CLASSIFIED

SHARING SPACE

THE SECRET INTERACTION BETWEEN
THE NATIONAL AERONAUTICS & SPACE ADMINISTRATION &
THE NATIONAL RECONNAISSANCE OFFICE

1961 - 1995

Vance O. Mitchell, Ph.D.

(U) Sharing Space:

the Secret Interaction Between

The National Aeronautics & Space Administration &

The National Reconnaissance Office

VANCE O. MITCHELL, PH.D.

CENTER FOR THE STUDY OF
NATIONAL RECONNAISSANCE

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(U) Contents

(U) Appendices

(U) List of Original Documents Appendices

(U) Note: In the Printed Edition All of the Following Appendices Listed are on the CD Located Inside the Sleeve on the Back Cover.

(U) Illustrations

(U) Figures

(U) TABLES

(U) Foreword

(U) For thirty-four years (1961-1995), the National Reconnaissance Office (NRO) and the National Aeronautics and Space Administration (NASA) had a working relationship. Because that relationship was highly classified, it has long been hidden from public view and seldom noted even in classified channels. In fact, the relationship was probably known only to a minority at the NRO and an even smaller number at NASA.

(U) This history, a joint NRO-NASA project, has tried to capture in a single volume those thirty-four years. There was some urgency to complete the project before any more government records are lost or destroyed and key personnel are still available for oral interviews. The appendices containing important documents from the period were a late addition that will hopefully provide the reader with further insights into that relationship.

~~(S//TK//NF)~~ The NASA-NRO collaboration involved a variety of programs ranging from the Apollo Lunar Reconnaissance Program (1963-1967) to NASA's ongoing Mission to Planet Earth beginning in 1992. In between, the reader will find such important programs as the Landsat earth observation satellites, [redacted] (b)(1) (b)(3) and the difficult relationship with the Space Shuttle. Lesser degrees of involvement marked programs that included the Seasat radar imager, the Infrared Astronomy Satellite, and the Manned Orbiting Laboratory.

(U) Both the nation and the two principal parties involved profited from this interaction, but it was not always the peaceable kingdom. As could be expected, there were any number of problems and disagreements, some of them rather serious, inherent in coordinating the activities of the most open of space agencies (NASA) with the most secretive (the NRO). Still, senior executives worked their way through the tangle in a professional manner largely, though not entirely, free of rancor as the two diverse entities learned to better accommodate each other as time passed. How they did that is a lesson in itself.

Robert A. McDonald, Ph.D.
Director, Center for the Study of National Reconnaissance
National Reconnaissance Office

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(U) PREFACE

(U) The vast majority of the pertinent records used in this history were in the NRO archives, with lesser amounts at NASA and only a few documents in the CIA. No contractor archives were exploited because they contained no applicable records. The key personnel selected for oral interviews were those closely involved with the various cooperative efforts engaged in by the two agencies. For the most part they were eager to share their experiences and proved information of value to this history.

(U) NASA's openness, penchant for publicity, and the public popularity of its programs translated into any number of secondary sources, mainly articles and books. None of the secondary sources were classified, but knowledge of the classified data base used for this manuscript allowed a surprising amount of unclassified material to be woven into the narrative. The combined classified and unclassified evidentiary base was adequate in almost all cases.

(U) Aside from researching the evidentiary base, putting this manuscript together required, or at least was made easier, by the efforts of associates who freely offered their support, counsel and criticism. Working with my principal contacts at NASA, the Associate Administrator, Dr. Scott Pace; the Chief Historian, Dr. Steve Dick; and the NRO liaison officer, Col. Jim Puhek was the opportunity of a lifetime. NASA may be heavily oriented toward advanced technology, but these gentlemen possess intellectual gifts that allow them to appreciate history and how it can aid their mission. And they were nothing short of gracious. It was my pleasure to have worked with them.

(U) Management and colleagues within the Center for the Study of National Reconnaissance (CSNR) were also helpful. Those in management, Dr. Robert McDonald, Mr. Bill Naylor, Dr. Clayton Laurie, Dr. Steve Rys, Mr. David Waltrop, and Dr. James Outzen worked to keep the project focused and on track. Among the colleagues, Dr. Jeff Charlson, Dr. Susan Schultz, Mr. Jim Rosolanka and Mr. Patrick Widlake did what they could to help even if only to lend a sympathetic ear.

(U) Another colleague, Ms. Diane Rosenberger, deserves special mention. Like previous editors that I have worked with, she had to deal with suspect grammar, inconsistent punctuation, and prose that fell short of Shakespearian quality. Her many corrections and firm guidance made life miserable for me, but her contribution to this history was substantial. It will be my pleasure if she serves as my editor on future projects.

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(U) Then, there was [redacted] Without being invited, he brazenly inserted himself into the project, and I will forever be grateful that he did. Indeed, not having him onboard from the beginning was an oversight. His exceptional knowledge of the NRO and its many programs filled in gaps and provided insights unavailable elsewhere. I look forward to working with him on future projects.

(U) Finally, no CSNR history is complete without a tip of the hat to [redacted] the NRO's Chief Archivist. His knowledge of the material entrusted to him was in some cases pivotal in finding documents. He recently decided to retire, something he richly deserves. Bon Voyage, [redacted] we will miss you.

(U) All these fine people in their own way made contributions, but this narrative is my responsibility. Factual errors, suspect reasoning, and other shortfalls are of my own doing.

Vance O. Mitchell, Ph.D.
Historian and Author

(U) Introduction

(U) In *Sharing Space: The Secret Interaction Between the National Aeronautics & Space Administration & the National Reconnaissance Office*, Dr. Vance O. Mitchell explores the decades long secret collaboration and sometimes tension between the National Reconnaissance Office (NRO) and the National Aeronautics and Space Administration (NASA). The NRO's charter was to conduct reconnaissance from space. In contrast, NASA's charter was to encourage the scientific use of space both domestically and internationally. The NRO was a very closed organization avoiding publicity at all costs. NASA actively sought to establish a very high public profile. Despite differences in missions and cultures, there were multiple opportunities to cooperate. Dr. Mitchell describes strong cooperation between two organizations as well as how conflicts and differences were settled. He discusses the benefits NASA reaped by securing a well resourced NRO as a partner in national space programs. In an intelligence community where more and more cooperation is encouraged, this study will help any interested reader better understand how to improve cooperation between government organizations, even when significant differences exist.

(U) By the late 1950s, several U.S. government organizations were undertaking space programs, including the Air Force, Army, and Navy. Most of the programs traced their heritage in some form to elements of the German rocketry program moved by the United States following World War II. The Eisenhower Administration increasingly recognized that greater order was needed in undertaking the nation's efforts to reach space. Two organizations were born from this recognition, NASA through a Congressional Act in 1958 and the NRO through a Department of Defense and Central Intelligence Agency agreement in 1961. NASA was responsible for civilian space exploration and the NRO was responsible for highly secret reconnaissance from space. During the next several decades, many opportunities to cooperate arose as well as some reasons for disagreement.

(U) The first significant opportunity to cooperate was in support of President John F. Kennedy's 1961 charge to carry out a manned moon landing by the end of the decade. NASA developed the Apollo program for that purpose. One of the essential requirements was imaging of the lunar surface with sufficient resolution to find suitable landing sites. In the late 1950s, the U.S. Air Force began a program for obtaining near-real-time imagery from space. The program would eventually be known as Samos and was turned over to the newly formed NRO in 1961. Although the NRO cancelled Samos shortly thereafter because of system development problems, the program did produce a camera system that would read-out imagery from space and transmit it to a terrestrial ground station in near-real-time. NASA incorporated this camera system into its Lunar Orbiters that provided the critical pictures for helping assure a successful Apollo program.

(U) The NRO's primary mission was to design, launch, and operate satellites that obtained images of nations opposing U.S. interests and intercepted signals with information helpful for understanding the intentions of and threats posed by those adversaries. In order to maintain a technological edge, the Department of Defense, with the NRO as the responsible organization, controlled the resolution of NASA satellites imaging the earth for scientific purposes. Technology advanced more quickly than the willingness to allow higher resolution images of the earth that could be used by U.S. adversaries to their military advantage. The NRO and NASA engaged in many discussions over time on how best to protect strategic intelligence advantages by limiting imagery satellite resolution yet permitting more effective earth observation for scientific and non-military purposes. At times those discussions were tense, but a healthy give and take and a willingness to compromise allowed both organizations to accomplish their missions.

~~(TS//TK/NF)~~ One of NASA's most significant undertakings following the Apollo program was Skylab, the orbiting laboratory in space. Skylab was launched in 1973. During the flight into space, a shield protecting the space vehicle deployed prematurely causing significant damage to the vehicle and jeopardizing the mission. In order for the mission to continue, NASA would need to deploy astronauts to carry out repairs. [redacted]

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~~(S//NF)~~ The most significant challenge to the relationship between the NRO and NASA was the Space Shuttle. NASA originally planned that the shuttle would become the primary means for placing in orbit most, if not all, of the nation's reconnaissance satellites. The NRO had concerns about the shuttle as the single means of launch and preferred back-up launch capabilities until at least shuttle reliability could be proven. The shuttle did provide some advantages to the NRO since it permitted larger diameter payloads than had previously been launched. The *Challenger* tragedy resulted in the NRO returning back to reliance on rocket launch, and ending almost two decades of tension and disagreement over shuttle related problems including diminished performance, mushrooming costs, and poor reliability.

~~(S//TK/NF)~~ In 1964, the NRO launched an experimental satellite confirming that radar imagery from space was possible. [redacted] Both organizations would need to accommodate each other's views of secrecy and openness in carrying out their unique space missions.

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~~(S//TK/NF)~~ The space community is relatively small, and consequently there have been many opportunities besides the Lunar Orbiter program of the 1960s for technology sharing between the NRO and NASA. [redacted] It serves as another important symbol of the successful relationship between the NRO and NASA.

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(U) Dr. Mitchell's history of the NRO-NASA relationship is an engaging book. His *Sharing Space* is important for documenting the relationship between the NRO and NASA. It is as important or more important for documenting how two organizations with common elements in their missions can mutually benefit from cooperation. It is a story about identifying opportunities of mutual benefit, resolving mutual concerns, and providing benefits to the nation by doing both. Dr. Mitchell's contribution, therefore, is commendable from both the perspective of history, but also from the perspective of leveraging U.S. resources more effectively to serve the citizens of the nation.

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Chief, Historical Documentation and Research
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(U) Chapter One

(U) The Early Space Age and the Beginning of NRO-NASA Interaction, 1957-1964

(U) When he entered the White House in January 1953, President Dwight D. Eisenhower was greatly concerned about the threat posed by a nuclear-equipped Soviet Union. The possibility that a surprise attack would sow untold death and destruction and cripple the United States' ability to retaliate most occupied his thoughts. The high altitude U-2 reconnaissance aircraft, which first flew in 1955, was to detect preparations for such an attack as well as to gauge the extent of the Soviet strategic threat. Work on Samos, the nation's first photoreconnaissance satellite began in 1955, but was inadequately funded because the U-2 carried out overflight reconnaissance of the Soviet Union well enough. There were no manned spaceflights under serious consideration and no major scientific space programs had advanced very far beyond the conceptual stage. All that changed literally overnight when the space age burst with sudden fury on America's shores.

~~(S//NF)~~ On 4 October 1957, the Soviet Union launched Sputnik-1, the world's first artificial satellite. The feat did not come as a complete surprise to knowledgeable government officials. Moscow announced its intention three years earlier of doing exactly that and subsequently released an unusual amount of information by Soviet standards to back up its claim. Moreover, intelligence estimates predicted they could do so, possibly as early as November 1957.[1]

(U) In contrast, Sputnik stunned a totally unprepared American public. A nation with an "oxcart economy" had somehow beaten the United States into space. In the popular perception, the nation had suffered a defeat bordering on humiliation and the United States' place atop the world's technological pyramid was now in question. Worse, when Moscow refined Sputnik's booster into a nuclear capable Intercontinental Ballistic Missile (ICBM) this nation faced sudden devastation from a weapon against which there was no defense. America's geographic isolation from the other world powers had long provided a security buffer, but that buffer, already weakened by the Soviet acquisition of nuclear-capable intercontinental bombers, was now completely gone.

(U) Other shocks soon followed. In November 1957, the Soviets orbited Sputnik-2, a 1,100-pound satellite carrying a dog (Laika), and a month later American morale hit rock bottom when a Navy Vanguard rocket primed to carry America's first satellite into orbit exploded on its launch pad. "Cold War Pearl Harbor" became a popular way of describing what had befallen the United States. The nation regained only a little ground when on 31 January 1958, an Army Jupiter C booster orbited Explorer-1, a 38-pound spacecraft carrying a small scientific payload and the United States' first artificial satellite.

(U) Meanwhile, Eisenhower, largely unaffected by the public angst and much more knowledgeable about Soviet capabilities, took events pretty much in stride. The Soviet achievements in his opinion neither amounted to much nor fundamentally altered the balance of power. Still, he had to do something given the prevailing national mood and his understanding that Soviet air defenses would in time bring an end to U-2 overflights of the Sino-Soviet bloc. Within a few months the President made a number of important decisions, two of which have had a lasting imprint on both the classified and unclassified portions of the American space program.

(U) Establishing the NRO

(U) In February 1958, Eisenhower secretly consigned a portion of the Samos photographic reconnaissance satellite program to accelerated development as a joint CIA-Air Force program. This marked the beginning of Corona, a system to launch film-based cameras into orbit, image selected targets, and physically return the film to earth. Meanwhile, Samos continued on as an Air Force project to electronically return images from space.[*2]

(U) When Corona first launched in January 1959, the program bore the public name Discoverer. Media releases stated that the Discoverer was for the peaceful, scientific exploration of space. That provided cover for Corona and was in keeping with the prevalent thinking that a scientific presence in space should precede a reconnaissance capability. Repeated failures marred the program, but in August 1960, Discoverer-14 successfully returned its film magazine to earth marking the first completely successful mission.[3]

(U) Corona's success came none too soon. On 1 May 1960, a surface-to-air missile brought down Francis Gary Powers' U-2 deep inside the Soviet Union. The shoot down could scarcely have come at a worse time; Eisenhower was in Paris for a summit meeting with Soviet Premier Nikita Khrushchev. The American President promised to terminate all over flight missions, thereby ending a vital source of information, but refused to apologize for having ordered them. A furious Khrushchev, who demanded both mission termination and an apology, promptly returned to Moscow and the summit collapsed.

(U) When Eisenhower, still smarting from the failed summit, returned to Washington, he ordered a top-to-bottom review of the intelligence establishment, including the nation's nascent reconnaissance satellite programs. The disparity in achievements between Samos and Corona soon focused attention on the former. Whereas Corona had made rapid progress, Samos struggled due to duplication of effort and slow decisionmaking. By mid-1960, the program had spent $750 million with too little to show for it. In August 1960, the National Security Council (NSC) recommended, and Eisenhower approved, establishing an office and associated support structure to supersede the arrangement in place since Sputnik. The new creation promised a streamlined chain of command and better management of Samos. Eisenhower selected Under Secretary of the Air Force Joseph V. Charyk to head the new office. Charyk kept his under secretary position and duties attendant to it. On matters of reconnaissance he reported to the Secretary of Defense, not to his usual superior, the Secretary of the Air Force. That chain-of-command remained in effect throughout the time covered by this narrative.[4]

~~(TS//TK//NF)~~ In the spring of 1961, Charyk approached Robert McNamara, the new Secretary of Defense, about expanding his authority to include all reconnaissance satellite programs, extant and proposed. McNamara asked him to put his recommendations on paper. Charyk responded by calling for a National Satellite Reconnaissance Office to manage all spaceborne reconnaissance assets. McNamara gave his approval.[5]

(U) In September 1961, an agreement between McNamara and Director of Central Intelligence (DCI) Allen Dulles established the National Reconnaissance Program (NRP), a funding line to support all

* (U) After the detachment of Corona, Samos had a secondary mission to develop a film return system should Corona falter, but none of the several attempts flew a complete mission.

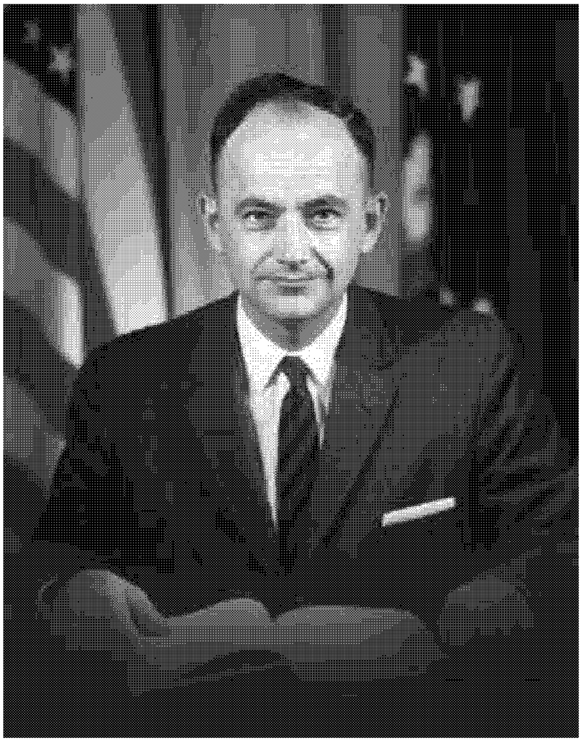

Figure 1-1. (U) NRO Director Dr. Joseph Charyk.
(Image: UNCLASSIFIED)

satellite and aircraft overflight projects intended to collect data relative to intelligence, mapping, and geodesy. The same accord established the National Reconnaissance Office (NRO), an organization so secret that its very existence was classified, to manage the equally secretive bevy of collectors. The CIA's Deputy Director of Plans, Richard Bissell, and Charyk served as NRO co-directors. Charyk now wore two hats by simultaneously serving overtly as Under Secretary of the Air Force and covertly as NRO co-director.[6]

(U) Because the two men respected each other, the dual directorship worked well until Bissell resigned from government service in April 1962, leaving Charyk alone at the top. At the NSC's direction, a new Department of Defense (DOD)-CIA agreement in May of that year installed Charyk as the NRO director, but made him responsible to the DCI as well as to the Secretary of Defense. Charyk quickly set up an NRO structure composed of three alphabetical programs: A (Air Force), B (CIA), and C (Navy). Program D (Airborne Assets)[†] followed in 1963. All alphabetized program managers reported to the NRO director.[7]

(U) The 1962 agreement marked the apogee in centralized management favored by Charyk and McNamara. The problem was Program B. Although the new structure gave each program a degree of autonomy in its affairs, it could do nothing about the CIA being the NRO's only non-DOD entity. Agency officials increasingly saw the NRO, and by implication DOD, as a threat to their programs and prerogatives. The CIA preferred the NRO as a vehicle of oversight and coordination rather than a strongly centralized organization.[8]

† (U) The airborne assets were U-2s and A-12s. The A-12s morphed into the more famous SR-71 "Blackbirds." Program D disbanded in the mid-1970 when the Air Force took operational control of both types of aircraft, although mission tasking remained at the national level.

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[redacted]

(U) Another agreement signed in August 1965 resolved the debate. The agreement, *inter alia*, created the Executive Committee (ExCom) of the NRP to allocate resources and make critical decisions. Until then powers were invested in the NRO Director, Brockway McMillan, who succeeded Charyk. McMillan protested his loss of authority, but to no avail. The CIA now had the decentralized structure it wanted, a structure that endured until the disestablishment of the ExCom a decade later. Even then, the alphabetized programs, along with a high degree of decentralized management, remained in place until the early 1990s.[9]

~~(S//TK//NF)~~ The tempest over management aside, the NRO and its growing constellation of reconnaissance satellites were already well on the way to providing routine and unimpeded access to otherwise denied areas. The NRO's signals intelligence (SIGINT) programs fielded a number of collectors. The first SIGINT satellite, a Program C (Navy) endeavor, entered orbit in June 1960 making it, not Corona, the world's first operational reconnaissance satellite. The public knew it as Grab, an acronym for Galactic Radiation and Background, a name that provided cover as a scientific satellite. The classified world knew it as Grab/Dyno, a 20-inch sphere that collected electronic intelligence (ELINT) against radars emitting in the S-band (2-4 GHz) frequency spectrum. Renamed Poppy in 1962, the tiny satellites flew missions on into the 1970s.[10]

~~(S//TK//NF)~~ At least eighteen other SIGINT satellite systems, bearing such fanciful names as Long John, Taki, Soctop and Bird Dog, also flew missions during the early 1960s. All, including Poppy, may have been small enough to ride piggyback into orbit on boosters carrying larger payloads. Some continued the ELINT mission pioneered by Poppy; others collected communications intelligence (COMINT).[‡] A few systems, such as Hayloft and Noah's Ark, both ELINT collectors, flew single missions before being terminated. Others continued for longer periods of time, though not as long as Poppy. By 1964, the NRO had successfully orbited thirty-five SIGINT collectors in forty-one attempts.[11]

‡ (U) COMINT and ELINT combined form SIGINT.

~~(S//TK//NF)~~ The NRO's family of photo-reconnaissance satellites was much smaller, numbering only two types, both film return systems, throughout the 1960s. The previously mentioned Corona was the first, enjoying initial success in August 1960. Over the next decade, technicians steadily improved Corona's reliability, added a second film magazine to each satellite and improved the resolution from 35 feet on the first mission to about 5 feet a decade later. In 1963, the first version of the Gambit imaging satellite went into orbit carrying an optical system with a 2.5-foot resolution (improvements to the Gambit optics yielded [redacted] resolution in the mid-1970s.) The two satellite systems complemented each other very well; Corona conducted broad area search while Gambit provided detailed imagery. Corona flew eighty-nine successful missions during the 1960s; Gambit flew fifty-five.[12]

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(U) The Formative Years of NASA

(U) Meanwhile, Eisenhower's most visible reaction to Soviet achievements in space was also making its mark. In July 1958, the President signed into law the "National Aeronautics and Space Act of 1958," transferring to an as yet unidentified civilian agency all non-military space programs, whether manned or unmanned. The new agency was to be a completely unclassified entity dedicated to international cooperation and the peaceful exploration of space.[13]

(U) The Eisenhower Administration first turned to the National Advisory Committee for Aeronautics (NACA) to carry out the new mission, but found it wanting. NACA, established in 1915 to keep the nation competitive in aviation, had relatively little experience with missiles, though work in that area increased after World War II. Moreover, it was small, lacked requisite numbers of scientists and technicians, and had little experience in managing large projects. Still, NACA could serve as the nucleus for the new organization, and on 1 October 1958 the newly created National Aeronautics and Space Administration (NASA) became operational, replacing NACA as it did.[14]

(U) Hugh Dryden, the much-respected head of NACA, was the obvious candidate to be NASA's first administrator, but his modesty and quiet demeanor counted against him. Congress wanted someone more assertive, especially in dealing with the press. He was also cautious about manned space flight, once stating that putting a man in space just to beat the Soviet Union to the punch had the same scientific merit as shooting a circus lady out of a cannon. That put him in general agreement with Eisenhower, who also had little enthusiasm for manned space flight, but not with Congress and public opinion. Instead, the job offer went to T. Keith Glennan, the President of Case Institute of Technology, although he too was skeptical of manned space flight. Glennan accepted, but only after Dryden supported his appointment and agreed to serve as deputy administrator.[15]

~~(S//NF)~~ NACA bequeathed to NASA 8,000 staff spread among the Lewis Research Center in Ohio, Langley Research Center and Wallops Island rocket test range in Virginia, and the Ames Research Center and Muroc test range in California. These assets, though impressive on paper, were not sufficient to carry out NASA's mission, so Glennan made acquiring additional resources his first priority. The military space programs were obvious targets. The Navy readily gave up its Vanguard program and associated personnel, thereby putting itself out of the space business. The Army likewise ceded its Jet Propulsion Laboratory in California and Redstone Missile Program. The nation's meteorological satellite program and the Saturn Program, charged with building a heavy lift booster, came under NASA control in 1959.[16]

(U) The prize, however, was the Army Ballistic Missile Agency (ABMA) at Huntsville, Alabama. The agency's director, Maj. Gen. John Mederis, resisted furiously, but in Glennan's blunt summation, "He simply didn't have the cards."[17] By mid-1960, the ABMA was in NASA's hands. Among other things, the transfer brought with it 6,400 personnel that included about 150 German scientists and engineers, Wernher Von Braun among them. The Army was now completely out of the space business. Only the Air Force enjoyed any success against Glennan's predations by preserving some space-related activities. Even so, it lost Project Mercury, America's first manned space program, and all lunar missions to NASA.[18]

(U) Despite accumulating an impressive assortment of assets and having total or partial control of twenty-seven space-related projects, NASA was slow getting started. Eisenhower's doubts about competing with the Soviets for supremacy in space, popularly known as the "space race," and his well-known determination to keep the federal budget under tight control, were in large measure responsible for the lag. Meanwhile, the Soviet Union continued making space history, much to the dismay of the American public.

(U) In September 1959, the Soviets sent Luna-2 plunging into the lunar surface, over four years before the United States accomplished that feat. The following year the Soviets sent a camera-equipped satellite around the moon, electronically returning the first pictures of that body's far side. Then, on 12 April 1961, Soviet Cosmonaut Yuri Gagarin became the first man in space when he made a single orbit of the earth in his Vostok spacecraft. Impressive as those achievements were, they did not override the growing perception in both Moscow and Washington that the gold medal in the space race would go to the nation that first landed a man on the moon and returned him safely to earth.[19]

(U) True to form, Eisenhower saw no need for a manned lunar mission, once stating that he didn't care if anyone ever reached the moon. Not surprisingly, funding for a lunar mission remained small. In fact, by the end of his presidency, Eisenhower had become so disillusioned with manned space flight that he was considering cancelling all such programs. Manned missions represented everything he wanted to avoid in space programs. They were hugely expensive, driven almost entirely by competition with the Soviet Union, and devoid of compelling scientific rationale.[20]

(U) Things began changing in January 1961 when John F. Kennedy entered the White House. The new President already knew from an ad hoc committee report that NASA could not, as constituted and funded, answer the Soviet challenge. Yet, Kennedy favored overtaking the Soviets in all aspects of space, including beating them to the moon. That required, first of all, an aggressive NASA administrator. The new President offered the job to James Webb, Director of the Bureau of the Budget and Under Secretary of State during the Truman administration and more recently a veteran of the Oklahoma oil business.[21]

(U) Webb accepted and kept Dryden as his deputy. He then appointed former MIT professor and RCA executive Robert Seamans as associate administrator to take advantage of his excellent grasp of management techniques. During the next several years, Seamans, more than anyone else, would play an important role in NRO-NASA relations. An even tempered man blessed with a sense of humor, he was willing to compromise to get things done, an important quality in dealing with the NRO. This highly qualified troika guided NASA until Dryden's untimely death in 1965.[22]

(U) Despite his desire for a vigorous space program, Kennedy had only the broadest outlines in mind. Shortly after Yuri Gagarin orbited the earth, the President asked Webb how much it would cost in the long run to overcome the Soviet lead in space. The President recoiled at the $40 billion answer, but a report written by Webb and McNamara emphasizing national prestige, the scientific knowledge to be gained, and Gagarin's success changed his mind. On 25 May 1961, Kennedy publicly announced what

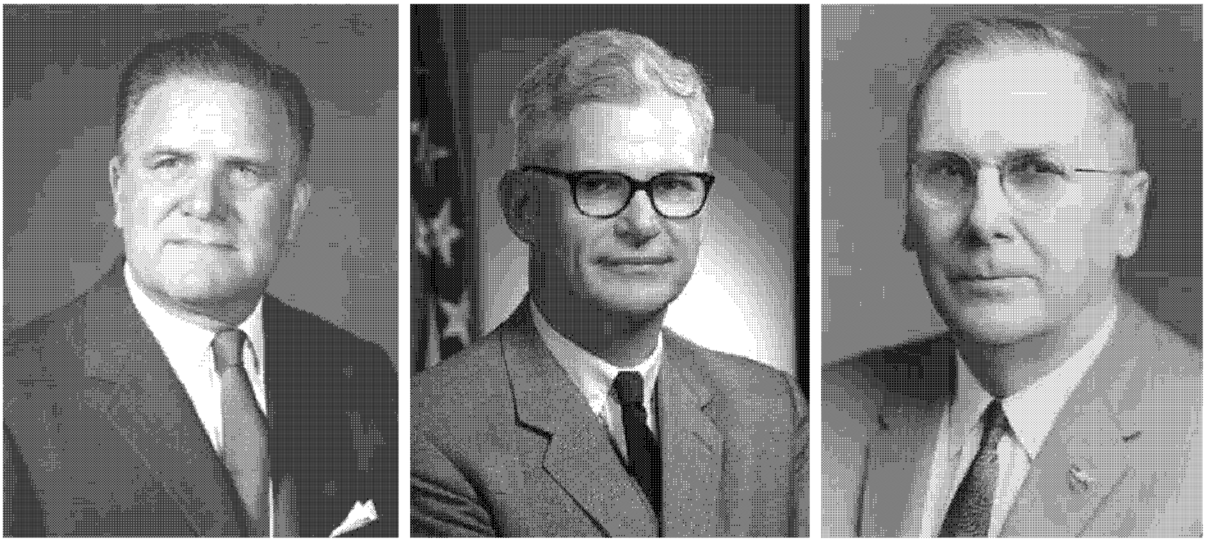

Figure 1-3. (U) The NASA troika, from left: James Webb, Robert Seamans, and Hugh Dryden. (Images: UNCLASSIFIED)

would dominate the American space effort for years to come, a manned lunar landing before the end of the decade. Project Apollo would execute that mission at a projected cost of about $20 billion.[23]

(U) Webb thought Apollo's goals were attainable, but completing manned lunar mission before 1970 was still a tall order. As of May 1961, NASA had one manned space program, Mercury, which had not beaten the Soviet Union into space, and an annual budget of only $1.2 billion. After Kennedy's decision, however, the public purse sprang open and the space program rapidly moved forward. NASA initiated plans for a manned spaceflight center near Houston, Texas, and the Cape Canaveral, Florida, launch complex began a significant expansion. In October 1961 North American Aviation won the contract for Apollo's command module. Two months later, NASA inaugurated Project Gemini, essentially a larger, two-man version of the Mercury spacecraft, to train additional astronauts and perfect rendezvous-in-space techniques. Gemini would also keep NASA in the public eye between the end of Mercury in 1963 and the first Apollo flight approximately four years later.[24]

(U) By 1964, NASA's annual budget stood at $5-$6 billion, greater than the budgets of some nations and sufficient to retain the services of over 400,000 individuals, about 90 percent of whom were in private firms under contract. The vast majority of the money went into manned space flight programs, much to the displeasure of some NASA staff. The disgruntled staffers, in an opinion reminiscent of Eisenhower's, believed that manned space flight siphoned off too much money from NASA's other major obligation, the scientific exploration of space. Webb tried to dispel that belief by ordering a reorganization that placed space science on a par with manned space flight, but he was a bit late. The perception of an agency bifurcated between manned space flight and everything else had already taken root. Some even speculated that NASA's very existence rested on manned space flight. The "no manned missions, no NASA" paradigm resonates internally to this day.[25]

~~(S//TK//NF)~~ The validity of the manned space flight versus scientific exploration split is beyond the scope of this study, but for sure the former dominated NASA throughout the 1960s with Apollo leading the way. Yet despite the money and talent involved, NASA still needed assistance that only the NRO could provide. There were no legal barriers in the way, but procedures to affect the necessary technological transfer without compromising either the NRO or NASA had to be worked out. Further, creating those procedures meant taking into account the ongoing international debate over the uses of space.

(U) The Uses of Space: A Balancing Act

(U) When Sputnik-1 went into orbit, outer space was as yet unencumbered by legal conventions. The best earth-bound analogy in the opinion of the United States was the high seas outside those contiguous waters claimed by nations with shore lines. No one owned the high seas, only international law applied, and all nations had freedom of access. Still, space was a totally new frontier and there were widely divergent opinions as to what principles should govern it, what types of missions could be flown and what kind of observations could be made from earth orbit.

~~(S//NF)~~ High government officials in Washington knew well before Sputnik that spaceflight in general and space reconnaissance in particular were going to generate controversy. By 1954 the Eisenhower Administration had already decided that scientific satellites should have first priority. Such satellites could truthfully be presented as non-threatening vehicles dedicated to enhancing the world's store of knowledge for the benefit of all mankind. Reconnaissance vehicles should wait until world opinion accepted scientific satellites. Eisenhower honored the spirit of the science-first decision by having the nation's first reconnaissance satellites—Corona and Grab/Dyno—fly under scientific cover. He could not honor the letter of that decision because the times did not permit him to do so. It might take years to get general acceptance of any observations from space, much less space reconnaissance. The nation urgently needed hard facts from behind the Iron Curtain, information no longer furnished by U-2s.

~~(S//NF)~~ American space policy of the early 1960s balanced professions of openness with secrecy and stonewalling. The openness came from the nation's position, based on the high seas analogy, that all nations had freedom of access to space and only international law applied. Outer space was free for exploration and use as long as it was in conformity with international law. That was also the United Nations' position as codified in a resolution sponsored by the United States. NASA offered support by openly flying missions under ground rules crafted to avoid confrontations and by pursuing multilateral development of non-military satellites.[26]

(U) America's openness did not extend to its reconnaissance satellites, which is where the secrecy came in. True, previous American and Soviet satellites had established the right of over flight, but not over flight for the purpose of reconnaissance. In fact, no legal conventions sanctioned reconnaissance of any type if flown without permission from the observed nation. That allowed Moscow to denounce, with complete justification, U-2 missions flown over the Soviet Union as blatant violations of international conventions to which the United States was signatory.

(U) Complete secrecy, therefore, surrounded the NRO and its satellite reconnaissance programs. Official policy maintained that observations from space were perfectly legal and that program secrecy did not mean nefarious intent. Looking further ahead, the argument continued, satellites could benefit all mankind through geologic surveys, weather forecasting, mapping, disaster relief, communications, and disarmament verification. The United States acknowledged developing reconnaissance satellites, but refused to release details or even admit that such spacecraft were already operational. The whole topic of satellite reconnaissance was so sensitive that unclassified discussions and correspondence employed euphemisms such as "photographic" or "observation." Using the word "reconnaissance" even at collateral classification levels also appears to have been taboo.[27]

Figure 1-4. (U) MIT President, Presidential Science Advisor, and longtime head of the PFIAB James Killian. (Image: UNCLASSIFIED)

(U) A number of nations, including some allies, were uneasy with America mixing professed openness with de facto secrecy. Moscow took full advantage of that unease. Khrushchev equated space reconnaissance with U-2 over flights, demanded an international convention banning such activities, and stated that nations had the right to take appropriate action against those missions. Part of Khrushchev's ire stemmed from the Soviet Union not yet having reconnaissance satellites, but he succeeded in putting the United States on the defensive before the international community. That did not, however, result in any release of information about America's classified programs. Instead, national policy was to stonewall by repeating *ad nauseam* that space was open to all, observation from space were legal, and refusing to reveal any information about the nation's space reconnaissance programs.[28]

(U) In May 1962, the President's Foreign Intelligence Advisory Board (PFIAB), a civilian watchdog committee that reviewed national intelligence activities, took note of the pressure being brought to bear on America's space programs. In a letter to Kennedy, PFIAB chairman James Killian warned of potential danger ahead. Discussions in the United Nations, forthcoming disarmament talks, and a suspicious international community might encroach on the nation's ability to carry out satellite reconnaissance, something that must not happen. The information from those programs was too vital to national security. The board recommended, *inter alia*, a complete review of procedures and policies with an eye to preventing any foreclosure, diminishment, or compromise of national programs.[29]

(U) The President responded on 26 May 1962 by signing National Security Action Memorandum (NSAM) 156. The directive tasked the State Department with convening a high-level panel to recommend policies protecting national programs while allowing the nation to work toward disarmament and international cooperation in space. The panel members selected should be fully cognizant of all programs involved. Kennedy wanted the panel's report and attendant recommendations by 1 July.[30]

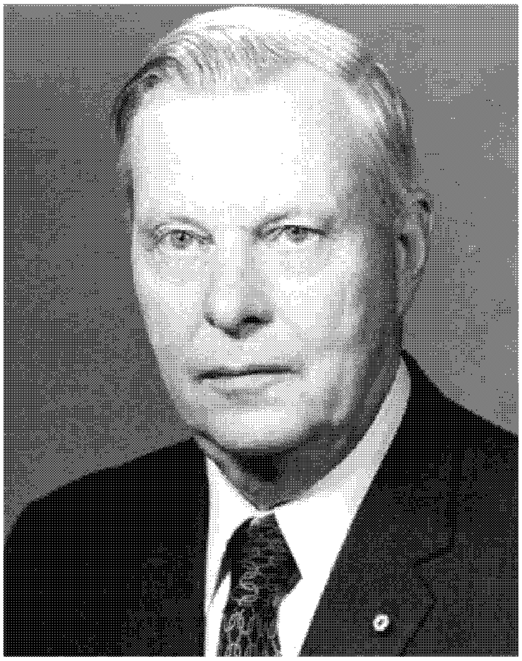

Figure 1-5. (U) Longtime head of NSAM 156 Committee U. Alexis Johnson. (Image: UNCLASSIFIED)

(U) U. Alexis Johnson, Deputy Under Secretary of State, chaired the panel, known as the NSAM 156 Committee. The NRO, DOD, the CIA, NASA, the White House staff, and the Arms Control and Disarmament Agency sent representatives. On 30 June, the committee's report, National Security Council Action (NSCA) 2454, "Report on Political and Informational Aspects of Satellite Reconnaissance Policy," arrived on Kennedy's desk.[31]

~~(S//NF)~~ NSCA 2454, also known as "the 18 Points," noted the inconsistent opinions as to what constituted peaceful or aggressive, military or civilian, and legal or illegal activities, as well as the lack of a settled regime on law governing outer space. That said, America's space operations did not threaten anyone and, on balance, the programs were on legal grounds. Political or physical interferance with those programs by any foreign nation must not be tolerated, exactly what Killian had earlier stated.[32]

~~(S//NF)~~ The committee reiterated that only international law applied in space and that the United States should support the legitimacy of reconnaissance satellites while continuing to euphemistically call them "observation" satellites. NASA should aggressively pursue international cooperation in civilian space ventures involving photography to help validate the principle of satellite reconnaissance. The reconnaissance programs themselves should remain secret, but with one significant exception. Noting that complete secrecy made it difficult to gain international support, the panel counseled that American envoys, at the proper time and under the proper conditions, *verbally* disclose selected information about reconnaissance satellites to representatives of allied and neutral nations. American representatives so informed all North Atlantic Treaty Organization (NATO) heads of state and foreign ministers by the end of 1963. Kennedy also wanted to extend disclosure to Soviet officials, probably including Khrushchev himself, but the committee recommended strongly against it.[33] Appendix 1 contains NSCA 2454.

