A History of United States National Security Space Management and Organization

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I. Introduction

Since the late 1950s, the United States Government has undertaken numerous efforts to reorganize and improve the management of its space functions. During the late-1950s and early-1960s, for example, the United States initiated a comprehensive restructuring of its national military space program to beat the Soviet Union into space. In recent years, however, the U.S. Government has reorganized because of financial considerations and concerns about inadequate space management practices.

This paper provides a historical overview of U.S. national security space management and organization. It identifies the key space management restructurings that have occurred since the launch of Sputnik in 1957 and evaluates the factors behind the government's decision to initiate management changes. The paper is not designed as a comprehensive history of the U.S. military space program. Rather, it provides a historical basis for current U.S. space management and organization.

Section II of this paper examines the evolution of Department of Defense (DoD) space management practices. This section evaluates the factors that led to the creation of the Advanced Research Projects Agency (ARPA), the National Aeronautics and Space Administration (NASA), the Office of the Director of Defense Research and Engineering (DDR&E), and the Office of the Assistant Secretary of Defense for Command, Control, Communications and Intelligence (ASD (C3I)) and outlines their respective roles in U.S. space management and organization. Section II also describes the restructuring of DoD space operations during the 1990s. It addresses the creation and subsequent abolition of the Office of the Deputy Under Secretary of Defense for Space (DUSD), and analyzes the effect of the 1998 Defense Reform Initiative on U.S. space management practices.

Section III examines the space organizations of the U.S. Armed Forces. It analyzes how the United States Air Force emerged as the lead service for space, and reviews past U.S. Army and U.S. Navy space activities. This section also discusses the creation of the United States Space Command in September 1985.

Section IV focuses on the history of the U.S. Intelligence Community's (IC) space operations. It describes the space programs and functions of the Central Intelligence Agency (CIA), the National

Reconnaissance Office (NRO), the National Security Agency (NSA), and the Defense Intelligence Agency (DIA). This section also provides a short history of the National Imagery and Mapping Agency (NIMA) and the Defense Information Systems Agency (DISA).

Section V discusses the acquisition of space systems by U.S. government agencies. This section analyzes the history of four U.S. Government satellite programs: the Defense Satellite Communications System (DSCS), the Defense Meteorological Satellite Program (DMSP), the Defense Support Program (DSP), and the Global Positioning System (GPS).

II. U.S. Department of Defense Space Management

A. From World War II to the Launch of Sputnik

The U.S. national security space program began in the 1940s. In 1946, the RAND Corporation conducted a space feasibility study on behalf of the U.S. Army Air Forces.[1] Shortly after the U.S. Congress passed the National Security Act of 1947, the DoD assigned responsibility for all space-related activities to the Research and Development Board's Committee on Guided Missiles, an entity jointly run by the U.S. Army and U.S. Navy.[2] By the early 1950s, the U.S. Army, U.S. Navy, and U.S. Air Force had each initiated independent space programs.

The United States Air Force, in conjunction with the CIA, commenced research on the WS-119L reconnaissance program during the early 1950s. This highly secretive program involved the use of high-altitude balloons equipped with cameras to collect aerial intelligence of the Soviet Union. Between December 1955 and May 1956, at least 448 U.S. Government balloons were covertly launched from Turkey and West Germany and flown east over the Soviet Union.[3] During the mid-1950s, the USAF also started advanced research on the WS-117L satellite

[1] Project RAND, *Preliminary Design of an Experimental World-Circling Spaceship* (Santa Monica, CA: Douglas Aircraft Company, 2 May 1946).
[2] United States Department of the Navy, "Naval Aviation Chronology 1946-1949: Post War Years," from the world wide web: www. history.navy.mil/branches/avchr6.htm. In addition to space and satellite research through the Guided Missiles Committee, the office conducted research on aeronautics, atomic energy, electronics, geographical exploration, and geophysical sciences.
[3] Curtis Peebles, *The Corona Project*: *America's First Spy Satellites* (Annapolis: Naval Institute Press, 1997), 32.

reconnaissance program (which would later become known as the Satellite and Missile Observation System - SAMOS), as well as research on its intermediate and intercontinental ballistic missile programs at the newly formed Western Development Division (WDD) under the direction of then-Brigadier General Bernard Schriever.

The U.S. Army and U.S. Navy also conducted space system research at this time. In 1951, the Army consolidated various research efforts at Redstone Arsenal in Alabama. Beginning in 1955, the U.S. Army commenced research in conjunction with the U.S. Navy on the *Project Orbiter* satellite reconnaissance program. In 1955, the DoD selected the Navy to lead development on Project Vanguard, a program that was designed to launch satellites into space using the Navy's Viking launch vehicle.

In 1957, as a part of the designated International Geophysical Year (IGY), the United States developed a "scientific satellite." Although the IGY program was designated a "scientific" enterprise, the National Security Council (NSC) believed that the program would produce a number of military benefits. NSC Resolution 5520 asserted that the findings of the scientific satellite could be applied to defense communication and missile research.[4]

The Soviet Union's launch of Sputnik I in October 1957 had a profound effect on the Eisenhower Administration's defense and security planning. U.S. entry into space suddenly became a national obsession. The launch of Sputnik ignited a comprehensive review of national space policy by the Eisenhower Administration, the organizational structure of existing programs, and the priority of space projects.[5] Between 1957-60, the U.S. space program was transformed from a small effort to a large enterprise with considerable Congressional and public support. As a result, a number of new government structures and policy measures were established that would serve as the foundation of the national space program.

[4] Paul B. Stares, *The Militarization of Space: US Policy*, 1945-1984 (Ithaca: Cornell University Press, 1985), 34-35.
[5] Ibid., 40.

B. Advanced Research Projects Agency

Secretary of Defense (SecDef) Neil McElroy created the Advanced Research Projects Agency (ARPA) in February 1958 in order to centralize all DoD space research and development activities. Senior defense and military planners believed that ARPA would be highly effective for two reasons. First, it would end the low priority accorded to space technology in the absence of clearly defined military applications. Second, it would limit inter-service rivalries and duplication of duties by transferring Service decision-making authority on space projects to a central DoD authority.[6] Although ARPA controlled and funded all military and civilian space projects, it depended on the individual services for both personnel and experience. As a result, ARPA designated the services executive agents for most of its projects. The U.S. Air Force received more than 80 percent of available ARPA funding.[7] ARPA served only briefly as the U.S. government's central focal point for space activities.

C. National Aeronautics and Space Administration

The creation of the NASA in 1958 stripped ARPA's broad authority over U.S. space programs, particularly those with "civil" applications. ARPA relinquished all of its "man in space" projects to NASA after the Eisenhower Administration awarded NASA responsibility for manned spaceflight in 1959. The Eisenhower Administration also ordered that NASA take control over ARPA's special engine research project, and its satellite tracking, communications, meteorological, and navigation programs.[8]

D. Office of the Director of Defense Research and Engineering

In 1958, the Eisenhower Administration submitted a DoD reorganization plan to the U.S. Congress that was designed to increase the authority of the Office of the Secretary of Defense (OSD) and reform combat commands along regional lines. Later that year, the Congress passed the DoD Reorganization Act. As a part of the Administration's reorganization plans for the DoD, the legislation established the office of

[6] David N. Spires, *Beyond Horizons: A Half Century of Air Force Leadership in Space* (Washington D.C.: USGPO, 1998), 58.
[7] Ibid., 59.
[8] Ibid., 65-66.

Office of the Director of Defense Research and Engineering (DDR&E).[9] This office assumed the roles and responsibilities of the former office of the Assistant Secretary of Defense for Research and Development. The Director of this office became the sixth highest-ranking official within the DoD, below the SecDef, the DepSecDef and the three Service Secretaries. The Director of DDR&E became the principal advisor to the SecDef on basic and applied research, development, test and evaluation of weapons and equipment.[10]

In 1959, SecDef McElroy placed all of ARPA's research and development activities under the supervision and direction of the DDR&E. Under DDR&E direction, ARPA would manage a limited number of advanced space research programs. Within three years, the authority that DDR&E and NASA gained over the U.S. space program obscured ARPA's space R&D activities.

During the Kennedy Administration, Department of Defense Directive (DoDD) 5160.32, "Development of Space Systems," bolstered DDR&E's authority over the development of military space systems. The March 1961 Directive granted DDR&E the authority to establish the guidelines under which the individual services could conduct research on military space systems.[11] Throughout the 1960s, DDR&E played a large role in the development of U.S. Defense Support Program (DSP) Satellites, U.S. ballistic missile defense technologies, and Intercontinental Ballistic Missile (ICBM) and Intermediate-range Ballistic Missile (IRBM) programs.

[9] A centralized office within the DoD for R&E activities existed since the creation of the Department in 1947. Between 1947-1953, R&E activities were handled by the Research and Development Board. After this board was dissolved by Reorganization Plan Number 6, its functions were transferred to two separate offices, the Office of the Assistant Secretary of Defense (Research and Development), and the Office of the Assistant Secretary of Defense (Applications Engineering). In March 1957, these two offices were combined into the Office of the Assistant Secretary of Defense (Research and Development), the predecessor to the Office of the Director, DDR&E. For more information, see Historical Office: Office of the Secretary of Defense, "DoD Key Officials, 1947-1995," (Washington D.C.: USGPO, 1996), 52.

[10] Edward Bulwer Lytton, "The Evolution of Defense Research," in *DOD Science and Technology: Strategy for the Post-Cold War Era*, ed. Doug Beason, NDU Press Books On-Line, from the world wide web: www.ndu.edu/inss/books/dodsnt/ch3.html

[11] DoD Directive 5160.32, "Development of Space Systems," March 6, 1961.

The position of Director DDR&E was renamed the Office of the Under Secretary of Defense for Research and Engineering in 1977. The Military Retirement Reform Act of 1986 (PL 99-384) re-established the position of Director of DDR&E, as a subordinate office within the Office of the Under Secretary of Defense for Acquisition.[12]

E. Assistant Secretary of Defense for Command, Control, Communications and Intelligence

The roots of the Office of the ASD (C3I) date to 1970 with the formation of the Office of the Assistant to the Secretary of Defense for Telecommunications.[13] This office was renamed the Office of the Assistant Secretary of Defense for Intelligence the following year. The ASD (C3I) was established by the FY 1984 Defense Authorization Act, and later mandated by the 1986 Goldwater-Nichols Act as one of three permanent Assistant Secretaries.

Since 1985, the ASD (C3I) has served as the principal staff officer to the SecDef for the establishment and implementation of information management policies. Its space-related responsibilities included supervising the development and acquisition of DoD space programs and space-related architectures, acquisition and technology programs in coordination with the Under Secretary of Defense for Acquisition and Technology, and overseeing the NSA, DIA, and NIMA after its founding in 1996 in compliance with DoD Directive 3100.10 on National Space Policy.

Within ASD (C3I) today, the Deputy Assistant Secretary of Defense for Command, Control, Communications, Intelligence, Surveillance, Reconnaissance (C3ISR) is currently responsible for guiding the development and integration of defense space control, and space support capabilities. The office is also responsible for space policy and spectrum

[12] See " DoD Key Officials, 1947-1995," 52.

[13] DoD Directive 5137.1 in March 1977 created the Office of the Assistant Secretary of Defense for Communications, Command, Control, and Intelligence by combining the functions of Assistant Secretary of Defense for Intelligence with the Office of the Director of Telecommunications and Command and Control Systems. Beginning in October 1977, the ASD (C3I) served as the Principal Deputy Under Secretary of Defense for Research and Engineering. The office of the Assistant Secretary for Command, Control, and Intelligence was renamed the Office of the Deputy Under Secretary of Defense for Communications, Command, Control and Intelligence in March 1981. In April 1985 DoD Directive 5137.1 reestablished this office as the ASD (C3I).

management. Five specific directorates assist the Deputy Assistant Secretary: Space Policy, C3 Systems, ISR Systems, Space Systems and Program Analysis and Integration.

F. DoD Space Management Restructuring During the Mid-1990s

Throughout the early 1990s, the U.S. Congress became increasingly critical of the DoD's space management practices. For example, in 1992, the House and Senate conference committee report on the FY93 Defense Authorization Bill asserted that the SecDef should develop a comprehensive and centralized space acquisition strategy that would improve efficiency and reduce costs of future space systems.[14] The following year, the House Appropriations Committee stated in its FY94 Defense Appropriations Bill that existing DoD space management structures were inadequate, and that a coherent management structure for space management programs should be formed.[15] Beginning in 1994, the DoD conducted a broad review of its space management practices. This review led to the restructuring of several DoD offices and directorates in an attempt to improve the integration and coordination of all DoD space activities.[16]

1. Office of the Deputy Under Secretary of Defense for Space

The first of three major organizational changes during the mid-1990s occurred in December 1994, when the Secretary of Defense (SecDef) created the position of Deputy Undersecretary of Defense (DUSD/Space). DUSD Space was created to serve as the principal point of contact within OSD for space matters, to develop, coordinate, and oversee implementation of DoD space policy and to provide oversight over all DoD Space architectures and the acquisition of DoD space programs. The DUSD Space reported directly to the Under Secretary of Defense for Acquisition and Technology. The DUSD Space also was responsible for interacting with the Congress and other government agencies, and for representing the SecDef at all interagency deliberations and international negotiations regarding space matters.[17]

[14] United States General Accounting Office, *National Space Issues: Observations on Defense Space Program and Activities*, August 16, 1994, GAO/NSIAD-94-253, 10.
[15] Ibid., 10.
[16] United States DoD, *Annual Report to the President and the Congress, 1996*, (Washington D.C.: USGPO, 1996), 79.

