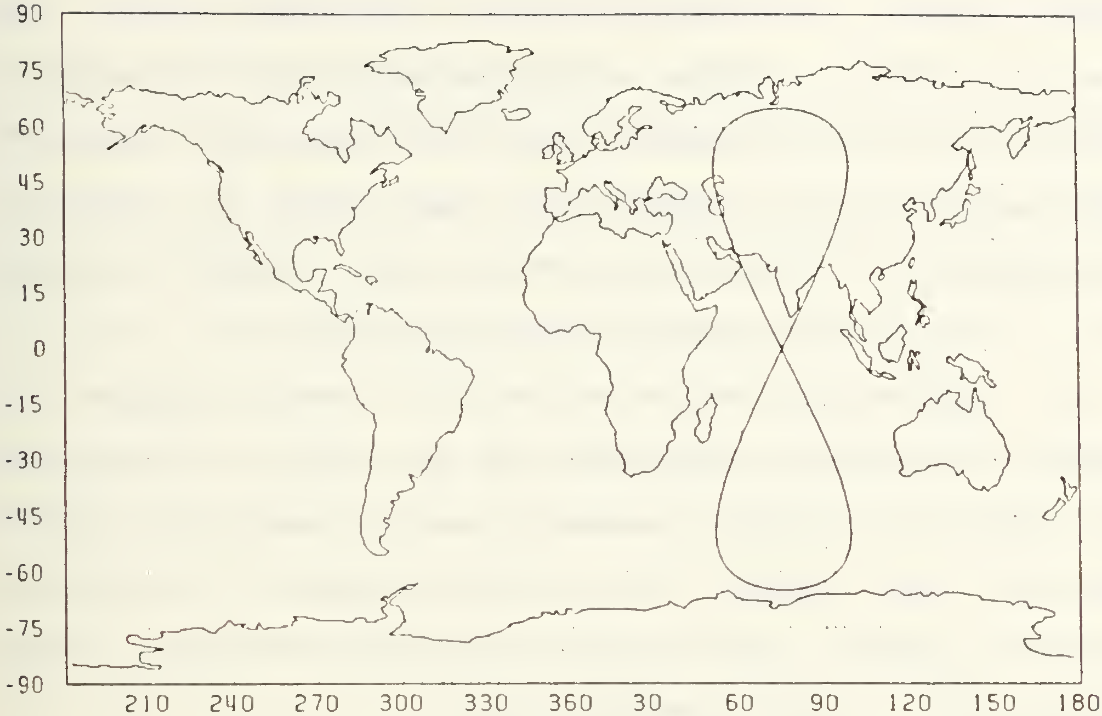

Figure 4-5. Ground Trace Path of a Geosychronous Satellite

The U.S. maintains four fixed command posts from which strategic decisions are synthesized and acted upon. The Soviet Union, on the other hand, has produced as many as 1500 of these types of facilities with special communications capabilities. It is estimated that more than 175,000 personnel can be sheltered and contribute to maintaining essential production and services during a nuclear war.[122]

To relay strategic orders, an extensive system of VLF radio stations would be used to communicate with the

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[122]Department of Defense, Soviet Military Power 1984, p. 40-41.

SSBN's at sea. Relying in part on underground cables, they have a certain degree of redundancy which provides a measure of connectivity once an exchange starts.[123] Additionally, the Soviet Union has begun to invest in development and construction of an ELF facility which will also be capable of communicating with SSBN's.[124]

Similar in nature to the U.S. Navy's TACAMO, the Soviet Union has recently deployed the Bear J aircraft with the capability of VLF communcations to SSBN's at sea.[125] However, the ability of the Soviet Union to field an airborne command post as sophisticated as the U.S. NEACP system has not been accomplished.[126]

D. CONCLUSIONS

Soviet command and control functions are very capable and are supported through a rigorously defined control structure that has excellent technical support. The amount of redundancy and system hardening that has been emphasized in their C^3I systems could provide them with the ability to

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[123]Robbin F. Laird and Dale R. Herspring, The Soviet Union and Strategic Arms (Boulder: Westview Press, 1984), p. 30.

[124]Department of Defense, Soviet Military Power 1988, p. 48.

[125]Department of Defense, Soviet Military Power 1988, p. 48.

[126]Congress, House of Representatives, Subcommittee of the Committee on Appropriations, Telecommunications, Command and Control Programs, 96th Cong., 1st sess., 24 April 1979, p. 143.

initiate and control a nuclear conflict. The Soviet space system, which includes satellites and their control systems, has been judged to be wartime survivable. In their drive to maintain strict political and military control over their nuclear weapons, they have succeeded in developing and fielding a robust command and control system.

In many areas, the Soviet C^3I systems are not as technically capable as U.S. systems, especially in early warning/attack assessment, airborne command post capability, and satellite systems; however, the Soviets more than make up for these deficiencies in duplication of systems and by providing extensive protection of facilities. One area of concern is that the Soviet Union has designed its space systems to be able to perform in a wartime environment. The Soviet Union is making great strides in resolving the technical issues involved in supporting the command and control architecture, but it still has a highly centralized military infrastructure that lacks the flexibility to delegate authority and expect independent action:

> This weakness of the Soviet C^3I system adds critical support to the doctrinal predilection of Soviet strategic planners to react to any actual or seemingly imminent U.S. nuclear attack, no matter how limited or supposedly controlled, with a massive response-especially since it is known that U.S. strategic nuclear targeting plans include a wide range of Soviet leadership and C^3I facilities.[127]

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[127]Desmond Ball, "Can Nuclear War Be Controlled?," Adelphi Papers Number One Hundred and Sixty-Nine (London: The International Institute for Strategic Studies, Autumn 1981), p. 26, 31-32.

It can be anticipated that in the 1990's the Soviet Union will continue to seek a more robust and survivable C^3I system.

V. TECHNICAL FACTORS AFFECTING C^3 IN A PROTRACTED NUCLEAR CONFLICT

In designing a C^3 system to support a protracted nuclear warfighting capability, one of the primary considerations to be addressed in the design stage should be how the effects of nuclear weapons will impinge on the system. The ability of the command and control structure to withstand a nuclear blast and its attendant effects will directly impact how the war will be fought and eventually its outcome. A C^3I system has many areas of vulnerability including susceptibility to blast and shock effects, thermal radiation, and electromagnetic pulse (EMP). Each of these effects will be addressed separately. The degree to which these factors contribute to damage sustained by structures, electronic equipment and personnel is dependent on the type of burst--subsurface, surface, high altitude, or underwater--and the yield of the weapon. Current U.S. and Soviet C^3 architecture designs now take these factors into consideration, and, consequently, robust and flexible systems are becoming more prevalent and operational.

During tests conducted after World War II until the Atmospheric Test Ban Treaty of 1962, it was demonstrated that the effects varied, based on the weapon height of burst and yield. The degree to which these effects can impinge on any C^3 system depend on the physical hardening the systems have undergone, the EMP protection built into the system, and the design of personnel protection systems.

A. BLAST AND SHOCK EFFECTS

In a low to moderate altitude or surface burst, several different phenomena occur. These include the formation of peak overpressure, the dynamic overpressure, the blast (or shock) wave, and the reflected blast wave. A large portion of the energy released by the explosion goes into the formation and propagation of a shock wave generated by the rapid expansion of heated gases in the immediate vicinity of the explosion. This rapidly expanding wall of air loses its energy to the atmosphere in the form of heat and slows down as it moves outward.[128] The maximum value of air pressurization is called the peak overpressure.

Most of the material damage caused by a nuclear weapon is due--directly or indirectly--to the shock wave. The distance to which this overpressure level will extend again depends primarily on the energy yield of the explosion and the height of burst.[129] As this shock wave travels away from the source of the explosion, the pressures in the front and behind it fall off in a regular manner. When the

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[128] Kosta Tsipis, Arsenal: Understanding Weapons in the Nuclear Age (New York: Simon and Schuster, 1983), p. 271.

[129] Samuel Glasstone and Philip J. Dolan, The Effects of Nuclear Weapons (Washington, D.C.: U.S. Government Printing Office, 1977), p. 80.

wave has traveled a certain distance from the fireball, the pressure behind the front drops below that of the surrounding atmosphere and a so-called "negative phase" of the blast wave forms. At the end of this negative phase the ambient atmospheric pressure is essentially back to normal. It is the combination of these two phenomena which causes the extensive damage observed in above-ground hardened or unhardened structures.

Another important quantity in the blast phenomena is the formation of dynamic pressure. This is the air pressure resulting from the mass air flow (or wind) behind the shock from a blast wave. It is equal to the product of half the density of the air through which the blast wave passes and the square of the particle velocity behind the shock front as it impinges on the object or structure.[130] The variation of overpressure and dynamic pressure with time at fixed location is shown in Figure 5-1.[131]

When an explosion occurs, an incident blast wave is formed which passes through the atmosphere and eventually reaches the earth's surface. When this wave strikes the earth, it is reflected back outward toward the incident wave. The four stages of the incident and reflected wave

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[130]Glasstone and Dolan, The Effects of Nuclear Weapons, p. 632.

