2008-06

Expanding the targeting process into the space domain

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NAVAL POSTGRADUATE SCHOOL

MONTEREY, CALIFORNIA

THESIS

EXPANDING THE TARGETING PROCESS INTO THE SPACE DOMAIN

by

Sean P. Riley

June 2008

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REPORT DOCUMENTATION PAGE		Form Approved OMB No. 0704-0188

1. AGENCY USE ONLY *(Leave blank)*	2. REPORT DATE	3. REPORT TYPE AND DATES COVERED
	June 2008	Master's Thesis

4. TITLE AND SUBTITLE Expanding the Targeting Process into the Space Domain	5. FUNDING NUMBERS
6. AUTHOR(S) Sean P. Riley	
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) Naval Postgraduate School Monterey, CA 93943-5000	8. PERFORMING ORGANIZATION REPORT NUMBER
9. SPONSORING /MONITORING AGENCY NAME(S) AND ADDRESS(ES) N/A	10. SPONSORING/MONITORING AGENCY REPORT NUMBER

11. SUPPLEMENTARY NOTES The views expressed in this thesis are those of the author and do not reflect the official policy or position of the Department of Defense or the U.S. Government.

12a. DISTRIBUTION / AVAILABILITY STATEMENT	12b. DISTRIBUTION CODE
Approved for public release; distribution is unlimited.	A

13. ABSTRACT (maximum 200 words)

The current targeting cycle used by the services relies heavily upon the use of space assets. The Global Positioning System (GPS) and satellite communications are just a few of these assets accessed thousands of times a day. With technology growing by leaps and bounds, it is a challenge for tactical and operational commanders to keep up with the growing capabilities offered by space-borne platforms. Having this in-depth knowledge can assist in all facets of combat, from the best time to attack, to acquiring and relaying battle damage assessment (BDA) and combat assessment (CA). One of the most vital roles for the warfighter is targeting. Effective targeting, with the right munitions on the right target at the right time, can make a difference in the battle and the overall war. Just as one misplaced or inaccurate bomb can fall on a peaceful village resulting in unwanted collateral damage and bad publicity immediately fed back to the U.S. impacting public opinion. Properly placed effects can shorten the span of a conflict, save lives, and satisfy strategic requirements. Space is a critical link in this process and is not being effectively used to its utmost capability. This thesis will discuss methods and databases through which space capabilities can be better integrated into the current targeting cycle.

14. SUBJECT TERMS	15. NUMBER OF PAGES
Space Targeting, Space Operations, Space Capabilities, Basic Encyclopedia, Targeting Folder	55
	16. PRICE CODE

17. SECURITY CLASSIFICATION OF REPORT	18. SECURITY CLASSIFICATION OF THIS PAGE	19. SECURITY CLASSIFICATION OF ABSTRACT	20. LIMITATION OF ABSTRACT
Unclassified	Unclassified	Unclassified	UU

NSN 7540-01-280-5500 Standard Form 298 (Rev. 8-98)
Prescribed by ANSI Std. Z39.18

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EXPANDING THE TARGETING PROCESS INTO THE SPACE DOMAIN

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Submitted in partial fulfillment of the
requirements for the degree of

MASTER OF SCIENCE IN SPACE SYSTEMS OPERATIONS

from the

NAVAL POSTGRADUATE SCHOOL
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ABSTRACT

The current targeting cycle used by the services relies heavily upon the use of space assets. The Global Positioning System (GPS) and satellite communications are just a few of these assets accessed thousands of times a day. With technology growing by leaps and bounds, it is a challenge for tactical and operational commanders to keep up with the growing capabilities offered by space-borne platforms. Having this in-depth knowledge can assist in all facets of combat, from the best time to attack, to acquiring and relaying battle damage assessment (BDA) and combat assessment (CA). One of the most vital roles for the warfighter is targeting. Effective targeting, with the right munitions on the right target at the right time, can make a difference in the battle and the overall war. Just as one misplaced or inaccurate bomb can fall on a peaceful village resulting in unwanted collateral damage and bad publicity immediately fed back to the U.S. impacting public opinion. Properly placed effects can shorten the span of a conflict, save lives, and satisfy strategic requirements. Space is a critical link in this process and is not being effectively used to its utmost capability. This thesis will discuss methods and databases through which space capabilities can be better integrated into the current targeting cycle.

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TABLE OF CONTENTS

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LIST OF FIGURES

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I. SPACE TARGETING CHALLENGE OVERVIEW

> The general who wins a battle makes many calculations in his temple before the battle is fought. The general who loses a battle makes but a few calculations beforehand. Thus many calculations lead to victory and a few calculations to defeat. It is by attention to this point that I can foresee who is likely to win or lose
>
> Sun Tzu, *The Art of War*

Targeting is the process of identifying enemy targets for possible engagement and determining the appropriate attack system to be used against those targets. The targeting process should identify resources that the enemy can least afford to lose. A target is an enemy function, formation, equipment, facility, or terrain planned for capture, destruction, neutralization, or degradation in order to disrupt, delay, or limit the enemy. It is an effects-based process whose ultimate purpose is to provide data and recommend plans of action to help commanders achieve specific and general objectives. Targeting proceeds from the commander's objectives to an assessment of the results achieved by the executed course of action (COA)[1]. Targeting takes place in peacetime in the form of deliberate planning and during wartime in the form of crisis action planning and operations. The process is a continuous method by which information is converted into intelligence and made available to users. Targeting personnel and organizations consume intelligence produced by various agencies and organizations. Actionable and predictive intelligence applies to all levels of warfare, and is crucial to all phases of the joint targeting cycle. Targeting is a discipline that combines both elements of the intelligence and operations communities (Figure 1).

[1] United States Department of Defense Joint Publication 3-60, Joint Targeting, 2007, II-2.