In addition, DUSD Space had oversight over a number of space programs, including: launch and support, reconnaissance and surveillance, tactical warning and attack assessment, communications, navigation GPS, environmental monitoring, and research and development of space systems.[18] All space functions pertaining to C3I activities, however, remained within the office of the ASD (C3I).[19] DUSD Space had three divisions: Space Acquisition and Management, Space Policy, and Systems and Architectures.

2. DoD Space Architect

A second organizational change occurred in March 1995 with the creation of the DoD Space Architect (DoD SA). This office was established to consolidate the responsibilities for DoD space missions and system architecture development, to eliminate "stovepiped" space programs, and to improve efficiencies in acquisition and future operations in support of U.S. military operations.[20] The office became the DoD's principal architect for launch and satellite control, and all space-related areas of tactical intelligence (targeting, surveillance and warning). The DoD SA worked with DUSD Space to develop and maintain an overall space system master plan, which specified how assured mission support was provided by space systems to the National Command Authority, Combatant Commanders, and deployed operational forces.

The DoD SA, a two-star general, reported through the Air Force Acquisition Executive to the Defense Acquisition Executive. The DUSD Space provided OSD policy guidance and oversight to the DoD Space Architect for the development of integrated and consistent space architectures.

[17] Prepared statement of Paul G. Kaminski, Under Secretary of Defense for Acquisition and Technology before the House Appropriations Subcommittee on National Security, March 23, 1995, from the world wide web: www.defenselink.mil/speeches/1995/di1041.html
[18] Aeronautics and Space Report to the President, Fiscal Year 1995 Activities, "Executive Summary: DoD," from the world wide web: www.hq.nasa.gov/office/codez/history/dptdefns.htm
[19] United States DoD, *Annual Report, 1996*, 79-80.
[20] "Stovepiping" occurs when agencies, individuals, or entities create their own individual plans and policies without coordinating with others.

3. Joint Space Management Board

In December 1995, several months after the creation of the DoD SA, SecDef William Perry and Director of Central Intelligence (DCI) John Deutch jointly established the Joint Space Management Board (JSMB). The JSMB was created as a part of a joint DoD-IC effort to consolidate defense and intelligence space architecture functions into a single national space architecture.[21] It was designed to ensure "that defense and intelligence needs for space systems (including associated terrestrial-based subsystems) are comprehensively satisfied within the available resources, using integrated architectures to the maximum extent possible."[22] It was also designed to integrate policy, requirements, architectures, and acquisition for defense and intelligence space programs. The JSMB was co-chaired by the Under Secretary of Defense for Acquisition and Technology and the Deputy Director of Central Intelligence (DDCI).

G. The Defense Reform Initiative and Space

In January 1997, SecDef William Cohen announced the Clinton Administration's intent to streamline DoD organization and infrastructure by introducing "business practices" to DoD operations.[23] Two Defense Reform Initiative Directives (DRID) led to additional changes in the DoD's space management and organizational practices. Whereas the DoD restructured its space management practices in 1994-1995 response to mounting Congressional criticism, the space management and organizational restructuring of 1998 was justified as part of the Clinton Administration's efforts to increase the DoD's efficiency, reduce its overhead costs, and help it shift towards pursuing commercial alternatives.

1. Defense Reform Initiative Directives 11 and 42

DRIDs 11 and 42 ordered the most significant changes to DoD space management responsibilities during the late 1990s. DRID 11, "Reorganization of DoD Space Management Responsibilities," (December

[21] Kaminski Testimony before the House Appropriations Subcommittee on National Security, March 23, 1995.
[22] Charter for the Defense Management Board, 13 December 1995. From the world wide web: www.defenselink.mil.
[23] In November 1997, the DoD released its *Defense Reform Initiative: The Business Strategy for Defense in the 21st Century*.

1997), abolished DUSD Space and temporarily assigned its space policy functions to both the Office of the Under Secretary of Defense for Acquisition and Technology and the Office of the Under Secretary of Defense for Policy.[24] An amendment to DRID 11 (May 20, 1998), ordered that DUSD Space's "space policy, space systems and architectures, space acquisition and management, and space integration functions" be transferred to the Office of ASD (C3I). DRID 42 (May 20, 1998) stated that the ASD (C3I) "shall work" with the Under Secretary of Defense for Policy to ensure that the ASD (C3I)'s space policy decisions are closely integrated with overall national security policy decisions. This Directive also gave the Under Secretary of Defense for Policy the authority to become involved in all aspects of policy development regarding space control, space-related arms control, and issues addressed through the NSC's interagency process.[25]

2. National Security Space Architect

A July 31, 1998 amendment to DRID 11 abolished the DoD SA and replaced it with the office of the National Security Space Architect (NSSA). In addition to assuming all of the responsibilities of the DoD Space Architect, the NSSA was assigned with a range of other architecture responsibilities, including:

- Maintenance, dissemination, and development of the National Security Space Master Plan
- Development of future transition strategies for future space architectures.
- Integration of requirements into future space systems architectures to include space, ground, and communication link segments, as well as user interfaces and equipment.

[24] Defense Reform Initiative Directive 11, "Reorganization of DoD Space Management Responsibilities," 19 December 1997, from the world wide web: www.defenselink.mil/dodreform.drids/drid11.htm
[25] Defense Reform Initiative Directive 42, 20 May 1998, from the world wide web: www.defenselink.mil/dodreform/drid/drid42.html

- Advising the ASD (C3I), the Deputy Director of Central Intelligence for Community Management (DDCI/CM), and their staffs of appropriate inputs to budget and other guidance documents.[26]

The office was also created to directly address the needs of the warfighter.[27] The NSSA reports directly to the ASD (C3I) on matters affecting the DoD, and to the DDCI on all IC related matters. As a practical matter, the IC supplemented the previous DoD SA workforce with IC manpower resources, and provided links directly to the IC.

3. National Security Space Senior Steering Group

DRID 11 also disestablished the Joint Space Management Board and created the National Security Space Senior Steering Group (NSS-SSG) in its place. The NSS-SSG is tri-chaired by the ASD/C3I, the Joint Staff/J-8 and the Deputy DCI. All interested national security and civil agencies have been invited to participate in NSS-SSG deliberations.[28] The NSS-SSG is responsible for addressing broad national security space management and integration issues in the DoD and IC. It approves and/or identifies alternatives to proposed architectural characteristics that affect DoD or IC responsibilities or policy implementation. The group also works to achieve consensus within the NSS-SSG for architectures that satisfy the critical requirements of all stakeholders. Where consensus cannot be reached, the NSSA, working with the NSS-SSG, may identify selected alternatives. The NSSA forwards architectural proposals, including all alternatives that the NSS-SSG wishes to propose, to the Joint Requirements Oversight Council (JROC).[29]

[26] Statement of Purpose of the National Security Space Architect, from the world wide web: www.acq.osd.mil/nssa/org/mou/nssa_mou.htm
[27] Ibid.
[28] Ibid.
[29] Ibid.

III. The Evolution of Military Space Management and Organization

A. The United States Army

1. "The First in Space"

After World War II, the U.S. Army initiated programs and developed technologies that were instrumental in the nation's early space program. These included research programs for liquid fueled missile boosters, guidance systems, warhead handling, nose cone survival, satellites, and air defense systems.[30] This research was initially conducted through the War Department's Office of Scientific Research and Development. In 1951, the Army consolidated various research efforts at the Redstone Arsenal in Alabama. Moreover, some U.S. Army space research was conducted in conjunction with the U.S. Navy through the Aeronautical Joint Research and Development Board.

The launch of Sputnik in October 1957, combined with continued test failures in the Viking Launch Vehicle, drove the DoD to focus on developing more reliable and technologically sophisticated space launch systems. In November 1957, the DoD authorized the Army Ballistic Missile Agency (ABMA) to launch a satellite using its ABMA Jupiter rocket. This marked the first successful U.S. satellite launch, earning the U. S. Army the right to claim that it was "the first in space" among the agencies of the U. S. government. Although the U.S. Army continued to conduct research on space-related technologies between 1958-1975, other conflicting initiatives, policy developments and the impact of the Vietnam War constrained its space program. For one the establishment of NASA led to the transfer of thousands of trained scientific and engineering personnel

[30] P.H. Satterfield, *Historical Monograph Army Ordnance Satellite Program*, (Army Ballistic Missile Agency: Redstone Arsenal, AL: November 1, 1958), 20-38, 58; J.V. Nimmen, *NASA Historical Data Book*, 1958-1968, (NASA: Washington, DC: 1976), Vol. 1, 353; H.B. Joiner and E.C. Jolliff, *The Redstone Arsenal Complex in its Second Decade*, 1950-1960 (Historical Division, Army Missile Command: Redstone Arsenal, AL: May 28, 1969), 3; D.S. Aikens, *SATURN Illustrated Chronology, April 1957 Through June 1964*, (NASA Historical Office: MSFC Redstone Arsenal, AL: January 20, 1971), 1; E. Stuhlinger, "Army Activities in Space—History," *IRE Transactions on Military Electronics*, Vol. Mil-4, No. 2-3, April-July 1960, 66; J. M. Grimwood and F. Strowd, *History of the Jupiter Missile System*, (AOMC History and Reports Control Branch: Redstone Arsenal, AL: July 27, 1962), 13. *Historical Origins of George C. Marshall Space Flight Center (MSFC)*, (NASA: Huntsville, AL: December, 1960), 18; *Aviation Week*, "Army Gaining Vital Space Assignments," January 16, 1958. Col. A. Downey, *The Emerging Roles of the U.S. Army in Space* (National Defense Press: Washington, D.C.: 1985), 65-66. All as cited in Eddie Mitchell, *Apogee, Perigee, and Recovery: Chronology of Army Exploitation of Space* (Santa Monica, CA: RAND, 1991).

from the Army to NASA between 1958-1961, thus harming the Army's space program in much the same manner as similar transfers of naval personnel to NASA harmed the Navy's space efforts.[31]

Moreover, DoD Directive (DoDD) 5160.32 of 1961 severely limited the scope of U.S. Army space programs. It prohibited the U.S. Army from developing independent reconnaissance satellites, space launch, and space system operations As a result of 5160.32, these missions were assigned to the Air Force, as was with the responsibility to meet the Army's requirements.[32] The formation of ARPA, the Defense Communication Agency (DCA), the DIA and the Defense Mapping Agency (DMA) further impeded U.S. Army efforts to exploit space.[33] As part of a general consolidation of DoD space activities, the aforementioned agencies took over Army space assets, and space missions that otherwise would have been performed by the Army. Furthermore, the Vietnam War also contributed to a decline in the Army's space capabilities, as Army research efforts were diverted away from space towards small battlefield missiles and other requirements.[34]

Notwithstanding these developments, the U.S. Army began to develop long-haul satellite communications support for theater commanders. In 1964 the Army established the Strategic Communications Command (STRATCOM) to handle the service's growing number of satellite-based communications systems. STRATCOM managed the U.S. Army portion of the Defense Communications System (DCS). STRATCOM's activities were focused primarily on the satellite ground stations that handled satellite communications data and voice circuits, not the satellite's operations. These satellites were launched, operated and controlled by the Air Force. [35]

[31] Ibid, 58.
[32] LTC J. W. Holdsworth, *The Army Role in Space*, (Carlisle Barracks, PA: Army War College, June 5, 1984), p. 18. As cited in Mitchel*l Apogee, Perigee, Recovery*, 59.
[33] Mitchell, *Apogee, Perigee, and Recovery*, 64.
[34] M. Matloff (ed.), *Army Historical Series American History* (Office of the Chief of Military History: U.S. Army: Washington, DC), 584; E.C. Joliff, *History of the U.S. Army Missile Command*, 1962-1977 (MICOM Historical Division: July 29, 1979), Monograph DARCOM-84M, 115-145. As cited in Mitchell, *Apogee, Perigee, Recovery*, 61.
[35] Mitchell, *Apogee, Perigee, Recovery*, 64-65.

2. The Re-emergence of U.S. Army Space Programs, 1977-1989

A slow recovery of Army space efforts began in 1973 with the implementation of their Tactical Exploitation of National Capabilities (TENCAP) program.[36] TENCAP constituted a series of programs instituted by each armed service in order to leverage the capabilities of national space assets for use in warfighting and decision-making. The TENCAP program depended heavily on quick and effective means for providing and processing intelligence data gathered from space systems for use by combat units.

