CHAPTER 7

NASA AND THE DEPARTMENT OF DEFENSE: ENDURING THEMES IN THREE KEY AREAS

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As with any large government bureaucracies with imprecisely delineated areas of responsibility and potentially overlapping missions, the quality and productivity of the relationship between the National Aeronautics and Space Administration (NASA) and the Department of Defense (DOD) have waxed and waned over the years. The NASA-DOD relationship has been shaped by a series of fundamental issues and questions that accompanied the opening of the Space Age, as well as by subsequent organizational structures, domestic and international politics, technology, and the personalities of key leaders. It is also helpful to consider these relations in terms of the three government space sectors and the bureaucratic roots and culture of the organizations created or empowered to perform these missions: the civil space sector for science and exploration missions performed by NASA, the intelligence space sector for intelligence collection from space by systems procured and operated by the National Reconnaissance Office (NRO), and the defense space sector for military missions enhanced or enabled by space systems procured and operated primarily by the Air Force.[1]

Although relations between these predominant space organizations have usually been quite harmonious and served the United States well, this analysis focuses more attention on periods of uncertainty or tension among these organizations in order to highlight enduring themes that were, and sometimes remain, at stake. Three key issue areas and time periods are examined: organizing to implement America's vision for space in the 1950s, wrestling with the rationale for human spaceflight in the late 1950s and early 1960s, and finding the logical next steps in space transportation and missions in the 1980s. The state of relations between the three predominant space organizations is also an important factor in shaping current issues such as how best to organize and manage national security space activities or implement the President's Vision for Space Exploration.

1. The fourth space sector, commercial activities for profit, is regulated by but not performed by government. See the comprehensive discussion of the activities included in each sector in *Report of the Commission to Assess National Security Space Management and Organization* (Washington, DC: Commission to Assess National Security Space Management and Organization, 11 January 2001), pp. 10–14.

DEVELOPING, ORGANIZING, AND IMPLEMENTING AMERICA'S SPACE AGE VISION IN THE 1950S

Following a long and difficult path, the United States Air Force was created as a separate service as a part of the National Security Act of 1947. Its raison d'être was strategic bombing, a mission that had enchanted airmen almost from the inception of flight, provided the foundation for the doctrine that guided America's use of airpower during World War II, and was of even greater concern following the advent of nuclear weapons. The Air Force was organized, trained, and equipped to provide a full range of airpower missions, but strategic bombing, the Strategic Air Command, and bomber pilots formed the institutional core of the new service. The development of long-range ballistic missiles and space systems presented difficult cultural challenges for the Air Force. These new systems held the potential to perform or support the Air Force's core strategic bombing mission, and the service was eager to develop and operate them rather than have them come under the control of the Army or Navy. At the same time, however, the new systems clearly threatened the bombers and bomber pilots at the Air Force's institutional core. The Air Force attempted to walk a difficult organizational tightrope through this situation by pursuing missiles and space strongly enough to keep them out of the grasp of the other services, but not so strongly as to undercut the bomber pilots who ran the service. This Air Force balancing act helps to explain much of its behavior at the opening of the Space Age and continues to be a useful illustration of its ongoing struggles to incorporate space most appropriately in its current and future missions.[2]

Space issues were not primary concerns in the wake of World War II, but America quietly struggled with many questions associated with why it should attempt to go to space and what it might do there. By the mid-1950s, a number of groups and individuals had advanced various reasons for going to space,[3]

2. On the evolution of air- and space-power doctrine and their role in Air Force institutional culture see, in particular, Phillip S. Meilinger, ed., *Paths of Heaven: The Evolution of Airpower Theory* (Maxwell Air Force Base [AFB], AL: Air University Press, 1997); Bruce M. DeBlois, ed., *Beyond the Paths of Heaven: The Emergence of Space Power Thought* (Maxwell AFB, AL: Air University Press, 1999); Carl H. Builder, *The Icarus Syndrome: The Role of Air Power Theory in the Evolution and Fate of the U.S. Air Force* (New Brunswick, NJ: Transaction Books, 1994); James M. Smith, *USAF Culture and Cohesion: Building an Air and Space Force for the 21st Century*, Occasional Paper 19 (U.S. Air Force [USAF] Academy: USAF Institute for National Security Studies, June 1998); Mike Worden, *Rise of the Fighter Generals: The Problem of Air Force Leadership, 1945–1982* (Maxwell AFB, AL: Air University Press, 1998).

3. In addition to the space-for-strategic-reconnaissance rationale advocated by RAND, other prominent rationales for space included the scientific imperative that found early expression in the International Geophysical Year (IGY) effort and the exploration imperative perhaps best captured by Wernher von Braun in a series of articles on future space stations published in *Collier's* magazine in the

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but the Eisenhower administration had secretly determined that its primary rationale for going to space was to attempt to open up the closed Soviet state via secret reconnaissance satellites. The RAND Corporation, a think tank sponsored by Army Air Force Commander General Henry H. "Hap" Arnold as a joint project with the Douglas Aircraft Company, was the first to study these issues systematically. RAND's very first report, "Preliminary Design of an Experimental World-Circling Spaceship," was delivered to the Army Air Force in April 1946 and not only detailed the technical design for and the physics involved in launching such a spaceship (the word satellite had not yet come into common usage), but also identified possible military missions for satellites, including communications, attack assessment, navigation, weather reconnaissance, and strategic reconnaissance.[4]

In October 1950, Paul Kecskemeti at RAND produced another comprehensive report on space that Walter A. McDougall believes should "be considered the birth certificate of American space policy."[5] This report highlighted the psychological impact the first satellite would likely have on the public and raised the issue of how the Soviet Union might respond to overflight of their territory and space-based reconnaissance. It even suggested that one way to test the issue of freedom of space would be first to launch an experimental U.S. satellite in an equatorial orbit that would not cross Soviet territory before attempting any satellite reconnaissance overhead the Soviet Union.

The Technological Capabilities Panel and NSC-5520

In March 1954, President Dwight Eisenhower commissioned a secret study and named Dr. James R. Killian, President of the Massachusetts Institute of Technology, as chairman of this Technological Capabilities Panel (TCP). With a thermonuclear standoff looming between the United States and the Soviet Union, Eisenhower wanted the best minds in the country to examine how technology might help to prevent another Pearl Harbor. The TCP report was delivered to the National Security Council (NSC) in February 1955. The report stands out as one of the most important and influential examinations of U.S. national security ever undertaken; it formed the foundation for U.S. national security planning for at least the next two years, made remarkably prescient

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early 1950s. Several of these articles are reprinted in John M. Logsdon, ed., *Exploring the Unknown*, vol. 1, *Organizing for Exploration* (Washington, DC: NASA SP-4407, 1995), pp. 176–200.

4. Merton E. Davies and William R. Harris, *RAND's Role in the Evolution of Balloon and Satellite Observation Systems and Related Space Technology* (Santa Monica: RAND Corporation, 1988), pp. 6–9. Portions of RAND's first report are reprinted in Logsdon, *Exploring the Unknown*, vol. 1, pp. 236–244.

5. Walter A. McDougall, . . . *The Heavens and the Earth: A Political History of the Space Age* (New York: Basic Books, 1985), p. 108.

predictions about the evolution of the superpowers' strategic nuclear arsenals, and called for crash programs to develop early-warning radars and ballistic missiles, as well as to improve the survivability of Strategic Air Command assets in the face of potential nuclear attack.[6]

The TCP also called for a vigorous program to improve U.S. technological intelligence collection capabilities. Killian and Edwin H. "Din" Land, founder of the Polaroid Corporation and chairman of the intelligence subcommittee of the TCP, were briefed on a wide range of potential collection methods and systems, including satellites, but became most enthused about attempting high-altitude reconnaissance overflights of the Soviet Union via a jet-powered glider that was then on the drawing boards at Clarence "Kelly" Johnson's Lockheed skunk works in Burbank, California. They recommended production of this new aircraft during a series of briefings that culminated in an Oval Office meeting on 24 November 1954, attended by the President, Secretaries of State and Defense, as well as top DOD and Central Intelligence Agency (CIA) officials.[7] The initial programs and structure for a national strategic reconnaissance program were discussed at this meeting; the President verbally authorized the CIA to begin development of the CL-282 (U-2) aircraft program with Air Force support.[8]

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6. For the text of the TCP report, see John P. Glennon, ed., *Foreign Relations of the United States, 1955–1957*, vol. 19, *National Security Policy* (Washington: Department of State, 1990), pp. 42–55. James R. Killian, Jr., provides details on the workings of the TCP in *Sputnik, Scientists, and Eisenhower: A Memoir of the First Special Assistant to the President for Science and Technology* (Cambridge: MIT Press, 1977), pp. 67–93. On the relationship between the TCP report and subsequent U.S. nuclear strategy, see Lawrence Freedman, *The Evolution of Nuclear Strategy* (New York: St. Martins Press, 1983), pp. 76–90.

7. Stephen M. Rothstein, *Dead on Arrival? The Development of the Aerospace Concept, 1944–58* (Maxwell AFB, AL: Air University Press, November 2000), p. 43; Clarence E. Smith, "CIA's Analysis of Soviet Science and Technology," in *Watching the Bear: Essays on CIA's Analysis of the Soviet Union*, ed. Gerald K. Haines and Robert E. Leggett (Langley, VA: Center for the Study of Intelligence, 2003); Gregory W. Pedlow and Donald E. Welzenbach, *The CIA and the U-2 Program, 1954–1974* (Langley, VA: Center for the Study of Intelligence, 1998). Land wrote a 5 November 1954 letter to CIA Director Allen W. Dulles outlining "A Unique Opportunity for Comprehensive Intelligence" via a specialized high-altitude aircraft; the letter is available electronically from the National Security Archive at *http://www2.gwu.edu/~nsarchiv/NSAEBB/NSAEBB74/U2-03.pdf*.

8. It is not clear from unclassified sources how much RAND reports or the Air Force's nascent WS-117L reconnaissance satellite system was discussed during these meetings. Satellite reconnaissance was strongly advocated by a series of RAND reports during the early 1950s (particularly the 1954 "Project Feed Back Report"; see Logsdon, *Exploring the Unknown*, vol. 1, pp. 269–274). In late 1953, the Air Research and Development Command (ARDC) had published a management "Satellite Component Study" and designated it Weapons System (WS) 117L. On 1 July 1954, the Western Development Division (WDD) of ARDC was established in Inglewood, CA, under the command of Colonel Bernard Schriever (who had participated in Project Feed Back), primarily to speed development of ballistic missiles. WDD formally initiated a program to develop reconnaissance satellites in Weapons System Requirements Number 5 (WS-117L), "System Requirement for an Advanced Reconnaissance System," secretly issued on 27 November 1954. According to Spires, "Focused on Project Aquatone,

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Following the start of these new technical intelligence collection initiatives, in early 1955 the National Academy of Sciences proposal for DOD to support the launch of a scientific satellite for research during the July 1957–December 1958 International Geophysical Year (IGY) landed on the desk of Donald Quarles, Assistant Secretary of Defense for Research and Development. Quarles used this opportunity to tie together various strands of the administration's embryonic policies on satellites, intelligence collection, and ballistic missiles by drafting a space policy for review by the National Security Council. His draft formed the basis for NSC-5520, the most important space policy of the Eisenhower administration. Portions of this document remain classified almost 50 years after it was written, but the basic themes are quite clear: the Space Age would soon open; the TCP "recommended that intelligence applications warrant an immediate program leading to a very small satellite in orbit around the earth" and a reexamination "of the principles or practices of international law with regard to 'Freedom of Space'"; DOD should provide support for launching the IGY satellite so long as such support would not delay or otherwise impede DOD programs; and all U.S. space efforts should be arranged to emphasize peaceful purposes and freedom of space.[9] NRO historian Cargill Hall succinctly summarized how Eisenhower's space policy was put into practice: "The IGY scientific satellite program was clearly identified as a stalking horse to establish the precedent of overflight in space for the eventual operation of military reconnaissance satellites."[10] The final piece of the policy, satellite, and booster puzzle fell into place when Quarles established an advisory committee to decide

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the U-2 project that promised immediate results, the military satellite program received little interest or support from Killian and his experts. At that time, he considered the Air Force's reconnaissance satellite a 'peripheral project.' This attitude from one so influential helps explain the less than enthusiastic administration support of the Air Force's Advanced Reconnaissance Satellite in the two years preceding *Sputnik*. Despite the growing need for strategic intelligence and awareness that the U-2 represented a temporary solution, Killian declined to actively support the military satellite until after the launch of the first *Sputnik*. He believed an American scientific satellite had to precede the launch of a military vehicle to provide the overflight precedent for military satellites to operate with minimum international criticism" (David N. Spires, *Beyond Horizons: A Half Century of Air Force Space Leadership* [Colorado Springs: Air Force Space Command, 1998], p. 39). See Robert L. Perry, *Origins of the USAF Space Program, 1945–1956* (Los Angeles: Space Systems Division, 1961), p. viii, microfiche document 00313 in *U.S. Military Uses of Space 1945–1991: Index and Guide* (Washington, DC: The National Security Archive, and Alexandria, VA: Chadwyck-Healey, Inc., 1991); Spires, *Beyond Horizons*.

9. NSC-5520 was approved at the NSC meeting on 26 May 1955, and Eisenhower signed it the following day. Quotations are from the declassified portions reprinted in Dwayne A. Day, "Invitation to Struggle: The History of Civil-Military Relations in Space," in *Exploring the Unknown*, ed. John M. Logsdon, vol. 2, *External Relationships* (Washington, DC: NASA SP-4407, 1996), p. 241.