~~(S//NF)~~ National policy as restated by the NSAM 156 Committee, with the exception noted above, endorsed much the same combination of professed openness, de facto secrecy, and occasional stonewalling that had been in place for a period of time. Therein lay a problem destined to endure for three decades: how could NASA, which thrived in the full light of publicity and served as a model of openness, do business with the NRO, an organization so wrapped in blankets of secrecy that none dare speak its name outside of designated secure areas?[34]

(U) In all likelihood, the first recorded NASA-NRO interaction did not test the security issue. The Corona imaging satellites needed accurate weather data so as not to waste precious film on cloud cover, something that happened all too often. The best answer was "scout" weather satellites that electronically downlinked television pictures in the same orbit and somewhat ahead of Corona satellites. Controllers could then assay the cloud cover and determine which targets to attempt and which to bypass.[35]

(U) NASA's Tiros weather satellite, first launched in April 1960, did not meet NRO requirements due to its limited scanning parameters. NASA promised an improved vehicle, the National Operational Meteorological Satellite System, but not until 1963 or 1964. That timetable did not satisfy Charyk, and in mid-1961 he initiated what became the Defense Meteorological Satellite Program (DMSP) whose schedule called for a first launch in ten months. In May 1962, the first DMSP satellite entered polar orbit as a weather scout for Corona.[36]

(U) The collaboration on a weather satellite, which might better be termed an attempted collaboration, did not bear fruit, but the next effort had quite a different outcome. As the DMSP program got underway, the two space agencies were moving toward their first true partnership, the transfer to NASA of NRO technology in support of the nation's preeminent space program, Project Apollo.

(U) Lunar Reconnaissance: The First Major Collaboration

(U) The Apollo program numbered among its early concerns locating suitable landing sites for the Lunar Excursion Modules (LEMs) scheduled to ferry astronauts from Apollo command modules in low lunar orbits to the moon's surface and back. The moon's dark areas, known as "seas," were actually massive lava flows that were much smoother than the lighter colored mountainous terrain and offered the best landing areas. Still, the seas contained many small craters and copious amounts of ejecta thrown up by numerous impacts that might damage or prove fatal to LEMs and their crews. Locating landing sites required reconnaissance quality cameras to image the moon's surface from satellites in low lunar orbit and electronically return the images to earth. NASA had no such cameras, but the NRO did.[37]

(U) Recall that when Corona separated from Samos in 1958, the former concentrated on returning film to earth, the latter on electronically downlinking images. Both systems worked. Samos developed exposed film onboard the satellite using a process similar to that of a Polaroid camera. A scanner moved back and forth across the developed negative picking up patterns of light and dark as it did so. The light and dark patterns next modulated an electronic signal transmitted to a California ground station for translation into photographs.[38]

(U) In January 1961, Samos flew its only mission, downlinking a few photographs before the system failed, probably due to a film jam. The images had a resolution of about 100 feet, making them of little value to intelligence and Samos had little potential for growth and improvement. Charyk cancelled the program later that same year.[39]

(U) In April 1961, unnamed NASA representatives called on Col. William King (USAF), the Samos program manager. The group wanted to evaluate the Samos camera for possible use in a lunar program as yet unnamed, but obviously Apollo. King gave his visitors a chilly reception. He considered them naïve about imaging from space and by implication unable to benefit from access to Samos technology. Charyk proved more accommodating, authorizing NASA to make direct contact with the camera's manufacturer, Eastman Kodak.[40]

(U) In reality, Charyk could not have summarily denied NASA's request even if he had been so inclined. The National Aeronautics and Space Act of 1958, NASA's founding document, identified a number of objectives for the nation's space programs. Two of those objectives were:

> THE MAKING AVAILABLE TO AGENCIES DIRECTLY CONCERNED WITH NATIONAL DEFENSES OF DISCOVERIES THAT HAVE MILITARY VALUE OR SIGNIFICANCE, AND THE FURNISHING BY SUCH AGENCIES TO THE CIVILIAN AGENCY ESTABLISHED TO DIRECT AND CONTROL NONMILITARY AERONAUTICAL AND SPACE AGENCIES, OF INFORMATION AS TO DISCOVERIES WHICH HAVE VALUE OR SIGNIFICANCE TO THAT AGENCY.
>
> AND
>
> THE MOST EFFECTIVE UTILIZATION OF THE SCIENTIFIC AND ENGINEERING RESOURCES OF THE UNITED STATES, WITH CLOSE COOPERATION AMONG ALL INTERESTED AGENCIES OF THE UNITED STATES IN ORDER TO AVOID UNNECESSARY DUPLICATIONS OF EFFORT, FACILITIES, AND EQUIPMENT.[41]

In other words, NASA and government agencies, including those associated with national security, of which the NRO was a component, must share information and work in cooperative endeavors when necessary. Although exemptions could surely have been made when national security might be jeopardized, such exemptions required justification. In the case of Samos, such justification was not possible.

~~(S//NF)~~ Given that NASA and the national security establishment must work in concert, it should come as no surprise that NASA had previously made forays into the world of intelligence and reconnaissance. The CIA furnished briefings and studies to NASA beginning in 1958 and a year later placed NASA on routine distribution for some intelligence publications. In return, NASA, and NACA before it, provided cover for the CIA's U-2s as weather reconnaissance aircraft until Powers' ill-fated mission on 1 May 1960. By 1961, NASA was assaying the effects of sonic booms in support of the CIA's nascent A-12 reconnaissance aircraft and helping intelligence agencies analyze spacecraft debris fallen to earth. Still other NASA activities included having its personnel serve on selected CIA panels and working on joint studies. Gaining technical support for Apollo would, however, involve NASA with the hyper security surrounding the NRO.[42]

~~(S//NF)~~ The next documented discussion related to NASA's lunar reconnaissance requirements took place in late 1962 when Associate Administrator Seamans met with John Rubel, the Director of Defense Research and Engineering (DD/R&E), whose duties included coordinating NASA-DOD activities. The two men agreed on what the reconnaissance requirements were, but several more months passed with no evidence of any follow up. In particular, NASA did not identify any particular type of lunar reconnaissance program or take initiatives toward involving other government agencies.[43]

~~(S//NF)~~ That changed abruptly in early May 1963 when a NASA contingent headed by Joseph Shea of the Manned Lunar Project Office met with a DOD delegation led by Eugene Fubini, who succeeded Rubel as DD/R&E. Shea laid out an agenda that included photographic reconnaissance from both unmanned vehicles and manned Apollo spacecraft flying lunar orbiting missions prior to any landing attempt. Further, Apollo spacecraft in earth orbit would fly photographic missions to evaluate equipment and train crew members. Shea believed that DOD, meaning the NRO, could help by virtue of its reconnaissance experience. The scope of NASA's ambition surprised Fubini and apparently annoyed him that he had not been informed earlier, but he agreed to review the plan. He then informed McNamara and NRO Director McMillan of the meeting.[44] (b)(1) (b)(3)

~~(S//NF)~~ Over the next several weeks Webb, Seamans, DCI John McCone, and others discussed procedures to simultaneously allow NASA access to sensitive reconnaissance equipment [redacted] Webb proposed having NASA let an unclassified contract for the camera system, [redacted] Webb pressed for a quick decision but McCone resisted in the interest of security, an issue destined to cloud NRO-NASA relations in later years. Despite the mandate in the National Aeronautics and Space Act of 1958, one of his many duties was protecting sources and methods of intelligence, including satellite reconnaissance, from compromise. He wanted time to weigh the implications of NASA, an above board national agency not noted for being security conscious, engaging companies associated with classified reconnaissance systems. Moreover, he wanted the initial focus limited to an unmanned lunar orbiter.[45]

~~(S//NF)~~ McCone was not alone in his concern. Albert Wheelon, the CIA's Deputy Director of Science and Technology and Director of NRO Program B, thought that the Agency, not NASA, should handle all contracts in the interest of security. Fubini was blunt about it. NASA, in his estimation, could not even control classified information much less protect sensitive national programs, an opinion echoed by some NRO staff. More temperate individuals saw the security problem as difficult, but not insurmountable, and there could be no ironclad assurance against compromise. Nevertheless, and despite the concerns voiced, Fubini asked the NRO to assess available cameras for one compatible with a lunar-orbiting satellite and capable of electronically returning images to earth. Like McCone, Fubini first wanted an unmanned orbiter, one that used extant technology and could be made operational in a relatively short time.[46]

~~(S//TK//NF)~~ A draft accord to permit the NRO's participation in Apollo started its way through coordination on 10 July 1963. It bore the title "DOD-NASA Agreement on NASA Reconnaissance Program." The draft recognized NASA's requirement for both manned and unmanned lunar reconnaissance and to occasionally test equipment in earth orbit. It obligated the NRO to develop the necessary technology, identify contractor resources, and implement appropriate security measures. NASA had authority to, as Webb had earlier suggested, initiate unclassified contracts with those contractors identified by the NRO. The contracts would contain just enough information for contractor personnel without special clearances to work on peripheral components such as electronic circuits, thermal protection, and power supplies. The real authority, however, resided with [redacted] (b)(1) (b)(3)

~~(S//NF)~~ The draft's coordination and approval process took six weeks. The most noticeable alteration was the title changing along the way to "DOD/CIA-NASA Agreement on NASA Reconnaissance Programs." McCone probably insisted that the CIA be incorporated in the title so he could more closely involve himself and better discharge his responsibility to protect sources and methods of intelligence.

Seamans wanted separate pacts for manned and unmanned programs, but that did not gain approval, at least not initially. Otherwise, the draft survived very much intact. On 28 August 1963, Webb and Deputy Secretary of Defense Roswell Gilpatric signed the agreement.[48]

~~(S//NF)~~ An accompanying security annex, signed by McMillan and Seamans, spelled out specific classifications for forty items. Unclassified items included the "fact of" a DOD-NASA agreement that manned lunar missions would carry cameras developed by the Air Force and that source selection was underway. BYEMAN security protected most other provisions, including the existence of an NRO-NASA relationship, the text of the 28 August agreement, and information contained in proposals submitted by civilian firms.[49] Appendix 2 contains the 28 August 1963 DOD/CIA-NASA agreement. Appendix 3 contains the associated security annex.

~~(S//NF)~~ In the meantime, NRO representatives had been searching for a camera that met NASA's requirement for a 5-foot resolution from a 24-mile high lunar orbit and electronically transmit imagery back to earth. The search did not take long, since there was only one system with that capability and NASA already knew about it. Within two weeks, and probably sooner, attention centered on Samos and its Eastman Kodak manufactured E-1 and E-2 cameras. The two cameras differed in several areas, most notably in their focal lengths and resolutions. The E-1 camera flew on the only Samos mission in January 1961; the more capable E-2 never ventured into space. See Table 1-1 for a side-by-side comparison of the two cameras.[50]

~~(S//NF)~~ On 24 July 1963, NASA, NRO, and CIA representatives met with Fredrick C. E. Oder, a retired Air Force colonel involved with Samos in the 1950s, and now an Eastman Kodak executive. Oder saw no impediments to modifying either the E-1 or E-2 to meet NASA's specifications. Eastman Kodak technicians agreed, stating that the firm could produce a modified camera weighing perhaps 120 pounds and capable of at least a 7-foot resolution. At Fubini's request, Eastman Kodak promised a technical proposal within a week. The only unusual aspect of this exchange was the stipulation that the satellite make only a single imaging circuit of the moon, develop and store the exposed film onboard, and return to within one thousand miles of earth before transmitting imaging data. The communications equipment available at the time imposed that mission profile, though it was never implemented when later technical advances made possible transmissions directly from lunar orbit.[51]

Table 1-1. ~~(S//NF)~~ Samos E-1 and E-2 Cameras: A Comparison

	E-1	E-2
Focal length (inches)	6	36
Operating altitude (miles)	260	260
Best Ground Resolution (feet)	100	20 (projected)
Shutter Speed (seconds)	1/50	1/100
Strip Width (miles)	100	17
Vehicle Life (days)	15-30	30-60 (projected)
Film Capacity (feet)	1200	4520
Projected Coverage during Vehicle Life (square miles)	42X106	6.7X106
Stereo	No	No

~~(S//NF)~~ Source: Memorandum for the Director of Defense Research and Engineering (S), Sub: Review and Recommendations of USAF Satellite Project SAMOS, Annex D, July 1960, Folder 21, Box 1, Job 199700073, NROARC.

~~SECRET//NOFORN~~

(U) With the NASA-NRO agreement signed, NASA established a Lunar Orbiter Program Office in September 1963. The new office immediately solicited proposals to fabricate a family of unmanned Lunar Orbiters and associated camera systems. The original plan called for ten orbiters, but NASA halved the number later in the year.[52] Five civilian firms—Lockheed, Boeing, Martin, Space Technology Laboratory (a division of Thompson-Ramo-Wooldridge), and Hughes—responded.

(U) NASA's Selection Evaluation Board found the Hughes, Space Technology Laboratory, and Martin proposals wanting. Hughes offered a spin stabilized satellite that imposed unacceptable limits on a proposed photographic system already burdened with excessive developmental risks. Moreover, the electrical power system was poorly designed. Space Technology Laboratory also proposed spin stabilization, which placed the same limits on a photographic system that also carried excessive developmental risks. Worse, the communications system did not meet specifications. Martin called for three-axis stabilization, which did not limit the camera system. The camera, onboard film processor, and communications capability passed muster, but post-launch operational procedures did not, and the overall satellite lacked adequate redundancies in critical subsystems.[53]

(U) The Lockheed and Boeing proposals, both with three-axis stabilization, were closely matched. Lockheed proposed a very efficient spacecraft based on technology the company had used on previous space vehicles, something that the selection board cited as a positive factor. The proposed photographic system was almost ideal for the purpose intended, but the onboard film processor required further development that might increase costs and cause delays. Still, the quality of the overall design kept Lockheed in the running. [54]

~~(S//NF)~~ In its proposal, a teamed effort with Eastman Kodak, Boeing showed a solid understanding of requirements, displayed a welcome flexibility should those requirements change, and, like Lockheed, incorporated proven technology in its design. What most impressed NASA evaluators, however, was the camera system and onboard film processor. That the camera and processor attracted favorable attention did not surprise knowledgeable personnel—the NRO had given Eastman Kodak permission to incorporate the technology the firm had developed for Samos in its portion of the proposal. Whether selection board members knew of the Samos connection is uncertain, but they gave the Boeing proposal high marks.[55]

~~(S//NF)~~ In December 1963, Seamans selected the Boeing-Eastman Kodak tandem for contract award and Webb subsequently endorsed the decision. Although the available documentation does not say so, the NRO, by virtue of the provisions of the 28 August agreement and its knowledge of reconnaissance camera systems must have played a role in the selection process.[56]

~~(S//TK//NF)~~ Then came the first problem, one related to security. Not long after the 28 August 1963 accord went into effect, McMillan decided that allowing NASA to enter into unclassified contracts with providers of sensitive equipment had been a mistake. Such contracts, in his opinion, did not provide adequate cover for the NRO's participation and opened the door to security breaches by having too many uncleared personnel involved. Better to have the NRO covertly manage all reconnaissance related procurement without any unclassified contracts. [redacted] (b)(1)
(b)(3)

~~(S//NF)~~ Martin met with Seamans on 6 February 1964. The associate administrator found himself in general agreement with McMillan’s argument and brought the matter to Webb’s attention. The NASA administrator raised minor objections, but, despite his earlier support of unclassified contracts, he now acknowledged that they were unnecessary. A week later, NASA agreed not to proceed with any further unclassified contracts relative to lunar reconnaissance.[58]

~~(TS//TK//NF)~~ In late March, McMillan and Seamans endorsed a “Supplemental Agreement on NASA Reconnaissance Programs’ [redacted] The two-man management team remained in place, as did provisions releasing selected information to personnel without special access so they could work on certain subsystems.[59] Appendix 4 contains the supplemental agreement.

(b)(1)
(b)(3)

* * * * *

(U) Given the international climate of the early space age, the entire American space program had to tread lightly. Satellites were new and little understood, particularly when it came to observations, civilian or otherwise, from space. Questions as to whether individual nations had the right to limit observations and whether those observations infringed upon national sovereignty and violated international law were prevalent and understandable. Spaceborne reconnaissance had no international acceptance at all. Hence, the United States supported the free use of space while denying it had already had a spaceborne reconnaissance capability as its best option, at least until the world community worked its way through the many difficult political questions of the early space age.

(U) It was against this background that NASA approached the NRO for assistance in the Lunar Reconnaissance Program. There was no doubt that such assistance would be forthcoming even though it placed both parties at some degree of risk. NASA could ill afford the damage to its public persona if its association with reconnaissance became public knowledge. The NRO, highly classified to shield a collection capability and stay out of the international limelight, risked having its mission compromised and perhaps its existence threatened if security measures failed. True, the 28 August 1963 agreement, negotiated with little difficulty, satisfied both parties, but the scenario of close NASA-NRO couplings and concerns over security would repeat several times in the years to come.

~~(S//NF)~~ Another reason that the two parties reached easy agreement on lunar reconnaissance was the NRO’s indifference to missions and sensors that looked skyward or targeted other worlds; its interests were in earthward-looking missions. However, that clear-cut division between upward and downward looking missions was about to end as NASA began planning planetary observations from low-earth orbit. Earth observations for peaceful purposes were legitimate NASA missions, but not if they edged over into quasi-reconnaissance. That looming problem, plus the systems acquisition and operational phases of the Lunar Reconnaissance Program are treated in the next chapter.

(U) Chapter Two

(U) The First Years of Significant Interaction, 1964-1967

~~(S//NF)~~ In 1963, NASA turned serious attention to identifying landing sites for the Lunar Excursion Modules (LEMs) scheduled to transport astronauts from Apollo command modules to the moon's surface and back. In June of that year, NASA addressed the problem by proposing a lunar photo-reconnaissance program, first using unmanned vehicles and then manned Apollo spacecraft orbiting, but not landing on, the moon. Because it lacked requisite optical systems, NASA asked the NRO to provide camera technology from its inventory. That led to a 28 August 1963 Department of Defense (DOD)/CIA-NASA agreement, modified in early 1964, allowing the NRO to make the technology transfer on a highly classified basis. The accord was both the beginning of the Apollo Program's first spaceborne segment and the first significant interaction between the nation's two premier space agencies.

(U) In December 1963, NASA selected The Boeing Company to build the five Lunar Orbiters destined to make up the unmanned portion of lunar reconnaissance. Boeing's success owed much to having Eastman Kodak, a major contractor for NRO optical systems, as its partner and the NRO secretly giving permission to incorporate technology from the defunct Samos photo-reconnaissance satellite in their proposal.

(U) Then in April 1964, NASA began the Lunar Mapping and Survey System (LM&SS), the manned phase of its Lunar Reconnaissance Program. The LM&SS is not as well known as the Lunar Orbiter portion, but it too involved the NRO. Whereas the NRO technology used in the Lunar Orbiters was obsolescent, if not obsolete, the LM&SS benefited from state-of-the-art systems. The system acquisition and operational phases of the Lunar Reconnaissance Program is the first major theme of this chapter.

~~(S//NF)~~ Elsewhere, another problem was just peering over the horizon. The 28 August 1963 agreement and supporting material dealt exclusively with lunar missions. The documentation made no reference to near-earth activities beyond acknowledging NASA's right to test lunar reconnaissance systems in earth orbit. Yet by 1964, NASA was actively planning earth observation missions in earth orbit, an area as yet untouched by negotiations, much less formal accords. The NRO objected to these plans, citing possible compromises of American technology in general and its own mission in particular. How NASA and the NRO reached agreement on ground rules for earth observation missions that at least minimally satisfied all concerned is the second major theme of this chapter.

(U) Lunar Orbiter Acquisition

(U) In May 1964, NASA and Boeing signed an $84 million acquisition contract that set delivery of the first two spacecraft for May 1966 and scheduled the first launch two months after that. The contract also called for all five orbiters to be in government hands by the end of that year. The short lead time made it incumbent upon Boeing, relying heavily on proven technology, to produce a reliable vehicle on the first try. There would be no time for extensive modifications and retesting. If the firm met all contractual obligations it stood to earn $4.7 million in profits.[1]

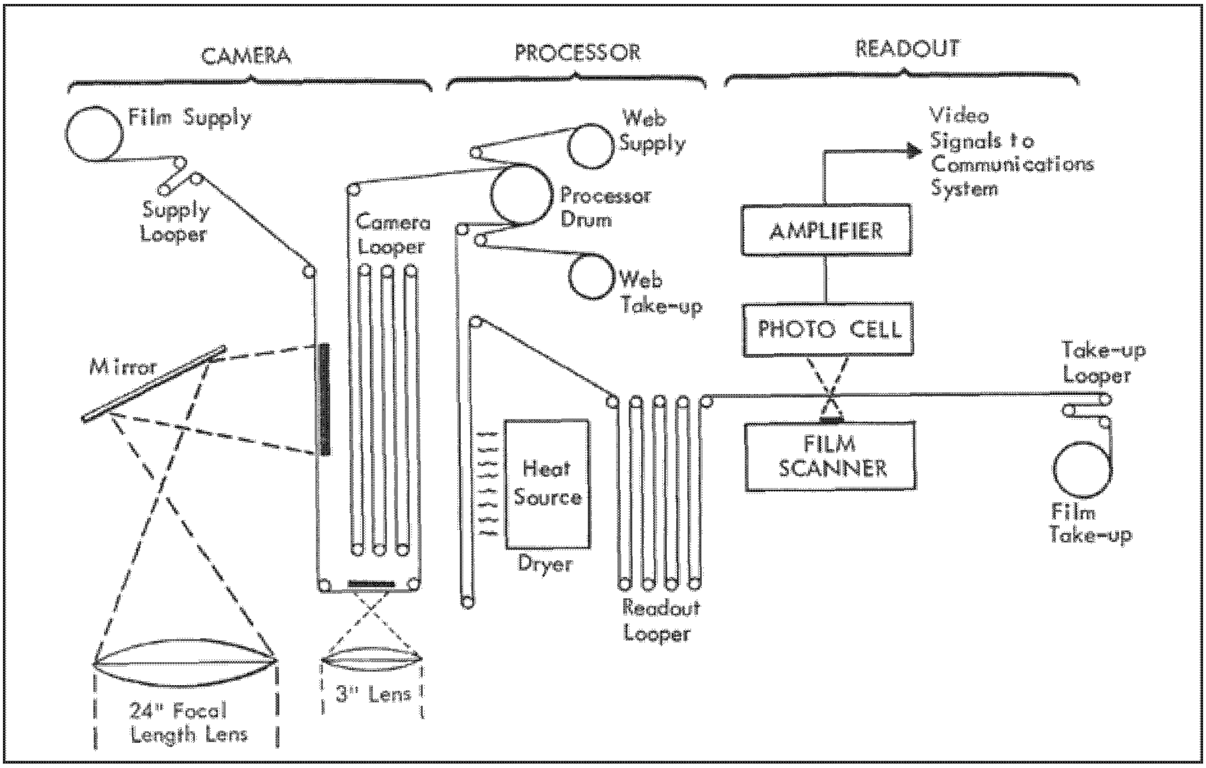

Figure 2-1. (U) Schematic of the Lunar Orbiter photographic subsystem. (Image: UNCLASSIFIED)

(U) The Lunar Orbiter featured a modified version of the Samos E-1 camera system. The E-1's 6-inch focal length lens, which could not satisfy NASA's resolution requirements, would be replaced with two lenses. A 3.2-inch focal length Schneider-Xenotar lens promised a 26.7-foot resolution from low lunar orbit, suitable only for wide area coverage. An off-the-shelf 24-inch telephoto lens procured from Pacific Optical could theoretically provide stereographic images with a 40-inch resolution, much better than the 5 feet NASA had originally specified. The two lenses, mounted side-by-side, would use the same camera and film supply. Both would be bore sighted to image the lunar surface from an altitude of 30 miles. Two secondary payloads would measure the moon's shape and gravitation field, along with micrometeoroid activity and radiation flux in the near-lunar environment.[2]

(U) The camera's film processing section was very nearly the same as that on Samos. Exposed film was developed onboard and stored on a series of loops until the satellite came within line-of-site of its earthly ground station. At that point a photomultiplier converted the light and dark patterns on the film into an analogue electronic signal. The satellite's communications system then transmitted the electronic signal earthward at a frequency of 2.295 GHz in the S-band (2-4 GHz) spectrum. Lastly, the ground station more-or-less reversed the process to reconstruct the original images.[3]

(U) The overall satellite would be temperature controlled, three-axis stabilized, pressurized to a minimum of 2 psi, and tip the scales at about 850 pounds. Its projected physical dimensions with solar panels and antennas folded were a 5-foot diameter and a 5.5-foot height. An Atlas main stage booster and an Agena D upper stage constituted the launch vehicle.[4]

(U) In July 1964, NASA's Lunar Orbiter Program Office compiled inputs from several offices in arriving at an overall mission tasking plan. Each Lunar Orbiter would photograph representative lunar terrain (mountains, rills, and seas) and image at least four other areas that might have suitable landing sites. The resulting imagery would be supplemented by photographs from earlier camera-carrying Ranger spacecraft that had hard impacted the moon and Surveyor soft landing spacecraft. The seven Surveyors would test the surface's weight bearing capability and transmit low resolution images of their surroundings back to earth via television. NASA also asked the world's largest radio telescope located at Arecibo, Puerto Rico, to collect radar data reflected off the lunar surface to help determine that surface's load carrying capability.[5]

(U) The Lunar Mapping and Survey System

(U) In the meantime, the less well known manned portion of the lunar reconnaissance program, the LM&SS, got underway more-or-less in parallel with the orbiters. Project Upward, a BYEMAN security program, supplemented the LM&SS to protect the transfer of more advance NRO optical technology to NASA and to obscure the NRO's participation in the program.[6]

(U) The LM&SS, an unclassified designation, never amounted to more than a contingency. Despite the Lunar Orbiter's projected 40-inch resolution, skeptics wondered if it could really do the job. Few doubted that orbiters, Rangers and Surveyors could *identify* Apollo landing sites, but could they *certify* their acceptability? The LM&SS, outfitted with a better camera system, would serve as a backup should the orbiters fall short.[7]

~~(S//TK//NF)~~ On 20 April 1964, NRO Director Brockway McMillan, in his overt role as Under Secretary of the Air Force, and NASA Associate Administrator Robert Seamans signed an agreement covering NRO participation in LM&SS. The accord, entitled "DOD/NASA Agreement on the NASA Manned Lunar Mapping and Survey Program," was unclassified because the Air Force stood in for the NRO. Its provisions were essentially the same as the 28 August 1963 pact, as subsequently modified. [redacted] (b)(1)

As with Lunar Orbiters, NASA would fund everything.[8] Appendix 5 contains the LM&SS agreement.

~~(S//TK//NF)~~ The LM&SS program kicked off in May 1964 with a series of contractor requirements studies and an investigation into which NRO imaging system could best satisfy them. At the same time, George Mueller, NASA Associate Administrator for Manned Space Flight, transferred over $800 thousand from his Fiscal Year (FY) 1964 budget to cover the studies and other technical support. NASA wanted an optical system capable of detecting features 18 inches in diameter and 8 inches high at sun angles of 15 to 45 degrees. As a hedge against any existing NRO optical system being unable to fulfill those requirements, building an entirely new system was an option. A new system would take eighteen to twenty-four months to realize, but Apollo's overall schedule had enough time to accommodate it.[9]

~~(S//NF)~~ The hedge proved unnecessary. Three extant NRO systems—Corona, Lanyard, and the first version of Gambit—could provide adequate imagery. Of the three, only Corona, operational since 1960, had a proven track record. Lanyard had never flown a successful mission. Gambit, though promising,

(b)(1)
(b)(3)

was new and had teething problems that limited it to one completely successful mission in it first six tries. It had the additional disadvantage of being, at just over 1,500 pounds, the heaviest of the three.[10]

~~(S//NF)~~ Despite its teething problems and weight, Gambit, the most capable of the three in terms of resolution, emerged as the front runner. It provided a 2-foot resolution from an 80-mile earth orbit and, free from atmospheric distortion, could achieve [redacted] from the same lunar orbit. It also had the flexibility to image from as low as thirty miles for extremely detailed photography and as high as two hundred miles to cover a wider area, which hopefully obviated the need for a separate camera for area coverage. Eastman Kodak, manufacturer of Gambit's optics, saw no impediments to installing the camera system, modified and slimmed down to 1,200 pounds, in bay no. 1 of the Apollo service module. Because Gambit was film-based, astronauts would have to return exposed film to the command module for the trip back to earth, though the method for doing that is unclear. The Gambit Program Office placed the cost of four test units and two flight units at about $36 million.[11]

~~(S//NF)~~ Then, the LM&SS encountered a number of issues that slowed its progress. In the summer of 1965, Mueller abandoned the idea of mounting the optical system in the service module in favor of placing it in a LEM-like Orbiting Control Vehicle (OCV). The OCV, 18 feet long and 5 feet in diameter, required fewer modifications to the camera and saved money. The OCV would rest in the Saturn booster's upper stage compartment normally reserved for the LEM. At some point early in the trip to the moon, the command module and service would separate from the upper stage, pivot 180 degrees, extract the OCV from its storage bay, pivot 180 degrees, and reattach to the service module. Whether the OCV while in lunar orbit would operate independent of or remain attached to the command and service module is not apparent in the available documentation, though the latter seems far more likely. Crews would have to retrieve exposed film prior jettisoning the OCV.[12]

~~(S//NF)~~ Still other changes and problems further muddied the waters. At some point NASA added a small Fairchild camera for area coverage to the LM&SS at a cost of just over $4 million, but canceled it in favor of a small off-the-shelf Itek tracking camera that flew on Corona. NASA also asked that BYEMAN security be relaxed to allow more people to have greater access. The small number of personnel presently with full access placed an additional and unnecessary burden on NASA. NASA further requested a greater say in camera selection to include performing independent internal reviews. Perhaps in response, the NRO significantly reduced its role in the camera selection process.[13]

~~(S//NF)~~ In June 1965, Lockheed bested General Electric in the competition to adapt the NRO's camera system chosen and install it in the OVC. Strangely, that competition took place before a final decision on the camera system itself. NASA did not complete all analyses and design reviews and confirm Gambit's selection until the fall of 1965. The contract specified delivery of the first unit in July 1967 and a flight test in earth orbit the following December. That put the LM&SS program at least a year behind schedule, but this did not cause concern because of the previously mentioned slack time in the overall Apollo schedule.[14]

(U) Lunar Orbiter Operations

(U) Meanwhile, Boeing's work on the Lunar Orbiters progressed well enough, though not without problems. The program encountered overruns that ultimately raised costs to $144 million, but that was not a novelty given that virtually every satellite program, reconnaissance or otherwise, had much the same experience. Indeed, NASA's Lunar Orbiter Program Office expected overruns and had budgeted

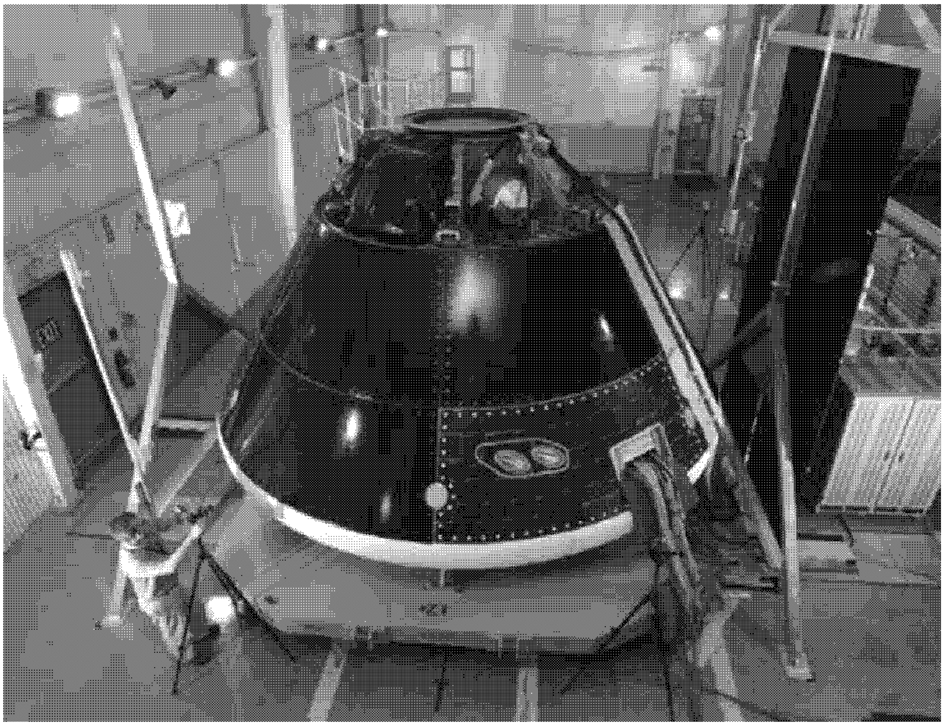

Figure 2-2. (U) The Lunar Orbiter without antennaes and solar panels. (Image: UNCLASSIFIED)

accordingly. Still, the overruns required reworking the acquisition contract and spawned an investigation on how to better control costs. In response, Boeing made a number of changes, the most notable being better management arrangements with two major sub-contractors, Eastman Kodak, maker of the photographic system and RCA, responsible for the communications equipment. Technical problems also arose, but Boeing resolved them without undue difficulty and in mid-1965 affirmed that it could deliver the first orbiter in May 1966 per the original contract.[15]

(U) By early 1966, however, difficulties with the inertial reference and photographic systems put Boeing behind schedule prompting Seaman's to remind the company of the program's importance and the ramifications of delayed launches. Despite the prodding, Boeing did not make good on the May delivery date, which delayed the first launch, but only briefly. On 10 August 1966, a month behind schedule, an Atlas-Agena D booster with Lunar Orbiter-1 encased within its payload fairing rose from the Kennedy Space Center, Florida. Despite anomalies that included a rather serious overheating problem, the spacecraft arrived in the lunar environs within six miles of the aiming point. On 14 August, ground controllers established the spacecraft in a 115X1600-mile orbit inclined at 12 degrees. Subsequent maneuvering lowered the perigee to about 35 miles and then to about 25 miles.[16]

(U) Lunar Orbiter I returned 205 images via NASA's Deep Space Network stations located in California, Spain, and Australia before exhausting its film supply on 28 August. The photography showed among other things the area around Surveyor-1, which had soft landed some months before, and the earth rising above the lunar rim. The onboard film developing equipment and the 24-inch telephoto lens' shutter did not work entirely as advertised due to electro-magnetic interference and the overheating problem, but NASA considered the overall mission a success. Lunar Orbiter-2 soared aloft on 6 November 1966. It

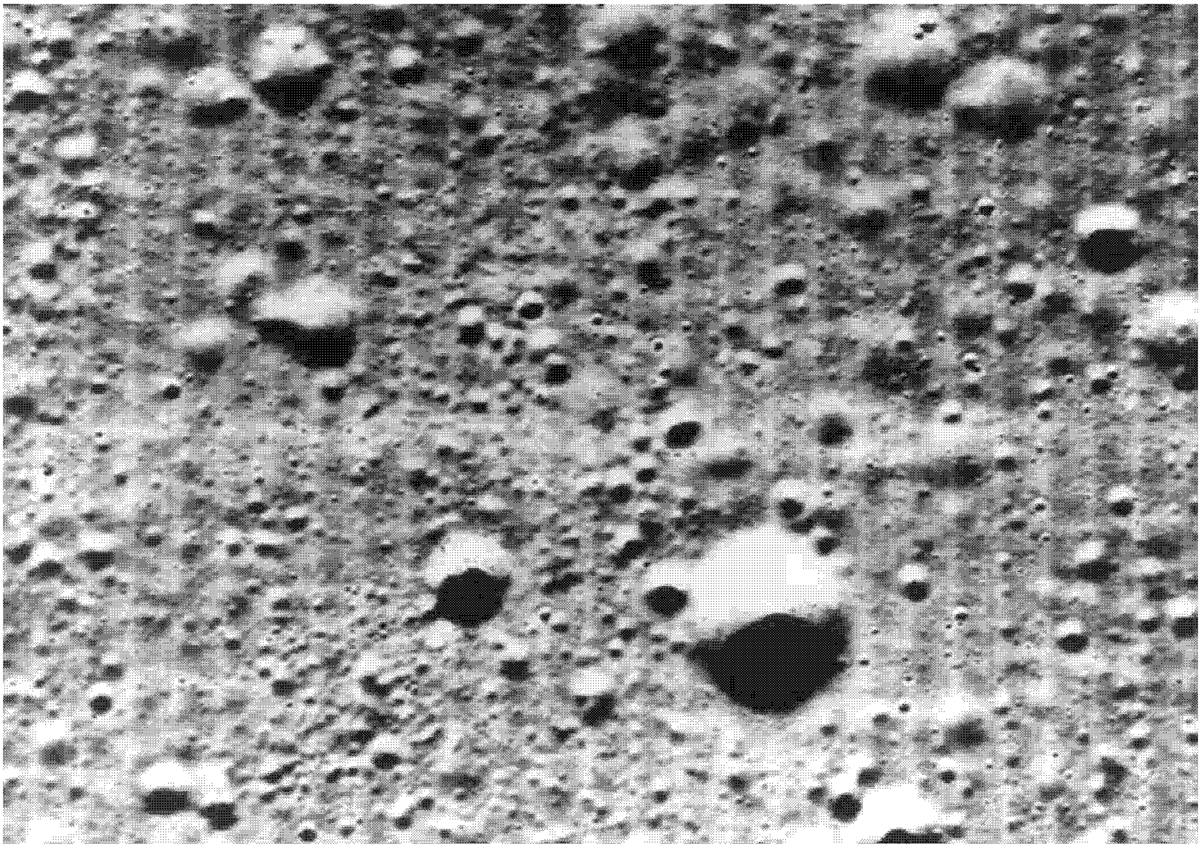

Figure 2-3. (U) Lunar Orbiter-2 imagery of an area unfit for a moon landing. Note the banding effect of the narrow transmission bandwith. (Image: UNCLASSIFIED)

also achieved success, returning, among other images, what Seamans called the photograph of the century, a low angle oblique image of the 56-mile wide Copernicus crater.[17]