Army space research also benefited from the development of the AirLand Battle doctrine, which required Army control over space through real-time sensors to monitor enemy forces.[37] In addition, President Reagan's Strategic Defense Initiative led to the development of new ABM technologies by the Army such as reduced-sized high-speed integrated circuit computer processors, High Endoatmospheric Defense Interceptors, the Ground Based Laser, and the Airborne Optical Adjunct.[38]

Army space activities also received a boost from the 1985 report, Army Space Initiatives Study, which provided a number of recommendations on how the Army could utilize its resources to effectively exploit space in the future.[39] Several of the study's recommendations were implemented in 1986-1987, These included the creation of a Space and Special Weapons directorate within the Office of the Deputy Chief of Staff, Operations and Plans, and the establishment of the Army Space Institute, the Army Space Technology Research Office (ASTRO), and the Army Space Agency.[40] In April 1988, the Army Space Agency became the U.S. Army Space Command (USARSPACE) as a part of a broader effort to integrate Army space activities into those of USSPACECOM.[41]

[36] Ibid., 72.
[37] Ibid., 74.
[38] Ibid., 73.
[39] Ibid., 76.
[40] Ibid., 77.
[41] Ibid., 76-77.

3. Army Space Evolution, 1992 – Present

In 1992, the Army Science Board reviewed Army space organization and management. It recommended the consolidation of Army space elements and functions. As a result, in 1993, the Army combined the Army Space Command with the Army Strategic Defense Command to form the Army Space and Strategic Defense Command (SSDC). In 1994, the Army transferred ASTRO's space technology functions to SSDC, and in 1996, it transferred the Army Space Program Office (ASPO) (which was responsible for the Army's TENCAP) to SSDC. Later that year an Army General Order re-designated SSDC as the U.S. Army Space and Missile Defense Command (SMDC), thus making it a major Army command. SMDC soon signed a Memorandum of Understanding with the Army's Training and Doctrine Command, giving SMDC responsibility for space combat development activities, including the development and integration of space requirements. SMDC executes these functions through its Force Development Integration Center and the Space and Missile Defense Battle Laboratory, both formed in 1997.

SMDC's Space operations organization, USARSPACE, serves as the Army Component to USSPACECOM. USARSPACE is comprised of four principal units: The 1st Space Battalion, the 1st Satellite Control Battalion, an Operations Division, and Regional Space Support Centers. The 1st Space Battalion provides direct space support activities for operational war fighting units. As a part of its mission, four Army Space Support Teams (ASST) are dispatched routinely to Army Corps operating in various parts of the world. Among the services provided by ASST are satellite advance notice, positioning and navigation with GPS systems, space weather forecasting, satellite imagery processing, intelligence support, satellite communications services, and operation of Joint Tactical Ground Stations (JTAGS).[42] The 1st Satellite Control Battalion handles day-to-day command and control of the DSCS payloads and related networks. The battalion operates five Defense Satellite Communication Systems (DSCS) control facilities across the globe.[43] The Operations Division is responsible for developing, managing, and archiving remote sensing products for ASST and other DoD users.[44] Some of these products are provided by commercial remote sensing companies, which obtain and provide images on request directly to an experimental transportable satellite ground station

[42] *A Quick Look at U.S. Army Space Command*, from the world wide web: www.spacecom.af.mil/usspace/army-fs.html
[43] Ibid.
[44] Ibid.

called Eagle Vision II, built for the Army by the National Reconnaissance (NRO). The Regional Space Support Centers (RSSC) (located at Wheeler Army Airfield, Hawaii, Patch Barracks, Germany, and Tampa, Florida) coordinate satellite communications in various regions and provide their services to the regional CINCS.[45]

SMDC also is the Army representative on a team developing a National Missile Defense (NMD) system. USARSPACE is designated as the user and operator of the ground based segments of the NMD system architecture.[46]

B. The United States Navy

1. Organizational Evolution—The 1940s to the Early 1970s

The U.S. Navy, in conjunction with the U.S. Army, pioneered the development of space technologies for the early U.S. space program. Between 1945-1947, the U.S. Navy and U.S. Army Air Forces, conducted extensive research on the German V-2 rocket program. This cooperation ultimately led the two services to initiate joint research on the Project Orbiter satellite reconnaissance program in 1955.[47]

The DoD selected the Navy in September 1955 to lead Project Vanguard, a program designed to launch satellites into orbit using the Navy's Viking launch vehicle. Notwithstanding continued failures of the Navy's Viking Rocket, and DoD's 1957 decision to shift DoD Space launch responsibilities to the Army, by 1960 the U.S Navy had developed several satellites, most notably, TRANSIT, the United States' first navigation satellite.[48]

The Navy's space research activities were initially centered within the Navy's Bureau of Aeronautics (Bu/Aer) and the NRL. Bu/Aer conducted research on the German V-2 program,[49] while NRL scientists focused their research on the Viking space launch system and ballistic missile systems.[50]

[45] Ibid.
[46] Ibid.
[47] Roger Bilstein, *Stages to Saturn* (Washington, D.C.: NASA, 1980), 15; and Paul B. Stares, *Militarization of Space*, 33.
[48] Bruce Wald, "The Origins of the NCST," unpublished paper, 7, from the world wide web: www.nrl.navy.mil/NCSTOrigin/NCSTOrigin.html
[49] Stares, *Militarization of Space*, 25-33.

Like the U.S. Army, the U. S. Navy's role in the development of space systems was reduced as a result of both the establishment of NASA and DoDD 5160.32. For example, most NRL scientists and engineers were transferred to the Goddard Space Flight Center shortly after NASA's creation.[51] In addition, the Air Force's emergence under DoDD 5160.32 as the DoD's focal point for space system research, development and engineering limited the U.S. Navy to conducting preliminary satellite technology research.

Despite these factors, the U.S. Navy conducted substantive research and development on satellite systems during the 1960s. It produced the SOLRAD series of solar observation satellites, and developed SURCAL surveillance satellites.[52] Navy scientists also refined navigation technologies previously developed in the TRANSIT platform to create "time navigation satellites." This research provided the technological base for the NAVSTAR GPS system.[53]

2. Evolution of the Navy's Space Objectives, 1970-Present

DoDD 5160.32 was revised in September 1970 in order to allow individual services to research and develop satellite programs to meet their own specialized warfighting requirements. Although the Air Force remained the leading service in the development of military space, the 1970 revision to DoDD 5160.32 permitted the individual services to play a greater role in space development. DoDD 5160.32 authorized the services to develop their own specialized satellite systems for ocean surveillance, communication, navigation, meteorology, mapping, charting, and geodesy.[54] This revision permitted the U.S. Navy to develop a "unique" space mission. Whereas the U.S. Air Force and the U.S. Army utilized space to support strategic nuclear warfare in general, the Navy sought to use space to gain and maintain Information Superiority in naval operations.[55]

[50] Wald, "The Origins of the NCST," 5
[51] Ibid.
[52] Ibid., 2-3.
[53] Ibid., 3.
[54] DoD Directive 5160.32, "Development of Space Systems," September 8, 1970. As cited in Mitchell, Apogee, Perigee, and Recovery, 59.
[55] Personal Interview with Bruce Wald, November 24, 2000.

As a result of the 1970 revision to DoD 5160.32, the U.S. Navy constructed several satellite systems. It developed and launched the GEOSAT series of satellites to collect oceanographic data that the Air Force's Defense Meteorological Support Program (DMSP) satellites failed to provide.[56] The Navy built the Fleet Satellite Communications System (FLTSATCOM) and UHF Follow-On communications satellites to meet the Navy's need for mobility and connectivity with hundreds of the Navy's warships.[57] Air Force systems such as DSCS and AFSATCOM were not considered suitable for this task, because the Air Force systems were built for users in a limited number of fixed locations. The Navy also developed systems that were later adopted by the other services. For example, the Navy's GPS technology ultimately proved to be more economical than the Air Force's, and was eventually adopted by the GPS program office to build the GPS constellation.[58]

To accommodate the expansion of space research, in 1986, the Navy created the Naval Center for Space Technology (NCST) within the NRL.[59] Since its founding, the NCST has built satellites for both the U.S. Navy and other government clients. The NCST also has competed for individual satellite projects, functioning as an alternative supplier to the Air Force and other agencies.[60]

The Navy's growing dependence on space prompted the Secretary of the Navy to create the Naval Space Command (NAVSPACECOM) in October 1983 to consolidate space activities and organizations that operate and maintain naval space systems.[61] NAVSPACECOM gained operational control over the Naval Space Surveillance Center (NAVSPASUR), headquartered in Dahlgren, Virginia, the Naval Astronautics Group (NAVASTROGRU) headquartered at Point Mugu, California, and elements supporting FLTSATCOM for the Naval Telecommunications Command.[62] Today, these organizations provide space support for day-to-day operations

[56] DMSP's polar sun-synchronous orbits supported weather data collection to optimize national satellite reconnaissance collection requirements, not the tactical/operational weather requirements of Army and Naval combatant forces.
[57] Wald, "The Origins of the NCST," 8. Bruce Wald, Interview by author, Alexandria, Virginia, November, 24, 2000. Air Force developed systems were built for fixed users in a comparably limited number of locations.
[58] Ibid., 9. Wald interview, November 24, 2000.
[59] Ibid., 6.
[60] Wald Interview, November 24, 2000.
[61] From the world wide web: www.spacecom.af.mil/usspace/navspace.htm
[62] "NAVSPACE History," from the world wide web: www.navspace.navy.mil

of the Fleet and USMC Forces for routine deployments, exercises, or actions in response to crisis situations.[63] In 1985, NAVSPACECOM was integrated into the newly-formed USSPACECOM.

In 1993, further Navy attempts to strengthen the naval space program resulted in the expansion of NAVSPACECOM. Its headquarters was merged with the Naval Space Surveillance Center into a single organization. As a result of that merger more than 300 civilian and military NAVSPASUR personnel were reassigned to NAVSPACECOM. Within two years, the consolidation achieved a 25 percent reduction in total manpower.[64] The expanded NAVSPACE includes an operational element that also contains most of the command's manpower. This element provides the operational management of space systems, operates the naval space surveillance network, provides operational and tactical space support to the Fleet and Fleet Marine Force, and serves as the Alternate Space Control Center for U.S. Space Command's primary center located at Cheyenne Mountain Air Force Base, Colorado.[65]

C. The United States Air Force

1. From World War II to the NRO's Creation

The Air Force's involvement in the military space program dates to the end of WWII when it was still the U.S. Army Air Forces. In 1945, Army Air Forces Commanding General Henry H. "Hap" Arnold wrote that the United States could construct a "space ship" within "the foreseeable future."[66] The following month, the Air Force Scientific Advisory Group determined that the construction of long-range rockets was technically feasible and that satellites were a "possibility." In 1946, the Army Air Forces asked Project RAND, a division of Douglas Aircraft Corporation, to produce the first study on the feasibility of an American satellite program. This study, the "Preliminary Design of an Experimental World-Circling Spaceship" produced a wide-ranging analysis of satellite technology and concluded that satellites could have significant military utility.[67]

[63] From the world wide web: www.spacecom.af.mil/usspace/navspace.htm
[64] "NAVSPACE History," from the world wide web: www.navspace.navy.mil
[65] Ibid.
[66] Curtis Peebles, *High Frontier: The U.S. Air Force and the Military Space Program*, (Washington D.C.: USGPO, Air Force History and Museums Program, 1997), 1.
[67] Project RAND, *Preliminary Design of an Experimental World-Circling Spaceship* (Santa Monica, CA: Douglas Aircraft Company, 2 May 1946).

In addition, between 1947 and 1954, RAND conducted several studies for the Air Force analyzing the potential use of satellites for communications and aerial reconnaissance. In 1953, the Air Force Air Research and Development Command (ARDC) assumed control over RAND's satellite research initiatives.[68] In December 1953, the ARDC commenced Project 409-40, "Satellite Component Study," (which was later designated WS-117L). Several months after the creation of Project 409-40, RAND completed its most comprehensive study on the emerging satellite program, the "Project Feed Back Summary Report." This report asserted that it was in the United States "vital strategic interest" to design, construct and utilize a "satellite reconnaissance vehicle." It also stated that the satellite could produce 30 million aerial photographs a year using an imaging orthicon television system. In March 1955, ARDC issued General Operation Requirement No. 80 which created an Air Force requirement for a reconnaissance satellite. In November 1955, the Air Force awarded Lockheed a contract to design and develop the WS-117L at Wright-Patterson Air Force Base, Ohio, with a scheduled operational date of 1963.[69]

Throughout the 1950s, the Air Force also became involved in the development of ICBMs. In 1954, an Air Force evaluation panel called the *Strategic Missiles Evaluation Committee* headed by Princeton University mathematician John von Neumann, stated that the United States should accelerate its Atlas ICBM development program in light of growing Soviet progress on its ICBM force as well as nuclear warheads that could be delivered by long-range missiles.[70] ARDC subsequently created the Western Development Division (WDD) at Inglewood, California and placed Brigadier General Bernard Schriever at the head of the new organization. In February 1956, Schriever centralized management of all military satellite and missile programs at the WDD, arranging the relocation of WS-117L activities and personnel in order to minimize competition for scarce resources and to avoid program delays. [71]

The future of the WS-117L remained in doubt for several years after the program's creation. It experienced severe budget shortfalls, receiving only $4 million of a requested $115 million in funding from the DoD in FY1956.[72] Moreover, in November 1956, Air Force Secretary Donald Quarles suspended Lockheed's development of the WS-117L and imposed

[68] Ibid., 5.
[69] David Spires, *Beyond Horizons*, p. 37.
[70] Ibid., p. 32.
[71] Ibid., p. 38.

limits on future funding for the program.[73] The USAF satellite program would remain a low-priority item until early 1958, when the Eisenhower Administration re-invigorated the U.S. space program in response to the October 1957 Soviet launch of Sputnik.