10. R. Cargill Hall, "Origins of U.S. Space Policy: Eisenhower, Open Skies, and Freedom of Space," in *Exploring the Unknown*, ed. Logsdon, vol. 1, p. 222.

which military booster should be used, and it recommended the Navy's Viking (Vanguard) booster rather than the Army or Air Force proposals.[11]

This most important but secret process to legitimize overflight spelled out by NSC-5520 was not at all clear at the time, even to many of the senior participants in the development of early U.S. space and missile programs. Indeed, it remained politically expedient to continue obscuring the origins and operation of space-based intelligence collection, America's first and arguably most important space program, for decades into the Space Age.[12] This subtext is, however, critical to understanding the nature of the relationships between NASA, the NRO, and the Air Force.

Responding to the Sputniks and Creating NASA

The Eisenhower administration carefully planned to use the opening of the Space Age to create a new legal regime that would legitimize the operation of reconnaissance satellites, but, despite repeated warnings, it did not prepare well for the psychological implications of this milestone. The worldwide public reaction to the Soviet successes with Sputniks I and II on 4 October and 3 November 1957 precipitated a crisis in confidence in Eisenhower's leadership that was seized upon by opponents of his New Look defense policies and shaped the remainder of his second term. In an attempt to limit the growing crisis, one of Eisenhower's first responses was to appoint Killian to a new position as science adviser to the President. A second major administration response was the establishment of the Advanced Research Projects Agency (ARPA) within DOD on 7 February 1958. ARPA was authorized to direct or perform virtually all United States space research and development efforts but was viewed by many as a stopgap measure and proved insufficient to derail the mounting pressure to create a comprehensive, independent, and civilian space agency.[13]

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11. The Army Ballistic Missile Agency's Project Orbiter proposal was the most advanced of the proposals presented to the Stewart Committee. On 20 September 1956, a Jupiter-C rose to an altitude of 600 miles while traveling 3,000 miles downrange despite having an inert fourth stage (it was filled with sand) to preclude this vehicle from accidentally launching the first satellite and thereby circumventing the IGY stalking-horse strategy laid out in NSC-5520. See Major General John B. Medaris, U.S. Army (USA) (ret.), *Countdown for Decision* (New York: G. P. Putnam's Sons, 1960), pp. 119–20, 147.

12. The existence of the NRO was first officially acknowledged in September 1992. The importance and uses of United States overhead photoreconnaissance (IMINT), as well as the fact that the United States conducts overhead signals intelligence (SIGINT) and measurement and signature intelligence (MASINT) collection, were first acknowledged in the 19 September 1996 National Space Policy Fact Sheet.

13. Other major responses included authorization for the ABMA to prepare to launch a satellite on the modified V-2 booster known as the Jupiter-C or Juno (this system boosted Explorer I, America's first satellite, into orbit on 31 January 1958), as well as the congressional hearings on satellite and missile programs that were called by Majority Leader Lyndon Johnson and held between 25 November 1957 and 23 January 1958.

Killian was the most important actor in creating NASA as the centerpiece of the organizational structure America developed in response to the Sputniks shock, but he worked very closely with other key actors and organizations such as the President, Senator Lyndon B. Johnson (D-Texas), and the military services. By the end of 1957, the President's Science Advisory Committee (PSAC), under Killian, had decided that a scientifically oriented civil space program, rather than a military program, ought to be the nation's top space priority and that the new civilian space agency ought to be built out of and modeled after the National Advisory Committee for Aeronautics (NACA). This approach was the primary recommendation of the PSAC headed by Edward Purcell; Killian used the Purcell Committee findings to help persuade Eisenhower of the need for a civilian agency and sent proposed legislation to Congress on 2 April 1958.

Both houses held extensive hearings on the civilian space agency proposal during April and May; soon, however, they drifted into positions that differed from one another and from the administration. The most contentious issues revolved around three areas: the relative priority of civil and military space efforts, the appropriate relationship between civilian and military space organizations, and the organizational structure for creating national space policy. Office of the Secretary of Defense (OSD) witnesses included Deputy Secretary Quarles, ARPA Director Roy Johnson, and ARPA Chief Scientist Herbert York. They emphasized that DOD must retain the power to define and control military space programs. Service witnesses generally took the same positions they had over the creation of ARPA. The Navy opposed a strong civilian agency and preferred an organization similar to NACA that would support but not shape military space efforts. The Air Force was confident of its position as the lead service for military space and supported a strong civilian agency as a means to undercut Navy and Army space efforts. By contrast, the Army opposed the creation of a civilian agency or the division of scientific and military space missions; the Army also urged if a civilian space agency were created that it, rather than DOD or the Air Force, should control the national space effort.[14]

Compromises were ironed out following a meeting between Eisenhower and Senator Johnson on 7 July and during Conference Committee meetings later that month. The major compromises included a modified version of the House's Civilian-Military Liaison Committee (CMLC), creation of the National Aeronautics and Space Council (NASC) at the White House, and carefully brokered language in Section 102(b) that was designed to delineate between NASA and DOD space missions. The latter issue was perhaps the most controversial aspect of the entire process. The final language called for NASA to exercise control over all U.S. space activities

14. Enid Curtis Bok Schoettle, "The Establishment of NASA," in *Knowledge and Power: Essays on Science and Government*, ed. Sanford A. Lakoff (New York: Free Press, 1966), pp. 162–270.

> except that activities peculiar to or primarily associated with the development of weapons systems, military operations, or the defense of the U.S. (including Research and Development necessary to make effective provision for the defense of the U.S.) shall be the responsibility of and shall be directed by the DOD.[15]

Eisenhower signed the National Aeronautics and Space Act into law on 29 July, and NASA was created on 1 October 1958.

Frictions over manned spaceflight, budgets, and organizational structure between NACA and ARPA were evident before NASA was established. Both NACA and ARPA strongly desired to control manned spaceflight, and both organizations fought hard for this mission during a series of meetings with the Bureau of the Budget during the summer of 1958. Once again, Killian was an important player behind the scenes; he helped broker a compromise whereby NASA would design and build the capsules for manned spaceflight and DOD would concentrate on the boosters required for this mission.[16] Killian also pushed to reprogram $117 million from ARPA and the Air Force to NASA, helped ARPA retain $108 million for space programs outside of the WS-117L (see note 8), and steadfastly refused to entertain any suggestions to change the organization or reduce the $186-million budget for the WS-117L.[17] Organizational changes were also looming. The Army's Jet Propulsion Laboratory wished to transition immediately to NASA, and the Army was close to granting this request, but it wanted to use the transfer of JPL as a bargaining chip in its efforts to retain its space crown jewel, the von Braun rocket team at ABMA.

Completing the Organizational Structure

Following the creation of NASA, there were three major tracks of activity that shaped NASA-DOD relations during the remainder of Eisenhower's term and into John Kennedy's administration: moving ABMA into NASA, consolidating DOD space activities under the Air Force, and establishing the NRO. Each of these tracks helped establish the basic organizational structures and bureaucratic interests that endure today.

Army Secretary William Brucker and ABMA Commander Major General John Medaris understood very well how hard the Army had worked to capture and maintain the von Braun group as one of the key spoils of World War II and just how important von Braun's expertise would be to any major U.S.

15. Ibid., pp. 260–261.

16. Robert A. Divine, *The Sputnik Challenge* (New York: Oxford University Press, 1993), p. 150. Divine notes that Killian had quickly emerged as Eisenhower's "key post-*Sputnik* advisor."

17. Ibid., pp. 151–152.

space effort—they were not about to give up ABMA without a fight. They had strongly opposed creation of a powerful civilian space agency, and after NASA was established, they redoubled their efforts to retain control of ABMA. NASA had inherited NACA's infrastructure but initially lacked expertise in many space areas such as the development of large boosters. By contrast, ABMA contained arguably the world's best booster development team, but it lacked a specific military rationale for developing large boosters.[18] In October 1958, T. Keith Glennan, NASA's first Administrator, and Deputy Secretary Quarles worked out a deal to resolve this anomalous situation by transferring JPL and ABMA to NASA. Brucker and Medaris successfully blocked transfer of ABMA at this time. But in December, the NASC brokered a second compromise that moved JPL to NASA and left the von Braun team under ABMA while directing that their work on Saturn would be under contract to NASA.

Significant military space organizational restructuring was also under way within DOD. Following creation of NASA and pressure on ABMA, the Navy and the Army, in particular, became increasingly concerned with retaining their military space capabilities, shoring up ARPA, and formulating the proper bureaucratic structure for military space. The Air Force, by contrast, was growing increasingly confident of its inside track for gaining control over military space missions, supported a strong NASA, and continued to oppose ARPA's direction of military space efforts. Another key player that entered the mix at this time was Herbert York, the first Director of Defense Research and Engineering (DDR&E), a position created by the 1958 Defense Reorganization Act.

Debates over DOD's space organizational structure became increasingly heated during 1959 and came to a head in September. In April, Chief of Naval Operations Admiral Arleigh Burke highlighted the indivisibility of space and proposed to the Joint Chiefs of Staff (JCS) creation of a unified (multiservice) command for space. Burke's proposal was supported by the Army but was strongly opposed by the Air Force. Arguing that space systems represented a better way of performing existing missions, the Air Force advocated treating space systems on a functional basis under ARPA or, preferably, under the Air Force. DDR&E York weighed in on this debate and sided strongly with the Air Force, largely because he was eager to consolidate military space efforts under the Air Force as a way to rein in what he considered to be overreaching space proposals on the part of all the services. A memorandum

18. ABMA had been tasked by ARPA to study and design a 1.5-million-pound-thrust booster that came to be known as the Saturn B. The Saturn B was, in turn, a primary driver behind the ABMA Project Horizon proposal to use 149 Saturn launches to build a 12-person lunar outpost by 1966. See John M. Logsdon, *The Decision to Go to the Moon: Project Apollo and the National Interest* (Cambridge: MIT Press, 1970), pp. 51–52.

from Secretary Neil McElroy to JCS Chairman General Nathan Twining on 18 September attempted to resolve these disputes and represented a significant bureaucratic victory for the Air Force. McElroy assigned responsibility for most satellite systems, payload integration, and "the development, production, and launching of space boosters" to the Air Force.[19] The memo also found that "establishment of a joint military organization with control over operational space systems does not appear desirable at this time."[20]

For the remainder of the Eisenhower administration and the beginning of the Kennedy administration, the space prospects of the Army continued to decline while those of the Air Force usually continued to rise. Following the transfer of the Redstone program in December 1958 and the Saturn program in November 1959, between March and July 1960 the Army moved the von Braun team and 6,400 other ABMA personnel under NASA control.[21] Eisenhower presided over the 8 September 1960 ceremony in Huntsville, Alabama, that dedicated the Marshall Space Flight Center and officially moved the Army out of the space business. It took decades for the Army to recover from this loss and regain its enthusiasm towards space, but today the Army is the largest user of military space data among the services, and it is eagerly considering a range of significant future enhancements such as Global Positioning System (GPS) III satellites and Blue Force Tracking.

Despite Air Force support for NASA's creation, NASA's role in absorbing the Air Force's most serious competition for developing military space systems, and generally good early relations between America's two largest space organizations, NASA–Air Force relations hit a snag after an internal letter from Air Force Chief of Staff General Thomas White to his staff was leaked to Congressman Overton Brooks (D-Louisiana), Chairman of the House Committee on Science and Astronautics. The bulk of White's 14 April 1960 letter urged the Air Force "to cooperate to the maximum extent with NASA, to include the furnishing of key personnel even at the expense of some Air Force dilution of technical talent."[22] The opening two sentences of White's letter, however, raised questions about the strength and longevity of Air Force support for NASA independence:

19. Spires, *Beyond Horizons*, p. 77. ARPA returned responsibility for the WS-117L to the Air Force. By this time, the program consisted of three separate developmental satellite systems: Corona, a recoverable film photoreconnaissance system; Samos, an electro-optical system designed to downlink imagery electronically; and Midas, an infrared satellite sensor system designed to detect ballistic missile launches. The Navy acquired the Transit satellite navigation systems, and the Army gained responsibility for Notus communications satellites. This approach overturned ARPA's monopoly on control over military satellite systems.

20. Ibid.

21. Day, "Invitation to Struggle," p. 253.

22. Ibid., p. 256.

President Dwight D. Eisenhower and Mrs. George C. Marshall unveil the bronze bust of General George C. Marshall during the dedication ceremony of the George C. Marshall Space Flight Center (MSFC) in Huntsville, Alabama, on 8 September 1960. On 21 October 1959, President Eisenhower directed the transfer of personnel from the Redstone Arsenal's Army Ballistic Missile Agency Development Operations Division to NASA. The complex of the new NASA Center was formed within the boundaries of Redstone Arsenal in Huntsville. MSFC began its operations on 1 July 1960 after the transfer ceremony, with Dr. Wernher von Braun as Center Director. *(NASA MSFC photo no. 9131490)*

> I am convinced that one of the major long term elements of the Air Force future lies in space. It is also obvious that NASA will play a large part in the national effort in this direction and, moreover, inevitably will be closely associated, if not eventually combined with the military.[23]

In March 1961, Brooks held hearings to discuss White's letter, the proper balance between military and civil space, and the general direction of U.S. space efforts. Brooks sought and even received clarification from President Kennedy. On 23 March, Kennedy wrote a letter to Brooks that emphasized several key points:

23. Ibid.

> It is not now, nor has it ever been, my intention to subordinate the activities in space of the National Aeronautics and Space Administration to those of the Department of Defense. I believe, as you do, that there are legitimate missions in space for which the military services should assume responsibility, but that there are major missions, such as the scientific unmanned and manned exploration of space and the application of space technologies to the conduct of peaceful activities, which should be carried forward by our civilian space agency.[24]

Kennedy's letter helped to delineate space missions between NASA and the Air Force and indicated Kennedy's growing emphasis on civil missions, an emphasis that would grow significantly stronger after Yuri Gagarin's orbital flight some three weeks later.

