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CRITICAL REVIEW OF THE NAVY SPACE CADRE

by

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The U.S. Navy has placed doctrinal emphasis on space-based capabilities as a key enabler of naval operations since 1959. But the service has not provided the associated organizational focus necessary to develop an educated, experienced, and qualified professional space cadre. Despite this management shortcoming, the Navy remains critically reliant on capabilities provided by space-based assets and has continued to exploit these capabilities.

This thesis critically reviews the current Navy Space Cadre and recent trends affecting its future. The origin of the cadre, management of its billet base, professional development of members, and future structure are examined. While the Navy Space Cadre meets minimum requirements set forth in Department of Defense and Department of the Navy directives, this study finds the effectiveness of the cadre is reduced due to a poor understanding of future requirements, an underdeveloped training and education progression, a non-standardized approach to operational unit support, and an undefined career path for cadre members. Recommendations are presented to improve the effectiveness without a wholesale restructuring of the community.

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CRITICAL REVIEW OF THE NAVY SPACE CADRE

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LIST OF ACRONYMS AND ABBREVIATIONS

AD	active duty
APL	Applied Physics Laboratory
AQD	additional qualification designator
ARG	amphibious ready group
ARPA	Advanced Research Projects Agency
A2/AD	anti-access/area denial
BMD	ballistic missile defense
CIA	Central Intelligence Agency
CMR	communications moon relay
CONOPS	concept of operations
CPR	amphibious squadron
CSG	carrier strike group
C5F	Fifth Fleet
C7F	Seventh Fleet
DARPA	Defense Advanced Research Projects Agency
DAWIA	Defense Acquisition Workforce Improvement Act
DCNO	Deputy Chief of Naval Operations
DDG	destroyer
DESRON	destroyer squadron
DMSP	Defense Meteorological Satellite Program
DOD	Department of Defense
DON	Department of the Navy
DS4	director of space forces
EAS	executive agent for space
ELINT	electronic intelligence
ESG	expeditionary strike group
FFG	frigate
FLTSATCOM	Fleet Satellite Communications System
GAO	Government Accountability Office
GPS	global positioning system

GRAB	galactic radiation and background
IC	Intelligence Community
IDC	Information Dominance Corps
IDWO	information dominance warfare officer
IGY	international geophysical year
IP	Information Professional Community
ISR	intelligence, surveillance, and reconnaissance
IW	Information Warfare Community
JFACC	joint force air component commander
JWICS	Joint Worldwide IC System
LCSRON	littoral combat ship squadron
METOC	Meteorological/Oceanography Community
MOC	maritime operations center
MS	masters of science degree
MUOS	mobile user objective system
NASA	National Aeronautics and Space Administration
NAVCENT	Naval Forces Central Command
NAVMAC	Navy Manpower Analysis Center
NCF	Navy Cyber Forces
NNWC	Naval Network Warfare Command
NOAA	National Oceanographic and Atmospheric Administration
NOC 2010	Naval Operating Concept 2010
NPS	Naval Postgraduate School
NRL	Naval Research Laboratory
NRO	National Reconnaissance Office
NSA	National Security Agency
NSC	Navy Space Cadre
NTM	national technical means
PAMOR	passive moon relay
PCS	permanent change of station
PQS	personnel qualification standard
PME	professional military education

PNT	position, navigation, and timing
RC	reserve component
R&D	research and development
SATCOM	satellite communications
SFE	space force enhancement
SIPRNet	secure Internet protocol router network
SPAWAR	Space and Naval Warfare Systems Command
SSA	space situational awareness
SSE	space systems engineering curriculum
SSFA	SPAWAR Space Field Activity
SSO	space systems operations curriculum
SSP	subspecialty code
SWPC	Space Warfighter Prep Course
S&T	science and technology
TENCAP	Tactical Exploitation of National Capabilities
TYCOM	type commander
UHF	ultra-high frequency
VCNO	Vice Chief of Naval Operations
ZBR	zero-based review

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I. INTRODUCTION

The Navy has long been interested in the study and exploitation of space-related capabilities. Navigation by the stars was key to open ocean operations and led to the establishment of the Naval Observatory in Washington, DC in 1830.[1] From this beginning, the Navy steered a course through rocketry expertise and upper atmosphere probes in the decade following World War II[2] to the successful launch in 1958 of the nation's second satellite under the Vanguard program.[3] These scientific research missions were key to both the nation's space program and the development of Navy space expertise. Science and exploration were not the only motivations. The Navy focused on operational requirements specific to its own mission set. In 1959, the Vice Chief of Naval Operations (VCNO) Vice Admiral John Hayward approved nine Navy operational requirements for space systems. Recognizing parallels among these requirements and those of the Air Force and Army, the VCNO set the Navy's policy to "support vigorously, by funding and otherwise, all of the operational requirements that are unique to the Navy, and to participate fully in the development of [all] those operational requirements which have Naval applications."[4] Hayward's requirements and supporting policy would prove to be the themes and methods of the Navy's space program over its next 60 years. How well the Navy performed in each would clearly indicate the effectiveness of the Navy space program.

In modern warfare, space assets provide critical capabilities such as communications and intelligence. Former Secretary of Defense Leon Panetta said, "Modern armed forces cannot conduct high-tempo, effective operations

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[1] Department of the Navy, *From the Sea to the Stars: A Chronicle of the U.S. Navy's Space and Space-Related Activities, 1944–2009*, (Washington, DC: Department of the Navy, 2010): 8, http://www.history.navy.mil/books/space/FromTheSeaToTheStars-2010ed.pdf.

[2] Ibid., 8–10.

[3] Ibid., 16–17.

[4] Ibid., 22.

without reliable information and communication networks and assured access to space and cyberspace."[5] The Navy's reliance on space can be understood in the nature of its operations. Free of land-based infrastructure, the Navy is critically reliant on space systems to conduct operations in the most effective manner. In the *Naval Operating Concept 2010* (NOC 2010), the sea service chiefs describe how the naval forces will accomplish the objectives set forth in *A Cooperative Strategy for 21st Century Seapower*. Space-based capabilities are integral throughout NOC 2010 as a key enabler to successful naval operations.[6] But doctrinal emphasis on space capabilities supporting naval operations is not enough to ensure organizational focus through commitment of funds and personnel. The Navy's role in space significantly diminished following the end of the Cold War, despite continued dependence on space-based assets.[7] The personnel and organizations required to adequately convey the Navy's needs were recognized in the 1994 Navy space policy, but funds to match the relative significance of space were not forthcoming.[8] The 2003 assignment as Executive Agent for Space to the Air Force provided a framework for Navy participation in joint programs, though its direct role in acquisitions and operations continued to diminish.[9]

The Naval Space Handbook states there has been an "increasing focus on re-invigorating Navy Space" in recent years.[10] In 2009, the Information Dominance Corps (IDC) was formed, joining together the

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[5] Deputy Chief of Naval Operations for Information Dominance, *Cyber Power 2020, Sustaining U.S. Global Leadership: Priorities for 21st Century Defense* (Washington, DC: Deputy Chief of Naval Operations for Information Dominance, 2012), Title Page, http://www.defense innovationmarketplace.mil/resources/NavyCyberPlan2012.pdf.

[6] Chief of Naval Operations, Commandant of the Marine Corps, Commandant of the Coast Guard, *Naval Operating Concept 2010: Implementing the Maritime Strategy* (Washington, DC: Chief of Naval Operations, 2010), http://www.navy.mil/maritime/noc/NOC2010.pdf.

[7] Department of the Navy, *From the Sea to the Stars*, 141.

[8] Ibid., 143.

[9] Naval Network Warfare Command, *Naval Space Handbook* (Virginia Beach, VA: Naval Network Warfare Command, 2013), 8.

[10] Ibid.

Meteorology/Oceanography (METOC), Information Warfare (IW), Information Professional (IP), Intelligence, and Navy Space Cadre (NSC) communities.[11] Operationally, the transformation of cyberspace into a fifth domain of warfare and the increased focus on information operations makes the information-focused IDC communities logical partners in modern warfare. While the IDC formation did little to change NSC development and management, it did assign an advocate for space.

The formation of the IDC resulted in a flurry of doctrine and strategy documents. By 2013, the IDC had released a vision document, a roadmap for the future of information dominance, a strategy document, and a human capital strategy. In all of these foundational documents, space plays an integral part to Navy information operations. Common themes exist across the 2012–2013 documents: focus on Navy involvement in broader acquisition and operations processes, advocacy for Navy-unique requirements addressed by space-based assets, conduct of space-related science and technology (S&T) and research and development (R&D), and emphasis on operational application of space-based capabilities. Is this more of the same or is it truly a step toward a deeper role for Navy space?

To accompany the doctrinal emphasis on space, the new space type commander (TYCOM), Navy Cyber Forces (NCF), conducted a zero-based review (ZBR) of the NSC workforce in 2012, releasing the report in February 2013.[12] The Navy Space Plan Task Force was also formed in 2012 to "codify those actions that Navy personnel must be ready and able to fulfill to ensure we

[11] Deputy Chief of Naval Operations for Information Dominance, *Navy Strategy for Achieving Information Dominance, 2013-2017: Optimizing the Navy's Primacy in the Maritime and Information Domains* (Washington, DC: Deputy Chief of Naval Operations for Information Dominance, 2012): 5, http://www.public.navy.mil/fcc-c10f/Strategies/Navy_Strategy_for_Achieving_Information_Dominance.pdf.

[12] Navy Cyber Forces Command, *Navy Space Cadre Workforce Zero-Based Review* (Suffolk, VA: Navy Cyber Forces Command, 2013).

have what is necessary to operate effectively in any environment."[13] While the effects of these efforts cannot yet be said to have re-invigorated Navy space, there is certainly much going on in terms of Navy space management and doctrine development.

The organizational focus of the NSC is an important indicator of how effectively doctrinal emphases will be implemented. This thesis critically reviews the NSC, focusing on the processes currently in place to address the management of officer billets and professional development of NSC members. Primary documents from Congress, the Government Accountability Office (GAO), the Intelligence Community (IC), Department of Defense (DOD), Department of the Navy (DON), and Navy subordinate communities are examined, as well as recent theses from Naval Postgraduate School (NPS) students. Rather than exploring alternative structures for the NSC, this work focuses on the NSC that exists today and proposes changes to improve its effectiveness and efficiency. Due to the dynamic state of the current NSC, this study cannot provide thorough investigation of the NSC billet base and its management. The changes in the billet base and the method of managing it are addressed and recommendations for future work are presented.

[13] Sandy Daniels, "Information Dominance and the Navy Space Plan," *Information Dominance Corps Newsletter* (October 2012): 2, http://www.public.navy.mil/bupers-npc/officer/Detailing/IDC_FAO/Documents/IDC%20Newsletter %20-%20SPACE%20(121011).pdf.

II. THE NAVY LEGACY IN SPACE: HISTORY OF NAVY PARTICIPATION IN EARLY SPACE PROGRAMS

A discussion of American military space efforts can begin with a list of Navy firsts. Navy research and development activities in the 1950s and 1960s included the first operational space communications, the first satellite tracking system, the first satellite navigation system, the first electronic intelligence (ELINT) satellite, and the first American in space.[14] These activities gave the Navy a lead role in early U.S. space explorations. Key Navy leaders, including Admiral Arleigh Burke, recognized the importance of space capabilities to Navy operations and began discussing the exploitation of space as one of the operational functions of Navy staffs.[15] Research by the Naval Research Laboratory (NRL) and Johns Hopkins University's Applied Physics Laboratory (APL) led to Navy-developed systems providing space force enhancement (SFE) through intelligence, reconnaissance, and surveillance (ISR), satellite communications (SATCOM), position, navigation, and timing (PNT), and environmental monitoring systems.

VCNO Hayward's recognition of parallel requirements across the services was a harbinger of future DOD policy.[16] As the military space program lagged Soviet efforts, the need for coordination and unity of effort led to the 1961 designation of the Air Force as the lead service for developing and acquiring space systems.[17] This limitation to the Navy's role was the first of several reductions in the Navy's organizational focus on space. After each diminishment,

[14] National Research Council of the National Academies, Committee on the Navy's Needs in Space for Providing Future Capabilities, *Navy's Needs in Space for Providing Future Capabilities* (Washington, DC: National Academies Press, 2005), 20–21.

[15] Department of the Navy, *From the Sea to the Stars*, 62.

[16] Ibid., 21–22.

[17] Ibid., 39.

the Navy never recovered its past national space leadership, though its dependence on and effective exploitation of space continued to grow.[18]

A. NAVY INVOLVEMENT IN THE DEVELOPMENT OF THE U.S. SPACE PROGRAM

Following World War II, Army and Navy researchers divided captured German V-2 rocket components to rebuild V-2 rockets and eventually develop the first American rockets.[19] The Navy began launching space probes on V-2 rockets in 1946, including from the deck of USS *Midway* (CVB-41) in 1947.[20] But the dwindling supply of V-2 rockets motivated the Navy to develop its own rockets. The *Aerobee* and *Viking*, would form a solid foundation on which the Navy would build its strategically important space program.

The Applied Physics Laboratory developed the smaller *Aerobee* rocket using Navy funding. The *Aerobee* was capable of lifting 150 pounds of payload to an altitude of 75 miles and doing so at 35,000 miles per hour, higher and faster than its contemporary, the Army's *Wac Corporal* rocket.[21] The *Aerobee* would serve not only Navy programs but all three service branches before the program was discontinued.[22] NRL developed the *Viking* rocket from the V-2 design, successfully launching in 1949.[23] It would later serve as the basis for the *Vanguard* launch vehicle.

In 1950, a group of international scientists proposed an international geophysical year (IGY) for 1957–1958. In 1955, President Eisenhower announced that the United States would launch artificial satellites during the IGY. The Soviet Union followed suit and announced in 1957 its intention to launch

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[18] Ibid., 114–115.

[19] Department of the Navy, *From the Sea to the Stars*, 8.

[20] Ibid., 9.

[21] Ibid, 11–12.

[22] Air University, *AU-18: Space Primer* (Maxwell Air Force Base, AL: Air University Press, 2009), 7, http://www.au.af.mil/au/awc/space/au-18-2009/au-18-2009.pdf.