(U) As early as December 1966, an unnamed NASA official, almost certainly Seamans, concluded that imagery from the two orbiters and Surveyor soft landers had both *identified* and *certified* an adequate number of landing sites. NASA's Apollo Program Office endorsed that view, but others were not entirely convinced. Lunar Orbiter images were, in the opinion of skeptics, only marginal for determining terrain slope, and the data extrapolated from Surveyor to determine soil characteristics were suspect. If the skeptics were correct, the backup LM&SS would have to fly on a number of manned missions; if not, it could be summarily cancelled.[18]

(U) The competing judgments deterred Seamans from making an immediate decision. Instead, he ordered a comprehensive review of the risks and benefits of limiting reconnaissance to the Lunar Orbiters. He also discussed the matter with an NRO-NASA Committee in April 1967. The committee agreed with delaying a decision until completion of the review, but recommended that Seamans consider three options vis-à-vis LM&SS: cancel it outright, continue it but without testing the system in earth orbit, or continue it as currently planned. Seamans offered a fourth option, converting LM&SS from site selection to the scientific exploration of the moon.[19]

(U) The review, probably completed in June 1967, offered little, if any, support for either the committee's last two options or Seamans' own suggestion. The Apollo Program Office held firm that the Lunar Orbiters had done the job, thereby making LM&SS unnecessary. Imagery from Lunar Orbiter-3, flown in February 1967, and Lunar Orbiter-4, flown the following May, supported that conclusion. The four missions had surveyed twenty-two potential landing sites and certified four as suitable for LEMs. NASA had partially certified four other sites, but awaited further coverage by Lunar Orbiter-5 before final certification. Another factor that NASA now had to consider was Eastman Kodak's plan to terminate production of the Gambit camera used by LM&SS in order to concentrate on more advanced models. Providing contractor support for cameras already purchased and keeping open the option of purchasing additional systems meant funding contracts just for those purposes, a very expensive proposition.[20]

(U) On 25 July 1967, Seamans informed selected NASA executives that he intended to cancel the LM&SS and Project Upward, but delayed notifying the NRO until 3 August, two days after the launch of Lunar Orbiter-5. He ordered all LM&SS hardware, primarily four optical units in various stages of development, placed in storage at Eastman Kodak and Lockheed, pending a decision on final disposition. Parties unknown suggested that LM&SS payloads be carried on Apollo missions attempting lunar landings, but size and weight considerations prohibited carrying both LEMs and LM&SS payloads. Had Seamans not cancelled it, the LM&SS would have first flown in December 1968 aboard Apollo-8.[21]

~~(S//TK//NF)~~ The LM&SS's demise spared the NRO and NASA a looming problem. At some point in 1966, General Electric proposed modifying the LM&SS's Gambit camera for long term use in earth observations. General Electric justified its proposal, called Project Percheron, by using the 28 August 1963 agreement, which allowed lunar reconnaissance cameras in earth orbit. The argument rested on shaky grounds. The agreement permitted only testing, not prolonged operations, in earth orbit. The Gambit optics would also grossly violate the 66-foot limit placed on NASA imaging sensors, a subject treated later in this chapter.[22]

~~(S//TK//NF)~~ General Electric persisted, much to the NRO's displeasure. True, NASA would consign LM&SS imagery taken from earth orbit to a codeword compartment, but pressure to make that imagery public would be intense. Some government officials were skeptical that NASA, unwilling to compromise its reputation of openness, could resist. By early 1967, Alexander Flax, who became NRO director in 1965, was laying the ground work to prohibit Percheron's implementation, a move that NASA Administrator James Webb and NASA might contest. LM&SS cancellation made Percheron a dead issue and averted a potential NRO-NASA confrontation.[23]

(U) Meanwhile, the Lunar Orbiter Program approached its end. Seamans briefly considered purchasing a sixth orbiter, probably for lunar terrain mapping, but could not justify the $16 million price tag. When Lunar Orbiter-5 transmitted its last image somewhere toward the middle of August 1967, NASA lowered the curtain on lunar reconnaissance in support of Project Apollo. In a final footnote, Lunar Orbiter-4 broke radio contact after transmitting its images and before ground controllers sent it plummeting to the lunar surface as they did the other four vehicles. Lunar Orbiter-4 probably impacted the moon sometime in September.[24]

~~(S//NF)~~ Thus ended the first space program uniting the considerable human resources and technological knowhow of the nation's two premier space agencies. Lunar reconnaissance had been completely successful. No subsequent landings on the moon's surface encountered problems that Lunar Orbiters working in conjunction with Surveyor soft landers should have detected. True, the LM&SS cost money and proved unnecessary, but it was a prudent contingency whose cancellation did not measurably detract from the overall mission. Looking back over the years, many of those affiliated with the Lunar Orbiters consider it the best program they ever worked on.[25]

(U) Reaching Agreement on Earth Observations

(U) NASA and the NRO carried out The Apollo Lunar Reconnaissance Program with a minimum of difficulty; there were no major disagreements and relations between the two parties remained good throughout. However, the same cannot be said of another NASA endeavor, the Apollo Applications Program, which formed the nucleus of a controversy involving roles, missions and security. The agreements between NASA and the NRO concerned lunar reconnaissance and had virtually nothing to say about near earth activities. When in 1965, NASA began seriously planning for earth observation missions from low-earth orbit that deficiency created problems destined to endure for some time. The problems were most acute between May 1965 and September 1966, when the two organizations, in the absence of precedents, tried to reach agreements acceptable to both.

~~(S//NF)~~ When the Apollo Applications Program got underway in 1964, it had four overarching missions—lunar landings, lunar surveys, manned space stations, and remote sensing of the earth surface. The last named meant using satellites in low-earth orbits to inventory natural resources, perform mapping surveys, assay the impact of human activity, carry out geodetic studies, and other missions as directed. All Apollo Applications were in complete accord with NASA's responsibility to advance the peaceful uses of space. Over the next several months information about earth observation missions leaked out, but the specifics did not fully emerge until 12 April 1965, when NASA representatives briefed a group of high-ranking government officials, NRO Director Brockway McMillan among them.[26]

(U) The briefing laid out an aggressive agenda. Earth observation would initially take place from manned space stations called "Clusters," an apt name for rather rudimentary assemblies of Apollo service and command modules, Saturn booster rocket upper stages, LEM variants, and docking adaptors. Astronauts would lash the main components, to be launched aboard separate boosters, together in space. The earth observation sensors would reside in some as yet undetermined part of the configuration. George Mueller supervised Apollo Applications, just as he had the Lunar Reconnaissance Program.[27]

(U) NASA had requisitioned twenty-four Apollo spacecraft and twenty-seven Saturn-1B boosters to support Apollo Applications; enough for fifteen earth-orbital missions over and above those needed for moon landings and manned space stations. Five missions would be given over entirely to earth observation using optical and infrared cameras, radar imagers, and mapping by naturally occurring microwave emissions (microwave radiometry). NASA had already canvassed the military services for cameras and radar systems, petitioned the Army to declassify a side looking radar, and intended to commission studies by civilian firms in support of the effort.[28]

(U) NASA representatives expounded further at a follow-up briefing given about a week later. NASA was set on conducting manned missions in earth orbit and planned to use earth observations that amounted to quasi-reconnaissance as one justification should that prove necessary to validate the program. In fact, the planned optical camera had a resolution of 15-20 feet, which to NRO observers must have seemed uncomfortably close to Corona's 9-foot resolution. If realized, a camera that good would indeed give NASA a quasi-reconnaissance capability.[29]

Figure 2-4. (U) NRO Director Dr. Brockway McMillan. (Image: UNCLASSIFIED)

Figure 2-5. (U) Secretary of Defense Robert McNamara. (Image: UNCLASSIFIED)

(U) The extent of NASA's ambitions both surprised McMillan and galvanized him into action. He ordered a detailed memorandum for record made of the meeting as background information and had his staff draft a memorandum alerting Secretary of Defense Robert McNamara. Informing McNamara was a necessary step because the NRO Director, although also Under Secretary of the Air Force, reported directly to the Secretary of Defense on reconnaissance matters.[30]

~~(S//NF)~~ In his memorandum to McNamara, McMillan made it clear that he did not welcome NASA's ambitions. He conceded NASA's right to conduct certain types of missions in earth orbit and even offered to make NRO assets available, but that was about as far as he was willing to go. In his opinion, NASA's plans for unclassified earth observations would force the United States to concede the "fact of" space reconnaissance when national policy was exactly the opposite. Further, NASA's penchant for publicity, weak regard for security, and projected interaction with firms associated with reconnaissance systems did not bode well for the NRO's security blanket. McMillan urged McNamara to reach a new agreement with NASA based on the 28 August 1963 pact. The new accord should define NRO support, NASA interaction with civilian firms associated with satellite reconnaissance, and the appropriate security controls.[31]

(U) It was unfortunate that McNamara had to deal with Webb on the issue because, to put it mildly, the two men did not get along. To begin with, they had very dissimilar personalities. Webb was outgoing, given to homilies, and so verbose that some considered him a "blabbermouth," traits vastly different from those of the taciturn, unsmiling Defense Secretary. Soon after assuming office, Webb detected signs that McNamara and DOD coveted control of NASA, an unfortunate perception since both men were combative and territorial. An open break came in the fall of 1961, when at a working lunch the Defense Secretary gave Webb a lecture so offensive that the NASA Administrator, his face flushed with anger, walked out. After that, they avoided face-to-face contact in favor conducting business through trusted lieutenants or via correspondence. Their estrangement was evident in letters between them concerning earth observation, letters with "Dear Jim" and "Dear Bob" salutations that otherwise crackled with tension.[32]

~~(S//NF)~~ McNamara began the correspondence in early May by communicating his position to Webb. Like McMillan, he had reservations about earth observation, but believed that both NASA's

(b)(1)
(b)(3)

requirements and the NRO's security concerns could be satisfied. [redacted] (b)(1) (b)(3) McNamara then signed and attached a short memorandum of agreement covering the last point and requested that Webb sign it if he agreed or make comments if he had problems with it. He did not, however, recommend a new agreement as suggested by McMillan.[33]

~~(S//NF)~~ Webb responded in early June, but he was non-committal, even evasive. He agreed that the NRO must be protected, but he wanted time to study the applicable documents and review NASA's obligations to other government agencies before committing himself. At about the same time, NASA security personnel asked for copies of selected NRO documents as well as germane Presidential, National Security Council, and similar directives. This reinforced a perception held by McMillan and others that NASA was neglecting space reconnaissance policy and the attendant security requirements.[34]

~~(S//NF)~~ Webb's follow-on letter in late June did nothing to resolve the matter. He allowed that Seamans and McMillan jointly review sensors approaching reconnaissance quality. He also agreed that sensor procurement and development should be handled in much the same way as prescribed in the 28 August 1963 pact. That said, however, Webb jealously guarded NASA's prerogatives. He did not offer to cancel the on-going studies, which he considered a proper NASA function. Further:

> I feel that the proposed arrangement wherein NASA [redacted] (b)(1) (b)(3) to conduct all studies potentially involving technical requirements which would reasonably be construed to be of reconnaissance quality would not meet NASA's responsibility. I also feel that [redacted] for all testing in earth orbit (b)(1) (b)(3) would not be necessary in order to realize the intent of your letter. In my view, the testing of sensor systems intended for use in surveys of a non-military character of the earth, the moon, or other bodies should be conducted by NASA, subject to security safeguards mutually agreed upon by the DOD, the CIA, and NASA . . . NASA's current activity in this area is fully covered by our agreement of 28 August 1963.[35]

He did not sign the memorandum of agreement McNamara had attached because he saw no need for it.

~~(S//NF)~~ Webb's response made it clear that, his personal dislike for McNamara aside, he intended to protect NASA against excessive oversight by DOD. His was not the only agency trying to protect itself from DOD encroachment at the time. Recall that beginning in about 1962, the CIA struggled to achieve greater control over its reconnaissance satellite programs rather than entirely subordinate them to the NRO. The CIA won its battle for greater autonomy at about the same time that Webb and NASA undertook an analogous campaign.[36]

~~(S//NF)~~ Webb ably defended himself and NASA in his letter, but McNamara was far from satisfied. He responded in late July by expressing understanding of Webb's position, but that made no difference in the larger scheme of things. All NASA's activities were not covered by the 28 August 1963 agreement; some required determination as to whether they should be classified or unclassified. Further, study groups commissioned by NASA to examine the requirements of Apollo Applications were encroaching on the already limited pool of talent needed by the NRO. The Defense Secretary then raised the stakes by pointedly asking Webb to disband the study groups until establishment of mutually acceptable management procedures.[37]

~~(S//NF)~~ Webb did not respond to the latest communication because by that time both parties had turned the problem over to Seamans and McMillan as Webb had suggested. In an oral interview with this author, Seamans did not recall Webb having specifically tasked him to conduct business with the NRO, but suggested that his associate administrator duties made him NASA's "general manager" and working with the NRO naturally fell within his bailiwick.[38]

~~(S//NF)~~ Seamans and McMillan met on 27 July 1965 to discuss how best to both protect the NRO and still allow NASA to proceed with earth observations. The meeting went smoothly. McMillan promised to keep NASA fully apprised as to the state of reconnaissance technology. Seamans agreed to set up a NASA three-man committee to work directly with the NRO on reconnaissance-related activity including funding study groups, and the design and fabrication of sensors. The two executives then took an extremely important step by defining an optical sensor with an angular resolution better than 0.1 milliradian as sensitive *technology,* and sensitive *imagery* as that with better than a 66-foot resolution. They also specified limits on system apertures, optical control standards, pointing accuracies and stabilization systems.[*39]

~~(S//NF)~~ Elsewhere, NASA and the NRO were working toward agreement on how to review photography the former received from missions already in operation. The issue was not new. DOD had earlier insisted on examining imagery returned by NASA's weather satellites, but there had been nothing to worry about. The imagery, transmitted to earth via television, had a best resolution measured in miles and revealed nothing sensitive.[40]

~~(S//NF)~~ In 1965, the concern was photographs taken by Gemini astronauts using hand-held, telephoto-equipped cameras. McMillan both raised the issue and offered a possible solution. He acknowledged that the great majority of Gemini imagery was suitable for public release, but some might have intelligence value or political significance. Rather than NASA continuing to process the film at its Manned Spacecraft Center near Houston, Texas[†], McMillan proposed having the National Photographic Interpretation Center (NPIC), which handled all reconnaissance satellite imagery, develop and evaluate the film prior to public release. NASA concurred with the recommendation.[41]

(U) At about this point, McMillan resigned as NRO Director, passing the baton to Alexander Flax. The new director brought with him both a technical background and high-level government experience. His doctoral degree in physics had served him well in his years of work on aircraft that included the problems of high-speed flight. He had previously served as Chief Scientist of the Air Force and as a member of NASA's Advisory Committee on Aircraft Aerodynamics. He was Assistant Secretary of the Air Force for Research and Development when appointed to his new position.[42]

~~(S//NF)~~ NPIC handled Gemini-5 photography in early October. Flax, Seamans, and representatives from the CIA, the State Department, and NPIC numbered among the reviewers. The photography had surprisingly good resolution, 20-50 feet for black and white film and 40-60 feet for color film, but only two pictures caused concern. One allowed a bomber count at Bergstrom Air Force Base, Texas, and the other permitted identification of a ship at an unnamed location as an aircraft carrier. Flax did not believe this was sufficient reason to involve NPIC. He proposed that the Manned Spacecraft Center

* (U) The available documentation indicates that Seamans and McMillan signed an agreement summarizing their decisions, but it was not found during research.

† (U) Later renamed the Johnson Space Center.

Figure 2-6. (U) NRO Director Dr. Alexander Flax. (Image: UNCLASSIFIED)

develop Gemini film just as before, but have NRO and Intelligence Community representatives review it prior to release. The new procedure went into effect with Gemini-6, launched in December 1965.[43]

~~(S//NF)~~ The July agreement reached by Seamans and McMillan on earth observations and the procedures for handling NASA photography represented progress, but did not resolve the central dispute. Webb and NASA still shielded the earth observation program against outside influence, citing the National Space Act of 1958 and applicable United Nations resolutions supporting scientific missions as further justification. NASA set the program's first orbital flight for March 1968 with follow-on missions until 1972. The onboard sensors, all unclassified, should be of sufficient quality to satisfy the scientific community's requirements, whenever feasible. None of the relevant correspondence mentioned the Seamans-McMillan agreement, and the three-man NASA committee working with the NRO staff proved ineffective, probably because it lacked sufficient weight within its own agency.[44]

~~(S//NF)~~ All this left Flax and NRO staff members suspecting that even now NASA was bent on expanding its orbital missions largely unchecked. Others, Deputy Secretary of Defense Cyrus Vance among them, shared that unease. In late August 1965, Vance curtailed NASA's access to DOD technology by prohibiting the military services from dealing with NASA unless they used the NRO as point-of-contact. That prohibition remained in effect until at least 1972 and probably longer.[45]

~~(S//NF)~~ Then, in December 1965 came the first hint of meaningful change. Having watched NASA's programs with growing concern, DCI William Raborn inserted himself into the dispute by invoking his statutory responsibility to protect sources and methods of intelligence. He followed up by appointing William A. Tidwell, a senior CIA executive associated with satellite reconnaissance, as his personnel representative to oversee NASA-NRO relations. A few days later, Flax petitioned Seamans for further action. The new director still did not believe that NASA showed sufficient restraint in either its public statements or its use of contractor personnel in areas affecting the NRO. In a key recommendation, he suggested that the two organizations arrive at a more complete understanding about NASA's use of sensitive information and technology and how NASA planned to protect the NRO from compromise.[46]

~~(S//NF)~~ Seamans, now promoted to NASA Deputy Administrator, did not need much prompting since he had been thinking along similar lines. For several months he had been pressing for a forum composed of more senior officials to oversee all manned space flight programs and coordinate NRO-NASA activities. John Foster, the Director of Defense Research and Engineering (DD/R&E) and DOD's point-of-contact in NASA matters, agreed, and on 9 January 1966 the two men met to lay the foundation for just such a forum.[47]

~~(S//NF)~~Their efforts paid dividends five days later when McNamara and Webb signed a memorandum of understanding establishing the Manned Space Flight Policy Committee (MSFPC). Foster (chair), his deputy, and Flax represented DOD; Seamans and two unnamed associate administrators spoke for NASA. The committee would meet periodically to resolve matters concerning participation in and support of manned space flight programs, make policy decisions, and facilitate the exchange of information.[48]

~~(S//NF)~~The MSFPC first convened in late January 1966 and again in April. The evidence from the January meeting is too sparse to form a clear picture of what transpired, but earth observation mission got a great deal of attention. So did unspecified NASA dealings with other government agencies that Flax thought encroached on the NRO's turf. There was also a minor flap over the precise chain of events in NRO-NASA interaction thus far, leading both sides to develop independent chronologies, though archival records do not mention for what reason.[49]

~~(S//NF)~~For certain there was progress at the April meeting. NASA formally recognized its responsibility to protect the NRO and agreed not to undertake any activity that might harm space reconnaissance. NASA further agreed to secure DOD concurrence for activities that might duplicate any part of the NRO's mission, a concession that must have lessened concerns that NASA was largely ignoring efforts to bring its programs under review. Still unresolved, however, were what activities NASA needed to fulfill its responsibilities and whether those activities should be publicized to enhance their acceptability, as NASA wanted, or kept low key to minimize public awareness, as DOD wished.[50]

~~(S//NF)~~As the MSFPC debated, two other high-ranking government officials, budget director Charles Schultze and Donald Hornig, Director of the Office of Science and Technology, watched events unfold. They too found NASA's proposed use of reconnaissance-like systems to be problematic and in need of high-level guidance. In a joint letter to Secretary of State Dean Rusk, dated 4 April 1966, they asked for a reconvening of the National Security Action Memorandum (NSAM) 156 Committee to update the guidance protecting the NRO and its programs. Some NRO staff had been thinking along similar lines for several months, but there is no evidence linking those reflections with the initiative taken by Schultze and Hornig.[51]

~~(S//NF)~~Recall that the NSAM 156 committee first came together in 1962 at the behest of President John F. Kennedy and met occasionally thereafter, but the first assembly was by far the most important. That meeting had resulted in National Security Council Action (NSCA) 2452, dated 30 June 1962, which established top-level policy guidance for America's space program, including the NRO. The 1966 reconvening included representatives from the same organizations that attended the first meeting. Flax was one of two DOD attendees; Seamans represented NASA. The White House, CIA, the Office of Management and Budget, and the Agency for Disarmament and Arms Control also sent delegations. Deputy Under Secretary of State U. Alexis Johnson reprised his 1962 role as Chairman.[52]

~~(S//NF)~~ The NSAM 156 Committee met on 6 May 1966 and periodically thereafter over the next two months. During the first meeting, Seamans outlined NASA's plans to collect data on meteorology, geology, water resources, and agriculture. NASA would encourage foreign participation in its programs to further legitimize observations from space, while keeping the NRO apprised of proposed sensors and their capability. He reaffirmed NASA's intent to use optical cameras, infrared sensors, and synthetic aperture radar imagers as well as magnetometers, radiometers, and gravity gradiometers. He then briefed plans to orbit optical cameras by 1971 with 100-foot resolutions and multispectral scanners with 400-foot resolutions, both well above the agreed upon 66-foot limit. Responding to a committee request for a catalogue of what NASA needed to entirely satisfy its earth observation requirements, Seamans submitted a list of six imaging systems, some with resolutions considerably better than 66 feet, and thirteen non-imaging sensors. See Table 2-1 for NASA's catalogue of proposed imaging systems and their capabilities.[53]

Table 2-1 (U) Selected Specifications of Proposed NASA Imaging Sensors

Sensor	Ground Resolution
Metric Cameras	< 40 feet
High Resolution Panoramic Cameras	< 10 feet
Ultra-high Resolution Panoramic Cameras	< 5 feet
Multispectral and Synoptic Cameras	< 100 feet
High Resolution Radar	50 feet (azimuth) 50 feet (range)
Infrared Imager	630 feet

~~(TS//TK//NF)~~ Source: Memorandum (TS//TK), Seamans to Multiple Addresses, Sub: Minutes of 6 May 1966 NSAM Committee Meeting, 13 May 1966, Folder 15, Box 5, Job 199700040, NROARC.

~~TOP SECRET//TK//NOFORN~~

~~(S//NF)~~ Flax addressed Seamans' list in a paper submitted in time for the committee's 25 May 1966 meeting. NASA's proposed non-imaging sensors did not concern him, and the infrared sensor's poor resolution made it inconsequential. The imaging radar, however, posed a problem due to its anticipated resolution and because it was an active emitter rather than a passive detector. The NRO had flown an experimental radar imager, Quill, on a single mission in December 1964, but operated it only over the continental United States. If NASA developed a similar system and operated it worldwide the targeted nations might detect the radar's transmission and determine its purpose. Should that happen and the observed nations object, the resulting diplomatic squabble might inhibit NRO plans to orbit its own radar satellite when more advanced technology became available. The committee did not further discuss the radar imager, probably because it was years away, and Flax's comments were mainly for the record.[54]

~~(S//NF)~~ Not surprisingly, Flax identified the optical cameras on Seamans' list as his greatest concern. Optical cameras could, in his judgment, begin detecting information of intelligence value at resolutions of 66-100 feet. He played it safe by disagreeing with the 66-foot resolution limit per the Seamans-McMillan agreement, preferring instead a 100-foot limit. That made all save one of Seaman's proposed systems reconnaissance capable and therefore unacceptable.[55]

~~(S//NF)~~ When the NSAM 156 Committee took up Flax's comments, Johnson seemed persuaded that a 100-foot resolution was the threshold for detecting items of intelligence value, but he pressed the issue. He asked about the resolution threshold that would truly cause security concerns. Flax didn't seem to have a ready answer, but ventured an estimate of about 33 feet. Johnson then inquired what would be the threshold in terms of risk that the Soviets and others would learn something of important technical assistance to their own programs. Flax hedged, but eventually estimated a resolution of 5-10 feet.[56]

(U) At this point Seamans stepped in to end the exchange. The whole debate about sensors was premature. His list was more a long range "wish list," not a statement of requirements for the nearer term. For the time being, NASA did not need high resolution and could live with a 100-foot limit until the end of the decade before deciding on future systems. All of which prompted Johnson to dryly observe that the main problem was where and how to turn off NASA's use of advanced technology.[57]

~~(S//NF)~~ The NSAM 156 Committee's report, released on 11 July 1966, was entitled "Political and Security Aspects of Non-Military Applications of Satellite Earth-Sensing," and largely reaffirmed the guidance furnished four years earlier in NSAM 2452. There must be no relaxation in security protecting spaceborne reconnaissance. True, the world political situation had changed now that the Soviet Union had its own reconnaissance satellites, but that fact had never appeared in the Soviet media and Moscow still referred to such activities as espionage. The American programs should, therefore, remain secret so as not to pose a direct challenge to Moscow on a still sensitive issue.[58]

(U) On the other hand, attitudes toward the non-military uses of space had undergone a more profound change. International tolerance of space observation, as opposed to reconnaissance, had reached a point where the focus could now shift from *establishing* acceptance to *preserving* it. Linking earth observation to scientific progress and economic betterment should continue, a solid endorsement of NASA's mission.[59]

~~(S//NF)~~ Non-military uses of space, the report acknowledged, required surveillance of the earth by a variety of sensors, therefore, NASA could proceed with experimental programs subject to limitations negotiated with the NRO. NASA's proposals and those from other agencies for sensors overlapping reconnaissance systems must be judged on a case-by-case basis. The criteria for judgment included feasibility, possible use of non-space alternatives (i.e.) land-based observations and airborne reconnaissance, and the risk of compromising classified technologies and programs.[60]

~~(S//NF)~~ Despite Flax's and Johnson's earlier agreement that a 100-foot resolution was the threshold for gaining useful intelligence, the committee kept the 66-foot limit per the Seamans-McMillan agreement. That resolution simultaneously marked the threshold of a reconnaissance capability and the best resolution NASA could incorporate in its earth observation satellites, at least for the time being. Looking ahead, the committee allowed that NASA could gradually acquire better sensors over time, but for the next five years should limit "discussions" of future systems to those with a ground resolution of 10-15 feet. There was no mention of NASA being able to take those systems beyond the discussion stage during that period. For its part, the NRO should consider downgrading selected satellite imagery to the collateral level for use by NASA and making selected cameras and other sensors available to NASA on a classified basis. The report closed by asking NASA to weigh the merits of manned versus unmanned space missions and again urging alternatives to spacecraft in earth observation.[61] Appendix 6 contains the 156 Committee's 11 July 1966 report.

~~(S//NF)~~ On 26 September 1966 Foster and Seamans signed "DOD-NASA Coordination of the Earth Resources Survey Program," the next step toward fully coordinating NASA-NRO activities. The new agreement brought together ad hoc arrangements made during the previous fourteen months, retained the MSFPC as it was, incorporated guidance from the NSAM 156 Committee, and laid down ground rules for earth observation. NASA had to coordinate the further development of reconnaissance-like sensors while still in the conceptual phase. [redacted] just as in previous agreements. There were also restrictions on sensor stabilization and tracking systems, and NASA could not duplicate any NRO equipment or operation without first getting MSFPC concurrence.[62] Appendix 7 contains the 26 September 1966 agreement. (b)(1) (b)(3)

~~(S//NF)~~ The 26 September accord also made an adjustment to the coordinating structure between the two agencies. Because it had responsibilities other than overseeing NASA-NRO relations, the MSFPC needed a subordinate panel to handle more routine matters. That led to the establishment of the Survey Applications Coordinating Committee (SACC) to work almost exclusively on NASA and NRO programs, coordinate contracts and studies, and, most importantly, ensure adherence to established guidelines. The SACC would identify troublesome issues in advance, handling as many as possible and referring only the more difficult ones to the MSFPC. Seamans named the members of the three-man committee—Edward Gray, Leonard Jaffe, and Frank Sullivan—as NASA's representatives; Flax responded with three NRO nominations—Colonels Paul Worthman, David Carter, and [redacted] Foster sent a single DOD delegate, identity unknown. The SACC held its first meeting on 29 September. (b)(1) (b)(3)

~~(S//NF)~~ Although earth observation satellites were not scheduled to orbit until the 1970s, NASA was already gearing up for those missions and preparing to take them in a new direction. Previous references to "earth observation," "remote sensing," "earth sensing" or "resource monitoring" were made in the context of the Apollo Application Program. Archival records contained only the slightest hints that NASA was preparing to change that. Then in November 1966 references to the NASA Earth Resources Survey Program (NERSP) began appearing in documentation. Possibly in response to the 156 Committee's recommendation, NERSP would use unmanned satellites carrying the same or similar sensors to collect the same or similar data as had been projected for the Apollo Applications space station. In May 1967, NASA contracted with Lockheed Martin and General Electric for concept studies of NERSP spacecraft.[64]

~~(S//NF)~~ The archival evidence contains material on NERSP as late as 1971, though in ever decreasing amounts. Only the name died out; however, the idea of unmanned earth observation satellites did not. Rather, NERSP dissolved into a number of individual programs, the most famous being Landsat, the world's first true earth observation satellite, destined to fly in 1972. Apollo Applications, with one minor exception, was now out of earth observations. In 1970, NASA created the Skylab program to pursue the nation's first manned space station, putting Apollo Applications out of that business as well. Landsat, Skylab, the remnant of Apollo Applications' earth observations, and their relationship with the NRO are detailed in later chapters.

* * * * *

~~(S//NF)~~ The first years of significant NASA-NRO interaction contained two themes destined to endure throughout their relationship: technology transfer and seeking common ground on missions that overlapped or came close to doing so. Technology transfer did not pose that big a problem. The NRO needed BYEMAN-level security to protect the specifics of the technology and to conceal its origin, but raised no objections once that requirement was satisfied. That applied to both the obsolescent Samos camera system of the Lunar Reconnaissance Program and the Gambit optics in the abortive LM&SS program. The same would be true for a later transfer of much greater significance involving NASA's Hubble Space Telescope.

~~(S//NF)~~ Negotiations seeking common grounds on earth observation had been more difficult. NASA had every right; indeed, a statutory obligation, to actively pursue the peaceful uses of space, which it would continue to do. The NRO could not and did not object to this even though it made future disagreements inevitable. NASA's future missions would vary over time, but the central issue remained the same—security. NASA's space programs had scant implications for national security, which meant that it always negotiated from a position of weakness. NASA, not the NRO, would have to give ground by accepting certain restrictions on its controversial program, the first notable instance being the 66-foot resolution limit on imaging sensors. Yet its statutory responsibilities required NASA, whatever the odds against it, to continue pressing for more capable systems by taking full advantage of wider opportunities as they became available.

(U) The end of the dispute over earth observations and successful conclusion of lunar reconnaissance coincided with a relatively uneventful period for the two space agencies. That interlude afforded time to work out lingering problems and establish a better working relationship, which meant a less strained association beneficial to both. Only two programs of the late 1960s, the Air Force-NRO Manned Orbiting Laboratory/Project Dorian and the remnants of NASA's Apollo Applications Program, brought them together, though not in significant ways. Those programs and the improved work environment are treated in the next chapter.

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(U) Chapter Three

(U) Looking Earthward, 1966-1971

(U) In August 1967, the NRO and NASA ended their first major collaboration, the Apollo Lunar Reconnaissance Program, in which the former provided optical technology for the latter's unmanned Lunar Orbiters. The five Lunar Orbiters had little difficulty locating and certifying a number of landing sites for Apollo's moon landings. Lunar reconnaissance, despite concerns about concealing the NRO's involvement, also worked well at the policy level because previously negotiated agreements provided a solid foundation for interaction.

~~(S//NF)~~ Less amity reigned over NASA's plans to survey the terrestrial environment with observations from satellites in low-earth orbit. The problem was, NASA now focused not on the moon, but on the earth, and planned to do so with imaging sensors that emulated the NRO's space reconnaissance operations. Given NASA's policy of openness, earth observations* might compromise the NRO and a range of sensitive technology. The near complete absence of any inter-agency agreements on earth observations made things worse. Negotiations on NASA sensors to be used in earth observations began in mid-1965 and culminated in September 1966 with an agreement codifying the two-layer coordination and approval structure discussed in the previous chapter.

(U) A 20 December 1967 DOD-NASA agreement† signed by John E. Foster, Director of Defense Research and Development, and NASA Associate Administrator Homer E. Newell, superseded the September 1966 document, which was in turn modified by a February 1968 annex. The two later documents changed little other than providing more staff support, making the senior DOD and NASA representatives co-chairs vice only a DOD chairman, and allowing them to choose their subordinates vice having them appointed by higher authority.[1] Appendix 8 contains the February 1968 Annex.

(U) In a bit of irony, the carefully worked out arrangements between the two agencies had relatively little effect for the rest of the decade. NASA had a number of programs in mind that potentially involved the NRO, but Apollo's expense left little money to advance those programs beyond their conceptual stages. In particular, after doing concept studies on earth observations in 1967, NASA had to delay contracting for the necessary satellites until 1969.

(U) That left two space programs during the last half of the 1960s—the Air Force's Manned Orbiting Laboratory (MOL)/NRO's Project Dorian and the remnants of NASA's Apollo Applications Program—that did involve the two agencies. Neither entailed significant interaction even though both proposed to look earthward. That ushered in a period of relative calm during which the NRO and NASA could improve their working relationship.

(U) Better Relations

(U) Of course, more harmonious relations did not happen overnight. It seemed that NASA was slow to abandon a former *modus operandi* notable for giving too little thought to security. Well into 1967,

* (U) Referred to as "remote sensing" and "earth resource monitoring" in some documents.
† (U) Not found during research.

NASA representatives took up most Survey Applications Coordinating Committee (SACC) meetings pursuing vested interests that included requesting more assistance, more security clearances, more technical support, and the loan of people. At the same time, NASA did not meet its obligation to submit appropriate studies, experiments, work statements, and contracts for coordination and approval. Worse, NASA funded studies of better optical sensors without approval, a violation brought to light only when an unnamed civilian contractor privately informed DOD officials.[2]

(U) This unfortunate state of affairs reflected problems in what was for many in NASA a new way of doing business, but Myron Krueger, NASA's Manager of Special Activities in the 1970, saw another influence. Reflecting back he recalled that:

> NASA IS MADE UP OF SCIENTISTS AND ENGINEERS. SCIENTISTS ARE STRANGE PEOPLE. THEY WILL ARGUE ENDLESSLY ABOUT THE NECESSITY FOR HOUSE NUMBERS AND STREET NAMES, BUT WILL NOT HESITATE TO NAME EVERY OBJECT IN THE HEAVENS. ENGINEERS ARE MORE ADAPTABLE. THEY HAVE NO INTEREST IN SECURITY.[3]

(U) In a more generous explanation, Martin Faga, who became the NRO Director in 1988, noted that the small number of cleared NASA personnel had to deal with the uncleared masses in an environment that wasn't supposed to be secretive, at least to those without clearances:

> THE NASA [PEOPLE] WHO WERE SPECIFICALLY INVOLVED [AND] FULLY CLEARED HAD ABSOLUTELY NO PROBLEMS, BUT AS YOU WORKED YOUR WAY OUT THROUGH THE ORGANIZATION IT WOULD BE VERY TOUGH ON THEM TO MAINTAIN SECRECY . . . . IN MANY CASES, IT WASN'T SECRECY IN THE SENSE THAT HERE IS A SECRET DOCUMENT, IT WAS JUST WE DON'T WANT YOU TO SAY ANYTHING ABOUT ONE THING OR ANOTHER. WE JUST DON'T WANT IT SAID, AND IT'S HARD TO GET PEOPLE TO UNDERSTAND THAT THERE ARE THINGS THAT ARE NOT SPECIFICALLY CLASSIFIED BUT THAT YOU DON'T WANT SAID. IT'S SOMETHING WE DO AT THE NRO ALL THE TIME, AND CERTAINLY WAS COMMON AT CIA WHEN I WORKED THERE. THAT WAS TOTALLY FOREIGN TO A CULTURE LIKE NASA'S.[4]

In other words, maintain security in a low-keyed way that did not raise unwanted questions rather than draw lines in the sand and tell people not to cross them.

