Military Space Culture

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The information presented in this paper is based on research done by the author. Although it was prepared for the Commission in conjunction with its deliberations, the opinions expressed in this paper are those of the author alone and do not represent those of the Commission or any of the Commissioners.

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I. Introduction

Since its inception, the hallmark of the U.S. military space program has been world-class scientists, engineers and operators. Sustained excellence in these disciplines is essential to the future of the nation's national security space program. It cannot be taken for granted.

Today, space is becoming a medium for military operations in its own right—much the same as land, air and sea—not simply a place from which information is acquired and transmitted or through which objects pass. New capabilities will be developed that can deter attack on and defend U.S. national interests and many of these capabilities will be based in space. Our nation will need to project power from space and respond to events anywhere on earth. A military space plane could use non-nuclear means to attack terrestrial targets within minutes, depending on its launch characteristics, ability to maneuver, or number deployed. Lasers from space could conduct strike operations against terrestrial targets at the speed of light. Unlike weapons from ships, aircraft, or land forces, space missions could occur with almost no transit, information or weather delay. In the future, the true advantage will belong to the first nation that best learns how to effectively build and use these advanced space capabilities. As in the past, ultimate success will depend on the experience, training, education, and vision of the leaders responsible for the success of our national security space program.

The space capabilities described above will cause military space professionals in the future to shoulder a heavier burden than their predecessors. To wring the greatest capability out of the medium of space they will have to master highly complex technology; develop new doctrine and concepts of operations for space launch, defensive space operations, power projection in, from and through space and other military uses of space; and operate some of the most complex systems ever built and deployed. Space leaders will need to understand how space power interacts with all U.S. capabilities in the pursuit of national objectives, as well as how U.S. space capabilities might be used as the primary instrument of power in pursuit of U.S. objectives. To ensure the needed talent and experience, the Department of Defense (DoD), the Intelligence Community and the nation as a whole must place a high priority on intensifying its investments in career development, education, and training to develop and sustain a cadre of highly competent and motivated military and civilian space professionals.

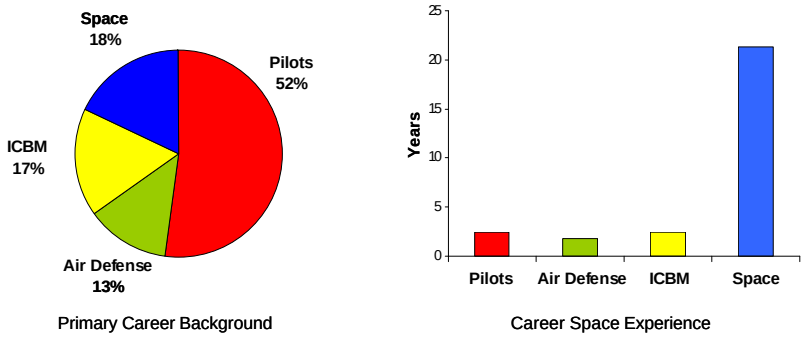
This paper examines military space culture issues addressed by the Commission to Assess United States National Security Space Management and Organization in more detail than possible in the Commission's main report. The paper expands upon issues pertinent to and supportive of the Commission's tasks. Specifically, it explores steps required to recruit and develop the cadre needed to lead future military space activities.

II. Experience of Space Leadership

The Department of Defense is not yet on course to develop or maintain the space cadre the nation needs

The Department of Defense is not yet on course to develop or maintain the space cadre the nation needs. DoD must create a stronger military space culture through focused recruitment, career development, education, and training within which the space leaders for the future can be developed.

In highly valued operational military career fields, such as Air Force pilots and Navy nuclear submariners, military leaders have spent about ninety percent of their careers within their respective fields. In contrast, among those holding military leadership positions in DoD's largest space organizations, there is little space experience. The lack of experience is most acute at the senior levels of DoD's operational space organizations. A review by the Commission of over 150 personnel in key space jobs found that over 80 percent of the flag officers come from non-space backgrounds and that as a group they average only about 8 percent of their career in space-related duties (Figure 1).



Flag Officers in Space Operations Positions

Source: Commission

Figure 1: Career Space Experience of Flag Officers

The merger in 1994 of the Air Force's space operations and intercontinental ballistic missile career fields offered more opportunities for operational positions, but at the same time it had an impact on the overall level of experience of space personnel. This was especially true of officers commanding operational space wings, groups, and squadrons. A review of records shows that roughly two-thirds of the commanders had spent less than ten percent of their careers in space assignments (Figure 2). New space personnel management policies and new career paths are needed to develop leaders with greater depth and breadth in the space career field.

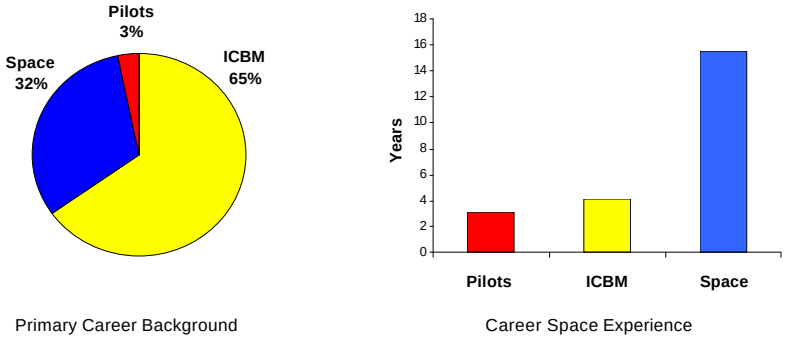


Figure 2: Career Space Experience of Air Force Field Grade Officers

III. Developing a Military Space Culture

The American people will expect the leaders of tomorrow's space organizations to have extensive experience in their field, especially in an era where space weapons are likely. However, existing space career paths within the DoD do not provide the depth and breadth of experience necessary to support future space operations.

The Army and the Navy have each developed space cultures, but their small relative size limits their impact on the overall military space culture. Because of the overwhelming size of the Air Force space program relative to the other Services, it has the dominant impact on military space culture.

A. Air Force Space Culture

Eighty-five percent of space-related budget activity within the Department of Defense, approximately $7 billion per year, resides in the Air Force.[1] The Air Force provides the facilities and bases and operates and maintains its assigned space systems to support the operational requirements of the U.S. Combatant Commands. These activities include surveillance, missile warning, nuclear detection, position, navigation, timing, weather, and communications. The U.S. Air Force launches satellites for DoD and other government agencies and is responsible for air and missile defense and space control operations. The Air Force does not develop, acquire, or operate the space-based reconnaissance satellites on which it and the other Services rely for precision targeting, location, and battlespace awareness. Those systems are developed, acquired, and operated by the National Reconnaissance Office.