[23] Department of the Navy, *From the Sea to the Stars*, 11.

satellites.[24] The U.S. military services each presented proposals for the IGY satellite, hoping for a piece of the growing space budget pie. The Army and Air Force presented proposals for *Project Orbiter* and *Project World Series*, respectively, using launch vehicles based on ballistic missile technology.[25] The NRL presented *Project Vanguard*, launched on a modified *Viking* rocket. In keeping with the scientific focus of the IGY, *Project Vanguard* and its modified *Viking* rocket were selected as the U.S entrant.[26]

On 4 October 1957, the Soviets successfully launched into orbit the world's first artificial satellite, *Sputnik*.[27] In response, the first U.S. satellite was placed atop the *Vanguard* rocket in December 1957, despite concerns over the program's readiness.[28] The resulting launch failure prompted President Eisenhower to approve launch of the *Explorer-I* (formerly, the Army's *Project Orbiter*) atop the *Juno* launch vehicle (a modified version of the Army's *Jupiter* rocket) in January 1958.[29] *Project Vanguard* successfully launched in March 1958, making it the nation's second artificial satellite.[30]

President Eisenhower believed strongly in the peaceful use of space as a means to avoid confrontation with the Soviet Union.[31] The need for a civilian agency to control the research and development of space systems and shape the future of the space program led to the creation of the National Aeronautics and Space Administration (NASA) in October 1958, which acquired the necessary resources and authority to administer and control the national space

[24] Ibid., 15.

[25] Ibid., 16.

[26] Ibid.

[27] Ibid.

[28] Air University, *Space Primer*, 8.

[29] Ibid., 8–9.

[30] Department of the Navy, *From the Sea to the Stars*, 17.

[31] Ibid., 18.

program in a matter of a few years.[32] While the structure and organization of civilian control over civilian space programs was solidifying, the Advanced Research Projects Agency (ARPA) was formed as a DOD space agency in 1957.[33] ARPA's role was to eliminate unnecessary competition and duplication of effort amongst the military services by controlling the funding for all space projects.[34] Although short lived and largely ineffective, the existence of ARPA did present a challenge to program development that the Navy would effectively overcome.

B. NAVY PARTICIPATION IN EARLY SPACE MISSION AREAS

Navy researchers at NRL and APL provided proof of concept for a variety of capabilities and developed operational systems providing SATCOM, ISR, PNT, and environmental monitoring space force enhancement. These systems supported operations of the Navy and other services and provided groundwork for future joint programs.

1. Satellite Communications

In 1948, two NRL scientists working on capture of Soviet RADAR signals began investigating the collection of radio signals reflected off the moon.[35] *Project PAMOR* (Passive Moon Relay) represented the beginning of SATCOM and ELINT collection from space for the Navy. From the classified *PAMOR* work, an operational program, the Communications Moon Relay (CMR) System, was begun in 1956.[36] When it went operational in 1960, the relay was used to transmit teletype and facsimiles to Hawaii, as well as from shore-to-ship.[37] The

[32] Air University, *Space Primer*, 10.

[33] Ibid.

[34] Department of the Navy, *From the Sea to the Stars*, 19.

[35] Ibid., 12.

[36] Ibid., 23.

[37] Ibid., 23.

only limitation to the system was the availability of the moon itself. For reliable and available communications, a constellation of satellites would be needed.

Following CMR, the Navy partnered with NASA, Jet Propulsion Laboratory, and Bell Laboratories in a passive communications relay project named *Echo-I.*[38] A 100-ft reflective, self-inflating balloon was launched to an altitude of 1000 miles in 1960. It was tested successfully and used by stations in the United States and abroad.[39] At the same time *Echo-I* was in development, ARPA disapproved Navy's proposal for a store-and-forward communications satellite. Navy participated in joint programs for active SATCOM in the late 1950s until 1961.[40] In 1961, an even more restrictive environment precluded Navy-acquired systems, forcing the Navy to rely on other services and commercial systems.[41]

In the 1970s, fleet SATCOM requirements dictated use of small, largely omnidirectional antennas for aircraft and smaller ships. The Navy proposed an ultra-high frequency (UHF) SATCOM system to meet these requirements. The proposal was approved and the Navy was given overall responsibility for the UHF system, named Fleet Satellite Communications System (FLTSATCOM).[42] Navy's leadership in UHF SATCOM continues today, as it fields the next generation system known as the Mobile User Objective System (MUOS).[43]

2. Intelligence, Surveillance, Reconnaissance

Passive collection of Soviet radio signals through *Project PAMOR* required high-gain antennas. The NRL's newly built Stump Neck antenna (measuring 220 feet by 263 feet) in Maryland proved unreliable in receiving the weakened

[38] Ibid., 28.

[39] Ibid., 29.

[40] Ibid., 29–30.

[41] Ibid., 45.

[42] Ibid., 78.

[43] Ibid., 175.

signals, leading to the design of a 600-ft steerable antenna in West Virginia.[44] Such was the size of the antenna required to capture the signals at the desired reliability and fidelity. The cost of the antenna proved too high, however. For roughly 20 times less money, an NRL-designed ELINT satellite could collect Soviet signals from space.[45] The West Virginia project was cancelled and Project Tattletale was formed..

Researchers at NRL began to consider using a submarine ELINT receiver onboard a satellite in 1958. The receiver was sensitive enough to detect radio signals hundreds of miles away.[46] If the receiver could be placed high enough, it could intercept Soviet signals from far within the borders. By summer 1959, the project had achieved presidential approval and ARPA funds: Project Tattletale was born. A leaked report in the *New York Times* threatened the program's continuation, but it survived under a new name, DYNO.[47] The ELINT project was a highly classified, interagency program between the services, the National Security Agency (NSA), and the Central Intelligence Agency (CIA). Operating under the cover name GRAB (Galactic Radiation and Background) and carrying unclassified sensors in addition to its classified payload, the DYNO/GRAB program was a tremendous success and allowed detection of Soviet signals far beyond previous limitations.[48]

In 1962, the National Reconnaissance Office (NRO) was organized and absorbed the DYNO program under the name Poppy. The NRO continued to operate the Poppy series of ELINT satellites until the mid-1970s as one of the national technical means (NTM) systems.[49]

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[44] Ibid., 13.

[45] Ibid.

[46] Ibid., 30.

[47] Ibid., 32–33.

[48] Ibid., 31.

[49] Ibid., 54.

3. Position, Navigation, Timing

When *Sputnik* was launched in 1957, Dr. William Guier of APL found inspiration. He accurately calculated the orbit of the Soviet satellite using a mechanical calculator, the Doppler shift of the satellite's signal, and the estimated time on top of Washington (broadcast by Soviet radio and discovered by Guier's colleague, George Weiffenbach).[50] Using a new digital computer and a single tracking station, the duo was able to track and conduct experiments on the signals from *Sputnik II* and *Explorer-I* more accurately than anyone at the time.[51] Dr. Frank McClure, Guier's and Weiffenbach's boss, suggested that if the station could determine the orbit, the location of the station could be determined from the orbit. Over the course of the next week, McClure and another APL researcher designed a navigation system. The first space-based navigation system, Transit, was proposed in spring 1958.[52]

The innovative beginning of the Transit system was not limited to its design. As the development of military space systems was the responsibility of ARPA, Navy officials leveraged concerns over *Polaris* missile accuracy to secure funding and support for the Transit system.[53] The world's first on-orbit navigation system began testing in 1959 and was operational in the mid-1960s.[54] The Navy continued to operate the system until 1996, when the transition to the multi-service Global Positioning System (GPS) was complete.[55]

4. Environmental Monitoring

In an effort to understand the impact of the ionosphere on radio communications, NRL and Navy-sponsored APL began launching space probes

[50] Ibid., 25.

[51] Ibid.

[52] Ibid.

[53] Ibid.

[54] Ibid., 26, 41–43.

[55] Ibid., 162.

on its cache of German V-2 rockets and its own *Viking* and *Aerobee* rockets.[56] Satellites presented a much greater opportunity for science and discovery, providing access to multiple orbits and longer periods of time in the environment than the short-lived space probes. NRL began the SolRAD program in 1960, gathering data on solar radiation.[57] In support of the Transit program, APL conducted important geodesy and magnetosphere research.[58] The Navy's primary emphasis in environmental monitoring was scientific. Operationally, the Navy partnered with other agencies, relying on military and civil systems for weather exploitation, including the National Oceanographic and Atmospheric Administration (NOAA) TIROS system and the Air Force Defense Meteorological Satellite Program (DMSP).

5. Space Situational Awareness

In support of *Vanguard*, the Navy built the Minitrack system, including a "fence" of ground stations from Maryland to Chile.[59] These passive stations relied on signals sent from a satellite. In order to track satellites and other space objects not emitting predictable signals, active antennas were required to track targets passing overhead. The Navy built the Space Surveillance System (Space Fence) from 1958 to 1961. The Space Fence included three transmitter and six receiver stations along the 33.5-degree parallel.[60] The active ground stations illuminated targets overhead and the receiving stations received the reflections, collecting data on orbiting objects. The Navy operated the Space Fence until it was transferred to the Air Force in 2004.[61] It continued to be an integral part of the nation's SSA capabilities until its closure in 2013.

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[56] Ibid., 9.

[57] Ibid., 33.

[58] Ibid., 61–62.

[59] Ibid., 34.

[60] Ibid., 35–36.

[61] Ibid., 36.

C. OPERATIONAL LEGACY

VCNO Hayward issued nine naval requirements for space systems in September 1959. His list included seven requirements that are core capabilities of ISR, environmental monitoring, SATCOM, and PNT space force enhancement operations.[62] These requirements flowed from the work the scientific community was performing (what was possible) and the problem set the Navy encountered on a daily basis (what was needed). Not surprisingly, the need for space force enhancement capabilities through ISR, environmental monitoring, SATCOM, and PNT was not unique to the Navy. The Army and Air Force would have similar requirements for space systems. Hayward set forth Navy policy acknowledging these parallels in requirements, pledging vigorous support for Navy-specific requirements and full participation in development of systems that supported naval requirements by other services or processes.[63] These requirements and policy statements were made during ARPA's control of defense space funding, so the statement was likely made out of necessity to accomplish objectives. But the operational requirements and policy model proved to be a blueprint for the Navy's future work in space and is one of the true legacies of Navy space.

The Navy continued to support operational requirements through system development efforts and scientific research work despite challenges such as the ARPA control of funds in the late 1950s. Where a restrictive environment limited control of development, Navy space provided fleet support by exploiting other systems such as DSMP and national systems through the Tactical Exploitation of National Capabilities (TENCAP) office.[64] TENCAP, in particular, provided a particularly good opportunity for operationally savvy Navy personnel to leverage national technical means capabilities. These initiatives focused on providing the

[62] Ibid., 21–22.

[63] Ibid., 22.

[64] Ibid., 57–58, 76.

information to the warfighter and the required SATCOM terminal development, conducting ship overhaul for receipt of data, and performing other functional changes to enhance fleet exploitation of space capabilities.[65]

Chief of Naval Operations Admiral Arleigh Burke in 1959 recognized the need for space expertise for operational commanders. His memo stated:

> I think it is time for each of the Fleet Commanders…to have a Space Section in their Staffs whose main function would be to ensure that the commands are fully cognizant of all Space activities and their influence upon war planning, readiness, et cetera. The initial staff sections *need not be more than one officer* but that officer should be very good and should be *thoroughly briefed before he takes the job* [emphasis added].[66]

Like VADM Hayward's requirements and policy statements later in the same year, ADM Burke's view of the need for space knowledge at the operational level was an indicator of the future of the Navy space mission. Though the role of a space section never truly settled in on operational staffs in the Navy, the function of space force enhancement has been incorporated, primarily in the Intelligence (N2) and Communications (N6) directorates. This operational fleet focus on the exploitation of space systems led these Navy operators to remain in their communities. The largely unorganized Navy space experts at NRL, APL, and the Naval Observatory were scientists and engineers, not Navy operators.[67]

D. CHALLENGES TO NAVY LEADERSHIP IN SPACE

The Navy had an innovative approach to space in the early years of the program, presenting creative solutions to real problems. These solutions provided a basis for the Navy's strong participation in space. Broader decisions within the DOD and government would present challenges to the Navy's role in developing and operating space systems.

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[65] Ibid., 39–62.

[66] Ibid., 62.

[67] Ibid., 62.

The Eisenhower administration formed ARPA in 1957 as a method to limit replication of efforts across the military services. The new agency held the purse strings for all military space programs and complicated the development and acquisitions process for the individual services.[68] But the Navy continued its development efforts, tactfully securing funding for programs such as Transit and DYNO. As NASA was growing as a civil agency for space, operational programs were transferred to the fledgling organization. The Navy's *Vanguard* program and *Viking* rockets were transferred, along with more than 200 NRL personnel working in the programs.[69] Navy officers also filled many early astronaut billets in NASA's manned spaceflight program.[70] The Navy would lose the experience and expertise of most of these personnel.

In 1961, the newly elected Kennedy administration saw a need for a single focal point within DOD space. Secretary of Defense Robert McNamara issued a directive assigning sole responsibility for development and acquisition of military space systems to the Air Force.[71] The directive presented new barriers to active Navy participation in development and acquisition of space systems and subordinated fulfillment of Navy requirements to those of the Air Force.[72] Also in the 1960s, the formation of the NRO consolidated the Navy's ELINT DYNO program into Program C as Poppy.[73] These systems continued to support the operational requirements of the fleet and the nation and the Navy retained the experience gained from operating and acquiring these systems through its participation in the NRO.

In a similar way, multi-service programs such as GPS brought operational capability to the fleet without the responsibility of developing and acquiring the

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[68] Ibid., 19.

[69] Ibid.

[70] Ibid.

[71] Ibid., 40.

[72] Ibid.

[73] Ibid., 54.

system. The challenge existed in the ability of the Navy to convey its operational requirements to the developing agency and for the system to meet the operational needs. Simply sending requirements to the Air Force was not sufficient to ensure fulfillment of the requirements. In the 1990s, Navy space advocates recognized the need to participate in the entire development process, from beginning to end, to achieve Navy-specific requirements while still operating the systems it was responsible to develop and operate.[74] Advocates for Navy's active role in space argued that continuation of the Navy's legacy of active participation and exploitation of available space systems was integral to its future success. In 2005, the Committee on the Navy's Needs in Space for Providing Future Capabilities recommended the Navy "fully support and exploit the ongoing transformation of the Department of Defense (DOD) and intelligence community" in order to become "an even more effective and relevant force within the DOD."[75]

[74] Ibid., 140.

[75] National Research Council, *Navy's Needs in Space*, 22.

III. FORMALIZATION OF THE SPACE CADRE

The Navy space team began as an ad hoc group of expert scientists and engineers at NRL, APL, and the Naval Observatory. These professionals sought innovative solutions to problems and afforded the Navy the opportunity to lead several early space force enhancement operations for the military. The cost of space systems and the need to eliminate duplication of effort forced DOD to consolidate development and acquisition processes at different times. The most recent of these consolidations was particularly critical to the management of space professionals and forced the formation and eventual evolution of the DOD Space Cadre.