[131]Glasstone and Dolan, The Effects of Nuclear Weapons, p. 84.

are shown in Figure 5-2.[132] In the region of the blast, two separate shocks will be felt, one from the incident blast wave and the other from the reflected wave. What occurs next is the formation of new wave front called the "Mach stem".

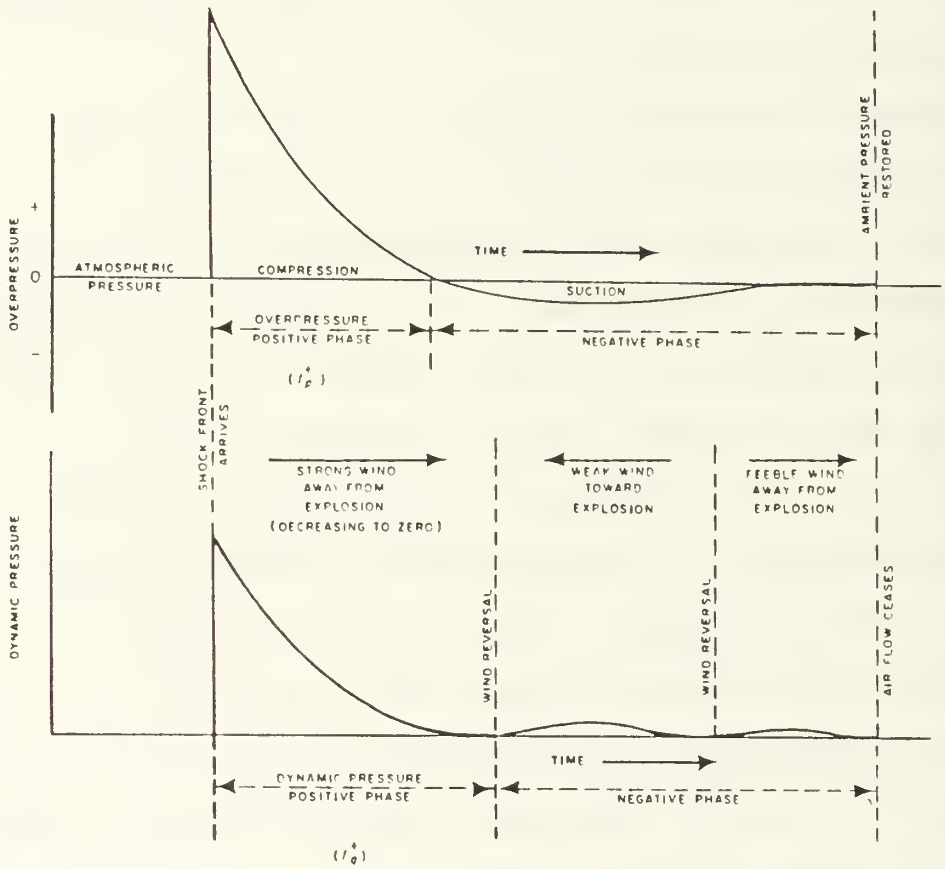

Figure 5-1. Diagram of Overpressure Variation and Dynamic Pressure Variation

[132]Glasstone and Dolan, The Effects of Nuclear Weapons, p. 87.

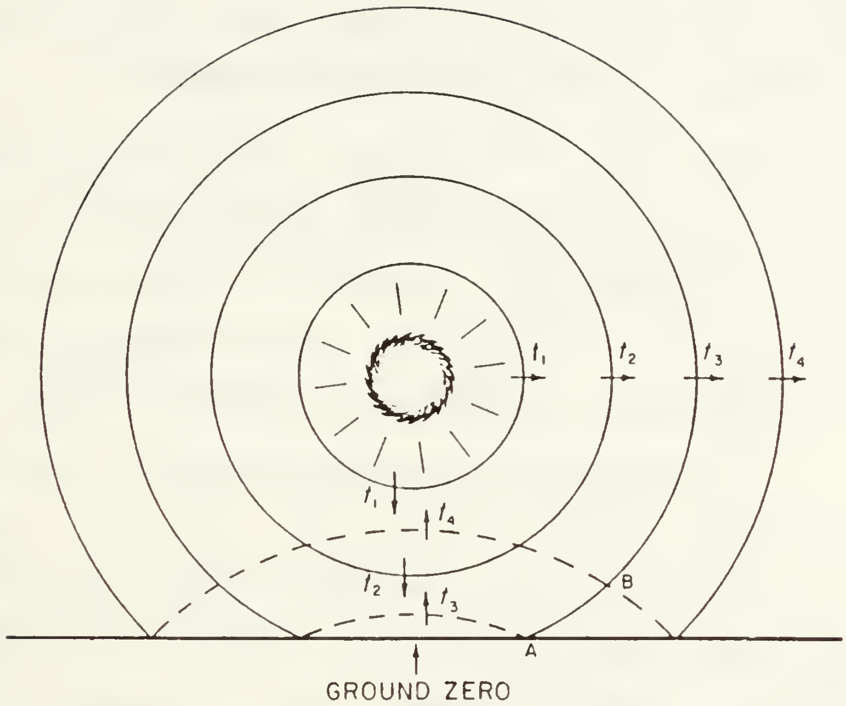

Figure 5-2. Four Stages Of The Incident And Reflected Wave

As the incident wave moves outward, the reflected wave is traveling through an atmosphere which has been heated and is highly compressed. Since sound travels better in this environment than in undisturbed air, the reflected wave travels faster than the incident wave, and at some point away from ground zero it will merge with it. This fusing of the two waves forms a front perpendicular to the ground known as the Mach stem.[133] As shown in Figure 5-3, the point at which the incident wave, reflected wave, and the Mach Stem all merge is called the "triple point" or

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[133]Tsipis, Arsenal, p. 274-276.

"Mach Y". The point continues to rise, and the height of the Mach stem increases, causing only one shock wave to be felt as the distance from the blast increases.[134]

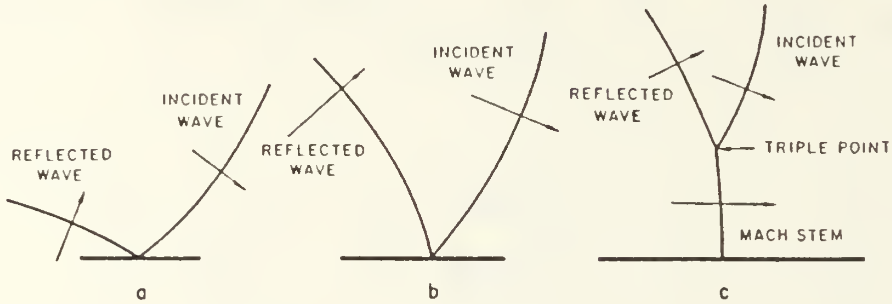

Figure 5-3. Triple Point Shock Wave or "Mach Y"

Utilizing changes in the height of burst and yield of the weapon, these phenomena can be varied to inflict the amount and type of damage desired for a particular target. As the height of burst for an explosion of given energy yeild is decreased, or as the energy yield for a given height of burst increases, two consequences follow:

1. Mach reflection commences nearer to ground zero.
2. The overpressure at the surface near ground zero becomes larger.

An actual contact surface burst leads to the highest possible overpressures near ground zero. Also, cratering and ground shock phenomena are observed; hence, physical damage to structures is greatest.[135]

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[134]Glasstone and Dolan, The Effects of Nuclear Weapons, p. 88-90.

[135]Glasstone and Dolan, The Effects of Nuclear Weapons, p. 90.

B. THERMAL RADIATION

After blast and shock, the second most devastating effect of a nuclear weapon is thermal radiation. In an atmospheric detonation, about half the energy released is emitted as X-rays which kinetically react with and heat up the surrounding air to create the fireball.[136] It is this pulse of thermal energy, traveling at the speed of light, whose effects on the surrounding environment depend on three properties of the source of radiation:

1. the intensity (how many thermal radiation photons leave it each second)

2. the temperature (how energetic each photon is), and

3. the length of time the radiation is emitted by the source.[137]

The main concern with thermal radiation is the creation of fires and subsequent firestorms which have the potential for extensive damage to unprotected facilities and equipment. Even if a communications facility did not sustain a direct hit, this effect could cause significant damage to unshielded wiring, cables, and support structures. Although the radiation attenuates at a rate roughly equivalent to one over the square of the distance ($1/D^2$), the atmospheric conditions directly contribute to its effect and the amount of damage it inflicts.