Within the Air Force, space-related activity is centered primarily in four elements. Space systems operations and requirements are organized under Air Force Space Command (AFSPC). The 14th Air Force launches the NRO, DoD and selected civil satellites and provides range support for commercial satellite launches. The 14th Air Force also provides space-based support to the CINCs, and supports NORAD by providing missile warning and space surveillance information. Air Force Space Command develops all Air Force space requirements and works with the other Services in developing their requirements.

Personnel assigned to the Space and Missile Systems Center (SMC) under Air Force Materiel Command design, develop, and acquire space launch, command and control, and satellite systems. The Program Executive Officer for Space and the SMC Commander, who also serves as the Designated Acquisition Commander, report to the Assistant Secretary of the Air Force for Acquisition on the cost, schedule and performance for

[1] *Space 101 Briefing*, Briefing presented to the Space Commission, Washington DC, 26 Jul 2000.

the programs in their portfolios. The Air Force Research Laboratory, also part of Air Force Materiel Command, conducts advanced technology research.

The Air Force role as the lead service for space dates to the 1950s with the creation of the Air Force Research and Development Command—the predecessor to Air Force Systems Command.[2] The Air Force has since made a series of adjustments in the organization of its space activities. In many cases, these responded to a growth in responsibilities for space operations and space mission management. In 1982, for example, the Air Force Space Command was created because of growing dependence on space, the evolving threat from the Soviets, the growing space budget, and a perceived need to "operationalize" space.[3]

One of these steps must be the creation of a culture dedicated to developing new space power theory, system concepts, and doctrine.

Despite official doctrine that calls for the integration of space and air capabilities, the Air Force does not treat the two equally. The Commission heard testimony that there is a lack of confidence that the Air Force will fully address the requirement to provide space capabilities for all the Services. Many believe the Air Force treats space as a supporting capability that enhances the primary mission of the Air Force, which is to conduct offensive and defensive air operations. Instead, the Air Force should take steps to foster the full development of space power by placing space on an equal footing with air. One of these steps must be the creation of a culture dedicated to developing new space power theory, system concepts, and doctrine.

1. Historical Perspective

It has only been 43 years since the Soviet Union launched the world's first satellite into orbit, 18 years since the creation of Air Force Space Command (AFSPC), 15 years since the creation of U.S. Space Command, and 10 years since the Persian Gulf War, often called the first space war. When compared to other career fields, space is relatively young and

[2] *Corona: America's First Satellite Program*, ed. Kevin C. Ruffner (Washington DC, CIA, 1995), p.4
[3] David N. Spires, *Beyond Horizons, A Half Century of Air Force Space Leadership*, Revised Edition, (Air Force Space Command with AU Press, 1998) pp 204.

immature. In addition, the space culture in the Air Force has undergone continuous change. To chart the best course for the future, it is helpful to understand the past and how changes have affected the space culture.

The Formative Era

In 1954, General Hap Arnold assigned General Bernard Schriever to command the Western Development Division (WDD) in Los Angeles, CA with initial responsibility to develop the nation's Intercontinental Ballistic Missile (ICBM) program.[4] This organization was the forbearer of all Air Force space programs and played a key role in early space reconnaissance capabilities. General Schriever and his early space pioneers built the Air Force's first launch vehicles and earliest missile warning, weather, and communications satellites. The Air Force in Los Angeles was also a major contributor to the National Reconnaissance Office's (NRO) early satellite reconnaissance efforts. Geographically, the hub was Los Angeles, but other key locations were developed such as the Air Force Satellite Control Facility (AFSCF) at Sunnyvale, California, several world-wide Remote Tracking Stations, and launch bases at Cape Canaveral, FL and Vandenberg AFB, CA.[5] The space professionals at these locations had strong engineering and technical backgrounds. They gained depth of experience by rotating through key jobs building satellites, launching satellites, and operating satellites. Rotational assignments were facilitated because all functions were under the same leadership using the cradle-to-grave approach. Cradle-to-grave meant that a single organization was responsible for all activities spanning the lifetime of a satellite program to include research, development, acquisition, launch, operations, and disposal. From the beginning, there was a cross flow of personnel between the Air Force acquisition organization in Los Angeles and the NRO's Air Force element, known as Program A. A strong bond existed between early Air Force space pioneers. Their common focus was to win the "Cold War" in an era when our Nation's survival was thought to be at stake. As a result, they developed a common culture and sense of connectedness.

[4] Bernard A. Schriever, "Military Space Activities Recollections and Observations," *The U.S. Air Force in Space, 1945 to the 21st Century*, edited by R. Cargill Hall and Jacob Neufel, (USAF History and Museums Program, Washington DC, 1998), p. 15.
[5] David D. Bradburn, "Evolution of Military Space Systems," *The U.S. Air Force in Space, 1945 to the 21st Century*, edited by R. Cargill Hall and Jacob Neufel, (USAF History and Museums Program, Washington DC, 1998), p. 61.

The Growth of Tribes

During the mid 1960s until the late 1970s some key changes occurred within the Air Force space community and three separate space cultures began to emerge. The largest and most mature remained the group that had originated in Los Angeles under Gen Schriever, but smaller space communities began to grow within Strategic Air Command (SAC) and the Aerospace Defense Command (ADCOM).

- Air Force and NRO space activities in Los Angeles, Sunnyvale, and the launch bases continued much as they did in the early 1960s. In addition to space research, development, and acquisition activities, the Air Force continued to conduct all satellite command and control activities at the AFSCF and Remote Tracking Stations. They also maintained their responsibility for most aspects of the satellite launch mission. Cross flow of some space personnel continued between the Air Force and the NRO's Program A, also located in Los Angeles. In many ways, the organizations were quite different, but they shared similar cultural and organizational philosophies. Coordination was facilitated because the Director of Program A was dual hatted as one of the deputy commanders within the Air Force organization.

- The most significant change during this era involved the assigning of new space missions to two additional Air Force commands, Strategic Air Command (SAC) in Omaha, NE and Aerospace Defense Command (ADCOM) in Colorado Springs, CO. Unlike their counterparts in Los Angeles, SAC and ADCOM did not conduct research, development, or acquisition of satellites. Their roles involved more operational space missions.[6] In these early days, SAC and ADCOM conducted a wide range of space activities such as:

  — Operating satellite systems (such as the Defense Meteorological Satellite Program (DMSP) weather satellites and the Defense Support Program (DSP) missile warning satellites)[7]

  — Operating ballistic missile warning radars[8]

[6] Bradburn, p. 62.
[7] Spires, pp. 155, 211.
[8] Spires, p. 156.