A. 2001 SPACE COMMISSION

Beginning in the 1970s and continuing through the 1980s, DOD space shifted from a strategic focus to supporting the warfighter. The confluence of international events in the early 1990s heightened the importance of this shift. When the Soviet Union fell in 1991, the superpower counterweight to the U.S. military was gone as well. Military spending declined, and space systems were on the block as they were largely considered strategic in nature.[76] However, in the same year, Operation Desert Storm highlighted the importance of space capabilities to achieving overwhelming military advantage at the tactical level. The capabilities of space systems in support of tactical military operations became a primary focus of Navy and national space policy over the next decade.[77]

The Commission to Assess United States National Security Space Management and Organization (Space Commission) was chartered in 1999 and released its report in January 2001. Chaired by Donald Rumsfeld and chartered to assess military space, a merger of IC and non-IC space systems, space in

[76] Ibid., 139.

[77] Ibid., 22.

professional military education (PME), and service solutions for national security space, the commission presented an urgent and cautionary tenor in terms of the leadership and security of national security space.[78] The report highlighted the importance of space to the national security of the United States and recognized the dependence of government agencies, including the military services, on capabilities delivered by space systems.[79] The report recommended a series of changes to the organization and management of national security space in part because a similar level of organizational focus did not accompany the doctrinal emphasis on space capabilities. The report states, “Our growing dependence on space, our vulnerabilities in space and the burgeoning opportunities from space are simply not reflected in the present institutional arrangements.”[80]

The commission made 16 recommendations, including 13 actions for the DOD.[81] Based on the report, the Air Force would be assigned the lead role in DOD space, acting as Executive Agent for Space (EAS) in charge of acquisition of military space systems.[82] The Army and Navy would retain their abilities to develop, acquire, and operate space systems necessary for their own missions, but the Air Force was seen as the best bridge to a dedicated national security space service in the future.[83] A qualified cadre of space professionals would thus be required in the Army and Navy to ensure their ability to collect and submit requirements, develop and operate unique space systems as required, and continue to perform S&T and R&D. Research and development endeavors by the Army and Navy were recommended not only for their obvious benefit but also to

[78] Commission to Assess United States National Security Space Management and Organization, *Report of the Commission to Assess United States National Security Space Management and Organization* (Washington, DC: Commission to Assess United States National Security Space Management and Organization, 2001): 1–5, http://www.dod.gov/pubs/space 20010111.pdf.

[79] Ibid., 18.

[80] Ibid., 99.

[81] Ibid., 82–96.

[82] Ibid., 89.

[83] Ibid., 89.

assist in the maintenance of a sufficiently experienced space cadre.[84] Accepting budgetary constraints as inevitable, the report recommended renewed innovation combined with unity of effort by research organizations. The report recommended a research organization be created to oversee and prioritize this research initiative and that Air Force Space Command be responsible for funding research, development, acquisition, and operations. [85]

Following the Space Commission, Rumsfeld became Secretary of Defense and implemented 10 of the 13 DOD recommendations.[86] The focus on space activity by the new Defense Secretary and research coordinated by the Defense Advanced Research Projects Agency (DARPA) and the services sparked an increase in space activity in the Navy (and all services).[87] But the Air Force's primacy as space leader was evident as it was assigned the role of EAS.[88] The Navy slowly adapted to the new construct and its role in a formalized DOD space cadre. In 2005, the National Research Council identified that "[t]he Navy's needs in space can be satisfied by focusing on the support elements: requirements, acquisition, science and technology, experimentation, and personnel."[89] This was the intent of the changes: that the Army and Navy support the joint programs with personnel and requirements input. The GAO assessed the services' efforts and provided critiques of the Navy's attempts to create the NSC.

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[84] Ibid., 96.

[85] Ibid., 89.

[86] Government Accountability Office, *Defense Space Activities: Status of Reorganization* (Washington, DC: Government Accountability Office, 2002), 3, http://gao.gov/assets/100/91333.pdf.

[87] National Research Council, *Navy's Needs in Space*, 22.

[88] Department of Defense, *Directive 5101.2: DOD Executive Agent for Space* (Washington, DC: Department of Defense, 2003), http://www.dtic.mil/whs/directives/corres/pdf/510102p.pdf.

[89] National Research Council, *Navy's Needs in Space*, 69.

B. NAVY SPACE CADRE

Although the Navy saw a decline in its space activities following the Cold War, the Navy still holds key acquisition and operational responsibility, primarily for narrowband SATCOM systems. Navy operations still depend on space capabilities, so requirements must be met and therefore conveyed. Unique requirements that cannot be met through joint programs must be researched and solutions developed. The Navy historically maintained a loose ad hoc group of space professionals. After the Space Commission and subsequent DOD directives, the military services were required to "[d]evelop, maintain, and manage a sufficient cadre of space-qualified personnel to support their DOD Component in space planning, programming, acquisition, and operations."[90]

1. Navy Space Cadre Formalization (2003–2010)

The DOD space cadre was slow to start department wide. In the 2002 and 2003 GAO assessments, critiques focused on the lack of a DOD human capital strategy and changes within the Air Force. After the 2003 assignment of EAS to the Air Force[91] and the completion of the DOD space cadre human capital strategy in 2004, the focus of the GAO turned to the Army and Navy. The oversight of the GAO was a positive force for the Navy, forcing formalization of its space cadre through a series of reviews.

Although the NSC was technically formed in July 2003, it was not until April 2004 that the Secretary of the Navy issued the Department of the Navy Space Policy (Naval Space Policy), directing the Navy and Marine Corps to develop and maintain a space cadre.[92] The CNO provided specific Navy

[90] Department of Defense, *Directive 5101.2.*

[91] Ibid.

[92] Department of the Navy, *SECNAV Instruction 5400.39C: Department of the Navy Space Policy* (Washington, DC: Department of the Navy, 2004), 4, http://www.fas.org/irp/doddir/navy/secnavinst/5400_39c.pdf.

guidance in May 2005 with the Navy Space Policy Implementation instruction.[93] Navy policy was to recruit, educate, qualify, and retain a professional space cadre in order to exploit current systems and influence future system design.[94] The NSC would include active duty and reserve officers and enlisted, as well as civilians.[95] It identified Naval Network Warfare Command (NNWC) as the TYCOM and functional authority for space.[96] The Deputy Chief of Naval Operations for Manpower and Personnel was directed to designate a Space Cadre Advisor that would act as a "virtual community manager for the Space Cadre."[97] As originally defined in 2002, the Space Cadre Advisor role had little official responsibility and a divided chain of command,[98] which the 2004 GAO report criticized.[99] The redefined Space Cadre Advisor met focal point concerns of the 2004 GAO report.

The 2004 GAO report also criticized the Navy for the lack of a human capital strategy for its space cadre. Without a strategy, the NSC did not have clearly defined goals and objectives.[100] To address these concerns, the Navy completed its NSC human capital strategy in January 2005. The strategy identified the dependence of the Navy on space primarily as a domain through which information flows. The report highlighted the need for operational commanders to be aware of the capabilities and limitations of space assets in order to optimize their exploitation today and their availability and effectiveness in

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[93] Chief of Naval Operations, *OPNAV Instruction 5400.43: Navy Space Policy Implementation* (Washington, DC: Chief of Naval Operations, 2005), https://www.fas.org/irp/doddir/navy/opnavinst/5400_ 43.pdf.

[94] Ibid., 3.

[95] Ibid., 3.

[96] Ibid., 3.

[97] Ibid., 4.

[98] Government Accountability Office, *Defense Space Activities: Additional Actions Needed to Implement Human Capital Strategy and Develop Space Personnel* (Washington, DC: Government Accountability Office, 2004), 19, http://www.gao.gov/assets/ 250/243703.pdf.

[99] Ibid.,18.

[100] Ibid.

the future.[101] The Navy identified members of the NSC by flagging individuals with space experience and education within each of the communities, but leaving the officers in the original communities. The strategy provided a defense of this structure,

> By grooming talented, educated, and operationally proven people to assume key decision making positions in space, the Space Cadre cross-designator community enables warfighters to succeed across the spectrum of conflict.[102]

The mission of the NSC was to provide qualified personnel to support assessments, requirements, S&T/R&D, acquisition, and operational roles in order to "influence the design of future systems to solve Naval warfighting gaps, and to maximize the capabilities of today's space systems…"[103] At the time of the report, the NSC had nearly 547 members identified across the active duty officer corps and 250 space billets across Navy, joint, and DOD commands.[104] The cross-community structure of the virtual community and small size highlighted the need to retain and reassign NSC members to future space jobs. While developing new NSC members was as simple as detailing an officer to a space-funded billet, promoting the members was a different story. Unfortunately, many officers viewed space jobs as career killers and promotion boards tended to agree. The strategy identified promotion rate, not recruiting, to be a significant challenge to maintaining end-strength.[105] To mitigate the stigma, the strategy identified the importance of providing specific information to promotion boards to highlight assignment to space jobs as career enhancing, thus ensuring NSC members promoted at community-average levels.[106]

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[101] Naval Network Warfare Command, *Navy Space Cadre Human Capital Strategy* (Virginia Beach, VA: Naval Network Warfare Command, 2004), 1.

[102] Ibid., 2.

[103] Ibid., 2-3.

[104] Ibid., 4, 6.

[105] Ibid., 15.

[106] Ibid., 5.

The strategy identified five goals to ensure the NSC fulfilled the Naval space policy and the Navy's implementation plan:

- Optimize the force structure in order to meet Fleet acquisition and operational requirements
- Align the Space Cadre with CNO goals, the Navy's overall HCS, Sea Power 21, and Joint Vision 2020
- Craft the training and education of the Space Cadre to ensure that the labor force contains the right skill sets to meet future manning needs
- Provide incentives, advancement opportunities, meaningful mission-relevant work, opportunity to compete for key jobs, and
- Gain senior leadership support throughout the Navy[107]

The strategy also identified challenges, gaps, and barriers to an effective NSC. Challenges included several concerns regarding civilian inclusion in the NSC, ranging from a need to capture the civilian billet base to a single skill set stigma that exists in the civilian workforce.[108] Significant attention was given to the cross-community sourcing of the NSC. With accession pathways limited to assignment to a graduate education program in space systems or assignment to a space-coded billet, the NSC had little control over the officers that would become members of the NSC. It also had no say in the other communities' reduction in commitment to space-coded billets. Once an officer was coded as a member of the NSC, there was concern that promotion boards would not value space assignments as highly as other assignments.[109]

The strategy identified gaps that existed and inhibited the NSC from meeting its potential. Some method of tracking civilian, reserve, and enlisted personnel was necessary to classify associated billets. In the active duty officer

[107] Ibid., 7.

[108] Ibid., 15.

[109] Ibid., 16.

corps, critical billets were not identified, a development track was not designated, and career paths were not defined. These gaps prevented shaping the NSC workforce for the future.[110]

Ultimately, the NSC human capital strategy was a first step toward a coherent, effective virtual community. If the Navy could effectively implement recommendations to mitigate challenges, barriers, and gaps identified in the strategy, the NSC could become a model for success. Nearly a decade after the human capital strategy was developed, however, many of the same challenges and gaps still exist. The failure to act to resolve these identified problems would be a common theme in the new NSC.

2. Navy Space Cadre within Information Dominance Corps

In June 2009, the CNO ordered the Director of Naval Intelligence (N2) to act as lead in a realignment of the office of the CNO (OPNAV). The memorandum recognizes that modern operations "demand a whole-warfighting approach" throughout the operational and tactical levels.[111] The reorganization was deemed necessary in order to achieve dominance "across the full spectrum of operations at sea, under the sea, in the air, in the littorals, and in the cyberspace and information domains."[112] The resulting reorganization merged the N2 and N6 directorates into a combined N2/N6 office. The reorganization brought together the information-related communities of IW, Intelligence, IP, METOC, and the NSC, forming the IDC.[113]

The IDC began disseminating guidance and policy almost immediately. The Deputy CNO for Information Dominance (DCNO N2/N6) issued a

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[110] Ibid., 17.

[111] Chief of Naval Operations, "Memorandum for the Director of Naval Intelligence: Reorganization of the Office of the Chief of Naval Operations (OPNAV) Staff," 26 June 2009, http://www.idcsync.org/documents/20090626 OPNAVN2-N6Merger.pdf?attredirects=0&d=1.

[112] Ibid.

[113] Deputy Chief of Naval Operations for Information Dominance, *Strategy for Achieving Information Dominance*, 5.

memorandum to the IDC in 2009, providing an overview of the forthcoming documents. The IDC strategic plan centered on issuance of a strategic roadmap followed by specific "sub-roadmaps" in specific mission areas.[114] These first documents did not directly reflect ownership of the NSC, nor did they suggest space would be an integral part of the IDC. In May 2010, the IDC issued its vision for Information Dominance. The vision followed the CNO guidance that information dominance would be a core capability of the Navy. It sought to define the "new niche Navy will fill at the intersection of maritime, information, and cyberspace domains."[115] A common theme throughout the vision is eliminating "stove-piped solutions that benefit only a single element."[116] The cost of these inefficiencies is too expensive to continue, particularly in the current fiscal environment. The vision depicts interconnected networks, sensors, and processes, extending beyond the technical realm and into the professional development scheme. Cross-training and cross-qualification are key components of the plan to strengthen the IDC. The plan with regards to space and the NSC, however, maintained status quo. While space-capability exploitation was implied in discussions of command and control networks, netted sensors, and electromagnetic spectrum management, the only direct mention of space capabilities envisions a future with an "integrated space-based earth observation remote sensing plan" that extends across interagency requirements and includes NTM capabilities.[117]

3. Professional Development

The Navy Space Cadre historically was defined in an ad hoc manner. There was no coherent plan to grow members. The formation of the Space

[114] Deputy Chief of Naval Operations for Information Dominance, "Memorandum for the Information Dominance Corps," 17 December 2009, http://www.hsdl. org/?view&did=734214.

[115] Deputy Chief of Naval Operations for Information Dominance, *The U.S. Navy's Vision for Information Dominance* (Washington, DC: Deputy Chief of Naval Operations for Information Dominance, 2010), 1, http://www.carlisle.army.mil/DIME/documents/Navy%20Information%20Dominance%20Vision%20-%20May%202010.pdf.

[116] Ibid., 8.

[117] Ibid., 16.

Systems curricula at NPS in 1982 introduced a formal program to educate space-savvy officers to return to fleet operational billets and engineers to fill acquisition billets in joint and Navy programs.[118] Following the formation of the NSC, the Space Systems Operations (SSO) and space systems engineering (SSE) curricula from NPS were the only formal accession source for members.[119] Officers in the SSO curriculum earned the 6206 subspecialty code (SSP), while SSE graduates earned the 5500 SSP. The SSP was qualified with a letter code suffix (see Table 1).