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[136] Glasstone and Dolan, The Effects of Nuclear Weapons, p. 276.

[137] Tsipis, Arsenal, p. 46.

When the pulse of thermal radiation reaches an object, part of it will be reflected, absorbed, or pass through the material. When radiation is absorbed by a material, it produces heat, which in turn determines the amount of damage it will sustain. The composition of the material also has a great deal to do with the amount of thermal radiation absorbed. Since only a small proportion of the heat generated by the pulse is dissipated by conduction in the short time the material is exposed to the radiation, the absorbed energy is largely confined to a shallow depth of the material. Consequently, very high surface temperatures are attained.[138]

In their book The Effects of Nuclear Weapons, Glasstone and Dolan point out a very interesting phenomenon:

> An important consideration in connection with charring and ignition of various materials and with the production of skin burns by thermal radiation is the rate at which the thermal radiation is delivered. For a given total amount of thermal energy received by each unit area of exposed material, the damage will be greater if the energy were delivered rapidly rather than slowly....
>
> There is evidence that for thermal radiation pulses of very short duration, such as might arise from air bursts of low-yield weapons or from explosions of large yield at high altitudes, this trend is reversed. In other words, a given amount of energy may be less effective if delivered in a very short pulse,...than in one of moderate duration...In some experiments in which certain materials were exposed to short pulses of thermal radiation, it was observed that the surfaces were rapidly degraded and vaporized. It appeared as if the surface had been "exploded" off the material,

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[138]Glasstone and Dolan, The Effects of Nuclear Weapons, p. 282-283.

> leaving the remainder with very little sign of damage. The thermal energy incident upon the material was apparently dissipated in the kinetic energy of the "exploding" surface molecules before the radiation could penetrate into the depth of the material.[139]

The importance of this phenomenon should be apparent in the application of exoatmospheric nuclear detonations and their long range effects on orbiting satellites. Also, the effect on exposed transmission and reception site equipment could prove critical in maintaining required communication and intelligence links to and from higher authority.

C. THE ELECTROMAGNETIC PULSE (EMP) PHENOMENON

At no time will the requirement for a robust and reliable communications system be more critical than during a crisis preceding a nuclear conflict and during the actual conduct of a nuclear strike. Until recently, one of the most important yet least understood phenomenon concerning a nuclear detonation was the effect of an electromagnetic pulse (EMP).

EMP is a time-varying electromagnetic radiation which increases very rapidly to a peak and then decays somewhat more slowly. It has a very broad spectrum of frequencies, ranging from very low to several hundred megahertz but mainly in the radiofrequency (long wavelength) region. It is this rapid increase in electromagnetic radiation and its attendant conversion into strong electric currents and high

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[139]Glasstone and Dolan, The Effects of Nuclear Weapons, p. 285-286.

voltages which causes the damage to electrical and electronic equipment.[140]

In a nuclear detonation about 0.3% of the energy released is carried by gamma rays that knock electrons from their orbits around atoms of the surrounding atmosphere. As these gamma rays move outward from the source of the explosion, they continue to strip away electrons and push them outward also. The larger, slower positively charged ions are left behind. This action creates the powerful current and voltage mentioned previously.[141]

In a surface burst, the gamma rays will be emitted into the ground and the atmosphere. Although quickly absorbed by the earth, it can serve as an alternate path for the electrons to return from the outer part of the deposition region toward the burst point where the positively charged ions, which have been left behind, predominate. The electric field produced is very strong but its power falls off rapidly with increasing distance from the deposition region. Thus, in a surface burst, the greatest potential hazard to electrical and electronic equipment from EMP will be greatest in and around the deposition region.[142] (Fig. 5-4)

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[140]Glasstone and Dolan, The Effects of Nuclear Weapons, p. 514-516.

[141]Tsipis, Arsenal, p. 58-59.

[142]Glasstone and Dolan, The Effects of Nuclear Weapons, p. 517-518.

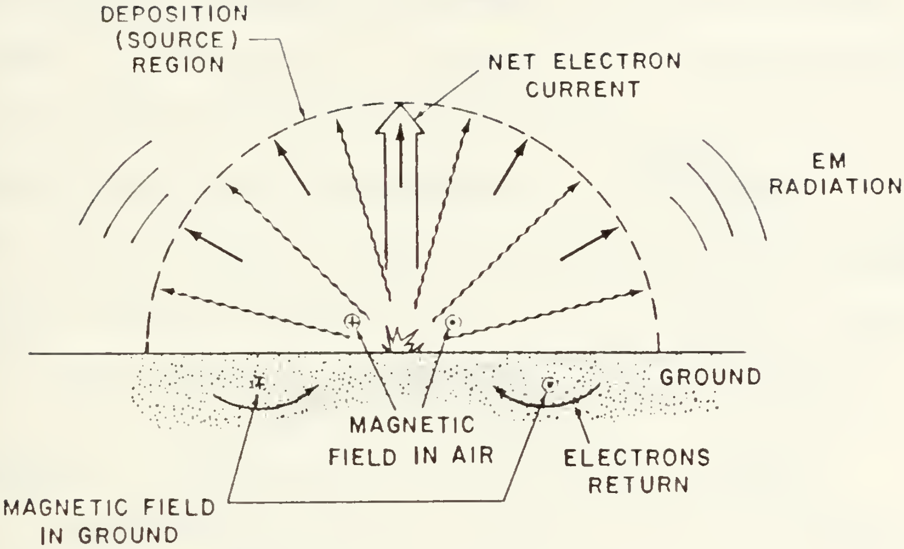

Figure 5-4. Surface Burst Deposition Region

In high altitude bursts, the potential is far greater for damage to electrical and electronic equipment. When the explosion occurs, the gamma rays will react with the atmosphere and strip a greater number of electrons from their atoms. These electrons create a deposition area that is pancake-shaped and may be up to fifty miles thick in the center, tapering toward the edge, with a mean altitude of twenty five to thirty miles.[143] Since there is little atmosphere to slow this expansion down, the deposition area expands over a great area. The EMP generated over this area is long range and persistent. Additionally, the field

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[143]Glasstone and Dolan, The Effects of Nuclear Weapons, p. 518.

strength remains fairly constant throughout the deposition area.[144] (Fig. 5-5)

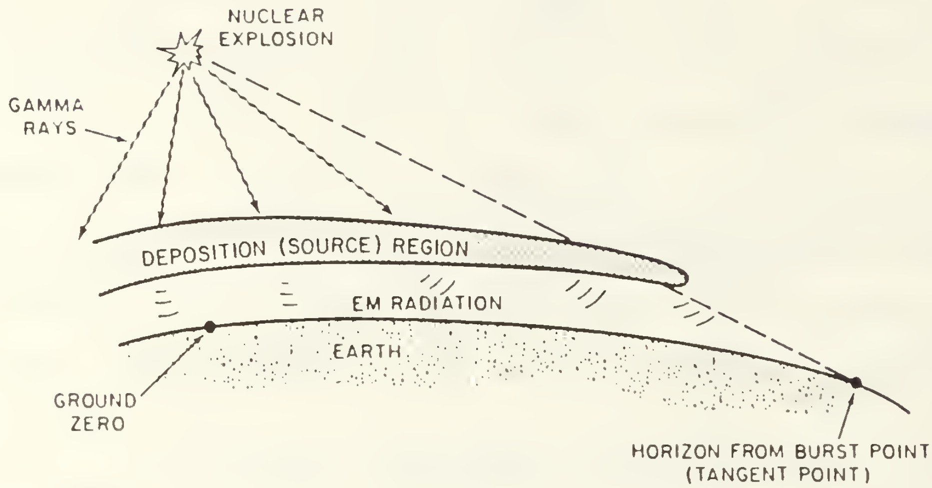

Figure 5-5. High Altitude Burst Deposition Region

It should be noted that the field strength observed at the surface from a high altitude burst is one-tenth to a hundredth of the field within the source region of a surface burst; the field is influenced by the earth's magnetic field. Also, the electric field strength varies by not more than a factor of two for explosions with yields of a few hundred kilotons or more.[145]

As indicated, the effects of EMP can be devastating on the full radio frequency range, as shown in Figure 5-6. The effect on communication systems can seriously impact the ability of the NCA to initiate, direct, and control nuclear

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[144]Tsipis, Arsenal, p. 60.

[145]Glasstone and Dolan, The Effects of Nuclear Weapons, p. 519.

forces before, during and after a nuclear strike. One of the keys to developing a robust and survivable command and control system for nuclear warfare will lie in the design of a system capable of withstanding the effects of a large EMP pulse. This rigorous and challenging design criteria is currently being employed in U.S. and Soviet systems for ground, air, and space-based C^3I systems.