During the same month as the Brooks hearings, Air Force control over military space programs was solidified when Secretary Robert McNamara issued Defense Directive 5160.32, "Development of Space Systems." This directive built on Secretary McElroy's September 1959 memo and the January 1961 recommendations of incoming science adviser Jerome Wiesner. It gave the Air Force operational control over almost every military space program from research and development through launch and operations and stopped just short of naming the Air Force as DOD's executive agent for space. This was, of course, a welcome development for the Air Force, but McNamara's motivation, like York's before him, was to consolidate and prune rather than to encourage Air Force leadership in developing more robust military space activities.

The creation of NRO was the final major organizational response to the opening of the Space Age and was, like the IGY stalking-horse strategy in NSC-5520, an official state secret hidden from the public and even many of the leaders of U.S. civil and military space efforts. Following Sputnik, in January 1958 the NSC granted highest national priority to development of an operational reconnaissance satellite, but Eisenhower had doubts about Air Force management of the WS-117L program and was particularly troubled by press leaks about the program. Decisions made at meetings on 6–7 February 1958 between the President, Killian, Land, Director of Central Intelligence Allen Dulles, Secretary of Defense Neil McElroy, and Eisenhower's staff secretary, Colonel Andrew Goodpaster, created ARPA and publicly gave this new agency all open military space programs. In secret, these decisions also gave ARPA direction over the highest priority WS-117L and moved control of the Corona recoverable film photoreconnaissance system from the Air

24. Logsdon, *Exploring the Unknown*, vol. 2, p. 317.

Force to the CIA in an organizational structure that initially mirrored that of the U-2.[25]

U.S. efforts to develop operational spysat systems faced very daunting technological challenges during the late 1950s and early 1960s. Corona was the most mature technology, yet between February 1959 and June 1960, it still suffered a string of 12 consecutive failures of various types that prevented recovery of film imagery from space before achieving its first success in August 1960. These problems with Corona, along with even more serious difficulties with Samos and Midas, prompted Eisenhower, in May 1960, to direct his new science adviser, George Kistiakowsky, to put together a committee to recommend changes to improve these programs. Kistiakowsky and Defense Secretary Thomas Gates decided on the structure and charter of what became known as the Samos Panel and selected members including Under Secretary of the Air Force Joseph Charyk, Deputy DDR&E John Rubel, Killian, Land, York, and Purcell. The Samos Panel reported its recommendations at an NSC meeting on 24 August. Eisenhower and the NSC strongly supported the primary recommendation, immediate creation of an organization to provide a direct chain of command from the Secretary of the Air Force to the officers in charge of each spysat project; this decision was the genesis of the NRO.[26] It represented another vote of no confidence in the Air Force to manage spysat programs through military channels, moved this highest priority space mission and its products out of the military chain of command, and completed America's three-legged organizational structure for space.

In addition to the organizational changes discussed above, beginning in 1961 there was a major change in the way information was released about U.S. military space programs that had a significant effect both on contemporary analyses and the historiography of space. A security clampdown was slowly implemented, first on spy satellite programs and then on all military space efforts. The Samos 2 launch on 31 January 1961 was the first to be affected by the Kennedy administration's new publicity guidelines. Assistant Secretary of Defense for Public Affairs Arthur Sylvester and NRO Director Charyk worked out a very terse statement provided to the press following this launch

25. R. Cargill Hall, "Clandestine Victory: Dwight D. Eisenhower and Overhead Reconnaissance in the Cold War" (paper presented at the "Eisenhower and National Security for the 21st Century Symposium," Industrial College of the Armed Forces, Washington, DC, 26–28 January 2005); Day, "Invitation to Struggle," p. 250; Kenneth E. Greer, "Corona," in *Corona: America's First Satellite Program*, ed. Kevin C. Ruffner (Langley, VA: Center for the Study of Intelligence, 1995).

26. George Kistiakowsky, *A Scientist at the White House: The Private Diary of President Eisenhower's Special Assistant for Science and Technology* (Cambridge: Harvard University Press, 1976); Hall, "Clandestine Victory"; Gerald M. Steinberg, *Satellite Reconnaissance: The Role of Informal Bargaining* (New York: Praeger Publishers, 1983); Jeffrey T. Richelson, *America's Secret Eyes in Space: The U.S. Keyhole Spy Satellite Program* (New York: Harper & Row, 1990).

that contrasted significantly with the large prelaunch publicity packages which had been given out previously.[27] The remainder of 1961 saw a gradual tightening of the security classifications with less and less information provided with each successive launch.[28]

The Air Force chafed at these restrictions, and many officers, including General Schriever, continued publicly to press the case for an increased military space program. This ongoing public discussion of military space programs by the Air Force greatly irritated President Kennedy, and on more than one occasion, he called Sylvester directly, demanding to know why he had "let those bastards talk."[29] Following these calls, Sylvester's office greatly intensified the screening process required for all public releases on space. As a result of this widespread clampdown, planned speeches by Air Force general officers were very carefully screened by civilians in Sylvester's office for any references to the Samos program, and the winter–spring 1960–1961 *Air University Quarterly Review* issue devoted to "Aerospace Force in the Sixties" was heavily censored, including the removal of an article entitled "Strategic Reconnaissance" in its entirety.[30]

The final step in this security-intensification process was the classified DOD directive issued on 23 March 1962 known as the "blackout" directive. According to Stares, this directive

> prohibited advance announcement and press coverage of *all* military space launchings at Cape Canaveral and Vandenberg AFB. It also forbade the use of the names of such space projects as Discoverer, MIDAS and SAMOS. Military payloads on space vehicles would no longer be identified, while the programme names would be replaced by numbers.[31]

While this directive may have made it somewhat more difficult for the Soviets to distinguish between different types of U.S. military space programs and launches, it certainly made it much more difficult for the Air Force to sell its preferred space program to the public or Congress and helped to establish and perpetuate a wide divergence between public knowledge and perceptions of the NASA and DOD space programs.

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27. Paul B. Stares, *The Militarization of Space: U.S. Policy, 1945–1984* (Ithaca: Cornell University Press, 1985), p. 64. Sylvester and Charyk were mindful of the volume of information provided in the past and deliberately opted for a slow blackout process in the hopes that this would arouse less attention than an abrupt blackout.

28. Richelson, *Secret Eyes*, p. 53. By the time of the Samos 5 launch on 22 December 1961, DOD officials would no longer confirm that the Samos program even existed.

29. Stares, *Militarization of Space*, p. 64.

30. Steinberg, *Satellite Reconnaissance*, p. 43.

31. Stares, *Militarization of Space*, p. 65, emphasis in original.

WRESTLING WITH THE RATIONALE FOR HUMAN SPACEFLIGHT IN THE EARLY SPACE PROGRAM

With the organizational structure for space completed, the majority of issues concerning the relationships and cooperation between NASA, the Air Force, and the NRO revolved around the rationale for human spaceflight, the organizations empowered to perform these missions, and developing and operating space launch vehicles. These issues were, of course, also instrumental in initially shaping and continuing to mold America's space bureaucratic structure.

Jockeying for Human Spaceflight Missions

The period from the opening of the Space Age until completion of NASA's Apollo Moon race was a time of both cooperation and intense competition between NASA and the Air Force. Both organizations were very interested in and believed they would be directed to develop major human spaceflight programs; their intricate dance fundamentally shaped these programs. The Air Force had emerged as the most powerful military space actor, advanced a variety of rationales for manned military spaceflight, and strongly believed—especially at the beginning of the Kennedy administration—that it would be given approval for a major manned spaceflight program. NASA, meanwhile, drew heavily on Army and Air Force expertise to develop its spaceflight programs and struggled to transition from science to prestige as the most important rationale for its manned spaceflight programs. During the 1960s, the Air Force was repeatedly rebuffed in its attempts to gain a foothold in military manned space missions; following the failure of Dyna-Soar, Blue Gemini, and the Manned Orbiting Laboratory (MOL), the Air Force was sufficiently chastened that it remains highly skeptical of manned military missions.

The Air Force had displayed a significant amount of interest in military manned spaceflight well before Sputnik, but, like almost all other space activities, this interest was energized following the Soviet triumph. The Air Force's earliest support was for the dynamic soaring (Dyna-Soar) concept for skipping off the Earth's atmosphere to extend the range of a spaceplane that might be used for a variety of missions including strategic bombing, reconnaissance, and antisatellite attacks.[32] By 1955, the Bell Aircraft Company had received

32. The idea of an antipodal bomber that would skip off Earth's atmosphere to achieve intercontinental range was developed by an Austrian, Dr. Eugen Sänger, and was considered in 1943 by von Braun and General Walter Dornberger at Peenemünde. Dornberger worked for Bell Aircraft after the war and was a tireless advocate for Dyna-Soar. The idea of flying to and from space held special appeal to the test pilots who derided the capsule approach to manned spaceflight as "Spam in a can." See Tom Wolfe, *The Right Stuff* (New York: Bantam Press, 1980). The definitive work on Dyna-Soar is Roy F. Houchin, *US Hypersonic Research and Development, 1944–1963: The Rise and Fall of Dyna-Soar* (London: Frank Cass, 2005).

over $1 million in Air Force funding and had raised an additional $2.3 million from six other aerospace firms willing to ante up company funds to support the prospect of a major Air Force manned military space mission.[33]

Following Sputnik, Air Force leaders were among the first to adopt a space-race attitude toward manned spaceflight and supported using either spaceplanes or capsules to achieve rapid results. In a 31 January 1958 letter from Deputy Chief of Staff for Research and Development Lieutenant General Donald Putt to the Air Research and Development Command, Putt advocated rapid development of manned spaceflight and indicated it was "vital to the prestige of the nation that such a feat be accomplished at the earliest technically practicable date—if at all possible before the Russians."[34] Recognizing that congressional deliberations on creating a civilian space agency were under way, the Air Force mounted a full court press to gain approval of its Manned Military Space System Development Plan (MISS) before the civilian agency was established.[35] The MISS plan received support from the highest levels of the Air Force and throughout many DOD offices but was shot down, first by ARPA Director Johnson on 25 July and then by the President a few weeks later, when he formally assigned the role of human spaceflight to NASA.[36]

The Rise and Fall of Dyna-Soar

After its failure to advance its MISS plans and Eisenhower's decision to make NASA primarily responsible for manned spaceflight, the Air Force refocused on the Dyna-Soar program, and it became the service's top space priority. The official start of the program came in November 1957, when Air Research and Development Command issued System Development Directive 464.[37] In May 1958, the Air Force and NACA signed a Memorandum of Understanding (MOU) indicating that Dyna-Soar would be a joint Air Force–NACA project managed and funded along the lines of the X-15 effort.[38] The program took more definite shape during 1959 and 1960, when the Air Force laid out a four-step development program that was designed to achieve full operational capability by 1966. The zenith for the program came early in the Kennedy administration, when the plans were finalized for a small, single-

33. McDougall, *Heavens and Earth*, p. 339.

34. "Early AF MIS Activity," microfiche document 00446 in *U.S. Military Uses of Space*.

35. Ibid. The MISS plan had four phases. The first, "Man-In-Space-Soonest," called for the first orbital flight by April 1960, and the last, "Manned Lunar Landing and Return," was to be accomplished by December 1965. The entire program was projected to cost only $1.5 billion.

36. Day, "Invitation to Struggle," p. 252.

37. "Review and Summary of X-20 Military Application Studies," microfiche document 00450 in *U.S. Military Uses of Space*.

38. "Memorandum of Understanding," document II-7 in *Exploring the Unknown*, ed. Logsdon, vol. 2, pp. 284–285.

seat, delta-winged space glider (designated as the X-20 in 1962) that would be launched atop a Titan III and land like an airplane.

Soon, however, the X-20 ran afoul of McNamara's systems analysis approach and his fears of provoking an action-reaction arms race in space. After McNamara refused to accelerate the program, even after receiving an unrequested extra $85.8 million from the House Appropriations Committee for fiscal year (FY) 1962, funding was cut to only $130 million for FY 1963 and 1964, and the first scheduled flight was slipped to 1966.[39] Next, McNamara's systems analysts "showed that a modified Gemini might perform military functions better and more cheaply than the X-20."[40] This finding prompted McNamara to attempt to gain a large role for the Air Force in Project Gemini, a move NASA Administrator James Webb successfully parried by citing the impact of such a restructuring on the nation's highest priority Apollo Program. Instead, on 23 January 1963, Webb and McNamara signed an agreement to allow DOD experiments on Gemini missions. During this time, the Air Force also proposed a plan to procure some of NASA's Gemini spacecraft under a program referred to as Blue Gemini.[41]

The creation of the DOD Gemini Experiments Program and studies on the military usefulness of a space station that would evolve into the Manned Orbiting Laboratory (MOL) program weakened the rationale for the X-20 and placed additional pressures on the troubled program.[42] In October 1963, the

39. McDougall, *Heavens and Earth*, p. 340; Stares, *Militarization of Space*, p. 130.

40. McDougall, *Heavens and Earth*, p. 340.

41. Stares, *Militarization of Space*, p. 79. DOD eliminated the Blue Gemini and Military Orbital Development System (MODS) programs from the Air Force budget in January 1963. The NASA-DOD experiment program was officially titled Program 631A, "DOD Gemini Experiments Program," and called for 18 experiments to be run on Gemini flights between October 1964 and April 1967 for a cost of $16 million. The experiments were programmed for areas such as satellite inspection, reconnaissance, satellite defense, and astronaut extravehicular activity. See Colonel Daniel D. McKee, "The Gemini Program," *Air University Review* 16 (May–June 1965): 6–15; Gerald T. Cantwell, "AF in Space, FY 64," pp. 31–36, microfiche document 00330 in *U.S. Military Uses of Space*.