Suffix	**Meaning**
S	One experience tour
R	Multiple experience tours
P	Master's degree
Q	Master's degree with experience

Table 1. Subspecialty code suffix.[120]

Officers with SSO masters' of science (MS) degrees from NPS were assigned the 6206P SSP. These officers were immediately incorporated into the NSC. Officers could also earn an SSP appended with the S or R suffix by assignment to a billet coded with the associated SSP.[121]

The formation of the IDC introduced the Information Dominance Warfare Officer (IDWO) qualification and associated Personnel Qualification Standard (PQS). The IDWO qualification process started with in-community qualification (e.g., intelligence) and concluded with completion of the IDWO PQS, which

[118] Department of the Navy, *From the Sea to the Stars*, 111.

[119] Naval Network Warfare Command, *Navy Space Cadre Human Capital Strategy*, 16.

[120] Navy Personnel Command, "Subspecialty Codes," *Navy Personnel Command Detailing*, http://www.public.navy.mil/bupers-npc/officer/Detailing/surfacewarfare/careerinfo/Pages/Subspecialties.aspx, accessed 11 March 2014.

[121] Naval Network Warfare Command, *Navy Space Cadre Human Capital Strategy*, 16.

provided a core of cross-community training in the form of level 100 and 200 line items.[122] Completion of the IDWO PQS was initially optional for members of the NSC because a Space Cadre PQS was not yet published.[123] In December 2010, the NSC issued its PQS and the IDC revised the IDWO qualification process to permit NSC members to qualify as IDWOs.[124] Completion of the Space Cadre PQS and IDWO qualification were ancillary to SSP and did not gain entrance into the NSC. Management changes announced in 2012 would drastically change the accession of NSC members.

[122] Naval Education and Training Command, *NAVEDTRA 43360: Personnel Qualification Standard for Information Dominance Warfare (IDWO) Officer* (Pensacola, FL: Naval Education and Training Command, 2010).

[123] Chief of Naval Operations, *OPNAV Instruction 1412.13: Information Dominance Warfare Officer Qualification Program* (Washington, DC: Chief of Naval Operations, 2010), http://doni.daps.dla.mil/Directives/ 01000%20Military%20Personnel%20Support/01-400%20Promotion%20and%20Advancement %20Programs/ 1412.13.pdf.

[124] Chief of Naval Operations, "NAVADMIN 292/11: Information Dominance Warfare Officer Program," 30 September 2011, http://www.public.navy.mil/bupers-npc/reference/messages/ Documents/NAVADMINS/NAV2011/NAV11292.txt.

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IV. CURRENT NAVY SPACE TRENDS

Space featured in early IDC documents as a key enabler of successful operations. In essence, this was a statement of status quo to the space community: the Navy has used space and will continue to do so. In 2012, the tenor began to change. In the *Navy Strategy for Achieving Information Dominance*, information is presented not only as an enabler of effective modern warfare, but also as a warfare domain, a weapon, a threat, and a vulnerability.[125] In this context, space (and the other disciplines of the IDC) is a key domain of warfare, one that commanders must consider in planning operations and fighting battles. This paradigm shift may provide the impetus for organizational focus on the NSC that space advocates have been requesting for years.

A. CURRENT NAVY SPACE POLICY AND DOCTRINE

In 2004, the Secretary of the Navy released the most recent departmental space policy. As previously mentioned, the policy requires a professional space cadre to fully exploit available space systems and to shape future designs.[126] This high-level document provides DON policy to align with DOD policies issued from 1999 to 2003 and reflects the Air Force assignment as EAS.[127] It does not reflect more recent focus on asymmetric threats to space capabilities, nor the concept of space as a domain for warfare. While the policy is in need of revision, it clearly outlines the need to partner beyond DON to fully integrate space capabilities in Marine Corps and Navy operations and for qualified personnel to complete the task. The policy is set for a revision some time in 2014.[128]

The most recent CNO Navy space policy implementation instruction is similarly outdated. It also reflects the role of space capabilities in modern Navy

[125] Deputy Chief of Naval Operations for Information Dominance, *Strategy for Achieving Information Dominance*, 5.

[126] Department of the Navy, *SECNAV Instruction 5400.39C*.

[127] Ibid.

[128] Linda Shultz, e-mail message to author, 27 February 2014.

operations and requires the maintenance of a space cadre, including officer, enlisted, and civilian personnel.[129] More significant than what the implementation plan contains is what it does not. The plan does not reflect the OPNAV N2/N6 merger and formation of the IDC. The entities assigned duties and responsibilities have all changed, meaning the specific actions are misdirected. This implementation plan is also set for revision, pending release of the DON space policy.[130]

The Navy Space Strategy of 2008 reflects a much more complete picture of space, including the importance of both exploiting available capabilities and protecting assets from threats.[131] The strategy seeks to continue to exploit available assets and to shape future systems by "vigorously engag[ing] with key national and joint space-related entities" in order to participate more effectively in development processes.[132] It presents five long-term goals:

- Mitigate impact of threats to critical capabilities.
- Identify, prioritize, and advocate Navy-specific requirements.
- Posture the NSC to be the Navy space requirements advocate.
- Conduct Navy-focused space S&T/R&D.
- Engage senior space leadership.[133]

The Navy space strategy action plan provides specific actions to accomplish strategic goals. In 2008, specific objectives for posturing the NSC for its advocacy role included identifying NSC critical billets; completing a zero-based review of space billets; instituting space billets at maritime headquarters with standing maritime operations centers (MOCs) and on strike group staffs;

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[129] Chief of Naval Operations, *OPNAV Instruction 5400.43A: Navy Space Policy Implementation* (Washington, DC: Chief of Naval Operations, 2007), http://doni.documentservices.dla.mil/Directives/05000%20General%20Management%20Security%20and%20Safety%20Services/05-400%20Organization%20and%20Functional%20Support%20Services/5400.43A.pdf.

[130] Linda Shultz, e-mail message to author, 27 February 2014.

[131] Chief of Naval Operations, *Navy Space Strategy* (Washington, DC: Chief of Naval Operations, 2008).

[132] Chief of Naval Operations, *Navy Space Strategy* (2008).

[133] Ibid.

identify and designate civilian members of NSC; update and recruit reserve NSC members; and monitor and improve payback tour rates for officers graduating from SSO/SSE programs at NPS.[134] The plan does not include an objective to include enlisted members in the NSC. While most objectives remain outstanding, a zero-based review (ZBR) of Navy space billets was completed in 2012 by the new TYCOM, NCF, and represented a major step forward for many of the objectives. The ZBR report will be discussed in detail below.

An updated Navy space strategy was released in 2011, but it is essentially a copy of the 2008 version, sharing the same five goals.[135] The *Fleet Space Effects Warfighting Concept of Operations* (Fleet Space CONOPS), released in November 2012, refers to the 2008 strategy as the most recent version.[136] Furthermore, the space strategy is not often referenced in the Fleet Space CONOPS or elsewhere, no matter the year released.

The Fleet Space CONOPS itself is a mid-term document that seeks to provide "enhancements to the mission capability of Fleets/Maritime Operation Centers, Strike Groups, Amphibious Ready Groups and U.S. Naval vessels."[137] Space mission areas, key Navy space organizations, and space weather are discussed as a sort of space operations crash course. The CONOPS presents several operational scenarios as examples to the warfighter of the current space-operating environment, particularly threats and vulnerabilities of space-based assets. It also describes operational planning of space capabilities, identifying joint entities relevant to space operations in-theater, such as the Director of space forces (DS4) on the Joint Force Air Component Commander (JFACC) staff. The NNWC Space Cell coordinates space support for maritime units, but

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[134] Chief of Naval Operations, *Annual Navy Space Action Plan* (Washington, DC: Chief of Naval Operations, 2008).

[135] Chief of Naval Operations, *Navy Space Strategy* (Washington, DC: Chief of Naval Operations, 2011).

[136] Fleet Forces Command, *Fleet Space Effects Warfighting Concept of Operations (CONOPS)* (Norfolk, VA: Fleet Forces Command, 2012).

[137] Ibid., Letter of Promulgation.

cannot fully accomplish the task for all customers. Carrier strike groups (CSGs), amphibious ready groups (ARGs), and other deployed units must make contact with the theater DS4 staff via a space operations officer in order to receive optimal support.[138] Independent deploying units, such as ballistic missile defense (BMD) destroyers, are also directed to utilize the space operations officer role in gaining proper space support.[139] The CONOPS, in some ways, is one half of the essential knowledge for a new space operations officer.

The other half of the essential knowledge is the *Naval Space Handbook*, a desk reference guide for space operations. The handbook starts with a space fundamentals chapter, in order to prepare the "new Space Operations Officer with a basic understanding of the space environment, space systems, space supporting organizations, doctrine and policy."[140] It describes tools that are available for use, points of contact for support, checklists for deployment, and links to relevant sites on the Secure Internet Protocol Router Network (SIPRNet) and Joint Worldwide IC System (JWICS). The handbook truly provides the core knowledge for a space operations officer. In combination with the Fleet Space CONOPS, it appears the Navy has a series of documents to inform an otherwise unprepared space operations officer and the broader Navy community.

B. 2012 AQD RESTRUCTURE

Since the formal beginnings of the space cadre in 2002–2003, graduate education from NPS was the primary on-ramp to NSC membership as indicated through P and Q suffixed SSPs. In addition to the SSP, the Navy uses additional qualification designators (AQDs) to track qualified personnel and to code billets with required qualifications. The NSC originally had four AQDs for its members.

[138] Ibid., 23.

[139] Ibid., 27-28.

[140] Naval Network Warfare Command, *Naval Space Handbook*, 9.

These AQDs, described below by the Navy space human capital strategy, valued graduate education in combination with greater than 18 months experience above all else:

- VS1 (Recruit) = Officer who has received a Space Certificate from the Naval Postgraduate School or an equivalent institution.
- VS2 (Apprentice) = Officer who has a space-related bachelor's degree from an accredited institution or has 18 or more months of experience in a space-related billet.
- VS3 (Journeyman) = Officer who has a space-related master's degree from an accredited institution, has proven experience (more than one tour of 18 or more months of experience) in a space-related billet; or a space-related bachelor's degree from an accredited institution plus 18 or more months of experience in a space-related billet.
- VS4 (Expert) = Officer who has a space-related masters or doctorate degree from an accredited institution and has proven experience of at least 18 months in a space-related billet.[141]

The Naval War College has described the Navy culture as one that learns on the job.[142] The Navy puts emphasis on operational billets and encourages completion of graduate education through distance learning by placing neutral value on in-residence education opportunities in selection boards.[143] The Navy, then, does not generally require graduate education to become a subject matter expert in a given field. In addition, many officers are unable to fit NPS curricula into their career progressions. Accordingly, in 2013, the Navy announced an AQD restructure that deemphasized graduate education and better represented the desired qualities of the space cadre.[144] The NSC replaced the VS1–VS4

[141] Naval Network Warfare Command, *Navy Space Cadre Human Capital Strategy*, 4.

[142] Naval War College, "Perspectives on Service Culture: Developing Awareness of the Impact of Culture in the Planning Group" (Newport, RI: Naval War College, 2009), 10.

[143] Ibid.

[144] Chief of Naval Operations, "NAVADMIN 110/13: Revision to Space and Electronic Warfare (SEW) Additional Qualification Designators (AQDs)," 23 April 2013, http://www.public.navy.mil/bupers-npc/reference/messages/Documents/NAVADMINS/NAV2013/NAV13110.txt.

AQDs with an operations branch (VS5 through VS8) and an acquisition branch (VR1 through VR3). Table 2 presents the new AQD structure and associated training requirements.

AQD	PQS	Space 200	Space 300	DAWIA (level)	Experience (years)
VS5	✓				1
VS6	✓	✓			2
VS7	✓	✓			4
VS8	✓	✓	✓		6
VR1	✓			I	2
VR2	✓			II	4
VR3	✓			III	6

Table 2. NSC AQD structure following 2013 revision.[145]

As a candidate for NSC accession, space operations officers report to a VS5-coded billet as a non-NSC member. Once in the position, the officer completes the Space PQS and completes one year in the space-related billet before applying for the VS5 AQD. In order to progress through the operations (VS5–VS8) AQDs, the officer must complete follow-on training requirements tied to VS6, VS7, and VS8 billets. The training requirements center around courses offered at the Air Force's National Security Space Institute (NSSI). Space 200 is an intermediate course designed for mid-career space professionals.[146] For VS6 billets, the Space Warfighter Prep Course (SWPC) is an alternate to the Space

[145] Ibid.

[146] Navy Cyber Forces Command, *Space Zero-Based Review*, 40.

200 course. It is designed specifically for operational personnel working to effectively employ space-based assets in exercise and real-world operations.

New space acquisition professionals report to a VR1-coded billet as a non-NSC member, as well. Once completing the Space PQS, two years of space acquisition experience, and acquisition-specific certification, the officer can apply for the VR1 AQD. Acquisition-specific training is accomplished through Defense Acquisition Workforce Improvement Act (DAWIA) certification. Space acquisition professionals are required to complete higher levels of DAWIA certification as they progress through the AQDs. DAWIA certification curricula are focused training for acquisition personnel in order to improve effectiveness of defense acquisition programs.[147] Certification requirements for the 14 career fields are divided into acquisition training, functional training, education, and experience areas. Each career field has differing requirements in each area. For example, level I certification in program management, a common function for military acquisition professionals, requires one year experience plus one fundamentals of acquisition course, an introduction to earned value management, a cost analysis course, and a fundamentals of systems planning, research, development, and engineering course.[148] These certification requirements do not capture specific space education or training, only acquisition and related material. But space acquisition professionals complete DAWIA certification in lieu of space education requirements for VR1 VR3 AQDs. A space VR1-candidate must complete the Space PQS, DAWIA level I certification, and two years of space experience prior to applying for the VR1 AQD.[149]

On the surface, the addition of the space acquisition branch to the NSC AQD structure appears to provide additional depth to the ability to track NSC personnel. But the operations–acquisition split was already present in the

[147] Defense Acquisitions University, *Defense Acquisitions University Catalog* (Fort Belvoir, VA: Defense Acquisitions University, 2013), 12, http://icatalog.dau.mil/onlinecatalog/Archived_Catalogs.asp.

[148] Ibid., 45.