D. SUMMARY

In order for the United States and the Soviet Union to successfully pursue their objectives during a protracted nuclear war, one of the critical options to consider is the degradation, disruption, or elimination of the command and control structure and its supporting elements necessary for control and execution of the war. One step that can be taken in this vein is to target the other's C^3 facilities.

This can be done in a myriad of ways, two of which include direct targeting--utilizing the effects of blast and shock and thermal radiation--and the use of EMP in a series of accurately placed and properly timed detonations. By capitalizing on the inherent effects of the weapons to be employed, a proper weapons to target match can be made that will achieve the desired goal. The subsequent loss of direct control over the nuclear forces may result in a hesitation or lack of a timely response allowing the other side to achieve a decisive military and political advantage through a decapitation strike followed by a dedicated strike on nuclear forces.

Frequency Band	Degradation Mechanism	Spatial Extent and Duration of Effects*	Comments
VLF	Phase changes, amplitude changes	Hundreds to thousands of miles; minutes to hours	Ground wave not affected, lowering of sky wave reflection height causes rapid phase change with slow recovery. Significant amplitude degradation of sky wave modes possible
LF	Absorption of sky waves, defocusing	Hundreds to thousands of miles; minutes to hours	Ground wave not affected, effects sensitive to relative geometry of burst and propagation path
MF	Absorption of sky waves, defocusing	Hundreds to thousands of miles; minutes to hours	Ground wave not affected
HF	Absorption of sky waves, loss of support for F-region reflection, multipath interference	Hundreds to thousands of miles, burst region and conjugate; minutes to hours	Daytime absorption larger than nighttime. F-region disturbances may result in new modes, multipath interference
VHF	Absorption, multipath interference, or false targets resulting from resolved multipath radar signals	Few miles to hundreds of miles; minutes to tens of minutes	Fireball and D-region absorption. FPIS circuits may experience attenuation or multipath interference
UHF	Absorption	Few miles to tens of miles; seconds to few minutes	Only important for line-of-sight propagation through highly ionized regions

*The magnitudes of spatial extent and duration are sensitive functions of detonation altitude and weapon yield.

Figure 5-6. EMP Effects On Radio Frequency Ranges

VI. U.S. AND SOVIET NUCLEAR WEAPON RELEASE PROCEDURES AND CRITERIA

In the United States and Soviet Union, particular attention and effort is given to the flow of information and commands for controlling the nuclear forces. This is especially true regarding the set of procedures and guidelines used for weapons readiness posture and weapons release. In both systems of command and control a strict heirarchy of command is followed, and numerous support systems are utilized. Both countries have redundant systems, each of which is designed to be capable of supporting the respective NCA's in decisionmaking.

Each has placed an increasing degree of emphasis on the survivability of the chain of command, political as well as military, and the systems used to provide intelligence and warning, and communications support. The Soviet Union has long emphasized the necessity of a surviving control structure in a nuclear environment, and the United States has recently begun to embrace this philosophy in earnest as well.

Previous chapters have covered the various U.S. and Soviet systems which support the strategic command and control architecture peculiar to fighting a nuclear conflict. This chapter will bring the procedures and systems into focus for their ability to support each country's desire to be capable of fighting a protracted nuclear conflict and prevailing at the termination of hostilities.

A. U.S. NUCLEAR WEAPONS RELEASE PROCEDURES

Utilizing the chain of succession in the Executive and Defense Departments, the NCA is the lead body responsible for making the decision to increase readiness or respond to a national threat. The United States has oriented its C^3I systems to deal with a nuclear confrontation with the Soviet Union which most likely will be a result of a crisis and not a surprise attack. Despite this, the United States continues to develop systems capable of sustaining a surprise attack with no strategic warning and minimal tactical warning and, while not maintaining a full capability to "ride out" a devastating strike, it could respond with all three legs of the triad destroying much of the Soviet Unions' nuclear forces, economic recovery base, and political-military control base.

Before considering the procedures used to execute the SIOP, it would be helpful to review the various groupings and options often attributed to it. The four principal groups are Soviet nuclear forces, general purposes forces, Soviet military and political leadership centers, and the

Soviet economic and industrial base.[146] The SIOP is reportedly further divided into four general categories of options available for the employment of nuclear weapons: Major Attack Options (MAO's), Selective Attack Options (SAO's), Limited Nuclear Options (LNO's), and Regional Nuclear Options (RNO's).[147]

For many years, the United States had adopted a "launch on impact" force posture in which it was assumed that weapons release criteria were not met until positive verification of Soviet weapons exploding on U.S. soil had been confirmed. The second status, referred to as "launch on warning" and reportedly adopted by the U.S. as part of the SIOP in the late 1970's, occurs when strategic and tactical warning of sufficient reliability indicates an attack is underway and launch orders are sent releasing the weapons.[148]

The United States currently relies on a system of tactical warning based on the principle of dual phenomenology. This procedure calls for NORAD to verify an

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[146]Congress, House of Representatives, Committee on Armed Services, Hearings on Military Posture and H.R. 1872: Hearing before the Subcommittee on the Department of Defense, 96th Cong., 1st sess., 14 February 1979, p. 186.

[147]Desmond Ball, "The Development of the SIOP, 1960-1983," Strategic Nuclear Targeting, eds. Desmond Ball and Jeffrey Richelson (Ithaca: Cornell University Press, 1986), p. 81.

[148]Bruce G. Blair, Strategic Command and Control, Redefining the Nuclear Threat (Washington, D.C.: The Brookings Institution, 1985), p. 235.

attack from at least two independent sources. It provides some degree of safety in ascertaining the reliability of an actual attack, giving the NCA critical information required to classify the attack, determine the scope, and select an appropriate response.

Once an indication of an attack is received by NORAD, SAC, and NMCC, a conference call is immediately established among these commands and the NCA to determine the validity of the data and select a course of action. If an attack is determined to be underway, an Emergency Action Message (EAM) is sent by the President. The EAM is a coded message which orders the execution of one or several options contained in the SIOP. The message should contain a minimum of four pieces of information:

1. a number or code letter indicating the strike option selected, taken from a menu specifying target class(es), selected from the SIOP

2. a date-time group indicating an "H-hour" for the strike

3. a code authenticating the message as having originated with an authorized commander, and

4. a code enabling the crew to carry launch sequence to completion[149]

This message is the vehicle used by the NCA and designated

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[149]Ashton B. Carter, "Communications Technologies and Vulnerabilities," Managing Nuclear Operations, eds. Ashton B. Carter, John D. Steinbruner, Charles A. Zraket (Washington, D.C.: The Brookings Institution, 1987), p. 223.

authorities to provide for positive weapon control and release.

Over a period of years, the United States has developed a very thorough system capable of providing the military and political leadership with the tools necessary for releasing nuclear weapons. One procedure is a system requiring two personnel, with adequate knowledge of the weapon system and the required training, to have access to the weapons. This "two-man rule" prevents only one person from having unauthorized access to a weapon or its components. The personnel involved in this type of work have undergone a screening through either the Air Force or Navy Personnel Reliability Program (PRP).[150]

A device called a Permissive Action Link (PAL) is another method used for control of nuclear weapons. This idea for exercising better control over nuclear weapons came about in the late 1950's. In 1962 President Kennedy signed National Security Action Memorandum (NSAM) 160 requiring PALS on most nuclear weapons.[151] Since then an elaborate set of procedures has been adopted in the launch control system of ICBM and SLBM strategic missiles. It has been speculated that the decision to install PALS on nuclear

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[150]Daniel Ford, The Button: The Pentagon's Strategic Command and Control System (New York: Simon and Schuster, 1985), p. 117.

[151]Donald R. Cotter, "Peacetime Operations," Managing Nuclear Operations, p. 49.

weapons did much to alleviate Soviet fears of an early first use of nuclear weapons instead of its intended and stated purpose of preventing unauthorized launches.[152]

The principle behind a PAL is relatively simple. When an EAM is received, the release code is entered into the weapons, giving them the capability to arm themselves when fired. PALS can have as few as four digits or as many as twelve. If a mistake is made while attempting to unlock a PAL, only a limited number of tries are permitted. The PAL is considered to be the "weak link" in the design of the weapon. Attempts to bypass the PAL or tamper with the weapon may cause the arming mechanism to become inoperative before any of the other components.[153] (Figure 6-1)

When a launch order is received by an ICBM Launch Control Center (LCC), the two officers on duty separately decode and authenticate the message to ensure its validity and accuracy. Once confirmed, the digits unlocking the PAL are inserted. Continuing the launch sequence involves each officer then inserting a launch key into a pair of widely separated keyholes. The keys must be turned simultaneously to initiate a launch sequence.[154]

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[152] Jeremy J. Stone, "Presidential First Use is Unlawful," First Use of Nuclear Weapons: Under the Constitution, Who Decides?, ed. Peter Raven-Hansen (Westport: Greenwood Press, 1987), p. 13-14.