42. NASA and DOD interactions during 1963 over the issue of future manned space stations greatly affected the X-20 and other Air Force man-in-space plans. In November 1962, the Air Force had completed a study on a limited military space station known as the MODS. Based upon the MODS concept, Webb and McNamara discussed the possibility of a joint station project, and on 27 April 1963, they agreed that neither organization would initiate station development without the approval of the other. McNamara pressed Webb for a commitment to a joint program, but Webb did not want to make any pledge that might sidetrack Apollo. Finally, after intervention by Vice President Johnson and the NASC, NASA and DOD agreed in September that, if possible, stations larger and more sophisticated than Gemini and Apollo would be encompassed in a single project. After DDR&E Harold Brown recommended to McNamara on 14 November that the X-20 be canceled and replaced by studies on what would become the MOL program, Brown next attempted, unsuccessfully, to coordinate a joint NASA-DOD station. NASA, wary that the fairly large and sophisticated station Brown favored might threaten its space turf, suggested that DOD pursue a smaller and less sophisticated space *laboratory* rather than a space station. DOD accepted at least the semantic importance of this distinction in initiating MOL studies for an independent military station. See Cantwell, "AF in Space, FY 64," pp. 16–23, microfiche document 00330 in *U.S. Military Uses of Space*.

PSAC compared the relative military utility of the Gemini, X-20, and MOL programs and judged that the X-20 held the least potential.[43] By this time, according to the editor of *Missiles and Rockets*, the X-20 had been "reviewed, revised, reoriented, restudied, and reorganized to a greater extent than any other Air Force program."[44] On 10 December 1963, Secretary McNamara publicly announced cancellation of the X-20 program and, at the same time, assigned primary responsibility for developing MOL to the Air Force.[45]

The MOL Program and the Demise of Military Spaceflight Dreams

Announced at the same time as the cancellation of the X-20, MOL quickly took the place of the X-20 and became the cornerstone of Air Force efforts to build a significant manned military presence in space. The Air Force put a great deal of energy, effort, and funding into MOL, and this project soon emerged as DOD's only manned military space program. Numerous technical and especially political problems beset the program, and MOL was repeatedly cut back and stretched out in the late 1960s. The Nixon administration officially canceled MOL on 10 June 1969. Having been repeatedly thwarted and left without any military man-in-space programs, for many years the Air Force became more resigned to the sanctuary school of thought on space and came to view plans and doctrines calling for the military to help control space or to exploit the high-ground potential of space as increasingly irrelevant.

The roots of the MOL program can be traced back at least to the "Global Surveillance System" proposed by Air Force Systems Command in November 1960.[46] As described above, the more direct inspiration for the MOL came from the MODS space station first proposed by the Air Force in June 1962, the 1963 DOD-NASA deliberations over the possibility of building a joint space station, and the cancellation of the X-20. In his Posture Statement for FY 1965, Secretary McNamara generally remained unconvinced of a specific need for military spaceflight but indicated that the time had come for U.S. military man-in-space efforts to "be more sharply focused on those areas which hold the greatest promise of military utility."[47] Accordingly, he had canceled the X-20, expanded the small-scale testing of the Mach 5-25 flight regime through the unmanned ASSET vehicle, initiated the DOD Gemini Experiments Program, and proposed MOL as a "much more important step" for investigating the possible military utility of man-in-space.[48]

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43. McDougall, *Heavens and Earth*, p. 340.

44. Ibid., p. 341.

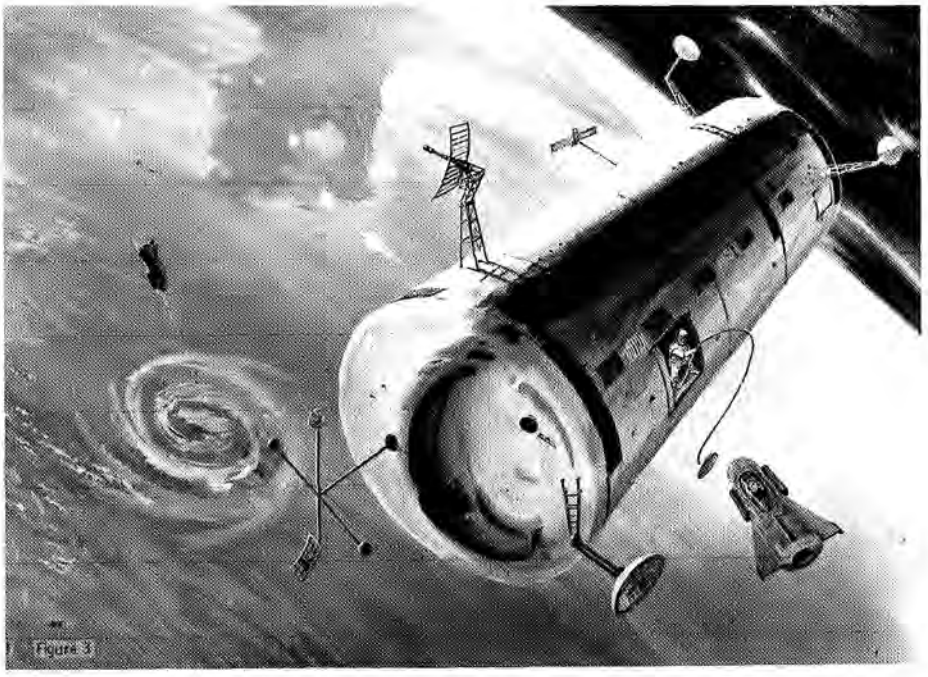
45. Between 1957 and 1963, the X-20 program consumed $400 million, or almost the same amount spent on Project Mercury.

46. Richelson, *Secret Eyes in Space*, p. 83.

47. House Committee on Armed Services, *Fiscal Years 1965–1969 Defense Program and Fiscal Year 1965 Defense Budget*, Hearing before the Committee on Armed Services, 88th Cong., 1st sess., 1964, p. 104.

48. Ibid., pp. 104–106, quotation from page 106.

During 1964 and the first half of 1965, the MOL program was subjected to intense scrutiny by OSD and underwent several design and program application changes. By mid-1965, specific missions and station designs were firmed up. Most importantly, MOL applications added in 1965 were designed to turn MOL into a formidable reconnaissance platform with a large 90-inch telescope and huge signals intelligence (SIGINT) antennas to be assembled on orbit alongside the station.[49] At a press conference on 25 August 1965, President Johnson formally



A 1960 concept image of the United States Air Force's proposed Manned Orbiting Laboratory (MOL), intended to test the military usefulness of having humans in orbit. The station's baseline configuration was that of a two-person Gemini B spacecraft that could be attached to a laboratory vehicle. The structure was planned to launch on a Titan IIIC rocket. The station would be used for a month, and the astronauts could return to the Gemini capsule for transport back to Earth. The first launch of the MOL was scheduled for 15 December 1969, but the program was canceled by Defense Secretary Melvin R. Laird in 1969. *(NASA HQ image no. 2B24070-Fig3)*

49. Stares, *Militarization of Space*, p. 98; Richelson, *Secret Eyes*, p. 85. Richelson indicates that the MOL telescope camera system would have had a resolution of approximately 9 inches and was designated as the KH-10. A depiction of construction of a 100-foot-diameter SIGINT antenna as a proposed MOL experiment is found in J. S. Butz, Jr., "MOL: The Technical Promise and Prospects," *Air Force/Space Digest* (October 1965): 44–45.

approved the development of MOL. The MOL design at this time called for a configuration approximately 54 feet long and 10 feet in diameter consisting of a Gemini B capsule attached to the 41-foot-long laboratory. The station was to be launched into polar orbit from Vandenberg AFB atop a Titan III-C booster.[50] The entire program was originally scheduled to include five manned flights of MOL beginning in 1968 at a cost of $1.5 billion.[51] The overall objectives of the program as approved in August 1965 were to

> a) learn more about what man is able to do in space and how that ability can be used for military purposes,
>
> b) develop technology and equipment which will help advance manned and unmanned space flight, and
>
> c) experiment with this technology and equipment.[52]

The Air Force directed the MOL program, and the Navy was a minor partner in the effort.[53] The initial Air Force support for this program was unmistakable. In congressional testimony in early 1965, Deputy Chief of Staff for R&D Lieutenant General James Ferguson indicated that "MOL would provide the space testing and evaluation facility which we have long sought. We consider it to be the keystone of our future space program."[54] Earlier, Ferguson had simply identified the MOL as the Air Force's "most important space program."[55] More generally, Ferguson highlighted the need for MOL due to the Air Force belief "that man is the key to the future in space, and

50. Richelson, *Secret Eyes*, p. 85; Executive Office of the President, National Aeronautics and Space Council, *Report to Congress on Aeronautics and Space Activities, 1965* (Washington: GPO, 31 January 1966), pp. 49–50. MOL astronauts would transfer into the shirtsleeve environment of the laboratory via a hatch through the heatshield of the Gemini B capsule. MOL was designed for 30-day missions. At the completion of the mission, the astronauts would transfer back into the capsule and reenter; the station itself would eventually also reenter and burn up. The Titan III-C had originally been developed to launch the canceled X-20.

51. Executive Office of the President, *Aeronautics and Space Activities, 1965*, p. 50.

52. Ibid., p. 49. These three objectives in *Aeronautics and Space Activities, 1965* were considerably less detailed and ambitious than the six MOL objectives that Secretary McNamara and DDR&E Harold Brown had outlined in congressional testimony in early 1965. See, for example, the statement of Brown in U.S. Congress, Senate Committee on Armed Services and Subcommittee on Department of Defense of the Committee on Appropriations, *Military Procurement Authorizations, Fiscal Year 1966*, Hearings before the Committee on Armed Services and the Subcommittee on Department of Defense of the Committee on Appropriations, 89th Cong., 1st sess., 1965, pp. 413–414.

53. Richelson, *Secret Eyes*, pp. 91–92. The original MOL schedule called for Navy MOL astronauts to conduct extensive ocean surveillance and submarine tracking experiments during the fourth mission.

54. U.S. Congress, House Committee on Armed Services, *Hearings on Military Posture, Fiscal Year 1966*, Hearings before the Committee on Armed Services, 89th Cong., 1st sess., 1965, p. 1229.

55. Ibid., p. 1219.

that certain military tasks and systems will become feasible only through the discriminatory intelligence of man."[56]

Soon, however, MOL ran into substantial technical and very difficult political problems. An unmanned Gemini B capsule was successfully tested and recovered from space on 3 November 1966, but design changes and technical difficulties with the laboratory portion of MOL caused delays and weight increases in this portion of the hardware. Due to the greater weight of the laboratory, the booster configuration for MOL was redesigned for more thrust and designated as the Titan III-M.[57] More significantly, the political support for MOL began to erode from all quarters. The Johnson administration was attempting to deal with the effect of the buildup of the war in Vietnam on its Great Society programs and had little time or inclination to focus on MOL. The program also suffered from a lack of strong support within Congress, where space attention was focused on the growing Apollo costs and the upcoming Moon landing. Even within the Air Force, MOL began to face serious questioning as the war in Vietnam heated up and resources were required for this conflict and for more traditional development programs such as the C-5A transport aircraft. With declining political support, funding for MOL began to be cut well below the levels required to keep the program on its original schedule. By early 1969, the first manned MOL mission had been slipped to 1972, while the total projected cost of the program had risen from $1.5 billion to $3 billion.[58] Despite these difficulties, in February 1969 incoming Secretary of Defense Melvin Laird endorsed a comprehensive review of the program that "concluded that the continuance of the program is fully justified by the benefits to our defense posture anticipated from MOL; and that all MOL objectives established by the President in 1965 can now be met with a six- rather than a seven-launch program."[59] Additionally, the Nixon administration initially requested $525 million for MOL in FY 1970.[60]

The Nixon administration quickly and completely reversed its initial support for MOL. President Nixon was eager to limit the budget, and MOL soon emerged as "an ideal target for OMB."[61] The actual decision to terminate MOL was apparently made at a White House meeting of OMB representative Robert Mayo, National Security Advisor Henry Kissinger, and President Nixon.[62] As

56. Ibid., p. 1228.

57. Richelson, *Secret Eyes*, p. 90.

58. Ibid., pp. 101–102.

59. Quoted from prepared statement of Air Force Chief of Staff General John McConnell in U.S. Congress, Senate Committee on Armed Services, *Authorization for Military Procurement, Research and Development, Fiscal Year 1970*, Hearings before the Committee on Armed Services, 91st Cong., 1st sess., 1969, p. 956. This cutback meant that MOL would now include only four manned missions rather than the five originally planned.

60. Ibid., p. 957.

61. Quoted from an unnamed "senior Air Force officer" in Stares, *Militarization of Space*, p. 159.

62. Richelson, *Secret Eyes*, p. 102.

they made clear in subsequent congressional testimony, Secretary Laird and the JCS were not consulted prior to this decision.[63] The public announcement of the cancellation of the MOL program came on 10 June 1969. A total of $1.4 billion was spent on the MOL program, making it one of the most expensive military programs ever prematurely terminated as of that date.[64]

The cancellation of MOL must also be viewed within a broader context than just the budgetary concerns of the Nixon administration. Shortly after entering office, Nixon had established a Space Task Group (STG) comprised of Vice President Spiro Agnew, Acting NASA Administrator Thomas Paine, Secretary Laird, and science adviser Lee DuBridge.[65] Nixon tasked the STG to complete a comprehensive review of the future plans of the U.S. space program. The STG national-level review was supported by reports from working groups at the departmental level. The DOD working groups in support of the STG studied future military space plans and budgets and again raised the issue of the military utility of MOL in an era of constrained budgets. More specifically, a report for the STG prepared by Walter Morrow of MIT's Lincoln Laboratory "declared that no significant increase in space spending was necessary to meet DOD requirements and that an annual military space investment of about $2 billion would suffice through the 1970s."[66] In competition for scarce space program funds, MOL did not necessarily do well even in DOD-sponsored analyses.