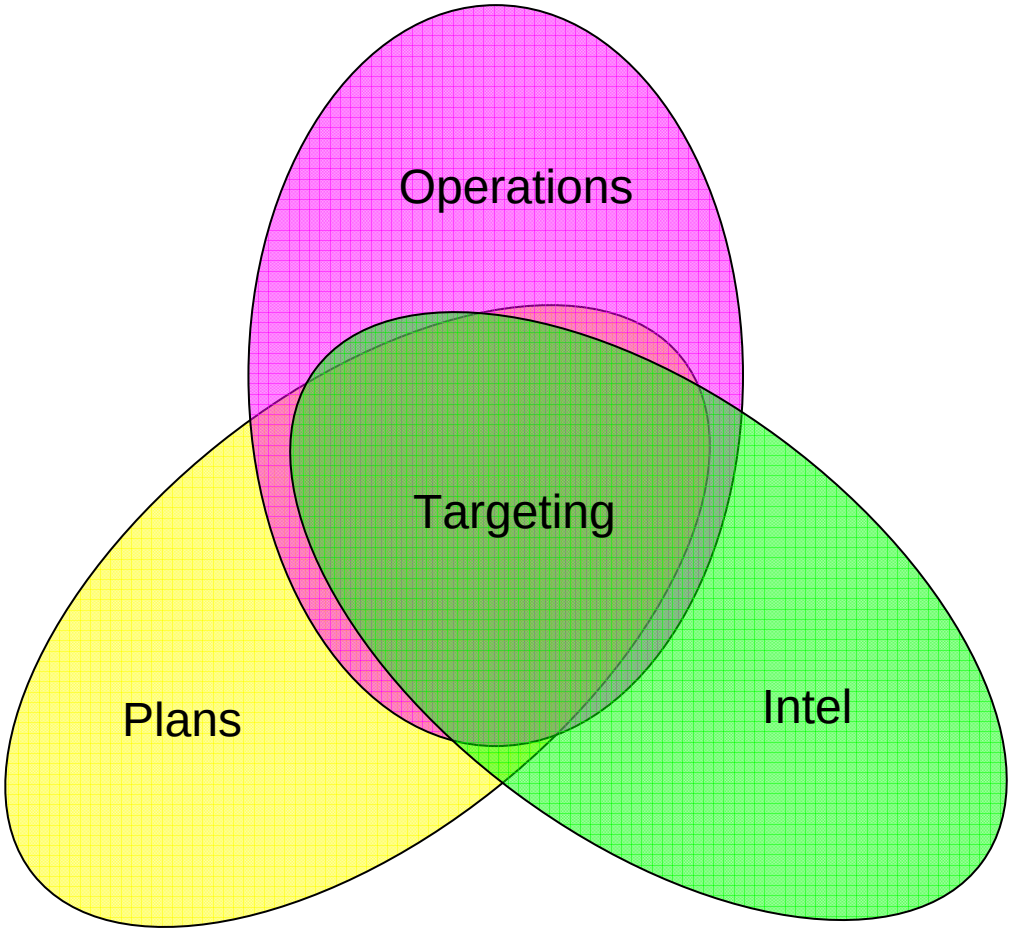

Figure 1. Targeting Interoperability

Space targeting focuses on five elements (annotated by green ellipses) in the six- step, joint targeting cycle (Figure 2) that targeteers and target intelligence officers will be primarily engaged in during peace and wartime activities. It is imperative that all phases of the targeting cycle be understood by those who are involved in the targeting process. Any misunderstanding or lack of clarity could evolve into mismanagement of crucial information and inaccurate intelligence reporting. Under the current space architecture the command and control of most space forces has been delegated to the Joint Space Operations Center (JSpOC) and the Joint Forces Component Commander- Space at Vandenberg AFB, CA.

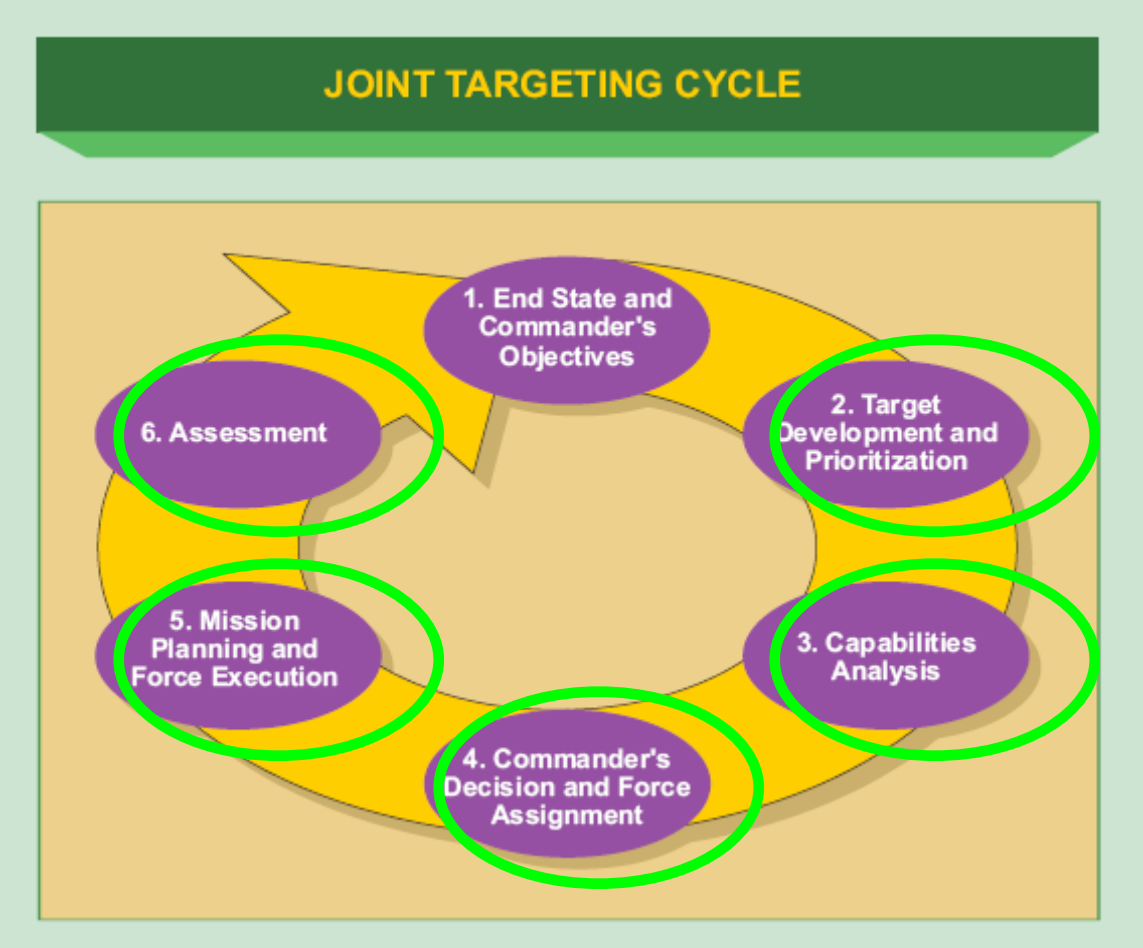

Figure 2. Joint Targeting Cycle[2]

Target Development is the second phase of the six-step joint targeting cycle. During this phase, a Joint Force or Combatant Commander's objectives are translated and ultimately become a joint integrated prioritized target list (JIPTL) generated by the guidance and apportionment targeting cell (GAT). Historically, GAT cells have had little to no knowledge of space assets or their capabilities (leading to a kinetic solution that may have been satisfied through non-kinetic space-based means further allowing deniability when required.) A JIPTL is best produced when effective target development has taken place with the support of all assets available to the joint forces or component commander. Target

[2] United States Department of Defense Joint Publication 3-60, Joint Targeting, 2007, II-3.

development entails the systematic examination of potential target systems within a nation or nation state, their components, individual targets, and even elements of the target to determine the necessary type and duration of the action that must be exerted to generate an effect that is consistent with the commander's specific objectives. Intelligence provides the basis for the target system analysis upon which effective target development is based. Integral to target development is target validation. This process determines whether a target remains a viable element of the target system, and whether it is a lawful target under the law of armed conflict (LOAC) and rules of engagement (ROE). Once potential targets are identified and validated, they are nominated, through the proper channels, for approval. Targets are prioritized based on the JFC's objectives and guidance.

As the world-wide component for space operations and as lead agent for maintaining space superiority, the Joint Functional Component Command for Space (JFCC-SPACE) has a critical stake in target development for theaters in the Department of Defense (DoD). Space targeting teams must drive and contribute to peacetime production of materials and targeting folders to support crisis action planning, and must be prepared to interact across the spectrum of DoD Combatant Commands (COCOMs) and other U.S. Agencies in peacetime and contingency operations. They must be the recognized experts on understanding the target systems that will need to be affected for JFCC SPACE to achieve their mission.

Combat Assessment (CA) is the sixth step in the Joint Targeting Cycle and is an all source, joint activity supported by all components and is designed to determine if required effects on the adversary have been or are being achieved. There are three elements of combat assessment: battle damage assessment (BDA), munitions effects assessment (MEA) and re-attack recommendations (RR). JFCC-SPACE will provide inputs to the JFC or his designated representative in charge of a campaign's CA in a variety of forums and mechanisms.