— Operating the Space Detection and Tracking System (SPADATS) operations[9]

— Operating an operational anti-satellite (ASAT) program (Program 437)[10]

— Conducting limited launch operations (Thor).

To support each of these missions, SAC and ADCOM needed a cadre of space personnel.

The Birth of the Space Operations Career Field

In 1970-71, the Air Force created a new space operations career field in the Air Force, designated by the officer Air Force Specialty Code (AFSC) 20XX. Primarily residing within SAC and ADCOM, this new career field was initially very small and consisted of a combination of some new accessions (i.e. newly commissioned lieutenants) and numerous crossovers from other Air Force career fields. Many of the cross flows came from the Air Defense Control field, but other career fields, such as engineering and intelligence, also contributed. As SAC and ADCOM matured their space missions, a new space culture began to develop separate and distinct from the research, development, and acquisition culture in Los Angeles.

The Ascendancy of the Space Operations Career Field

The 1980s saw the establishment of Air Force Space Command (AFSPC) in 1982 and United States Space Command in 1985.[11] AFSPC assumed control of the 20XX space career field and eventually assumed responsibility for all of the space operations in ADCOM and SAC. From a personnel and cultural perspective, this was a straightforward process, because AFSPC adopted many ADCOM and SAC personnel policies.

However, there were two events in latter half of the decade that impacted the Air Force space community. First was the transfer the Air Force Satellite Control Facility (AFSCF) and all of its Remote Tracking Stations from Space Division to AFSPC in 1987.[12] Second was the transfer

[9] Spires, p. 161.
[10] *Weapons in Space*, ed. Franklin A. Long, Donald Hafner, and Jeffrey Boutwell, (New York, W.W. Norton and Co, 1986), pp. 22-23.
[11] Spires, pp 205, 217.
[12] Spires, p. 232.

of the launch mission from Space Division to AFSPC in 1990.[13] The impacts caused by these changes continue to be felt within the Air Force. Space Division, whose heritage went back to the beginning of our nation's space program, felt the AFSCF and launch missions were core to their research, development, and acquisition missions. AFSPC took a different view and categorized their new missions at Sunnyvale, Vandenberg AFB, and Cape Canaveral as "operations." These decisions had numerous impacts.

- Because of the new missions, the 20XX space career field grew much larger and gained new flexibility in how it managed its personnel.

- AFSPC personnel viewed the mission transfers as strong steps toward operationalizing and normalizing space activities with those in the rest of the Air Force. They forged ahead with efforts to bring a new operational discipline to the space business.

- Space acquisition personnel found themselves on the outside looking in as the decade of the 1980s progressed. As more Air Force space missions migrated to AFSPC, senior leadership decided that AFSPC would not develop a career track for the space engineering personnel within the operational command. Air Force Materiel Command (AFMC) retained responsibility for the career tracks of all space engineering and acquisition personnel. This had a negative impact on the morale and space career paths of space engineering and acquisition professionals and reduced overall program continuity and expertise. It also limited the ability of AFSPC to perform legacy system operations not designed to be fully operational or sustainable.

- Cross flow of personnel between the launch bases, the Air Force Satellite Control Facility, and Space Division program offices slowed to a trickle. To a lesser degree, this also reduced the cross flow of space experts between Space Division and the NRO.

- New acquisition policies and legal requirements levied upon acquisition officers meant they were no longer able to pursue a space acquisition career. Instead, their new acquisition career paths consisted of jobs in space and non-space programs.

[13] Spires, p. 240.

- Some level of tension grew between the NRO and AFSPC. AFSPC did not share Space Division's long history of close support and common bonds with the NRO. The NRO depended on the Air Force satellite Control Network (AFSCN) and the launch bases, but were used to playing a dominant role in the operation of these functions.[14] AFSPC felt they were the operational command and should be "in charge" rather than accepting the role of supporting the NRO as a customer like Space Division had done.

- Over time, some organizations perceived a reduction in overall technical competency of Air Force space operations especially in the launch arena. This was viewed as an overall increase in operational risk by the NRO who responded in many cases by creating its own key processes to keep mission risk at levels they considered to be acceptable.

Continued Turbulence

The decade of the 1990s continued the pace of change within the Air Force space community. Below are the key changes and their impact.

- The re-organization of the NRO in 1992 disestablished Program A and moved most of the NRO's California-based functions to Washington DC. Senior government leaders thought disestablishing Program A, Program B (CIA), and Program C (Navy) were important steps to ending destructive competition between the Air Force, CIA, and the Navy elements of the NRO. However, this action had numerous unintended consequences for the Air Force space cultures within Space and Missiles Systems Center (SMC) (the successor to the Space Division) and the NRO.

  — Ending over 30 years of physical collocation between SMC and Program A caused the most obvious change. Physical collocation creates its own dynamic in the way that organizations relate to one another. The departure of the Air Force component of the NRO changed the relationship between the Air Force and the NRO.

  — The NRO re-organization also ended the dual hatting of the Director of Program A as the Deputy Commander of SMC. This

[14] Bradburn, p. 64.

change, combined with those described above, effectively ended the natural and regular cross flow of space personnel between SMC and the NRO. Certain levels of cross flow between the Air Force and the NRO continued to exist, but to a much smaller degree and in more limited areas than in the past.

— A less obvious change was caused by the nature of the new NRO. The 1992 reorganization created a new NRO organized according to functions (Imagery Intelligence (IMINT), Signals Intelligence (SIGINT), Communications, etc). NRO personnel from the Air Force, Navy, CIA, and other government agencies were dispersed throughout the new organization without regard to parent agency affiliation. The long standing Air Force, CIA, Navy identities within the NRO began to dissipate.

- The Persian Gulf War in 1991 was a watershed event for the recognition of the potential use of space at the operational and tactical levels of war. The war also shone a bright light on the lack of space integration into operational and tactical warfighting. The Air Force recognized the need to make changes to remedy the weaknesses and many of the changes involved the makeup, training, and focus of space personnel.

  — Gen Charles Horner, the commander of the Persian Gulf air war, was assigned as CINCSPACE in June 1992. Gen. Horner embarked on an effort to develop a new mentality within AFSPC and to break down the barriers between space and the rest of the Air Force. He challenged the status quo in every area where he felt change was needed. He spoke out against the overwhelming "national" focus of the Air Force and NRO space missions in favor of giving military commanders much greater say in the priority and use of national security space systems.