The most significant factor in the demise of the program, however, was the growing belief that unmanned spy satellites could perform the primary mission of MOL as well as or better than MOL and at a lower cost. According to Richelson, the NRO and CIA had been leery of the idea of a manned reconnaissance system from the outset. They reasoned that a manned system might present more of a provocation to the Soviets, that the contributions of manned operators in space would not be all that significant when balanced against the costs and requirements of life-support systems, and that any accident involving MOL astronauts might set back the whole space-based intelligence-gathering process unacceptably.[67] Moreover, beginning in 1965, NRO had begun development of the United

63. Ibid.

64. Ibid.

65. Air Force Secretary Robert Seamans represented Secretary Laird at STG meetings. Seamans had previously been NASA's Associate Administrator.

66. Jacob Neufeld, "The Air Force in Space. 1969–1970," Secret History, Office of Air Force History, July 1972, p. 4, microfiche document 00338 in *Military Uses of Space*. The overall military input to the STG, "DOD Programs, Options, Recommendations," was largely shaped by the Air Force and outlined four primary military space objectives: "(1) information gathering; (2) deterrence; (3) limiting enemy damage to the nation; and (4) support of Allied forces." This report also grouped possible future space efforts into three categories: 1) improvements on existing and planned mainstream space systems, primarily for force enhancement; 2) systems responsive to "significant technological or engineering advances, changes in national policy, or the emergence of new threats" such as a deep space command post; and 3) "undefined" systems such as Earth illumination systems or weather-modification systems (ibid., pp. 2–4).

67. Richelson, *Secret Eyes*, p. 103.

States' fourth-generation photoreconnaissance satellite known as the KH-9 or "Big Bird"—a system originally planned to serve as a backup to MOL.[68] In the late 1960s, with MOL already in jeopardy, the NRO now argued that the projected capabilities of the KH-9 system would make the MOL unnecessary. It is not possible in open sources to trace the exact impact of this argument on the decision to cancel MOL, but it may have been the clincher, given the development paths of both programs and subsequent events. The first KH-9 was launched from Vandenberg AFB atop a Titan III-D on 15 June 1971.[69]

The saga of the demise of the MOL program served as another painful lesson to the Air Force and the military that their preferred military space doctrines and programs would not come to fruition. The loss of MOL hit the Air Force very hard because 1) it was the Air Force's only attempt to establish a major manned military space program during this period, 2) the Air Force had planned to use MOL as the basis to build a larger manned military space presence, and 3) the program had been specifically tailored primarily to support the space-as-sanctuary school but had still been rejected. After the Air Force's plan to use men in space to support the nation's highest priority military space mission was not approved, it was very unlikely that any other military man-in-space program would be approved. For a number of years after the cancellation of the MOL, the Air Force largely lost interest in high-ground and space-control doctrines and basically considered the development of a significant manned military space presence a lost cause. Stares summarizes the organizational impact of the loss of the X-20 and the MOL programs upon the Air Force during this period very well:

> With the cancellation of the Dynasoar and MOL, many believed in the Air Force that they had made their "pitch" and failed. This in turn reduced the incentives to try again and reinforced the bias towards the traditional mission of the Air Force, namely flying. As a result, the Air Force's space activities remained a poor relation to tactical and strategic airpower in its organizational hierarchy and inevitably in its funding priorities. This undoubtedly influenced the Air Force's negative attitude towards the various ASAT modernization proposals put forward by Air Defense Command and others in the early 1970s. The provision of satellite survivability measures also suffered because the Air Force was reluctant to propose initiatives that would require the use of its own budget to defend the space assets of other services and agencies.[70]

68. Ibid., p. 105; Stares, *Militarization of Space*, p. 160; William E. Burrows, *Deep Black: Space Espionage and National Security* (New York: Berkley Books, 1986), pp. 228–229.

69. "Launch Listing," in *U.S. Military Uses of Space*, p. 100. The Titan III-D launch vehicle for the KH-9 was very similar to the Titan III-M designed to launch the MOL.

70. Stares, *Militarization of Space*, p. 242.

DOD AND THE DEVELOPMENT OF THE SPACE SHUTTLE

Interactions between NASA, the NRO, and the Air Force were among the most important inputs in structuring the development and operation of the Space Transportation System (STS) or Shuttle program. STS interactions deserve special attention because they were the most focused, longest running, and most intense interplay among these organizations and became the single most important factor in shaping their interrelationships. NASA's decision to pursue a large shuttle vehicle program to serve as the national launch vehicle was the Agency's primary post-Apollo space program goal. This decision necessitated that the Shuttle design be able to accommodate the most important potential users and satisfy the military in particular. Accordingly, DOD was instrumental in setting Shuttle payload and performance criteria. Even more importantly, when the STS ran into great political and budgetary problems during the Carter administration, DOD stepped in to help save the program—largely due to the Shuttle's projected capability to launch huge spy satellites. Thus, the rationale behind the STS development became increasingly militarized and related to spy satellites. Additionally, STS operations up to the *Challenger* disaster allowed the military to again entertain plans to develop a manned military presence in space.

The question of what the U.S. should focus on in space following its triumph in the Moon race was the overriding issue for U.S. space policy in the late 1960s and early 1970s. President Nixon created the Space Task Group (STG) in February 1969 to examine this issue. On 15 September, the STG presented Nixon with three options for post-Apollo U.S. civil space plans. Option one called for a manned mission to Mars by 1985 supported by a 50-man space station in orbit around Earth, a smaller space station in orbit around the Moon, a lunar base, a space shuttle to service the Earth space station, and a space tug to service the lunar stations. Option two consisted of all of the above except for the lunar projects and delayed the Mars landing until 1986. Option three included only the space station and the space shuttle, deferring the decision on a Mars mission but keeping it as a goal to be realized before the end of the century.[71] The report estimated that option one would cost approximately $10 billion annually, option two would run about $8 billion per year, and option three would be $5 billion annually.[72] Considering that NASA's budget had peaked at the height of the Moon race in 1965 at a little more than $5 billion and that political support for space spectaculars was rapidly eroding, the STG recommendations seemed fiscally irresponsible and politically naive.[73]

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71. Colonel Cass Schichtle, USAF, *The National Space Program From the Fifties to the Eighties* (Washington: National Defense University Press, 1983), pp. 72–73; McDougall, *Heavens and Earth*, p. 421.

72. McDougall, *Heavens and Earth*, p. 421.

73. Schichtle, *National Space Program*, p. 69.

Meanwhile, the Air Force and NASA had begun coordinating with one another concerning the need for, design criteria, and performance capabilities of a shuttle vehicle. In March 1969, STG Chairman Agnew had directed that a joint DOD-NASA study on a shuttle system be completed to support the overall STG effort.[74] During the spring of 1969, Air Force Chief of Staff General John McConnell was very impressed with the military potential of a shuttle vehicle and even "proposed the Air Force assume responsibility for STS development."[75] Air Force Secretary Robert Seamans was also impressed with the potential of a shuttle but "he vetoed the proposal that the Air Force take charge of STS development, preferring to await additional study results."[76] In June, DOD and NASA submitted to the STG their coordinated report that strongly backed development of a shuttle.[77] By contrast, the Morrow report, which was also prepared for the STG, questioned the technical feasibility of a shuttle and specifically refuted the projected STS launch rates and cost estimates. The Morrow report recommended "the DOD postpone its participation in the system's development pending technical and economic analysis."[78]

DOD and the Air Force acknowledged some of the potential STS difficulties raised by the Morrow report but remained supportive of shuttle development. The military specifications for the shuttle at this time included a 50,000-pound payload capability for launches into a 100-nautical-mile (NM) due-east orbit, a payload compartment measuring 15 by 60 feet, and a cross-range maneuvering capability of 1,500 NM.[79] Some NASA shuttle designs did not meet all of these criteria, but NASA quickly recognized the political necessity for strong Air Force support in attempting to sell the shuttle within the administration and agreed specifically to include the Air Force in future STS design and policy decision-making.

74. Neufeld, "Air Force in Space. 1969–1970," p. 5, microfiche document 00338 in *U.S. Military Uses of Space.*

75. Ibid., p. 6.

76. Ibid.

77. Ibid., pp. 6–7. Specifically, "the report concluded that STS development (1) would require no significant 'breakthrough' in technology, (2) could achieve 'a major reduction in the recurring costs of space operations,' and (3) could meet the requirements of both agencies without 'major technical penalty, development risk, limitation on mission flexibility, or cost increase.'" Neufeld's interior quotations are from the report itself. The report recommended a $52-million allocation in FY 1970 for design studies. Moreover, the report also found that the STS could be operational by 1976 for $4–6 billion; projected a launch rate of 30 to 70 flights per year; and estimated that with 100 uses, the STS would lower launch costs per pound into low-Earth orbit to $50–100 and into geostationary transfer orbit to $500.

78. Ibid., p. 7. The Morrow report is also discussed in relation to the MOL in the MOL section above.

79. Ibid., p. 8. The Air Force's weight and volume requirements for the STS seemed to be driven by projected spysat designs, whereas the cross-range maneuverability requirement was apparently a general military requirement relating to safety, survivability, and flexibility considerations. Some critics within NASA and other analysts have charged that these requirements (especially the cross-range criteria) were arbitrarily set too high, caused very significant design changes, and later contributed to STS program delays. See, for example, the positions raised in John M. Logsdon, "The Decision to Develop the Space Shuttle," *Space Policy* 2 (May 1986): 103–119.

To formalize this arrangement, on 17 February 1970 the Air Force signed an agreement with NASA that established the joint USAF/NASA STS Committee.[80]

On the basis of the STG report and the recommendations from other space studies during this period, President Nixon moved to formalize U.S. post-Apollo space policy goals in March 1970.[81] Nixon only endorsed the development of a shuttle and left a space station or a Mars mission contingent upon the successful completion of a shuttle program. Of course, this was far less than NASA had hoped for, and the agency that had conquered the Moon was initially less than enthused about the prospect of building a nonglamorous space truck as its primary post-Apollo mission.[82] Soon, however, NASA came to realize that a space shuttle was the only major program that stood a chance of being approved at this time and the only possible way to preserve at least a part of NASA's integrity in the face of radical cuts in civil space programs and budgets.[83]

Faced with this situation, NASA continued its attempts to design a space shuttle during 1970 and 1971. In late 1970 and early 1971, acting Administrator George M. Low continued Paine's emphasis on the shuttle as a national vehicle by moving NASA from concept towards design of a larger and more capable shuttle. Thus, by 1971, NASA was hard at work on what has been described as a "Cadillac" shuttle system—very large, very capable, and completely reusable, but very expensive to develop.[84] These very capable designs proved to be too expensive, especially after the Office of Management and Budget (OMB) reiterated that NASA could expect no more than $6.5 billion to develop the shuttle.[85] Meanwhile, the Air

80. Neufeld, "Air Force in Space. 1969–1970," p. 9. Creation of this committee did not solve all of the Air Force–NASA differences over STS design issues. Powerful elements within NASA, such as Associate Administrator for Manned Spaceflight Dr. George E. Mueller, continued to press for a smaller STS design that would not meet all of the Air Force's criteria.

81. Two of the most important other studies on U.S. post-Apollo space goals that were also completed during this period but not mentioned above were 1) the overall NASA input into the STG, known as the Mueller report after its chairman, George Mueller, and 2) the PSAC report, headed by Lewis Branscomb. The Mueller report stressed a building-block approach for the next major civil space programs and emphasized the general utility of a space shuttle for all other projects. The Branscomb report urged that the U.S. place more emphasis on unmanned versus manned exploration and recommended robotic exploration of Mars. On these two reports and their impact, see Hans Mark, *The Space Station: A Personal Journey* (Durham, NC: Duke University Press, 1987), pp. 31–34.

82. NASA Administrator Thomas Paine resigned in September 1970 over this issue and over his general perceptions of a lack of support for NASA within the Nixon administration. See Joseph J. Trento, *Prescription for Disaster* (New York: Crown Publishers, 1987), pp. 84–99.

83. NASA's budget (in constant dollars) fell to only 36 percent of its 1965 peak by the time of its nadir in 1975. The speed of these reductions meant that NASA's budget often was reduced by more than $500 million, or more than 10 percent, in constant dollars each year. Moreover, the number of jobs in the civil space sector dropped from a peak of 420,000 in 1966 to only 190,000 by 1970 and continued down from that point. See Schichtle, *National Space Program*, p. 73; "NASA Budget History," *Aviation Week & Space Technology* (16 March 1992): 123.

84. Alex Roland, "Priorities in Space for the USA," *Space Policy* 3 (May 1987): 106. Roland is a former NASA historian.

85. Logsdon, "Decision to Develop the Space Shuttle," p. 107.

Force remained adamant on its payload and performance criteria and apparently even raised its maximum payload weight requirement to 65,000 pounds.[86] During the remainder of 1971, NASA came up with a revised shuttle design known as the Thrust-Assisted Orbiter Shuttle (TAOS) that seemed to meet these demanding development cost ceilings and performance criteria better.[87] After very intense scrutiny from the OMB during the fall of 1971, the TAOS design went forward to President Nixon for final approval.[88] Nixon privately decided to approve the full-scale TAOS at the Western White House at San Clemente over the 1971–72 New Year's weekend.[89] James Fletcher, the new NASA Administrator, went to the Western White House to brief the President and to be present when the decision to approve the STS was publicly announced on 5 January.