In addition to setting the highest national priority for all U.S. ballistic missile systems—Atlas and Titan ICBMs and Thor and Jupiter IRBMs—as well as the Ballistic Missile Early Warning System, in January 1958 the National Security Council also assigned the highest national priority to the development of an operational reconnaissance satellite. The Air Force WS-117L program, which was later renamed Sentry and then Satellite and Missile Observation System (SAMOS) continued to be developed by Lockheed at the company's Sunnyvale, California facility. The SAMOS program involved the collection of photographic and electromagnetic reconnaissance data, and the transmission of information through a "readout" or "actual recovery" system.[74]

A second Air Force satellite program, the Missile Defense Alarm System (MIDAS), was derived from the WS-117L during the late 1950s. MIDAS consisted of infrared sensors designed to detect Soviet ICBM exhaust plumes.[75] *Project Discoverer*, the cover for the CIA's Project Corona, was a third Air Force satellite program derived from the WS-117L during the late 1950s. Beginning in February 1958, research on *Discoverer*/CORONA was conducted as a joint CIA-ARPA-Air Force enterprise within the WS-117L program. The satellite was designed to use the Thor booster.

The creation of the NRO in 1960 ended the USAF's direct control over satellite reconnaissance programs. After 1960, however, the USAF retained considerable space activities that focused on the launching and tracking of missiles, and the conduct of various military support missions including communications, missile early warning, meteorology, navigation, and the detection of nuclear detonations on earth from space.[76]

[72] Bernard A. Schriever, "Military Space Activities: Recollections and Observations," in *The U.S. Air Force in Space: 1945 to the Twenty-first Century*, eds. R. Cargill Hall and Jacob Neufeld (Washington D.C.: USGPO, 1995), 15.
[73] Peebles, *High Frontier*, 7.
[74] Spires, *Beyond Horizons*, 71.
[75] See pp. 58-59 for more information on MIDAS
[76] Peebles, *High Frontier*, 15.

2. Emergence as the 'Executive Agent'

NASA's absorption of the space programs of the U.S. Army and U.S. Navy in 1958-1959, particularly Project Vanguard's personnel and facilities and the Army's Jet Propulsion Laboratory, marginalized the U.S. Army and U.S. Navy's future in space and made the USAF the "front-runner" in the military space mission.[77] The USAF's civilian and military leadership envisioned that the USAF's goal to have an expanded role in space would only benefit from a cooperative relationship with NASA, as the Air Force's virtual monopoly in available space boosters would make them indispensable to the national space program. Over the next two years, NASA became increasingly dependent on the USAF for launch boosters and range support. In 1962, DoD made the USAF the "executive agent" for NASA support, giving it wide-ranging responsibility for NASA research, development, test and engineering activities.[78]

The Kennedy Administration's "national" and "integrated" space programs further enhanced the USAF's space leadership role. The USAF's effort to become the lead space service was greatly aided by SecDef McNamara's decision to centralize space system development within the Air Force through Directive 5160.32. This Directive assigned the USAF responsibility for research, development, test and engineering of DoD space development programs and projects, and in turn, made the USAF the executive agent for military space development.[79] By mid-1961, the USAF was responsible for more than 90 percent of all U.S. military space efforts.[80]

In March 1961, the USAF created the Air Force Systems Command (AFSC) in order to manage its newly acquired responsibilities for all research, development, and acquisition of aerospace and missile systems more efficiently. Four divisions were set up within the AFSC: an Electronics Division, an Aeronautical Systems Division, a Ballistic Missile Division and a Space Systems Division. In addition, an Office of Aerospace Research was established on the Air Staff to foster basic research. General Bernard Schriever was named the first commander of the AFSC, and promoted to four-star rank.

[77] Spires, *Beyond Horizons*, 65-66.
[78] Defense Department Directive 5030.18, "DoD Support of National Aeronautics and Space Administration"
[79] Ibid., 89.
[80] Ibid., 99.

The AFSC supervised the rapid growth of USAF space infrastructure during the 1960s. As a result of this growth, AFSC planners determined that it was in the USAF's best interest to create new, more efficient management structures for range-management, launch and on-orbit authority, payload recovery, and operational command and control of satellite systems.[81] In January 1964, AFSC created the National Range Division, headquartered at Patrick Air Force Base, Florida, to coordinate DoD and NASA activities at both the eastern and western launch sites, and to control the Air Force Satellite Control facility. AFSC also was responsible for the establishment of the Space and Missile Systems Organization (SAMSO) in July 1967, which combined USAF missile and space functions into a single entity. SAMSO later gained control over the development of USAF unmanned communications, weather, navigation, and early warning satellite programs.

3. The Disestablishment of the Aerospace Defense Command and the Creation of Air Force Space Command

The notion of a centralized USAF entity for space operations dates from at least 1974, when the Commander in Chief of Aerospace Defense Command (ADCOM) sent a letter to the Air Force Chief of Staff suggesting that an enhanced space organization be created within ADCOM.[82] During the late1970s, the USAF conducted several studies to review space management practices and to explore the notion of a centralized space organization within the USAF. A 1977 space policy study called the Navaho Chart outlined all of the organizations involved in the functioning of USAF space systems. The results of this study led in turn to the creation of another study panel, led by Brigadier General James Creedon on the Air Staff, that analyzed how the USAF might be able to eliminate both the North American Aerospace Defense Command (NORAD) and ADCOM. The group concluded that NORAD could not be eliminated because of Canadian involvement, but that the organization and functions of ADCOM, which possessed responsibility over the air defense, space surveillance, and missile-warning missions for the USAF, should be re-evaluated.[83]

[81] Ibid., 168.
[82] Earl S. Van Inwegen III, "The Air Force Develops an Operational Organization for Space," in *The U.S Air Force in Space: 1945 to the Twenty-first Century*, 135.
[83] Ibid., 136.

The conclusions generated by Creedon's study group prompted a comprehensive study committee on ADCOM headed by Lieutenant General William Creech. The panel recommended in its "Green Book" report that ADCOM be disestablished, its air defense assets transferred to the Tactical Air Command, and its space surveillance and missile warning assets given to the Strategic Air Command (SAC). It was also recommended that a small Air Force air defense element be retained to provide operation control over air defense.

The ADCOM was ultimately disestablished on October 1, 1979 as an Air Force major command. Its air defense, and missile and space defense systems were transferred to the Tactical Air Command and Strategic Air Command. Moreover, the day after ADCOM was deactivated, the USAF announced that it would divide SAMSO's functions and responsibilities between two entities—The Ballistic Missile Office and the Space Division. Elements of ADCOM continued to function, however, as a specified command, serving as the US component of NORAD. This organization remained active until December 1986, when it was deactivated and replaced by US Element NORAD.[84]

In addition to ADCOM's disestablishment in 1979, *The Space Missions Organizational Planning Study* (SMOPS), a paper published by the Air Staff in late 1978, was circulated among the USAF's senior leadership. This study laid the groundwork for several structural changes that would consolidate USAF space operations over the next several years. It evaluated the future of USAF space operations and space mission management, and concluded that the USAF was faced with five alternatives that ranged from maintaining the status quo to creating an independent space command.

The following year, the Air Force Scientific Advisory Board concluded in its August 1980 "Summer Study on Space" that although the USAF had successfully conducted space operations for the last fifteen years, the service was nevertheless, "inadequately organized for operational exploitation of space and has placed insufficient emphasis on inclusion of space systems in an integrated force study."[85] The study also concluded that the USAF's space objectives, "are not clearly defined," that its space systems are "not integrated" into force structures, and that the USAF's space requirements and employment strategy were neither "clearly

[84] Spires, *New Horizons*, 195.
[85] Van Inwegen, 139.

understood", nor "fiscally obtainable".[86] Shortly after the publication of this report, the AFSC created the position of Deputy Commander for Space Operations, and named Major General Jack Kulpa as its commanding officer. This office became responsible for all space functions except those that were specifically acquisition related. These included USAF coordination with NASA, and the integration and operational support of all USAF shuttle payloads.[87]

Momentum for a centralized USAF space entity continued to grow throughout 1981 following the publication of an internal USAF report, the *Space Policy and Requirements Study*, which advocated a "space-based" military capability. Lieutenant General Jerome F. O'Malley, the USAF Deputy Chief of Staff for Operations, Plans and Readiness, spearheaded the USAF's efforts to centralize and broaden space operations. In September 1981, the Air Force Directorate of Space was created within O'Malley's office to provide a focal point for space affairs at USAF headquarters.[88] Immediately after its creation, the Directorate worked to create an Air Force Space Master Plan, as well as a detailed space surveillance architecture report that would serve as the basis for the USAF's *Space Systems Architecture 2000* study published in 1983.[89]

During the early 1980s, the U.S. Congress became increasingly critical of the USAF's space management activities. For one, the U.S. Senate Subcommittee on Strategic and Theater Nuclear Programs began to express more interest in national security space organization. Second, U.S. Representative Ken Kramer introduced Resolution 5130 that called for the USAF to rename itself the "Aerospace Force." In addition to ordering that the USAF create a separate space command, the legislation stated that such a force, "be trained and equipped for prompt and sustained offensive and defensive operations in air and space, including coordination with ground and naval forces and the preservation of free access to space for U.S. space aircraft." [90]

A number of watershed events occurred in early 1982 that set the stage for the creation of an Air Force Space Command that would serve as the operational and managerial focal point for USAF space activities. First, in January 1982, a GAO report criticized the DoD's management and

[86] Spires, *New Horizons*, 198.
[87] Ibid., 197.
[88] Van Inwegen, 140.
[89] Spires, *New Horizons*, 201.
[90] For more information on Congressional activities, see Spires, *New Horizons*, 202.

organization of space systems. It also recommended that the DoD create a single manager for the military exploitation of space, and asserted that the Consolidated Space Operations Center (CSOC) in Colorado Springs, Colorado could serve as the central point for a future Space Command or space force.[91] The study also recommended that funds be withheld from the CSOC until the DoD presented a revised plan for space management and organization.

Second, in February 1982, AFSC Commander General Robert Marsh proposed a reorganization of USAF space management practices. Marsh concluded, "there is not enough interface between designers and users. We should 'dual hat' the commander of Space Division as the commander of Space Command."[92] Shortly thereafter, Air Force Chief of Staff General Lew Allen directed Marsh to create a study group to explore Marsh's proposal, particularly the potential creation of a centralized Space Command that would consolidate USAF space operations. An ad hoc working group consisting of representatives from the AFSC, the Aerospace Defense Center and the Office of the Secretary of the Air Force was formed to study a number of proposed space management initiatives.

Four months later in June 1982, General Allen announced that an Air Force Space Command would be established on September 1, 1982. He asserted that the Air Force Space Command would become responsible for managing and operating space assets, consolidating space planning, defining requirements, providing operational advocacy, and ensuring "the close interface between research and operational users.[93] Allen also asserted that General James Hartinger would serve as Air Force Space Command's first commander, while continuing to hold on to his responsibilities as commander of the specified ADCOM and U.S./ Canadian NORAD.

Moreover, General Allen announced that the USAF would establish a Space Technology Center at Kirtland Air Force Base, and that this entity would consolidate the responsibilities of three AFSC laboratories that dealt with space-related research on geophysics, rocket propulsion, and weapons.[94] A news release accompanying General Allen's statement added

[91] Van Inwegen, 141.
[92] Ibid.
[93] Spires, *New Horizons*, 205.
[94] Ibid.

that "it is the Air Force's hope and belief that Space Command will develop quickly into a unified command."[95] Two years later such an entity would be created in the United States Space Command (USSPACECOM).

D. The Establishment of the United States Space Command

USSPACECOM was created in September 1985 by the Joint Chiefs of Staff, who envisioned a need for a unified space command to support U.S. space operations. USSPACECOM's creation was driven by at least three factors. First, President Reagan's 1983 Strategic Defense Initiative (SDI) highlighted the importance of strategic aerospace defense. There was a growing sentiment among civilian and military planners that a unified space command would be an appropriate operational focus for SDI planning and systems operation.[96] Second, although the USAF controlled 70 percent of all DoD space systems and 80 percent of the funding by the mid-1980s, there was increased political pressure on the USAF to share space program management with both the other services and defense agencies. Finally, the effectiveness of third generation space systems garnered considerable support from the services for a centralized DoD entity that would be responsible for space systems. USSPACECOM is headquartered at Peterson, AFB in Colorado Springs, Colorado.

IV. The U.S. Intelligence Community and Space

A. The Central Intelligence Agency

The Central Intelligence Agency (CIA) was created by the National Security Act of 1947. The Act established the CIA as an independent agency within the Executive Office of the President, and outlined five functions:

- Advise the National Security Council (NSC) on U.S. government intelligence activities.
- Make recommendations to the NSC for the coordination of such activities.

[95] Ibid.
[96] Ibid.