- The Air Force began assigning greater numbers of combat pilots into key space positions to bring a warfighting perspective to AFSPC. This further diminished leadership opportunities for career space professionals, but rated Air Force leaders gained some level of space experience that they were able to utilize in later assignments. The Air Force recognized that Air Force warriors needed space expertise and that space was crucial to the success of future air campaigns. Recent major air campaigns such as DESERT FOX in 1998 and ALLIED FORCE in 1999 demonstrated that the

efforts started by Gen Horner in 1992 paid handsome dividends years later. AFSPC's focus was firmly on the operational and tactical warfighter.

— AFSPC stood up new organizations such as the Space Warfare Center, Space Support Teams, and the Space Division of the Air Force Weapons School to assist in these efforts.[15] The major focus of these offices was to rapidly integrate space support capabilities into air operations.

— AFSPC also created 14th Air Force at Vandenberg AFB.[16] The 14th Air Force commander was also the Commander of Space Forces (COMSPACEAF) and functioned as the Air Force warfighting space component to USSPACECOM. COMSPACEAF continued to mature the Air Force warfighting focus of AFSPC and its people. New concepts for the command and control of space forces and their integration into the air campaign were developed and implemented. COMSPACEAF's primary tool in these efforts was the creation of the Aerospace Operations Center (AOC) at Vandenberg to interface with CINCSPACE and Joint Force Air Component Commanders (JFACC) around the world and to direct the operational Air Force space units supporting worldwide military operations.

The changes further exacerbated the growing trend towards less experienced and less technically trained personnel in key space positions.

The changes described above created undeniable benefits for the Air Force. They drastically improved the integration of space into the operational Air Force. However, the changes further exacerbated the growing trend towards less experienced and less technically trained personnel in key space positions.

[15] Gary R. Dylewski, "The USAF Space Warfare Center," *Spacepower for a New Millennium; Space and U.S. National Security,* ed. by Peter L. Hays, James M. Smith, Alan R. Van Tassel, and Guy M. Walsh, (New York, McGraw Hill, 2000), pp. 94, 97.
[16] Ronald Fogleman, "*Epilogue: Spacepower for a New Millennium; Space and U.S. National Security*," ed. by Pete Hays, James Smith, Alan Van Tassel, and Guy Walsh, (New York, McGraw Hill, 2000), p. 289.

The Space Operations and Missile Cultures Combine

The disestablishment of SAC in the early 1990s initially caused Air Force ICBM forces to be assigned to Air Combat Command. This move was short lived and ICBM forces were reassigned to AFSPC in 1994. Soon the decision was made to merge the space and ICBM career fields into a new career field known by the Air Force Specialty Code 13SXX. After nearly 25 years, the 20XX career field faded from sight. This decision had numerous impacts on the Air Force space culture.

- The first impact was the large increase in the number of personnel assigned to the command. The ICBM career field was twice as large as the space career field and AFSPC's new mass made it a much larger command.

- Second, the longstanding SAC heritage of the ICBM personnel was a tremendous benefit to the strength of their personnel records. They had developed finely honed processes to develop personnel and their records typically outshone those of their space counterparts. ICBM personnel competed better for key jobs and promotion and within a short period had assumed the majority of the leadership positions within AFSPC not occupied by rated officers.

- Last, the integration of the ICBM force into AFSPC infused the command with a culture that placed a premium on the types of skills that were necessary to command and control nuclear weapons. ICBM personnel operated in a system with rigid operational and weapons systems safety controls and mature logistics, depot systems, and operational procedures. These aspects of the ICBM culture had positive and negative impacts on the space culture.

  — The operational discipline brought into AFSPC by the ICBM personnel was applied to many Air Force space missions that sprung from the research, development, and acquisition culture within SMC. Sometimes these changes were beneficial, but in some instances, the changes were not made with a full understanding of their impacts.

  — Accompanying this new perspective was the accelerated move to reduce the AFSPC reliance on Air Force space engineers assigned to operational space units. Though this movement started in the early 1980s, it became more focused by the mid

1990s. The rationale being that mature operations could rely on good training, sound procedures, and strong logistics. By the mid-1990's reduced reliance on Air Force engineers in Air Force space operations was seen as an indication that efforts to operationalize space were successful. As a result, the number of engineers began to be reduced and they were forced to build their careers in AFMC, especially as the senior leadership had decided not to create career paths for them in AFSPC.

— When the infusion of ICBM personnel occurred throughout AFSPC, personnel policy began to reflect their culture. Highly developed and mature processes allowed the ICBM professionals to accomplish the ICBM mission with little requirement for technical education in science and engineering. Instead, they were able to accomplish their mission because of strenuous weapon system training and exercises, stable operational environments, and mature logistics and maintenance systems. As a result, very few ICBM professionals possessed the technical backgrounds that were needed in several 20XX mission areas. To give ICBM personnel the broadest possible opportunities in space units, AFSPC policy was changed to eliminate any requirement for space operators to have technical backgrounds as a prerequisite for entering the career field.

History's Impact on Space Culture

Each of the changes discussed above brought a new emphasis on what skills were required, what functions would be performed, what the priorities would be, which organizations within the Air Force were responsible, what the career progressions would be, and what senior leader experience was required. Each of the changes may have made sense at the time, but snapshots of the current military space community indicate that the career field is not where it must be to support space operations in the future. The unintended consequences of the changes that have occurred over the past 40 years within the Air Force space community have increased instability, caused serious reductions in depth of experience, fostered inadequate technical education and training, and increased isolation between various aspects of the space community. These shortfalls must be remedied through aggressive pursuit of improvements across all aspects of the space career field.

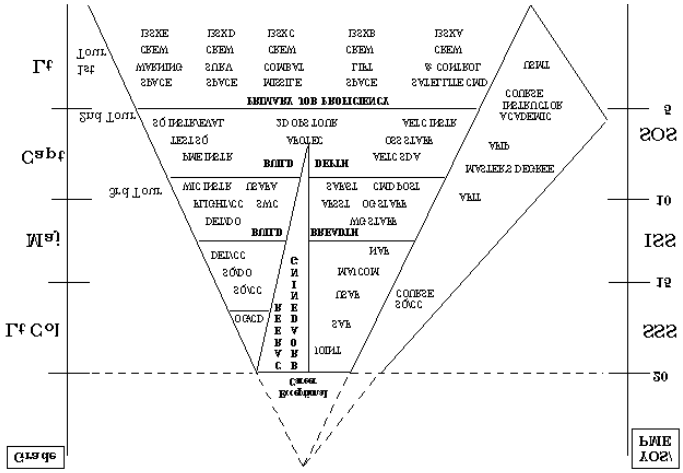
2. Today's Model

Existing space career paths within the Air Force today do not provide the depth and breadth of experience necessary to support space operations in the future.