Other than setting the payload and performance design criteria discussed above, the Air Force was not very involved, financially or otherwise, in the STS program during most of its development period. In 1971, the Air Force agreed that it would not compete against the STS and would forgo the development of any new expendable launch vehicles (ELVs).[90] In April 1972, the Kennedy Space Center (KSC) and Vandenberg AFB were selected as Shuttle launch and landing sites, and the Air Force agreed to reconfigure the planned MOL launch complex at Vandenberg, known as space launch complex (SLC)-6, for STS launches into polar orbit.[91] Interestingly, former NASA Administrator Fletcher claimed in a later interview that the Air Force had verbally committed to him during STS development that they would buy the planned fifth and sixth orbiters.[92]

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86. Ibid., pp. 108–110. Here, Logsdon discusses the Air Force's payload and performance criteria. He indicates that the most important Air Force weight requirement was for the capability to launch 40,000 pounds into polar orbit and that the 15-foot dimension of the cargo bay was a NASA requirement for possible future station construction rather than an Air Force criterion.

87. The TAOS design moved away from the original designs, which called for a vertically stacked booster-orbiter configuration staging in sequence, as in all previous spacecraft designs, to a horizontally stacked booster-orbiter design where the booster and orbiter engines could be used at the same time. This design also moved the large main fuel tank outside the booster and made this section expendable rather than reusable. The TAOS design lowered the overall size and weight of the vehicle by allowing the Space Shuttle Main Engines (SSMEs) to contribute to takeoff thrust, but it also greatly increased the technological challenges for designing the SSMEs and introduced the problem of asymmetrical thrust on takeoff. This and other design decisions at this time lowered the development costs for the STS but would also contribute significantly to the much higher than desired STS operations costs.

88. Logsdon describes the NASA-OMB exchanges in detail in "Decision to Develop the Space Shuttle," pp. 112–116.

89. Ibid., p. 118.

90. Ibid., p. 110.

91. Major General R. C. Henry and Major Aubrey B. Sloan, "The Space Shuttle and Vandenberg Air Force Base," *Air University Review* 27 (September–October 1976): 19–26. The Aeronautics and Astronautics Coordinating Board formally approved SLC-6 reconfiguration for STS launches in January 1975.

92. Trento, *Prescription for Disaster*, p. 128. I was unable to find any hard evidence of such a commitment. In the wake of the *Challenger* disaster, many varied theories were advanced to determine culpability for the woes of the STS program.

Throughout the remainder of the 1970s, the STS faced difficult technical and political challenges. Three major technical challenges were the most difficult: developing the computer software and interfaces for the orbiter's computer-controlled flight system, designing and especially attaching the ceramic tiles for the orbiter's heat-protection system, and designing and testing the Space Shuttle Main Engines (SSMEs). Politically, the STS faced even more difficult challenges at the outset of the Carter administration. Several powerful individuals and organizations such as Vice President Walter Mondale, the OMB, and the Office of Science and Technology Policy (OSTP) favored drastically cutting back the STS if not canceling the program outright.[93] In the summer of 1977, as the test vehicle *Enterprise* was about to begin STS approach and landing tests at Edwards AFB, President Carter asked newly appointed NASA Administrator Robert Frosch to evaluate comprehensively whether to continue with the STS program.[94] Thus, the stage was set for the most difficult challenge the STS would face during its development process.

At this point, DOD stepped in strongly to defend the STS as a program critical to national security and to play an important role in preserving this program. In July 1977, Dr. Hans Mark, who had been Director of NASA's Ames Research Center, became Under Secretary of the Air Force (and NRO Director). As an avid manned spaceflight enthusiast who believed the STS was an essential step towards a future manned space station and future exploration, Mark was instrumental in lining up DOD support for the STS in its time of peril. During November and December of 1977, OMB called a series of meetings on the future of the STS.[95] The OMB had urged that the STS program be converted into a three-orbiter test project and that only the KSC launch site be built.[96]

According to Mark, Secretary of Defense Harold Brown was persuasive in making the DOD's need for the STS clear at these meetings:

> [Brown] made the case that at least two launch sites (one on the east coast and the other on the west coast) would be required and that at least four Orbiters would be necessary to meet the requirements of national security. This last argument was based on the fact that the first two Orbiters to be built (OV-102, *Columbia*,

93. Mondale had helped to make a name for himself in the Senate both with his attacks on the "bloated" NASA budgets of the late 1960s and as a leader of congressional opposition to building the STS. In 1973, President Nixon had abolished the NASC and moved the science adviser's office out of the Executive Office of the President (EOP). In 1976, President Gerald Ford created OSTP within EOP. Carter's OSTP Director, Dr. Frank Press, saw government funding for all scientific efforts as a zero-sum game and was eager to address the deficiencies he perceived in basic scientific research funding by reducing quasi-scientific efforts such as manned spaceflight.

94. Trento, *Prescription for Disaster*, p. 149.

95. Mark, *Space Station*, pp. 71–73.

96. Ibid., p. 72.

> and OV-099, *Challenger*) would be somewhat heavier than the following vehicles and would therefore not be capable of carrying the very heaviest national security related payloads. It was therefore necessary to have at least two Orbiters capable of carrying the very heaviest payloads in order to have a backup in case one of these vehicles was lost. This argument carried the day and the decision was reached to build four Orbiters (OV-103, *Discovery*, and OV-104, *Atlantis*, in addition to the first two) and to continue with construction of the west coast launch site. (The west coast launch site was deemed necessary in order to conduct polar orbiting flights required for national security related missions.)[97]

Although Mark does not highlight another aspect of saving the STS, sometime during this period, perhaps at these OMB meetings, the decision was also taken to make the STS virtually the only launch vehicle for both NASA and DOD.

The outcome of these meetings marked a definite shift in the rationale for the STS program that again illustrates the overriding impact of spysats on all other types of space policy. NASA was publicly selling the STS program as a way to meet U.S. civil space policy goals and on cost-effectiveness grounds, but the rationale that saved it during the Carter administration was its ability to launch huge spy satellites. Moreover, with the pending debate over the ratification of the SALT II Treaty, spy satellites as national technical means of verification took on added significance. On 1 October 1978, President Carter marked the first official break with the blackout policy on spysats promulgated in 1962. In a speech at the KSC, Carter noted that "photoreconnaissance satellites have become an important stabilizing factor in world affairs in the monitoring of arms control agreements. They make an immediate contribution to the security of all nations. We shall continue to develop them."[98] Meanwhile, however, the NRO was ambivalent about the prospects of using the STS as its sole launch vehicle: on

97. Ibid.

98. Cited in Stares, *Militarization of Space*, p. 186. According to Richelson, *Secret Eyes*, pp. 140–143, various agencies within the administration debated during early September how far to go in declassifying spysats. The primary motivation behind the desire to loosen the security restrictions on spysats was publicly to provide administration officials with better evidence of U.S. ability to verify SALT II adequately. Those arguing for greater declassification included Secretary of State Cyrus Vance, Arms Control and Disarmament Agency Director Paul Warnke, Director of Central Intelligence Stansfield Turner, National Security Agency Director Bobby Inman, and NRO Director Mark. Secretary Brown, backed by the JCS and the Defense Intelligence Agency, strongly opposed widespread declassification. The most powerful argument raised by DOD (which apparently won the day) was that the release of one spysat photo would lead to a deluge of Freedom of Information Act (FOIA) requests and thereby tie up the manpower of the intelligence agencies in nonproductive activities. On 13 September, the Policy Review Committee (Space) voted for declassification, but only of the fact that the United States conducted photoreconnaissance from space—a "truly minimalist decision," in Richelson's opinion.

the one hand, it was already planning the large spysats that would take advantage of STS capabilities; but on the other hand, it did not want to lose control over its launch vehicles, feared the possible disruption of spysat launchings due to accidents with astronauts, and also chafed at the prospect of the increased media attention that NASA involvement would bring.

General Air Force attitudes towards STS were also ambivalent during this period. While STS was strongly supported by elements within the Space and Missiles Systems Organization and by Mark (who became Secretary of the Air Force in July 1979), other elements such as the Secretary of the Air Force Special Projects Office were less enthusiastic. Mark attempted to push STS and a general space emphasis on the Air Force.[99] These efforts, along with the military potential of the STS, certainly were important in helping to revive Air Force interest in space and in possible military man-in-space applications. At the same time, however, the Air Force was very much a junior partner on STS in terms of funding and effort. Moreover, the Air Force dragged its feet on refurbishing SLC-6 at Vandenberg for STS operations and in developing the Inertial Upper Stage (IUS) to be used for boosting payloads into higher energy orbits than possible with the STS.[100] In sum, then, although the STS program did reignite some Air Force interest in more ambitious space missions, the level of Air Force support for this program by the end of its development did not approach the level of enthusiasm the Air Force had displayed for the X-20 or MOL, and this ambivalent support undoubtedly reflected the fact that the Air Force did not control STS.

The Military, Space Transportation Policy, and STS Operations

The 1980s witnessed both the long-awaited arrival of STS operations and the wrenching reordering of U.S. space transportation policy following the *Challenger* disaster. DOD interactions with the STS program continued to be a very important factor in shaping this program, while DOD's stance on STS provides important insights into the military's space priorities and actual level of commitment to various space programs. Despite the great military potential of the STS and the considerable support for the STS within elements of the Air

99. Mark listed "the development of a doctrine and an organization that will permit greatly increased Air Force activities in space in order to take advantage of new technology to enhance communications, reconnaissance, and other vital Air Force functions" as one of the USAF's top priorities. Hans M. Mark, "USAF's Three Top Priorities," *Air Force Magazine* (September 1979), reprinted as appendix 3 in Mark, *Space Station*, pp. 235–236.

100. It is difficult to apportion blame for delays on the STS program; however, STS was originally scheduled to be launched from SLC-6 in December 1982 (after "more than forty launches will have taken place from KSC"!), and SLC-6 would barely have been ready for its rescheduled first launch in March 1986 had the *Challenger* disaster not derailed that plan. In practice, there were only 5 STS flights by December 1982 and a total of only 24 flights prior to the *Challenger* disaster. See Henry and Sloan, "Shuttle and Vandenberg," p. 25; Edgar Ulsamer, "Slick 6," *Air Force Magazine* (November 1985): 47–48.

Force and elsewhere in DOD, several significant points of friction remained between the Air Force, NRO, and NASA concerning STS operations and plans. Even prior to the *Challenger* disaster, the NRO had managed to gain formal approval to build a backup launcher, the Complementary ELV (CELV), for its most important payloads. Following the *Challenger* disaster, U.S. national space transportation policies were completely reordered under the Space Launch Recovery Plan, and the Air Force planned to move almost all DOD payloads onto ELVs. NASA-DOD interactions over STS during the 1980s led to the reversal of several major space transportation policies, abandonment of the original STS program goals, and the demise of yet another potential vehicle for significant military spaceflight.

DOD was instrumental in saving STS from cancellation at the outset of the Carter administration and was again a key player in defending STS late in the Carter administration when the program faced significant political opposition due to successive schedule slips and funding shortfalls requiring supplemental appropriations.[101] DOD support for the STS was critical in maintaining political support for STS within the administration and culminated in a 14 November 1979 White House meeting between the President and all key actors on this issue, where Carter firmly committed his administration to fully funding and rapidly completing STS.[102] DOD support for the national security mission of the STS was also a key factor in pushing the supplemental appropriations through Congress following hearings in March 1980.[103]

DOD exacted a price from NASA for its indispensable support: on 25 February 1980, NASA and DOD signed an extensive MOU on management and operation of the STS which was very favorable to DOD.[104] Specifically, the MOU indicated that "DOD will have priority in mission preparation and operations consistent with established national space policy."[105] Further, the

101. In 1979, NASA required supplemental appropriations totaling over $1 billion (1972 dollars) to keep the STS program on track. See Mark, *Space Station*, p. 93.

102. Mark, *Space Station*, pp. 101–103; Trento, *Prescription for Disaster*, p. 169.

103. Representative Edward Boland (D-Massachusetts) was instrumental in gaining approval for these supplemental appropriations as chairman of the NASA appropriations subcommittee. His support for STS stemmed from his position as Chairman of the House Permanent Select Committee on Intelligence, where he learned about the STS-spysat link in detail. See Mark, *Space Station*, p. 105; Trento, *Prescription for Disaster*, pp. 156–157.

104. "NASA/DOD Memorandum of Understanding on Management and Operation of the Space Transportation System," 25 February 1980, microfiche document 00561 in *U.S. Military Uses of Space*. This MOU replaced the 14 January 1977 NASA-DOD MOU on STS and provided the basis for several NASA-DOD subagreements.

105. Ibid., p. 3. The "established national space policy" referenced is presumably Presidential Directive (PD)-37 signed by President Carter on 11 May 1978 (unclassified version available at *http://www.au.af.mil/au/awc/awcgate/nsc-37.htm*). This DOD mission priority on the STS was often referred to as the right of DOD to "bump" other payloads from the STS manifest in favor of top-priority national security

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MOU established two categories of DOD STS missions: 1) national security missions conducted by NASA and 2) "Designated National Security Missions" controlled by the Air Force.[106] Overall, this MOU went a long way towards giving the Air Force the type of operational control over a manned space vehicle it had sought since the late 1950s—an arrangement which was quite remarkable, considering that the Air Force had not paid for the development of the STS.