(U) Whatever the reason, Foster was having none of it. In a 17 July 1967 letter to Seamans, he reviewed recent NASA transgressions that, in his words, required DOD "to chase NASA around only to find out what was going on after damage had been done." He expressed his disappointment at events and warned that unless the situation improved he would not hesitate to disband the present coordinating structure in favor of another.[5]

~~(S//NF)~~ When asked by this author to comment on Foster's letter, Seamans, a remarkably witty man despite his advanced age, replied, "Oh, I got a lot of letters like that." That may be true, but at the time Foster's blistering rebuke had an immediate and profound effect. NASA, in the words of Col. Paul Worthman, an NRO representative to the SACC, soon showed a new attitude that included a willingness to "clean house." Within a month NASA submitted 106 items, ranging from research to test site development to passive microwave studies, for coordination. At some later point, observers noted, with obvious approval, that NASA and NRO representatives to the SACC were now working for the common good.[6]

(U) Personalities also played a role in the improved atmosphere. When Seamans, who had capably handled relations with the NRO for several years, left NASA in January 1968, Homer Newell assumed the position in a seemingly smooth transition. Retired Air Force General Jacob Smart, Assistant NASA

Figure 3-1. (U) NASA Administrator Thomas O. Paine.
(Image: UNCLASSIFIED)

Administrator for DOD and Interagency Affairs, had an even greater impact. Smart, a soft-spoken and thoughtful man, strongly supported earth observations, but he was practical and diplomatic. NASA's efforts, he reasoned, should be governed by what was possible, given concerns about national security and international relations. That made him a strong proponent of working toward better understandings with other government agencies. Not surprisingly, his efforts earned praise from NRO staff members.[7]

(U) The other personality with impact was Thomas Paine who moved up from the deputy position to succeed James Webb as NASA Administrator in October 1968. Paine, who held a doctoral degree in physical metallurgy, had previously served as head of General Electric's research and development center, and as director of the firm's center for advanced studies. He had also been on a number of high level panels and committees associated with science and engineering.

(U) In a 1997 interview, former NRO Director Alexander Flax recalled that he and Paine got along splendidly. In fact, they worked together so well that Paine awarded Flax the NASA Distinguished Service Medal when he left the NRO in March 1969. That Flax did not mention his rapport with Webb does not necessarily indicate conflict, but as he reflected back during an oral interview, Seamans suspected that the two men had a problem. Flax was a scientist and technician with a background in physics; Webb was a lawyer and oil man turned politician, experienced manager, and Washington insider. That gave them differing perspectives that may have sometimes made it difficult for them to understand each other. If true, Paine's technical background did away with the problem by making it easy for him and Flax to communicate.[8]

~~(S//NF)~~ Better relations made it easier to implement two recommendations made by the National Security Action Memorandum (NSAM) 156 Committee during its 1966 reconvening. The first called for downgrading selected NRO imagery to the collateral level to achieve wider distribution. An interagency panel headed by William Tidwell, Committee on Overhead Reconnaissance chairman and the Director of Central Intelligence (DCI) representative in NRO matters, took the recommendation under advisement. Flax, for one, saw little merit in it. In particular, he wondered what downgrading would do for NASA since it needed unclassified imagery. There was also general resistance due to security implications. Nevertheless, the panel gave its approval, and in January 1967, DCI Richard Helms authorized a small number of cleared personnel from five government agencies, NASA among them, to examine NRO photography for possible downgrading.[9]

~~(S//NF)~~ The NSAM 156 Committee recommendation that the NRO make available to NASA selected cameras and other sensors was a bit trickier. Helms sought Flax's counsel before taking action. The NRO Director delayed answering until an interagency panel he appointed had assayed available systems and made its report. Louis Mazza, Assistant for Security, NRO staff, chaired the group.[10]

~~(S//NF)~~ The panel worked for five months before reporting in January 1967. Only optical systems received consideration. There were no objections to providing such systems so long as their projected resolutions fell within existing guidelines and security arrangements protected their origins and prior usage. Only four cameras in the NRO's inventory did not violate guidelines, two manufactured by Itek and two by Fairchild. All four served as mapping cameras on Corona and Gambit satellites. Their resolution roughly compared to that of hand held cameras carried into space by Gemini astronauts. Flax accepted the report and so notified Helms. The DCI concurred, but he first wanted the Lunar Orbiter Program and any problems it might still pose out of the way. He therefore delayed implementation until September 1967.[11]

~~(S//NF)~~ Three months later, in December 1967, the NRO began work on its first consignment to NASA outside the Lunar Orbiter Program, Itek's (-9) camera. Its short focal length could not produce quality imagery from earth orbit, but NASA still wanted it for use in earth observations, possibly to collect mapping data for the Department of the Interior. The terms of consignment, [redacted] (b)(1) allowed NASA to exploit the (-9) as unclassified equipment in any way it wished and to name Itek as the manufacture. However, there must be no revelation that the (-9) was flight qualified and no association with classified programs past, present, or planned. Newell accepted the camera in July 1968 and, seemingly against all odds given its limited capability, the (-9) became part of Apollo contingency planning in the 1970s, a subject discussed in detail later in this chapter.[12]

~~(S//NF)~~ The (-9) transfer paled in comparison to the next initiative. In 1966, NRO Program A (Air Force) contracted with Itek, Perkin-Elmer, Lockheed, and McDonnell for a new reconnaissance satellite, Hexagon. Hexagon would have wide area coverage capability, a best ground resolution of less than 3 feet, and carry an astonishing 200,000 feet (almost 40 miles) of super-thin Mylar film in four return capsules. When launched in 1971, it would replace the older and less capable Corona in operation since 1960. If Hexagon held to that schedule, at least two Corona vehicles would be left over. NASA might be able to use the surplus vehicles at some later date in its earth observation program.[13]

~~(S//NF)~~ The idea was not all that new. Seamans and Carl E. Duckett, Director of NRO Program B (CIA), had discussed it in 1967, but encountered general opposition to such a close coupling of NASA and NRO programs, another example of the delicate balance between protecting sensitive assets and mission accomplishment. A more favorable climate existed in the summer of 1969 when NRO Deputy Director F. Robert Naka again raised the possibility with DCI Helms and John L. McLucas, Flax's successor as NRO Director. This time all agreed that the concept was sound and worth pursuing.[14]

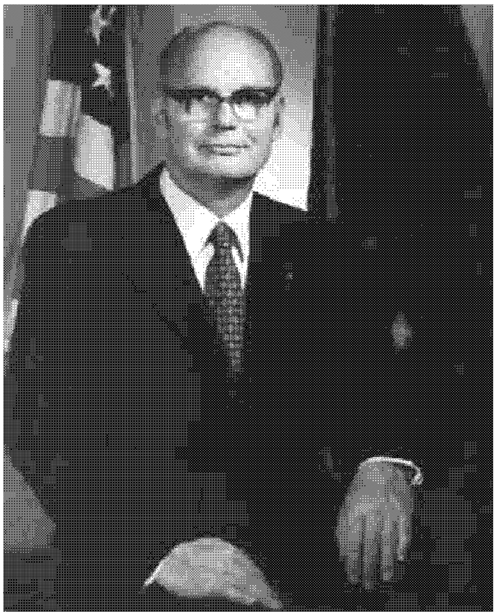

Figure 3-2. (U) NRO Director Dr. John McLucas. (Image: UNCLASSIFIED)

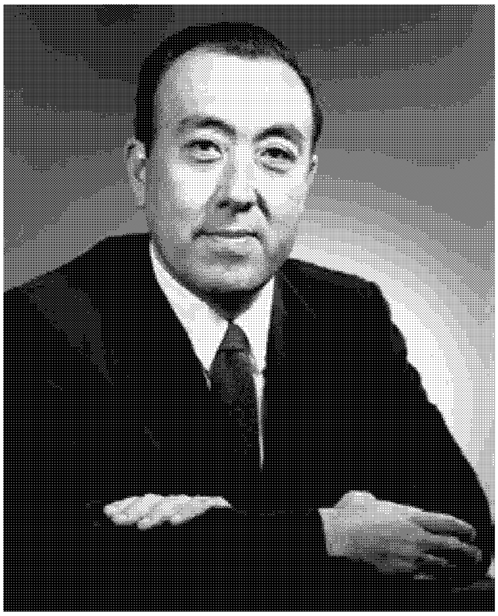

Figure 3-3. (U) NRO Deputy Director Dr. F. Robert Naka. (Image: UNCLASSIFIED)

(U) As an aside, McLucas and Naka merit a few extra words not only for their exemplary public service but also because both were remarkable men who overcame significant disadvantages during their formative years. McLucas' parents essentially abandoned him as a child, but he flourished under an aunt who saw his talent and supported him. A World War II combat veteran with a doctorate in physics, he had founded his own firm and served as president of it and another company by the time he was thirty-seven. He subsequently became Chief Executive Officer of the Mitre Corporation and held two high level government positions before coming to the NRO in 1969. His selection of Naka, with whom he had previously worked, as his deputy proved to be a good choice. They agreed on policy, liked each other, and formed a highly effective working relationship.[15]

(U) Naka, a second generation American of Japanese ancestry (Nisei), was like so many with that heritage interned, albeit briefly in his case, during World War II. He earned a doctorate in electron optics from Harvard in 1951 after which he worked for the CIA on the U-2. He joined Mitre in 1959, ultimately becoming its Chief Scientist. That was where he met McLucas. In an interview with this author, Naka marveled at living in a country where he could go from being a de facto prisoner-of-war to positions of the highest trust, but his overall tone made it apparent that he still felt like an outsider. That was perhaps most obvious in his insistence that everybody, subordinates included, call him "Bob" and by reducing his first name, Fumio, to an initial.[16]

~~(S//NF)~~ A few months after Naka made his suggestion McLucas began paving the way for a possible Corona transfer when he proposed easing the restrictions on NASA's optical sensors. Better relations with and greater trust of NASA surely played a part in his decision, but other considerations predominated. For some time NASA had not been able to respond positively to those customer requirements that would have violated the 66-foot limit on optical system resolution, a restriction that was already obsolescent. By 1969, rapid advancements in optical technology enabled commercial systems to acquire imagery from space with resolutions better than 66 feet. Therefore, it no longer made sense to cite protecting

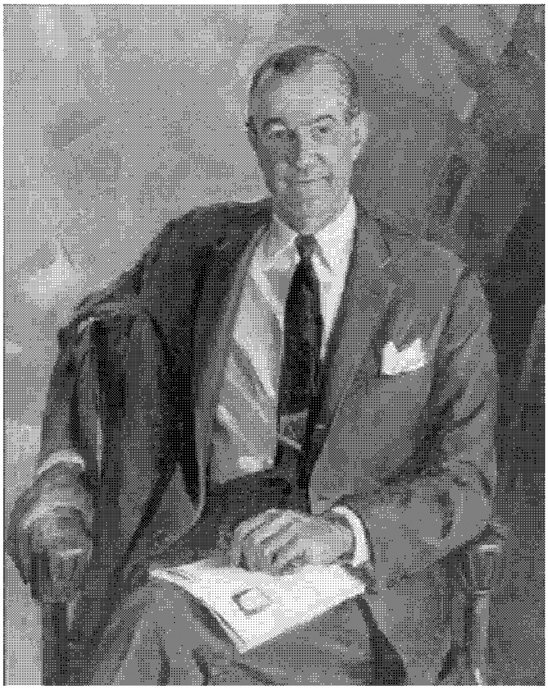

Figure 3-4. (U) Director of Central Intelligence Richard Helms. (Image: UNCLASSIFIED)

American technology from compromise as a reason for denying NASA access to more advanced optical systems. NASA should at least be permitted to begin planning for, though not as yet procuring, more advanced systems.[17]

~~(S//NF)~~ McLucas summed up his thinking on the restrictions placed on NASA in a 7 October 1969 memorandum to the Executive Committee (ExCom) of the National Reconnaissance Program, which oversaw the nation's satellite reconnaissance programs. NASA's proposed orbiting astronomical programs, he wrote, should be exempt from any review since they looked skyward rather than earthward. The NSAM 156 Committee, which imposed the 66-foot limit in 1966, had recommended that NASA be allowed to consider imaging systems with resolutions as low as 17 feet beginning in 1971. In McLucas's opinion it was already time to implement that recommendation. He further proposed removing entirely other restrictions on earthward-looking programs, such as aperture diameter and system stabilization. It was, all-in-all, a remarkable declaration from the head of an agency that had previously worked so diligently to keep the lid on NASA's technology.[18]

~~(S//NF)~~ McLucas expected approval for all his recommendations, but that didn't quite happen. DCI Helms, himself an ExCom member, along with some NRO staff members objected to entirely exempting NASA's astronomical programs from review. The imagery from those programs posed no discernible problems, but unclassified NASA plans and blueprints for astronomical systems that could be adapted for reconnaissance might compromise American technology and ultimately the capability of the NRO. McLucas acknowledged the counsel and reinstated NASA's astronomical programs in the coordinating process if only to identify those aspects that might cause concern. Otherwise, his suggestions won ExCom approval, and in doing so made it possible to at least explore a Corona consignment.[19]

~~(S//NF)~~ Naka discussed that possibility at a 28 October 1969 working lunch with Smart and the NRO Staff Director, Brig. Gen. Lew Allen. Early acceptance by NASA meant that Corona vehicles would be ready for transfer in 1972, in time for installation in the third or fourth earth observation satellite. Because those satellites would have orbits much higher than Corona, the best resolution would be on the order of 17-27 feet, which was within the ExCom's newly endorsed limits for planning purposes. Naka sweetened his proposal by allowing that the NRO would permit NASA to order more Corona systems if it wished. Naka conceded that self interest was involved—if NASA placed additional orders it would maintain the Corona production capability, which the NRO could also use should the need arise.[20]

~~(S//NF)~~ On 19 November 1969, Naka again met with a NASA delegation this time headed by SACC Co-chairman Leonard Jaffee. Jaffee acknowledged that NASA needed more time to study the offer, but the initial reaction had been positive. Using just three Coronas could save as much as $150 million in developmental costs. Further, substituting different cameras for the Corona cameras or adding new ones would allow earth observation satellites to carry color, infrared, and black and white film sensitive in various spectral ranges. Naka closed by inviting Jaffe to forward a list of questions that NASA wanted answered and suggesting a December meeting to discuss security arrangements.[21]

~~(S//NF)~~ Meetings took place on 4 December 1969 and again in early January 1970. Jaffee had visited Lockheed, the primary contractor for the basic Corona satellite, prior to the 4 December meeting. While there he had explored adding 15-inch sections to Corona vehicles and installing additional cameras. Lockheed responded on 18 December 1969 with two options: Configuration C, three new Fairchild and two standard Corona cameras, and Configuration D, three new Eastman Kodak and two standard Corona cameras. A two-vehicle buy would cost $26.4 million and $35.9 million, respectively, more than Jaffee had anticipated, but still acceptable figures.[22]

~~(S//NF)~~ Everything seemed to be order and at some point not identified in the documentation, but likely during February 1970, McLucas formally proffered excess Coronas to NASA. Newell responded with expressions of gratitude, but declined. The Office of Management and Budget would not provide extra funds and he could not find sufficient headroom in NASA's FY 1971 budget to cover the cost. He kept the door ajar by stating that the money might be available in the FY 1972 budget. With that in mind, NASA Administrator Paine, in separate correspondence, asked McLucas to preserve the option of eventual NASA utilization of the technology, facilities, and projects teams that had made Corona so successful. In other words, the NRO should be the one to keep a Corona production capability intact.[23]

~~(S//NF)~~ In his 26 March 1970 reply, McLucas expressed understanding and appreciation and kept open the possibility of transferring surplus Corona vehicles at some future date. He did not mention maintaining the Eastman Kodak production capability. Rather, the NRO Director suggested that other, unnamed NRO-NASA cooperative efforts involving alternate systems might better meet earth observation requirements.[24]

~~(S//NF)~~ Two months later, Paine returned to the subject of sensors. Selecting a firm to manufacture the first earth observation satellites was close at hand, but important questions remained. He asked McLucas to send NRO representatives to a June 1970 meeting to evaluate potential optical systems. Paine made no reference to Corona. The tone of his letter and that of McLucas's 26 March communication meant that both organizations had turned their attention elsewhere and Corona was no longer a candidate for transfer.[25]

~~(S//NF)~~ While economic considerations surely influenced Paine's rejection of Corona, it was not the main reason. The film supplies on film-based satellites dictated how often individual areas be imaged. Since the earth observation program planned to "monitor" earthly conditions rather than merely "sample" them, repetitive coverage would be the rule, something that could only be done by electronically returning images to earth. Therefore, Corona, despite its merits, simply would not do. NASA and the earth observation program were moving away from film and in the direction of electronic downlink.

(U) Better relations and more attempts to transfer hardware aside, another NRO-NASA interaction of the mid-to-late 1960s involved a manned military program, but in minor ways. That program was an Air Force endeavor with roots dating to the end of World War II when the service began thinking of space as a logical extension of the atmosphere and therefore a logical extension of its sphere of operation. Manned missions formed a key part of that thinking, but prospects of fulfilling that role dimmed appreciably with the creation of NASA and its absorption of virtually all manned space programs. The Air Force persisted, but by 1964 was down to its last hope, the MOL and its NRO connection, Project Dorian.

(U) The MOL and Dorian

(U) The MOL‡ to some degree owed its existence to the Air Force's DynaSoar, a small piloted space glider and a precursor to the Space Shuttle, which it physically resembled. A Titan booster would launch DynaSoar on a suborbital trajectory from where it would glide back to a landing at a pre-selected location. It would test materials to protect against the heat of atmospheric reentry and assess the ability of a winged vehicle to maneuver under those conditions.[26]

(U) The Boeing Company began work on DynaSoar in November 1959. In 1961, Robert S. McNamara, newly installed as Secretary of Defense, increased program objectives to include orbital flight, a comprehensive test of launch procedures, and a study of problems inherent in sustaining humans in space. That decision bought time to do such things as select pilots for DynaSoar, one of which was Neil Armstrong, at the time a NASA employee and destined to be the first to walk on the moon. However, more time could not save the program in the long run. NASA's Project Mercury was already answering questions about space flight and DynaSoar came across to many high-ranking individuals, including some in the Air Force, as a dead-end endeavor. McNamara canceled the program in December 1963.[27]

(U) The Defense Secretary proved more receptive to another Air Force proposal, which became the MOL. As visualized in 1963, the MOL would have a cylindrical shape some 77 feet long and 10 feet in diameter and a weigh of 15 tons. The 41-foot long laboratory would be pressured to achieve a 1,500-2,000 cubic foot "shirtsleeve" work environment. The MOL would ride a Titan III booster into orbit with the two-man crew making the trip in a modified NASA Gemini spacecraft affixed atop the laboratory. Once in orbit, the crew would transfer to the laboratory, perform military-related experiments for about a month, and then return to the Gemini for deorbit. If carried to fruition, the MOL would be both the world's first manned space station and an ideal place to test the effects of long-duration space missions on humans. McNamara, with President Lyndon B. Johnson's backing, authorized MOL planning to proceed at about the same time that he cancelled DynaSoar.[28]

~~(S//NF)~~ McNamara's support for the MOL likely came from knowledge of its true mission. Whatever the military-related experiments envisioned, the Air Force knew that turning the MOL into a manned

‡ (U) Called the Manned Military Orbiting Laboratory (MMOL) throughout 1963.

Figure 3-5. (U) DynaSoar. (Image: UNCLASSIFIED)

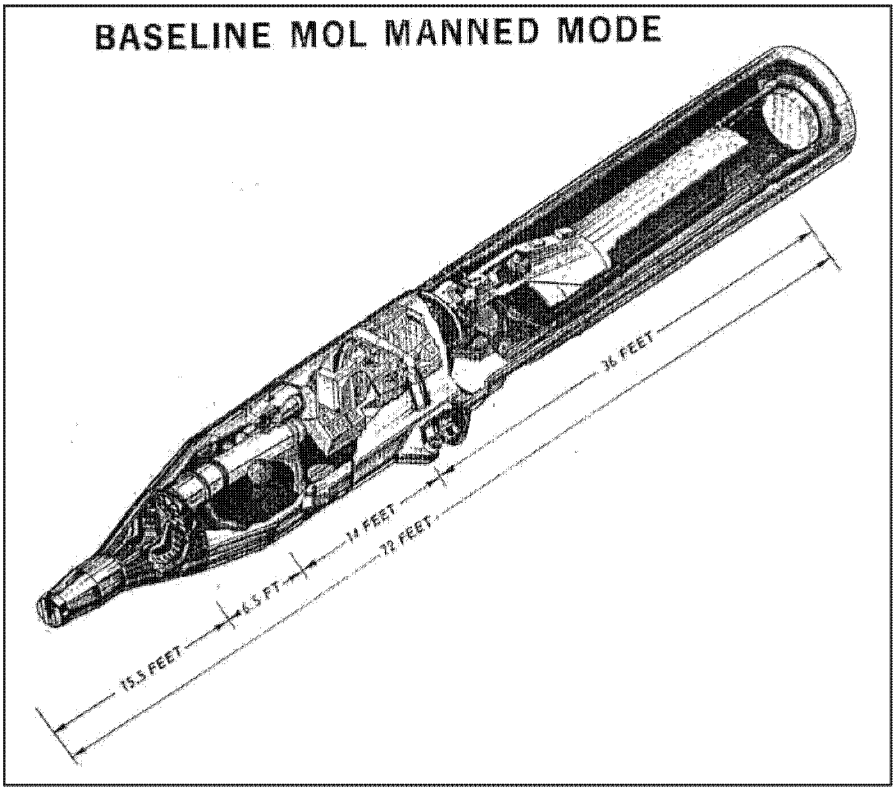

Figure 3-6. (U) Manned Orbiting Laboratory (MOL) schematic showing the Dorian system. (Image: ~~SECRET//TK//NOFORN~~)

reconnaissance platform was the only way to justify its expense. Potential reconnaissance payloads included optical and infrared cameras, high-resolution radars, signals intelligence collectors, or all four. An optical system with a resolution [redacted] less attracted the most attention, prompting the I(b)(1) to take two important steps. On 3 December 1963, the NRO signed a $350,000 contract with East(b)(3) Kodak to study the relative merits of manned and unmanned photo reconnaissance systems and in April 1964 established Project Dorian, a BYEMAN-level security compartment to conceal the undertaking.[29]

~~(S//NF)~~ Eastman Kodak's study, completed in July 1964, came down solidly in favor of a manned system. As reconstructed from other sources, the firm concluded that crewmen could fine tune focus, drift, and exposure controls and better center targets so as to produce a ground resolution on the order [redacted] That resolution, superior to Corona's 10 feet and the 2-3 feet of the newly launched Gam(b)(1) would greatly aid technical analysts in determining the capabilities of and modifications to weap(b)(3) systems. Moreover, operators could avoid filming areas with cloud cover, make repairs, and use a less capable optical system to aim the primary optics, detect and image unusual activity, and image targets where significant changes had occurred since last observed. Exposed film would either be returned to earth with the crew or, as in the Samos and Lunar Orbiter programs, developed onboard, scanned, and electronically transmitted to a terrestrial station.[30]

(U) Not everybody thought that highly of a manned system, however. Sam Tennant, an Aerospace Corporation consultant, and Col. Lew Allen, Director of Plans for NRO Program A at the time, pointed out that MOL/Dorian required a greater number of design compromises than did unmanned systems. MOL's primary design consideration had to be the safety of crewmembers, but another important factor was giving crewmembers something to do even though automated systems could perform just as well. Others wondered if the added value of a manned system over an unmanned system justified the very substantial increase in cost. Still, the national commitment at the time was to manned spaceflight and MOL/Dorian remained on track.[31]

(U) Other analyses, including pre-contract definition studies, followed in early 1965 and in late June 1965 Secretary of the Air Force Eugene Zukert recommended program approval. He received seconds from Donald F. Hornig, the President's Science Advisor, and Charles L. Schultze, the Director of the Budget, who, like Zukert, based their support on the anticipated benefit to the intelligence community. At McNamara's urging, President Lyndon B. Johnson gave his consent on 25 August. On 1 October, the NRO assumed responsibility for the reconnaissance payload; the Air Force's MOL Program Office did the same for the overall spacecraft. Public statements referred to the MOL mission as the investigation into and development of orbital capabilities, manned and unmanned, associated with national defense.[32]

(U) NASA's involvement in the MOL was largely driven by its own manned space station project that proposed exploring the near-earth environment, conducting earth observations, and carrying out non-military experiments. Unfortunately, the two projects were quite similar at the unclassified level, something that in December 1964 generated Congressional questions about duplication of effort. DOD and NASA quickly took measures to head off further criticism. The MOL would accept NASA experiments in basic science and general technology, including evaluating the biological responses of humans to extended space flight. Sometime in early 1965, NASA got a place in the MOL's management structure, though one largely limited to coordination and payload studies.[33]

(U) In March 1965, NASA forwarded a list of eighty-four experiments for possible inclusion in the MOL, but that was the high-water mark in its participation. Documentation subsequent to that date reflected a change in direction. For one thing, DOD lacked enthusiasm for NASA's participation and all along assigned that participation a low priority and then only on a non-interference basis. NASA certainly wasn't that interested. When in September 1964 McNamara offered to include NASA experiments aboard the MOL as a forerunner of all space stations, NASA Administrator James Webb politely declined. Webb approved of the MOL and offered NASA assistance in developing it, but that was the limit of his commitment. Tenacious as ever in defending NASA's programs against DOD encroachment, he would neither cede priority to the MOL as the nation's first manned space station nor let it impede any NASA program. Only the possibility that Congressional criticism might lead to funding problems changed everybody's mind. That made NASA's participation in the MOL something of a "shotgun wedding," desired by neither partner and like most such unions destined to be brief and unhappy.[34]

(U) There were other considerations as well. Even as he endorsed the MOL, Presidential Science Advisor Hornig pointed out another problem with NASA's role. The experiments that NASA might place on the MOL were trivial when compared to the damage that might come from openly associating its peaceful image with a military program. It might be better to delete NASA participation in the short term while keeping open the possibility of inclusion at some future date.[35]

(U) The lukewarm commitments by both parties to a NASA role and the possible damage to NASA's image certainly influenced events, but the most significant event came when key Congressional members learned the MOL's true mission. The reconnaissance mission was important enough for Congress to support full scale MOL development without prejudicing NASA's program for a manned space station. By the time President Johnson approved the MOL in August 1965, NASA involvement was no longer an issue. NASA's place in the management structure disappeared, and although attempts to include some NASA experiments continued for a period of time, no real effort went toward achieving that goal.[36]

(U) The absence of onboard experiments did not entirely exclude NASA. In March 1966, the MOL Program Office handed NASA a list of items it needed to support the Gemini portion of the mission. The items requisitioned ranged from almost six hundred pieces of auxiliary equipment to Gemini spacecraft, making it the first documented NASA transfer in support of an NRO mission. Negotiations pared the list down somewhat and both sides agreed to share rather than transfer some items. NASA also offered to share airlock technology under development for its own space station, but there is no indication whether or not the MOL Program Office accepted. A final accounting of what NASA actually transferred was not found during research, but the assessed value came to $50 million.[37]

(U) NASA's main contribution was a modified Gemini spacecraft, known as Gemini-B. The main modification was a hatch cut in the protective heat shield to allow the crew to enter and exit the MOL laboratory. Atmospheric friction on reentry would melt part of the shield's ablative material, which would flow into and seal the crack made by the hatch, thereby protecting the crew from incineration.§ Sub-orbital tests flown in late 1966 validated the procedure. The Air Force and NASA then discussed at some length which of them should manage the modification contract, awarded to McDonnell Aircraft, before agreeing to share responsibility.[38]

(U) By mid-1966, NASA's contribution to the MOL Program, though small, had not produced anything in return, something that Newell sought to remedy. NASA already had long-range plans for an orbiting celestial telescope, but in the interim could Dorian, which featured a 70-inch aperture and [redacted]

§ (U) Lt. Richard Truly (USN), who later crewed on the Space Shuttle, rose to the rank of vice admiral, and served as NASA Administrator, numbered among the first contingent of MOL Astronauts. The third contingent included Maj. James Abrahamson (USAF), who served as NASA's manager for the Space Shuttle program in the 1980s and retired a lieutenant general.

(b)(1)
(b)(3)

focal length, perform astronomical experiments on a non-interference basis? Newell discussed the possibility with the Air Force Maj. Gen. Harry L. Evans, Vice Director of the MOL Program, in July 1966. They agreed it was worth looking into.[39]

(U) A MOL-NASA panel began examining the possibility in October. Strangely, the panel did not seem to have a meaningful NRO presence, although General Evans kept NRO Director Flax fully informed of what was going on. The panel considered three options: use the extant Dorian system, make minor modifications to it, or initiate major modifications.[40]

(U) The panel released its report in February 1967. It contained bad news for NASA. The specialization built into Dorian's attitude and azimuth stabilization, designed to image only targets on the sunlit earth, would limit celestial observations to the brightest nighttime objects, namely the moon and perhaps nearby planets. Imaging stellar bodies was impossible without expensive modifications. Newell apparently did not wish to fund the modifications, but he considered planetary observations using the present optics worthwhile and asked that it be carried out on a non-interference basis. Whether or not his request ever got factored into the MOL's mission was not found during research nor could those interviewed for this history provide an answer.[41]

(U) The next opportunity for closer NASA involvement arose in mid-1968. By that time budgetary concerns had reenergized criticism, largely dormant since 1965, of duplications in the MOL and NASA space station programs. In response, NASA, the Air Force, and the NRO began examining hardware that might be used in both programs, though there still did not appear to be much enthusiasm by any of the concerned parties.[42]

~~(S//NF)~~ As it turned out, the level of enthusiasm did not really matter because the MOL was fast approaching an untidy end. A comprehensive analysis of why the project faltered is beyond the scope of this narrative, but several reasons, none of them particularly surprising, stand out. By 1969, Gambit had achieved resolutions on the order [redacted] and projections called for it to do better than that.¶ Such resolution still did not equal predictions for Dorian, but it made defending a manned system and its additional cost ever more difficult.[43]

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(U) Reflecting back in an interview, former NRO Deputy Director Jimmie D. Hill cited other MOL/Dorian deficiencies. His recollections are worth repeating verbatim:

> At the time the program got started, the longest we could keep a satellite in orbit at low altitude, the altitude of imaging satellites, was still counted in days, not weeks or months. And MOL was supposed to stay up a month. . . . By using film more efficiently over a longer period of time, you could indeed get significantly more value out of the system. The problem was that during the development of the MOL program . . . the technology evolved to where we could make satellites live for months, if not years. So what had started out to be something that would enhance your ability by having a man on board actually evolved into something that would cause you to terminate the mission at the end of a month . . . .[44]

(U) Similar reflections by Col. Allen, whose pithy summary highlighted something even more basic, are also worth repeating. The project, in his opinion:

> . . . really had no purpose other than to get the Air Force into manned spaceflight and enormous efforts were spent trying to find out what you were going to do with it [and] what the mission was

¶ ~~(S//NF)~~ In 1976, Gambit achieved a [redacted] to the best of any system as of this writing. (b)(1) (b)(3)

FOR. . . . IT WAS NOT A GOOD BARGAIN. . . . THE NRO DIDN'T NEED THE SENSOR AND THE AIR FORCE WAS STRUGGLING TO FIND A PURPOSE FOR MAN. . . . MOL [WAS] DESIGNED WAY OFF OPTIMUM TO GIVE MAN SOMETHING TO DO.[45]

(U) On top of everything else, the MOL lagged over two years behind the original schedule, which had called for the first launch in 1968, and more delays were on the horizon. Worse, program cost, estimated at $1.5 billion in 1965, had ballooned to twice that, making it one of the most expensive programs in the DOD budget. With the Vietnam War and the many social programs of Johnson's "Great Society" Program consuming huge amounts of money and the national budget running a sizable deficit, the pressure to reduce spending was intense. All these factors combined to make the MOL little more than a "sitting duck," and on 9 June 1969 President Richard M. Nixon cancelled the program.[46]

~~(S//NF)~~ The termination delighted McLucas who did not believe that the program was worth the expense, but the NRO still examined one last proposal that might salvage at least something out of Dorian. The proposal, referred to as "Hexador," advocated mating Hexagon spacecraft with Dorian optics. The result would be an imaging satellite whose aperture, enlarged from 70 to [redacted] could also achieve a [redacted] and make it a possible successor to Gambit. For whatever reason, the idea did not bear fruit and quickly vanished from the written record.[47]

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(U) Elsewhere, the MOL Program Office went about its three remaining tasks—terminating contracts with civilian firms (idling almost 4,500 workers), disposing of project residuals, and closing itself down. With regard to residuals, Robert Seamans, now Secretary of the Air Force, invited NASA and DOD offices to identify hardware and technology that might benefit them. NASA requested a number of minor items, such as waste management hardware, pressure suits, fuel cells, the astronaut feeding system, and environmental assemblies, and two major components, the MOL Module Simulator and its specially modified IBM 360/65 mainframe computer. Seamans approved the request, which involved only unclassified items, and returned the hardware NASA had furnished in support of Gemini-B.[48]

(U) Dorian-related transfers proved more difficult. NASA showed an interest in the Acquisition and Tracking System, the smaller MOL optics meant to acquire targets and aim the primary optics, and its simulator. During discussions with NRO staff members in September 1969, Newell speculated that the tracking, then an advanced engineering model rather than a finished unit, might be made part of NASA's space station. Once there, it could perform celestial observation, a mission largely without restrictions on sensor capabilities and where the NRO's concerns were minimal. Still, Newell wanted to be sure, and in late October 1969, he initiated a joint NASA-DOD study to ascertain the tracking system's proper role and contracted with Eastman-Kodak to assay Dorian technology in general.[49]

(U) The results of the NASA-DOD study were not found during research, but Eastman Kodak thought that a modified tracking system had a good chance of fitting into the NASA's space station, by then known as Skylab. On 30 March 1970, Newell formally requested transfer of the optics, the MOL simulator, and associated peripherals. The request contained some unexpected provisions, most notably that the equipment would be for earth, rather than celestial, observations. The second Skylab, known as Skylab-B, offered the earliest employment for the tracking system. The NRO raised no objections to the switch to earth observations because it was within the previously mentioned guidelines that permitted NASA to at least plan for improved sensors.[50]

(U) Three weeks later, McLucas tentatively agreed to the transfer, though some on his staff urged caution. NASA had neither funded Skylab-B nor formally committed to its mission. There was no reason to consign something that might never be used. Skeptics recommended going ahead with the transfer, but requiring NASA to store everything until it firmly committed to Skylab-B and identified the planned usage of each piece of equipment. McLucas discussed the matter with Newell in a May meeting, but in the end rejected his staff's advice. On 15 June 1970, he consigned the tracking system to NASA subject only to security precautions that obscured the equipment's origin and previous history.[51]

(U) In the end, the skeptics had it right. NASA found little, if any, use for Dorian hardware. The same applied to unclassified MOL equipment. In March 1971, Naka requested return of the MOL mission simulator and the associated mainframe computer for use in an unspecified Air Force program. The archival record does not mention the ultimate fate of either the simulator or the tracking system, but for sure the latter never flew in space. NASA cancelled Skylab-B in 1976 to free up funds for the Space Shuttle program.[52]

(U) One other possibility for Project Dorian remained. In 1967, when Newell found that the existing Dorian optics were ill suited for celestial observations he had made another suggestion. If marrying NASA's requirements to existing Dorian hardware was not a good idea, maybe the NRO should secretly consign the technology rather than hardware just as it had in the case of the Lunar Orbiter Program. The suggestion struck a responsive chord with Alexander Flax, the NRO Director at the time, who had been thinking along the same lines. McLucas also liked the idea. Both NRO directors believed that a transfer could, if managed properly, avoid security problems and allow NASA to freely modify Dorian technology to meet its needs.[53]

~~(S//NF)~~ In 1969, NASA went a step further by assessing Dorian as the basis for an orbiting astronomical telescope, which we know today as the Hubble Space Telescope. The findings were positive, and in 1970, Newell asked for consignment of the technology, a request McLucas honored. At this point, however, references to Dorian vanished from the archival record making it uncertain what happened in later times. [redacted] (b)(1)
This will be discussed further in later chapters.[54] (b)(3)

(U) Earth Observations from Apollo Spacecraft

~~(S//NF)~~ The demise of MOL/Dorian left only one other instance of NASA-NRO interaction on a space program during the late 1960s and early 1970s. NASA's 1967 switch from manned to unmanned spacecraft for earth observations left Apollo Applications with only one near earth mission, to establish a manned space station as a technological bridge to more advanced manned space operations. Still, earth observations from Apollo spacecraft enjoyed a rebirth in the late 1960s, albeit only as a shadow of its former self. The rebirth began with Apollo-6.