- Correlate, evaluate, and disseminate intelligence relating to national security.

- Perform any additional intelligence activities that the NSC deems necessary.

- Perform other functions and duties related to intelligence affecting U.S. national security as the NSC directed.[97]

The CIA became the primary U.S. government agency for intelligence analysis, clandestine human intelligence (HUMINT) operations, and covert operations.[98] The CIA also played a central role in the development of early reconnaissance programs. The CIA was instrumental in the development and operation of the WS-117L program and the U-2 reconnaissance program. It also directed development of the CORONA satellite reconnaissance program, which was given the public name *Discoverer*.[99] The public purpose of the *Discoverer* project was to provide advanced biomedical research and development to the U.S. space program. The CIA and USAF jointly funded the project.[100] In 1959, the first *Discoverer* satellite was launched from Vandenberg AFB aboard a Thor Agena booster. The *Discoverer* program was officially terminated after the launch of Discoverer XXXVIII in February 1962.[101]

Although the NRO became the focal point for U.S. satellite reconnaissance activities after its creation in 1960, the CIA continued to research and develop satellite and space technologies. CIA space activities were initially located within the Directorate for Research. All CIA offices with responsibility for technical intelligence collection, including the Directorate for Research, were consolidated into the Directorate of Science and Technology (DS&T) in 1963. Since its creation, the directorate has been headed by the Deputy Director for Science and Technology (DDS&T). This directorate also has experienced several reorganizations.[102]

[97] U.S. Congress, House Permanent Select Committee on Intelligence, *Compilation of Intelligence Laws* (Washington D.C.:USGPO, 1981), 7. As quoted in Jeffrey Richelson, *The U.S. Intelligence Community* (Cambridge, MA: Ballinger, 1985), 20-21.
[98] Ibid., 21.
[99] Paul D. Stares, "Space and U.S. National Security," in *National Interests and the Military Use of Space*, ed. William J. Durch (Cambridge: Ballinger, 1984), 38.
[100] Stares, *The Militarization of Space*, 45.
[101] SMC Historical Overview Satellite Systems, "Satellite Systems," from the world wide web: www.fas.org/spp/military/program/smc_hist/SMCHOV10.htm. More than 100 launches of the system took place until 1972, however, under the (then) top-secret CORONA designation.
[102] Richelson, *The U.S. Intelligence Community*, 29.

In 1958, the CIA established an office to interpret photography for intelligence purposes called the National Photographic Interpretation Center (NPIC). In 1973, NPIC was transferred from the CIA's Directorate of Intelligence to DS&T.[103] DS&T supervised all NPIC activities including, the production and dissemination of imagery interpretation reports, briefing reports, briefing boards and videotapes. NPIC remained under DS&T until 1996, when it became a part of NIMA.[104]

In addition to directing NPIC, DS&T has supervised CIA satellite reconnaissance Research and Development, including all programs within the Office of Development and Engineering (OD&E), an element of the CIA formed in 1973.[105] OD&E is responsible for providing requirements definition, design engineering, and test and evaluation for highly classified intelligence community satellite reconnaissance programs.[106] It conducts research on laser communications, digital imagery processing, real-time data collection and processing, electro-optics, advanced signal collection, and advanced antenna designs for satellite systems.[107]

In July 1994, DCI James Woolsey initiated a comprehensive strategic plan for the intelligence community to better prepare the CIA to meet the security challenges of the 21st century. This plan included a substantial restructuring of the Agency. Woolsey "encouraged" DS&T to initiate a "vigorous" restructuring program that would reduce 25 percent of its personnel within five years.[108] The unclassified body of literature, however, provides no information on the progress of DS&T's restructuring and the subsequent organizational changes that have taken place.

B. The National Reconnaissance Office and the National Reconnaissance Program

One month after Francis Gary Power's U-2 reconnaissance aircraft was shot down over the Soviet Union in May 1960, President Eisenhower ordered SecDef Thomas Gates to outline options for the future of

[103] Ibid.
[104] "National Photographic Interpretation Center," from the world wide web: www.fas.org/irp/overhead.npic.htm
[105] Richelson, *The U.S. Intelligence Community*, 29. This office was previously named the Office of Special Activities and the Office of Special Projects.
[106] "Directorate of Science and Technology," from the world wide web: www.sites.netscape.net/oglaighnaeireann/cia17.htm
[107] Ibid.
[108] "The Central Intelligence Agency: Future Directions," from the world wide web: www.fas.org/irp/cia/ciafut.htm

intelligence collection from space. Gates created a three-person panel comprised of the Air Force Under Secretary, the Deputy Director of Defense Research and Engineering and the Presidential Science Advisor to address the issue. Two months later, on August 25, 1960, the panel submitted a report to the National Security Council. That report led to the creation of the NRO, a classified organization that would centralize all DoD satellite and air vehicle overflight projects for intelligence.

The panel's recommendation to create a "national" satellite reconnaissance agency was designed to guarantee that the interests of both the military and civilian intelligence communities would be represented in the operation of satellite reconnaissance systems. The creation of the organization, however, stemmed directly from the growing involvement of the CIA in the development of reconnaissance satellites as well as the increasing amount of technical problems that materialized from the transmission of data from space.[109]

In 1960, Air Force Under Secretary Joseph Charyk was named the first director of the NRO. Charyk and subsequent NRO directors reported directly to the SecDef and the DCI on the status and operation of NRO activities.

1. NRO Management and Organization, 1960-1992

During the first decade of the NRO's existence, a series of agreements between the SecDef and DCI gradually granted SecDef wide-ranging authority over NRO operations. The first of these agreements, signed in September 1961, focused on the creation of the National Reconnaissance Program (NRP) within the DoD that included both overt and covert reconnaissance projects. The agreement stated that the NRO would manage the NRP under the supervision of the Air Force Under Secretary and the CIA's Deputy Director for Plans. The agreement also stated that the United States Intelligence Board (USIB) would set the intelligence requirements and priorities for the NRO.[110]

[109] Ibid., p. 44.
[110] The National Commission for the Review of the National Reconnaissance Office, October 2000, Appendix D: Historical Development of The Secretary of Defense—Director of Central Intelligence Relationship with the NRO, from the world wide web: www.nrocommission.com.

A second agreement between SecDef and DCI in May 1962 established technical and financial management, security, and operational policies that the NRO Director would follow in establishing DoD and CIA interests within the NRP. The agreement also provided that the NRO Director would be given authority over NRP planning, although such planning would be coordinated with the DCI.

A third agreement signed by the SecDef and DCI in March 1963 moved NRO management authority to the Defense Department, as DoD became the executive agent for the NRP. Under this accord, the SecDef established the NRO as an independent entity within the DoD. The NRO Director, now a SecDef appointee, remained responsible for the management of the NRP, but "subject to the direction, authority, and control" of SecDef.

A fourth agreement, signed in August 1965, increased SecDef's authority over the NRO. While the NRO remained a separate DoD agency, SecDef retained "ultimate responsibility" for its operations and management. SecDef gained "the final power" to approve the NRP budget and became the final decision-maker on all NRP issues. This agreement also created an NRP "Executive Committee" (EXCOM) comprised of the DepSecDef, who also served as chair, the DCI, and the Science and Technology Advisor to the President. Although the EXCOM was granted the authority to "guide and participate in the formulation" of the NRP, the SecDef became the final arbiter over any EXCOM disagreement.

During the next decade, the trend reversed. The DCI gained increased authority over NRO operations. This can be attributed to at least two factors. First, in 1973, the DCI became Chair of EXCOM. The DepSecDef, who outranked the DCI, subsequently stopped attending EXCOM meetings, sending the Assistant Secretary of Defense for Intelligence to EXCOM meetings in his place until the EXCOM was disbanded in 1976. Second, Executive Order 12036 gave the DCI "full and exclusive" authority over the preparation of the National Foreign Intelligence Program (NFIP) budget. As a result of this Directive, by the end of 1978 the Director of the NRO (DNRO) was reporting directly to the DCI on all issues pertaining to NRP funding and requirements.

Notwithstanding a number of shifts in its management and oversight arrangements during the 1960s and 1970s, the NRO's acquisition and operations processes remained unchanged from its founding until the early 1990s. Shortly after its creation in 1960, the NRO was divided into

Programs A, B, and C. Each program office was responsible for the design, development, and operation of satellite reconnaissance systems. Program A comprised all USAF satellite intelligence assets. It was managed by the Special Projects Office, the successor to the SAMOS Project Office, at the Air Force Space and Missile Systems Center at Los Angeles AFB.[111] The CIA's satellite reconnaissance program, Program B, was operated in Reston Virginia. The Agency's Director for Science and Technology was placed in charge of all CIA satellite programs within the NRO. The U.S. Navy's satellite programs within the NRO were run through Program C. The Navy's Space and Naval Warfare Systems Command (SPAWAR), located in Crystal City Virginia, comprised Program C, which included the Galactic Radiation and Background (GRAB) satellite. During the 1960s, the NRO added a fourth directorate, Program D, which was comprised of aerial reconnaissance programs such as the U-2 and the A-11. These aircraft were later operated by the USAF Strategic Command.

2. The 1992 Reorganization

During the late 1980s and early 1990s, there was increased interest on the part of the intelligence community and the U.S. Congress to restructure the NRO. It appears that the publication of at least two reports that criticized the NRO's management and organization were instrumental in the NRO's 1992 restructuring.

In 1989, the NRO published the *NRO Restructure Study*, conducted by Rear Admiral Robert Geiger and Mr. Barry Kelly. In addition to evaluating the NRO's existing management practices, the study identified changes that would help the NRO respond to future intelligence challenges. Shortly after publication of the study, then-NRO Director Edward Aldridge stated that he would construct a plan to implement several of the report's recommendations, including, the creation of mechanisms to conduct cross-system trades and simulations within the NRO, the creation of a "User Support" function to improve NRO support to intelligence community and military users, and the collocation of all NRO elements in the Washington D.C. area.[112] Aldridge expressed hope that these changes could be completed by 1991-1992.

[111] "Memorandum for NRO Program Directors/Director, NRO Staff: Organization and Functions of the NRO," July 23, 1962, in Jeffrey Richelson, U.S. Intelligence Policy Documentation Project, September 27, 2000, from the world wide web: www.hfni.gsehd.gwu.edu/nsarchiv/nsa/.
[112] "The NRO Declassified," from the world wide web: www.hfni.gsehd.gwu.edu/~nsarchiv/nsa/.

In response to the findings of the *NRO Restructure Study*, the U.S. Congress began to express concerns about management problems and other operational inefficiencies within the NRO. Later that year, the U.S. Senate Select Committee on Intelligence stated that, "the best approach to ensuring a robust national reconnaissance program is to reorganize the NRO in a way which facilitates greater communication, cross-system and cross-program fertilization, and common security, support and administrative practices."[113] The Committee also recommended that the CIA, U.S. Air Force, and U.S. Navy collocate their program offices into a central authority to increase operational efficiency.

A subsequent study, the 1992 *DCI Task Force on the National Reconnaissance Office*, further evaluated the NRO's current and future reconnaissance systems as well as its security, and management and organizational structure. The study panel, headed by former Lockheed CEO Robert Fuhrman, concluded that the NRO's "Program" structure failed to "enhance mission effectiveness" and led "to counterproductive competition."[114] The report also recommended that the "fact" of the NRO be declassified, and that information about the NRO's mission and the identities of senior NRO officials be made public.

Shortly after publication of the *DCI Task Force On the National Reconnaissance Office Report*, the NRO commenced a restructuring. As a part of this effort, the NRO combined Programs A, B, and C into a single entity with four directorates: Imaging, Signals Intelligence, Communications and Space Launch.[115] The NRO declassified both its existence and mission. The NRO also centralized its offices and staff in a new complex in Chantilly, Virginia. Moreover, a Management Services and Operations (MSO) organization was constructed in order to consolidate the NRO's communications, human resource management, administrative services, facilities acquisition and logistics support.

The NRO's current director, Mr. Keith Hall, initiated several management and organizational changes. To improve the NRO's financial accountability and management, Hall created the Office of the Deputy Director for Resource Oversight Management (DDROM). In addition, he

[113] Ibid.
[114] Report to the Director of Central Intelligence, DCI Task Force on the National Reconnaissance Office, Final Report, from the world wide web: www.gwu.edu/~nsarchiv/NSAEBB/NSAEBB35/.
[115] R. Cargill Hall, *The NRO at Forty: Ensuring Global Information Supremacy*, (Washington D.C.: USGPO, 2000), 7.

established an Advanced Systems and Technology (AS&T) office for advanced Research and Development. It has been reported that 10 percent of the NRO's aggregate budget is allocated to AS&T programs.[116]

C. National Security Agency

The National Security Agency/Central Security Service is a combat support agency of the DoD under the authority, direction, and control of the SecDef. It serves as the Executive Agent for U.S. government signals intelligence, communications security, computer security and operations security training activities.