Existing space career paths within the Air Force today do not provide the depth and breadth of experience necessary to support space operations in the future. The primary cause of this shortfall stems from how the Air Force defines the space operations career field. Today the 13SXX career field is called the "Space and Missile Operations" career field. The career field is broken down into the following five mission areas: (1) Satellite Command and Control, (2) Spacelift Operations, (3) Missile Operations, (4) Space Surveillance, and (5) Space Warning. However, there are several weaknesses in the current policies that govern how the career field is defined and managed.

Lack of Depth Within Mission Areas

First the current career path does a poor job of developing technical or operational "depth" within any of the four space mission areas. The Commission's research into the career backgrounds of space leaders and current career path policy indicates officers rarely have more than one or two assignments in a particular mission area over the course of a career. The career path pyramid from the Air Force Personnel Center Officer Career Path Guide for Space and Missile Operators illustrates the point (Figure 3). The primary weakness in the pyramid is that it is a one-size fits all approach that builds space and missile generalists, but inhibits the development of experts within specific mission areas or weapon systems.



Source: U.S. Air Force Personnel Center

Figure 3: Space Operations Career Field Pyramid

Insufficient Breadth

The second weakness stems from the manner in which Air Force space operations personnel policies define breadth of experience. The basic problem is caused by the one-size fits all approach described above. Currently, achieving breadth for space operators in Air Force Space Command has several components.

- The first component is common to most career fields. Personnel are encouraged to gain experience in a variety of operational and staff positions such as crew member, crew commander, instructor, evaluator, flight commander, operations officer, and headquarters staff officer. This is an excellent approach to providing a long-term build-up of experience in a variety of positions that increase in scope and responsibility over time.

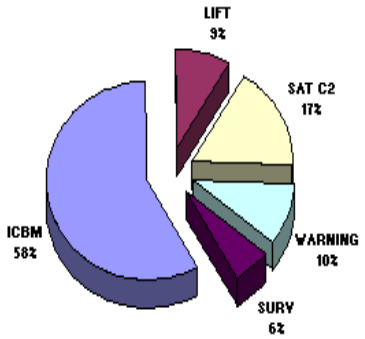
- The second component of AFSPC's formula for building breadth is where the major flaw occurs. Personnel do not gain breadth within a particular space mission area. Instead, they are encouraged to gain experience in as many of the five space mission areas as possible. While a broad space background in multiple space mission areas can be useful, it cannot come at the expense of building depth for leaders who must command units or organizations with specific space missions. Today's approach does not strike the proper balance between depth and breadth.

Segregated Space Communities

The third weakness involves the segregation between the space operations, research and development, and acquisition communities. Perhaps more than any other area, space benefits from a unique and close relationship among research, development, acquisition, and operations as spacecraft are usually procured in far fewer numbers, sometimes as few as one or two, than are tanks, airplanes or missiles. Cross flow across space communities—between the operational commands, space acquisition commands and the National Reconnaissance Office—is clearly desirable. Today, numerous barriers restrict the cross flow of personnel between the space operations commands, space acquisition commands, and the National Reconnaissance Office (NRO). Current policies and laws foster space personnel systems that are increasingly independent and insulated from one another. Space engineers, having no career path in AFSPC and needing to meet acquisition career field legal requirements, literally have

abandoned AFSPC. The result prohibits the free exchange of space expertise among the various organizations that is desirable. Current management and organization practices, especially within the Air Force, do not leverage space research, development, or acquisition knowledge or expertise to benefit space operations, nor do space operations personnel routinely infuse the space research and development communities with their operational expertise and knowledge.

Unintended Consequences of Space and ICBM Integration



Source: U.S. Air Force Personnel Center

Figure 4: Space Operations Career Field Breakout

The final weakness stems from the manner in which space and ICBM personnel were combined when their career fields merged in 1994. Then and today, the ICBM mission area is larger than all four of the space mission areas combined and more than three times larger than the largest space mission area, satellite command and control (Figure 4). Despite the disparity in size between ICBM and the four space mission areas, the Air Force decided to fully integrate space and missile personnel in an effort to broaden career opportunities for the ICBM community and to bring more operational discipline to space operations. While the merger had some benefits, there were a number of serious unintended consequences on the ability for AFSPC to grow leaders with the levels of space experience required for the future.

- This approach complicated the career field manager's ability to build the proper depth and breadth into its officers because two of every three operational positions in Air Force space command are ICBM positions. When combined with the policy of maximizing the opportunity for career ICBM personnel to serve in space positions, regardless of their rank, a dynamic was created within the career field that made it almost impossible to create officers with sufficient experience in specific space mission areas.

- As already mentioned, one unintended consequence was the drastic reduction of space experience among many general officers in AFSPC and among the majority of space squadron, group, and wing commanders. Conversely, career space personnel were leading some ICBM units despite having no experience in ICBM-related matters.

- Another unintended consequence was in unhealthy expectations and pressures created on the ICBM personnel within AFSPC. During the early days of the merger, young ICBM personnel were told that the future was "in space," and they had to get space experience in order to be competitive for future leadership positions. This denigrated the ICBM career field that had a proud heritage and a critical national mission. Soon there was a crush of ICBM personnel wanting to leave ICBM units for space jobs in an effort to stay competitive for future promotion. Personnel policies were adjusted to maximize the opportunities for ICBM personnel to obtain space jobs.

3. A New Model

As shown by the preceding historical perspective, the Air Force has a significant and proud heritage in the space arena. However, the challenges of tomorrow require additional changes. To improve the manner in which future space leaders acquire the proper balance of depth and breadth of experience, new career paths must be developed. Future space leaders and commanders at all levels must have the right expertise within specific space mission areas. They must also develop sufficient breadth to allow them to successfully compete for and hold the most senior military positions in the DoD. To accomplish this, several steps should be taken.

Build Mission Area Depth

Changes are required to ensure leaders acquire sufficient depth of experience in specific space mission areas. Criteria should be developed for the selection, training, qualification and assignment of all personnel who lead, operate, design, develop and acquire each of the nation's national security space systems. The criteria should encompass experience, education, and training milestones.

It is important to note that the criteria may not be identical for all space mission areas. Some areas may be less technically demanding than others. Some mission areas may be similar enough to one another that

significant cross flow opportunities could exist between each of them without impacting the ability to gain depth in one or the other. The Air Force should carefully balance the need to build depth with the desirability to build breadth.