[153] Ford, The Button, p. 117.

[154] Ford, The Button, p. 118.

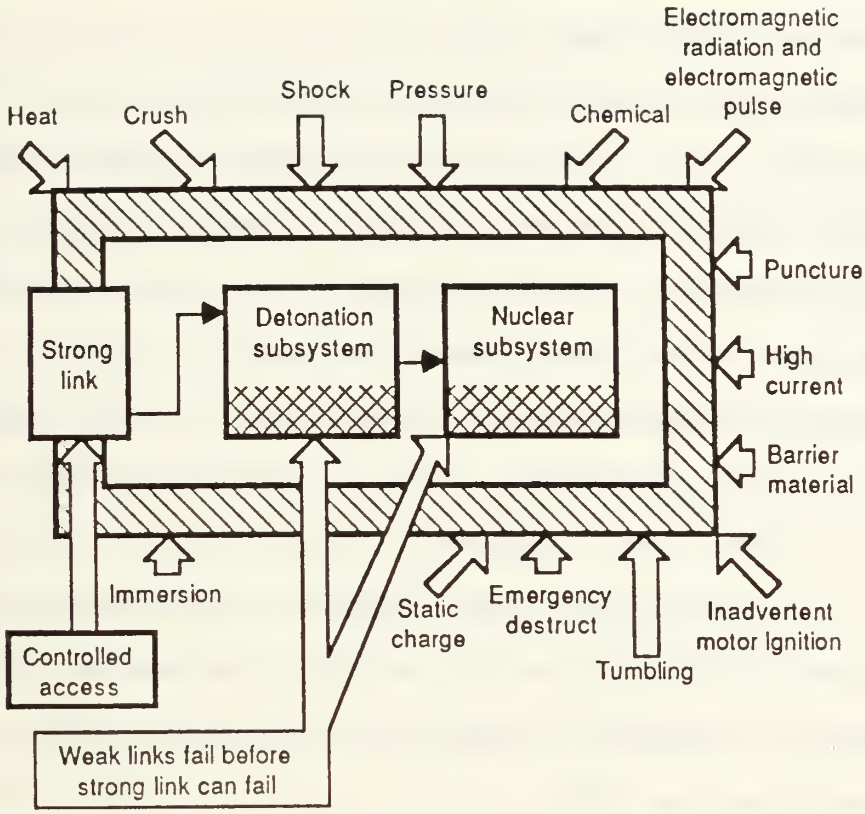

Figure 6-1. "Strong Link-Weak Link" Principle in Nuclear Weapon Design

An additional control procedure incorporated into LCC's is the requirement for a separate crew in another LCC to also turn their keys confirming the launch orders. In the event a number of LCC's are destroyed or incapacitated, control reverts to the surviving LCC's, even to the point where one LCC could launch the surviving ICBM's.[155] The importance of this feature is critical, considering its applicability and usefulness to conducting a protracted

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[155]Ford, The Button, p. 118.

nuclear conflict where control of subsequent strikes could effect launch operations.

Although ICBM's have incorporated PAL's as part of the weapons system, the Navy has not adopted the PAL devices on SLBM's and instead relies on the nuclear weapons surety program to prevent unauthorized access or launching of missiles. In this case, when the EAM is received, it is decoded and authenticated by two teams of officers (not including the commanding oficer, weapons officer, or navigator, whom have separate functions in the launch sequence). Once this is done, special keys are then issued to personnel so that a series of "permission" switches can be closed in a prescribed sequence, thereby, completing the launch requirements.[156]

As shown, the planning and preparation for a nuclear exchange is long and detailed. When the strategic warning and information fusion centers such as NORAD, SAC, and NMCC receive indications of an imminent or inbound attack, they must quickly determine the validity of the data, and upon verification notify the NCA in order to commence SIOP execution utilizing an EAM. The SIOP options must be clearly laid out and readily available to the President or his successor to allow for selection of an option and execution in a timely manner. There will be little time to decide on strategies and even less time given no warning.

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[156]Cotter, "Peacetime Operations," p. 52.

B. SOVIET NUCLEAR WEAPON RELEASE PROCEDURES

The Soviet Union has postulated three conditions of readiness in preparing for nuclear war. Similar in nature to the United States, they function under conditions of peacetime operations, a crisis environment, and, lastly, the imminent outbreak of hostilities or the commencement of war. Their operating conditions under peacetime are similar to the United States', but under crisis and wartime there are significant shifts in political and military procedures.

In peacetime the Soviet Union performs like any country with the leadership tending to the day-to-day matters of state. The Soviet NCA and its attendant authority over nuclear weapons is vested in one of three possible organizations. First is the Politburo since it controls Soviet national decisionmaking and hence political-military control over nuclear weapons. Second would be the Defense Council. As a powerful state organization, it is responsible for the national security issues facing the country and is well suited to handle the flow of information that would occur in the event of a surprise attack. Third is the General Secretary. As head of the Politburo and chairman of the Defense Council, he is the commander-in-chief of the armed forces. This may be the most likely since it has been observed that the Soviet "football" was present at Leonid Brezhnev's funeral, thereby lending credence to the General Secretary's role in the nuclear force chain of command.[157]

In the event of a surprise attack, the issuance of a launch order would be based on the tactical information received, and the critical decision regarding whether to launch-on-warning or attempt to "ride out" the first attack would be made. One consideration that would weigh heavily in the decisionmaking process is the amount of time available to choose a course of action.

In a crisis or wartime scenario, the General Secretary would still play a lead role in the conduct of military readiness and operations, but the Politburo would have time to influence his decisions and actions. Like the United States, the Soviet Union has most likely designated successors to the General Secretary, and they would be covertly dispersed to hardened command centers around Moscow and elsewhere within the country to provide a continuing line of authority in the event the General Secretary was wiped out in a strike.

An additional precaution that could be taken would be the increased readiness of the Soviet equivalent to the NEACP, an increase in communications to strategic forces, and activation of additional radar facilities located throughout the country. One key advantage the Soviet Union

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[157]"Catching the Soviet Football on Film," Newsweek, 1 August 1983, as cited in Stephen M. Meyer, "Soviet Nuclear Operations," Managing Nuclear Operations, p. 484.

has over the United States is the redundancy and interoperability of communications systems from the strategic level down to the tactical troop level. This feature allows for escalation control in a conflict and a tight rein over the actions of engaged forces. The orders to launch weapons can be communicated through HF, UHF line-of-sight and UHF relay, land lines and cables, and satellites.

Once the decision to launch has been made, the order is relayed from the General Staff to the main staff of SRF (RVSN) for relay to the ICBM command posts in the field or the General Staff can communicate directly with the command posts, bypassing the RVSN.[158] No information has yet been published concerning the composition of nuclear release orders or the specific breakdown of the Soviet equivalent to the United States' SIOP, called the RISOP.

Although no specific information has been obtained concerning the RISOP, Soviet writings have given some clue as to the objectives, strategy, and operating principles obtained within it:

1. Destroy most threatening enemy forces, usually interpretted to mean U.S. ICBM fields.

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[158]A. Yeveseyev and O. Gurov, "Organizatsiya informatsionnoy rabot v General'nom shtabe, shtabakh frontov i armiy," Voyenno-istoricheskiy zhurnal, no.3, March 1981 14; Viktor Suvorov, Inside the Soviet Army (New York: Macmillan, 1981), p. 56; Department of Defense, Soviet Military Power 1981 (Washington, D.C.: U.S. Government Printing Office, 1981) 55, as cited in Meyer, "Soviet Nuclear Operations," p. 495.

2. Select main "links" and nodes in target set, referring to command authority and related communications capability.

3. Do not destroy large areas or create radioactive deserts.

4. Use minimum yields to avoid "overkill" of the target.

5. Targeting of population and all industry is unnecessarily destructive and not effective.

6. Strike simultaneously in several TVD's.

7. Prepare to strike "most important" targets twice.

8. Political leaders will determine relative weight of strikes in the various TVD's.[159]

These basic tenets also closely follow the doctrine and strategy espoused by the Soviet Union for many years, thereby lending some degree of credibility to their formulation and accuracy.

The Soviet Union still considers the procedures and communications to nuclear forces to be of paramount importance and, as such, it has invested considerable time in developing a set of procedures and equipment capable of supporting this requirement. The flexibility of the system is considered very good, and it certainly has the requisite facilities needed to conduct not only a first-strike attack but also follow-on strikes as required. The amount of control that would be delegated to TVD commanders in a strategic conflict is unknown; however the means to carry

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[159]William T. Lee, "Soviet Nuclear Targeting," Strategic Nuclear Targeting, p. 97.

out such an order are in place, operationally tested, and ready for use should a conflict occur.