(U) Apollo-6, an unmanned vehicle scheduled for launch in April 1968, was the second Apollo to carry a camera and the first to attract the NRO's attention. Its flight plan called for two low altitude orbits of the earth before departing on the high altitude portion of the mission. A small Maurer camera would photograph the earth directly beneath the spacecraft while in low orbit to record its orientation. In a disquieting note, NASA did not submit the plan for coordination and approval until less than three weeks prior to execution, something that Flax was quick to point out.[55]

~~(S//NF)~~ For obscure reasons, imaging the earth from Apollo-6 went to the 40 Committee,** a White House panel charged with overseeing high-risk covert operations, for a decision. Flax communicated his recommendations to the committee. He raised no objections so long as the camera's resolution fell within established guidelines, NASA exercised care in selecting the countries imaged, and the

** (U) Called the 303 Committee during some periods.

photographs thus obtained underwent screening prior to public release. The 40 Committee authorized the photography using Flax's comments as guidance, but as it turned out, no one need have concerned themselves. A less than successful 4 April 1968 launch placed Apollo-6 in an anomalous orbit almost 200 miles high, nearly double the planned altitude. The resulting imagery had degraded resolution and little or no stereographic coverage.[56]

~~(S//NF)~~ Then came Apollo-7, an earth orbit mission that imaged test targets in the United States as a check on similar photography taken by aircraft. No other information on that mission turned up during research. Apollo-7 was followed by a two-year hiatus before, again for obscure reasons, earth observations from Apollo spacecraft resurfaced with Apollo-13. That mission, like all missions beginning with Apollo 8, the first to orbit the moon, would carry cameras to image the lunar surface. If an anomaly prevented departure on a lunar trajectory, Apollo-13 could salvage at least something by flying a six-day contingency mission in earth orbit in support of earth observations. Apollo 13's plans called for cameras with varying focal lengths. The Hycon Lunar Terrain Camera's 16.5-inch focal length was capable of resolutions as low as 40 feet from earth orbit.[57]

~~(S//NF)~~ NASA informally coordinated the Apollo-13 contingency mission with the NRO and the State Department. When the State Department questioned plans to image the Sino-Soviet bloc, NASA turned to the White House for arbitration. On 3 April 1970, NASA Associate Deputy Administrator Willis H. Shapley forwarded an approval request to the 40 Committee, now chaired by Henry A. Kissinger, the President's Assistant for National Security Affairs. Shapley's communication listed the cameras to be carried, their expected resolutions, the post-mission film review process, and asked to image the Soviet Union and China. The committee approved the contingency mission, but forbade photographing the Soviet Union and China.[58]

~~(S//NF)~~ The four lunar missions subsequent to Apollo-13 carried better cameras, some with projected resolutions of 25 feet from earth orbit. The cameras included at least three transferred from the NRO—an Itek (-9) tracking camera used on Corona, a mapping camera from Hexagon, and an Itek optical bar panoramic camera apparently designed for either the U-2 or the SR-71. The NRO approved use of the cameras, but approval came with a recommendation for strict controls on what could be photographed. The 40 Committee saw things the same way. Apollo-14 through Apollo-17 could fly contingency missions, but with progressively increasing restrictions that ultimately limited photography to North and South America and adjacent coastal waters. In the end, it did not matter because no Apollo ever flew a contingency mission. Apollo-13 came closest, but it suffered its near-catastrophic anomaly, an explosion in the service module, after departing on a lunar trajectory.[59]

* * * * *

~~(S//NF)~~ The near absence of NASA activities outside of Apollo made the last half of the 1960s a fallow period in which almost all dealings with the NRO were minor. True, the NRO consigned an Itek (-9) tracking camera to NASA; reluctantly opened its photo archives to other government agencies, NASA among them; and permitted reconnaissance quality cameras to be used on Apollo contingency mission, but those were the only instances of successful interaction. NASA's participation in the MOL/Dorian program never really got started, in large measure because both parties wanted it that way. Transferring Corona cameras and MOL/Dorian hardware came to naught as did NASA's plans to fly contingency earth observation missions from Apollo spacecraft.

~~(S//NF)~~ The same was true of transferring Dorian optical technology, which at least superficially seemed applicable to what became the Hubble Space Telescope. Why Dorian failed to benefit Hubble is not clear, but the changing requirements for celestial observations from space during the next several years probably numbered among the reasons. That failure did not, however, alter what was becoming clear by 1970: transferring technology achieved more success than transferring hardware. Hardware, especially highly specialized hardware, cannot readily be put to other tasks without extensive modifications. Transferring technology allowed recipients to build systems to their exact specifications in a more orderly and less expensive way.

(U) The fallow period at least gave time for the coordination and management structure put in place in 1966-1967 to begin carrying out its duties. That was fortuitous because the downturn in Apollo funding in the late 1960s would free up money for NASA to begin moving forward with a number of other plans and programs that involved the NRO. Unfortunately, the increased NRO-NASA interaction soon revealed weaknesses in the management and coordination structure that required a complete revamping less than a decade later. In much the same way, the nation's overall space effort had by the mid-1970s outgrown the largely ad hoc measures previously governing it. National decisionmakers needed to take remedial action to put all space programs, military and civilian, on a more solid foundation. How the NRO and NASA reordered their affairs during that period and the changes made in the management and decisionmaking structure of the nation's space program are treated in the next chapter.

(U) Chapter Four

(U) The 1970s: Structural and Political Changes

(U) The Apollo Program and the vast amount of money it consumed dampened down NASA's other missions. True, NASA launched thirty unmanned probes during the 1960s, but twenty-one of them—Rangers, Surveyors, and Lunar Orbiters—supported Apollo. Although NASA carried out Mercury and Gemini manned orbital flights, both programs were at least partially to test equipment, improve techniques, and train crewmembers for Apollo. Other than a small number of weather satellites, nothing related to earth observations advanced beyond the planning stage.[1]

(U) That started changing in about 1969 when Apollo's funding began winding down, thereby freeing up money for other projects. Cancellation of three planned Apollo missions released additional funds. Some of the freed-up monies went into three follow-on manned endeavors: Skylab, the nation's first space station; a rendezvous in space with the Soviet Soyuz spacecraft (the Apollo-Soyuz Test Project); and the Space Shuttle, a winged spacecraft intended to boost payloads into orbit, reenter the atmosphere, and land similar to a conventional aircraft.

(U) Apollo's decline also resulted in funding the transition of a number of scientific programs from drawing boards to launch pads. During the 1970s, NASA launched planetary probes and propelled into earth orbit an array of communications relay satellites, astronomical observatories, and satellites to study solar radiation and the upper atmosphere. Most importantly, in 1977, NASA contracted for the Hubble Space Telescope, an instrument whose ultimate benefit to science in general and astronomy in particular is almost beyond calculation.[2]

(U) NASA's earth observation programs underwent a similar flowering during the 1970s. By mid-decade, at least thirteen such programs either had satellites in orbit or scheduled to be launched by decade's end. These included, most prominently, Landsat,* as well as a number of more obscure programs such as Geodynamic Experimental Ocean Satellites, a synthetic aperture radar satellite, and Applications Technology Satellites. Subsequent chapters will address the NRO connection to earth observation programs, Skylab, the Hubble Space Telescope, and the Space Shuttle.[3]

~~(S//NF)~~ Meanwhile, the NRO retired Corona, the world's first photoreconnaissance satellite, in 1972, replacing it with Hexagon. Hexagon, an area search satellite, and the high-resolution Gambit satellite, first launched in 1963, were, like Corona, film return systems. The NRO continued both of them into the 1980s [redacted]

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~~(S//NF)~~ The NRO orbited far fewer signals intelligence (SIGINT)† collecting satellites in 1970s, but qualitative improvements more than offset the numerical decline. Earlier SIGINT satellites had limited intercept capabilities and short useful lives measured in weeks, if not days. Those in the 1970s featured broader intercept spectrums and operational lives that sometimes exceeded [redacted] The newer SIGINT collectors flew in a variety of low-earth and highly elliptical orbits, and in some cases hovered in geosynchronous positions [redacted]

(b)(1)
(b)(3)

* (U) Known as the Earth Resources Technical Satellite (ERTS) until the mid-1970s.
† (U) SIGINT is made up of Electronic Intelligence (ELINT) and Communications Intelligence (COMINT).

(U) As if that wasn't enough, the 1970s were equally vibrant in terms of political changes, both international and domestic. The Cold War waned somewhat during the late 1960s and continued to do so for the next decade. Soviet-American relations, though never toasty warm, improved. In 1972, Washington undertook the first in a series of initiatives that would lead to resumption of diplomatic relations with mainland China. International acceptance of NASA's space observation programs grew, though there remained troubling questions about the right of individual nations to limit observations of sovereign soil.

(U) These events and others brought pressure to reduce the security surrounding the NRO and its bevy of satellites. Even though satellite reconnaissance was more or less an open secret by the early 1970s, the NRO, the Intelligence Community, and, surprisingly, NASA resisted change. Declassifying, or at least downgrading, the "fact of" the NRO and satellite reconnaissance remained contentious throughout the decade even though no one advocated revealing missions specifics.

(U) Easing the 1966 restrictions placed on sensors aboard NASA's earth observation missions proved only a bit less controversial. Those restrictions, primarily a 66-foot resolution on optical sensors, for a number of reasons became increasingly difficult to defend as the 1970s progressed. Yet, as with downgrading or declassifying the "fact of" satellite reconnaissance, most of the decade passed before that limitation came under serious review.

(U) This rather extensive litany of events is intended to alert the reader to a particularly dynamic period in the nation's space history. So involved were the issues and programs that it will take the next five chapters to adequately document them. This, the first of those chapters, sets the scene in terms of international and domestic politics and changes made in the NASA-NRO relationship.

(U) International Issues

(U) Every President since at least John F. Kennedy had supported cooperation with the international community in the peaceful uses of space. In fact, only three weeks before his tragic and untimely death, Kennedy had ordered that cooperation be extended to the Soviet Union. Still, it took time and a slow thaw in the Cold war to bring Moscow and Washington to the negotiating table. In January 1971, representatives of the Soviet Academy of Science and a delegation headed by NASA Deputy Administrator George Low finalized an agreement pledging cooperation on peaceful space programs. In the agreement, Moscow took positions previously unthinkable, including sharing information on the exploration of near space (i.e., the moon and planets), surveys of the world's natural resources, and meteorology. The two nations could use any sensors they wished, including active emitters such as space-based radar. Both agreed that there be no restrictions on imaging any portion of the globe, but respect for national sovereignty made negotiations with individual counties advisable.[5]

(U) The international response to Landsat's scheduled 1972 launch, and with it the prospect of observation from space, was muted, but not entirely absent. Smaller countries had long accepted, albeit tacitly, that the United States and the Soviet Union flew reconnaissance satellites. They based their acceptance on the knowledge that they were not being threatened and, indeed, effective space reconnaissance programs reduced tensions between the superpowers. With regard to Landsat the only international concerns of consequence were what got imaged and, as predicted, issues of national sovereignty.[6]

~~(S//NF)~~ Still, NRO Director John McLucas was wary. He did not want international disputes of any kind focusing unwanted attention on earth observation in general and satellite reconnaissance in particular. He asked the State Department to guard against official statements that highlighted capabilities, listed specific objectives, [redacted] McLucas made his point, and the State Department responded with a special committee to clear all government statements regarding Landsat.[7]

(b)(1)
(b)(3)

(U) The broad international acceptance of space reconnaissance and the generally favorable reaction to Landsat's upcoming launch added to a brewing controversy surrounding the NRO. Since the beginning of the space age, a strong consensus within the federal government had favored protecting the United States' space reconnaissance with dense layers of security. By the early 1970s, however, that consensus had begun to fray as other voices could be heard.

(U) Proponents of easing NRO security marshaled a number of telling arguments to support their position. It was an open secret, they argued, that both superpowers flew reconnaissance satellites, so nothing would be lost by admitting it. Landsat's upcoming launch would sharpen interest in space observation, making it more difficult to maintain the current policy of deflecting or stonewalling outside queries about space reconnaissance. Besides, the United States would have to acknowledge that spaceborne assets numbered among the "national technical means" used to monitor compliance with any agreements resulting from ongoing Soviet-American arms control talks.[8]

~~(S//NF)~~ That said, however, proponents of cutting back on security could not agree on specifics. The State Department wanted to protect reconnaissance technology, but considered the codeword security compartments surrounding every aspect of the NRO to be overly restrictive. The "fact of" spaceborne reconnaissance should be downgraded to collateral Secret or even declassified. Others, NASA included, supported some form of relaxation, but had wide ranging views on what that relaxation should amount to. For sure, NASA Administrator James Fletcher opposed declassification because it might raise embarrassing questions about NASA's relationship to space reconnaissance.[9]

(U) The NRO opposed almost all modifications to security, but, like the proponents of change, could not reach complete agreement on specifics. In recommendations made in the summer of 1971, Brig. Gen. Lew Allen, NRO Program A Director, urged keeping changes to a minimum and only if they did not impact the mission. Program B Director, Carl E. Duckett, and Program C Director, Capt. Robert K. Geiger, opposed any change whatsoever.[10]

(U) When the issue came before the Executive Committee (ExCom) of the National Reconnaissance Program in March 1972, McLucas supported Duckett and Geiger by taking a hard line. If space borne reconnaissance was already an open secret, as proponents of change argued, nothing could be gained by admitting it. Besides, the NRO had operated successfully under strict security and he saw no reason to alter that. He then deferred to the Director of Central Intelligence (DCI), Richard Helms, whose statutory responsibilities included protecting intelligence sources and methods. Helms, an ExCom member, lived up to his long-standing reputation for caution when it came to security. Although the Intelligence Community had periodically considered relaxing security, the DCI had consistently resisted any change. He still opposed change and that remained the Intelligence Community's position.[11]

(U) That did not resolve the matter, however. Parties unknown asked the National Security Action Memorandum (NSAM) 156 Committee, which met periodically on issues affecting space policy, for its opinion. The same parties also asked the Verification Panel, charged with monitoring compliance with arms reduction agreements, to state its position. Both recommended at least acknowledging the use of satellites for treaty verification, but Henry Kissinger, the President's National Security Advisor, disagreed. The first agreement emerging from the Soviet-American talks, called the Strategic Arms Limitation Treaty (SALT-1), had not produced any significant pressure to either openly discuss "national technical means" of verification or to relax security. He decided to let sleeping dogs lie and declined to place the question before President Richard Nixon, the only official with sufficient authority to render a decision.[12]

(U) SALT-1, signed in late May 1972, alluded to satellite reconnaissance by stating that the signatories would rely on "national technical means" for treaty verification. The treaty obligated both parties not to interfere with the other's verification process. That, plus the generally favorable international response to Landsat-1, launched two months later, widespread use of Landsat imagery, and pressure from governmental agencies for greater access to reconnaissance imagery kept the issue alive. Downgrading or declassification soon returned to the spotlight. In September 1973, the United States Intelligence Board, the Intelligence Community's highest decision making body, petitioned to have both selected imagery and the "fact of" spaceborne photographic reconnaissance reduced to the collateral level. This time, Kissinger agreed and later in the year Nixon reduced the classification of both to collateral Secret. The codeword classification of SIGINT collecting satellites did not change.[13]

(U) Questions of Technology

~~(S//NF)~~ As the international and domestic political climate changed, NASA and the NRO reached a tipping point regarding technology and technological transfer. NASA's use of NRO technology, which dated to 1963, would probably increase as the number and variety of NASA's programs grew. In the opinion of some NRO staff, the long-term result would be a progressive convergence of NASA and NRO technology and capabilities. That convergence could at some point result in the nation having two separate satellite reconnaissance programs, one *de jure*, the other de facto, and increase the risk of compromising both the NRO and American technology. This was not a new topic, such concerns having first been addressed in 1965.[14]

(U) Other government agencies agreed and in 1973, the NRO, DOD, and the Arms Control and Disarmament Agency (ACDA) petitioned for a reconvening of the NSAM 156 Committee to assess this possible convergence and other aspects of space policy. It would have been the first national level review since 1966, but it did not happen. The evidentiary base does not say why, but the State Department, whose Under Secretary for Policy Affairs chaired the committee, declined to act on the request.[15]

~~(S//NF)~~ Rebuffed, but undeterred, the NRO a year later addressed the matter in another way. Some NRO staff repeated the long-held belief that NASA had too little concern for security and possessed an independent streak when pursuing programs with reconnaissance overtones. In this latest iteration, staff members believed that NASA's ongoing relationship with selected civilian firms, some of whom were eager to use NRO-related technology to gain business in the commercial world, was edging toward the unacceptable. It was time to negotiate an accord that would still allow NASA access to NRO technology, but subject that access to more rigorous oversight. The staff urged James Plummer, who succeeded McLucas as NRO Director, to be firm with NASA in this matter.[16]

Figure 4-1. (U) NRO Director James W. Plummer.
(Image: UNCLASSIFIED)

~~(S//NF)~~ Plummer had no need for firmness. NASA Administrator Fletcher doubted that NASA-NRO technology was converging, but agreed that the question needed airing. Beginning in late 1974 and continuing into early 1975, the two agencies worked on an accord entitled "The Terms of Interface between NASA and NRO for Technology, Hardware, and Facilities." The new agreement, signed no later than August 1975, began by affirming that national interest profited from making relevant NRO technology available, thereby guaranteeing continued NASA access. As in the past, the NRO had responsibility for developing the procedures whereby that technology would be made accessible. NASA personnel would continue to be briefed into the BYEMAN security compartment in a manner controlled by the NRO and based on need to know.[17]

~~(S//NF)~~ None of the above provisions broke fresh ground, but other measures did. Coordinators appointed by each agency, with the NRO appointee having the higher rank of Principal Coordinator, would control interaction to the point of approving all contact between the two agencies. Cleared personnel from NASA and civilian firms could initiate classified contracts, but needed prior approval from the two coordinators to do so.[18] Appendix 9 contains an unsigned draft of the terms of interface, the only copy found during research.

~~(S//NF)~~ The new agreement clearly strengthened the controls governing access to sensitive technology, but some NRO staffers, led by the Deputy Director for Plans and Policy, Lt. Col. Harold S. Coyle, Jr., were not satisfied. There were larger issues that needed to be examined. The very nature of the earth observation program and NASA's pursuit of ever more capable sensors meant that NASA could achieve a de facto reconnaissance capability *without* access to NRO technology. Nations with no space reconnaissance capability could then use the openly distributed imagery for their own intelligence purposes. And what would be the effect on the NRO if international opinion, relatively quiescent for the moment, took offense at the improved imagery and turned against NASA's earth observation programs? Concerned staff members presented Plummer with options, but recommended a national-level review of NASA-NRO activities to bring NASA under still further control. Plummer agreed, and in late February 1975, he asked Secretary of Defense William Clements to reconvene the NSAM 156 Committee for that purpose.[19]

~~(S//NF)~~ The Program Review Board and the Space Policy Committee

~~(S//NF)~~ Clements delayed two months before taking further action, probably awaiting a concise statement of the major issues involved and endorsement of the Terms of Interface. During the interim, DOD, the NRO, and NASA turned their attention to the coordinating and decision making structure that bound them together. That structure, in effect since 1966, consisted of the Manned Space Flight Policy Committee (MSFPC) and a subordinate panel, the Survey Applications Coordinating Committee (SACC); the latter handled minor problems while the former tackled more difficult issues and established overall policy. By 1974, however, and quite possibly earlier, that structure had fallen into disuse. Archival evidence suggests that the last SACC meeting took place in 1971. Problems and issues that subsequently arose were handled in an ad hoc manner and without strict guidance. The whole coordinating and decisionmaking arrangement needed to be rethought and a new structure established.

~~(S//NF)~~ If anyone needed evidence favoring a new structure, it came in December 1974 when an executive from an unnamed civilian aerospace contractor visited the NRO. He informed NRO official that NASA had twice during the last year requested proposals from two civilian firms for system definition and detailed system designs of a High Resolution Pointable Imager for use in earth observations. [redacted]

(b)(1)
(b)(3)

~~(S//NF)~~ Fortunately, an NRO evaluation showed that the proposals had stayed in BYEMAN channels and there had been no security breach. Nevertheless, the project had to be halted because the pointable imager had an anticipated resolution of 33 feet, much better than that allowed by existing guidelines. NASA tried and failed to work out procedures that would allow continuation of the project, leading Fletcher to issue a termination order in late February 1975.[21]

~~(S//NF)~~ The termination order came about a month before Plummer hosted a breakfast meeting that included DOD, NRO, and NASA representatives. They quickly agreed on a Program Policy Committee, soon changed to Program Review Board, to replace the MSFPC. The name change came about because there was no requirement to make public the existence of a board, thereby giving the new structure a lower profile and additional protection against unwanted scrutiny.[22]

(U) The initial thinking foresaw the new board having the same membership as the MSFPC, but NASA Deputy Administrator Low demurred. He wanted three other governmental departments—Interior, Commerce, and Agriculture—added. All three made extensive use of Landsat imagery and should have some say in decisionmaking. Low may also have believed that their Landsat connection would

‡ ~~(S//TK//NF)~~ Called [redacted] at the time.

(b)(1)
(b)(3)

make them sympathetic to NASA's position on some issues. Whatever the reason, his suggestion won approval.[23]

~~(S//NF)~~ The Program Review Board's duties included, *inter alia*, resolving interagency policy issues, coordinating various programs on a continuing basis, and recommending changes in program direction. Board membership consisted of the NRO Director, NASA Deputy Administrator, Deputy Director for Research and Engineering (DD/R&E) representing DOD, and Deputy Director of Science and Technology representing the CIA. The DD/R&E served as chairman, just as in the MSFPC. Meetings took place quarterly or more often if requested by a member. There was no mention of including other members in the decision making as Low wanted; that would come later.[24]

~~(S//NF)~~ The Policy Review Board had two, rather than one, subordinate bodies. A Technology Committee, chaired by a senior DOD official, assessed the sensitivity of civil and military technology flowing into the public arena and coordinated the development, transfer, and public release of that technology. A Data and Information Release Committee, chaired by a senior NASA executive, had oversight responsibility for the release of that technology. Both committees referred to the Policy Review Board matters beyond their expertise. The new structure, contained in "Memorandum of Agreement: Conduct of Intelligence and Civil Space Programs," was signed by Secretary of Defense James Schlesinger, DCI William Colby, and NASA Administrator Fletcher. It went into effect in August 1975.[25] Appendix 10 contains that memorandum of agreement.

~~(S//NF)~~ Meanwhile, Secretary Clements had gathered the supplementary information he needed to convene the NSAM 156 Committee. He addressed his request, dated 21 April 1975, to Kissinger. He attached two documents, the Terms of Agreement and a synopsis, developed by Lt. Col. Coyle and David Williamson, Jr., Assistant NASA Administrator for Special Projects, laying out the major problem areas. The synopsis asked that the review consider only two issues: How could civil and military space programs be better managed to avoid compromising classified capabilities. And what might be the impact on the NRO should NASA's various earth observation programs at some point generate international resistance.[26]

~~(S//NF)~~ The Secretary's request contained one very unusual feature. He did not request a convening of the NSAM 156 Committee, but rather an interagency panel *similar* to the *old* NSAM 156 Committee, one with the Departments of Commerce, Interior and Agriculture participating. Established by Presidential order in 1962, the NSAM 156 Committee had ceased to exist, almost certainly because the nation's civilian and military space programs had grown too large and complex to rely on a panel that met so infrequently for guidance.

~~(S//NF)~~ Kissinger did not respond until 15 July 1975, though some of what he had to say had already leaked out. He had consulted with President Gerald Ford who directed the formation of a permanent body, the Standing Committee on Space Policy, popularly known as the Space Policy Committee, within the National Security Council (NSC). The new group's membership consisted of the NSC's under secretaries augmented by representatives from NASA, the NRO, the Office of Management and Budget (OMB), the Under Secretary of State for Political affairs, the President's Science Advisor and, later, the Assistant Secretary of Defense for International Security Affairs. As with the NSAM 156 Committee, the Under Secretary of State for Political Affairs occupied the chair. The Space Policy Committee could invite participants from other agencies as appropriate to the issues under discussion, thereby satisfying Low's request for wider representation in decision making. It would concern itself with policy, not operations, when rendering decisions or making recommendations to the President. Operations properly came under the purview of the Program Review Board.[27]

~~(S//NF)~~ The Space Policy Committee began working the problems associated with earth observation and space based reconnaissance in August 1975. Committee members identified a number of issues beyond what Coyle and Williamson had suggested. Things got a bit more complex when the President and the OMB, in the interest of economy, asked about combining the NRO's reconnaissance operations and NASA's earth observation missions into a single program. Answering that question first required considerable preliminary work by a subordinate panel, the Space Policy Committee Working Group.[28]

~~(S//NF)~~ The Working Group, under the direction of Leon Sloss, first solicited inputs not only from NASA, the NRO, DOD, and the CIA, but also from a range of other government agencies. Then the effort shifted to identifying the more important issues for further consideration. What emerged were five topics: the technology used in NASA's earth observations; broader use of NRO imagery by civilian agencies; declassifying the "fact of" satellite reconnaissance; NASA's policy of openly distributing Landsat imagery, and possible changes in NASA and NRO organization and management. Sloss placed these issues on the agenda for the 18 November 1975 Space Policy Committee meeting.[29]

~~(S//NF)~~ At that meeting, attended by Plummer and Fletcher, each representative at the table had his say. The available minutes are sketchy, but did record some comments. Plummer repeated concerns that a shift in international opinion might disrupt space reconnaissance, but others thought he was overreacting; the United States would never let other nations interfere with programs vital to national security. Fletcher opposed any change in the open distribution of Landsat imagery and for the first time specified a 33-foot resolution as the best that NASA would ever need for earth observations. Both men cited NASA-NRO relations as being good and both believed that the NSAM 156 Committee's 1966 recommendations on national space programs should remain the basis for making policy changes.[30]

~~(S//NF)~~ Not until November 1976 did the Space Policy Committee send its report to the President, a testament to the difficulty in developing and coordinating a single document that dealt with the questions raised. The report, entitled "Remote Earth Imagery: Policy Issues, Options, and Recommendations," was in turn attached to a Memorandum for the President entitled "Policy on Remote Earth Imagery." The two documents contained one conclusion, six recommendations, and one set of options.

~~(S//NF)~~ The conclusion addressed combining the NRO and NASA earth observation missions into a single program. The Committee found no merit in such a radical alteration to the existing relationship. The two organizations had developed separately in response to different requirements, and they had different technical approaches, objective, and policies. Besides, the dual approach—separate but closely coordinated—had served national interests well over the years.[31]

~~(S//NF)~~ The six recommendations enjoyed unanimous agreement. Four recommendations—the NRO and NASA continue coordinating their programs, Washington resist pressure to restrict NASA's earth observation programs, the President reaffirm that space reconnaissance would continue even if pressure made it necessary to accept some restrictions on NASA, and that there be a limited expansion in use of reconnaissance imagery by the civil sector—probably did not create controversy. For sure, the sixth and last recommendation, that the President approve the Committee's other recommendations, enjoyed smooth sailing.[32]

~~(S//NF)~~ Similarly, the fifth and remaining recommendation allowing NASA to acquire imagery with a 33-foot resolution also breezed through without dissent. There were no longer valid reasons to oppose it. In 1969, former NRO Director John McLucas had predicted that events would in time force such a move and that had come to pass. When Skylab, America's first station, launched in 1973, it carried an optical system with a 33-foot resolution as a one-time exemption to the 66-foot limit, an event covered later in this narrative. The released imagery did not create a stir. The Department of Agriculture, the Environmental Protection Agency, and the Forestry Service clamored for better resolution, well below 30 feet, if possible. Commercial interests wanted better resolution to aid in exploiting mineral deposits. A European space imaging system with a 33-foot resolution would orbit in the early 1980s, and that imagery would be publicly available. American firms eager to produce space-rated optics competitive with European systems should no longer be denied that opportunity. In fact, NASA could, if it wished, begin actively planning for improved optics, but needed prior approval until Presidential endorsement of the Committee's report.[33]

~~(S//NF)~~ The report's set of options concerned the only unresolved issue: whether or not to declassify the "fact of" satellite reconnaissance. The topic remained as hotly contested as ever. Although the security blanket protecting the NRO had frayed still further since Nixon had downgraded the "fact of" spaceborne reconnaissance to collateral Secret in 1973, the pros and cons of declassification remained virtually the same. NASA still did not want to answer possible questions about its relationship to space reconnaissance. The NRO still believed that secrecy had benefited it in the past and should be continued. In fact, the NRO felt strongly enough about the matter to encourage the ACDA to participate in the debate because that organization also opposed declassification.[34]

~~(S//NF)~~ In the end, seven government entities—DOD, the NRO, NASA, the State Department, the Joint Chiefs of Staff, the ACDA, and the CIA—opposed declassification; four—the Departments of Commerce and Interior, the Agency for International Development, and the OMB—favored it. The final decision rested entirely with the President.[35]

(U) That was followed by a delay. By the time the Committee's report arrived at the White House, Gerald Ford was a "lame duck," having lost the recent presidential election. With little time remaining in office he deferred some decisions to his successor, Jimmy Carter. Final action on the report had to await the new administration.

~~(S//NF)~~ Actually, Ford passed along quite a number of important space-related decisions besides those in the Space Policy Committee's report. These included the survivability of reconnaissance satellites in time of war, establishing an anti-satellite capability for the United States, putting space reconnaissance assets to tactical military use, international cooperation in space programs, and an unspecified number of interagency disputes. The new President would have to make decisions without firm guidelines because no individual or group had ever set down national space policy in a single authoritative document. Instead, policy had evolved over the years into a rather untidy mosaic of official statements, treaties, agreements, legislation, ground rules, and customary practices that represented a set of governing principles. The nation's space program had become too large and too complex for that to continue.[36]

(U) The unidentified NSC representatives who briefed Carter in February or March 1977 on the situation brought with them a proposed course of action. They advised him to establish by Presidential Review Memorandum a study group subordinated to the Space Policy Committee. The new group would recommend for Presidential approval a national space policy, appropriate implementing instructions, and disposition of the various documents currently guiding the nation's space program. In the meantime, Carter could use interim guidance to decide the issues before him.[37]

~~(S//NF)~~ Carter responded with Presidential Review Memorandum/NSC-23, signed on 28 March 1977 and addressed to thirteen high ranking government officials beginning with Vice President Walter

Mondale. The memorandum followed almost exactly the NSC's recommendation, but had a rather ambitious timetable attached. Carter wanted interim guidance by 15 April and a completed national space policy on his desk by the first of July.[38]

(U) The study group had absolutely no chance of meeting that schedule, at least as far as a completed policy was concerned. It took until at least August 1977 just to bring together the many shards currently directing the nation's space program and identifying which merited inclusion in the new policy decree. That was followed by the difficult task of winnowing everything to fit into a single, brief document and getting that document through coordination. Action on the Space Policy Committee's recommendations, already deferred until Carter took power, now awaited presidential approval of a national space policy.[39]

~~(TS//NF)~~ Carter signed the national space policy decree, Presidential Directive/NSC-37 (PD/NSC-37), "National Space Policy," on 11 May 1978. It was a brief document, totaling less than seven pages, but covering a lot of ground. Some of the provisions had been policy for years, including rejecting national claims of space or efforts to impede the rite of passage through or operations in space. The United States intended to pursue scientific space programs and was willing to cooperate with other nations in these programs. The directive allowed that civilian earth sensing (i.e., observations) from space could henceforth include sensors with 33-foot resolutions, but only after weighing the benefits against the effects on national security and foreign policy. Other provisions amounted to conventional, if secret, wisdom, such as maintaining a satellite reconnaissance program and conducting any space activity necessary for national defense.[40] Appendix 11 contains PD/NSC-37.

(U) PD/NSC-37 took the middle ground on the "fact of" satellite reconnaissance by reducing its classification only slightly, to collateral Confidential, but that decision did not long endure. Arms reduction talks with Moscow had produced another arms control treaty, SALT-2, which was coming up for Senate ratification. Secretary of State Cyrus Vance wanted to mobilize public opinion in favor of ratification. In June 1978, he warned Carter that not declassifying space reconnaissance and highlighting it as a national technical means of verification jeopardized that effort.[41]

(U) Carter agreed, and on 29 September, State Department representatives privately notified the Kremlin of the impending move. Soviet officials took the disclosure in stride and without serious comment. The President went public two days later during a speech at Cape Canaveral, Florida. He praised the role of photographic satellite reconnaissance in stabilizing world affairs and the immense contribution it made to monitoring arms control treaties. He did not mention spaceborne SIGINT collection, whose existence remained classified. Ironically, the disclosure did not help SALT-2 gain Senate approval. When the Soviet Union invaded Afghanistan in late 1979 Carter halted the ratification process effectively killing the treaty, although both sides informally agreed to abide by its provisions.[42]

(U) There remains one other policy note from the 1970s that merits mentioning. In late 1979, Hans Mark, who followed Plummer as NRO Director, revived the declassification issue. The NRO's existence had been compromised several years earlier when a letter with the NRO logo somehow got mixed in with unclassified documents. Moreover, he continued, public disclosure would make it easier to work with Congress. A DOD study followed, but the idea ran into substantial resistance. Declassifying the "fact of" the NRO, and with it the working relationship with NASA, still lay over a decade in the future.[43]

* * * * *

(U) The policy and management changes made during the 1970s meant that the crash programs prominent in the earlier American space program had ended. A more methodical and reasoned approach was now in order. The new maturity required, among other things, accepting new ways of viewing space to include more systematic methods of decision making. The Space Policy Committee, as a permanent body, replaced the older NSAM 156 Committee, and moved the senior level of space policy development from DOD and NASA to the NSC. The new committee took away most policy development prerogatives of the former structure, established in 1966, though it wisely left day-to-day operations in hands of a new DOD-NASA level group, the Program Review Board.

(U) A maturing space program was clearly one reason for the structural changes, but there was another consideration. As NASA progressively freed itself from the burden imposed by Apollo, the number, variety, and complexity of its missions proliferated. The MSFPC and the SACC alone could not adequately handle everything, making the Program Review Board and its two subordinate panels a necessity. Thus a clear division of responsibility emerged: major policy development at the NSC level and operational decisions at the DOD-NASA level.

~~(S//NF)~~ It was inevitable that several of the new NASA projects would involve the NRO. Some were relatively small and short lived, but others were large, expensive, and long in duration. The two largest programs—the Space Shuttle and the Hubble Space Telescope—are treated in the next chapter.

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(U) Chapter Five

(U) Big Ticket Projects: The Shuttle and Hubble, 1970-1978

(U) When funding for the Apollo moon landing program began winding down in 1968, NASA put a large portion of the newly available funding into diversifying its space effort. That diversification produced two relatively small programs, at least by NASA standards, during the first half of the 1970s: earth observation satellites and, more spectacularly, the manned Skylab space station. Earth observation satellites have performed very well and remain an active program to this very day. Skylab, on the other hand, had an operational life of less than two years before being abandoned. Both programs involved the NRO and the Intelligence Community and both will be treated in subsequent chapters.

(U) At the same time, NASA initiated two ventures whose expense justifies calling them big ticket projects. The first was the Hubble Space Telescope[*] for deep space observations from outside the Earth's atmosphere. The other was the Space Transportation System, popularly known as the Space Shuttle, a reusable winged vehicle meant to replace conventional boosters. Both were long-term endeavors that, unlike Landsat and Skylab, did not bear fruit for years to come.

~~(S//NF)~~ The NRO's involvement with Hubble mimicked its association with the Lunar Reconnaissance Program (1963-1967) when the NRO transferred obsolescent technology to NASA for imaging potential Apollo lunar landing sites. [redacted] (b)(1)
(b)(3)

(U) As initially envisioned, the shuttle would support construction and maintenance of NASA's most ambitious post-Apollo endeavor, a manned International Space Station. Without shuttles to ferry building material and crews to and from the construction site, there would be no space station. That made the shuttle central enough to NASA's ambitions to dominate that organization's planning and funding for over a decade in ways similar to Apollo in the 1960s.

(U) The Shuttle: A Difficult Episode in NASA-NRO Relations Begins

(U) The idea for a Space Shuttle dated from the 1930s when Eugen Sanger, a German,[‡] conceived a spacecraft, dubbed *"SilberFogel"* (Silver Bird) that combined a rocket booster with an aerodynamic glider. After that, little work went into advancing the idea for the next three decades. That changed in the 1960s when NASA and the Air Force tested a number of vehicles, manned and unmanned, to assay a winged spacecraft's ability to return from space. These included the X-15, a piloted hypersonic rocket plane; lifting bodies, manned wingless aircraft that depended on bathtub-shaped fuselages for lift;

* (U) Named in honor of the astronomer Edwin Hubble. Originally known as the Large Space Telescope, it did not get its modern name until 1983. The modern name is used throughout this manuscript.

† ~~(S//NF)~~ Known as [redacted] at the time.

‡ (U) Some sources say Austrian.