The initial STS spaceflight took place on 12 April 1981 when *Columbia* was launched from KSC. This marked a bittersweet milestone because it was the world's first reusable spacecraft and signified the return of manned American spaceflight. But the STS was also two years behind schedule and cost $2 billion more to develop than originally projected. Moreover, it rapidly became apparent that due to very intensive and difficult refurbishing requirements following each flight, STS could not come close to meeting its planned flight schedule.[107] However, the military potential of the STS was also apparent from the outset. The second STS mission in November 1981 conducted radar-imaging experiments from orbit that pinpointed an ancient city buried beneath the sands of the Sahara and thereby demonstrated the significant military potential of this type of spaceborne sensor.[108] The first classified military payload was carried into

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payloads. Other significant provisions of this MOU indicated that 1) the Air Force was DOD's "sole point of contact with the NASA for all commitments affecting the STS and its use in matters regarding national security space operations and in international defense activities covered by Government to Government agreements"; 2) the Air Force would "develop, acquire, and operate a dedicated Shuttle mission planning, operations, and control facility for national security missions"; and 3) "an STS mission assignment schedule and plan" would be developed to facilitate the "expendable booster transition and phaseout plans" of NASA and the Air Force.

106. Ibid., pp. 3–4, 6–9. Specifically, for category one DOD STS flights, NASA would exercise flight control from JSC, but "NASA will be responsive to DOD Mission Directors," who would retain "overall responsibility for achieving mission objectives." For these missions, Air Force personnel "will be integrated into NASA line functions for training" in order to "allow the USAF to develop the capability to plan, control, and operate national security missions." For category two DOD STS flights, an Air Force Flight Director "will be responsible for overall mission accomplishment and operational control, including flight vehicle and crew safety, through the Air Force chain of command." Although not specified in this MOU, the implication is that category two DOD STS missions would be controlled from the Shuttle Operations and Planning Complex (SOPC) at the Consolidated Space Operations Center at Falcon (now Schriever) AFB.

107. NASA's STS mission models adopted in the early 1980s were far more realistic than the 60 flights per year originally projected for the Shuttle in the early 1970, but they still called for 24 flights per year from the complete four-orbiter STS fleet. In practice, orbiter turnaround time was approximately 60 days rather than the 7 days originally projected, and the turnaround operation required 6,000 people, nearly four times the expected number. There were only 24 total flights in the nearly five years of STS operations prior to the *Challenger* disaster. See E. C. "Pete" Aldridge, Jr., "Assured Access: 'The Bureaucratic Space War,'" Dr. Robert H. Goddard Historical Essay, n.d., p. 5. Offprint provided to author by the Office of the Secretary of the Air Force.

108. Trento, *Prescription for Disaster*, pp. 200–201; Richelson, *Secret Eyes*, p. 219. These first radar-imaging experiments were conducted with Shuttle Imaging Radar (SIR)-A. SIR-B experiments were conducted with updated hardware on mission 41-G in October 1984. According to Richelson, the SIR-A radar could apparently image objects 16 feet beneath dry sand.

orbit aboard *Columbia* during the STS-4 mission in June–July 1982, which also marked the end of the STS flight-testing phase.[109]

Meanwhile, elements within the Reagan administration and Congress were carefully monitoring early STS developments. On 13 November 1981, President Reagan signed National Security Decision Directive (NSDD)-8 that reaffirmed the space transportation policies of the Ford and Carter administrations by stating, "The STS will be the primary space launch system for both United States military and civil government missions. The transition should occur as soon as practical."[110] According to Mark, NSDD-8 also indicated "that the president had a strong personal interest in the space shuttle program."[111] Reagan's first comprehensive space policy, NSDD-42, was publicly announced by the President himself at a 4 July 1982 ceremony at Edwards AFB marking the beginning of the operational phase of STS operations, with *Columbia* in the background. In terms of space transportation policy, NSDD-42 reaffirmed that the STS was the nation's primary launch system, declared that the United States "is fully committed to maintaining world leadership in space transportation," stated that the "first priority of the STS program is to make the system fully operational and cost-effective in providing routine access to space," and indicated that U.S. "government spacecraft should be designed to take advantage of the unique capabilities of the STS."[112] Additionally, this directive indicated that "for the near-term," the STS would be managed under the terms of the NASA/DOD MOUs but as "STS operations mature, options will be considered for possible transition to a different institutional structure."[113] Finally, NSDD-42 made a concession to the NRO: "Unique national security considerations may dictate developing special-purpose launch capabilities."[114]

Early STS operations presented a variety of challenges and opportunities for the Air Force and NRO. Different elements within the Air Force had particular space priorities and viewpoints on the potential of the Shuttle. The space enthusiasts former Secretary Mark had reenergized within the Air Force were excited about exploring the military potential of STS, especially for military

109. Melvyn Smith, *Space Shuttle* (Newbury Park, CA: Haynes Publications, 1989), appendix 7; "Chronology," in *U.S. Military Uses of Space*, p. 52.

110. NSDD-8, "Space Transportation System," 13 November 1981, cited in "Chronology," in *U.S. Military Uses of Space*, p. 51.

111. Mark, *Space Station*, p. 131.

112. NSDD-42, "National Space Policy," 4 July 1982, pp. 2–3, NSC box, National Archives, Washington, DC. Two complete pages and approximately five additional paragraphs are deleted from the sanitized version of this directive. The White House also issued a five-page fact sheet, "National Space Policy," on 4 July 1982, reprinted in NASA, *Aeronautics and Space Report of the President, 1982 Activities* (Washington, DC: GPO, 1983), pp. 98–100.

113. NSDD-42, "National Space Policy," p. 4.

114. Ibid.

man-in-space missions.[115] The NRO was not very happy with being directed to abandon ELVs for STS but was in the process of redesigning and reconfiguring its future payloads to take full advantage of STS's substantial payload capabilities.[116] Other groups within the Air Force were far less excited with space or STS and opposed the substantial Air Force expenditures required to prepare for DOD STS operations. Major Air Force programs designed to support DOD STS operations included the ill-starred Inertial Upper Stage (IUS) program, modifications of SLC-6 at Vandenberg AFB for STS launch, construction of the Space Operations Planning Complex (SOPC) at Falcon AFB, and modifications to the Kennedy, Johnson, and Goddard Space Flight Centers for "controlled mode" DOD STS operations.[117]

115. Military uses of STS are not often or fully discussed in open sources. In answering congressional questions in March 1983, DOD drew a distinction between "payload delivery" and "full exploitation" of STS, defining the latter as follows: "In the longer term, when the capabilities of the Shuttle will be routinely available, the DOD envisions use of the enhanced capabilities unique to the Shuttle, such as on-orbit assembly of large structures; checking out payloads prior to deployment; repairing and servicing of satellites on-orbit; retrieving spacecraft for repairs and refurbishment; and performing man in the loop experiments." See House Committee on Appropriations, Subcommittee on the Department of Defense, *Department of Defense Appropriations for 1984*, Hearings before Subcommittee on Department of Defense, 98th Cong., 1st sess., pt. 8, 1983, p. 508. See also Edward H. Kolcum, "Defense Moving to Exploit Space Shuttle," *Aviation Week & Space Technology* (10 May 1982): 40–42. Kolcum notes that DOD's space test program (STP) experiments (e.g., Teal Ruby) would henceforth use STS rather than ELVs.

116. One of the most sensitive points for NASA regarding STS performance is that it never met its original 65,000-pound payload specification as set in conjunction with the Air Force in the early 1970s. The NASA STS performance data in the *President's Space Report* for 1981–87 indicated that the STS was able to boost approximately 65,000 pounds "in full performance configuration." However, the figure in the *Aeronautics and Space Report of the President* for 1988 (after resumption of STS operations) indicated a significant drop in STS full-performance configuration capabilities to approximately 54,895 pounds. Moreover, during congressional testimony in 1981, Air Force Assistant Secretary and NRO Director Robert J. Hermann indicated that "current projections of Shuttle performance show it to be about 8000 lbs lower than the original commitment. DOD missions can profitably use the full capability of the original performance commitment" (Senate Committee on Commerce, Science, and Transportation, Subcommittee on Science, Technology, and Space, *NASA Authorization for Fiscal Year 1982*, Hearing before the Subcommittee on Science, Technology, and Space, 97th Cong., 1st sess., pt. 2, 1981, p. 349). In 1982, Aldridge, Hermann's successor as NRO Director, indicated that the first Vandenberg AFB Shuttle launch scheduled for October 1985 "will require full specification Shuttle performance—as called out in our Performance Reference Mission 4 requirements. Specifically, the Shuttle must be capable of delivering 32,000 pounds to a 98 degree inclined, 150 nautical mile circular orbit and, then, recover another satellite weighing 25,000 pounds and return it to Vandenberg. The Shuttle with its current performance estimate cannot achieve this long standing defense requirement" (prepared statement of Under Secretary Aldridge in Senate Committee on Commerce, Science, and Transportation, Subcommittee on Science, Technology, and Space, *NASA Authorization for Fiscal Year 1983*, Hearing before the Subcommittee on Science, Technology, and Space, 97th Cong., 2nd sess., 1982, p. 166). Later, Aldridge simply indicated that the "final Shuttle capabilities were nearly 20% short" of NASA's originally promised "65,000 pounds of payload to low earth orbit from Kennedy Space Center and 32,000 pounds to a polar orbit from Vandenberg AFB, California." See Aldridge, "Assured Access," p. 3.

117. See Senate Committee on Commerce, Science, and Transportation, *NASA Authorization for Fiscal Year 1982*, pp. 340–341, 346–350, 444, 484. At this time (April 1981), the first STS launch from Vandenberg

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Despite these widespread efforts and considerable expenditures, the Air Force and DOD basic positions on how the STS fit into long-range military space plans or doctrine remained far from clear, at least in the available unclassified material. Undoubtedly, the basic Air Force overall organizational ambivalence towards space missions was a factor in structuring the long-term Air Force relationship with the STS, especially in light of all the rejected military man-in-space programs the Air Force had previously proposed.

In the early 1980s, former astronaut, space enthusiast, and Space Subcommittee Chairman Senator Harrison Schmitt (R-New Mexico) was among those most clearly upset with the apparent lack of Air Force long-range planning for STS use. During exchanges with Air Force and DOD witnesses at congressional hearings in 1981, Schmitt charged that "historic inertia" as well as "the lack of an organizational focus that has [space] as a primary mission" had made the Air Force "relatively slow to grasp the opportunities that the Space Shuttle provides, not only as a launch vehicle, but as a test and operational vehicle in space."[118] Moreover, Schmitt opined that "within a few years, you all are going to come back in and say 'We need a dedicated shuttle fleet.' And it's painted blue that we could use for our purposes."[119] Further, he warned that unless the Air Force pursued space missions more aggressively, "I can almost predict that there is going to be another Department of Something in the Department of Defense. And the Air Force will be flying airplanes, and not Shuttles."[120]

More widespread congressional concern in 1982 focused on Air Force–NASA relations in regard to the question of whether the U.S. should procure a fifth STS orbiter vehicle before the Rockwell orbiter production lines shut

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was scheduled for August 1984. Assistant Secretary Hermann indicated that the term *controlled mode* "signifies that we are protecting the classified information used in the planning and execution of a DOD mission by controlling access to it. The modifications include construction changes to the buildings to isolate certain areas, the procurement of additional equipment, and the shielding of certain equipment to preclude electronic eavesdropping." He also stated, "All defense payloads will have completed their transition to use of the Space Shuttle as the primary launch vehicle by 1987." The SOPC was to "provide the management and control needed for our national security space operations in the post-1985 timeframe." Additionally, the SOPC would provide a backup to the single STS control node at JSC and would "provide a maximum opportunity to fully exploit the Shuttle unique capabilities, in particular the presence of military man in space." At these same hearings, Dr. James Wade, Acting Under Secretary of Defense for Research and Engineering, estimated that all of the DOD STS-related activities would cost approximately $3 billion through FY 1986. In March 1983, DOD provided figures indicating that "DOD's portion ($15.2 billion) of the total STS cost ($51.1 billion) is 30 percent [these figures are projected through FY 1988]." See House Committee on Appropriations, *Defense Appropriations for 1984*, p. 513. On the Air Force's STS-related expenditures and infrastructure, see also William P. Schlitz, "USAF's Investment in the National Space Transportation System," *Air Force Magazine* 65 (November 1982): 106–112.

118. Senate Committee on Commerce, Science, and Transportation, *NASA Authorization for Fiscal Year 1982*, pp. 458–459.

119. Ibid., p. 447.

120. Ibid., p. 460.

down. Many believed that it would be wise to procure a fifth orbiter as a backup and to provide greater STS capability.[121] The Air Force was very interested in producing another of the lighter weight and more capable orbiters but was unwilling to use DOD funds to procure this fifth orbiter.[122] Meanwhile, NASA was less supportive of the need for a fifth orbiter, largely because Administrator James Beggs and Deputy Administrator Mark had privately agreed that NASA should push a permanently manned space station as the nation's new major civil space goal and were therefore unwilling to take on other major new projects at this time.[123] By the end of 1982, despite considerable congressional support for a fifth orbiter, the NASA compromise solution of keeping the Rockwell lines partially open to produce spare parts won out, and the decision to build a fifth orbiter was deferred.[124] This decision was formalized by NSDD-80, issued on 3 February 1983.[125]

During 1983 and 1984, NRO Director Aldridge waged a mostly secret and very difficult, but eventually successful, campaign against NASA to obtain approval to develop a new ELV capable of launching the spy satellites designed to fit into the STS.[126] Building upon the opening in NSDD-42 to consider building "special-purpose launch capabilities" for "unique national security considerations," on 23 December 1983 Aldridge issued a memorandum, "Assured

121. Those favoring a decision to build another orbiter at this time also used arguments about the economic impact of keeping the Rockwell production lines open and the lower costs of building a fifth orbiter in sequence. In *Prescription for Disaster*, Trento speculates that a decision to build the fifth orbiter at this time (with the lines open) would have cost approximately $1.2 billion instead of the $2.1 billion that the fifth orbiter (*Endeavour*) actually cost; see p. 205.