1. Early History

The roots of NSA date to the late 1940s. The NSA's predecessor, the Armed Forces Security Agency (AFSA) was created within the DoD in May 1949 by then SecDef Louis Johnson, and made subordinate to the Joint Chiefs of Staff. The mission of the AFSA was "to provide for the placing under one authority the conduct of communications intelligence and communications security activities … within the National Military Establishment, except those which are to be conducted individually by the Departments of the Army, Navy, and the Air Force."[117] The Directive establishing AFSA also created AFSA's governing board, the Armed Forces Security Agency Council (AFSAC). The AFSAC was comprised of two United States Communications Intelligence Board (USCIB) members from each service, plus one additional representative from each of the services.[118] In September 1949, AFSAC was given the authority to establish AFSA's policies, operating plans and doctrines.

In December 1951, CIA Director Walter Bedell Smith wrote to National Security Council Executive Secretary James B. Lay stating that "control over, and coordination of, the collection and processing of communications intelligence have proved ineffective."[119] Smith recommended a review of U.S. communications intelligence activities. Six months later, a study on U.S. communications intelligence activities

[116] Ibid., 8.
[117] James Bamford, *The Puzzle Palace: A Report on America's Most Secret Agency* (Boston: Houghton Mifflin, 1982), 47.
[118] Ibid., 48.
[119] Richelson, *The U.S. Intelligence Community*, 15.

entitled the "Brownell Committee Report" was completed. The report concluded that U.S. communications intelligence activities required a much greater degree of coordination and national-level direction.[120] Thereafter, on October 24, 1952, President Harry Truman issued National Security Council Intelligence Directive No. 9.[121] This Directive reiterated many of the Brownell Reports recommendations.[122] It abolished AFSA, and created the NSA in its place. Major General Julian Canine was named the NSA's first director. The NSA's existence was not officially acknowledged by the U.S. government until 1957 when the U.S. Government Organizational Manual first recognized it as a "separately organized agency within the DoD" that "performs highly specialized technical and coordinating functions relating to national security."[123]

On December 23, 1971, DoDD 5100.20 established the Central Security Service (CSS) within the NSA, and renamed the organization the NSA/CSS.[124] The CSS was created to promote a full partnership between the NSA and the cryptologic elements of the Armed Forces, and to promote a more unified DoD cryptologic effort.[125] It is largely a product of the 1971 reorganization of the intelligence community.[126] The CSS is comprised of the Army Intelligence and Security Command, the Naval Security Group, and the Air Force Security Service.[127] The Director of the NSA also serves as the Chief of the CSS.

The NSA's charter was outlined in 1972 in National Security Council Intelligence Directive 6, "Signals Intelligence."[128] This Directive directs the NSA to produce intelligence "in accordance with the objectives, requirements, and priorities established by the DCI and the United States Intelligence Board."[129] It also gives the NSA Director the authority to "issue direction to any operating elements engaged in SIGINT operations such instructions and assignments as are required."[130]

[120] Ibid., 15.
[121] "*Frequently Asked Questions" at the NSA's website*, from the world wide web: www.nsa.gov/about_nsa/faqs_internet.html
[122] *Bamford, The Puzzle Palace*, 55.
[123] Richelson, *The U.S. Intelligence Community*, 16.
[124] National Archives and Records Administration, "Records of the National Security Agency/Central Security Service" (Record Group 457), from the world wide web: www.nara.gov/guide/rg457.html
[125] "*Frequently Asked* Questions," from the world wide web: www.nsa.gov/about_nsa/faqs_internet.html
[126] Ibid.
[127] Bamford, *The Puzzle Palace*, 156.
[128] Richelson, *The U.S. Intelligence Community*, 15.
[129] Ibid.
[130] Ibid.

2. Organizational Structure

The NSA's current roles and responsibilities are outlined in Executive Order 12333 of December 1981. It is designated with accomplishing two national missions: First, the Information Assurance Mission "provides the solutions, products and services, and conducts defensive information operations, to achieve information assurance for information infrastructures critical to U.S. national security interests." Second, the Foreign Signals Intelligence mission, "allows for an effective, unified organization and control of all the foreign signals collection and processing activities of the United States. NSA is authorized to produce SIGINT in accordance with objectives, requirements and priorities established by the DCI with the advice of the National Foreign Intelligence Board."[131]

The NSA's organizational structure has been one of its most closely guarded secrets, and therefore, it is very difficult to identify and evaluate specific managerial and organizational changes that have occurred since its creation. While the CIA has made public much of its "upper framework," Public Law 86-36 of 1959 states, "nothing in this Act or any other law … shall be construed to require the disclosure of the organization or any function of the NSA, or any information with respect to the activities thereof, or of the names, titles, salaries, or number of persons employed by such Agency."[132] Nevertheless, analysts and historians of the NSA have stated that the NSA was long comprised of ten *key components*: four operational offices, five staff and support directorates, and one entity that was responsible for training. The four following NSA offices at one time possessed various space-related responsibilities.

Office of Signals Intelligence Operations

Originally named the Office of Production, the Office of Signals Intelligence Operation is the largest organization within the NSA. Within this office, the Deputy Director for Operations (DDO) oversees the range of signals intelligence, including, cryptanalysis, traffic analysis, analysis of clear text, low-level radio telephone, and the internet.[133]

There are a number of staff components within DDO. Among the most important are PO5, the NSA's consumer staff liaison, which serves as the NSA's principal point of contact for all U.S. intelligence agencies.[134]

[131] NSA "Mission Statement," from the world wide web: www.nsa.gov/about_nsa/mission.html
[132] Bamford, *The Puzzle Palace*, 88-89.
[133] Ibid., 90.

The intercepts that the NSA collects are transmitted through PO5 to the CIA, DIA, FBI, and other intelligence community members. In addition to PO5, PO4 is the DDO staff entity that is responsible for the formulation of operational policy and plans within the Office of Signals Intelligence Operations.

Office of Communications Security

The NSA's Office of Communications Security (COMSEC) is responsible for constructing the methods, principles and equipment to protect the U.S.'s classified communications systems, procedures and codes, including command and control, voice, data, teletype, and telemetry.[135] As a part of this effort, COMSEC is responsible for developing secure voice and data transmission links for the U.S. DSCS, and the Satellite Data System (SDS).[136] COMSEC also is responsible for communications security for the Minuteman and MX strategic weapons systems, and for developing the codes that the President uses to identify himself to authorize the use of nuclear weapons.

Office of Research and Engineering

Since the early 1960s, the Office of Research and Engineering (R&E) was the focal point of the NSA's Research and Development activities. Upon its creation, R&E was divided into three divisions. The Research, Engineering, Mathematics, and Physics (REMP) directorate conducted broad crypto-analytic research, concentrating primarily on codebreaking activities. REMP was later renamed the Mathematical Research Techniques Division.[137] The Research and Development (RADE) directorate has focused on constructing sophisticated intercept and signals analysis hardware. RADE was subsequently renamed the Intercept Equipment Division. The Standard Technical Equipment Development (STED) directorate was initially formed to assist COMSEC in research and developing advanced cryptographic equipment. STED later became the Cryptographic Equipment Division. An internal re-organization that changed the names of REMP, RADE and STED also created a fourth directorate within R&E, the Computer Techniques Division. The NSA's advanced computer research has since been conducted in this office.[138]

[134] Ibid., 91.
[135] Ibid., 94.
[136] Richelson, *The U.S. Intelligence Community*, 16.
[137] Bamford, *The Puzzle Palace*, 96.
[138] Ibid., 96-97. It is difficult to ascertain from the unclassified literature when the re-organization of R&E occurred.

Office of Telecommunications and Computer Services

This office supervises the NSA's massive network of computer systems. Until the mid-1970s, the Agency's telecommunications and computer services were managed by two separate organizations. The NSA's communications activities were centered within the Office of Telecommunications. Its computer services were contained within other offices. For example, DDO's C Group controlled the NSA's largest computer capability, *Harvest*, and provided codebreaking divisions with computer support. Sometime in 1976, a reorganization occurred which eliminated Group C and transferred all NSA computer functions to the newly created Office of Telecommunications and Computer Services, commonly known as the "T" Organization.[139]

3. The 1991 DoD Inspector General's Report on the NSA

In 1991, the DoD's Inspector General conducted its first comprehensive inspection of the NSA. The inspection occurred in order to evaluate the processes that the NSA uses to measure mission achievement and its functions and organizational elements. The Inspector General concluded that the growth of the Agency had not been centrally managed or planned and that the NSA did not possess oversight mechanisms to ensure that the Agency accomplished its mission. Moreover, the investigation revealed that the NSA had conducted a number of internal reviews, but had taken no effective action as a result of those studies.[140]

In 1996, the DoD Inspector General's office completed a second investigation of the NSA to determine how and to what extent the Agency attempted to correct problems identified during the 1991 inspection. The Inspector General examined 16 of the 36 problem areas identified during the 1991 inspection. These included strategic planning, internal management, manpower, contract management, budgeting, financial planning, and oversight processes and mechanisms.[141] Of the 16 areas examined, the Inspector General concluded in its 1996 report that the NSA had not adequately addressed at least ten management issues.

[139] Ibid., 102.
[140] DoD Inspector General, *Final Report on the Verification Inspection of the National Security Agency*, Report Number IR 96-03, February 13, 1996, 1.
[141] Ibid.

Although most of these issues were not related directly to NSA space operations, the report stated that "the signal intelligence production process does not function as an interrelated process and is hampered by a lack of effective management oversight."[142] The study recommended that the NSA "develop a measurable, internal oversight mechanism to track requirements through the entire production process" and ensure that a clear link is made "between the analytical efforts and the National Signal Intelligence Requirements List that allows managers to measure progress against meeting those requirements."[143] It also advised that the NSA "develop and document Signal Intelligence procedures for the collection and analysis process."[144]

4. The 2000 Restructuring

In December 2000, the *Washington Post* reported that the NSA had completed a wholesale restructuring. The Post also reported that as a result of that restructuring, there are now just two directorates—a SIGINT and Information Assurance Directorate.[145] This reorganization was undertaken in order to eliminate duplication in support services and to improve the organization's responsiveness to the Director. The two new groups have been labeled as *mission-oriented* directorates. All other NSA operations fall under the responsibility of either the NSA director, or the NSA Chief of Staff.[146]

D. Defense Intelligence Agency

The DIA is a combat support agency of the DoD that operates under the authority, direction, and control of the ASD (C3I). It is responsible for collecting, producing, tasking and coordinating military-related intelligence for SecDef, the Joint Chiefs of Staff (JCS), and both defense and non-defense agencies. It collects and provides military intelligence for national foreign intelligence and counterintelligence products, and manages both the Defense Attaché system and the General Defense Intelligence Program (GDIP). The DIA is headed by a three star military officer, and is staffed by almost 3,000 civilian and military personnel.

[142] Ibid., 13.
[143] Ibid., 14.
[144] Ibid.
[145] Vernon Loeb, "NSA Reorganization," *Washington Post*, December 19, 2000, p. A 37.
[146] Ibid.

1. DIA History

During the late 1950s, the Eisenhower Administration determined that the armed force's general intelligence activities—all non-SIGINT, non-overhead (ie.non-satellites), non-organic (i.e. not organic to service intelligence organizations), intelligence functions—needed to be consolidated.[147] Each military department separately collected, produced and disseminated intelligence for their individual use. A 1960 report completed by a Joint Study Group recommended that a coordinating Defense Intelligence Agency be created to represent the armed services as a member of the United States Intelligence Board.[148]

In August 1961, SecDef McNamara, acting upon the recommendations of the Joint Study Group, created the DIA through DoDD 5105.21. The new organization reported to the SecDef through the Joint Chiefs of Staff. It was tasked with organizing, directing, managing, and controlling DoD intelligence resources; reviewing and coordinating DoD intelligence functions retained by and assigned to the military departments; and supervising the execution of all approved plans, programs, policies, and procedures for intelligence functions not assigned to the DIA. In January 1963, the DIA created a new Productions Center. Over the next three months, the DIA's Automated Data Processing Center (ADP), Dissemination Center, and Scientific and Technical Intelligence Directorate were formed.

In 1964-1965, the DIA's responsibilities were further expanded. It was charged with establishing and operating facilities for military photographic processing, printing, interpretation, and analysis for the entire defense community. It also became responsible for communicating both raw and "finished" intelligence from both Defense and non-Defense sources to the entire defense establishment.

During the late 1960s and early 1970s, DIA personnel strength was reduced 31 percent and the organization was broadly reorganized.[149] As a part of this reorganization, the DIA established a Directorate for Estimates in November 1970, and the J-2 Support Office in 1974 to better satisfy JCS intelligence needs.[150] It subsequently became the program manager for the

[147] Richelson, *The U.S. Intelligence Community*, 35.
[148] Ibid., 36. This office supported the intelligence needs of the CJCS, as espoused by the JCS J2 (Director for Intelligence).
[149] "DIA History," from the world wide web: www.dia.mil/site5/aboutdia/present/dia-history_intro.html

General Defense Intelligence Program (GDIP). In 1977, DIA's relationship with the JCS and OSD was revised, transferring DIA staff supervisory responsibilities regarding resources to the ASD (C3I). The Assistant Secretary of Defense for International Security Affairs became responsible for overseeing all DIA policy matters.[151]

2. The 1979 Reorganization

The most substantial reorganization of the DIA occurred in 1979 after the promulgation of Executive Order 12306, which restructured the DIA's national and departmental responsibilities. The Agency was split into five major directorates: Production, Management & Operations, Resources, Intelligence and External Affairs, and J-2 support.[152] Several of these directorates are responsible for DIA space missions and activities.