Due to special technical operations (STO), special access programs (SAP), and other compartmentalized programs known only to few space professionals the space targeting team's involvement in target development and knowledge of target systems is a critical element in these targeting efforts. The space targeting team acts as the executive agent for providing intelligence from and to JFCC-SPACE and the JSpOC on the status of the campaign or crisis actions. Due to the sensitive nature of the extraterrestrial and terrestrial collection and CA methods, the space team should act as an advisor on Phase III Battle Damage Assessment for national agencies and provide garrison expertise to the JSpOC on all aspects of the process. Figure 3 below provides a broad scope depiction of combat assessment:

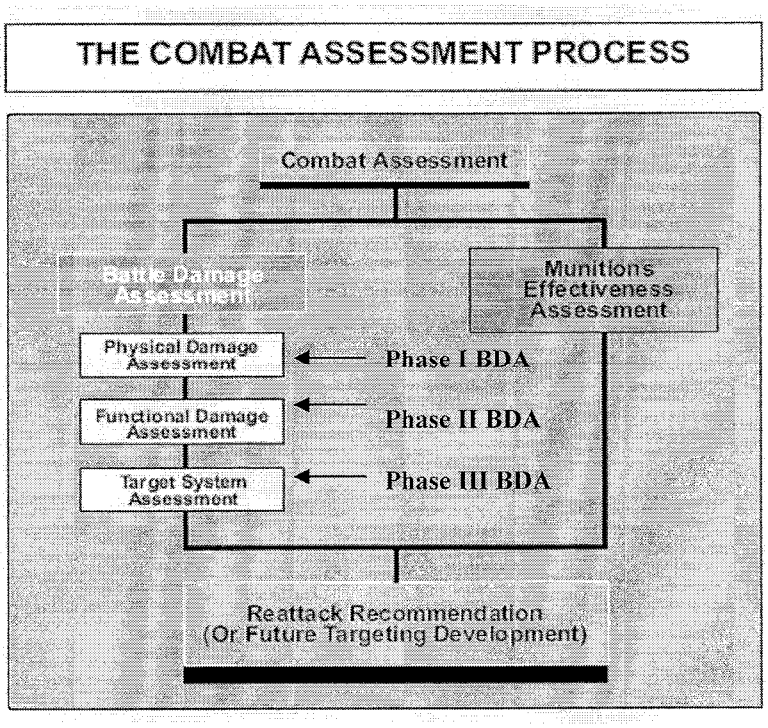

Figure 3. Combat Assessment Process[3]

The space targeting team should play a critical role in nominating targets to a theater's executive agent for targeting during peacetime and wartime. This

[3] Untied States Department of Defense, Joint Targeting School Publication, 2006.

role involves coordination with other targeting and intelligence entities around the DoD and other agencies. The space targeting personnel must be actively involved in the targeting processes of all COCOMS. Prudent peacetime communication and interaction will greatly facilitate proactive planning. One of the key things the space targeting personnel must do is become aware of appropriate levels of details of deliberate planning in each of the COCOMs. This requires space professionals to be assigned (TAD or permanent personnel) to all COCOMs in an effort to assist in the building of the operational plans (OPLANS) and operational orders (OPORD) as well as workings with the COCOM targeting cell to coordinate/assemble the target nomination list (TNL). Joint Publication 3.60 defines a TNL as:

> ... a list of targets nominated by component commanders, national agencies, supporting commands, or the JFC staff for inclusion on the JIPTL to support JFC objectives and priorities[4].

The TNL will allow intelligence/operations teams to discuss the best COA's to effect the target as desired. This includes the compartmentalized targeting capabilities available from space - both non-kinetic and future kinetic. In order to prepare the TNL, target folders must be assembled for each possible target, both stationary and mobile. A basic encyclopedia (BE) number will be assigned by the modernized integrated database (MIDB) managed by the Defense Intelligence Agency (DIA). This BE number is an alpha-numeric number that provides details on the country, functionality of the target and other details that will assist in the targeting process. This has already been completed for most terrestrial targets, however has not been completed for extraterrestrial assets. The challenges with creating a BE number (or space control number) for these extraterrestrial assets are vastness of its area of operations (due largely to the orbital mechanics of the motion of these items and the strategic (even global) concerns of these types of targets) the intelligence collected on the space platform itself, and the nodal analysis of these platforms both as a system and as

[4] United States Department of Defense Joint Publication 3-60, Joint Targeting, 2007.

a system of systems. Lastly, the assessment of the non-kinetic targeting of these platforms adds an additional challenge; this will include, and to a great extent, utilize electromagnetic-spectrum analysis through our ISR capabilities. For example, a non-kinetic attack on a spacecraft could involve effectively jamming the spacecraft's command link until the target's command structure changed the command frequency or the jamming source was out of range. Timely and accurate intelligence support is crucial in all steps of the targeting cycle. From the identification of possible targets to the creation of the target folders accurate intelligence reports (initial and follow-on reports) are required. This intelligence is gathered through multiple sources and fused to provide a complete situational report and tactical picture by which decision-makers can make decisions and perform the conduct of the battle. This intelligence process is a cycle and must be updated to provide this timely, perishable, and fused data to the commanders. When intelligence does not provide the needed information in support of any operation, specifically space targeting, gaps are identified and must be satisfied by current intelligence gathering by the space targeting officer/collection manager submitting a request for information (RFI) and production requirement (PR) to the higher echelon command or national intelligence community.

Collectively the services are getting much better at educating the commanders on the assets, services and products provided from space. In 2003 the Air Force stood up the Space 200 and 300 level courses specifically to educate mid-level and senior staff about space-borne assets. This was huge step in the right direction, aiding in the proper assignment of space professionals in space billets. With the increasing use of space assets there comes a requirement not only for space-educated senior leadership but trained and experienced analysts and space professionals. Over the past two decades space assets have increased while personnel assigned to space positions has decreased. For example in 1991 U.S. Space Command (USSPACECOM) had 400 intelligence analysts from all four services. When U.S. SPACECOM

transferred requirements/responsibilities to U.S. Strategic Command (USSTRATCOM) in 2002 only 80 intelligence analysts remained to provide space intelligence support to U.S. STRATCOM. The other 320 were reassigned to Global War on Terrorism (GWOT) support. In 2004, U.S. STRATCOM reorganized and dissolved the STRATCOM Joint Intelligence Center (JIC) and created JFCC Space and Global Strike (SGS). During this 2002 transition, the intelligence analysts originally transferred to STRATCOM were transferred out and not replaced leaving the SGS to find its intelligence support within the 14th Air Force out of Vandenberg AFB, CA[5]. This shortage of intelligence analysts is the main reason we must become more proficient at working in the joint space environment and sharing information, lessons learned, and managing the space resources we currently have. As with all other types of intelligence and processes there must be inter-service and inter-agency sharing of knowledge and cooperation. Space targeting personnel should also be active participants in the various targeting forums that take place across the DoD - to include representation to the Military Targeting Committee (MTC) and the Joint Targeting Automation Steering Group (JTASG). The Joint Staff Directorate of Targets (JS/J2T), located at the Pentagon, is executive agent for these space and space targeting forums. Working with these agencies and sister services TNL should be constructed to support the COCOM's OPLANs for the near and long term. One of the key planning tools for space targeting is the Basic Encyclopedia (BE) number for these space assets. As with every installation this BE number will provide detailed information about the spacecraft, it's physical and electromagnetic characteristics, its mission, as well as the link system for its support, TTC, and up/download requirements. Due to the classification of these systems this information may be compartmentalized with access to a select few involved in the space targeting and COCOM OPLAN development cells. To support the growing administrative and support needs of space the Pentagon continues to undergo a manning restructuring within the J2T increasing their personnel. The

[5] Steve Kiser, LtCol/USAF, J2T2, Personal Interview, January 2007.

current manning configuration is not sufficient to provide the proper support based on the current operational tempo. The desired target manning level by the J2T is an increase of over 35% in personnel and is configured to support operations by a COCOM both in theater and from CONUS.