122. See, for example, the testimony of Major General James Abrahamson (NASA Associate Administrator for Manned Spaceflight) and Air Force Under Secretary Aldridge in House Committee on Science and Technology, Subcommittee on Space Science and Applications, *The Need For a Fifth Space Shuttle Orbiter*, Hearing before the Subcommittee on Space Science and Applications, 97th Cong., 2nd sess., 15 June 1982.

123. Mark, *Space Station*, pp. 121–122; Trento, *Prescription for Disaster*, pp. 180–181. Following a long NASA campaign within the administration, President Reagan announced in his 1984 State of the Union Address the national goal of building a permanently manned space station (*Freedom*) within 10 years.

124. Trento, *Prescription for Disaster*, p. 205. On congressional support for a fifth orbiter, see, for example, the position of many Representatives in House Committee on Science and Technology, *Need For a Fifth Space Shuttle Orbiter*, as well as the formal recommendation for a fifth orbiter in House Committee on Science and Technology, Subcommittee on Space Science and Applications, *The Need for an Increased Space Shuttle Orbiter Fleet*, 97th Cong., 2nd sess., 1982, Committee Print Serial HH.

125. William Clark, NSDD-80, "Shuttle Orbiter Production Capability," 3 February 1983, NSC box, National Archives, Washington, DC. Specifically, this one-page directive indicated that a warm production line would "be achieved through the production of structural and component spares necessary to insure that the Nation can operate the four Orbiter fleet in a robust manner."

126. The intense NRO-NASA struggles of this period (a "bureaucratic space war") are the primary focus of Aldridge, "Assured Access," pp. 3–15. Naturally, this piece covers the positions of Aldridge and the Air Force far more sympathetically than the positions of Beggs or NASA, but it is by far the most detailed description of developments surrounding the CELV decision uncovered during research for this study.

Access to Space," to Air Force Space Command and Space Division.[127] This memorandum directed these organizations to plan for the procurement of a complementary ELV (CELV) capable of boosting a payload the size of the STS cargo bay and weighing 10,000 pounds into geosynchronous transfer orbit.[128] According to Aldridge, NASA Administrator Beggs "was furious" with these developments and saw them as "only a ploy of the Air Force to abandon the Shuttle."[129] However, in August 1984, Aldridge's position was formally supported by the NSC in NSDD-144 that approved Air Force development of the CELV.[130] Nonetheless, Beggs and NASA continued to oppose the CELV option and enlisted considerable congressional support in opposition to the CELV.[131]

Aldridge notes that the NSC staff hosted "the *critical* meeting" on the CELV issue on 14 February 1985.[132] At this meeting, Aldridge and Beggs finally reached agreement. This agreement was reflected in NSDD-164, issued on 25

127. "Chronology," in *U.S. Military Uses of Space*, p. 55. The primary rationale behind developing such a capability was to avoid dependence on a single system for space launch. Additionally, the final Air Force ELV buys were being completed at this time, and the production lines were in danger of being shut down unless new orders were found.

128. Ibid. Secretary Caspar Weinberger outlined a new DOD space launch strategy relying on a mixed fleet of ELVs and the STS in a letter to the President on 7 February 1984; see Aldridge, "Assured Access," p. 6.

129. Aldridge, "Assured Access," p. 6.

130. "Chronology," in *U.S. Military Uses of Space*, p. 56. Presumably, NSDD-144 was the subject of the White House fact sheet "National Space Strategy," issued on 15 August 1984 and reprinted in *Aeronautics and Space Report of the President, Fiscal Year 1984*, pp. 137–139. According to this fact sheet, the directive specified two requirements for "assured launch capability": "the need for a launch system complementary to the STS to hedge against unforeseen technical and operational problems, and the need for a launch system suited for operations and crisis situations." However, there is some confusion about at least the number of this classified directive in open sources. Scott Pace, in "US Space Transportation Policy: History and Issues for a New Administration," *Space Policy* 4 (November 1988): 307, 309, indicates that NSDD-144, "National Security Launch Strategy," was not issued by the EOP until 28 February 1985. Aldridge does not discuss this directive in "Assured Access." NSDD-144 was not available in the NSC box at the National Archives.

131. According to Aldridge, NASA had several concerns with and employed several tactics against the CELV. NASA felt that if DOD moved away from the STS, the costs per launch would increase and NASA would need to charge its commercial customers more for each launch. This, NASA officials thought, would drive more commercial customers towards the Ariane. In an 18 May 1984 letter from Administrator Beggs to Secretary Weinberger, NASA indicated that an STS backup was not necessary but that if DOD was determined to build a new launch vehicle, it should be derived from STS components. Next, NASA supporters in Congress specified that a competition would be run between NASA designs and industry designs for a system to meet Air Force requirements. Aldridge claims in "Assured Access" that NASA put subtle pressure on its suppliers not to compete against its Standardized Launch Vehicle (SLV-X) by indicating that their behavior would have consequences for future NASA purchases. A modified Titan III called a Titan 34D7 was the winner in the industrial competition conducted by the Air Force, while the NASA entry was judged by the Air Force Space Division to be uncontrollable during the boost phase of flight. Finally, as the ELV production lines were beginning to shut down, NASA recommended that several major and lengthy studies be undertaken on the CELV issue as a delaying tactic ("Assured Access," pp. 7–13).

132. Ibid., p. 13, emphasis in original.

February 1985.[133] Specifically, NSDD-164 authorized the Air Force to buy 10 CELVs and to launch approximately 2 CELVs per year in the period 1988–92.[134] Thus, Aldridge won his victory in the bureaucratic space war less than one year prior to the complete reordering of U.S. space transportation policy caused by the *Challenger* disaster.

In hindsight, given large impact of the *Challenger* disaster, it is remarkable that there was such sustained opposition to acquiring a backup capability for the STS. Moreover, while access to space is a prerequisite for any space activity, it is unfortunate that Aldridge and the top levels of Air Force space leadership, as well as much of NASA's leadership, were largely consumed with this issue during the mid-1980s rather than focusing on broader, more important, or more future-oriented space policy issues. Finally, it is also interesting to note that many groups were dissatisfied with STS performance capabilities and especially the mounting STS payload backlog of the mid-1980s but that only the NRO had the clout to develop a new ELV and move its most important payloads off the STS.[135]

The *Challenger* disaster completely reordered U.S. space transportation policy and effectively deferred any Air Force plans to use STS as a vehicle to build a significant manned military presence in space. During 1986 and 1987, NASA, DOD, and the newly formed Office of Commercial Space Transportation (OCST) within the Department of Transportation worked together to produce a new U.S. space launch strategy and the Space Launch Recovery Plan. NSDD-254, "United States Space Launch Strategy," was completed on 27 December 1986.[136] This directive specified that the U.S. would henceforth rely upon a

133. NSDD-164, "National Security Launch Strategy," 25 February 1985, NSC box, National Archives, Washington, DC. This unclassified directive was publicly released on 14 November 1985.

134. Ibid., p. 1. NSDD-164 also 1) indicated that a "competitive decision" on a specific CELV would be made by 1 March 1985, 2) directed that "DOD will rely on the STS as its primary launch vehicle and will commit to at least one-third of the STS flights available during the next ten years," 3) directed NASA and DOD to "jointly develop a pricing policy for DOD flights that provides a positive incentive for flying on the Shuttle," and 4) authorized a joint NASA-DOD effort to produce a national security study directive (NSSD) on the development of "a second-generation space transportation system."

135. Some of the strongest opposition to STS "forced busing in space" came from within NASA's own space science community. NASA had directed that all its payloads be launched exclusively by the STS, but by the mid-1980s, the STS backlog and problems with the STS upper stages were causing multiyear delays and significant design changes for key space science projects such as the Galileo Jupiter probe and the Hubble Space Telescope. See, for example, Bruce Murray, "'Born Anew' Versus 'Born Again,'" in "Policy Focus: National Security and the U.S. Space Program After the Challenger Tragedy," *International Security* 11 (spring 1987): 178–182. Even more significantly, because STS was not providing low-cost launch rates (even at its generous pre-*Challenger*-disaster subsidized rates) or reliable service and launch schedules, commercial customers were "voting with their feet" and moving in increasing numbers onto the more commercially viable Ariane ELV.

136. NSDD-254, "United States Space Launch Strategy," 27 December 1986, NSC box, National Archives, Washington, DC. Approximately three sentences of this two-page directive are deleted in the sanitized version. The White House released a fact sheet on this directive on 16 January 1987. NSDD-254 superseded NSDD-164.

"balanced mix of launchers" consisting of the STS and ELVs defined "to best support the mission needs of the national security, civil government and commercial sectors of U.S. space activities."[137] Further, "selected critical payloads will be designed for dual-compatibility, i.e., capable of being launched by either the STS or the ELVs."[138] In order to accomplish these objectives, the directive indicated that DOD "will procure additional ELVs to maintain a balanced launch capability and to provide access to space."[139]

The Space Launch Recovery Plan dealt with the means to implement this new launch strategy in greater detail. The plan focused on the revitalization of the nation's ELV production base and attempted to use government ELV purchases as a means to stimulate the development of a more robust commercial ELV industry. The plan also provided $2.1 billion to NASA for the production of a fifth orbiter, *Endeavour*, to be ready for flight by 1992. In addition, under this plan, the Air Force completely reoriented its future space support infrastructure and plans. The Air Force launched a $12-billion program to initiate or expand four ELV programs.[140] These Air Force ELV programs included expansion of the original 10 booster CELV program to 41 Titan IVs, two medium launch vehicle programs consisting of 20 Delta 2 and 11 Atlas-Centaur 2 ELVs, and refurbishing 14 decommissioned Titan II ICBMs for space launch.[141] Additionally, the Air Force took drastic steps to reconfigure the infrastructure it had developed to operate DOD STS missions, including placing the unused SLC-6 at Vandenberg AFB into "minimum facility caretaker" status in July 1986, eliminating the 32-member-strong Manned Spaceflight Engineer (MSE) program within the Space Division, disbanding the Manned Spaceflight Control Squadron at the JSC as of 30 June 1989, and ending development of the SOPC at CSOC in February 1987.[142] Further, as a result of this plan, the DOD scheduled only seven

137. Ibid., p. 1.

138. Ibid.

139. Ibid. Additionally, NSDD-254 specified that NASA would no longer provide commercial or foreign launch services on the STS "unless those spacecraft have unique, specific reasons to be launched aboard the Shuttle." The directive also set a 1995 "commercial contract mandatory termination date." This policy meant that of the 44 commercial and foreign launch commitments NASA had in January 1986, only 20 of these payloads still qualified for STS launch. See *Aeronautics and Space Report of the President, Fiscal Year 1986*, p. 33.

140. Pace, "US Space Transportation Policy," p. 310.

141. Ibid.; William J. Broad, "Military Launches First New Rocket for Orbital Loads," *New York Times* (6 September 1988): 1; Joint Statement of Air Force Secretary Aldridge and Chief of Staff General Larry D. Welch in Senate Committee on Appropriations, Subcommittee on Department of Defense, *Department of Defense Appropriations for Fiscal Year 1988*, Hearings before the Subcommittee on Department of Defense, 100th Cong., 1st sess., pt. 3, 1988, pp. 301–303.

142. William J. Broad, "Pentagon Leaving Shuttle Program," *New York Times* (7 August 1989): A13. Broad estimated the costs for these programs to be "at least $5 billion," the lion's share of which was the $3.3-

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dedicated STS launches for the period 1991–95 and thereafter planned to rely almost exclusively on ELVs.[143]

The relationships between the Air Force, DOD, and NASA over STS operations were clearly marked by great difficulties during the 1980s. The development of military space launch policy during this period provides one of the most powerful instances of organizational behavior inputs shaping U.S. space policy and significantly impacting military space doctrine. Despite building a large and expensive infrastructure for launching and controlling DOD STS missions, the Air Force never fully exercised this capability prior to the *Challenger* disaster, and, following the disaster, the Air Force and NRO were instrumental in leading DOD's rush off the STS in favor of ELVs. The bitter fight with NASA over the CELV and the general desire to fully control its launch vehicles were important factors in motivating this Air Force space launch policy reversal; however, the speed and complete nature of the virtual abandonment of the STS and the significant infrastructure designed to support DOD STS missions is remarkable and not well explained in open sources. The lack of clear and powerful military space doctrine undoubtedly contributed to these false starts, reversals, and lack of clear direction for the DOD STS mission. Cumulatively, this episode seems to be an excellent illustration of the general Air Force ambivalence over the military potential of space and military man-in-space, as well as evidence of its lack of clear and accepted doctrinal guidance on these issues.

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billion SLC-6 at Vandenberg AFB. The SOPC building at CSOC was converted into the National Test Bed (now the Joint National Integration Center) for the Strategic Defense Initiative (SDI) program. As Broad relates, military space critics such as John Pike of the Federation of American Scientists charged that the Air Force went overboard in developing new ELVs and abandoning the STS.

143. Pace, "US Space Transportation Policy," p. 310. The first Titan IV launch took place on 14 June 1989 from Cape Canaveral; see "Chronology," in *U.S. Military Uses of Space*, p. 61.