VII. NET ASSESSMENT OF U.S. AND SOVIET COMMAND AND CONTROL SYSTEM SURVIVABILITY IN A PROTRACTED NUCLEAR CONFLICT

Since the United States and the Soviet Union achieved parity in their nuclear weapons, each side has sought to shift the balance of power to their favor. Commencing in the early 1970's, the Soviet Union's strategic nuclear force modernization effort still goes unmatched in the West. They have devoted significant effort to weapons system yield, accuracy, throw weight, and survivability. They have also spent considerable effort modernizing their command and control structure to afford them the means of conducting a protracted nuclear exchange and achieving their war aims. The United States, on the other hand, has been slow to modernize and only recently began to upgrade weapons systems, intelligence and warning platforms, and command and control facilities.

The United States and Soviet Union now supposedly possess threat warning and attack assessment forces sophisticated enough that plans for a surprise "bolt-out-of-the-blue" attack are rarely addressed. By observing historical actions and writings, it appears the United States has always been more prone to plan for this contingency. Current readiness levels are a prime indication of this relationship. Today, more than 80 percent of Soviet ICBM's, carrying more than 95 percent of the Soviet's ICBM-based warheads, are ready to be launched on short notice; 30 to 40 percent of Soviet SSBN's are on alert, with only 20 percent on station to launch a strike; and no intercontinental bombers are on either air or ground alert status.[160]

The United States, on the other hand, maintains a much higher readiness posture. The alert rate for ICBM's is kept at approximately 98 percent.[161] Usually only 30 percent of the bombers are kept on alert and 50 percent of the submarines.[162] The higher rate for submarines is due to the Blue/Gold two crew manning system employed by the Navy whereby two seperate crews are assigned to the same submarine, allowing quicker turn-around time in port. Although these readiness postures indicate the availability of forces on a day-to-day basis, in a generated alert situation the forces available could go much higher for each leg of the triad.

These readiness levels set the stage for evaluating whether or not the United States or the Soviet Union has

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[160]Stephen M. Meyer, "Soviet Nuclear Operations," Managing Nuclear Operations, eds. Ashton B. Carter, John D. Steinbruner, Charles A. Zraket (Washington, D.C.: The Brookings Institution, 1987), p. 494.

[161]John M. Collins, U.S.-Soviet Military Balance: Concepts and Capabilities 1960-1980 (New York: McGraw-Hill Publications Co., 1980), p. 129.

[162]Roger D. Speed, Strategic Deterrence in the 1980's (Stanford: Hoover Institution Press, 1979), p. 32.

the capability to initiate a nuclear conflict and endure through it to achieve a workable war termination. As observed by Stephen J. Cimbala:

> The search for enduring C^3 systems may divert attention from the search for forces and commanders that are 'merely' survivable. The U.S.-Soviet arms race has been stimulated by the concerns of each side for the survivability of its forces and command structure against preemptive attack. Improved capabilities for protracted war do not necessarily lessen the danger of preemption, and might increase the danger. While the odds in favor of simple decapitiation go down, the odds in favor of multiple dysfunction might increase. Social systems, including the command structures for retaliatory forces, cannot be programmed only to do what their designers expect, or hope.[163]

A. U.S. C^3 SURVIVABILITY CONSIDERATIONS

On July 25, 1980, PD-59 which bore the title "Nuclear Weapons Employment Policy" was signed. This directive altered U.S. nuclear strategy in two fundamental ways. First, it shifted targeting emphasis from the economic recovery targeting mandated in NSDM-242, to the targeting of Soviet political and military assets, strategic military targets, leadership targets, and Other Military Targets (OMT). Second, it mandated development of the capability to wage a protracted nuclear conflict. Two additional presidential directives were also reportedly adopted which supported PD-59. PD-53, entitled "National Security Telecommunications Policy," and PD-58, entitled "Continuity

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[163] Stephen J. Cimbala, <u>Nuclear War and Nuclear Strategy, Unfinished Business</u> (Westport: Greenwood Press, 1987), p. 137.

of Government," set the stage for increased emphasis on flexible and enduring communications systems capable of supporting the NCA and its chains of succession in the event of a nuclear conflict.[164]

When President Reagan assumed office, he reaffirmed the strategy espoused in PD-59 and issued his own doctrine statement in National Security Decision Directive (NSDD) 13. Using this directive, the United States embarked on the ambitious Strategic Modernization Program. In his Fiscal Year 1983 Annual Report to the Congress, Secretary of Defense Caspar W. Weinberger expanded on the purpose behind the modernization effort one step further:

> The United States will maintain a strategic nuclear force posture such that, in a crisis, the Soviets will have no incentive to initiate a nuclear attack on the United States or our allies. U.S. forces will be capable under all conditions of war initiation to survive a Soviet first strike and retaliate in a way that permits the United States to achieve its objectives. Nuclear weapons systems will not be funded merely to make our forces mirror Soviet forces according to some superficial tally of missiles or aircraft deployed in peacetime. Obtaining a facade of symmetry between U.S. and Soviet forces in terms of such simplistic counts is not a requirement for which I would allocate scarce defense dollars. Instead, our goal will be to gain and maintain a nuclear deterrent force which provides us an adequate margin of safety with emphasis on enduring survivability (emphasis added).[165]

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[164]Jeffrey Richelson, "PD-59, NSDD-13, and the Reagan Strategic Modernization Program," Nuclear Strategy, Arms Control and the Future, eds. P. Edward Haley, David M. Keithly, and Jack Merritt (Boulder: Westview Press, 1985), p. 124-126.

[165]Department of Defense, Report of the Secretary of Defense, Caspar W. Weinberger, to the Congress on the FY 1983 Budget, FY 1984 Authorization Request and FY 1983-1987

This statement summarizes the requirement for the United States to maintain a C^3 system capability to sustain a protracted conflict and prevent the Soviets from achieving their war aims.

To date, the United States has initiated a series of programs designed to enhance the survivability characteristics of the C^3 system. Upgrades in physical and EMP hardening as well as improvements in communications have underscored the desire to achieve a flexible C^3 system capable of sustained combat operations in a protracted nuclear war.

1. **EMP Hardening**

EMP hardening has been the main focus of funding during the Strategic Modernization Program. All new strategic systems funded for present and future deployment have had EMP hardening as a primary consideration in design, full scale development, and operational deployments. Future systems scheduled to benefit from this effort include the NAVSTAR GPS system including the NDS subsystem onboard, the MILSTAR satellite system, GWEN, and the E-6A TACAMO aircraft.

Although little information exists on exact Soviet targeting policy, it has been postulated that high altitude multi-megatonnage bursts above the United States could be

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<u>Defense Programs</u> (Washington, D.C.: U.S. Government Printing Office, 1982), p. I-17.

used to disrupt critical C^2 communication links.[166] Upgrades to currently existing systems are also underway. Of extreme importance in maintaining strategic connectivity to NMCC, ANMCC, SAC, and NORAD, the E-4B NEACP aircraft was built with EMP hardening incorporated from the ground up.[167] Also, current versions of the DSCS III satellites, DMSP satellites, and FLTSATCOM satellites have taken EMP hardening aspects into consideration. The systems listed so far pertain mostly to communications, there has also been significant effort put forth in hardening the early warning portion of strategic forces as well.

Very little concrete information exists on the exact effects of EMP. Much of the data obtained to date has been gleaned from the analysis of atmospheric test data, underground explosions, computer simulations, calculated projections and non-nuclear explosions.[168] One point to be considered, however, is that for high altitude bursts to have a degrading EMP effect on electronic equipment, the

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[166]Robbin F. Laird and Dale R. Herspring, <u>The Soviet Union and Strategic Arms</u> (Boulder: Westview Press, 1984), p. 81-82.

[167]Defense Electronics, <u>C3I Handbook</u>, 1st ed., ed. Defense Electronics (Palo Alto: EW Communications, Inc., 1986), p. 115.

[168]Samuel Glasstone and Philip J. Dolan, <u>The Effects of Nulcear Weapons</u>, 3d ed. (Washington, D.C.: U.S. Government Printing Office, 1977), p. 514.

yield must be in the megaton range.[169] It should be noted that the Soviet Union currently possesses these multi-megaton warheads which are ideally suited for such attacks. The United States, however, does not possess any warheads of this size on a delivery system suited for high altitude bursts.

The amount of EMP hardening built into U.S. command and control systems is highly classified and the degree to which they could withstand the continued shock of EMP bursts over the continued period projected in a protracted nuclear conflict is unknown. Microelectronic components are extremely susceptible to variances in electrical current and degradation can quickly occur if not adequately protected by shielding and grounding. Existing systems have never been put to the "test" of combat; therefore, their anticipated performance is an educated guess at best.