(b)(1)
(b)(3)

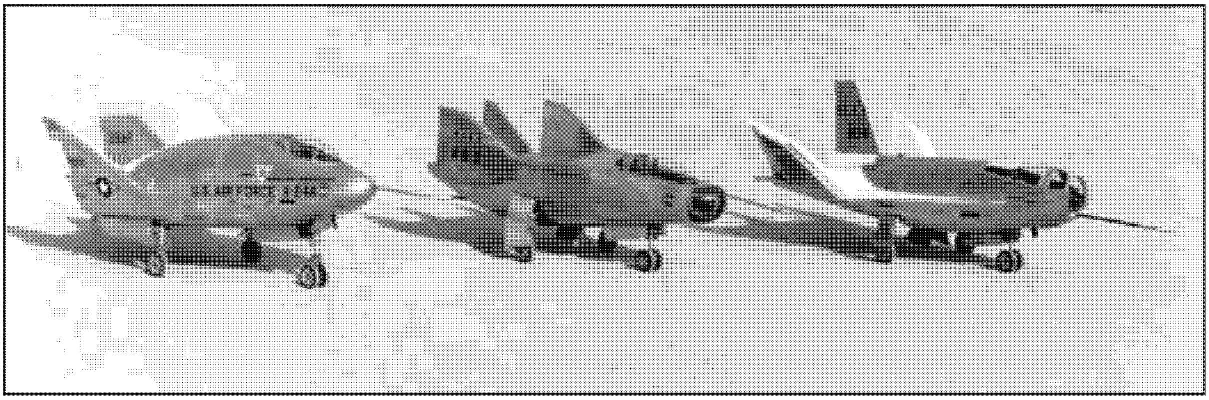

Figure 5-1. (U) Various NASA lifting bodies of the 1960s. (Image: UNCLASSIFIED)

ASSET,[§] an unmanned suborbital vehicle to test heat resistant materials; and PRIME,[¶] an unmanned suborbital craft to test maneuvering during atmospheric reentry. The programs were successful, providing NASA with engineering data critical to the shuttle's later design.[1]

(U) Beginning in about 1967, civilian contractors—North American Rockwell, Grumman/Boeing, McDonald Douglas, Convair, and Martin—experimented with a variety of shuttle designs. The initial designs featured variations of a totally reusable configuration consisting of a winged booster and a winged orbiter, but the approach always yielded assemblies that were too large, too complex, or too heavy. Then, in 1971, Grumman/Boeing recommended moving almost all liquid fuel to an external tank, which once drained would be jettisoned, and adding two large strap-on solid fuel boosters for brute lifting power during the first two minutes of flight. That configuration, called a Thrust Assisted Orbiter Shuttle, permitted a smaller, lighter, and presumably cheaper assembly, factors much more important than the sacrifice of the external tank.[2]

(U) Meanwhile, NASA had been working to head off a serious threat to both the space station and the shuttle. NASA planned to seek simultaneous funding for both programs, an extremely expensive proposition. If funding covered only one program, that program would have to be the shuttle. But using the shuttle only to support the space station was a narrow mission profile that might not be sufficient to secure funding. The shuttle program, therefore, needed additional justification.[3]

~~(S//NF)~~ Securing the additional justification meant having the shuttle declared a national carrier to be used as the primary launch vehicle for all satellites, foreign and domestic. NASA had previously limited its association with military and intelligence activities to protect its good name and public image. Now, however, program survival loomed and a change was in order. That change meant including support of national security as part of the shuttle's justification. It was no coincidence that the shuttle's planned payload bay measured 15X60 feet, just big enough to accommodate the largest payload in the nation's satellite inventory, the yet to be launched Hexagon photo reconnaissance satellite. Early on, NASA and DOD began working together to advance the shuttle's cause in a collaboration that, the NRO connection excepted, was completely unclassified.[4]

(U) In July 1969, a NASA-DOD study group concluded that the shuttle could perform missions beneficial to both organizations. These included carrying payloads into orbit, replacing, servicing, and

§ (U) ASSET: Aerothermodynamic/elastic Structural Systems Environmental Tests.
¶ (U) PRIME: Precision Recovery Including Maneuvering Entry.

recovering satellites, and short duration orbital flights. The shuttle further promised great savings over convention boosters and a 50,000 pound lifting capability, later increased to 65,000 pounds, for low inclination orbits. In fact, the shuttle might ultimately reduce the cost per pound from $1,000 to $40-$50 for low altitude orbits and from $10,000 to $500 for geosynchronous orbits. In February 1970, NASA Administrator Thomas Paine and Secretary of the Air Force Robert Seamans signed an unclassified agreement covering the NASA-DOD relationship and pledging both to make full use of the shuttle.[5]

(U) The White House showed interest in the additional missions, and in June 1970, Paine awarded contracts to Mathematica, a Princeton University think tank, for an economic analysis, The Aerospace Corporation for cost estimates, and Lockheed for payload studies. Mathematica's main task was to determine from data furnished by NASA if the shuttle would be cost effective in non-space station roles. The final report came due in June 1971.

(U) The Mathematica contract was NASA's first attempt at validating a program on a cost-effective basis rather than on technological gain or scientific contribution. Critics quickly denounced that approach as the first step down the wrong road. By emphasizing economics at the expense of scientific and technological benefits, NASA would have to commit the shuttle to a launch schedule and level of performance it could not meet even by cutting corners. In all fairness, however, the choice was not NASA's alone. Congress, having already spent $24 billion on the Apollo Program, wanted the shuttle to pay its own way, and the Office of Management and Budget (OMB), which opposed shuttle development, took its cue from Congress by insisting on a cost-effective analysis.[6]

(U) The Mathematica report arrived at NASA in early June 1971. Using the Thrust Assisted Orbiter Shuttle Configuration, Mathematica examined flight rates ranging from forty to eighty per annum over a twelve-year period beginning in 1979. Using a forty-four mission profile as a model, the shuttle promised a savings of almost $1 billion annually. The shuttle could pay its own way with twenty-five to thirty flights per year, figures well below the fifty-seven missions per year settled on by NASA. The launch rate, an overestimation of monumental proportion, later came back to haunt NASA as critics made use of it to question the program. James C. Fletcher, who served two terms as NASA Administrator, 1971-1976 and 1986-1989, recalls that during his second tenure some of his own staff asked who had been smoking what to come up with such outlandish figures.[7]

(U) Not surprisingly, other agencies scoffed at both Mathematica's report and NASA's projected launch rate. A White House panel chaired by former NRO Director Alexander Flax found problems with Mathematica's reasoning and expressed doubt that the shuttle could ever be justified on an economic basis. OMB, equally dubious, went so far as to conduct its own analysis. September 1971 brought more bad news when Congress decided to fund either the shuttle or the space station, but not both. NASA understandably chose the former.[8]

~~(S//NF)~~ None of these events deterred NASA from pursuing a cost-effective justification if it meant the shuttle's survival. In the summer of 1971, NASA again contracted with Aerospace, Lockheed, and Mathematica for what appears to have been a short analysis based solely on DOD *and* NRO needs. This was the first evidence found during research of NASA specifically citing support of the NRO as part of program justification. It would not be the last.

(U) The NRO Staff Director, Col. David Bradburn, did not like the latest study one bit. He did not trust NASA and had his own doubts about the shuttle. He recommended that NRO Director McLucas have NRO representatives oversee the Aerospace study to protect DOD interests, probably by keeping an

Figure 5-2. (U) NRO Staff Director Brig. Gen. David D. Bradburn. (Image: UNCLASSIFIED)

eye on the supporting data furnished by NASA. McLucas did not heed the advice, listing security and other issues as being more important.[9]

(U) McLucas' security concerns were prophetic. On 9 September, Deputy NRO Director Robert Naka and Bradburn learned that Aerospace had prepared both unclassified and classified studies for NASA. That contradicted McLucas' understanding that the only unclassified item under contract was a number of brochures on the overall project. This appeared to be yet another example of what some NRO staff had thought for years: NASA was ill-equipped in the areas of security and program protection. Fortunately, an Aerospace executive smoothed things over with assurance that his firm really intended to send the classified material to the NRO, not NASA. The classified study arrived in McLucas' office on 20 September where it became available to cleared NASA personnel.[10]

~~(S//NF)~~ The Aerospace, Lockheed, and Mathematica studies, completed in September 1971, further fanned the flames of suspicion and misunderstanding. In particular, estimates that the shuttle would cut NRO launch costs by \$3.47-\$5.31 billion over the first thirteen years of operation drew particular attention. Bradburn completely rejected the figures. Further, he now believed that DOD should neither commit to the shuttle nor agree to phase out expendable launchers. NASA's argument that support of national security was vital to the shuttle's future did not move him. Citing problems in the just completed studies, Bradburn recommended that the NRO conduct its own analysis. McLucas agreed.[11]

~~(S//NF)~~ The in-house study rested on a number of assumptions, some of them admittedly optimistic. The assumptions included each launch costing \$5 million, shuttles retrieving 30 percent of reconnaissance satellites for refurbishment and reuse, shuttles being available when needed, no launch or on-orbit failures, NASA not charging to piggyback small payloads, and the NRO not bearing any shuttle-related costs. Even with such sanguine postulations, the in-house study, completed in mid-October, sharply contradicted the NASA-funded studies. The projected NRO savings came to between $1.4 and $2.5 billion over thirteen years, about half of what the NASA-sponsored study estimated. Worse, a similar analysis by the Air Force found little if any financial advantage in selecting the shuttle over expendable launchers.[12]

(U) The influence of all these studies is not documented, but the time for NASA to place the shuttle proposal before President Richard Nixon was fast approaching. Paine resigned as NASA Administrator in September 1970 because, depending on the source cited, he was disillusioned with a lack of high-level support for NASA's programs or he wished to pursue opportunities in civilian industry. Congress confirmed James Fletcher as his replacement in April of the following year. He guided the shuttle program in the final months prior to seeking presidential approval.[13]

(U) Fletcher, like virtually all NASA administrators, had a technical background that included a doctoral degree in physics from the California Institute of Technology. He subsequently held teaching and research positions at Harvard and Princeton and served in a number of high-level management jobs in civilian industry before becoming president of the University of Utah in 1964. He was in that position when he accepted NASA's job offer, making him the second administrator, after Keith Glennan, to come directly from academia.[14]

(U) The shuttle's projected $5.5 billion acquisition price tag worried the new Administrator. It was, in his opinion, more than the federal budget could bear, at least for the near term. On 29 December 1971, he trimmed the orbiter's payload bay to the next smaller size under consideration, 14X45 feet, even though he still favored the 15X60 foot variant. The smaller bay saved $200 million, but limited the maximum payload weight to 45,000 pounds and halved the number of DOD payloads the shuttle could carry. Fletcher made his decision in the interest of program survival, but it was probably not a good tradeoff. Fortunately, it was short lived. On 3 January 1972, two days before his scheduled meeting with Nixon, word came down that the administration had already decided to fund the larger vehicle. The next day, Fletcher reversed the decision he had made a week previous.[15]

(U) Nixon approved shuttle development on 5 January 1972. Seven months later, NASA awarded North American Rockwell the acquisition contract for four orbiters; its Rocketdyne division would fabricate the liquid-fueled engines. Martin-Marietta would build the external liquid fuel tank. Morton-Thiokol's Wasatch Division prevailed in the solid rocket booster competition.[16]

(U) All major government contract awards raise eyebrows, and the shuttle was certainly no exception. Congressional Democrats condemned the whole program as pork to enhance Nixon's reelection prospects later in the year. Others noted that five of North American Rockwell's most senior executives had made large contributions to Nixon's 1968 presidential campaign. Some expressed unease that Dale Myers, NASA Deputy Administrator for Manned Space Flight and a former vice president of North American Rockwell, had assembled the various selection panels.[17]

(U) The solid rocket booster award in particular drew hostile fire. The selection panel had rated Morton-Thiokol's proposal as third best out of four competitors, but Fletcher overruled them. Critics charged that Fletcher, a Utah native, had biased the competition in favor a Utah-based firm. He had definitely been under pressure from Utah constituents, but the subsequent appeals process found no evidence of wrongdoing and Morton-Thiokol kept the contract. Still, the award remained controversial and allegations of impropriety dogged the Administrator for years to come.[18]

Figure 5-3. (U) NASA Administrator James Fletcher getting approval from President Richard Nixon for the Space Shuttle. (Image: UNCLASSIFIED)

(U) Meanwhile, on 3 February 1972, DOD and NRO representatives met with Under Secretary of the Air Force for Research and Development Grant Hansen to discuss the Air Force and NRO studies and to establish DOD policy vis-à-vis the shuttle. Hansen accepted the more pessimistic NRO and Air Force figures, but that was largely immaterial. Nixon, as NASA wished, had declared the shuttle a national program that at some future date would be the primary launch vehicle for all satellites. There could be no outright rejection of its services. Hansen made two important decisions—commit no payloads to the shuttle until it proved itself ("fly before buy") and support shuttle development with studies, but not financially. Funding rested entirely with NASA.[19]

(U) DOD/NRO coolness toward the shuttle did not bother NASA in the least. The shuttle was a national program that enjoyed Presidential support, which gave NASA all it needed to press ahead. In April 1972, Fletcher asked Director of Defense Research and Engineer John E. Foster, whose duties included overseeing NASA-related activities for DOD, to support the shuttle during upcoming Congressional budget hearings. Foster, who wished to help, named Frank W. Lehan,[**] a DOD consultant and former member of the President's Science Advisory Committee, to head an in-depth look at shuttle usage. He also asked the heads of various intelligence-related agencies, the NRO among them, to participate. McLucas named his scientific advisor, Dr. Robert Kahal, as his personal representative.[20]

** (U) Foster originally named Dr. Robert Ling to head the effort, but Ling for obscure reasons could not accept the job.

~~(S//NF)~~ Nine groups and agencies made inputs to Lehan's study, but only the one from Leslie Dirks, acting director of the CIA's Office of Special Projects and a leader in photographic reconnaissance satellites, was found during research. Dirks went to some lengths in noting the potential advantages offered by the shuttle. He was particularly impressed by its ability to lift as much as 65,000 pound into low inclination orbits, making it superior to the Air Force's Titan-IIID booster. It also had the flexibility to launch large diameter optical reconnaissance satellites, place multiple small signals intelligence collectors into low-earth orbit, retrieve spent satellites for refurbishment, repair satellites in orbit, perform on-orbit checkouts before deploying satellites, and support a manned space station as a reconnaissance platform. With the exception of the last named, nothing in Dirks' analysis reflected new thinking, and the same could be said for his bottom line: the shuttle must result in significant dollar savings whatever it did.[21]

(U) Lehan's report, entitled "Space Shuttle Implications on Future Military Space Activities," arrived in Foster's office on 9 August 1972. The report made virtually the same points in favor of the shuttle as had Dirks, but noted a number of problem areas. The shuttle could lift lighter payloads, about 40,000 pounds, into very high inclination or polar orbits, but not from Cape Canaveral, Florida. The eastward protrusions of Canada and South America would mean launching over land masses, which was unacceptable. The solution was to build at considerable cost a shuttle launch facility at Vandenberg Air Force Base, California. Beyond that, significant technological barriers lay ahead, potential customers needed to look at the expense of redesigning or modifying their payloads to fit the shuttle, and, most significantly, nobody had as yet made a convincing case that the shuttle would save money. Indeed, there was almost complete agreement in DOD, the NRO, and other agencies that the NASA-funded economic analyses were wrong, a fact made abundantly clear to Fletcher and NASA Deputy Administrator George Low.[22]

(U) Lehan recommended that DOD formulate a utilization plan that identified program milestones, decision points, and alternate approaches to shuttle exploitation. The plan would govern the timing and degree of DOD's commitment. For its part, NASA needed to better understand the capabilities and limitations of crewmembers in space and must keep the shuttle's weight down. Coordination between the two agencies was important. Lehan closed by warning as had Dirks that everyone must work to control costs.[23]

(U) In late September 1972, Foster acted on Lehan's major recommendation by directing the Air Force to take the lead in developing a DOD Shuttle Utilization Plan that contained no provision for commitment. Deputy Secretary of Defense Kenneth Rush, at McLucas' request, tightened security by establishing a special path by which potentially sensitive information could make its way into the utilization plan. Rush then mandated a high level panel to oversee DOD's relationship with the shuttle. This led in 1973 to the Space Transportation System Users Committee[††] made up of representatives from all DOD departments including the NRO and the Joint Chiefs of Staff. The committee's charter called for, *inter alia*, guiding DOD shuttle applications, developing payload concepts, and constructing mission models on an annual basis. NASA representatives would participate. The committee would report directly to Under Secretary Hansen. McLucas named Kahal as the NRO representative.[24] Appendix 12 contains the committee's charter.

(U) The charter, in combination with what Bradburn, Dirks, and Hansen had written, formed the basis of DOD/NRO's relationship with the shuttle program for the next half decade. The DOD and NRO would support shuttle development with studies, but without any commitment to using it as a launch vehicle.

†† (U) Initially called the Shuttle Users Committee.

There was not much money available for studies, only $300,000 in FY 1973, and full development of the shuttle could not be taken for granted at this early date. NRO studies should, as McLucas had decided sometime before, be low-level efforts until NASA completed major design decisions and made a full commitment to shuttle development.[25]

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~~(S//NF)~~ The NRO did not undertake significant studies until 1974, a delay probably attributable to funding shortfalls. In February of that year, an in-house team, probably related to the Space Transportation System Users Committee, made a cost analysis that hypothesized launching four NRO satellites—the Gambit and Hexagon imagers, [redacted]—on the shuttle over a 12-year period beginning in 1980. The team also considered variables in shuttle launch date from Florida and California and whether the latter should host only conventional boosters. Later in the year, the NRO, bolstered by additional funding, contracted with Lockheed to identify modifications needed to make the [redacted] compatible with both the shuttle *and* the Titan. Boeing, also under contract, did the same for [redacted] Including the Titan in the mix and questioning Vandenberg as a shuttle launch site were undoubtedly examples of keeping one's options open.[26]

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(U) Despite the caution, there was movement and progress. The NRO committed $1 million to shuttle-related studies in FY 1975 and requested $6.4 million for FY 1977. In November 1975, the Space Transportation System User Committee went on record supporting a five-orbiter (rather than a four-orbiter) fleet, the last to be delivered in January 1983. NASA needed the additional orbiter to meet its schedule of forty-two missions in 1983 and fifty-seven the following year. Still cautious, the committee recommended that all agencies involved have firm estimates of backup launch vehicle requirements ready by November 1977.[27]

(U) The Committee further identified two issues that needed further thought. NASA should defer estimates of what to charge customers for shuttle services because it was a revolutionary program with too many unknowns. Plans for and funding of a DOD control facility at the Johnson Space Center in Houston, Texas, pointed to a 1985 completion date, three years after the shuttle's latest projected operational date. The Committee found the three year gap unacceptable due to security requirements and urged that the matter receive fresh attention.[28]

(U) The Committee's report and other related documentation also took notice of the shuttle launch facility at Vandenberg. That facility would be expensive to build, so expensive in fact that the initial estimate of a late 1981 operational date vanished in favor of late 1982. This was the first archival evidence of a problem destined to plague the west coast facility throughout its existence.[29]

(U) Fletcher did not care much for the skepticism about Vandenberg, nor did he appreciate DOD withholding its commitment to the shuttle. In June 1974 and July 1975, he warned Defense Secretary James Schlesinger that slippage in the Vandenberg schedule would combine with DOD's lack of commitment to increase program costs, encourage shuttle opponents, and further endanger funding. Fletcher's objections, however valid, could not override budgetary constraints. Vandenberg's estimated Initial Operating Capability (IOC) remained in late 1982, but projected funding shortfalls already suggested that the date would not hold.[30]

~~(S//NF)~~ Expenses were rising in other areas as well. Rough estimates of launch costs had risen from the earlier $3-5 million to perhaps $10 million per flight, but that did not present a problem at the time. Conversely, the figure associated with transitioning all NRO payloads to the shuttle was definitely a

‡‡ ~~(S//NF)~~ Known as [redacted] at the time.

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problem. When all the studies were completed, including the previously mentioned ones of Gambit, Hexagon, [redacted] those costs came to about $400 million over a five year period beginning with FY 1977, and another $100-$200 million per annum for some indeterminable period thereafter.[31]

(U) The figures came as a shock; no one had foreseen transition costs of such magnitude. Director of Central Intelligence William Colby, acting in his role as manager of the intelligence budget, raised the issue with OMB Director James Lynn in a November 1975 letter. Colby still thought that the shuttle offered potential long term benefits and deemed an NRO commitment inevitable at some point. He wanted transition costs funded and he was adding them to NRO budget requests starting with FY 1977. He asked Lynn to support the increases. Whether Colby's upbeat assessment of the shuttle was sincere, or merely an embellishment to gain Lynn's support, is unknown.[32]

(U) A final factor worth noting in the first few years of the shuttle program was the cross current of attitudes within DOD toward those vehicles. NASA did not appreciate the official policy of support without commitment, but the irritation it caused was handled without undue rancor. No one questioned the importance of a DOD commitment to the shuttle, and everyone accepted that carrying national security payloads would enhance the shuttle's worth in the eyes of national decisionmakers, in particular those involved in budgetary matters.[33]

(U) Conversely, some in the NRO and elsewhere took exception to some of NASA's tactics. Critics charged that NASA "loaded the dice" by using overly optimistic assumptions in important shuttle analyses to insure favorable conclusions. Some believed that NASA "would lie, cheat, and steal" to keep the shuttle program on track.[34] When asked to comment on the latter, Robert Frosch, NASA Administrator during the late 1970s, replied:

> OF COURSE. EVERYBODY IN WASHINGTON LIES, CHEATS, AND STEALS TO PROTECT THEIR PROGRAMS AND GET MONEY FOR THEM. IT'S AN OCCUPATIONAL HAZARD OF BEING RESPONSIBLE FOR PROGRAMS. I SAY THE WAY TO DO IT IS TO ALWAYS TELL THE TRUTH WHEN YOU CAN, BUT YOU DON'T MAKE A HABIT OF GOING AROUND TELLING EVERYBODY THINGS. YOU KEEP YOUR WORRIES TO YOURSELF.[35]

Frosch's comment is exaggerated, even cynical, but rings true. Protecting programs is a life and death business that sometimes requires shady tactics no matter the agency or program involved.

(U) Such recriminations aside, Bradburn, now Program A Director and a newly minted Brig. Gen., brought together the most negative feelings within the NRO. In an April 1974 message to NRO Director James W. Plummer he ticked off objections to the shuttle. Every part of the shuttle, including payloads, had to be designed and fabricated at great expense to protect flight crews (i.e., man rated). Even then, missions would be hazardous to crews, particularly during satellite retrieval. Designing and modifying payloads to fit the shuttles were going to make them heavier and impose restrictions not associated with expendable launchers. Any idea that the shuttle might save money ignored such things as developmental cost, crew training, and ground facility construction. Plans for a shuttle facility at Vandenberg should be scrapped. In fact, Bradburn concluded, weaving the shuttle's negatives (particularly the true cost) into a balanced evaluation would result in immediate program cancellation. It is difficult to imagine a more pessimistic assessment.[36]

(U) Many of Bradburn's criticisms would be validated by time and events, but his missive and others like it had scant effect because at the time the shuttle program, despite problems, was doing well enough. By 1975, the estimated IOC had slipped to 1980; a two year delay, but slippages were the rule in virtually all space programs. On the positive side, the major contractors had significantly trimmed the shuttle's overall weight, a notable achievement since affecting any weight loss in any space system is difficult. The shuttle passed its Preliminary Design Review in February 1974 and a few months later North American Rockwell began fabricating the first orbiter, later named *Enterprise*. By 1975, Rocketdyne was actually a month ahead of schedule in developing the liquid fueled engine. Bradburn, et al, would probably have had more impact had they raised their voices as the payload commitment decision neared and the shuttle's many problems became apparent, but that was several years in the future.[37]

(U) Another of the shuttle's planned payloads involved a NASA scientific apparatus every bit as revolutionary as the shuttle itself. Since at least 1946, scientists had speculated about and dreamed of a telescope that operated outside the atmosphere. By the early 1970s, such an instrument was inching toward reality. Complete realization required an assist from the NRO.

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(U) Chapter Six

(U) Earth Observations and Skylab, 1970-1979

(U) In July 1969, Apollo 11's Lunar Excursion Module (LEM) touched down in the Sea of Tranquility, thereby winning a high-stakes competition with the Soviet Union. However, a lunar landing was only one of four objectives within the overall Apollo Applications Program. The other three goals were a lunar survey, earth observations from low-earth orbit, and a manned space station. Yet as with other NASA programs, the last two named lived in the shadow of the Apollo Program during the 1960s; nothing must stand in the way of a lunar landing. Earth observations and a manned space station had to wait until the 1970s to begin picking up speed.

(U) Apollo Applications had apparently disbanded as a program in 1971; at least its name disappeared from the archival record at that time. That left the two near-earth missions, Landsat, the first earth observation satellite, and Skylab, the nation's first space station, to form distinct programs. At the same time, NASA also began upgrading its small fleet of aircraft that formed the airborne portion of the earth observation program. Landsat, the aircraft upgrade, and Skylab raised issues and questions that in diverse ways involved spaceborne reconnaissance and the Intelligence Community, and, therefore, required NASA-NRO interaction. This chapter deals with that interaction.

(U) Earth Observations Get Underway

(U) The NRO's involvement with Landsat started very slowly because the early sensors were not of sufficient quality to concern it. Over time, however, interest grew as sensors improved, Landsat imagery found a wider audience, international politics entered the picture, and the program ran into serious trouble in the 1980s. These events will be more fully treated in a later chapter, but to adequately understand them requires taking up the Landsat story at an early date despite scant NRO interest at the time.

(U) NASA's founding document, The National Aeronautics and Space Act of 1958 charged that organization with the peaceful uses of space. Earth observations from space, also known as remote sensing and earth surveillance, fell within the scope of that responsibility. As first envisioned in 1964, manned Apollo spacecraft would carry out observations from low-earth orbit. NASA showed little interest in either unmanned satellites or aircraft during that early period, and so it remained until late 1966 when costs, international politics, and security concerns began to force changes.

(U) Although NASA committed itself to earth observation satellites in mid-1967, the $2 million necessary to solicit proposals to build the first spacecraft did not arrive until Fiscal Year (FY) 1970. The final competition, held during the summer of 1970, pitted General Electric against Thompson-Ramo-Wooldridge (TRW). General Electric prevailed, winning a contract that set the first launch for 1972.[1]

(U) The first earth observation satellite, Landsat-1,* had only modest specifications. Plans put forth in 1966 had identified eighteen potential sensors, but General Electric's winning proposal contained only two. The first was an RCA-manufactured return beam vidicon system with three television cameras sensitive to red, blue, and green in the visible spectrum. The other, a four-channel Hughes-manufactured multispectral imager, could collect in two visual and two near-infrared bands. Both imaging systems would eschew film in favor of recording data and electronically downlinking it when ground stations located in the United States and Canada came within line-of-sight. That would allow Landsat-1 in polar orbit to revisit any point on the globe every eighteen days and carry out imaging unconstrained by an onboard film supply. Landsat-1 could, therefore, *monitor* conditions rather than merely *sample* them. It also had a projected operational life measured in years rather than the weeks or months that characterized film-based systems.[2]

(U) Landsat-1's planned cameras did not by any stretch threaten to compromise the NRO or the level of American technology. When NASA opted for wide area coverage as the best way to execute the earth observation mission it did so at a considerable cost in resolution. From a 500-mile operational altitude, the return-beam vidicon had a predicted resolution of 300 feet, the multispectral camera no better than 200 feet. Neither figure came close to the 66-foot limit governing NASA optical sensors at the time.[3]

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(U) As Landsat began system acquisition, NASA began beefing up its fleet of earth observation aircraft. For years, NASA had remained committed to satellites even though properly equipped aircraft could satisfy all or virtually all requirements in certain areas. Several governmental agencies questioned the satellites-only policy. DOD emphasized potential problems in the international arena, almost certainly because of harm that might come to the NRO. DOD acknowledged that acceptance of satellite overflights and observations from space had increased substantially over the years, but was still not a given. The United States would be in an awkward position if individual countries protested. Washington could ignore objections and stand on the principle of freedom of space; ignore objections and hope they went away; give assurances against observations without prior approval, but lie about it; or give assurances and honor them despite damage done to overall collection. None of the options were entirely satisfactory, which led some to recommend negotiating agreements wherever possible to conduct foreign surveys using aircraft. The observed countries could monitor operations and control where the aircraft flew.[5]

(U) A second consideration was a straightforward matter of dollars and cents. Manned Apollo spacecraft in earth orbit could definitely carry out earth observations even though this approach would not be cost effective. The manned Apollos could cover 147 million square miles per mission, but the $95-$100 million per mission made it a very expensive option. That was surely a major consideration in the 1967

* (U) The first two satellite were originally named Earth Resource Technical Satellite (ERTS) A and ERTS B. In 1975, NASA changed the name to Landsat and the suffix from an alpha to a numeric designator. The latter designation will be used throughout this manuscript in the interest of consistency and simplicity.

switch to unmanned satellites, but their cost would still be fairly high, $9-$10 million per mission. On the other hand, a single U-2 could cover an area the size of Canada in thirty-one missions; a single SR-71 "Blackbird" could do the same in twenty-five missions. Aircraft could reduce costs by an average of 90 percent, but given the SR-71's operating costs of approximately $100,000 per hour of flight, the savings probably applied more to the U-2, which cost a mere $1,500 per hour of flight. Either way, both aircraft had the additional advantage of being reusable assets.[6]

(U) Imagery obtained from aircraft also promised better resolution and fewer security problems. The restrictions on satellite optical systems did not apply to aircraft, whose cameras could achieve resolutions as low as 20 inches from operational altitudes. If it became necessary to protect the capabilities of selected cameras, that could be done by misrepresenting the aircraft's altitude. Because aircraft imagery need not observe strict security measures, personnel with lesser clearances, or even no clearances, could work with it and NASA could more easily release it into the public arena.[7]

(U) If NASA chose to more aggressively pursue using aircraft, its existing inventory, a few twin-engine Convair 240As and four-engine Lockheed Electras, would have to be upgraded. U-2s and SR-71s offered the best upgrade options, but they were tainted. Although the Air Force operated and on paper owned both aircraft, they secretly belonged to NRO Program D (airborne assets).† Moreover, their well documented roles in reconnaissance made them unwelcome in parts of the world. In those areas NASA would have to negotiate overflight rights using its less controversial aircraft.[8]

~~(S//NF)~~ Despite the advantages offered by aircraft, NASA, riding a ground swell of interest in observations from space, remained almost exclusively committed to satellites in its earth observation program well into 1968. A discrete NRO survey carried out in June of that year found only two prominent NASA officials, the Assistant Administrator for DOD and Interagency Affairs, retired Air Force Gen. Jacob Smart and his Chief Assistant, Myron Krueger, truly interested in aircraft photography. But that was changing even as the NRO made its inquiry. By the end of 1968, NASA was considering negotiations with five nations—Mexico, Canada, India, Brazil, and Liberia—to conduct earth observations over sovereign soil using aircraft.[9]

(U) By 1970, NASA's aircraft inventory had improved somewhat, now including a single P-3 Orion, the military version of the Electra commercial airliner; two C-130s; and one RB-57F. The older Convair 240As no longer graced the fleet. The P-3 and C-130s handled imaging requirements up to an altitude of 30,000 feet. The RB-57F, a highly modified version of the Air Force's light bomber, operated as high as 60,000 feet and until about 1970 flew reconnaissance missions along the peripheries of selected nations.[10]

(U) Unfortunately, the RB-57F could not, for reasons unstated, satisfy all high-altitude requirements. Smart addressed the problem in March 1970 when he asked NRO Director John McLucas about excess U-2s in the Program D inventory. McLucas indicated that a limited number were available and in November of that year discussions began on the loan of two aircraft. Program D Director, Col. Frank W. Hartley, in his overt role as Chief of Special Projects, Headquarters United States Air Force, represented the NRO and the Air Force fronted for the NRO during the entire transfer. NASA made no attempt to hide its interest in the aircraft, going to some lengths to make everything seem above board.[11]

~~(S//NF)~~ The talks went smoothly. The NRO proffered two of its older U-2Cs that had been in storage for some time and were therefore surplus. The NRO secretly contracted with Lockheed, the U-2s builder,

† (U) Project Idealist, a BYEMAN security compartment, protected the NRO's relation with U-2s. Project Oxcart did the same for the SR-71s. In 1974, the NRO disbanded Program D and transferred both aircraft to the Air Force, although collection objectives determined by higher authority still directed their mission.

Figure 6-1. (U) NASA Deputy Administrator George Low. (Image: UNCLASSIFIED)

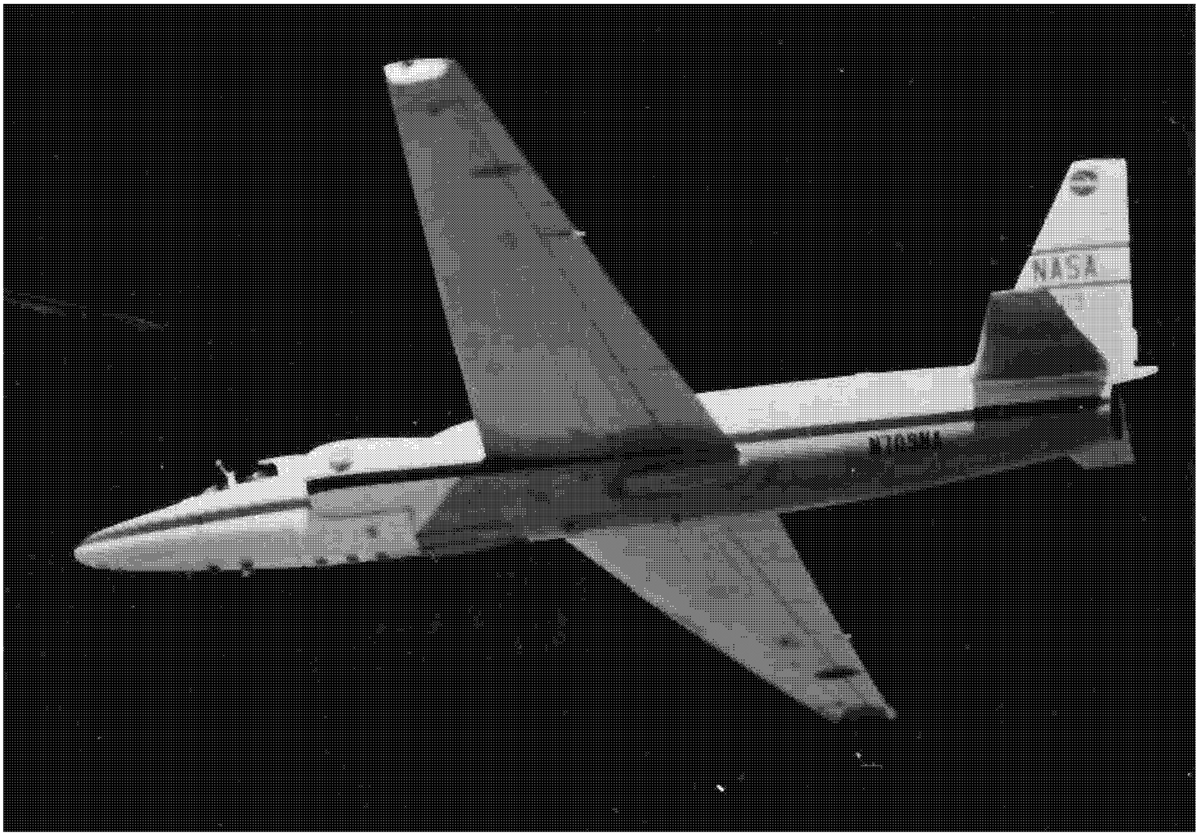

Figure 6-2. (U) A U-2 in the NASA livery. (Image: UNCLASSIFIED)

for pilots and other types of support for the first 18 months of operations. NASA's Ames Research Center at Moffett Naval Air Station, California, agreed to host both aircraft. NASA had full responsibility for funding, including an initial outlay of over $9 million to modify the aircraft for their new mission and operate them for one year. The associated security guide made the existence of NRO Program D and the aircrafts' previous history BYEMAN-level information. Aircraft performance data and technical manuals were classified collateral Secret.[12] Appendix 14 contains that security guide.

(U) NASA Deputy Administrator George Low had one more concern he wanted addressed. The aircrafts' history as a reconnaissance asset was a permanent fixture no matter who owned them; nothing could be done about that. He did, however, try to soften the sinister visual effect generated by their flat-black exteriors by having the two aircraft painted white.‡ He gave his approval to the U-2 transfer on Christmas Eve 1970.[13]

~~(S//NF)~~ Low next outlined NASA's plans for the U-2s to the 40 Committee, a White House panel chaired by National Security Advisor Henry Kissinger and charged with overseeing high risk covert missions, and the CIA. The plans, as reconstructed from other documentation, called for photographic missions over test sites in California, Arizona, and the Chesapeake Bay area. The acquired imagery would simulate as closely as possible the spectral content, scale, and time interval predicted for Landsat imagery. That would, in turn, allow analysts to better interpret Landsat imagery when it became available and thereby alert potential customers, both foreign and domestic, to the value of earth observations. The aircraft would fly similar missions against test sites if and when future Landsats carried better imaging systems. Other potential uses included astronomical observation, geophysical experiments, and participation in earth observations. The missions, Low emphasized, would support only those NASA projects free of security implications.[14]

~~(S//NF)~~ The CIA and the 40 Committee had no objection to any kind of operations over American soil, but vetoed Low's plans to negotiate with other nations for U-2 missions in their airspace. That was out of the question due to the aircrafts' reputation, something that a change of ownership and a fresh coat of paint could not erase. Any foreign missions by U-2s or any other reconnaissance-related aircraft required 40 Committee approval before NASA initiated any action, even if the host nation requested it.[15]

~~(S//NF)~~ On 3 April 1971, NASA received its U-2s, although for some reason the unclassified transfer agreement was apparently not signed until later in the month. In a public release, NASA referred to its new acquisitions as "NASA Earth Survey Aircraft." The NRO secret contracting for aircraft support terminated on 30 September 1972, leaving NASA to deal directly with the applicable firms, mainly Lockheed for overall support and Pratt and Whitney for maintenance on the J75-P-13 engines.[16] Appendix 15 contains the transfer agreement.

(U) The transfer agreement is the last documented NRO involvement with the U-2s even though the aircraft remain NASA assets to this day. In 1981, NASA retired one U-2C, replacing it with a more advanced model, the U-2R, but changed the aircraft's designation to ER-2—ER meaning Earth Resources. In 1989, another ER-2 replaced the remaining U-2C, and in 1997 both aircraft moved to NASA's Dryden Flight Research Center, co-located with Edwards Air Force Base, California. Over the years, they have, in addition to earth observations, flown missions against forest fires, collected data on hurricanes, taken part in ozone depletion studies, observed the effects of global warming, and in 2003 searched for debris after the Space Shuttle *Columbia* broke apart during atmospheric reentry. In

‡ (U) They were actually painted white with a sky blue line running the length of the fuselage. In 1970, NASA also received two A-12s, precursors to the SR-71, from NRO program D. The aircraft tested the aerodynamics of high-speed flight, a mission that did not concern the NRO. One aircraft was lost the following year when an in-flight fire forced the pilot to eject. The other A-12 left the NASA inventory in 1979. NASA received an SR-71 in 1990 after all had been retired from active service.