The targeting process is challenging and time-sensitive. Add to this the sensitive nature of the collectors and clearances required and you have a need for highly-educated, school-trained space professionals. Currently the Navy and Air Force are the only two services with institutions providing advanced degrees in Space Systems Operations and Engineering. The Air Force has been very proactive and in a "Space Force" mode has led the charge for education, use, and exploitation of space capabilities to include dedicating personnel and funding to this role. Air Force efforts have been followed closely by the Marines in effectively and efficiently utilizing their dedicated space professionals in specific, space-related billets. The Army has recently started to take a more active role in creating their space professionals and placing these space professionals in billets that will utilize their extra training and education. Though the Navy is one of the larger users of space-borne assets and possesses a long-standing graduate level space systems education program, it frequently returns its degree-holding space certified professionals to non-space operational billets where their perishable space specific knowledge will go unused. Only recently has this been brought to the attention of the CNO and major changes in the assignment process of these space professionals begun to take place. Once educated, the proper assignment of these space professionals is crucial. As the JFCC-Space / STRATCOM / JSpOC reorganization continues it should be exactly that- JOINT. This environment allows not only for the representation of that service but also allows a cross-pollenization of knowledge between the services. These personnel issues are made even more challenging by the continuing GWOT and combat operations in the Middle East. In addition to these real-world, day to day operations, the space community must take a look at the long- term, bigger picture. Former Soviet Union (FSU), China, and many "third world" countries

are quickly growing to be forces that have the capabilities to effect and challenge us in the space environment and require us to focus long-term efforts in the areas of space situational awareness and targeting of these unknown, neutral, and enemy space systems. In a recent article in InfoDomain, VADM James D. McArthur Jr. stated

> Not only is this (a focused space campaign) essential for our current Force- it is vital to our future warfighters. We will be that outspoken advocate!"[6]

Properly trained space professionals assigned to the right positions will be able to answer this call; properly trained space professionals assuming duties as section-heads in non-space, intelligence or I0 billets will leave the call unanswered.

[6] Space Campaign Focuses on Future, InfoDomain, Summer 2006.

II. SPACE BATTLESPACE TARGETING COORDINATION

> The unqualified importance of information will not change in 2010. What will differ is the increased access to information and improvements in the speed and accuracy of prioritizing and transferring data brought about by advances in technology. While the friction and the fog of war can never be eliminated, new technology promises to mitigate their impact.
>
> General John M. Shalikashvili, Chairman of the Joint Chiefs of Staff, Joint Vision 2010, 1996

A pint of sweat saves a gallon of blood.

General George C. Patton

Since the advent of the computer, the Intelligence Community (IC) and combat planners have identified serious deficiencies in how to best organize and catalog the vast amount of information required for a proper targeting solution, as well as increase exchange of that information with other systems. These targets exist in both the terrestrial and extraterrestrial realms. The Modernized Integrated Database (MIDB) provides warfighters with the ability to put the right weapon on the right targets by providing the most up-to-date picture of the battlefield. According to senior leadership within the Intelligence Community, the theater CINCs, and CINC J-2s, database management is the community's number one issue. The Defense Intelligence Producer's Council (DIPC), chaired by the Defense Intelligence Production Functional Manager and consisting of principals from the Defense Intelligence Agency (DIA) – functional manager for the MIDB, the military Services, and the Unified Commands, has the responsibility to develop Department of Defense Intelligence Production Program (DoDIPP) policy. With that responsibility, it also has the authority to change database management policy and procedures

Although the predecessors of the MIDB were designed to mainly support nuclear targeting, today's MIDB is used to provide the basis for target identification, description, and selection to support commanders responsible for executing our national military objectives. Based on a 1995 National Intelligence Council (NIC) strategic assessment, the results of two surveys conducted by the DIA Deputy Director for Analysis and Production (DIA/DI), and lessons learned from Operations DESERT STORM, DESERT FOX, and ALLIED FORCE, significant deficiencies exist within the MIDB which negatively impact combat operations. Other complications related to database management were also evaluated during Operation ALLIED FORCE when the Chinese Embassy in Belgrade was inadvertently damaged on 7 May 1999 causing national embarrassment, increased international tension, human loss, and payment of $32.5 million in restitution costs for property damage.

In today's battlespace, technological advances have made it faster and easier to collect and disseminate targeting information, resulting in an overabundance of information through multiple databases – both civilian and governmental – at the multiple levels of war (strategic, operational, and tactical). Today's challenge is to correctly fuse these databases to a single source so targeting professionals can coordinate efforts and prevent targeting of protected areas for purposes of further exploitation. For example, a targeting development team for the Joint Forces Air Component Commander (JFACC) may decide that a strike on a communication tower is required to satisfy the commander’s guidance and intent. Once this information is loaded into the MIDB database the JFACC targeting development team discovers that the target is being exploited and recently has been identified as a no-strike target. Within the operational and intelligence communities this overabundance of information can lead to confusion over the best course of action rather than enabling a quick responsive decision.

The basics of database management and the MIDB:

The following definitions are essential to understanding the MIDB and how best to integrate it with current and future databases.

Extensible Markup Language (XML). Extensible Markup Language, is an advanced technology tool available to software and database developers that identifies specific data within a document or file. Currently, many of the Intelligence Community's products are posted on command or unit homepages using HTML (Hypertext Markup Language)[7]. HTML pages start and end with metatags that identify the page as an HTML document. For example, accessing a webpage using the "view source" function of any web browser will reveal the metatags at the top and bottom that look like this: <HTML>, </HTML>. These metatags simply allow a computer to recognize that a document is written in HTML and how to display it. Both XML and HTML are actually subsets of a broader "parent language" called Standard Generalized Markup Language (SGML). What XML can do is identify data more precisely on a webpage by placing metatags in front of and behind specific data. For example, within an XML page a set of geographic coordinates may look like this with the opening and closing metatags in bold font:

<COORD> 12-34-56.789N 123-45-12.345E</COORD>

Because of the <COORD> metatags, these geocoordinates can now be shared between multiple databases that recognize this string of numbers and letters as a defined and meaningful set of coordinates. This XML process breaks down an HTML page into separately identifiable "pieces of data" known as objects that a computer can recognize independently of the rest of the document or within a database. A good example of the XML metatag concept is the barcode and nutrition information on a candy bar. The computerized cash register recognizes the barcode and associates it with the price while a person

7 Norman Walsh, “A Technical Introduction to XML,” 3 October 1998, http://www.xml.com/pub/a/98/10/guide0.html. February 2007.

can tell what the contents of the candy bar are without having to open the wrapper. Both the human and the computer can identify the object based on the data printed on the outside.