[149] Chief of Naval Operations, “NAVADMIN 110/13.”

categorization of the NSC: the SSP 6206 implied space operations while 5500 denoted space acquisition. In addition to the graduate education requirement, the Navy used S and R suffixed SSPs to indicate the experience gained (or desired) for a specific billet. The SSP is not adaptable enough to capture training requirements, however; it only captures graduate education (masters or certificate) or experience. The AQD provides greater refinement as it is able to capture training requirements and additional levels of experience. In addition, the NSC requires applications to be submitted for each AQD, allowing it to verify the completion of requirements prior to awarding the new AQD.[150] The revised AQD structure provides a clearer picture of the true experience and NSSI education level of NSC members, while P and Q suffixed SSPs continue to track completion of graduate education.

C. ZERO-BASED REVIEW

In 2012, Navy Cyber Forces conducted a zero-based review of space billets in order to establish a manpower baseline and to inform the Navy Space Plan Task Force.[151] The study included officer, enlisted, and civilian positions and sought to validate the requirements for space-coded billets. The ZBR considered 1,144 total billets, validating 980 of those as space-related.[152] The report recommended changes to be implemented in the NSC manpower billet base, including a sweeping overhaul of AQDs and SSPs, assigned.[153]

The work began with a formal definition of the NSC:

> The Navy Space Cadre is the total force that provides leadership and technical expertise to develop, evaluate, acquire, operate, and exploit space capabilities in order to meet the full spectrum of Naval and Joint warfighting requirements.[154]

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[150] Ibid.

[151] Navy Cyber Forces Command, *Space Zero-Based Review*, 6.

[152] Ibid., 7.

[153] Ibid., 17.

[154] Ibid., 22.

The definition goes on to say the NSC includes active duty component (AD) and reserve component (RC) Navy members (officer and enlisted) and DON civilians, but it does not include personnel who simply use space capabilities (e.g., SATCOM terminal operators).[155] A workforce construct was then developed, adding operational and tactical focus to a cadre structure that was primarily acquisition and policy focused.[156] After pulling data for 930 billets that include space-coding or space-related duties in titles, the ZBR validated billets using input from the owning commands. The commands responded with an additional 214 space-related billets and provided input for non-space related billets, resulting in the removal of 164 billets. The final validated NSC manpower requirement was determined to be 980 billets across military (officer and enlisted) and civilian (government and contractor) positions.[157] Table 3 shows the breakdown of billets (one billet of the 980 total is unaccounted for). The ZBR also presented a breakdown by AQD across AD and RC officer billets (see Figure 1).

The ZBR validated SSP-coding for billets, as well. Each command provided input for billets that required MS education. These billets were coded with P or Q suffixed SSPs, as appropriate for current requirements. The experience-based (S and R suffixed) SSPs were removed and those billets were given appropriate VS or VR AQDs. The resulting billet base did not make a significant change to the number of billets requiring MS education. The combined effect of the AQD revision and the ZBR validation is a billet base not focused on graduate education as a primary accession source, but with validated 6206/5500 SSP-coded billets defining the current NSC manpower requirements.

[155] Ibid.

[156] Ibid.

[157] Ibid., 26.

Type	Billets
Officer (AD and RC)	358
Enlisted (AD and RC)	266
Civilian (government and contractor)	355

Table 3. ZBR billet breakdown.[158]

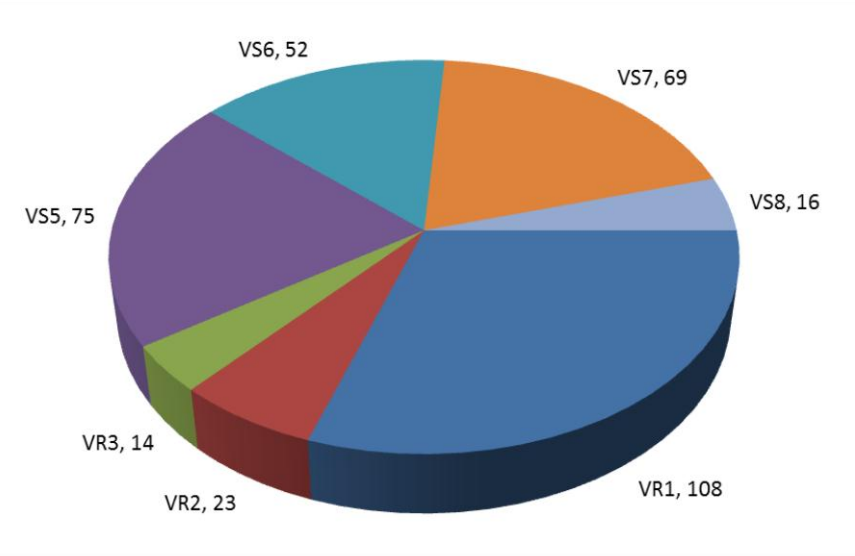

Figure 1. AD and RC officer billets by AQD.[159]

During validation of the billets, the ZBR did not address critical billets directly. It did include critical billets in its data, but the criticality of the billets was

[158] Ibid., 50–51.

[159] Ibid., 48.

not validated. The review validated 45 of 78 critical billets as space-related. The remaining 33 billets were cut as not space-related. The ZBR did not consider whether or not the 214 added billets were critical.[160]

The method of validating billets deserves a closer inspection. When the ZBR collected data and sent it to the owning commands, it expected input on what space-related billets were needed for current operations. The quality of the input depended on the knowledge and understanding of the submitting entity. But the ZBR received less than optimal feedback from more than one command. In one instance, a command declined its previously assigned NSC billet because it is assigned a space task only when needed, not daily.[161] The ZBR did resolve this discrepancy and included this billet as a validated billet, but the event highlights the possibility of poor input. Furthermore, the input from units not familiar with space-related tasking (e.g., strike groups) is particularly suspect given the lack of understanding of space operations. Yet, the ZBR included these inputs with the same weight as inputs from long-standing units such as the Space and Naval Warfare Systems Command (SPAWAR) Space Field Activity (SSFA). The validated requirements were then bundled together as the recommended billet base and forwarded to the Navy Space Plan Task Force.

As a result of the input process, billets added across operational units (e.g., CSGs) were not standardized. Each CSG and Amphibious Squadron (CPR) commander was allowed individual input for the CSG/CPR in order to maintain "the commander's prerogative to assign these duties as he/she sees fit."[162] But in the same paragraph the ZBR identifies an inability to provide a complete listing of CSG/CPR space operations billets "due to lack of response from some of the units."[163] Despite this discontinuity, the report recommends continuing tailored space operations billet coding on each CSG/CPR staff despite

[160] Ibid., 16-17.

[161] Ibid., 15.

[162] Ibid., 12.

[163] Ibid.

the lack of understanding of space operations and the lack of response.[164] These problems are not isolated to CSGs/CPRs, but extend to numbered fleets (e.g. Fifth Fleet).

Navy Cyber Forces began to implement its billet base changes in 2013, beginning with a shift to the revised AQD structure. The AQD change for personnel was not a one-for-one exchange but required reapplication by each member no later than the November 2013 deadline.[165] As a result of the change, the NSC went from 1033 AD and RC officers in 2011[166] to 124 members in February 2014.[167] NCF also continued to improve its billet base following the release of the ZBR report. The current billet list awaiting full implementation includes 382 AD and RC billets.[168] A breakdown of AD and RC officer recommended billets is included in Table 4.

Type	**Billets**
AD Officer	296
RC Officer	86
Total	382

Table 4. NCF implemented billets.[169]

[164] Ibid., 13.

[165] Chief of Naval Operations, "NAVADMIN 110/13."

[166] Clint W. Miller, "Optimizing the Navy's Investment in Space Professionals" (Master's thesis, Naval Postgraduate School, 2011), 38, www.dtic.mil/cgi-bin/GetTRDoc?AD=ADA552417.

[167] Navy Space Cadre Office, "20140228 – SC Office Dashboard v2" (internal document, Navy Space Cadre Office, Deputy Chief of Naval Operations for Information Dominance Washington, DC, 2014).

[168] Navy Cyber Forces Command, "NOOCS Billet List" (internal document, Navy Cyber Forces, Suffolk, VA, 2013).

[169] Ibid.

The AQD breakdown for all billets is shown in Figure 2 and reflects changes to VS5, VS7, and VS8 billet numbers. The updated billet list is now 62 percent operations (VS5–VS8; 236 billets) and 38 percent space acquisition (VR1–VR3; 145 billets). (There is one billet for a professor at the U.S. Naval Academy, which is coded with the PROF AQD. This billet is not included in further discussions.) Space acquisition billets represent a larger percentage of AD officer billets (43 percent; see Figures 3 and 4). Previously, the acquisition–operations billet split was much closer to 50 percent for AD officer billets, so the ZBR billet base clearly represents added investment in space operations.[170]

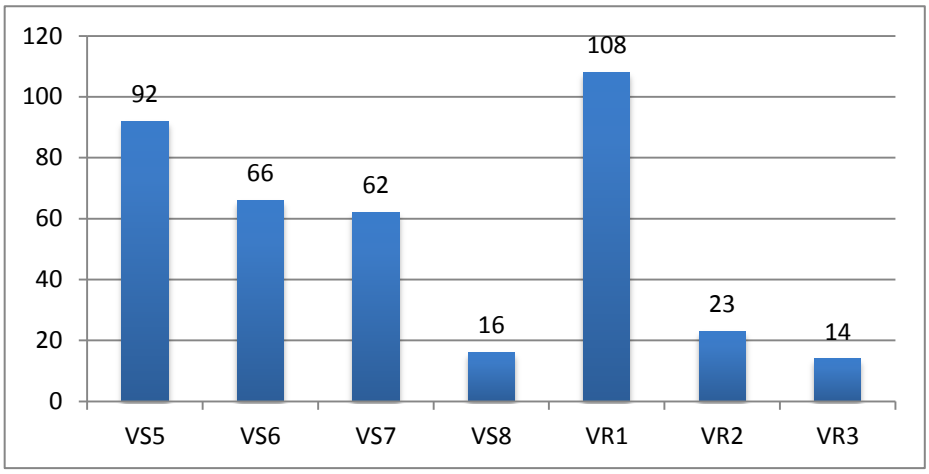

Figure 2. AD and RC billets by AQD.[171]

[170] The current breakdown is 68–71 (acquisitions–operations). These numbers are in a period of transition, which will be discussed at length in Chapter 5. Navy Space Cadre Office, "20140228—SC Office Dashboard v2."

[171] Navy Cyber Forces Command, "NOOCS Billet List."

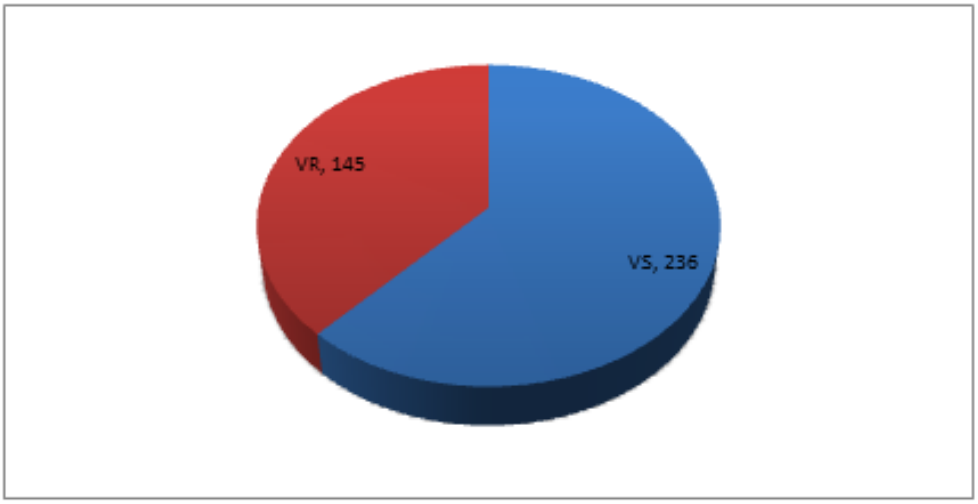

Figure 3. Overall officer billets by AQD type.[172]

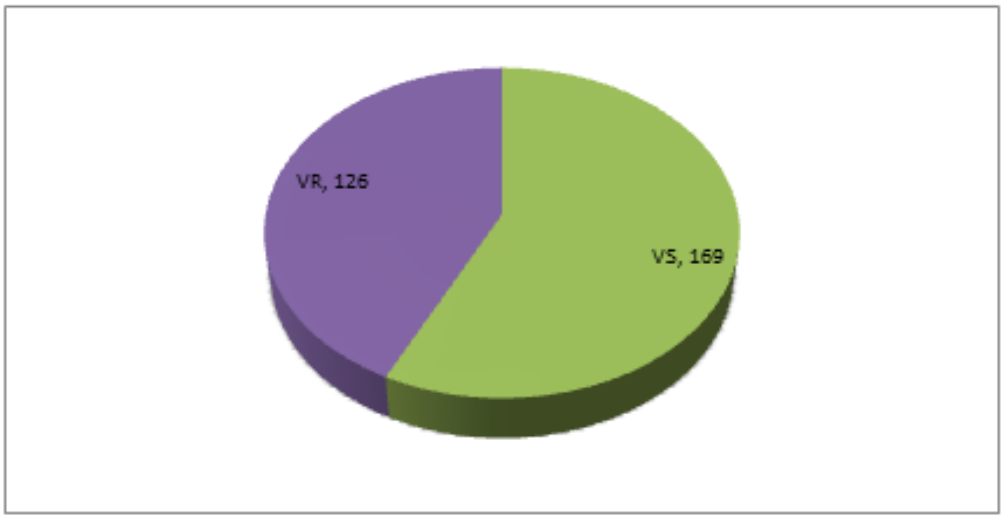

Figure 4. AD officer billets by AQD type.[173]

The added operations billets are mostly coded as shore duty, however. The ZBR found that 99 percent of space-related billets are shore-based.[174] The addition of space operations billets on afloat staffs has increased the total sea-based billets to 10, representing 3.5 percent of total AD officer billets and 6.3

[172] Ibid.

[173] Ibid.

[174] Navy Cyber Forces Command, *Space Zero-Based Review*, 11.

percent total AD officer VS billets.[175] The sea-based billets are on CSG and CPR staffs, as well as one billet on Commander, Seventh Fleet (C7F) staff.[176] There are nine additional billets on CSG, CPR, or expeditionary strike group (ESG) staffs that are not coded as sea-based billets.

Overall, the ZBR report and recommended billet base provides a clear snapshot of the current NSC billet base while the revised AQD structure provides an improved (and more accurate) categorization of NSC members. The billet base not only captures currently filled requirements, but also provides a recommended base of what *should* be filled. These manpower requirements remain focused on the here and now, however. The NSC needs to know the future requirements in order to properly posture its personnel to achieve those requirements. The Navy Space Plan Task Force was chartered to consider this and other topics related to the future of Navy space.