Build Breadth Within a New Integrated Space Career Field

Changes are needed to ensure future space leaders acquire sufficient breadth of experience both inside and outside the space career field. A major element of this change would be the establishment of a new space career field created by combining the existing 13SXX Space and Missile Career Field and those portions of the space research, development, and acquisition career fields devoted to space related missions.

Breadth within the space career field should include experience across space research, development, acquisition, launch, and operations. This approach leverages the unique and close relationship between the various space functions by encouraging the free exchange of space personnel between each of them. Personnel leading operations units would benefit immensely from the experience gained in other areas. Space research and development communities would also benefit from officers with expertise and knowledge in operational areas. This approach has numerous other advantages. It enlarges the space manpower base and provides new degrees of flexibility to career field managers. It begins to align Air Force and NRO personnel practices in support of possible future mergers. It could also serve to reverse the retention problem among space acquisition officers by opening up new career paths and leadership opportunities for them within the Air Force. The same benefits might also apply to enhancing retention of space operations officers.

Space officers should also acquire breadth outside the space career field especially as they rise in rank. At more senior levels, space officers should gain experience at Headquarters Air Force, the Joint Staff, or within a Unified Command. A higher percentage of promotable jobs should be opened to space professionals to ensure they gain the experience necessary to lead at the highest levels.

Separate Space Career Path Pyramids

AFSPC should build separate career path pyramids for each space mission area to ensure leaders gain the proper balance of depth and breadth over the course of a career. The Air Force should consider adding new or

redefining current space mission areas to better match future missions such as “space control” or “space force application.” It is also desirable to create acquisition and operations tracks within each mission area to allow some personnel to specialize in one or the other.

For example, a career path could be created for satellite command and control officers. Air Force Space Command would need to determine what assignments an officer would need to be qualified to be a satellite command and control squadron commander or system program office (SPO) director. It would be desirable for the officer to have several satellite command and control assignments to gain sufficient depth and breadth in the mission area. Below are some of the types of jobs that should be considered to gain the right balance between depth and breadth for a squadron commander or SPO director.

- In the operations area, the officer might perform duties such as crewmember, crew commander, instructor, evaluator, flight commander, and/or operations officer.

- The individual might serve in a variety of positions within a satellite command and control SPO developing and acquiring satellites.

- Satellite command and control staff experience at the group, wing, numbered Air Force, major command headquarters, or Headquarters Air Force would also be desirable to provide additional breadth.

- The officer could be broadened in positions outside satellite command and control. Assignment in other space mission areas should occur early in the officer’s career unless the other mission area is closely related to satellite command and control.

Leadership Emphasis on Importance of All Mission Areas

The Air Force must emphasize that all AFSPC mission areas are important to the defense of the nation and to the United States Air Force. There should be no actual or perceived distinction as to the importance of Satellite Command and Control, Spacelift Operations, Missile Operations, Space Surveillance, and Space Warning. Personnel must understand the needs of the Air Force dictate the requirement to create the career paths described above. Commanders at all levels must explain why each mission area is important and that leaders will be required in each of them. This step is needed to establish a vision within the command that values the

right mix of experience, technical skill, and leadership in all of AFSPC's missions. Without this leadership emphasis, efforts to develop the space culture the nation requires will be difficult.

New Emphasis on Recruiting Space Professionals

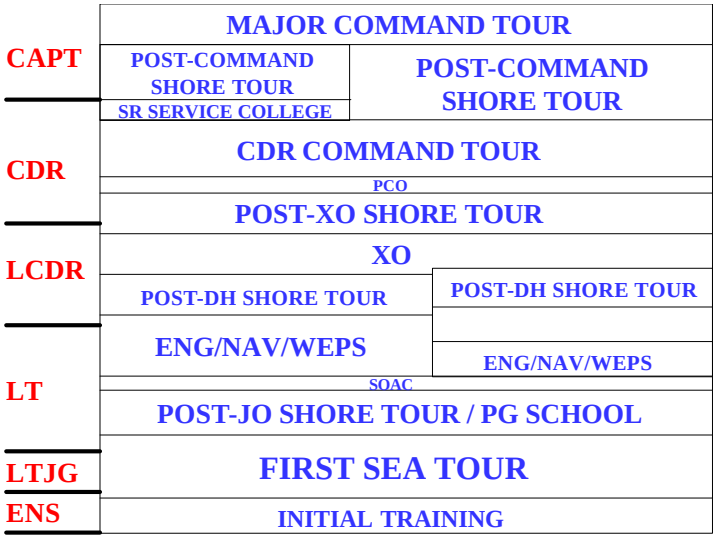
The Air Force must emphasize the need for recruiting science and engineering graduates from all commissioning sources to meet Air Force needs in the space arena. Space is not the only career field with these requirements, but an aggressive recruiting and advertising campaign aimed at building careers in the space arena could attract more young people into the field. Other incentives, such as bonuses and additional educational benefits, should also be considered.

4. The Nuclear Navy Model

The Commission investigated other military career fields in an attempt to find models that could prove useful to the space career field. The Navy has an excellent model for developing highly experienced and technically qualified officers to command submarines and submarine units. Understanding this process is important to see potential application to the space arena.

The career path for nuclear submariners has very strict job experience and professional education criteria. For example, it is helpful to look at the career path of nuclear submarine captains, the first level of command for a Navy line officer. Captains of nuclear submarines typically hold the rank of Commander, and this level of command is roughly equivalent to command of an Air Force squadron. Before a Navy officer takes command of a nuclear submarine, he has had at least three substantial operational tours in a submarine and has qualified as a division chief; engineering, navigation, or weapons department head; and the submarine Executive Officer, which is the submarine's second in command. He has also completed intensive schooling prior to the assumption of each of those levels of leadership. By the time a nuclear submariner reaches the level of a submarine captain, he has acquired the equivalency of a master's degree in nuclear engineering (Figure 5).

Obviously, part of this career path is predicated on the need for nuclear submariners to safely operate the nuclear reactor on their submarine and to ensure the safety of the submarine's crew under demanding conditions. However, their career path has other operational



Source: U.S. Navy Bureau of Personnel

Figure 5: Nuclear Submariner Career Path

and tactical objectives. The Navy's philosophy is that the nuclear submarine captain should be the most experienced and most knowledgeable individual on the submarine. A submarine captain understands the design and engineering limits of his vessel. He has performed and understands the roles of all of the officers below him. He is an expert on tactics and the employment of his submarine as an instrument of war. All of these factors contribute to the overall effectiveness of the submarine, especially during combat operations.