This identification of data, or schema, allows the same piece of data to be shared among several documents and databases. Essentially, all independently identified data pieces or objects can be shared across different computer systems and each system knows how to display and store the shared data. This creates interoperability between various computer networks and systems since each piece of data is specifically identified through metatagging. By combining all the data pieces into one huge interoperable database, a knowledge sphere (KS), information sphere (Infosphere), or object-oriented environment (OOE) is created whereby data are stored and moved seamlessly between interoperable databases. These definitions outline the basic concepts for XML and allow flexibility in sharing data objects across multiple computerized display and storage systems. The military application of this technology is known as the "Ops/Intel Infosphere" by combining "friendly" operational data with intelligence about the enemy in one interoperable environment. The Ops/Intel Infosphere is an interoperable environment designed to meet the goals outlined in Joint Vision 2020, including the establishment of a Common Operating Picture (COP) of the battlespace to support the targeting and commander's decision making processes.

Modernized Integrated Data Base (MIDB). The MIDB is the Department of Defense's analytical tool used for tracking data related to facilities of interest around the world. Until recent developments in software integration XML was the choice of software over SYBASE due to the latter’s lack of interoperability among computer networks and systems. The MIDB system has been designed by the Department of Defense (DoD) as the migration system for the production and analysis of the general military intelligence database[8]. This program replaced the

[8] United States, Department of Defense, U.S. Air Force, USAF Intelligence Targeting Guide, Air Force Pamphlets 14-210, 1 February 1998.

Military Intelligence Integrated Data System/Integrated Database (MIIDS/IDB) and integrates data and applications from over 50 other existing intelligence database systems from multiple commands and agencies into a common baseline. The MIDB program objective is to provide a controlled set of common data elements and applications which permit rapid, accurate exchange and analysis of intelligence information at production centers, joint commands, service components, and tactical units.

The original definition of MIDB is derived from MIIDS/IDB. Per Joint Pub 2-01.1:

Military Intelligence Integrated Data System/Integrated Data Base (MIIDS/IDB). An architecture for improving the manner in which military intelligence is analyzed, stored, and disseminated. The Integrated Data Base (IDB) forms the core automated data base for the Military Intelligence Integrated Data System (MIIDS) program and integrates the data in the installation, order of battle, equipment, and selected electronic warfare and command, control, and communications files. The IDB is the national-level repository for the general military intelligence information available to the entire Department of Defense Intelligence Information System community and maintained by DIA and the commands. The IDB is kept synchronized by system transactions to disseminate updates, also called MIIDS/IDB[9].

Similar to the original MIIDS/IDB, MIDB provides the baseline general intelligence information that can be used for targeting analysis. Target systems analysis includes selection of critical nodes, targets, and networks (like highways, railways, inland waterways, telephone communications, electric power distribution, and pipelines for example) as well as critical infrastructure to include storage sites, airfields, air defense sites, government buildings, and military bases or barracks. MIDB is also used for tracking "no-strike" facilities protected

[9] United States, Department of Defense, Joint Publication 2-1.1, Joint TTP for Intelligence Support to Targeting, 9 January 2003.

under the Laws of Armed Conflict such as churches, embassies, and hospitals. MIDB users - like intelligence producers, analysts, and targeteers - store, track, access, and assess MIDB data.

Unless specified for space related targeting the term "targets" are generally fixed objects or networks known as installations or facilities, except when the term "target" is associated with imagery intelligence (IMINT). The following basic MIDB terms used for targeting purposes are defined and their relationships are explained below: installation, facility, BE Number, category code, and O-suffix.

Installation: An installation is defined as a Facility or group of Facilities in a specific geographic area and within reasonable proximity which support a general functional purpose, collective activity, or mission. For example, a petroleum production area composed of all the collocated activities of storage, processing, cargo loading, and unloading would constitute an Installation; an air base and all the collocated activities of headquarters, barracks, commissary, motor pool, and airfield would constitute an Installation; an airframe production plant and all collocated activities of production, research testing, evaluation, storage, and repair would constitute an installation. The installation definition process in the end is an intelligence call based upon analytical review of the information available[10].

Facility: A Facility is a fixed property entity performing a unique function consisting of one or more of the following: a building, structure, a utility system, pavement, or underlying land. For example, the specific functional activities associated with a petroleum production Installation, such as a petroleum storage area, crude oil storage, the refinery, the pumping station, etc. are separate

[10] United States, Department of Defense, Joint Publication 1-02, DoD Dictionary, 262, 12 April 2001.

Facilities; on an air base, the airfield, collocated headquarters, additional Facilities such as weapons storage areas, missile sites, and electronic sites are all separate Facilities[11].

A facility is uniquely identified in the database by an OSUFFIX. Each facility is assigned a CATEGORY (or CATCODE) to classify the function or purpose of the facility. The definition of a facility provides no direct correlation with physical buildings. There may be several buildings collocated functioning as barracks. In this case, the group of buildings would function as a barracks. In this case the facility would receive a single facility code. Conversely, there may be a single building processing several different ferroalloys. In this case, a single building would receive several facility codes, one for each ferroalloy.

Differences between Installations and Facilities: The difference between an Installation and a Facility is a critical difference in MIDB. An Installation is uniquely identified by a BE NUMBER. A Facility is uniquely identified by the combination of a BE NUMBER and OSUFFIX. (The MIDB Installation record will always show DDOOO in the OSUFFIX field and 00000 in the Category Code field.) Every Installation must have at least one Facility, and a Facility cannot exist without an Installation. The number of Facilities at an Installation is limited in only one aspect. Only those Facilities within the physical geographic boundaries of an Installation shall be assigned to that Installation. The physical geographic boundaries of an installation may be physical (i.e., enclosed with a perimeter fence), or implied (i.e., a perimeter defined by analytical experience.) For purposes of space targeting there would have to be cross service/agency agreement on the specific definition of what makes a space target a space target for targeting by any resource (ISR, EW, IW, etc).

Historical use of the IDB/MIDB focused on targeting nuclear weapons against large installations or complexes where precision was not a significant factor. However, facilities are becoming more important to targeting due to

[11] United States, Department of Defense, Joint Publication 1-02, DoD Dictionary, 202, 12 April 2001.

advancements in precision munitions and the growing use of MIDB to conduct non-nuclear targeting. In many cases, an installation may contain several facilities, each with different functions. For instance, an installation such as an airfield may have several facilities on it: a control tower, aircraft hangars, parking areas, air defense sites, fuel storage, ammunition storage, maintenance areas, barracks, headquarters buildings, base operations, dependent family housing, and one or more runways. To specifically identify each facility on an installation, a further subdivision of unique identifiers was implemented called the OSUFFIX or O-SUFFIX. This allows different facilities on an installation to share the same BE number and CATCODE but still uniquely identify each facility. Similarly with a space target the primary platform will have a BE number with each subsystem being assigned its own OSUFFIX. For example a satellite has an S-Band communication package and a Ku-Band communication package. The satellite itself would have a BE number of XXXXSDXXXX, the S-Band communication package would have an OSUFFIX of XXXXCDXXXX and the Ku-Band communication package would have an OSUFFIX of XXXXVDXXXX. Within MIDB under the "Space" category you could do a query of systems with S-Band communication packages and the database would return all related search results by OSUFFIX numbers.