D. NAVY SPACE PLAN TASK FORCE AND EXPECTED DOCUMENTS

In April 2012, DCNO N2/N6, VADM Card, appointed Rear Admiral Sandy Daniels as Senior Advisor for Space and to chair of the Navy Space Plan Task Force.[177] The task force was chartered "to develop, design, and produce the Navy Space Plan to assess the Navy's space workforce requirements, capabilities and capacity, as well as the Navy's role in space."[178] The ZBR report and associated billet base are the starting point for the task force, which will analyze gaps and present a plan to "create a sustainable Navy Space workforce."[179] The charter also identifies the future report of the task force as the

[175] Navy Cyber Forces Command, "NOOCS Billet List."

[176] Ibid.

[177] Kendall Card, "Information Dominance Corps," *Information Dominance Corps Newsletter* (October 2012): 1, http://www.public.navy. mil/bupers-npc/officer/Detailing/IDC_FAO/Documents/IDC%20Newsletter %20-%20SPACE%20(121011).pdf.

[178] Deputy Chief of Naval Operations for Information Dominance, *Navy Space Plan Task Force Charter* (Washington, DC: Deputy Chief of Naval Operations for Information Dominance, 2012), 1.

[179] Ibid.

Navy's input to the biennial report to Congress on DOD space cadre management.[180] Thus, the task force is tasked with presenting the current status of NSC management, the vision and requirements for Navy space moving forward, and the plan to connect the present to the future.

A recent draft of the upcoming Navy Space Plan shows the task force's focus areas are the space requirements process, space-related S&T/R&D, space acquisition, operational support, and the NSC.[181] The task force recommends the implementation of the ZBR billet base in order to address inconsistencies and current gaps that exist across the fleet.[182] While the plan recognizes budget constraints as a barrier to rapid change in Navy space functions and roles, it makes several recommendations to improve efficiency and effectiveness. In the S&T/R&D focus area, the task force recommends more efficient S&T/R&D processes, focused by a funding strategy, that translate successful S&T endeavors into requirements for future systems.[183] In order to effectively advocate for solutions to Navy requirements gaps, the plan recommends establishing and maintaining senior positions at key Air Force and joint commands.[184] Though the plan calls for maintenance of acquisition billets at current (ZBR-recommended) levels, it does recommend further investigation of assuming responsibility for a future space-based weather system.[185] The operational support section highlights the need for experience through exercises in anti-access/area-denial (A2/AD) environments.[186]

The task force is critical of the NSC. It found that members "sometimes lack the formal training and/or skills required to fill key space-related

[180] Ibid., 2.

[181] Navy Space Plan Task Force, "Navy Space Plan" (draft, Navy Space Plan Task Force, Deputy Chief of Naval Operations for Information Dominance, Washington, DC, 2013), 8.

[182] Ibid., 12.

[183] Ibid., 15.

[184] Ibid.

[185] Ibid., 17.

[186] Ibid., 19.

positions."[187] Sometimes the shortfalls are due to a lack of formal training processes and other times the NSC member with the required skill set is not assigned to the priority position. In addition, the plan identifies the lack of formal tracking processes for civilian and enlisted members. In order to better posture the NSC, the task force recommends 15 actions, which include:

- Formalize NSC training.
- Update the space cadre human capital strategy, including for enlisted and civilian members.
- Implement ZBR-recommended billet base.
- Standardize coding of space operations officers on afloat staffs.
- Track enlisted NSC billets.
- Track civilian NSC billets.
- Require training en route during permanent change of station (PCS).
- Prioritize NSC billets.[188]

The Navy Space Plan will ultimately inform the development of an updated Navy space action plan, Navy space strategy, and NSC human capital strategy during 2014.[189] These documents, in concert with implementation of the ZBR billet base, may implement changes advocates have championed since the current DOD space cadre and space management structure was formed following the Space Commission. The work is not complete, however, and several areas deserve closer inspection and specific recommendations.

[187] Ibid., 21.

[188] Ibid., 23–25.

[189] Ibid., 26.

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V. ANALYSIS

The current trends in Navy space doctrine and policy as well as NSC management are encouraging. The Navy Space Plan Task Force is taking an important role in recommending NSC changes to build a more effective and streamlined cadre. The task force must focus attention on the vision of the future NSC, current and future manpower requirements, and professional development of the NSC to be effective.

A. MANPOWER ANALYSIS

1. ZBR Billet Base Implementation

Navy Cyber Forces, the NSC TYCOM, currently has developed a draft package for submission to Navy Manpower Analysis Center (NAVMAC) for the revised billet base. According to CDR Dejesus at NCF, current funding limitations are preventing full implementation.[190] In order to transition, funds must be made available to cover the costs of the training requirements for VS6, VS7, and VS8. While the quotas at NSSI are available, the funding is not yet solidified. In the interim, the billets are being managed through SSPs, as before. According to the OPNAV NSC status brief, there are currently 140 billets in the NSC.[191] While the billets are in this state of limbo, the effectiveness of the NSC is significantly limited.

2. Non-Standardized Billets on Operational Staffs

The ZBR-recommended billet base offers an increased investment on afloat staffs. Unfortunately, these billets are not standardized. All nine active CSGs have billets in the draft billet list. However, the specific billets include six IW billets, one command and control billet, one mine warfare billet, one METOC

[190] Adam DeJesus (NCF N13/N17) in discussion with the author, 6 February 2014.

[191] Navy Space Cadre Office, “20140228—SC Office Dashboard v2.”

billet, and one communications billet.[192] CSG-8 has two space billets, one each for IW and mine warfare. All three active ESGs have space-coded billets, including two IW billets and one METOC billet.[193] Billets are standardized across the CPRs, with all seven commanders assigning space operations to an IW billet.[194] The lack of standardization is likely an indication of who is currently in the position as opposed to who should be assigned the duty. Although the preponderance of space operations billets are assigned to IW officers, the lack of standardization not only indicates lack of a consistent manpower strategy, but also requires individual tailoring of strike group training prior to deployment. This is an unnecessary complication.

While the assignment of the NSC billets across operational staffs is not standardized across staff functional offices, there is consistent AQD standardization. The CSGs are assigned VS6 billets, with CSG-8 assigned a VS5-level officer along with the VS6 billet. The ESGs and CPRs are assigned VS5 billets. The geographic numbered fleets (except the omitted C5F) are assigned VS7 billets, though C6F has a VS6 billet in addition to the VS7-level officer. The C10F billets are broader, ranging from VS5 to VS8.

Fleet Space CONOPS instructs all deploying units to utilize space reach-back support through a space operations officer.[195] But individual ships will not have space operations officers assigned under the ZBR-recommended billet base. For an independently deploying destroyer (DDG) or frigate (FFG), reach-back support through NNWC or theater DS4 is the most effective and directed avenue for space support coordination.[196] In not standardizing staff support across the fleet, space support for these individual deploying units is left to chance that there is an officer with space experience onboard. A candidate for

[192] Navy Cyber Forces Command, “NOOCS Billet List.”

[193] Ibid.

[194] Ibid.

[195] Fleet Forces Command, *Fleet Space Effects Warfighting Concept of Operations (CONOPS)*, 27–28.

[196] Ibid., 23.

theater space support is the numbered fleet headquarters, with associated MOCs. Five of six numbered fleets or the associated Navy regional command include space operations billets in the recommended billet base. The notable omission is Fifth Fleet/Naval Forces Central Command (C5F/NAVCENT). It is clear that operational support for deployed units is not yet standardize nor well defined.

The Navy has discussed how to integrate space operations since ADM Burke's comments in 1959. Even today, 55 years later, the Navy has not fully integrated space operations on afloat staffs. This could be a reflection of the general static nature of space operations. Despite the tremendous speeds involved with orbiting satellites, "flying" the spacecraft is a fairly static operation due to well-determined orbits and relatively few changes to numbers of on-orbit objects on a daily basis.[197] This aspect of space operations has not changed tremendously since the 1960s. In addition, the afloat staffs were not directly involved in operating or tasking the space systems. Instead, the operational commander was concerned with what capabilities were available to the fleet for exploitation, which were similarly static. Only when new assets were launched or on-orbit assets suffered failures did these capabilities change.

Today, space operations are changing from operations enabled *from* space to operations *in* space. Emerging threats to on-orbit assets as well as threats to end-user terminals force commanders to be updated more frequently on available capabilities. Maneuvers in space may become more frequent as a means to protect satellites from adversary-based threats such as anti-satellite weapons and unintended threats such as the increasing numbers of orbital debris. The dynamic capability may be necessary to maintain space (and information) superiority in a denied or degraded environment.[198] While satellite operators will require more sensors and data in order to increase the pace of

[197] Daniel Beary et al., "Leading into the Future: Creating the Cadre of Space Professionals," *High Frontier* 7, no. 4 (2011): 22, http://www.afspc.af.mil/shared/media/document/ AFD-110825-027.pdf.

[198] Ibid.

satellite maneuvers, operational commanders must be aware of current capabilities and limitations of systems in order to make battlefield decisions. This requires a space operations function, which is what the author believes ADM Burke was referring to when he said commanders had to remain "fully cognizant of the rapidly changing Space Picture."[199]

3. Future Requirements

In 2004, the NSC human capital strategy identified the inability to determine future manpower requirements as a gap limiting the effectiveness of the NSC.[200] This still appears to be the case a decade later. The ZBR did not address future requirements of the NSC, but did a tremendous job improving the current billet base. That impressive task must not be allowed to be the final result. The Navy Space Plan Task Force is left to identify gaps in the ZBR-recommended billet base by analyzing the billets in terms of the future requirements for the NSC. But the task force is also assigned the task of defining the future role of Navy space.[201] The task force must address the future of Navy space honestly and resist the urge to set strictly achievable requirements. Only by knowing what the Navy wants to achieve with its future space professionals can the NCS be structured effectively.

B. PROFESSIONAL DEVELOPMENT ANALYSIS

1. AQD Revision

The AQD revision in 2013 resulted in a dramatic reduction in NSC membership. While the revised AQDs do a better job of defining space experience and expertise requirements, the current strength of 197 AD and RC officers is not an accurate reflection of space expertise within the Navy officer community.[202] The low numbers are likely a result of the requirement for

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[199] Department of the Navy, *From the Sea to the Stars*, 62.

[200] Naval Network Warfare Command, *Navy Space Cadre Human Capital Strategy*, 17.

[201] Deputy Chief of Naval Operations for Information Dominance, "Task Force Charter," 1.

[202] Navy Space Cadre Office, "20140228—SC Office Dashboard v2."

reapplication for all AQDs. The NSC is now in a position that it must recruit new members to regrow the community. In the interim, effectiveness of the NSC (not to mention fit/fill rates of billets) could suffer substantially.

2. Space PQS + Minimum Experience

The Space PQS introduced a single entry point for officers into the NSC. For new space acquisition personnel, this is a task to be completed at a command with senior VR personnel. The natural junior–senior relationship will be present and will encourage mentorship and training on the job. In the space operations realm, however, the officers are likely the only space operations officers. The question then is: How will the officer complete the PQS? The answer must be that he/she studies independently and makes contact with NNWC, C10F, or some other space activity by phone or email to complete the PQS. Clearly this is not the optimal method of conducting training. The challenge of receiving valuable training on the job and through individual study while completing the space PQS combined with the lack of formal training or education en route to a VS5 billet creates a perfect storm of ineffectiveness.

The experience requirement prior to applying for the AQD is also a significant concern. Once an officer reports for duty in a VS5 billet, he/she must wait one year prior to applying for the AQD.[203] Thus, for that first year, the billet is filled but there is not a fit. The effectiveness of the officer in the role will depend greatly on the motivation of the officer, additional tasking (especially relevant because space is likely a collateral duty), and the experience he/she gains. In space acquisition, the VR1-candidate is a non-fit in the position for two years, as he/she gains the experience needed for the AQD, though this is probably less of an issue for VR1 billets because there will be more senior space acquisition personnel at the command. The assignment of the AQD following experience gained at the command also sets a dangerous precedent, particularly in light of the low numbers in the NSC currently. Larger and more senior commands

[203] Chief of Naval Operations, “NAVADMIN 110/13.”

requested more senior AQDs (e.g., VS6 at CSGs) during the ZBR billet validation process. Since the VS5 AQD is assigned mid-tour, the same may be true for VS6–VS8 billets once the new billet base is implemented. This could effectively send officers with less experience than requested. Again, this is clearly not the most effective means of managing billets.

The minimum experience requirement also prevents immediate inclusion of NPS SSO and SSE graduates in the NSC. These officers return to their primary communities without a space-related AQD. Though they carry the 6206P or 5500P SSP, they must gain entrance to the NSC through a VS5 or VR1 coded billet. This is a potential loss of a significant investment in the education of these officers. Furthermore, no VS5 billets are coded with the 6206P SSP. An SSO graduate must be detailed first to a VS5 billet and then subsequently to a 6206P-coded VS6 billet in order to capitalize on the NPS education investment.

3. Space Operations Rank Structure and Career Progression

In order to have a sustainable community, the NSC must have sufficient junior personnel to promote to senior ranks. The ZBR did not specifically address this type of community planning in its manpower validation. Space acquisition billets present a natural progression in billets available to junior and senior officers (see Figure 5). Space operations billets, on the other hand, are not so systematically structured (see Figure 6). While these figures illustrate billets and not personnel, it is unlikely that a billet structure such as in Figure 6 can sustain a personnel structure required to build the future leaders of the NSC, particularly from lieutenant commander to commander. Since not every lieutenant commander is promoted to commander, the NSC must structure the billet base to support more junior rank members in order to develop sufficient numbers in the senior ranks.

There are two keys to building a sustainable community: knowing the target end-strength and knowing (or assuming) an expected promotion/attrition rate. The ZBR did not address these matters at all, as it was a manpower study.

Personnel from NCF and the OPNAV NSC Office familiar with the ZBR and current NSC trends did not have the promotion rate statistics for NSC members.[204] Promotion rates for NSC members and individual communities are necessary for understanding how many junior personnel are needed to develop the necessary end-strength at senior ranks. Tracking reassignment rates is also important in order to know how often officers are assigned out of their primary communities into NSC billets.