2. Physical Hardening

The physical hardening of command and control facilities has long been neglected in the United States due to budgetary constraints and political biases concerning the deterrent value of such an action. In light of appearing to believe that nuclear war can be fought and won, given a secure facility from which the battle could be conducted, the Reagan Adminstration backed away from

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[169] Glasstone and Dolan, The Effects of Nuclear Weapons, p. 516.

earlier statements regarding the requirement for "enduring survivability". Additionally, all follow-on inquiries regarding this subject have been explained away by denying the plausibility of having these types of facilities.

Of the four major command and control centers associated with strategic forces, only the ANMCC and NORAD have any degree of physical hardening protection. The NMCC, located in the Pentagon, has no physical hardening attributed to it; and given a one megaton burst at less than two miles, the structure would sustain severe damage which would degrade if not eliminate its usefulness as a data fusion and command and control center.[170] The facility at SAC headquarters at Offutt AFB is likewise an unhardened facility capable of withstanding less than twenty psi overpressure.[171] Although a new command center was completed in late 1988, it too is reportedly only 30-50 feet underground and is not capable of sustaining a direct hit or near miss. The United States only possesses two types of mobile systems for strategic command and control: the E-4B and the EC-135. These aircraft are limited in number, and the support facilities required for continual maintenance may prove their undoing in a conflict. This

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[170]Glasstone and Dolan, The Effects of Nuclear Weapons, p. 216, 219.

[171]Theodore Jarvis, "Nuclear Operations and Strategic Defense," Managing Nuclear Operations, p. 662.

also discounts the possibility of follow-on strikes incurred in a continuing conflict.

When it was constructed in the 1960's, the facility in Cheyenne Mountain, known as NORAD, was considered a hardened facility. With increased progress in weapons yield and accuracy, this command post soon became physically vulnerable and could be incapacitated with a dedicated first strike or retaliatory strikes.[172] Although this is the United States' most hardened facility, this weakness is still inherent today and due to budgetary constraints, no plans exist to move the facility or provide additional hardening by moving it under Cheyenne Mountain.

The only other facility to have any degree of hardening incorporated into its design is the ANMCC at Ft. Ritchie, Maryland. The post is located within the Catocin mountains and its survivability has been rated as moderate at best.[173] It serves as the transition facility by which transfer of control from the ground facilities to airborne command posts could be effected in an orderly fashion during the brief period between detection of an inbound

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[172]Jarvis, "Nuclear Operations and Strategic Defense," p. 662.

[173]Congress, House of Representatives, Committee on Armed Services, Hearings on Military Posture and H.R. 5068: Hearing before the Committee on Armed Services, 95th Cong., 1st sess., 1 February 1977, p. 1055.

ICBM attack and weapons impact.[174] Although not classified as one of the primary command and control facilities, the Federal Emergency Management Agency (FEMA) facility at Mount Weather, Virginia serves as a backup ANMCC. It has all the communications systems the NCA might need during and after a nuclear attack but is no less vulnerable that Ft. Ritchie.[175]

The command post rated which is rated as most survivable in a nuclear conflict is the NEACP aircraft. With airborne refueling, it is designed to remain aloft for up to 72 hours.[176] The aircraft requires at least 30 minutes to warm up equipment and go through preflight checks, possibly making the aircraft subject to destruction in a surprise attack. Originally stationed at Andrews AFB outside Washington, D.C., it was considered too vulnerable and was moved to Grissom AFB, Indiana in 1983.[177]

Little information is available concerning the existence of other hardened command and control facilities. There are six sites other than Mount Weather which are

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[174]Bruce Blair, Strategic Command and Control, Redefining the Nuclear Threat (Washington, D.C.: The Brookings Institution, 1985), p. 109.

[175]Desmond Ball, "Can Nuclear War Be Controlled?," Adelphi Papers Number One Hundred and Sixty-Nine (London: The International Institute for Strategic Studies, Autumn 1981), p. 39.

[176]Defense Electronics, C3I Handbook, 1st ed., p. 114.

[177]Blair, Strategic Command and Control, p. 189.

operated by FEMA, but little information on them is available. The United States is well prepared to operate under the adverse conditions that would typify the start of a nuclear exchange, but the ability to wage a protracted conflict beyond a few hours or days is questionable.

No Soviet writings indicate a desire to exclude U.S. command and control facilities or capabilities from targeting. This policy leaves open the question of how and with whom they could conduct war termination. The ability of the NCA to maintain connectivity and control over the nuclear forces must be preserved if reconstitution of forces is to occur, the fight continued, and the conflict concluded.

B. SOVIET C^3 SURVIVABILITY CONSIDERATIONS

The Soviet Union has always considered a conflict with the West to be inevitable. During the 1970's, the Soviet Union fully integrated the use of nuclear weapons as an extension of a conventional arms conflict. A.A. Kir'ian, a Soviet military analyst, stated it quite succinctly:

> A future war could be fought with both conventional and nuclear arms; beginning with conventional arms, it could at a definite stage become transformed into a nuclear war."[178]

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[178]M.M. Kir'ian, ed., Voenno-tekhnicheskii progress i vooruzhennye sily SSSR (Moscow: Voenizdat, 1982), p. 312 as cited in Laird and Herspring, The Soviet Union and Strategic Arms, p. 25.

Today, the Soviet Union's policies have evolved slightly. They anticipate that a nuclear confrontation will arise from a crisis situation and a conflict could initiate at the conventional level. During this stage in the conflict, it is quite possible that nuclear weapons will be called into use and they could prove to be the decisive factor in war termination and victory.[179] To support this, the Soviets have developed and synthesized a complex and reliable command and control heirarchy.

Desmond Ball has observed the degree of centralized control that would probably be prevalent in a nuclear exchange:

> ...the highly centralized procedure employed by the Soviet command-and-control expose the whole system to disruption. Observation of Soviet military exercises gives the impression that ships, aircraft and commands have carefully and specially planned roles, and that operational communications flow directly between headquarters in Moscow and the individual units in the field. Local commanders seem to have relatively little scope to adapt general orders to field conditions or to use their own initiative if they do not receive central orders. This tendency could be even more pronounced in the strategic forces, since Soviet leaders would be particularly loath to allow lower commanders much room for initiative where nuclear weapons were concerned.[180]

Many of the supporting systems have been pointed out in previous chapters, but their ability to function in the demanding environment of a protracted nuclear conflict and prevail needs to be addressed.

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[179]Laird and Herspring, The Soviet Union and Strategic Arms, p. 25.

[180]Ball, "Can Nuclear War Be Controlled?," p. 45.

1. **EMP Hardening**

The United States has targeted Soviet C^3 and political-military facilities since the adoption of PD-59 and NSDD-13. In adopting this strategy one must question the degree to which the Soviet Union has armored their electronic and computer-based command and control system to prevent disruption from the effects of EMP. To an extent, they still rely on tube-technology in their communication systems which significantly enhances the immunity of their C^3 system to disruption.[181] In addition to not knowing how much effort has been devoted to EMP hardening of systems, the exact locations of many command and control centers remain unknown, thereby complicating the targeting effort.[182]

Like the United States, the Soviet Union faces a similar problem in how the devolution of command will work if the Soviet NCA is unable to maintain connectivity with the nuclear forces. Although the Soviets do have an airborne command post, the degree of sophistication is questionable and the amount of EMP hardening, if any, is

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[181]William C. Martel and Paul L. Savage, Strategic Nuclear War: What the Superpowers Target and Why (Westport: Greenwood Press, 1986), p. 69.

[182]Martel and Savage, Strategic Nuclear War, p. 85.

unknown.[183] According to John Steinbruner of the Brookings Institutuion:

> Although the Soviets have made extensive investments in measures to protect their command systems and, whether by intention or necessity, have utilized relatively primitive communications equipment significantly less sensitive to nuclear weapons effects, the consequence of their systematic attention to the subject appears to be awareness of exposure rather than confidence in secure protection.[184]

2. Physical Hardening

The Soviets place great emphasis on maintaining control over nuclear weapons at the highest levels of government and delegation of this authority is not anticipated under any circumstances. It is because of this reason that the Soviet have taken such extensive efforts to ensure the survival of the leadership in the event of a nuclear war. The great number of hardened command and control bunkers is a prime indicator of their intentions.

In the early 1980's, the Soviets began to espouse the view that nuclear war might not be a spasm attack and could be protracted in nature. This statement coincided with a new round of construction of deep underground facilities designed to protect the political and military leadership. Also, the support infrastructure provided in

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[183]Congress, House of Representatives, Committee on Appropriations, Telecommunications, Command and Control Programs: Hearing before the Subcommittee on the Department of Defense, 96th Cong., 1st sess., 24 April 1979, p. 143.