After nuclear submariners complete their initial submarine commander assignment, they are more likely to be assigned to jobs that provide depth outside of the nuclear submarine field. These assignments could be at Headquarters Navy, the Joint Staff, or on the staffs of Unified Commands. The Navy career path for nuclear submariners is broad enough that they can attain the most senior ranks in the Navy.

The Air Force should consider this model as the core career path concept for future space operations officers. It contains many of the elements necessary to ensure future space leaders are the most experienced and most highly trained people in the world.

5. Centralized Space Cadre Management

The Space Commission recommends that responsibility for space career field management be moved from the Air Staff to the Commander of Air Force Space Command.

The Space Commission recommends that responsibility for space career field management be moved from the Air Staff to the Commander of Air Force Space Command. This recommendation was made in conjunction with two additional Commission recommendations—the organizational change to place the Space and Missiles Systems Center (SMC) under AFSPC and the management change to have the SMC Commander control all space research and development priority and funding. The changes give the Commander of Air Force Space Command responsibility for all Air Force space operations, as well the organize, train, and equip functions for Air Force space research, development, and acquisition programs. To effectively oversee the development of the nation's new space culture, the AFSPC commander must have authority to create a new set of space career paths without the burden of meeting broader non-space Air Force personnel goals. The AFSPC commander requires full management control and authority over the existing 13SXX Space and Missile Career Field and the portion of the current Air Force Materiel Command research, development, and acquisition career field devoted to space related missions. Without centralized management authority, it will be almost impossible for the Commander of Air Force Space Command to create the space cadre our nation needs.

B. Other Military Services Space Cultures

In addition to the Air Force, the Army and the Navy also have highly capable and long-standing space programs and space cultures. Army and Navy space programs are relatively small as a percentage of the overall DoD space program, but they are vital to their Service's missions and the overall national security space program. Each has deep roots in space research, development, acquisition, and operation of space hardware. However, the focus of the Army and the Navy is to build space cadres that contribute to using space in support of their missions.

1. Department of the Navy

Naval Space Command serves as the naval component of U.S. Space Command. Its responsibilities include: operating assigned space systems for surveillance and warning; providing spacecraft telemetry and on-orbit engineering; developing space plans, programs, concepts, and doctrine; and advocating naval warfighting requirements in the joint arena. The Naval Research Laboratory conducts space research and development in the Navy. Naval Space Command develops space requirements for the Navy and Marine Corps, and the Space and Naval Warfare Systems Command acquires space systems. The Navy also maintains a small Tactical Exploitation of National Capabilities (TENCAP) office to enhance warfighter use of national security space information.

Naval Space Command serves as U.S. Space Command's Alternate Space Command Center. It is also responsible for operating the Navy Radar Fence which contributes to space surveillance. The Navy operates the UHF Follow-On constellation of communication satellites, is responsible for the development and acquisition of its replacement system, the Multi User Objective System, and acquires Navy ground terminals. The primary mission of Naval Space Command is to provide direct space support to Fleet and Fleet Marine Force operational units around the world whether for routine deployments, exercises or crisis response.

To perform their space missions, the Navy maintains a cadre of space professionals. Unlike the Air Force, the Navy space cadre does not comprise its own career field. Instead, the Navy creates space expertise by educating personnel, primarily from the operational warfighting community, through special education or experience. The primary source of Naval officer space education is provided at the Naval Postgraduate School in Monterrey, CA. The curriculum includes degrees in Space Systems Operations and Space Systems Engineering. Once officers complete their degrees, they are assigned to one of 253 space-coded billets throughout the Navy, the Joint Staff, and certain Unified Commands.

Today, the primary focus of the Navy's space career field is to further enhance the combat effectiveness of the Fleet by conducting Navy space operations, integrating space into Naval operations, and generating Naval space requirements. It is not clear if the Navy has plans to develop a space culture beyond the one already in place. Nonetheless, some of the suggestions stated in the Commission report and in this staff paper may have application for the Navy.[17]

[17] Department of the Navy Information Paper, CNO/N6, Input to the Space Commission, Oct 2000.

2. Department of the Army

Army Space Command, the Army component to U.S. Space Command, and a subordinate element of the Army's Space and Missile Defense Command (SMDC), conducts space operations assigned to the Army. Army Space Command is assigned payload control responsibility for the Defense Satellite Communications System (DSCS) and operates Ground Mobile Forces terminals providing DSCS communications to DoD forces forward deployed worldwide. The Army conducts space surveillance operations from Kwajalein Atoll in the Republic of the Marshall Islands. Satellite terminal and receiver operations are spread throughout the Army which are functionally based in units responsible for a particular function. Joint Tactical Ground Stations are co-operated by the Army Space Command and Naval Space Forces in Europe, Korea, and the Middle East. Army intelligence units assigned worldwide operate a variety of terminals and receivers that collect and receive space, air, and ground intelligence.

The Department of the Army Headquarters approves Army space requirements developed by SMDC's Force Development Integration Center. However, Army Space Command and the Army Training and Doctrine Command also influence the development of Army space requirements. Research, development and acquisition of space-related equipment are generally conducted within the SMDC, the Intelligence and Security Command or the Communications Electronic Command. The Army Space Program Office has responsibility for the operation of systems acquired through the Army's TENCAP program.

To perform their space missions, the Army maintains a cadre of space professionals. Recently the Army created a new space functional area called Functional Area 40 (FA 40) within the Information Operations Career Field. FA 40 officers are trained to assist in the managing, planning, and integrating of space systems capabilities to benefit the Army warfighter. To become an FA 40, the officer must attend several training programs. First, they attend the Army Command and General Staff College's (CGSC) 81-hour space elective. Next they attend the Interservice Space Fundamentals Course. The Army is working to further mature FA 40 training by developing a separate FA 40 qualification course to augment the CGSC course and replace the Interservice Space Fundamentals Course. The Army is also supportive of sending FA 40 officers to other Service space schools and space-related degrees at civilian institutions.

The creation of the FA 40 career field reflects the Army's understanding that space plays a key role in supporting Army operations. However, there are two known shortfalls in the current implementation of the functional area. First, there are few space opportunities for Army officers below the rank of major. This makes it difficult to build technical depth of an Army space officer over the course of a career. Second, the FA 40 pool is very small. There are only 146 officer slots between the ranks of major and colonel and the Army's officer distribution plan only allocates personnel to fill 80 percent of the 146 slots. Despite these shortfalls, the Army is making good progress towards the development of an Army space culture. Like the Navy, the primary focus of the Army's space program is to enhance the Army's combat effectiveness by conducting Army space operations, integrating space into Army operations, and generating Army space requirements. There are no indications that the Army has plans to expand their core missions into space or to develop a space culture beyond the one already in place. Nonetheless, some of the suggestions stated in the Commission report and in this staff paper may have application for the Army.[18]

C. Education

To ensure the creation of a highly skilled workforce, technical education programs will have to be enhanced. Space systems under development, such as the Space-Based Infrared System High and Low and the Global Positioning System III, and future systems envisioned, such as a space-based radar and a space-based laser, will be far more complex than today's systems. Other career fields, such as the Navy's nuclear submarine program, place strong emphasis on career-long technical education. This approach produces officers with a depth of understanding of the functions and underlying technologies of their systems that enables them to use the systems more efficiently in combat. The military's space force should follow this model.