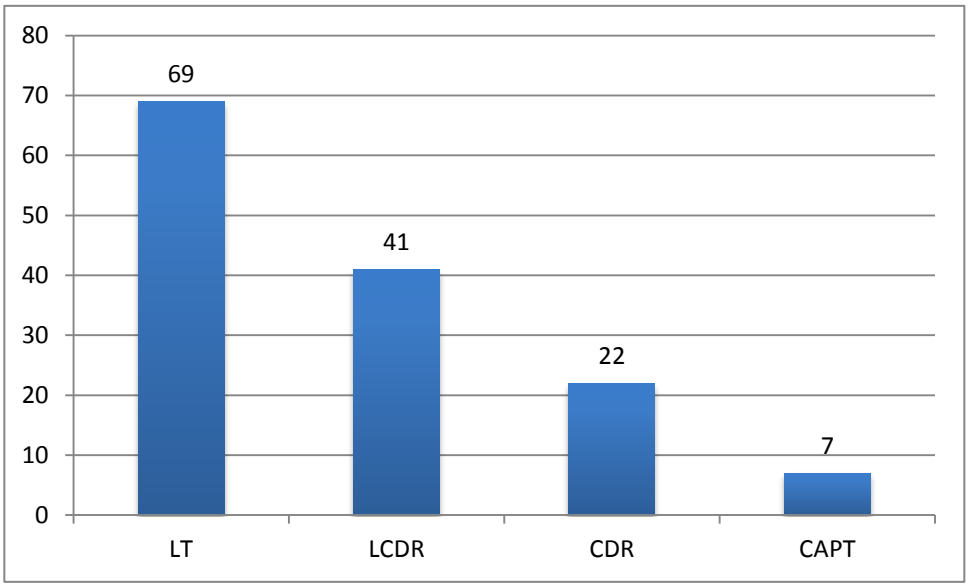

Figure 5. Space acquisition billets by rank.[205]

[204] Adam DeJesus, e-mail message to author, 27 February 2014; Michael Landers, e-mail message to author, 27 February 2014.

[205] Navy Cyber Forces Command, "NOOCS Billet List."

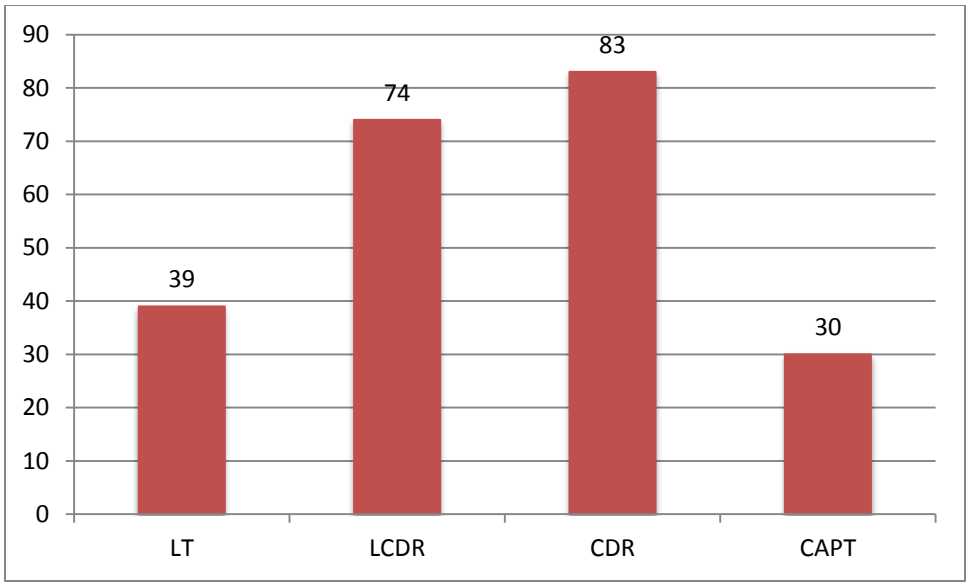

Figure 6. Space operations billets by rank.[206]

During a recent visit to NPS, the author asked the Navy Space Plan Task Force lead how future NSC flag officers, particularly in the operations branch, would be developed. She believes officers in the RC are most likely to have the desired balance of leadership and space experience needed for future space operations flag officers.[207] This signifies a corresponding failure to develop senior NSC members within the active duty component of the Navy. Leadership in the Navy shouldn't require civilian experience. But the lack of a planned rank structure and a viable career path for even a set of space operations officers prevents the AD NSC members from seeing a senior NSC position as a career possibility, let alone likelihood. Without changes to the rank structure and a viable career path, the NSC cannot commit to building its own future space operations leaders.

4. AQD Structure

An examination of the space operations AQD structure reveals a similar development problem. In Figure 7, AD space operations billets are shown,

[206] Ibid.

[207] RADM Sandy Daniels, in discussion with the author, 25 February 2014.

illustrating an increase in VS7 billets over VS6. In a virtual community such as the NSC, assignment rates from contributing communities, particularly URL, will be fairly low. It is unlikely that a one-for-one development from VS6 to VS7 will occur. Furthermore, assignment rate, not just payback completion, is important to track in order to develop assumptions on which to base community development.

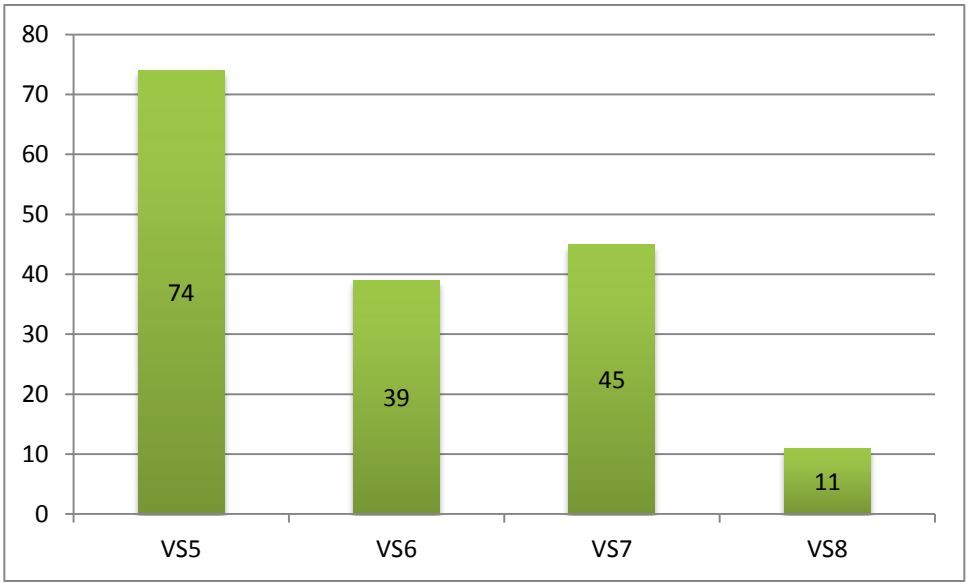

Figure 7. AD space operations billets by AQD.[208]

The same problem is not manifest in the space acquisition AQD breakdown (see Figure 8). In fact, the steep decrease in number of VR2 billets compared to VR1 may present an opposite kind of problem. One of the goals of the revised AQD structure was to focus space acquisition experience (vice other acquisitions experience) in the VR2–VR3 ranks. But the extremely low total of VR2 billets unnecessarily limits a potential career path for space acquisition officers and forces most officers with space acquisition experience into other acquisition jobs, which is ultimately counterproductive.

[208] Navy Cyber Forces Command, "NOOCS Billet List."

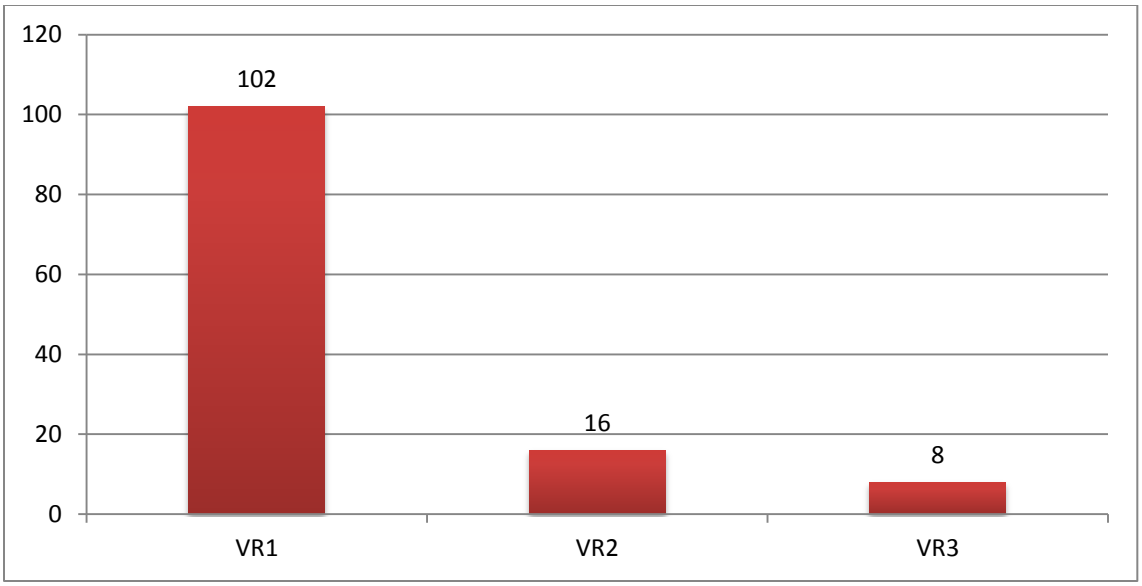

Figure 8. AD space acquisitions billets by AQD.[209]

5. No Space Education Requirement for Space Acquisition Professionals

One effect of the AQD revision is the removal of all formal space education and training for space acquisition personnel. The logic from NCF is that it is essential for space acquisition professionals to have experience in kind for space systems.[210] The implication is that buying radios or servers is not the same as space systems. It is not essential to have Space 200 or Space 300 at predetermined points in the career progression. There is a difference, however, between Space 200 not being essential and space education not being essential. Space 200 is a mid-career course with two main focuses: development of systems and application of space power.[211] If the focus on space power application is superfluous, a different course (or partial course) can be developed. But space education is important for space acquisition professionals. In other domains, expertise and education are earned through in-domain

[209] Ibid.

[210] Adam DeJesus, e-mail message to author, 12 March 2014.

[211] National Security Space Institute, "Space 200 Course," *National Security Space Institute Courses*, accessed 20 March 2014, https://www2.peterson.af.mil/nssi/public/.

experience. For instance, an aviator working with acquisition of aircraft components has experience flying in that domain and possibly in that aircraft. Most Navy officers do not have similar space systems experience, however. While on-the-job training may be a viable solution to this lack of experience problem, a course of instruction may be more effective in providing the foundational knowledge a space acquisition professional would need.

To gain in-domain experience, space acquisition professionals need to understand the environment the satellite is operating in, the method of launch, the composition of the satellite itself, the means of controlling it, the means of employing its capabilities, and the threats and vulnerabilities to the system. A level of understanding of orbital mechanics and the space environment is required to understand the satellite's physical domain. An understanding of the electromagnetic spectrum, satellite communications, and signal processing are also required to fully understand the operating domain. Spacecraft are complex systems, with propulsion, electrical power generation and distribution, attitude determination and control, thermal control, communications subsystems and a primary payload, all of which must be understood. While the Space PQS has a Fundamentals section requiring signature for all of these topics, formal education would provide a deeper level of understanding than individual study.

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VI. RECOMMENDATIONS

The Navy Space Task Force and follow-on activities are expected to form a vision of future requirements for the NSC. Any changes that come will be to the existing NSC structure, not a whole revision to the community. Recent theses from NPS recommended options for sweeping changes to the NSC. In 2007, Paul Bandini and Andrew Dittmer focused their recommendations on operational support and streamlined processes. They recommended abandoning satellite operations and focusing on S&T addressing Navy requirements while consolidating requirements generation within the NRL.[212] Redundancies were heavily criticized, including NNWC as a coordinating entity for space support to deployed naval forces.[213] Despite recommending elimination of these roles for Navy space, they acknowledged Navy operations require a robust and empowered NSC.[214] To achieve more effective NSC management, the thesis encouraged clarity in Navy space policy and doctrine with unambiguous guidance for the community, as well as further integration of space capabilities in operational afloat staffs.[215]

In 2011, Clint Miller conducted a review of NSC management and found that rates of filling billets with personnel (fill rate) and filling billets with qualified personnel (fit rate) were insufficient. He recommended three options for the overall community. First, formation of a dedicated space cadre designator or warfare community would warrant the attention of an entire community and be the most effective solution.[216] Second, an auxiliary community of "space enablers" could fill fleet billets in order to coordinate space support primarily

[212] Paul V. Bandini and Andrew R. Dittmer, "A Modest Proposal: For Preventing Space Operations from Being a Burden to the Navy, and for Making the Space Cadre Beneficial to the Community" (master's thesis, Naval Postgraduate School, 2007), 101, http://www.dtic.mil/dtic/tr/fulltext/u2/a473712.pdf.

[213] Ibid., 88.

[214] Ibid., 101.

[215] Ibid., 102.

[216] Miller, "Optimizing the Navy's Investment," 61.

through reach-back tools while the bulk of the traditional NSC billets would be filled with NPS-educated officers.[217] He recommended a short course for space enablers to ensure a basic level of knowledge. Third, he recommended a specialty career path for unrestricted line (URL) officers, allowing designated officers to continue their community-specific career path while focusing out-of-community tours in one area.[218]

Each of these recommendations is a reasonable method of managing the community. But budget limitations and the fact that the Air Force and IC provide the preponderance of space capabilities and support forces the author to constrain the recommendations of this thesis to those that are likely given the current state of the NSC and the standing of Navy space. Three assumptions form the foundation of the recommendations. First, the Navy will not create a new designator for space professionals. Since its beginning, the Navy has valued operational experience across the domains to fill the NSC ranks. Second, most new space systems will be developed by entities other than the Navy. Again, budget constraints force this realization. Finally, the Navy will continue to develop, acquire, and operate the narrowband SATCOM capability.

A. MANPOWER RECOMMENDATIONS

1. Fully Implement ZBR-Recommended Billet Base

The ZBR-billet base in combination with the revised AQD structure is a dramatic change to the NSC. But the inability to implement the ZBR billet base due to funding issues is a significant barrier to an effective NSC. The current billet base of 140 billets does not include space operations billets on afloat staffs. According to a billet list from the OPNAV Space Cadre office, CSG/ESG billets are instead assigned to CVN/LHD ship's company, primarily as METOC officers. Furthermore, C10F has only one billet instead of six. This is particularly

[217] Ibid., 62.

[218] Ibid., 63.

significant given the potential C10F MOC has as an enhanced operational space coordination capability for deployed Navy assets.