Basic Encyclopedia Number (BE NUMBER, BENUMB or BENUM). A BENUM is a 10- character code that identifies a specific installation within a geographic area based on the "combination of the WAC [World Aeronautic Chart] number and the originator code plus machine generated numbers."[11] BENUMs are part of the basic, "Logical Record Identifier" used to specifically label each installation within MIDB that are used by the targeting community to perform nodal analysis and track targets. MIDB uses Basic Encyclopedia Numbers or BE Numbers to track individual installations for use in providing a simple, unclassified, unique identification number for each installation or network that can be shared over open telephone and computer networks when they are not associated with specific information about the installation.

Category Code (CATEGORY, CATCODE or IDHS Code). Facilities are described by their functionality through the use of a five-digit code known as a Category Code (CATEGORY or CATCODE).

CATEGORY is a system used to differentiate a facility by its product or the type of activity in which it is engaged. The classification system identifies a data code and data items for each specific facility function. The data code is based upon an initial breakdown of facilities into nine major groups[12].

O-Suffix (OSUFFIX). "A machine generated alpha numeric identifier to distinguish different facilities from one another on the same installation." OSUFFIX is a combination of a two-letter code of the originating intelligence producing agency and a four-digit, consecutively sequenced number for each new facility identified by the originating agency at that installation[13].

OSUFFIX is not only important for specifically identifying separate facilities on an installation, but also for distinguishing between facilities with the same function, such as identifying each of two runways at an airfield-for example, one small, unused runway and a main runway. In this example, the center point of the main runway (Facility) for a multi-runway military fighter base (Installation) in an enemy country can be described as:

> BENUM 1234AA5678, XYZ AIRFIELD (Installation), XYZ AIRFIELD MAIN RUNWAY (Facility), CATCODE 80000, OSUFFIX BB0001 at COORD 12-34-56.789N 123-45-12.345E.

Likewise, the unused runway may be identified as:

[12] Unites States, Defense Intelligence Agency 65-3-1, “Standard Coding Systems Functional Classification Handbook”, 17 May 1985.

[13] Ibid.

BENUM 1234AA5678, XYZ AIRFIELD (Installation), XYZ AIRFIELD AUXILIARY RUNWAY (Facility), CATCODE 80000, OSUFFIX BB0002 at COORD 12-34-56.000N 123-45-12.000E[14].

From the space target development perspective, the most important data contained in the MIDB is the basic naming nomenclature to identify a specific spacecraft with its respective functions, signals of interests, and orbit. Therefore, the minimal amount of data needed to begin the target nomination process are the BENUM, SATELLITE NAME, TTC FACILITY NAME (F AC NAME or "target" name), CATCODE, OSUFFIX, and the geographic coordinates (COORD) of the support installation(s). These six data fields in MIDB contain the basic information and naming nomenclature needed for targeting to assist in target selection, nodal system analysis, and eventually OPLAN, ATO, or fire support mission production. However, it is important to note that MIDB does not contain any data on specific targeting aim points such as a specific building in a group of buildings with the same functional CATEGORY, OSUFFIX, and Facility Name. MIDB does not contain accurate coordinates and other data for precision engagement for individual "targets" subordinate to a facility designation.

Two additional definitions needed to understand the targeting process are related to MIDB and intelligence production within the Department of Defense (DoD): DoDIPP and RESPROD:

The Department of Defense Intelligence Production Program (DoDIPP) establishes the policies, procedures, responsibilities, priorities, and relationships for the Defense Intelligence Production Community, to fulfill its role of supporting warfighters, policy makers, and defense acquisition / force development.

[14]Unites States, Defense Intelligence Agency 65-3-1, “Standard Coding Systems Functional Classification Handbook,” 17 May 1985.

The Department of Defense Intelligence Production Program (DoDIPP) establishes policies, responsibilities, priorities, procedures, and relationships for the DoD Intelligence Production Community (DoDIPC) to fulfill its preeminent role of supporting the warfighter. It also establishes community-wide goals, guiding principles, and standard procedures to satisfy the full range of foreign military and military-related intelligence requirements of customers of military intelligence in support of defense acquisition and defense policymaking. The goal of the DoDIPP is to shape a functionally integrated and seamless military intelligence community to ensure the best quality intelligence support to customers in the most complete, responsive, and efficient manner possible. The Responsible Producer, or RESPROD, is the intelligence production center that maintains the data on any given intelligence topic. An MIDB production analyst assigned to a RESPROD is involved in the creation of new records, modification of already existing records, and deletion or inactivation of records.

RESPRODs are obligated to follow the Shared Production Program (SPP) rules and regulations established by the Defense Intelligence Producers Council (DIPC). RESPRODs use the MIDB Standard Operating Procedures (SOP) to determine which data elements must be filled in for each record. The data in MIDB are generally used to simultaneously support all of the following twelve functional activities defined by the DIPC:

> Single Integrated Operational Plan (SIOP), precision strike, major regional contingency (MRC), small-scale regional contingency (SSRC), peacemaking/peacekeeping, ops/deployment support, force modernization/force planning, counterproliferation, special missions, disaster relief, humanitarian operations, and NEO [noncombatant evacuation operations][15].

RESPROD is used by MIDB to indicate the production center responsible for maintaining the information for a facility or installation record. Only one primary production center can be assigned at a given time to a facility/installation

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[15] Brian Shellum, "Defense Intelligence Crisis Response Procedures and the Gulf War," 1996.

record to prevent overlapping analysis and provide a single data entry control point for each record in the database. RESPRODs are essentially managers of the data in MIDB but do not necessarily conduct their own quality, accuracy, or precision checks on the data. RESPROD is assigned under the DoDIPP process and posted on Intelink, the Intelligence Community's classified Intranet. RESPROD responsibilities include accomplishing the required production for the combination of both substantive topics (known as Intelligence Functional Codes or IFC) and geographical areas such as countries or nation-states. Defining the three dimensional area of space is the challenge. RESPRODs complete original research on intelligence topics and produce documents or shared national-level database information (such as MIDB). They also provide analysis and substantive judgments in response to customer requirements when validated. Currently there are multiple databases that are being integrated with MIDB.

A few definitions are needed to focus on the problems associated with MIDB and specifically space effects based targeting. Most importantly, an understanding of the targeting cycle and related requirements are necessary to assess the effectiveness of XML and MIDB. The basic targeting cycle begins with the commander's guidance and objectives. This is what the CJTF or CINC wants to accomplish during strategic planning. The next step is target development - the target selection process based on the needs of the commander's objectives and guidance along with the production of target materials including imagery, maps, and details about the target. Target development is the main area of concern related to this thesis but it will also have implications for the remaining steps of the targeting cycle since the cycle continues to repeat itself until all the objectives are satisfied.

Target development is followed by the weaponeering process, which determines the type of weapon or weapon effect to be employed to achieve the required result required by the commander's objectives. Force application is the next step in which the appropriate units are tasked to provide specific weapons and delivery platforms to accomplish the objectives and where ATO and fire

support missions are developed. After the weapons are employed during the execution planning and force management phase, the final phase is the assessment phase. It is comprised of three sub-steps: Battle Damage Assessment (BDA), Munitions Effectiveness Assessment (MEA), and Mission Assessment (MA)[16]. Assessment aids the commander by recommending a re-attack or shift in objectives before the targeting cycle repeats itself.

Although MIDB was not specifically designed to accomplish the steps in the targeting cycle, it is the main source for target development for the CINCs. Several different targeting databases are used by the various commands, however the basic intelligence information for targeting is derived from the MIDB in most cases. MIDB data is completely separate from the data used for collection management (Requirements Management System or RMS), as well as imagery intelligence (IMINT) or signals intelligence (SIGINT) products and related systems. Overall, when MIDB is properly populated and utilized by the IC community it is an effective tool for targeting, adding the three-dimensional challenges of space make coordination and utilization of a shared targeting database more essential. The addition of Space targeting information to this database will continue to be challenged by the various SAP/STO programs in which they reside, further increasing the need to have a SAP/STO cleared space professional on the targeting development team.