Figure 6-3. (U) Landsat multispectral imagery of the Vandenberg AFB area. (Image: UNCLASSIFIED)

1998, one of the aircraft set a world record for an aircraft in its class by reaching 68,700 feet. The most unusual event came in 2003 when Russia approved an ER-2 ozone sampling mission in its airspace. Given that country's long-standing resentment of U-2 reconnaissance missions over its soil during the 1950s, the approval was little short of unthinkable even after factoring in the end of the Cold War.[17]

(U) Meanwhile, at 11:06 AM on 23 July 1972, a Delta booster carrying the 1,965-pound Landsat-1 rose from Vandenberg Air Force Base, California. The satellite entered a 570-mile high, near-polar orbit from where it began repetitive coverage of the entire globe save tiny slivers near each geographic pole. Unfortunately, Landsat-1's return-beam vidicon system failed only thirteen days into the mission, reducing the satellite's capability by half. Fortunately, the multispectral imager proved to be a sturdy instrument, returning over 300,000 images and still counting when NASA removed Landsat-1 from service in 1978.[18]

(U) Landsat-1's multispectral imagery had a best resolution of about 260 feet, somewhat poorer than predicted. Imagery analysts within the Intelligence Community scanned the photography, but found no sensitive items. True, larger features, such as harbor complexes, cities, and major arteries of communications were visible and identifiable, but even analysts who knew what they were looking for detected nothing of interest. NASA was free to sell Landsat-1 imagery to anyone who wished to purchase it.[19]

~~(S//NF)~~ The international reaction to Landsat-1 and its imagery was generally positive. A few nations, as predicted, expressed concern about observations from space and raised questions related to national sovereignty, but there were no outraged protests. Indeed, within a year, thirty-eight nations and two international agencies were on distribution for Landsat imagery. Three countries—Mexico, Venezuela, and Brazil—had applied for ground stations to receive imagery directly. Most of the favorable response was due to what NASA had been publicizing for years, that Landsat was an above board program of benefit to all mankind. While that was certainly true, Landsat undertook two missions that had to be handled carefully lest the international welcome mat be suddenly withdrawn. The two missions illustrated the difficulty, perhaps impossibility, of distinguishing between earth observations to collect economic data for peaceful purposes and spaceborne reconnaissance to collect economic intelligence.[20]

~~(S//NF)~~ Landsat as a Reconnaissance Asset: [redacted] (b)(1) (b)(3)

(U) Throughout its history, the Soviet Union, and Tsarist Russia before it, could not always adequately feed its populace despite having some of the best farmland in the world. In Tsarist Russia, the stultifying legacy of serfdom, primitive agricultural techniques, rudimentary farm equipment, and extremely poor land management meant low yields during many years. A poor harvest placed sections of the population at risk; a crop failure left them in dire peril. The Soviet Union improved conditions through the forced collectivization of agriculture, but a state bureaucracy that smothered initiative and apathetic peasants who worked but did not own the land still resulted in a weak agricultural sector. As a consequence, the Soviet Union had to purchase millions of tons of grain abroad to meet basic needs; wheat was a primary concern. The United States was a major source of that wheat, leading to the gibe that the Soviet bread basket was not the Ukraine, but Nebraska and Kansas.

~~(TS//NF)~~ When the Soviet Union came to buy wheat, the United States, as did other countries, set its price based on intelligence about the Soviet harvest. A sub-par Soviet harvest meant higher prices; a good harvest meant lower prices. In 1972, the Soviet wheat crop fell far short of meeting requirements, but other nations, the United States included, expected a bumper harvest. As a result, the Soviets purchased 24 million tons of the grain abroad, much of it from the United States, at absurdly low prices. The incident, lampooned in the press as the "great grain robbery," embarrassed official Washington and brought promises that it would not happen again. [redacted]

(b)(1)
(b)(3)

~~(S//NF)~~ Fletcher was candid as to his motives. Worldwide crop inventories would help all nations manage their food supplies, an objective well within NASA's span of responsibility. At the same time, the inventories would provide the United States with economic intelligence valuable in formulating both foreign and domestic policy. His proposal, if accepted, would also help justify moving the launch of Landsat-2 to 1974 (from 1976) and help secure funding for additional satellites in the out years. The last named rational was why George Schultz, a persistent Landsat critic, received one of the letters.[25]

~~(S//NF)~~ Fletcher's initiative was the second instance, the first being the Space Shuttle, of NASA breaking with the past by citing national security to help justify a program. Fletcher asking that NASA be categorized as an intelligence collector was definitely something new, but the overall idea was not. In 1966, the Intelligence Community had investigated the potential contribution of earth observation imagery when it became available.[26] Landsat imagery was now accessible and there was no reason why the Intelligence Community should forego using it if done in a way that protected NASA. And how does one distinguish between collecting economic data and collecting economic intelligence? The answer had much less to do with how information was gathered than how it was used. Given that "intelligence is where you find it," virtually any activity from perusing technical and professional journals from the Sino-Soviet bloc to spaceborne reconnaissance qualified as intelligence collection.[§]

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~~(S//NF)~~ Despite the advantages cited, Fletcher's initiative got mixed reviews. The Secretaries of the Interior and Agriculture liked the idea, but others were less enthusiastic. William E. Colby, the newly installed DCI, preferred to see if Landsat-2 was in fact launched in 1974 and how much interest the proposal generated government-wide before obligating the CIA. Both McLucas, now the Secretary of the Air Force, and other DOD officials wondered about closely coupling a civilian agency dedicated to the peaceful uses of space with reconnaissance. They counseled that the National Security Council first gives its approval. Schultz was non-committal, but at least he did not come out against the idea. There was apparently no direct NRO involvement in the exchanges since it was a NASA initiative that did not threaten to compromise either satellite reconnaissance or American technology.[28]

~~(S//NF)~~ The responses did not faze Fletcher; indeed, they spurred him into further action. He initiated another round of correspondence in which he refined his arguments and hinted at other benefits that might accrue from using Landsat in a reconnaissance role. Besides, in his opinion, such usage was inevitable in the long run so it behooved all concerned to begin policy development and implementation procedures.[29]

¶ (U) Stressed crops reflected less sunlight, something that registered on Landsat's near-infrared bands.

Table 6-2. (U) The World's Major Staple Crops and their Estimated Monetary Value, 1974		
Crop	**Annual Production***	**Monetary Value****
Wheat	310	55
Rice	290	130
Corn	280	35
Potatoes	230	30
Barley	140	15
Sorghum	50	4
Oats	40	5
Soybeans	40	15
Rye	25	2
Bananas	20	13
Cotton	15	25
Coffee	5	13
Total	**1,445**	**342**

(U) Note: All figures are approximations.
* (U) Millions of metric tons
** (U) Billions of 1973 U.S. dollars

(U) Source: World Crop Study (U), Undated, Black [redacted] Proposal, December 1974-January 1975, Drawer 4, Safe 3, NASA/CA. (b)(3)

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~~(S//NF)~~ Fletcher's persistence paid off. In late 1973 or very early 1974, an ad hoc committee (composition unknown) advanced Landsat-2's launch date to January 1975. The same committee authorized NASA to allot a significant percentage of Landsat-2's time to collecting against Soviet grain crops in general rather than just wheat and apparently approved some worldwide collection. By the end of January 1974, the CIA and NASA were working in a cooperative planning effort to carry out that collection, but the collaboration was brief and did not seem to imply complete Agency cooperation.[30]

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~~(S//NF)~~ As Landsat embarked on its role as a reconnaissance asset, another of NASA's orbital programs was making its mark. Skylab, the nation's first manned space station, began making real progress in the very early 1970s following an almost decade-long developmental process plagued by design changes and low priority. Although the initial experiments planned for Skylab made it largely a non-issue for the NRO, sporadic events over the years changed that.

(U) Skylab

(U) Skylab benefited from a last major design change made during the early 1970s. Previous planning for the space station called for it to consist of a modified LEM, docking ports, airlock mechanisms, and the spent upper stage of a Saturn-1B booster lashed together in space. The first crew sent aloft would face the difficult task of purging the upper stage's empty fuel tank and turning it into an orbital workshop (the wet option).

(U) In 1970, NASA both changed the name to Skylab and simplified the overall concept. A new design eliminated the modified LEM entirely and upgraded the booster from the Saturn-1B to the much larger Saturn-5, which did not need a Saturn-IB upper stage for Skylab to achieve orbit. That left NASA free to turn the booster's upper stage into an orbital workshop before launch (the dry option). The new configuration consisted of the orbital workshop, an airlock module, a multiple docking adapter, and an Apollo Telescope Mount. Separate solar panel arrays would provide electrical power for the telescope and the workshop.

(U) Skylab was by far the largest, measuring 22 feet in diameter and 118 feet long, and heaviest, weighing 90-100 tons, object ever intended for earth orbit. By comparison, the Air Forces' defunct Manned Orbiting Laboratory, discussed in an earlier chapter, had a design weight of only 15 tons. Skylab would not launch with its crew aboard. They would arrive later in Apollo command modules sent aloft using smaller boosters and return to earth by the same means. NASA scheduled the first launch for sometime in 1973.[36]

~~(S//NF)~~ Two scientific payloads planned for Skylab stood out, the Apollo Telescope for astronomical observations, and the Earth Resources Experimental Package (EREP). The EREP was to conduct earth observations using an array of sensors, a multispectral imager, an infrared spectrometer, a 13-band spectrometer, a microwave radiometer/scatter meter and altimeter, and an L-band radiometer, among them. For a time, unclassified literature made no mention of another referred EREP sensor, the Hycon 18-inch Earth Resource Mapping Camera hereafter renamed as the Mapping Camera, and for good reason. It was at the center of a minor, albeit lengthy, controversy involving NASA, the NRO, and the Intelligence Community.[37]

~~(S//NF)~~ When Deputy Administrator Low announced in April 1971 NASA's plans to incorporate the Mapping Camera onboard Skylab, he justified the idea as yet another way to assist in interpreting imagery from the yet-to-be-launched Landsat-1. The camera had a projected resolution on the order of 30 feet, much better than what the guidelines on NASA optical systems permitted, but he nevertheless pushed for its inclusion. Low noted that when the National Security Action Memorandum (NSAM) 156 Committee codified the guidelines in 1966 it also allowed for their relaxation over time, and in his opinion that time had come. He asked Kissinger and the 40 Committee to examine the issue and render a decision. In the interim, Fletcher proposed procurement of and installation design work for the Mapping Camera, but without either a public announcement or a commitment to flight operation. Kissinger raised no objections.[38]

~~(TS//NF)~~ Speaking for the NRO, John McLucas had no problem with the Mapping Camera. In his opinion, it fell within the guidelines adopted in 1969 that a 17-foot resolution was acceptable at some future date. He doubted, however, that the 40 committee was the proper forum for a decision. The NSAM 156 Committee should pass judgment on the Mapping Camera. Kissinger held the same opinion, so he asked the Committee to reconvene.[39]

~~(TS//NF)~~ President John F. Kennedy had established the NSAM 156 Committee to recommend ways to protect the nation's reconnaissance satellite programs from disruption and compromise. The committee had first met in May 1962 and several times thereafter before being abandoned in 1975. When it reconvened in early July 1971, the agenda contained a single item, the Mapping Camera. The State Department, NASA, DOD, the White House, the CIA, and the Arms Control and Disarmament Agency (ACDA) sent representatives, just as in the past. Ambassador U. Alexis Johnson, the Under Secretary of State for Political Affairs, chaired the group, just as he had at every previous convening.[40]

~~(S//NF)~~ The Committee's preliminary working group considered two questions during its deliberations: whether to approve the Mapping Camera aboard Skylab and, if approved, as a one-time exception or a general revision to the existing limitation imposed on NASA. The group recommended approval as a one-time exception. The 66-foot limit should remain in force, though comments by various group members left no doubt that it was only a matter of time before it would be eased. Parties unknown apparently tried to push the resolution issue further by suggesting a review of all previous NSAM 156 Committee policy decisions, but the idea quickly died out. What did not die out were questions about how various countries might react to the Mapping Camera's much improved resolution when NASA released the imagery. And what might be the effect if NASA restricted coverage of politically sensitive areas without being able to provide plausible explanations?[41]

~~(S//NF)~~ The NSAM 156 Committee's final draft, issued on 20 August 1971 and slightly modified in mid-September, closely followed the working group's recommendations. NASA could employ the Mapping Camera as a one-time exception and release imagery after proper screening. Designated sensitive areas would be off limits to photography. Since the Mapping Camera was not part of Skylab's original specifications, NASA should take care when making public its inclusion so as to minimize adverse reactions and unwelcome inquiries. The 66-foot limitation remained in place, but its days were numbered. In fact, cameras with better resolution were, in the Committee's opinion, already a DOD-NASA working assumption.[42]

~~(S//NF)~~ Possible international reaction to a 30-foot resolution posed a much more difficult problem because Skylab would not launch for another two years. Landsat-1's launch in 1972 would provide evidence as to international attitudes, but the predicted resolutions of its cameras were extremely poor when compared to the Mapping Camera. The NSAM 156 Committee took a sensible path by recommending that the 40 Committee assess the international climate just prior to launch. That review would provide last minute guidance as to where the camera could and could not be used or whether it could be used at all. The 40 Committee endorsed the report, which became the basis for operating the Mapping Camera.[43] Appendix 16 contains the NSAM 156 Committee's 20 August 1971 final draft with two pages containing the mid-September changes inserted.

~~(S//NF)~~ Skylab proceeded smoothly throughout the remainder of 1971 and all of 1972. The launch, now set for April 1973, intended to insert the space station into a 350- mile high orbit inclined at 50 degrees, taking it over most of the world's inhabited areas. Skylab imagery faced the same screening process that had governed NASA space photography since 1965. NASA adopted a low-keyed approach, as counseled by the NSAM 156 Committee, in announcing the Mapping Camera to the public.[44]

~~(S//NF)~~ In early 1973, and as Skylab's launch, delayed until 14 May, drew nearer, the final review process got under way. As a first step, a high ranking government official, possibly Kissinger, asked the NSAM 156 Committee to examine the Mapping Camera's imaging plan in view of the current international situation. Although, international attitudes were generally positive about Landsat-1, launched the previous year, the Mapping Camera still held the potential for trouble.

~~(S//NF)~~ The NSAM 156 Committee noted that only a small number of Skylab orbits were scheduled for photography of any type. The imaging plan called for approximately seven thousand pictures, less than half of which involved the Mapping Camera. NASA labeled the Soviet Union, the People's Republic of China, Israeli-Arab borders and adjacent areas, the Pakistani-Indian border, and North Korea as potentially sensitive. The Committee provided firmer guidance by prohibiting Mapping Camera photography of the Soviet Union, the People's Republic of China, the Israeli-Arab area, and apparently North Korea. The Committee approved imaging the Pakistani-Indian border only because both countries wanted coverage of the entire subcontinent. Otherwise, Skylab could image only the United States, Mexico, and Canada as a way to gauge international reaction to the released photography. In its 22 February 1973 summation, The NSAM 156 Committee recommended approval of these limitations and reminded the 40 Committee that it still needed to gauge the international political climate prior to launch.[45]

~~(S//NF)~~ At the behest of DCI Colby and some of its own members, the 156 Committee met again the following month to review the imagery screening process and to reconsider foreign sensitivity to space observation and its relationship to intelligence collection. The Committee considered both issues, but made few changes to its September 1971 report. Also in March, an Ad Hoc Committee with unspecified membership, but probably related to the NSAM 156 Committee, [redacted] (b)(1)

~~(S//NF)~~ The 40 Committee's last minute international review found no reason to delay the mission, and on 14 May 1973 a Saturn-5 carrying Skylab thundered aloft from the Kennedy Space Center.[††] Just over a minute into the flight, a vibration rippled through the booster as aerodynamic pressure caused the 1,200-pound micrometeoroid shield surrounding the booster's upper stage (i.e., the orbital workshop) to deploy prematurely and tear away. In addition to protecting against micrometeoroids, the shield had painted on it a pattern to balance solar heating across the sun-exposed surface of the workshop. Subsequent telemetry indicated that the shield had also carried with it one of the orbital workshop's solar panel and damaged the other, leaving it only partially deployed.[47]

(U) It was a disaster in the making. Without shielding against solar heating, temperatures inside the orbital workshop would steadily rise to a point beyond human toleration. If the damaged solar panel could not be fully deployed there would be no electricity to power the workshop. Worse, if debris clogged the two docking ports, the Apollo Command Module ferrying the first crew could not link up with the station. In all three scenarios, Skylab loomed as a failed mission.[48]

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†† (U) The Soviet Union won the race to orbit a space station by launching Soyuz-1 in 1971.

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the drag on Skylab and began pulling it down. In September 1977, NASA Administrator Robert Frosch warned the White House that the space station would fall to earth sometime in 1979, and there was little chance of the shuttle being ready by that time. In all probability, Skylab's reentry would be largely uncontrolled.[68]

(U) NASA officials did not relish the reentry of such a massive vehicle without adequate control. Alarmists conjured up doomsday scenarios should the debris field, estimated at 3,000-4,000 miles long and 50-100 miles wide, center on a densely populated area. Although more sober calculations placed the chances of Skylab debris even injuring anyone at only 1 in 150, NASA had to control the reentry using whatever methods were available. There were only two options: turning Skylab so as to take advantage of the ever-so-slight pressure induced by ionized particles from the sun (the solar winds) and briefly firing the stabilization thrusters using the little remaining onboard fuel. Neither option could exert meaningful influence, but NASA had to try. To do otherwise would be a serious public relations *faux pas* even if falling debris caused neither casualties nor property damage.[69]

~~(TS//TK//NF)~~ The first step in the deorbiting was to reestablish control over Skylab, long derelict and out of communication with ground controllers. In late 1977, NASA began the process [redacted]

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(U) Skylab reentered the atmosphere in spectacular fashion on 11 July 1979, breaking into countless pieces as it did so. Most of the debris fell into the Pacific Ocean, the remainder in the thinly populated Australian outback. No deaths or injuries occurred, but thirty-four Australian citizens filed claims, four for property damage, and the remainder for emotional distress or disruption of travel plans. One township fined NASA for littering. NASA apparently ignored both the claims and the fine. Skylab-B never flew. Cancelled in 1976 to free up funds for the Space Shuttle, it became a featured exhibit in the National Air and Space Museum in Washington, D.C., where millions view it each year.[71]

* * * * *

~~(S//NF)~~ Neither Landsat nor Skylab represented any major difficulties for the NRO and NASA even though both looked earthward. True, NASA released 41,000 Landsat brochures without proper clearance, but in general followed the specified coordination and approval procedures. NASA certainly went through the proper channels when committing Landsat to [redacted] was also the second instance of NASA using support of national security to help justify a program threatened by funding problems.

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~~(S//NF)~~ For its part, the NRO showed increasing flexibility in dealing with NASA by not seriously objecting to a Skylab optical system with capabilities better than those authorized. Consignment U-2s from NRO Program D to NASA, carried out under proper security, strengthened the latter's small fleet of earth observation aircraft with little additional expense for the government. In fact, one could say that

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NASA-NRO interaction on earth observations and Skylab had flourished in ways that both agencies must have hoped would continue in all their cooperative efforts.

(U) Unfortunately, that was not going to be the case, at least in regard to the Space Shuttle. Shuttle development was progressing well enough by mid-decade, but DOD still kept its distance. Proof of reliability remained the criterion for committing payloads to it. The wait-and-see policy held forth into the last half of the decade, but with waning strength as time and events brought increased pressure on DOD to speed up its payload transition schedule. That schedule and the problems associated with command and control of shuttle missions carrying classified payloads and shuttle launches from the West coast are treated in the next chapter.

(U) Chapter Seven

(U) Modest Progress: The NRO and the Shuttle, 1975-1980

~~(S//NF)~~ As the 1970s progressed, the two major NRO-NASA collaborative efforts of the decade, the Space Transportation System, (i.e., Space Shuttle) and the Large Space Telescope Program (i.e., Hubble), took much different paths. The NRO seemed to separate itself from the Hubble program following acquisition contract awards in October 1977. As a result, Hubble virtually disappeared from the NRO archives, the major source of material used in this manuscript, for over a decade.

~~(S//NF)~~ NASA-NRO collaboration on the Space Shuttle steered a much different course because the shuttle, unlike Hubble, had postulated for it a role central to the NRO mission. The shuttle was a national program to be used in time by all government and civilian interests as their primary launch vehicle. Everyone, DOD and the NRO included, was obligated to at some point transition their payloads from conventional boosters to the shuttle.

(U) Not everyone was comfortable with such a cut-and-dried approach, however. The shuttle was a highly experimental vehicle that understandably gave rise to skepticism that it could meet program objectives and performance standards. Accordingly, DOD elected to maintain an inventory of expendable launchers and transition payloads to the shuttle only after proof of performance and reliability, a policy popularly known as “fly before buy.”

(U) In addition to payload transition, two other shuttle-related issues troubled the waters. The first was whether shuttle missions with classified payloads required a separate command and control facility. DOD thought so, but NASA favored integrating all missions regardless of payloads into its Johnson Space Center (JSC) near Houston, Texas. Shuttle launches from Vandenberg Air Force Base, California, constituted the other problem. The Vandenberg site was critical to attaining high inclination orbits, an important consideration for the NRO, but building shuttle facilities there would incur considerable costs. The alternative was to use expendable launchers out of Vandenberg as in the past and reserve the shuttle for missions out of the Kennedy Space Center in Florida. Both command-control and Vandenberg were complex and contentious problems that defied simple solutions.

(U) Easing Toward Transition

~~(S//NF)~~ On 20 March 1975, NRO Director James W. Plummer signed a three- page memorandum outlining his agency’s policy toward the shuttle. The directors of Programs A (Air Force), B (CIA), and C (Navy) were responsible for transitioning their respective missions to the shuttle. Other than a few cautionary notes about mission accomplishment, security, and cost-effective operations, Plummer left it up to the program directors to determine how that should be done. In his only other major guidance, the NRO Director devoted almost half his missive to maintaining conventional boosters as backups. Plummer set no milestones and stated that the plans and procedures developed were for information only. His instructions were in complete agreement with the “fly before buy” policy.[1]

(U) In December 1975, DOD formulated, if only hypothetically, the first payload transition plan found during research. The plan, classified collateral Secret, made no mention of the NRO, whose influence cannot be determined. The shuttle would attain an initial operating capability in Fiscal Year (FY) 1980; DOD would start transitioning payloads the following year and complete the process during FY 1985. Otherwise, the plan dealt only with generalities.[2]

~~(S//NF)~~ The pace picked up a bit in 1976. In February of that year, the newly established Payload Accommodation Working Group[*] held the first of its monthly meetings. The group, composed of codeword-cleared NRO, NASA, and DOD personnel, addressed problems associated with transitioning selected payloads to the shuttle. The NRO payloads under preliminary consideration included (b)(1)
[redacted] Hexagon) and [redacted] (b)(3)

(U) Meanwhile, DOD was issuing collateral Secret quarterly updates to its transition plans that still did not reference the NRO. DOD examined several areas including transition models, costs, backup conventional boosters, funding, flight standards, and procurement. The plans contained decision milestones relative to backup expendable launchers, but were otherwise very general and devoid of transition schedules. The December 1975 DOD schedule remained the only timetable thus far.[4]

~~(S//NF)~~ Also in 1976, work on the shuttle's upper stage reached a turning point. The shuttle would only deploy payloads into low-earth orbits, but 35 percent of DOD and NASA satellites required additional boosts to achieve operational altitudes. In the early 1970s, NASA envisioned a liquid-fueled upper stage based on the Centaur, a controversial idea given that the Centaur had originally been intended only for unmanned flight. Many Centaur design features were not compatible with manned flight. In particular, the cryogenically cooled fuels were volatile, highly explosive, and had to be continuously vented. The smallest leak in the orbiter's payload bay would put shuttle and crew in grave peril. A breached fuel tank meant disaster.[5]

~~(S//NF)~~ Possibly in recognition of Centaur's risks, NASA in 1973 expanded its search for an upper stage, but kept the Centaur option open. The expanded effort called for a solid-fuel interim vehicle known as the "Inertial Upper Stage,"[§] popularly called the Inertial Upper Stage (IUS), for use on both the shuttle and conventional boosters. A "Space Tug" powered by more stable liquid propellants would replace the IUS sometime between 1983 and 1986. Whereas the IUS would carry payloads to higher altitudes on one-way trips, the Tug could be reused if launched from a shuttle orbiter. It could lift 10,000 pounds into geosynchronous orbit on one-way missions or half that on round trips. NASA cancelled the Space Tug in 1977, probably because of its $1 billion developmental cost. In reality, NASA likely decided to do so the previous year when the Air Force, as the responsible agent for both the Tug and the IUS, awarded a $21 million IUS design study contract to Boeing Aerospace. Boeing later won the IUS acquisition contract as well.[6]

~~(S//NF)~~ Elsewhere, NASA priced the initial shuttle launches dedicated to single payloads at $12-$24 million. Both figures were well under the $40 million for a Titan-III, the only other heavy lift booster, though considerable more than earlier estimates of $5-$10 million per shuttle launch. NASA optimistically predicted that later missions would be cheaper, making the shuttle more competitive with smaller conventional boosters such as Atlas and Thor. In Congressional testimony, Director of Central Intelligence (DCI) George H. W. Bush predicted complete transition of all NRO missions to the shuttle sometime in the early 1980s, a forecast consistent with the December 1975 forecast for all of DOD.

* ~~(S//NF)~~ Sometimes referred to as the NASA/NRO STS Working Group or the Secretary of the Air Force for Special Programs Payload/Space Transportation Working Group.

† ~~(S//NF)~~ Known as [redacted] at the time.

‡ ~~(S//NF)~~ Known respectively as [redacted] at the time.

§ (U) Called the "Interim Upper Stage" early in the program.

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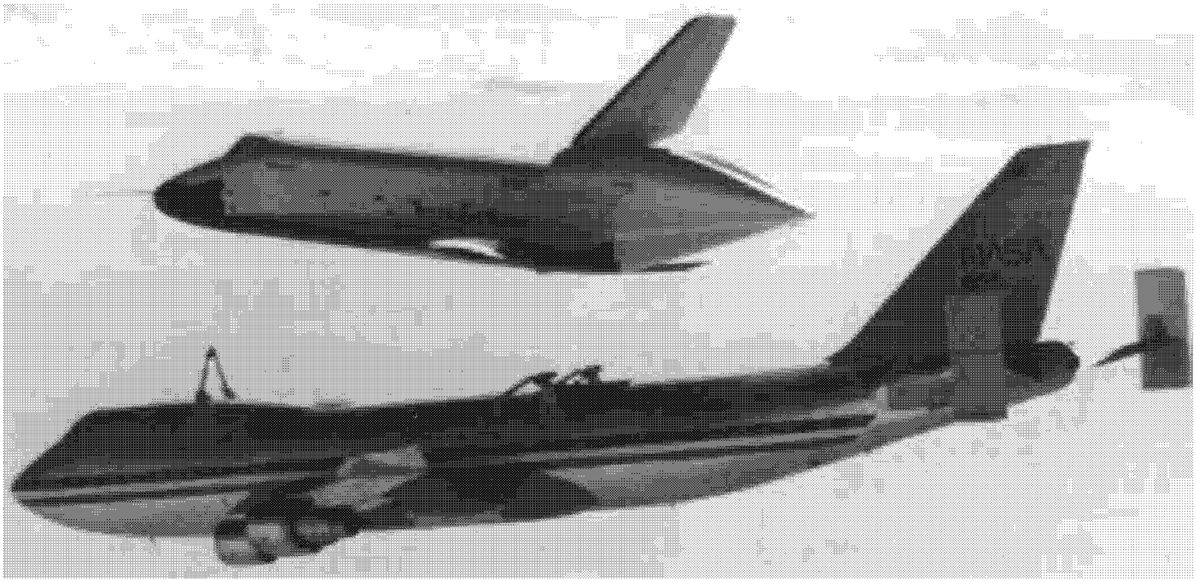

Figure 7-1. (U) *Enterprise* orbiter undergoing drop test in 1979. (Image: UNCLASSIFIED)

He placed NRO transition costs at about $250 million. The few NRO-related documents mentioned contracting out transition studies and pledged to transition payloads as soon as practicable, but did not supply dates. Other documents continued the emphasis on maintaining an inventory of conventional boosters. None of this broke new ground.[7]

(U) In September 1976, the shuttle program passed an important milestone when the first orbiter, *Enterprise*, rolled out of Rockwell International's Palmdale, California, plant. Though scheduled to be a test vehicle never to venture into space, it provided important visual evidence of progress. Indeed, some NASA employees speculated that Rockwell International rushed the roll out for that very reason.[8]

(U) The following February, a modified Boeing 747 carried *Enterprise,* sans liquid-fueled engines and the heat shield that would (maybe) protect against the heat of atmospheric reentry, into the air, but without releasing it. Several more "captive" flights followed. Then, in August, the orbiter separated from the 747 in the first of five glide tests to determine its aerodynamic characteristics and handling qualities. The tests went well overall and forecasts called for the first manned orbital flight in early 1979, but the heat shield and the liquid-fueled engines posed difficulties that soon forced delays.[9]

(U) Problems with the heat shield and liquid-fueled engines surprised no one. NASA had long before identified them as potential troublemakers. Previous heat shields consisted of ablative material attached as one piece to small, rigid reentry vehicles, as in Projects Mercury, Gemini, and Apollo, and lasted only one mission. In contrast, the shuttle's orbiter was large, its frame would flex slightly under stress loads, and the shield had to be reusable. That required a shield made up of some 34,000 small tiles, each shaped slightly different from the others. Each tile had a number affixed to its precise location on the orbiter's underside. Further, the completed shield had to be lightweight and keep the orbiter's aluminum skin at 350 degrees or less despite reentry temperatures as high as 3,000 degrees.[10]

(U) The problems with the tiles, most of which were foamed silica coated with borosilicate glass (i.e., ceramic), were as much mechanical as technical. If installation went well, a small army of workers would need over six months to install an entire shield, and installation did not go well. Individual tiles failed to withstand the conditions anticipated at reentry and had to be removed. In some weeks, workers removed more tiles than they installed. *Columbia*, the first operational orbiter, arrived at Kennedy in April 1979, with approximately 7,000 tiles not yet installed and shield certification nowhere near complete.[11]

(U) The tile problems paled when compared to those of the liquid-fueled engines and their subsystems. The three engines in each orbiter not only had to generate a combined 1.3 million pounds of thrust, but for the first time in any spacecraft, be throttle controlled. To meet power requirements, the engines had to withstand predicted burn chamber pressures of 3,000 psi, four times greater than anything previous, and temperatures of 6,000 degrees. Getting the liquid hydrogen/liquid oxygen fuel from the external tank to the engines promised to be just as daunting. The liquid hydrogen pump, which had a much greater workload than the liquid oxygen pump, would have to feed the burn chambers at the rate of 750 gallons per second. Maintaining such a flow meant generating 70,000 horsepower in a unit no larger than an outboard motor, using turbines spinning at 37,000 rpm, enduring internal pressures of 7,200 psi, and operating lubricant-free.[12]

(U) The problems with the liquid-fueled engines were purely technical. Seals ruptured, turbine blades cracked, burn chamber nozzles failed, and several fires erupted during test firings. Then, in December 1978, fuel leaks caused two more fires and an explosion completely destroyed another engine. NASA delayed the first orbital flight until late 1980. Even then, flight was contingent on the heat shield passing its certification tests and overcoming the liquid-fueled engine problems.[13]

(U) Meanwhile, shuttle transition planning had been picking up speed. January 1977 alone saw three major events. On 6 January, Deputy NRO Director Charles Cook updated the NRO's guidance vis-à-vis the shuttle. Cook used only three pages to identify twelve planning objectives including having sufficient control over operations involving NRO payloads, designing no payloads as shuttle-only, and maintaining an expendable launcher capability. In addition to backing up the shuttle, expendable launchers would be used when elevated world tensions made risking an orbiter and crew unwise. NASA must be brought on board for all NRO planning. Though more specific and at least a small step toward transition, the new guidelines did not amount to a significant change since it, much like Plummer's 1976 Directive, maintained the "fly before buy" policy that had guided DOD since 1972.[14] Appendix 17 contains the updated transition policy.

(U) Eight days later, NASA and DOD inked the first agreement on what the former would charge customers, or at least DOD, for using the shuttle. The agreement was Unclassified and loosely worded. DOD would reimburse NASA for seven categories of materials and services that included contract management, solid rocket booster refurbishment, spare parts, operating costs, additive expenses associated with short-term requirements, and launch support. The two organizations agreed to renegotiate the agreement at intervals. The only items given price tags were payloads smaller than 5 cubic feet and weighing less than 200 pounds, which would cost \$3,000- \$10,000.¶[15] Appendix 18 contains a draft of the NASA-DOD pricing agreement. Research failed to turn up a final, signed copy.

(U) Generalities dominated the pricing agreement because of so much uncertainty. The shuttle and its winged orbiter would push the frontier of space flight to a new and much different level. There were no precedents to fall back on in many areas, pricing included, and no way to accurately project either operating expenses or what to charge customers. Informed guesswork, not logic, was the order of the day. Cook professed no understanding of shuttle pricing and declined to discuss the subject in an

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interview with this author. Hans Mark, NRO Director (1977-1979) believed that shuttle pricing amounted to little more than picking numbers out of the air. Robert A. Frosch, NASA Administrator (1977-81), acknowledged much the same:

> WE DIDN'T KNOW, SO WHAT WE DID WAS SORT OF PUT NUMBERS TOGETHER AS BEST WE COULD AND SAY THAT WAS WHAT IT WAS GOING TO COST. WE REALLY OUGHT TO CHARGE SOMEBODY FOR SOMETHING. THE CONFUSING FACTOR IS THAT YOU ARE TRYING TO BUILD UP BUSINESS IN A BRAND NEW TECHNIQUE. SO, THE QUESTION IS A REASONABLE CHARGE, PARTICULARLY FOR A SMALL PAYLOAD, WHEN YOU WANT PEOPLE TO GET INTERESTED IN USING [THE SHUTTLE] FOR THEIR PURPOSES.[16]

Frosch's use of the term "reasonable charge" meant that NASA, caught between covering expenses and attracting customers, tilted toward the latter because a firm customer base was more important to program justification and continued funding.

(U) DOD and NASA also reached their first understanding on managing and operating the shuttle fleet in January 1977. Like the pricing agreement, it was Unclassified and given to generalities. DOD agreed to provide NASA with data necessary to integrate national security payloads, manage the Vandenberg launch facilities, and build the IUS. For its part, NASA pledged to develop the shuttle, conduct overall operations planning, make every effort to accommodate DOD needs, manage payload integration, and use the IUS.[17] Appendix 19 contains the January 1977 Memorandum of Understanding on Shuttle management and operation.