[184]John D. Steinbruner, "Nuclear Decapitation," Foreign Policy 45, Winter 1981-82, p. 20.

these facilities is quite substantial, according to the Defense Department's Soviet Military Power: An Assessment of the Threat 1988:

> A highly redundant communications system, consisting of both on-site and remote elements, supports these complexes and permits the leadership to send orders and receive reports through the wartime management structure.[185]

The current Soviet system provides at least 80 command and control facilities just around the Moscow area. Additionally, more than 1500 alternate hardened bunkers have been built to accommodate roughly 175,000 key Party and government personnel throughout the Soviet Union.[186]

C. CONCLUSIONS

While little is actually known or available in open sources concerning Soviet capabilities to ensure connectivity and decisionmaking during a protracted nuclear conflict, they have implemented many programs designed to withstand such an environment. Their reliance on redundant communications systems which make extensive use of underground cables and EMP shielding, combined with their unwavering requirement for hardened command and control facilities for political and military officials, stresses

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[185]Department of Defense, Soviet Military Power: An Assessment of the Threat 1988 (Washington, D.C.: U.S. Government Printing Office, 1988), p. 60.

[186]Martel and Savage, Strategic Nuclear War, p. 56, and Department of Defense, Soviet Military Power 1987 (Washington, D.C.: U.S. Government Printing Office, 1987), p. 52.

the degree to which they desire to directly control the war effort, especially the nuclear dimension. This is very important considering that estimates to knock out the entire Soviet command system would require more than two thousand warheads. Even then, it is probably not possible to completely isolate the Soviet leadership from the strategic forces or impair Soviet strategic intelligence flow.[187] Expenditure of effort on these programs continues and should be taken at face value for the warfighting capability it gives them.

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[187]Daniel Ford, The Button: The Pentagon's Strategic Command and Control System (New York: Simon and Schuster, 1985), p. 127.

VIII. CONCLUSIONS AND RECOMMENDATIONS FOR THE UNITED STATES' APPROACH TO FIGHTING A PROTRACTED NUCLEAR CONFLICT

A. CONCLUSIONS

In developing a realistic and workable strategy for fighting a protracted nuclear war, the United States has made significant strides in improving weapons capability in accuracy and yield, in data processing capability using computer upgrades, and, most important, in communications improvements to strategic forces. Obviously, all these improvements could be much broader in scope and more capable than those already in place or planned, but fiscal restraints and the dynamics of a democratic form of government place ceilings and restrictions on new systems implementation.

Many approaches have been proposed to enhance the utility of command and control as it pertains to a protracted nuclear war. The systems in place now and the future command and control systems require design and update specifications that include those criteria--endurance, survivability, sustainability, and flexibility.[188]

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[188]Christopher I. Branch, Fighting a Long Nuclear War: A Strategy, Force, Policy Mismatch (Washington, D.C.: National Defense University Press, 1984), p. 40.

B. RECOMMENDATIONS

Regardless of whether or not the United States receives indications and warning concerning a strategic nuclear exchange with the Soviet Union, the C^3I systems required to support this conflict beyond the initial outbreak will have to have been developed, deployed, and operational if they are to be of any use. The United States has made significant strides in recent years in fielding systems capable of surviving the the devastation of the initial onslaught. However, the considerations of military strategy versus political realities and the attendant conflicts of interest inherent in this dialogue go far in shaping U.S. strategic doctrine. As noted by Branch:

> In the United States, planners have often been reluctant to tackle the "unthinkable" long war and deal with the loathsome details of such an abhorrent subject. The repugnance of this topic as well as convenience of not needing to plan beyond a single strike-counterstrike kept strategic thinkers away from serious public examinations of nuclear warfighting. Limited resources, too, made the short-war scenario easier to deal with.[189]

The effects of this discussion are readily apparent in the problems encountered during the installation of the GWEN and ELF communications systems.

The minimum essential portions of these systems are now installed and operational, but several years were spent pacifying concerned citizens as to the absolute need for their existance. The issues surrounding nuclear warfare

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[189]Branch, Fighting A Long Nuclear War, p. 10.

must no longer be dealt with in such a secretive and "taboo" manner. Enlightened discussion of the positions held by the United States and Soviet Union might go far in assuaging the inherent biases involved in this topic.

Once these obstacles are reduced or overcome, the problem still remains that the United States is beginning to possess a survivable command and control system, but very little exists in the way of enduring systems. Although current command and control systems may be survivable to the point of an initial exchange, they must have the capability to endure repeated attack and still function as required to maintain connectivity to the forces. All systems put into operation within the last few year and those scheduled to be placed into operation in the 1990's have incorporated some degree of EMP hardening into their design. The amount of physical hardening that each has received is subject to debate on a system by system basis.

The problem still lies in that fact that no concerted effort is being made to coordinate and develop a systematic and progressive approach to reconstituting the NCA and the nuclear forces once their connectivity has been disrupted by a nuclear strike. A number of options exist that would help in alleviating this problem:

1. Develop Post-Attack Reconstitution Procedures

Develop a set of prearranged and preauthorized procedures for the chains of succession in the NCA to contact each other and establish the leading person for NCA responsibilities. This is for both the Executive and Department of Defense chains. These procedures should also be followed by surviving strategic forces--ICBM facilities, bombers, and SSBN's in port and at sea.

Provide provisions for continued smooth transition from one command and control facility to the next. A straightforward set of criteria that must be met should suffice. This will reduce or eliminate the possibility for hesitation or miscalculation in choosing a follow-on course of action. The process of reconstitution is critical if any semblance of a coordinated continuation of the conflict is to occur.

2. Develop Robust Communications Equipment

Procure more aircraft capable of carrying out the functions currently performed by NEACP. Additionally, develop and field a series of communications equipments capable of utilizing the full range of radio frequency options, including a portable satellite capability. This capability will be especially important in the reconstitution of SSBN forces at sea which must be fully integrated into any coordinated follow-on strikes.

3. Develop a Long-Term Survivable Aircraft Support Scheme

This applies to the NEACP capable aircraft that will require maintenance support. The designation of relocation facilities that have prestaged maintenance packages capable of providing aircraft maintenance and fueling needs, as well as electronic replacement and repair needs will be necessary for sustained combat operations.

4. Develop Threat Warning/Attack Assessment Reconstitution Procedures

Develop the procedures to reconstitute those surviving facilities capable of providing threat warning and attack assessment support to deter follow-on strikes. This should include those assets available for conducting battle damage assessment and determining what post-attack options can be executed based on available forces. This may consist of activating prestaged relocatable OTH-B radar units along anticipated approach corridors and reconstituting satellite assets that may have survived.

5. Hardened Facility Construction

Construct a number of hardened command and control facilities capable of withstanding a dedicated attack and executing the recovery and reconstitution of remaining forces. A series of these facilities will be required since follow-on strikes will probably incapacitate or destroy them.

6. Develop Robust Command and Control Platforms and Supporting Equipment

Procure more aircraft capable of carrying out the functions currently performed by NEACP. The four aircraft in use today may not be adequate for providing continued support required in a protracted conflict. Develop and field a ground-mobile facility. Produce and disperse a number of these facilites throughout the United States to provide as much redundancy as possible. As stated by Ford in The Button:

> Such command posts, if they were properly designed and deployed, might substantially reduce the risk of a decapitating attack. They would deny the Soviets an easy shot at the present U.S. command system, in other words, if they were built in sufficient number, suitably dispersed, and if the delegation procedures were streamlined so that if the President were killed, the surviving commanders could collaborate to issue an Emergency Action Message.[190]

The main problem facing this approach lies in the capability of such a small facility to receive, process, analyze, and coordinate the necessary post-attack information required to plan continued follow-on strikes.

7. Develop a Protracted Nuclear War Annex to the SIOP

Develop an annex to the SIOP which fully integrates the strategic reserve forces into a protracted version of SIOP execution. It should possess flexibility in the manner of reconstituting and executing remaining strategic nuclear forces and should also address the inclusion, at this point, of tactical weapons in strategic roles.

Even if only a minimum of communications and warning systems remained intact, the facilites to direct their efforts exist only minimally. The Soviet Union has reportedly built such facilities and is probably capable of

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[190]Daniel Ford, The Button: The Pentagon's Strategic Command and Control System (New York: Simon and Schuster, 1985), p. 221.

surviving a dedicated attack and continuing to function. The United States must continue to address this aspect of a survivable command and control system.

The requirement to remain within the bounds set forth in the Constitution should be adhered to at all costs, and close involvement of the chains of succession in meeting this requirement will go far in stabilizing the government during this challenging period. Reconstitution and execution of remaining nuclear forces along with termination of the conflict at a level that denies the Soviets their war aims and secures the terms most favorable to the United States and her allies is the end goal that should be worked toward.[191]

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[191]Department of Defense, Annual Report to the Congress Fiscal Year 1988 (Washington, D.C.: U.S. Government Printing Office, 1988), p. 46.

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