[16] United States Department of Defense Joint Publication 3-60, Joint Targeting, 2007.

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III. SPACE CADRE TRAINING AND EDUCATION

> The Americans will always do the right thing... after they've exhausted all the alternatives.
>
> Winston Churchill, Sir (1874-1965)

> Develop and advance a cadre of personnel with specialized expertise in space operations and space systems development.
>
> Dept of the Navy Policy (1993)

Since the beginning of the space race the United States has always found itself trying to make the best use of rapidly advancing space technologies and to keep educated space professionals in positions to best serve the DoD. Due to the vastness of this topic this chapter will only discuss the space professions being trained and utilized by the Army, Navy, Air Force, and Marines.

This section will answer the following questions:

1. Are the service space professionals properly trained to be able to execute current space targeting initiatives and satisfy the growing space requirements?

2. Are those trained space professionals being properly utilized by their various services?

Since the beginning of the space race, there has been an increasing number of space professionals needed to continue the scientific and operational study of this area for military and civilian purposes. Adding the additional challenge of targeting in this environment adds more complexity requiring highly educated space professionals. Each service has answered DoD's call for these

space professionals with varying levels of vigor and success. In this chapter we will discuss how each service prepares their service members for this duty.

Air Force: The Air Force has been designated by DoD as the Executive Agent for Space. The DoD Space program comprises 5.4% of DoD's total funding ($22.7 Billion for FY 2006) of which the Air Force receives 92.6% ($20.1 billion of this money) of this money[17]. For financial reasons alone the Air Force organizes, equips, and trains the largest number of space professionals in the DoD. They have the following schools to educate their senior leadership and space cadre:

Space 100 - Space 100 is the basic indoctrination into space operations.

Space 200 - Space 200 is the second course specifically developed to answer the Space Commission's recommendation to develop a cadre of space professionals. Space 200 is a four-week course offered 14 times in FY '07 providing students a broad space background in areas such as warfighter integration of space power, and significant technical, nuclear and acquisition content. The target audience is DoD civilians and military at the 8-10 yr point[18].

Space 300- Space 300 is the 15 day capstone course offered nine times in FY '07 for space professional development at the NSSI. Designed for space professionals at the 13-15 year point, Space 300 is a thinker's course, primarily using guided discussion techniques to teach tomorrow's space leaders to solve problems of space bearing on national security[19].

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[17] United States, General Accounting Office, Report to the Secretary of Defense. Military Space Operations: Planning, Funding, and Acquisition Challenges Facing Efforts to Strengthen Space Control. Washington: GAO, 2002.

[18] United States, DoD, USAF, Air Force Space Command. 20 March 2007 < http://www.afspc.af.mil/> May 2007.

[19] United States, DoD, USAF, Air Force Space Command. 20 March 2007 <http://www.afspc.af.mil/>. April 2007.

Space Fundamentals Course- The Space Fundamentals Course (SFC) is a 2-week familiarization course for all branches of service designed for all military and civilian personnel that provides an educational and training bridge for new space support personnel or those within operations with little space exposure[20].

Space Operations Course- the SOC is a two-week course providing a common picture of space operations to DoD personnel from diverse backgrounds, services and agencies. This course highlights capabilities, limitations, vulnerabilities, applications and employment considerations of the numerous space systems integrating space power into military operations. The SOC is an AFSPC AEF training resource[21].

Space Operations Course Mobile- The purpose of the Space Operations Course Mobile (SOC-M) is to provide the students a broad awareness of the capabilities, limitations, vulnerabilities and applications of DoD, national, commercial and foreign space systems. The SOC-M has core lessons designed to provide a foundation of information on how national security strategy, military doctrine and strategy and campaign planning and employment are enabled by space capabilities[22].

Space Operations Executive Level Course- SOC-Es are designed for senior MAJCOM staff personnel, NAF and CAF commanders, senior-ranking individuals new to the space operations career field, or those simply requiring a

[20] United States, DoD, USAF, Air Force Space Command. 20 March 2007 <http://www.afspc.af.mil/>. April 2007.

[21] United States, DoD, USAF, Air Force Space Command. 20 March 2007 <http://www.afspc.af.mil/>. March 2007.

[22] Ibid.

refresher course in the capabilities, limitations and vulnerabilities of critical DoD, National, civil and commercial space systems[23].

In addition to these formal resident courses the Air Force has classes at both the Air Force Institute of Technology (AFIT)[24] and at the Center for Space Studies and Research. All Air Force Space courses provide an excellent baseline for the target student or compliment the education/experience of the attendees. Space targeting adds an extra challenge and interpolates both the disciplines of space and targeting. Currently there is no formal education track for the training of any personnel on how to target objects in space but of all of the services the Air Force is best postured to take on this role. Upon assignment of the space designator or graduation of the multiple space courses the Air Force Officer will spend most of their career in or around a space related field. The Air Force is trained, ready, and able to meet the growing needs of Space with the exception of space targeting. Though they have the bodies and training in various areas there remains the need to integrate personnel to form a space targeting cell capable of front-loading electronic target folders (ETF's) and giving the commander another tool to use in his development of the campaign or conflict.

Army: The Army started the Functional Area 40 (FA 40) program in FY 1999, pulling personnel from multiple specialties, to "ensure the Army's Space Operations Officers were thoroughly trained and assigned effectively to meet the needs of Joint and Army Commanders"[25]. Note the term "assigned effectively"; the Army does an outstanding job of educating and properly utilizing their space professionals. With their aggressive FA 40 program they have been able to organize, train, and lead the organization and integration of the Space Support

[23] United States, DoD, USAF, Air Force Space Command. 20 March 2007 <http://www.afspc.af.mil/>. May 2007.

[24] United States, DoD, USAF, Air Force Institute of Technology. 3 May 2007 < http://www.afit.edu/>.

[25] United States, DoD, U.S. Army Space Policy, April 2003.

Teams (SSTs) which provide space support directly to the COCOM's. The Army currently has over 170 FA 40 officers assigned to approximately 30 Army, Joint Commands, and DoD organizations with plans to qualify another 2250 in the next few years. These include those filling and leading the Space Support Teams (SST's) providing space support to COCOM and JTF Commanders under the direction of the Space DIRFOR.

Marines: The Marine Corps has the fewest number of Space Systems Operations (SSO) Officers with 19 active duty officers. These officers earn the MOS 8866 by attending the Naval Postgraduate School (NPS). Upon graduation from NPS the Marines have a four-year payback tour, three years in a space related billet and one year back in their primary MOS. The Marine Corps also has 39 active duty officers designated Space Operations Staff Officers (MOS 9933). These are officers that have experience in a space related field and, due to the increased requirement of space professionals, are utilized when a Space Operations Officer (MOS 8866) is not available. Though the Marine Corps is the smallest branch it is placing its SSO officers in critical billets providing the most impact for the Marine Corps while increasing its number of personnel assigned to the NPS studying the SSO curriculum. Though trained in targeting the Marine Corps does not have the manpower, money, or resources to create or maintain a space targeting cell.