Within the Management and Operations Directorate, the collection management division has supervised and evaluated all DoD intelligence collection and processing requirements, including, HUMINT, IMINT, SIGINT, and technical sensors. It also manages and coordinates DoD Imagery processing and exploitation activities, and serves as the focal point for coordination and support of national and departmental reconnaissance activities.[153] It operates the Collection Coordination Facility (CCF) for tasking of collection systems, and maintains liaisons with the Joint Reconnaissance Center. Through the Management & Operations Directorate, the DIA also participates in the Defense Special Missile and Astronautics Center (DEFSMAC), an office jointly operated with the NSA.[154] DEFSMAC was created in 1966 to provide warning of missiles and space launches.

The Command, Control, and Space Division within the Intelligence & External Affairs Directorate also is responsible for space management functions. The division reviews and validates requirements and establishes production priorities for scientific intelligence. This division also develops, manages and directs DoD wide production of scientific intelligence.[155]

[150] Ibid.
[151] Ibid.
[152] Ibid.
[153] Richelson, *The U.S. Intelligence Community*, 40.
[154] Ibid.
[155] Ibid.

3. The 1980s and 1990s

Throughout the 1980s, the DIA focused on improving its tactical and theater intelligence capabilities in order to meet wartime intelligence requirements. As a part of this effort, the DIA created the office of the Functional Manager for Intelligence Processing in 1982.[156] It also bolstered its ability to disseminate national level intelligence to tactical commanders by creating standard intelligence communications architecture.

After the cold war, the DIA attempted to improve management over its intelligence production. Not only was the authority and control of the ASD (C3I) over DIA increased, it adopted "functional management" practices to address internal intelligence issues. Moreover, in January 1992, DoD gave the DIA control over the Army's Missile and Space Intelligence Center (MSIC) to consolidate national intelligence production and improve its efficiency. The MSIC manages and produces all-source scientific and technical intelligence on foreign missiles, missile defense systems, directed energy weapons, selected space programs and systems, and relevant command, control, communications and computer systems.[157] The MSIC is located at Redstone Arsenal in Huntsville, Alabama.

E. The National Imagery and Mapping Agency

The NIMA was created on October 1, 1996 as a DoD combat support agency. NIMA comprises the imagery tasking, exploitation, production and dissemination responsibilities and the mapping, charting, and geodetic functions of eight former entities within the Defense and Intelligence communities, including the Defense Mapping Agency (DMA),[158] the Central Imagery Office (CIO), the Defense Dissemination Program Office, the missions and functions of the CIA's National Photographic

[156] "DIA History," from the world wide web: www.dia.mil/site5/aboutdia/present/dia-history_intro.html

[157] DoD Press Advisory, January 22, 1998, from the world wide web: www.defenselink.mil/news/Jan1998/p01221998_p012-98.html

[158] The DMA was created in 1972 to consolidate the mapping, charting, and geodesy activities of the military services. It was responsible for producing strategic and tactical maps, charts, geodetic information, databases, and specialized products to support weapons and navigations systems. In 1982, the DMA created a Special Program Office for Exploitation Modernization (SPOEM) in order to allow the DMA to receive and utilize the readouts of KH-11 and KH-12 reconnaissance satellites. The DMA had two principal facilities, one at the DMA Aerospace Center in St. Louis, Missouri, the other at the DMA Hydrographic/Topographic Center in Brookmont Maryland. For more information on the DMA, see Richelson, *The U.S. Intelligence Community*, 42.

Interpretation Center (NPIC) as well as the imagery exploitation, dissemination and processing elements of the Defense Intelligence Agency, NRO, and the Defense Airborne Reconnaissance Office (DARO).[159]

The United States Congress was the primary force behind NIMA's creation. The Congress determined that it was necessary for the DoD and the IC to create "a single agency focus for the growing number and diverse types of customers for imagery and geospatial information resources within the Government, to ensure visibility and accountability for those resources, and to harness, leverage, and focus rapid technological developments to serve the Government's imagery, imagery intelligence and geospatial information customers."[160] On October 11, 1996, DoDD 5105.60 established NIMA and prescribed its mission, organization, responsibilities and management functions.

The organization was established to provide timely and relevant imagery, intelligence, and geospatial information to military and civil users through its U.S. Imagery and Geospatial Information System (USIGS).[161] It was also created to serve as the U.S. Government's focal point for managing the disciplines of imagery and mapping. NIMA has technical and liaison representatives at the CINC level. These individuals establish requirements and priorities, and identify the appropriate products and services that NIMA can provide.[162]

NIMA's most important current functions include:

- Serving as the program manager for both the National Imagery and Mapping Program within the NFIP, and the Defense Imagery and Mapping Program within the Joint Military Intelligence Program (JMIP).

- Serving as the as the Functional Manager for imagery, imagery intelligence, and geospatial investment activities including RDT&E and procurement activities within the NFIP, JMIP, and TIARA.

[159] "National Imagery and Mapping Agency Established," October 1, 1996, from the world wide web: www.defenselink.mil/news/Oct1996/b
[160] Text of P.L. 104-201, National Imagery and Mapping Agency Act, "Congressional Findings."
[161] "National Imagery and Mapping Agency," from the world wide web: www.icweek.com/nima-sum.htm
[162] "The National Imagery and Mapping Agency," from the world wide web: www.fas.org/irp/agency/nima/nima_intro.htm

- Prescribing and mandating standards and end-to-end technical architectures related to imagery, intelligence, and geospatial information for DoD components and non-DoD elements of the IC.

- Disseminating imagery, imagery intelligence, and geospatial information by the most efficient and expeditious means consistent with DoD and IC security standards.[163]

The ASD (C3I) supervises NIMA's activities. All substantive intelligence that NIMA produces is submitted directly to the SecDef, DepSecDef, Chairman of the Joint Chiefs of Staff and DCI.[164] The Director of NIMA is appointed by the President upon recommendation by SecDef. When the Director is a member of the Armed Services, the individual carries a three-star rank.

Since its 1996 creation, NIMA has been the subject of a number of studies. An April 2000 Defense Science Board Task Force study of NIMA, published for the Office of the Under Secretary of Defense for Acquisition and Technology, concluded that NIMA will play a central role in the future Tasking, Processing, Exploitation, and Dissemination (TPED) of geospatial information for the U.S. Government, that the organization needed to evolve into a smaller, elite mission-driven organization, and that in order to become "more organic," NIMA must deploy more people to the field and at the NRO, and integrate more service personnel at NIMA.[165]

Most recently, in December 2000 the Report of the Independent Commission on the NIMA concluded that "the promise of converging mapping with imagery exploitation into a unified geospatial information service is yet to be realized, and NIMA continues to experience 'legacy' problems, both in systems and in staff."[166] The Commission recommended the establishment within NIMA of an "Extraordinary Program Office" (EPO) "armed with special authorities" of the DCI and SecDef "which will be charged with and responsible for all pre-acquisition activities, systems engineering and architecture, and acquisition of TPED from end-to-end, and from national to tactical."[167]

[163] DoDD 5105.60, Section 6.0, "Responsibilities and Functions." The Directive outlines 33 responsibilities and functions for NIMA.
[164] DoDD 5105.60, "National Imagery and Mapping Agency."
[165] Report of the Defense Science Board Task Force, "National Imagery and Mapping Agency," Office of the Under Secretary of Defense for Acquisition, Technology & Logistics, April 2000, 33.
[166] Report of the Independent Commission on the National Imagery and Mapping Agency, Executive Summary and Key Judgments, from the world wide web: www.nimacommission.com
[167] Ibid.

F. Defense Information Systems Agency

The Defense Information Systems Agency (DISA) is a combat support agency of the DoD under the authority, direction and control of ASD (C3I). DoDD 5105.19 restructured the Defense Communications Agency (DCA) in June 1991, and created DISA in its place. Although DISA has performed the functions of the former DCA, DoDD 5101.19 also expanded the organization's responsibilities, functions and authorities.

DISA is responsible for planning, developing, and supporting C3I systems that serve the needs of the National Command Authority.[168] It provides guidance and support on technical and operational C3 and information systems issues affecting OSD, the military departments, the Joint Chiefs of Staff, the Unified Combatant Commands, and the Defense Agencies. It ensures the interoperability of the Worldwide Military Command and Control System, the Defense Communications System, theater and tactical command and control systems, North Atlantic Treaty Organization and allied C3 systems, and national and/or international commercial communications systems that effect DISA's mission.[169] DISA also manages the Defense Information Infrastructure (DII) through which it integrates hardware and software and constructs a common operating environment to sustain the warfighters information needs.

DISA's plans and policies are created by a Command Staff headed by a Director, Vice Director and Chief of Staff.[170] The Command Staff has primary staff responsibility for managing DISA. DISA is currently organized into eight directorates, each of which is headed by a Deputy Director: Manpower, Personnel and Security; C4 & Intelligence Program Integration; Operations; Acquisition, Logistics and Facilities; Strategic Plans and Policy; Information Engineering; Joint Requirements Analysis and Integration, and; C4I Modeling, Simulation & Assessment.[171]

[168] DoD Directive 5105.19, "Defense Information Systems Agency (DISA)," Section C, Mission, from the world wide web: www.defenselink.mil/pubs/ofg/of_disa.html
[169] Ibid.
[170] "DISA Organizational Structure," from the world wide web: www.disa.mil/org/disaorga.html
[171] Ibid.

V. Space Systems Acquisition

Over the years, U.S. government agencies and the Armed Services have acquired various satellite programs to perform a variety of functions. In this paper, four of these systems have been chosen for examination because of their relevance to the history of DoD space. [172] These programs include the DSCS, DMSP, DSP, and GPS. This section outlines the acquisition process of these programs, including the satellite, the launch vehicle, the capability to command and control the satellite, and the receivers that utilize the data from the satellite.

A. Defense Satellite Communications System

During the 1960s, the DoD launched its first satellite communications system, the Initial Defense Communications Satellite Program (IDCSP), which included 26 geosynchronous earth orbiting (GEO) communications satellites. These satellites were originally designed as an experimental program. Defense planners later concluded that the satellites were highly effective in providing survivable communications for both strategic and tactical purposes. In 1968, IDSCS was renamed the Defense Satellite Communications System (DSCS) Phase I.

In November 1971, the USAF launched the first of sixteen DSCS II satellites. DSCS II possessed greater communications capacity and transmission strength, and an expected lifetime of five years, nearly twice that of IDCSP's.[173] It was designed to transmit high priority information between defense officials and commanders on the battlefield. The military also uses DSCS II satellites to transmit space operation and early warning data to various systems and users around the world.

In 1982, the U.S. Air Force initiated DSCS III, which is more technologically advanced system than DSCS II. The system utilizes multiple-beam antennas that provide greater coverage than DSCS II, and a gimbaled-dish antenna for spot coverage and earth-coverage antennas. Each satellite is designed with six high frequency transponder channels that can provide worldwide secure voice and data transmissions. It also is

[172] For an explanation of NRO systems acquisition, see Baker, Kruse, Cushman and Noricks "*U. S. Space Management and Organization: Evaluating Organizational Options,* Space Commission staff paper, January 2001.
[173] For a comprehensive overview of the DSCS, see the world wide web: www.zianet.com/jpage/spysats/communications/dscs.html

equipped with a single transponder that can disseminate "emergency action" and "force direction" messages to U.S. nuclear forces.[174] The life expectancy of each DSCS III satellite is ten years.

The U.S. Air Force Material Command's Space and Missile System Center at Los Angeles, California is responsible for the acquisition and development of DSCS satellites.[175] There are two DSCS II and eight DSCS III satellites currently in operation in space. Satellite control facilities of the USAF's 50th Space Wing's 3rd Operations Squadron at Falcon AFB, and the 5th Space Operations Squadron at Onizuka Air Station are responsible for the satellite platform control of these systems.[176] The Army Space Command's DSCS Operations Centers perform the payload control for DSCS, supporting nearly 2000 requests for mission support annually.

B. Defense Meteorological Satellite Program

Beginning in the early 1960s, the USAF, through the Aerospace Corporation, commenced research on military weather requirements that could be met by satellites. In 1963, the Aerospace Corporation concluded that there was a requirement for the DoD to develop a dedicated meteorological system that focused on cloud-cover photography to support national reconnaissance collection. In 1965, the USAF launched the first of its then-designated Defense Satellite Applications Program (DSAP) satellites.[177] Development of DSAP satellites was intended to provide specific weather data in support of SAC and NRO requirements.[178] The program remained classified until April 1973, when its performance data was made available to the civil and scientific communities DSAP was renamed the Defense Meteorological Satellite Program (DMSP) in December 1973.

[174] "Defense Satellite Communications System Phase III" at Los Angeles Air Force Base's homepage. from the world wide web: www.laafb.af.mil/SMC/PA/Fact_Sheets/dscs_fs.htm
[175] "Defense Satellite Communications Systems," from the world wide web: www.spacecom.af.mil/usspace/dscs.htm
[176] Ibid.
[177] "Defense Meteorological Satellite Program (DMSP) F8 Satellite" at NASA homepage. From the world wide web at www.podaac.jpl.nasa.gov:2031/SOURCE DOCS/dmsp f8.html. The satellites were also known as Program 417.
[178] Spires, *Beyond Horizons*, 147.