The recommended billet base also provides additional billets in Navy support to joint and Air Force DOD space entities similar to its SSFA billets at NRO support IC space programs. The Navy space acquisition presence at the MILSATCOM office grows from one to three billets, supporting UHF and EHF SATCOM and GPS programs. The Joint Navigation Warfare Center now has two VS7 billets, supporting PNT superiority for operations. Ultimately, the future of the NSC starts with full implementation of the ZBR-recommended billet base.

2. Determine Desired End-Strength and Work Backwards

The Navy Space Plan Task Force is chartered to determine if gaps exist between the ZBR-recommended billet base and the future requirements of the NSC.[219] There is a required step before a gap analysis can be completed: determining the future requirement for the NSC and the desired end-strength. While the ZBR presented an improved billet base with increased Navy support to DOD and joint space entities, it did not address whether these billets adequately support the Navy's future role in space. For instance, the Navy may seek responsibility for future weather space system.[220] But the recommended billet base does not provide billets for DMSP program support. Once future personnel and system requirements and desired end-strength are known, the NSC can apply assumptions on promotion rates (which it must determine), payback and reassignment rates (which it must track), and attrition rates across communities to build a billet plan to develop the desired NSC. With this approach, the NSC will be more strategically and methodically managed and better positioned to meet future Navy needs for space capabilities and expertise.

[219] Deputy Chief of Naval Operations for Information Dominance, "Task Force Charter," 1.

[220] Navy Space Plan Task Force, "Navy Space Plan," 17.

3. Standardize Operational Staff Billets

The draft Navy Space Plan recommends standardization of space operations billets across afloat staffs.[221] This is essential to developing effective lessons learned and best practices for coordination that can be shared through strike group training cycles. Furthermore, standardization must extend to all afloat staffs, including assigning VS5 billets to destroyer squadrons (DESRON) and future littoral combat ship squadrons (LCSRON). These classes of ships will deploy independently and require dedicated space support. While DESRON and LCSRON staffs may not provide around the clock support for the deployed units, the space operations officers on the staff can act as space mentor for the inexperienced ship's officers during training prior to deployment. Addition of DESRON and LCSRON space billets will also increase at-sea billets, an important incentive for URL participation in NSC billets.

The most glaring gap in Navy space support coordination is in-theater. The Fleet Space CONOPS identifies that NNWC cannot handle the volume of space coordination across the globally deployed forces.[222] Each geographic combatant command has a DS4 assigned, but the Navy does not have a corresponding position. The numbered fleet MOCs are an obvious place to designate a Navy space operations coordinator. The ZBR-recommended billet base includes VS6 or VS7 billets on all fleet staffs except C5F/NAVCENT. The billet base also dramatically increased the C10F space operations billets. The NSC must codify, through policy, the relationships between fleet MOCs (including the omitted C5F/NAVCENT MOC) and the deployed units they support. Given the number of space operations billets slated for C10F, it is the most logical lead space coordinating entity for deployed units, allowing numbered fleet space operations officers to focus on planning in their respective theaters. The Navy

[221] Ibid., 24.

[222] Fleet Forces Command, *Fleet Space Effects Warfighting Concept of Operations (CONOPS)*, 23.

must also consider what the future relationships between FCC/C10F, NNWC, and JFCC-Space will be in order to eliminate redundancies and convoluted coordination pathways.

4. Team Space Operations Billets on Afloat Staffs

The ZBR-recommended billet base moves space operations officers to CSG/ESG staffs. But these singular billets should be pairs of billets: a senior and a junior. Although space operations officer is a collateral duty and there is not likely to be work sufficient to require a shared workload, sharing the experience between a senior and a junior is tantamount to building mentor relationships and fostering a NSC sub-culture. The senior–junior division could be a literal senior officer supervising a junior in the same shop (e.g., N-3). The most effective method, however, is to assign a senior AQD (e.g., VS6) in one shop and the junior AQD (e.g., VS5) in another. On numbered fleets and CSG/ESGs, the senior AQD could be an IDC billet with a URL filling the junior role. This arrangement would continue the cross-community sourcing of the NSC while giving the IDC an increased leadership role in operational staffs. This would also increase sea-duty billets, further encouraging inclusion in URL career progression.

B. PROFESSIONAL DEVELOPMENT RECOMMENDATIONS

1. Short Course for VS5 Personnel

As discussed previously, the Space PQS requires individual study of complex topics, possibly without a more experienced NSC member at the command to help. This method of training new NSC members will yield insufficient depth and non-standardized training for those personnel. The current funding challenges will prevent adding a required course as a prerequisite for these billets. To ensure adequate depth and standardization of training for new space operations officer, a short course should be developed. The Naval Space Handbook could serve as a model for an unclassified course, while the Fleet Space CONOPS could serve as an introductory classified curriculum. The short

course could be added to the fleet training cycle, through Commander, Strike Force Training Pacific/Atlantic (CFTP/CFTL) to ensure adequate training prior to deployment. Alternatively, a distance-learning course could be developed and made available on Navy Knowledge Online (NKO). With

2. Develop Training Series for VR Personnel

Space acquisition professionals require space-specific education to be effective. In the long-term, the Navy must replace the current NSSI courses with its own series of training courses or work with other services to develop an acquisition-specific course. In the interim, several short courses can be implemented to cover essential topics and delivered through NKO or other distance learning methods.

3. Add VR2 Billets

The current balance of VR1–VR2 billets does not provide adequate opportunities for development of space acquisition experience or career progression. In order to sustain sufficient numbers of space acquisition professionals with real space acquisition experience, VR2 billets must be increased to provide a path for VR1 officers. These billets need not be added, simply changed from VR1 to VR2.

4. Capitalize NPS Graduates

With the revised AQD structure, NPS graduates are not automatically members of the NSC. The NSC is currently undermanned, largely due to the AQD revision, and is in need of identified members to fill the ranks. Including these officers as members of the NSC, though not truly experienced, is a better method of identifying those with space knowledge, whether education or experienced based. To capture NPS graduates as NSC members, the Navy could waive experience requirements for the first three to five years following completion of the SSO or SSE degree. This would allow URL officers to return to their community career paths but encourage their payback tour as soon as

possible. The experience waiver could expire or require the officer to reapply after the designated waiver period ends if the experience requirement is not fulfilled.

5. Develop Career Path

The NSC human capital strategy emphasized that the NSC does not establish a new career path for its members.[223] As a virtual community, NSC members flow in and out of space billets as available from primary communities. But officer availability from primary career paths is not consistent. A career path is needed, especially in space operations, to create a sustainable, effective NSC capable of growing future senior officers organically. Figure 9 shows IDC billets by rank across space operations billets. Compared to the poorly defined rank structure in Figure 7, the IDC space operations rank structure is much clearer and sustainable.

Given the relative commitment of the IDC (see Figure 10), overall responsibility for NSC management, and existing rank structure, the IDC communities should develop career paths for core NSC members (not supplemental members from other communities). A viable career progression for a significant portion of the virtual community will provide a foundation to build the future NSC and limit its vulnerability to inconsistent commitment by other communities. This construct would not change the cross-community experience base, with IDC members bringing operational experience in the information domain and non-IDC members providing other domain experience. Once core IDC NSC career paths exist and are shared, other communities can address space billets during human capital strategy processes. But the IDC must take the lead in addressing the career path problem if changes are to be made.

[223] Naval Network Warfare Command, *Navy Space Cadre Human Capital Strategy*, 3.

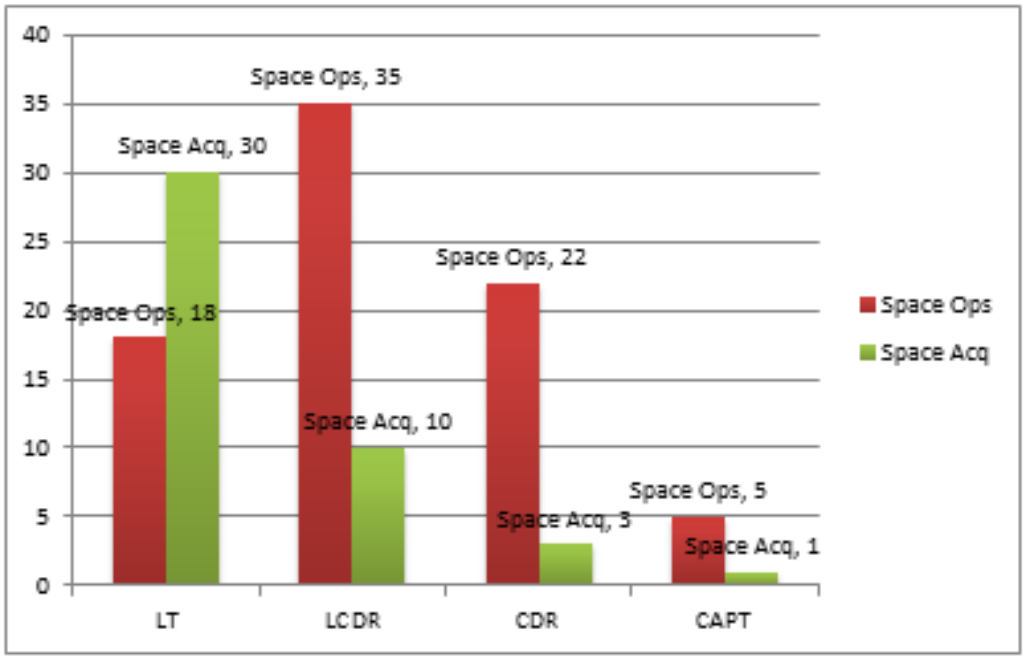

Figure 9. IDC space billets by rank.[224]

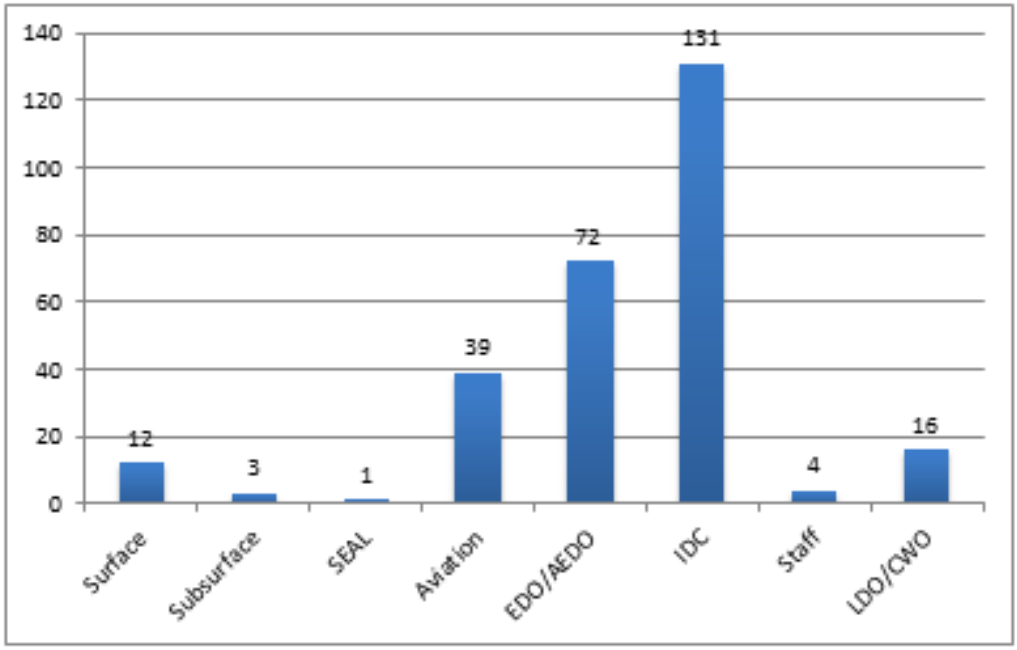

Figure 10. Space billets by community.[225]

[224] Navy Cyber Forces Command, "NOOCS Billet List."

[225] Ibid.

VII. CONCLUSION AND RECOMMENDED FUTURE WORK

A. CONCLUSIONS

The Navy has long used space capabilities to enhance its operations. Its legacy of operating and developing systems, participating in DOD and national space processes, researching Navy-unique space technologies, and exploiting all available space assets provides a blueprint for continued effective use of space. The Navy will continue to exploit space assets extensively and effectively for the foreseeable future. Measured in these terms, the Navy's operations in space are effective.

The internal effectiveness and efficiency of the NSC management, however, is a different matter altogether. While meeting minimum DOD and DON requirements, the NSC has focused on the here-and-now, striving to maintain current levels of investment and not growing a sustainable cadre of professionals. Since its inception, space cadre leadership has recognized its limitations: lack of a defined career path; lack of a defined accession process and training progression; lack of a clear vision for the future cadre; and inconsistent participation by Navy communities. But recognizing these shortfalls has not led to the organizational focus required to address problem areas. The work of the ZBR in 2012 and the Navy Space Plan Task Force may force some organizational focus. While it is not clear exactly what recommendations the Space Task Force will make, it is clear that additional incremental steps must be taken.

This thesis found that the NSC does meet its responsibilities and that the ZBR-recommended billet base will more effectively perform these duties. The AQD structure, rank structure, and non-standardized application of the revised billets, however, reflect the lack of planned career progressions and may lead to an unsustainable billet base. Furthermore, the professional development progression for both space operations and space acquisition officers is insufficient. While space operations officers receive training at NSSI en route to

VS6–VS8 billets, officers in VS5 billets are left to learn on the job and through the Space PQS. As the VS5-level officer is likely the only space operations officer at their command, this is not likely to produce well-qualified and experienced officers. Space acquisition professionals, on the other hand, receive no formal space education or training at any level. Finally, the future NSC has not been defined, nor considered, in the allocation of NSC billets. Without knowing what is expected of the NSC in the future, the effective development of the NSC is hampered. The Navy Space Plan Task Force and other Navy space activities must consider desired end-strength, promotion rates, attrition rates, and reassignment rates in order to build the future NSC.

B. FUTURE WORK

1. Manning Review

The dynamic state of NSC manning, particularly due to the AQD revision, prevented a full analysis of NSC personnel management. Once the NSC ranks have filled out with officers awarded the revised AQDs, a manning study of fit rates, fill rates, reassignment rates, and examination of payback tours will provide useful insight into the effectiveness of the NSC virtual community.

2. Analysis of USMC Space Cadre

The Marine Corps does not acquire or develop space systems, but it does require space capabilities in its operations. The Marine Corps space cadre includes dedicated space operations officers and space operations staff officers. The space operations officers focus on Marine Corps participation in national space processes while staff officers focus on operational commands and support to the warfighter.[226] This could prove to be an effective model for improved operational support for deployed units.

[226] Naval Network Warfare Command, *Naval Space Handbook*, 62–64.

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