Like the nuclear Navy, career field entry criteria should emphasize the need for technically oriented personnel whether they are new lieutenants or personnel who cross train from other career fields. This will require new entrants to meet minimum educational requirements prior to entry into the

[18] Department of the Army Information Paper, Input to the Space Commission, Oct 2000.

space career field. In some cases, this may not require an undergraduate degree in a technical field, as long as the individual possesses a technical background or aptitude that will allow successful completion of training.

In-depth space-related science, engineering, application, theory and doctrine curricula should be developed, and its study required for all military and government civilian space personnel as is done in the Naval Nuclear Propulsion Program and the Naval Submarine School. This will require a significant investment by the Air Force to develop the necessary schools and curricula. However, the investment is needed to provide a career long path of education and training for tomorrow's space leaders.

Below is a notional example of the levels of training a space professional might need to attend over the course of a career. This example is only provided to illustrate the principle of career long training and education. Exact course content and course timing would depend on the results of careful study by AFSPC.

Initial Space Training

Initial training would first focus on building a strong science and technical foundation to provide theoretical background knowledge on space systems design and operation. Subjects might include advanced mathematics, physics, chemistry, thermodynamics, electrical engineering, materials, propulsion and power systems, space communications, microprocessor and computer operations, software, space environment, and orbital mechanics. Fundamentals of spacecraft, launch vehicle, and ground system design would also be part of the curriculum. This is only a representative sample of the training that might comprise initial space training. The Air Force should leverage curriculum from the Air Force Institute of Technology Space Operations Master of Science program or the Naval Postgraduate School Space Systems Engineering or Space Systems Operations program to support this new training.

Initial Space System Training

Immediately following Initial Space Training, the individual would be trained in duties directly related to their first space assignment. This training would certify an individual to perform crew member duties in a specific space system.

Space System Acquisition Training

Space personnel might need to attend some or all of the current Air Force training for acquisition professionals. The content and timing of these courses would need to be coordinated with other education milestones in the space career path.

Squadron Operations Officer Course

Prior to becoming a squadron operations officer, the individual would go back to school to strengthen their technical foundation, refine skills learned in previous assignments, gain a broader understanding of operations and maintenance of their assigned space system, and study the employment of their space system in support of joint operations. Specific aspects of the curriculum would focus on science and technical refresher courses, operations and maintenance practices, configuration control principles, and anomaly resolution disciplines. Initial courses on joint forces employment of the space system should also be taught. The goal is to prepare prospective Operations Officers by providing them an in-depth understanding of all squadron processes and functions involved in the operation of a space system.

Squadron Commander Course

The last significant element of the career long education would occur prior to assuming squadron command. The individual would now receive the final portion of their technical, operational, and tactical training in their space system. The curriculum would consist of science and technical refresher courses, advanced space system application courses, and other concepts related the employment of their weapon system at the operational level of war. At this point, the officer should be expert in the design, engineering, and operation of their space system including hardware and software elements. The officer would also be highly expert in the employment of the space system in peacetime and at the tactical and operational levels of war. The squadron commander would be among the most knowledgeable and experienced of all personnel in the squadron.

D. Senior Leadership Concerns

As they rise in rank, military officers typically remain in their assignments for only a year or two. This creates fewer problems if the they have experience and training in their specialties. But for senior officers new to a specialty area, they barely have time to learn about their job and system before they are reassigned.

Personnel in the space field suffer from:

- Limited experience
- Inadequate technical education
- Tour lengths that average less than a year and a half.

Today, many leaders of space organizations spend most of their assignments learning about space rather than leading.

This keeps space organizations from reaching their potential. Today, many leaders of space organizations spend most of their assignments learning about space rather than leading. This can weaken their effectiveness as military leaders by placing too heavy a reliance on staff support. Until space leaders have extensive experience and technical training in space activities, longer and more stable tour lengths are desirable.

IV. Professional Military Education

Space capabilities are already integral to all traditional air, land, and sea military operations. They have contributed to U.S. successes in conflicts during the past decade from DESERT STORM in 1991 to the air campaign against Serbia in 1999. Soldiers, sailors, marines, and airmen need an understanding of how space systems are integrated into nearly all military operations particularly as new systems and applications emerge.

Programs in the four Service's professional military education institutions are key sources of space education programs. In all the military schools, space education is gaining in prominence. Within the Air Force, space education is now integrated into all phases of professional military education. New Air Force lieutenants who attend the Aerospace Basic Course are taught space fundamentals and space systems integration into

the tactical and operational levels of war. Other Service schools offer space electives as well as optional space focus areas. The Naval War College offers several elective courses allowing students at both its intermediate and senior service schools to focus on space. The Army Command and General Staff College offers a focused study program requiring 81 hours of space-related instruction. Students completing this program are awarded a special skill identifier qualifying them to serve in space-related positions in Army and Joint commands.

Professional military education does not stress the tactical, operational or strategic application of space systems to combat operations.

Despite the increased attention given to space within the military education system, the core curriculum does not stress at the appropriate levels the operational or strategic application of space systems to combat operations. Military commanders and their staffs continue to rely on "space support teams" assigned to them in time of crisis to advise on the use of space capabilities. Commanders would be better able to exploit the full range of combat capability at their disposal if they were educated from the beginning of their careers in the application of space systems.

V. Conclusion

The U.S. has been the world leader in space since the early 1960s. However, the nation cannot rest upon the successes of the past 40 years to ensure success in the future. A forward leaning vision for space and national leadership will be an important element of our success in the coming decades and will set the stage to ensure we develop space capabilities to deter threats against and defend U.S. national interests. Without a cadre of capable and dedicated space professionals, progress will remain slow. However, the Department of Defense in general and the U.S. Air Force in particular will play the most significant role. They must aggressively develop a space culture to ensure leaders at all levels are developed to lead our space organizations. Only with these actions will the success of the U.S. national security space program be ensured in the coming decades.

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