Navy: The Navy currently has approximately 1000 Space Operations and Engineering Officers (active and reserve) assigned to numerous positions in the Navy, Joint, and DoD Commands. Their officers, like the other services, attend NPS and graduate with a Master's Degree in either Space Systems Operations or Space Systems Engineering. This is where the Navy Space Cadre becomes disjointed. By agreeing to attend NPS for their Master's Degree in a Space Systems curriculum they incur a payback tour in a space billet sometime in their career. There are two problems with this. First, the Navy considers NPS a shore

tour and upon graduation want their senior O-3's and junior O-4's back in the fleet immediately following graduation from NPS. When they return to their primary MOS, they fall under the assignment responsibility of their "detailer," whose job it is to assign qualified Navy officers to positions. Though they are highly encouraged to ensure the officer completes his payback tour, that is seldom seen through or assigned years after graduation. The knowledge learned at NPS studying Space Systems is very perishable. Utilizing it years after the instruction was given is setting the officer and whom he is working for up for limited success. The Navy does an excellent job or educating its officers but a very poor job of utilizing them, providing little or no "bang for the buck".

Overall the DoD Space Cadre has answered the call for Space Professionals but due to funding, the Global War on Terrorism (GWOT) and overall shortages in manpower the DoD is becoming more and more ineffective in a field that continues to grow by leaps and bounds. In 2004 testimony before the Strategic Forces Subcommittee Dan Bursh, (USN/Retired) testified to the increasing requirements put upon space professionals and the challenges of the services to effectively assign them:

> The Joint Space Advisory Group, or academic group, was formed as part of the AFIT-NPS alliance. When we first started getting together at the end of this year, we quickly realized that the scope of our charter would probably end up expanding beyond AFIT and NPS, not just to look where graduates go after our schools, but also looking at what they are getting from service academies and other Institutions."[26]

The 2002-2005 Defense Space Activities Report to Congressional Committees created by the United States Government Accountability Office reiterates the increasing need for these space professionals. Due to the increased pace of space technologies, there are more positions available than there are bodies to fill them. From a military standpoint, better utilization of DoD

[26] United States, Space Cadre/Space Professionals, Hearing Before the Strategic Forces Subcommittee of the Committee on Armed Services, House of Representatives, Testimony of Dan Bursch, USN/CAPT. 22 July 2004.

space professionals in positions to increase the commander's situational awareness and able to recommend "non-kinetic space options," will increase our chances of satisfying strategic, operational, and tactical goals with less collateral damage, but only if those space professionals are assigned positions where their expertise can be utilized by the commander.

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IV. SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

> From the dawn of time, a key to victory on the battlefield has been to control the high ground. Space is the ultimate high ground.
>
> Secretary of Defense Donald H. Rumsfield
> Testimony prepared for the House Armed Services Committee
> 2003 Defense Budget Request
> February 6, 2002

Throughout this thesis there were specific issues discussed and options weighed. In their finality, the below are the questions asked and recommendations provided based upon research findings, interviews, and multiple readings of where space based targeting is and where it should be going.

This thesis describes shortfalls and mismanagements in the targeting cycle as it relates to utilizing space professionals and the information they can provide, as well as space based targeting effects. This shortage has only recently (openly) been identified as a critical shortfall and assigned as a matter of point from Gen Cartwright (Commanding General, USSTRATCOM) and Gen Shelton (Commanding General, JFCC – Space) as taskers to JFCC-Space. As we continue to grow more and more dependent on military, governmental, and commercial space assets; it is only reasonable to identify this as one of our growing centers of gravity if not a critical vulnerability.

1. Why should we be concerned with targeting effects in the space environment and by what process (who and where) should accomplish this "mission"?

There has been an exponential increase in the number of spacecrafts launched and utilized while the number of target intelligence analysts has decreased significantly with the multiple reorganizations of U.S. Space Command (SPACECOM), U.S. Strategic Command (STRATCOM), the Joint

Space Operations Center (JSpOC), and Joint Functional Component Commander Space (JFCC-Space). There needs to be a concerted effort put forth by commanders to challenge their operation/intelligence teams to engage the use of space as a viable option. From the standpoint of targeting, having a space professional sitting on the Joint Targeting Coordination Board (JTCB) is crucial as well as providing his expertise to the members of the board further educating these junior and senior leaders alike. Gone are the days when a targeting board should echo "I want that target destroyed" when one should be hearing "what effect do you want to produce." More times than not it will be a kinetic solution and/or involve Special Operations Forces (SOF), but the times that are going to be most crucial are when you need an effect on a target, that from previous nodal analysis, can only be effected from space.

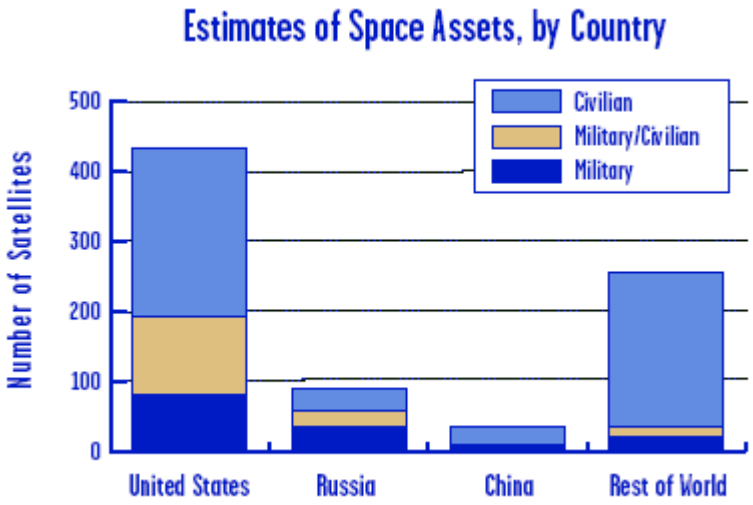

Figure 4. 2004 Estimate of Space Assets

Recommendations:

Targeting: Continue to cross pollinate space cadre with targeting professionals to ensure the expertise is located in the right place at the right time (now). Coordinate a space targeting cell to be located at the Joint Warfare Analysis

Center (JWAC), Dahlgren, VA, where most of the analytical expertise already resides. Inherent to this space target development team should be representatives from NSA, NGA, and DoD with expertise from the following disciplines; MASINT, SIGINT, IMINT, aviation and general intelligence analysts. They should be tasked to begin to create EFT's on all known space assets utilizing all assets inherent to intelligence gathering to create and post these targeting folders to SAP/STO databases accessible by "read-in" Space Cadre personnel. As time and resources allow begin to build JSpOC and JFCC-Space to allow them to be manned and trained to continue to build and update these Space EFT database as required.

Training and Education (T & E): All services are meeting the required quotas for school seats at the various Air Force and Navy Space Schools. This should be continued and numbers increased as seat availability increases. The Air Force, Army and Marines are assigning their recently graduated space cadre members with space related follow-on assignments, but the Navy needs to re-engage how it utilizes it space cadre. Many U.S. Navy students in the Space Systems curricula at NPS are not being assigned to positions in which they will be able to use their recently earned degree adding to a "I'm being assigned as a department head after this so I'll never use this" mentality. This results in a "why do I need to really learn this if the Navy isn't going to let me use it" attitude. CNO needs to release detailed guidance on the assignment of these space cadre personnel upon their graduation from NPS. Until then the Navy Detailer and Space Cadre Advisor with NETWARCOM guidance need to work together to identify follow-on space tour opportunities while the Space Student is attending the space curricula but also in his/her subsequent fleet tour. It is unrealistic to think there will always be a space related billet available upon graduation for every Navy Space Cadre student

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