Since 1965, more than 35 DMSP satellites have been launched into low earth orbits that pass over the north and south poles.[179] Continued technological improvements in the systems bus and instrument payload have produced six different DMSP variants. The system now provides global, visual and infrared cloud data and other specialized near-real time meteorological, oceanographic and solar-geophysical data to support the intelligence community as well as DoD operations.[180] DMSP satellites possess scanning radiometers that can determine cloud type and height, land and surface water temperatures, water currents, ocean surface features, as well as ice and snow.[181] DMSP data is provided to Air Force Global Weather Central (AFGWC), the Navy Fleet Numerical Oceanography Center (NFMOC) and to other civilian authorities through the U.S Department of Commerce.

Three segments comprise the DMSP program. The Space segment acquires environmental data through DMSP satellite sensors. The Command, Control and Communications (C3S) Segment, which consists of a Multi-Purpose Satellite Operations Center (MPSOC) and the Fairchild Satellite Operations Center (FSOC), conducts all mission planning, generates program commands, and handles telemetry acquisition, processing and post-pass analysis. The user segment, through the AFGWC and NFMOC, receives and processes DMSP data in combination with meteorological, solar-geophysical, and oceanographic observations from other sources. This segment also disseminates DMSP data to the DoD and other agencies as appropriate.[182] Since 1996, the Army has operated the Integrated Meteorological System (IMETS) in each Army Division. IMETS receives DMSP data through a three-foot antennae. The Air Force, Navy and Marine Corps also receive and use DMSP data in support of their meteorological requirements.

As a result of a May 1994 Presidential Directive that ordered the DoD and Department of Commerce (DoC) to merge their separate polar orbiting weather satellite programs, the DMSP is now operated as a tri-agency (DoD, DoC, and NASA) organization. Nevertheless, DMSP operations continue to be managed by the Air Force Material Command's Space and Missile Systems Center at Los Angeles Air Force Base. The 6th Space

[179] "Defense Meteorological Satellite Program (DMSP)," from the world wide web: http://sama-dhi.jpl.nasa.gov/msl/Programs/dmsp.html
[180] "Defense Meteorological Satellite Program (DMSP) F8 Satellite," from the world wide web: www.podaac.jpl.nasa.gov:2031/SOURCE_DOCS/dmsp_f8.html
[181] "DMSP Overview," from the world wide web: www.laafb.af.mil/SMC/CI/overview/index.html
[182] Ibid.

Operations Squadron, Offutt Air Force Base, Nebraska, under the 50th Space Wing at Falcon Air Force Base, Colorado, provide command and control support for all DMSP satellites.[183]

C. Defense Support Program

The DSP has been the cornerstone of the North American Aerospace Defense Command's Tactical Warning and Attack Assessment (TWAA) System since the early 1970s. TWAA is needed to immediately alert the National Command Authorities in the event of detection of suspected launch of missiles that may impact the continent of North America. A constellation of USAF Space Command-operated DSP satellites in GEO have used infrared sensors to detect heat from missile plumes, space launches, and nuclear detonations.[184]

The current U.S. DSP program dates to the late 1950s to the Vela Hotel and MIDAS systems. The Vela Hotel satellite system, a joint initiative between the DoD and U.S. Atomic Energy Commission, was designed to detect nuclear/thermonuclear detonations in the atmosphere and space, as well as to serve as an instrument to ensure Soviet compliance with the 1963 Limited Test Ban Treaty. In October 1963, two Vela Hotel satellites were placed in a 70,000-mile orbit. Between April 1967—April 1970, the U.S. Air Force launched eight subsequent Vela Hotel satellites, one of which operated for fourteen years.[185]

Between 1958-1959, the USAF and ARPA produced a number of studies that outlined tenets of a constellation of MIDAS satellites.[186] Although the specifics of the proposals differed, there was consensus among USAF and ARPA officials that space-based infrared radiometers could be extremely effective in detecting Soviet missile launches. As a result of increasing program costs, declining budgets, and continued disagreement between Air Force Systems Command and DDR&E about the technical feasibility of the system, MIDAS remained a test program until the mid-1960s. In August 1966, American research on infrared

[183] "The Defense Meteorological Satellite Program ," from the world wide web: www.space-com.af.mil/norad/dmsp.htm
[184] United States Air Force, "Fact Sheet: Defense Support Program Satellites," from the world wide web: www.af.mil/newsfactsheets/Defense_Support_Program_Satel.html
[185] Jeffrey T. Richelson, *America's Space Sentinels: DSP Satellites and National Security* (Lawrence, Kansas: Kansas University Press, 1999), 79. The majority of Vela Hotel satellites operated for at least five years, well beyond the anticipated eighteen month lifespan
[186] Ibid., 11.

detection satellites shifted to MIDAS's successor, Program 949, which three years later would be renamed the Defense Support Program (DSP). DSP satellites proved to be far more technologically advanced than the MIDAS system. Unlike MIDAS, DSP satellites possessed the ability to detect three potential space and missile threats—ICBMs, Soviet Fractional Orbital Bombardment (FOB) systems, and SLBMs. The first DSP satellite was launched to GEO in November 1970 aboard a Titan IIIC booster.

The U.S. Satellite Early Warning System currently consists of five DSP spacecraft, three of which are used for frontline operational service, and two for backup. Five technological upgrades to the DSP program have occurred since 1980. These upgrades have enhanced sensor resolution, increased signal-processing capabilities, and improved the systems survivability and lifespan.[187] In 1994, the U.S. Army and U.S. Navy jointly created the JTAGS program. JTAGS receives DSP data directly downlinked from DSP satellites, and when JTAGS are deployed into a theater, remove the risk that a communications outage could deny time-critical missile warning information from reaching the theater from the Air Force's CONUS-based ground station. The following year, the DSP Attack and Launch Early Warning to Theater (ALERT) system was created by Air Force Space Command. This data processing system provides an improved early warning capability against short-range ballistic missiles in theater.[188] Together, the AFSPACECOM's ALERT system, and the Army/Navy JTAG's comprise USSPACECOM's Tactical Event System which provides and de-conflicts missile warning data to theater CINCs.

The Air Force Space Command gained operational control of the DSP program after its creation in 1982. The USAF 21st Space Wing at Peterson Air Force Base is responsible for platform control of the DSP constellation, and for reporting warning information to NORAD and USSPACECOM early warning centers within Cheyenne Mountain. Moreover, the 50th Space Wing at Schriever Air Force Base provides requisite command and control support for the DSP system. The Space Based Infrared System Program Office at USAF Material Command's Space and Missile Systems Center manages development and acquisition of DSP satellites, and is responsible for fielding DSP's replacement, called the Space-Based Infrared System (SBIRS), beginning in 2006.

[187] Department of the Air Force, "Fact Sheet: Defense Support Program Satellites," from the world wide web: www.af.mil/news/factsheets/Defense_Support_Program_Satel.html
[188] Ibid.

D. Global Positioning System

In 1968, the DoD established a tri-service steering committee called NAVSEC (Navigation Satellite Executive Committee) to coordinate various satellite navigation groups.[189] Prior to that time, each of the services had been developing their own satellite and navigation concepts. The Army's concept was called SECOR (Sequential Correlation of Range System). The SECOR program consisted of a small geodetic satellite and 4 ground stations with known coordinates. The first SECOR satellite was launched in January 1964 and other SECOR satellite launches continued until 1969.[190]

The program that was to become GPS merged both the U.S. Navy and U.S. Air Force concepts. The Navy's satellite positioning and navigation test project was called Timation (Time Navigation), developed at the Naval Research Laboratory (NRL) in 1964.[191] The NRL project included the development of high-stability clocks, time transfer capability and two-dimensional navigation. The first Timation satellite, launched in May 1967, verified that passive ranging signals from a satellite could be used in conjunction with highly accurate clocks to obtain navigation and positioning information for small boats, aircraft, and trucks.[192] The Air Force's program, known as System 621B, was based on a 1963 Aerospace Corporation study that posited a concept involving measurements of the time of arrival of radio signals transmitted from satellites with known positions.[193]

Between 1969 and 1972 there were intense debates in NAVSEC concerning the Navy's desire to expand the Timation System and the Air Force's desire for an expanded System 621B. During this time, neither of the two concepts, nor a third satellite system called Transit, developed by the Applied Physics Lab at Johns Hopkins in the late 1950s, emerged as a clear choice for a national satellite navigation and positioning system.[194]

[189] The International Trade Administration, *Global Positioning System: Market Projections and Trends in the Newest Global Information Utility*, September 1998, 87.
[190] SECOR description, from the world wide web: www.friends-partners.org
[191] The International Trade Administration, *Global Positioning System: Market Projections and Trends in the Newest Global Information Utility*, September 1998, 87.
[192] *Timation and GPS Satellite History*, from the world wide web: http://ncs-www.nrl.navy.mil/NCS-TOrigin/Timation.html
[193] The International Trade Administration, *Global Positioning System: Market Projections and Trends in the Newest Global Information Utility*, September 1998, 87.
[194] Michael Geselowitz, Interview with Bradford Parkinson (Washington, DC, November 2, 1999), from the world wide web: www.ieee.org

In April 1973, the DepSecDef established a joint program called the Defense Navigation Satellite System (DNSS) to examine concepts for a military global navigation and positioning system. The Air Force was designated as program manager. In addition, a joint program office (JPO) was established with Colonel Bradford Parkinson as director. In August 1973, Parkinson presented the Air Force's 621B concept to the Defense System Acquisition and Review Council (DSARC), the top DoD decision-making body on research and acquisition matters.[195]

After DSARC rejected the initial proposal because it did not include U.S. Navy and U.S. Army concepts, the JPO made every attempt to gain support from all three services. Instead of testing the satellite concept at an Air Force base, for example, Parkinson chose Yuma Proving Grounds, an Army test facility. The JPO also had to win over the Air Force leadership, who did not fully back the system because they felt that most of the costs for the joint program would come from the Air Force budget.[196] In December 1973, Parkinson and the JPO presented a sufficiently joint program to DSARC and received approval for the start of the program that would become known as NAVSTAR GPS. The approved system consisted of a 24-satellite constellation placed in 12-hour inclined semi-synchronous orbits.[197]

On May 2, 1974, the joint Air Force-Navy program was renamed the NAVSTAR Global Positioning System. In July 1974, the first NAVSTAR-GPS satellite, essentially a refurbished U.S. Navy Timation device, was launched carrying the first atomic clock launched into space. In 1977 a second Navy Timation satellite was launched, validating their GPS system concept.[198]

Between 1978 and 1985, eleven Block 1 satellites were launched into orbit, and one was lost due to a launch failure. In 1982, the Air Force sought to cut 30 percent of the GPS budget from FY 1981-1986 and approved a reduction in the number of satellites in the NAVSTAR constellation from 24 to 18. Six years later, in March 1988, with the first Block II satellites in development, the Secretary of the Air Force

[195] Ibid.
[196] Ibid.
[197] The International Trade Administration, *Global Positioning System: Market Projections and Trends in the Newest Global Information Utility*, September 1998, 87.
[198] Ibid., 88.

announced that the GPS system would be expanded to 21 satellites, plus three operational spares.[199] In January 1989, the first of 28 GPS Block II satellites was launched.

DoD's GPS is currently a joint Army-Navy-Air Force program designed to locate positions on the earth's surface using radio signals and satellites. GPS has been expanded to include non-military users, including civilians and international governments. The GPS JPO is located at Los Angeles Air Force Base. The Air Force is the Executive Agent for system management. Since its establishment, the functions of the GPS JPO have evolved to include not only acquisition, deployment, logistic support, tests and integration, but also foreign military sales, user equipment upgrades, cross-agency coordination, and marketplace exploitation.[200] The GPS space segment is operated and controlled by the 50th Space Wing, Air Force Space Command in Colorado. The U.S. Army and U.S. Navy have been designated deputy program managers, as has the Department of Transportation and NIMA.[201]

The management of U.S. GPS reflects the broad interests of the U.S. military and civilian and international concerns. For example, in 1996, President Clinton established an Interagency GPS Executive Board (IGEB) to manage GPS.[202] A permanent Executive Secretariat was set up in Washington, D.C. to provide staff support to the IGEB principals. The IGEB is chaired by the Departments of Defense and Transportation, with other board members including the Departments of State, Agriculture, Commerce, Interior, as well as the Joint Chiefs of Staff and NASA. DoD is tasked with acquisition, operation, and maintenance of GPS.[203] The Department of Transportation serves as the lead agency for all federal civil GPS matters, and Department of State is charged with developing bilateral and multilateral guidelines on the provision of GPS services.

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[199] Ibid., 90.
[200] From the world wide web: www.fas.org/spp/military/program/nav/uenovpr.htm.
[201] From the world wide web: http://gps.laafb.af.mil/jpo
[202] The Office of Science and Technology Policy, *U.S. Global Positioning System Policy*, Fact Sheet, March 29, 1996.
[203] Ibid.

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