~~(S//NF)~~ Elsewhere, NASA, DOD, the CIA, and the NRO agreed to support a five-orbiter shuttle fleet, sufficient to meet an ambitious agenda of 560 flights from Florida and California during the first eleven years of operation. That schedule, about fifty-one sorties per annum, was not a random selection. NASA now believed that to be the breakeven point in economic terms, about double what it had estimated at program inception. A smaller fleet would force NASA to shorten turnaround times to levels incompatible with maintenance and safety requirements to meet that schedule and might not support operations from both coasts.[18]

(U) Then in late 1977, the White House dealt plans for five orbiters a significant, if not entirely unexpected, blow. The Office of Management and Budget (OMB) expressed concern over whether NASA could meet such an ambitious launch rate, repeated its long-held skepticism about program costs, and recommended funding only four orbiters. President Jimmy Carter accepted the OMB's judgment, though he left open the possibility of a fifth vehicle at some future date. NASA immediately set to work on a more modest launch timetable that, despite the smaller fleet, still included launches from both coasts.[19]

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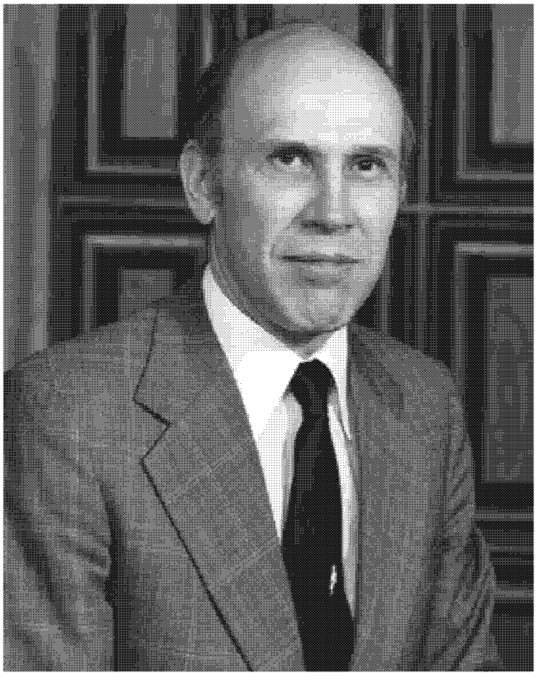

Figure 7-2. (U) Program B Director Leslie Dirks.
(Image: UNCLASSIFIED)

~~(S//NF)~~ By early 1978, DOD had identified twelve satellite systems, six belonging to the NRO, as candidates for transition. In a major change, the NRO dropped consideration of Gambit and Hexagon, scheduled for termination by the mid-1980s. Broadening their scope a little, DOD and the NRO for the first time began seriously examining the shuttle's potential, long known, but as yet given little thought, to serve as other than a launch vehicle. That potential included on-orbit checkouts after satellite deployments, on-orbit repairs of ailing vehicles, and retrieval and return of spent or failed spacecraft to earth. A sufficient conventional booster backup now defined as eleven Titans in various stages of manufacture—three ready-to-go, four partially assembled, and four sets of long lead time parts—remained a firm requirement. Some would be Titan- 34Ds, an upgraded model to augment and ultimately replace older, increasingly obsolescent variants that might not meet future needs.[21]

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~~(S//TK//NF)~~ Early 1978 also saw the first recommendation found during research that the NRO break with "fly before buy." Interestingly, the recommendation came from within the NRO. In a memorandum to Mark, Program B (CIA) Director Leslie C. Dirks questioned long term plans to make the [redacted] compatible with both the shuttle and the Titan (i.e., dual-launch capable). Despite developmental problems and never having flown an orbital flight, Dirks argued, the shuttle had made progress sufficient to justify configuring [redacted] scheduled for launch before 1983, as shuttle-only to reduce program complexities and save money. Reconfiguring [redacted] to dual-launch capability could be done with little delay or additional cost if the requirement arose early in fabrication. The importance of NRO satellites to national security, Dirks continued, meant that there was no question about securing the necessary funds if a more expensive reconfiguration became necessary later on. For some reason, Dirks omitted mention that [redacted]

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(U) To pause for a moment, dual compatible is a somewhat misleading term. Dual capable payloads had to be configured for one vehicle. Although they could be switched to another launcher, they could not do so at will because shuttle orbiters and conventional boosters had different attachment points that held satellites in place. For example, a dual capable payload configured for, say, a Titan would have to be returned to the manufacture for modifications of its attachment points before being placed on a shuttle. The actual modification took only about a month, but systems testing and recertification extended the factory time to approximately six months. The point is that dual capable payloads were not entirely flexible and did impose delays.[23]

~~(S//NF)~~ Whatever the impact of Dirk's memorandum, the main events driving transition during 1978 were political. In May of that year, President Carter signed Presidential Directive/NSC-37 (PD/NSC-37), "The National Space Policy," establishing the nation's first ever comprehensive guide for its space program. Among PD/NSC-37's provisions was a directive to maximize use of the shuttle. Shortly thereafter, Congress, armed with PD/NSC-37 and possibly annoyed at what it perceived as foot dragging, followed up by ordering DOD, the NRO included, to submit a detailed transition plan by year's end. The time for specifics had arrived and with it came a major step away from the NRO's own 1977 guidance as well as near total abandonment of "fly before buy."[24]

~~(S//NF)~~ The most noticeable feature of the 1978 transition plan from the NRO's perspective was that only those payloads entering their final design phases prior to 1980 required a backup conventional booster. All others would be "shuttle optimized," a somewhat vague term when used in the late 1970s. Shuttle-optimized could mean fabricated for a shuttle launch with the possibility of launching on a conventional booster (dual capable) or it could mean "shuttle only." The evidence lends more support to the latter interpretation.[25]

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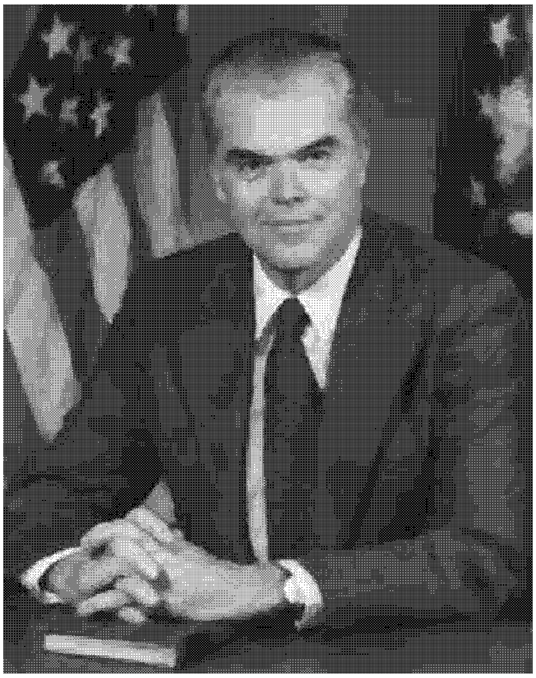

Figure 7-3. (U) NRO Director Dr. Hans Mark.
(Image: UNCLASSIFIED)

(U) The events of 1978 triggered a controversy involving Hans Mark that smolders to this day. Mark came to the NRO from NASA, where he had been Director of the Ames Research Center. In his new duties, he established the reputation of a difficult, hard-driving boss who worked long hours and required little sleep. He did not easily delegate authority, choosing instead to personally oversee important projects and make all major decisions. Deputy Director Cook resented being frozen out and spent a great deal of time finding ways to be useful. Others, however, even those who sometimes felt the lash of Mark's temper, are more generous in their estimates of the man. Those estimates can be summed up as "if you understood Hans and made allowances you could work with him."[27]

(U) The controversy was whether Mark overcommitted the NRO to the shuttle during his time as director. His management style, former association with NASA, and the unfavorable consequences arising from shuttle problems during the 1980s made him vulnerable to the charge. Mark understandably does not agree the over commitment accusation and during an interview with this author he betrayed a residual sensitivity to it.

(U) Nothing in the available documents supports the over commitment charge; indeed, quite the contrary. Mark was merely following national policy as outlined in PD/NSC-37 and responding to a Congressional mandate when he helped develop the 1978 transition plan. Besides, even had he wanted to expand the NRO's commitment to the shuttle he alone could not have done so. A decision of that magnitude could only have been made at the Secretary of Defense level or higher.

(U) In 1979, the NRO and NASA moved ahead with other initiatives related to transition. In January, Mark established the Manned Space Flight Engineers Program†† to qualify crewmembers to handle

†† (U) Also known as the Payload Specialist Program.

classified payloads. NASA agreed to have experienced astronauts assist in selecting the best qualified among those under consideration and the NRO agreed to reimburse NASA for their training. The first contingent of selectees, twelve Air Force and two Navy officers, reported in February 1980. Later groups included Army officers.[28]

~~(S//NF)~~ Other planning, possibly undertaken at White House direction, specified one retrieval mission of an NRO satellite, probably [redacted] and one on-orbit repair mission per annum beginning in about 1985. Still other initiatives sought to determine how satellites should be fabricated to withstand the shuttle's payload bay environment, which differed from that of a conventional launch vehicle, and to further examine which NRO payloads could best benefit from riding on the shuttle.[29]

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(U) Meanwhile, two other shuttle-related issues, integrating classified payloads into NASA's launch environment and constructing launch facilities at Vandenberg, had encountered rough going. As Mark himself noted, the shuttle represented unknown territory in that the NRO would for the first time be consigning to a civilian agency an important part of each mission profile, the launch phase. How could highly classified missions be assimilated into the shuttle's control facility, NASA's JSC near Houston, Texas, whose open door policy now included a permanent Soviet presence? Answering that meant bridging a gap pessimistically described as the basic incompatibility between NASA's peacetime charter and DOD's national security requirements.[30]

(U) The issues surrounding Vandenberg were straightforward questions of cost and utility. For the better part of a decade beginning in mid-1977, the NRO, DOD, and NASA had to repeatedly justify the multi-billion dollar cost of constructing west coast shuttle facilities. Other government offices, the OMB prominent among them, had persistent doubts whether such facilities were even necessary. Mark considered defending the Vandenberg construction as one of his most difficult tasks during his tenure at the NRO and later as Secretary of the Air Force and NASA Deputy Administrator.[31]

(U) Sticky Issues: Mission Integration and Vandenberg

~~(S//NF)~~ A joint committee probably made up of DOD and NASA representatives took the first serious look at integrating classified missions into the latter's environment in 1976. Committee members concerned themselves only with the period of time that classified payloads remained aboard the orbiters. Once released, command and control of the payloads would revert to the [redacted]

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(U) The committee's report, finished in January 1977, based its major conclusion on precedent. In the past, DOD and NASA conducted their respective operations separate from each other and that should continue; DOD needed detached, dedicated facilities within the larger JSC confines. It was the only way both organizations could maintain adequate command and control over their respective portions of each mission and still satisfy DOD's security concerns. In other words, mission integration would be much less than total.[32]

(U) No one at any level questioned the desirability of a separate facility, but the price tag, $215 million over twelve years, gave pause. There were also questions as to whether two facilities could work well together as well as doubts that a separate facility could be ready for the first classified launch set for 1982. In May 1977, Deputy NASA Administrator Alan M. Lovelace offered an interim solution he called "exception-basis."[33]

Figure 7-4. (U) Deputy NASA Administrator Alan M. Lovelace. (Image: UNCLASSIFIED)

~~(S//NF)~~ Under exception-basis, NASA would turn the JSC's mission simulator and Mission Control Center over to DOD for specific launches. The idea got a cool reception. Training DOD personnel and keeping them current in JSC procedures promised to be difficult and expensive. Moreover, the disruption to center operations would limit turnovers to no more than four per year, sufficient to cover 1982, but not thereafter as the launch tempo of classified payloads picked up. Lovelace had acknowledged upfront the limited utility of his suggestion, but at least it bought an additional year in which to find a better answer. Others, however, believed that the flaws in exception-basis so far outweighed its advantages that it never gained serious attention.[34]

(U) In the meantime, other groups looked into other options. The most important got its start in May or June 1977 when the Air Force, as DOD's representative in shuttle matters, asked DCI Bush to examine the minimum level of JSC security needed to protect classified payloads. In his July reply, Bush advised that collateral secret sufficed. That left unanswered what to do about BYEMAN-level NRO missions, but the DCI did not offer anything in the way of help. He did not support a separate facility, directing instead that DOD, the Intelligence Community, and NASA solve the mission integration problem using existing and programmed JSC facilities.[35]

(U) The DCI's marching orders led to the formation, probably in the same month, of an Ad Hoc Committee to attack the problem. The committee entertained a number of possibilities before finishing its report the following November. The report's main recommendation called for "Control Mode Operations," which allowed for the semi-isolation of shuttle missions carrying classified payloads from the Mission Control Center. DOD mission controllers would be secretly housed within the control center's building in a third-floor suite formerly used for offices. The area had been and would remain off-limits to visitors. Within that facility, the DOD staff would plan for and monitor their portion of missions (i.e., payloads and the

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mission payload specialists) using UNIVAC 1108s or 1110s computers compatible with those in the control center. The remainder of the control center would be cleared to collateral Secret as Bush had specified.[36]

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~~(S//NF)~~ Limiting certain information to DOD payload specialists was surely a short-lived consideration. All crewmembers identified for classified shuttle missions were trustworthy military officers and civilians who could easily be cleared for complete access. Besides, denying information to onboard mission commanders violated one of the cardinal rules of flight: those with overall responsibility must be cognizant of all onboard activities. Limiting information probably did not endure past early 1980, when the first contingent of payload specialists entered training.

~~(S//NF)~~ Control Mode represented a quantum improvement over the exception-basis method recommended by Lovelace, and at $5-$10 million was far cheaper than a separate DOD facility. Still, the Ad Hoc Committee did not consider it to be the final word. Control Mode was also an interim measure capable of handling classified launches until the end of the 1980s or nearly so before steadily increasing launch rates overwhelmed it. The Ad Hoc Committee recommended a separate DOD facility as the only long-term solution, thereby adding weight to the work done by the 1976 committee that first seriously studied the problem.[39]

~~(S//NF)~~ Still other objections to Control Mode surfaced over the next eighteen months. Sharing operational authority over critical military space operations with a civilian entity grossly violated the unity of command principle. On-orbit repairs and satellite retrievals would complicate the interaction between crewmembers and payloads, require much better coordination, and with it more complex communications than did launches. That complexity would probably require improvised "workarounds" that might defeat security safeguards. In some cases, it would be impossible to conduct all mission functions in a control center cleared only to the collateral Secret level. And what would happen should an emergency make successful recovery of orbiter and crew the sole focus and pushed security considerations well into the background?[40]

(U) The mission integration problem reached the front burner in early 1979 when OMB Director, James T. McIntyre, Jr., asked DOD, NASA, and the Intelligence Community to further assess the wisdom of either a separate DOD facility or working with NASA at the JSC. He particularly wanted data on such things as configuration alternatives and, of course, costs. Congress had not funded either option, but there was still time to work recommendations into the FY 1980 budget. McIntyre wanted an answer by 1 August.[41]

(U) Mark played a central role in formulating the DOD position. Criticisms of the Control Mode method gave him plenty of ammunition and he made good use of it. Previous launches, he argued, had a high success rate because the NRO maintained full control, a model for shuttle missions with classified payloads, but one impossible to attain at the JSC. Further, the JSC had an elevated risk of a security compromise and represented a single-point-of-failure, something that a separate facility acting as the primary mission control center and the JSC as backup avoided. The primary-backup scenario, Mark concluded, best answered the mission integration problem and should be funded. Other documents of the time were in step with that position.[42]

(U) Despite his assertiveness, Mark, along with others, saw problems ahead. The Intelligence Community and DOD were not entirely in agreement on specific mission control requirements, a deficiency that needed attention. McIntyre and his staff showed more interest in a cost-effective solution than in operational requirements and mission security, which did not bode well for a separate DOD facility. Neither did the high probability that NASA would use its considerable political clout to oppose any approach that did not assign a predominant role to the JSC.[43]

(U) McIntyre's decision must have supported Mark's position because DOD began planning a separate facility. Early shuttle missions would still be integrated into the JSC, and the JSC might still serve as a backup later on, but the long-term need for a separate facility was no longer in question, at least in DOD circles. The Consolidated Space Operations Center, DOD's name for the separate facility, would cover some 107 acres and have 1,800-1,900 staff. It had to be largely self sufficient with its own maintenance facility, administrative area, electrical power plant, fire fighting capability, and, if necessary, sewage disposal.[44]

(U) Site selection for the new operations center did not take long. DOD never intended to locate it within or near the JSC and for sure it would not be at or near the Air Force Satellite Control Facility in Sunnyvale, California. Urban sprawl had completely hemmed in the Sunnyvale location, popularly known as the "Blue Cube," since its construction in the early 1960s, leaving no room for growth. In early 1980, DOD settled on a plot of land near Colorado Springs, Colorado, an area free of major electromagnetic interference. The site was near Peterson Air Force Base should the need for additional support arise, and had ample government land on which to build. DOD immediately requested supplemental FY 1980 funding for construction so as to be operational in 1985. Whether or not the new facility would ultimately absorb the "Blue Cube" is not apparent in documentation from that time.[45]

(U) Meanwhile, the shuttle facility construction at Vandenberg moved ahead, albeit slowly. In the early 1970s, NASA had evaluated around 140 candidate locations for shuttle launch operations, though it is difficult to see what motivated a search of that magnitude. The already well-developed launch infrastructures at both Kennedy and Vandenberg made any other choices at best remote possibilities. Moreover, both sites offered overwater trajectories during the early portion of flight. That was important in diminishing the effect of sonic booms, protecting civilians in the event of an accident, disposing of external fuel tanks in remote ocean areas, and affording watery landings for the reusable solid rocket boosters. NASA would fund and operate the Kennedy shuttle facilities while the Air Force, as DOD representative, did the same at Vandenberg.[46]

~~(S//NF)~~ Above all, Vandenberg offered something that the Florida site did not. All low altitude reconnaissance satellites, whether photographic or signals collectors, required polar or near-polar orbits. Because common sense and diplomacy meant avoiding land masses during initial flight stages, launches from Florida were limited to inclinations of about 65 degrees. On the other hand, launches from Vandenberg, though not entirely free of restrictions, could achieve any high inclination orbits, and since 1958 many payloads had followed such trajectories aboard conventional boosters.[47]

(U) In fact, high inclination orbits were so important that DOD considered buying two additional orbiters for exclusive use at Vandenberg, this despite the 1972 decision to avoid investing significant amounts of money in the shuttle program. The expense made buying two orbiters highly unlikely, but DOD representatives were working on various options as late as 1975 when Secretary of Defense Robert Clements quashed the idea in favor of emphasizing construction.[48]

(U) In November 1977, the Vandenberg construction had its first recorded scrutiny and its first serious challenge when NASA Administrator Frosch and OMB Director McIntyre conferred with President Carter on shuttle budgetary matters. The agenda for that meeting was important enough for officials to urge Defense Secretary Harold Brown to attend so he could protect DOD's interests. The specifics of that meeting are unknown, but may have foreshadowed subsequent events unfavorable from the NASA-DOD point of view. In January 1978, the General Accounting Office (GAO), the governmental watchdog monitoring the federal budget, circulated a draft containing three shuttle-related recommendations it proposed to put before Congress:

1. Fund no more than four orbiters and possibly fewer.

2. Terminate shuttle-related activity at Vandenberg in favor of a smaller launch facility at a site not identified or launch shuttles only from Florida. The projected savings came to $2.7 billion.

3. Refocus the shuttle on the nation's long-range purposes in space.[49]

(U) The recommendations did not set well with Frosch who had little regard for the GAO in the first place. He considered the organization so short on talent that it should be called the "General Amateurish Office." His animosity may have been why the less opinioned Lovelace penned NASA's rebuttal. Lovelace disagreed with further limiting the number of orbiters, but that battle was largely over, President Carter having already endorsed four vehicles. He chose not to mention either refocusing the shuttle program on the nation's long range space goals, probably a reference to a Manned Space Station, which was in NASA's interest, or constructing small launch facilities.[50]

(U) Lovelace did, however, comment at length on terminating the Vandenberg construction. High inclination orbits out of Florida were impossible under the existing ground rules unless NASA exercised one of two options. The first was to develop a more powerful IUS to permit flying "dog legs" around land masses, notably the Canadian maritime provinces of Newfoundland and Labrador. The second option meant using shuttles to assemble expendable launchers in space and firing them when achieving high inclination orbits did not require over flying landmasses. Both options were expensive. In fact, Lovelace warned, any savings from adopting either option would amount to perhaps $300 million and probably less, nowhere near the $2.7 billion forecast by the GAO. Other governmental agencies apparently rebutted the GAO report in similar fashion.[51]

(U) The two sides aired their differences at a 9 March 1978 Congressional hearing attended by representatives from the GAO, NASA, DOD, and other government agencies, the Subcommittee on Defense and Military Construction among them. A great deal hinged on the size of the shuttle fleet. If, as the GAO now advocated, funding covered only three orbiters there would be no requirement for a second launch site. On the other hand, if funding supported four orbiters, two launch sites were viable

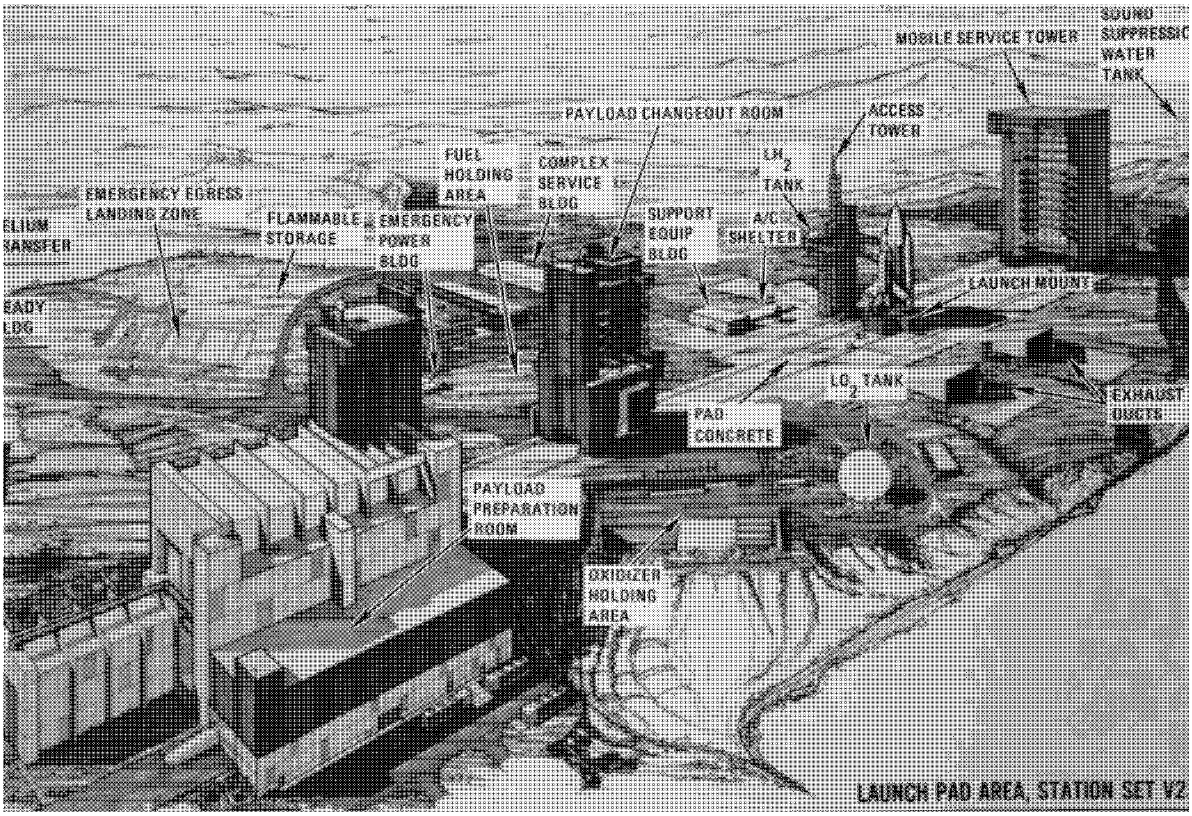

Figure 7-5. (U) Concept of shuttle launch facilities at Vandenberg AFB. (Image: UNCLASSIFIED)

and Vandenberg had a future. The hearing reaffirmed a four-orbiter fleet and the FY 1979 budget contained the first sizable expenditure for construction at Vandenberg, a victory for DOD and NASA. The construction would be in an area designated years before as the launch site for two defunct space programs mentioned earlier in this narrative, the DynaSoar winged space glider (1959-1963) and the Manned Orbiting Laboratory (1965-1969).[52]

(U) The GAO, in August, in response to a Congressional request, weighed in with yet another report. The new report accepted a four-orbiter fleet, but not the West Coast facility. By relaxing the prohibition against over flying land masses, the GAO argued, high inclination orbits would be possible from Florida thereby greatly reducing, perhaps obviating, the need for the Vandenberg construction. The fallout from the latest GAO study was probably scant. The prohibition against launching over land remained in effect and the Vandenberg shuttle facility held onto its funding. Construction began in January 1979.[53]

(U) With the California launch facility secure and the shuttle fleet sized, at least for the time being, NASA and DOD began revamping their respective schedules. NASA trimmed the overall number of shuttle flights from 560 in eleven years for four orbiters to 488 in twelve years, just over forty per annum, for four orbiters. In NASA's opinion, the reduced figure would still meet all government requirements and attract business from both domestic and foreign interests. Vandenberg would commence shuttle operations in late 1983, a year later than previously forecast, but DOD's intention to completely transition its payloads in 1985 remained firm.[54] Table 7-2 contains the revised shuttle launch schedule by number, site, and customers.

Table 7-2. (U) Planned Distribution of Shuttle Missions by User and Launch Site as of February 1979

User	Kennedy Space Center	Vandenberg	Total
NASA	166	35	201
Dept. of Defense	64	59	123
Other U.S. Government	5	25	30
Domestic civilian	64	5	69
Foreign	54	11	65
Total	353	135	488

(U) Source: The Essentially and Benefits of Both East and West Coast STS Launch and Landing Sites in Support of All future National Space Operations (U), 2 February 1979.

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(U) Although the latest NASA projection substantially cut the projected mission total, 488 was still a large number. For sure, there was little basis for the numbers in Table 7-2. As Frosch admitted with his usual candor, mission rates throughout the 1970s were long term objectives built on assumptions. Moreover, what the table shows did not reflect pledges to use the shuttle or even what NASA could reasonably expect.[55] NASA would pay a price for that in the 1980s as events began working against the shuttle.

(U) As a final note on the 1970s, DOD and NASA staffs had been working for some time to update the January 1977 agreement on shuttle management and operations. The update, like its predecessor, was Unclassified and thirteen pages in length. Most of the policies and procedures were the same or similar to those in the earlier document, albeit more firmly stated. One new provision, however, stands out. In that provision, NASA ceded priority to national security payloads if asked to do so by the Secretary of the Air Force or higher authority. The update went into effect on 27 March 1980.[56] Appendix 21 contains the updated agreement.

* * * * *

~~(S//NF)~~ The late 1970s marked the apogee in the DOD/NRO's association with the shuttle. The unease of earlier years when NASA had committed that vehicle to a ludicrous flight schedule and unrealistic performance standards had largely dissipated. Systems acquisition was progressing well enough, although not free of delays and problems. DOD began planning the transition of its payloads from conventional boosters in 1975, but with little enthusiasm, or so it seemed, until 1978 when Congress ordered formulation of a detailed plan. Questions about the shuttle now centered on command and control of classified missions and launches out of Vandenberg, not on the vehicle itself. Most importantly, nothing threatened the shuttle program's long term viability and no serious NASA-NRO disagreements about it roiled the waters, but that would change in just a few years. Even as it flew its first missions and advanced to operational status, the shuttle's problems became ever more apparent and DOD reservations about it, still smoldering just out of sight, bubbled to the surface.

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~~(S//TK//NF)~~ Before continuing the shuttle story, however, there were other instances of NRO-NASA interaction during the 1970s that merit discussion. Only one, [redacted] The others were less substantial, even obscure, but they further illustrate the range of issues and programs that pushed NASA and the NRO into interaction. Those issues and programs are discussed in the next chapter.

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(U) Chapter Eight

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~~(S//TK//NF)~~ [redacted] AND OTHERS, 1975-1982

~~(S//TK//NF)~~ The preceding chapters detailed a number of major issues and programs that brought the NRO and NASA into cooperative interaction during the 1970s. These included the Hubble Space Telescope, the Space Shuttle, Skylab, earth observations, and the complex political and structural changes that took place. The list is still not complete, however. At least five other points of interaction took place during the last half of the decade; the most important involved a NRO radar imaging satellite and a constellation of NASA relay satellites in geosynchronous orbits.

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~~(S//TK//NF)~~ The other NRO-NASA interactions involved programs and issues that can be dealt with in relatively few pages. The most significant involved the NRO's [redacted] The two systems merit discussion because their electronic capabilities and physical appearances were similar and [redacted] The remainder had to do with even smaller programs that demonstrated NASA's commendable ability to reach compromises that preserved and advanced its programs even when issues of national security were involved. (b)(1) (b)(3)

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~~(S//NF)~~ The NRO's film based imaging satellite systems—Corona (1960-1971), Gambit (1963-1982), and Hexagon (1971-1986)—revolutionized intelligence collection by providing routine, unimpeded access to any point on earth. However, the exposed film remained on board sometimes for weeks until parachuted back to earth, which heavily discounted its value as tactical intelligence. [redacted] (b)(1) (b)(3)

~~(S//NF)~~ The British developed the first conventional radars in the 1930s, and advances over the years brought improved reliability and performance. Their resolution, however, remained far too poor for most intelligence purposes. Radar that employed a synthetic aperture, first developed in the 1950s and [redacted] (b)(1) (b)(3)

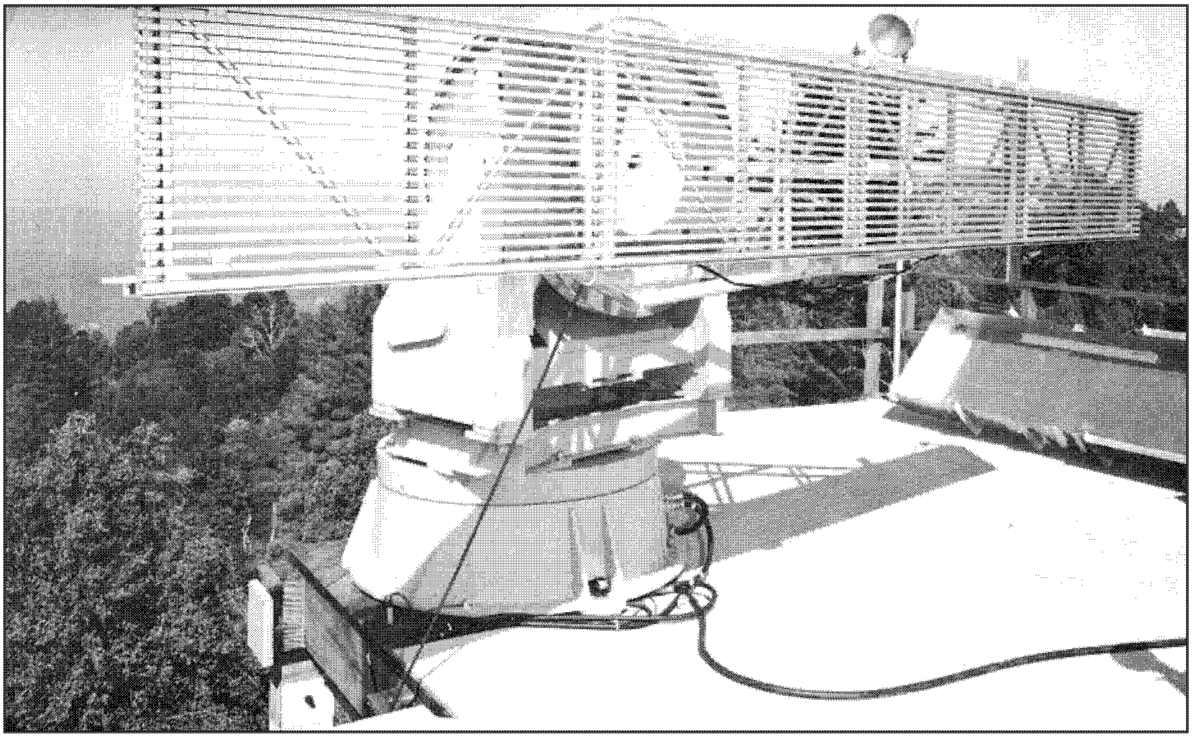

Figure 8-1. (U) Quill antenna. (Image: UNCLASSIFIED)

subsequently mounted on aircraft, promised to overcome the resolution problem. Without going into technical details, Synthetic Aperture Radar (SAR) focused multiple and sequential beams on a target and processed the reflected energy into reconnaissance quality imagery.[1]

(U) In December 1964, the NRO launched Quill, a prototype SAR satellite cobbled together using parts cannibalized from various aircraft-mounted systems. Quill operated for four days, both electronically downlinking imagery and recording it on film for later recovery. The imagery's resolution, 10-15 feet in azimuth and 60 feet in range somewhat exceeded expectations, but the system was purely experimental with no plans for further development. Quill plunged into the Atlantic Ocean in January 1965, having provided proof of concept if little else.[2]

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Figure 8-2. (U) Program A Director Maj. Gen. John Kulpa.
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Figure 8-3. ~~(S//TK//NF)~~ [redacted] (Image: ~~SECRET//TK//NOFORN~~)

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relationship between Program A and Program B. Others went so far as to cite antagonism as the only reason for the decision.[15]

(U) That antagonism started in the early 1960s when, it will be recalled, the CIA concluded that being the NRO's only civilian component placed it at a disadvantage. Beginning in 1962, Director of Central Intelligence (DCI) John McCone and Program B Director Albert Wheelon waged a bitter, protracted battle for greater autonomy. Since the Air Force was the dominant NRO entity, the struggle largely pitted Program A against Program B. Program B got more control over its assets with a 1965 update of the NRO's charter, but the conflict left bruised egos, hurt feelings, and a deep well of resentment in its wake.

(U) When he became NRO Deputy Director in 1969, F. Robert Naka immediately noticed coolness between the two programs. There was little contact, even in those instances where there should have been, something everyone seemed to accept with a shrug of their shoulders. Naka, however, refused to shrug his shoulders. To him, the situation was intolerable, and during his tenure he pressured the two programs into greater interaction. He left the deputy director position in 1972, satisfied that the problem was a thing of the past.[16]

(U) Naka was wrong. The coolness continued and certainly affected Program A and Program B interaction into the late 1970s and probably a good deal longer. Some Program A staff suspected that

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(U) The success of the television and radio relay mission led to significant changes to ATS-6. At 2,800 pounds, 26 feet tall, and 53 feet wide, solar panels included, the Fairchild-manufactured satellite was several times larger and heavier than the five previous models. Its mission differed somewhat from its predecessors. In addition to accommodating the equipment carried on earlier satellites, ATS-6 would allow participating countries to relay television broadcasts directly to users in remote or underdeveloped areas within their own borders, Appalachia and Alaska in the case of the United States. ATS-6, unlike its predecessors, had planned for it a mesh-like parabolic antenna some 30-feet in diameter. Unfurled in space, the antenna could radiate a strong television signal accessible to small receivers.[32]

(U) ATS-6 differed from its predecessors in another way. Since at least early 1968, NASA and the Federal Communications Commission had been proposing a survey of the world's electronic emissions to identify sources of communications interference. Since ATS-6's antenna could intercept the interfering electronic emissions as readily as it could relay television broadcasts, NASA had every intention of using it to do both and made no secret of the antenna, its capabilities, and the plans for it.[33]

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(U) Chapter Nine

(U) The Shuttle and the Manned Space Station, 1979-1985

(U) The 1970s witnessed great strides in the American space effort. Several NASA space programs of the period received wide and generally favorable publicity. The NRO launched the world's first electro-optical imaging satellite thereby giving the Intelligence Community the world's first near-real-time photography. Other events were political in nature. National decisionmakers declassified the "fact" of photographic satellite reconnaissance, permitted NASA to incorporate better optical sensors on its earth observation satellites, and for the first time brought together in a single document a coherent national space policy. The political changes acknowledged the impact of advancing technology, a changing world, and that the nation's space program, both overt and covert, had outgrown the governing mechanisms, some of them admittedly ad hoc, of previous years.

~~(S//TK//NF)~~ The NRO and NASA also modified their interaction to include an improved coordinating and decisionmaking structure and a general tightening of the security safeguarding technological transfers. To be sure, the political considerations that influenced the national level also swayed the two organizations, but the burgeoning numbers of space projects in which they interacted provided the main motivator for change. Those projects ranged from the famous—the Space Shuttle, the Hubble Space Telescope, the Skylab space station, and Landsat—to the more obscure— [redacted]

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(U) Of those programs, the Space Shuttle more and more dominated NASA-NRO interaction as the decade progressed. That was particularly true after mid-1978 when Congress ordered DOD to submit a detailed plan for transitioning payloads, including those of the NRO, from expendable launchers to the shuttle. NASA, which had lobbied intensively in favor of the shuttle, needed the additional justification coming from supporting national security to help maintain funding and assist in building a robust base of customers seeking launch services. A viable shuttle would, in turn, allow NASA to pursue its next great space project, a permanent manned space station that would dwarf the Skylab program of the 1970s. For DOD and the NRO, less enthusiastic about the shuttle, it was more a matter of obeying Presidential directives establishing the shuttle as the primary launcher for all American satellites and implementing a Congressional mandate to begin serious transition planning.

~~(S//TK//NF)~~ During the first half of the 1980s, NASA and the NRO had to deal with two overarching programs, the shuttle and the Manned Space Station. The applicable archives yielded over one thousand pages of material from the period, but few deal with other than those two issues. Only about forty pages concerned NASA's Landsat program [redacted] The only other interaction mentioned came from a tiny bit of material on the NRO's transfer to NASA of two reentry vehicles from the recently terminated Gambit photographic reconnaissance program. NASA proposed using them to return payloads from a probe scheduled to sample material in the tail of a comet.[1] Appendix 22 contains the September 1984 agreement on the reentry vehicles, which is appended to affirm a transfer that might otherwise be lost to history.

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(U) An Operational Shuttle and a DOD Commitment

(U) Congressional testimony by NASA Administrator Robert A. Frosch and Secretary of the Air Force Hans M. Mark, along with archival evidence, presented a mixed picture of the shuttle program in 1980. A listing of positive factors showed the orbiter *Columbia* undergoing checkout at the Kennedy Space Center, Florida. The shuttle's liquid fueled engines, long problematic in their development, had been improved to reach 106 percent of rated power level, a requirement for launching heavier payloads. The thermal protection system still posed difficulties, but new methods of strengthening and testing its many thousands of individual tiles pointed to a certifiable system within a few months. NASA now had enough confidence to schedule the first orbital mission between November 1980 and March 1981, about two years later than originally planned. Having a shuttle retrieve and return spent satellites for refurbishment and reuse remained a possibility, but probably not until the end of the decade. Rockwell International scheduled delivery of the three remaining orbiters—*Challenger, Discovery,* and *Atlantis*—in 1982, 1983, and 1984, respectively.[2]

(U) On the problematic side, the liquid fueled engines had only a slim chance of attaining full power level, defined as 109 percent of rated power level, needed to launch the heaviest payloads before 1984. The Inertial Upper Stage (IUS), a solid-fueled vehicle to boost payloads from shuttle deployment to operational altitudes, had technical problems and cost overruns sufficient to delay its availability until mid-1981, a one year slip. Work had begun on shuttle launch facilities at Vandenberg Air Force Base, California, in 1979 and the Fiscal Year (FY) 1980 budget had $82 million earmarked for the project, but the site would not be ready until June 1984, a two year slip.[3]

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~~(S//NF)~~ If the NRO could hold to that launch schedule, it would meet the goal set some years earlier for a complete transition to the shuttle by 1985. Holding to the schedule was, however, by no means a given. As the shuttle met or failed to meet program milestones, NRO program managers would have to make critical determinations, the most important being whether to make payloads dual-launch capable (use either the shuttle or an expendable launcher) or shuttle-only and what, if any, expendable launch backup to maintain.

~~(S//NF)~~ Individual payloads took perhaps five years to journey from conception to launch pad. Program managers had to make the dual-launch or shuttle-only decisions on a case-by-case basis at or before certain points in each payload's manufacture. Delaying too long meant substantial reengineering along with increased program costs and setbacks in achieving launch-ready status. For example, [redacted] (b)(1) (b)(3)

* ~~(S//NF)~~ Known as [redacted] at the time. (b)(1) (b)(3)

~~(S//NF)~~ On the other hand, judgments in favor of dual-capability, even if made at or before the decision points, would cost an estimated [redacted] for all programs, conventional boosters included. The NRO could avoid that expense if the shuttle proved itself and a viable shuttle-only option emerged. The point is that a shuttle-only/dual-capable decision was extremely difficult and could not be avoided. It was a decision that had to be made both correctly and at the right time for each payload to hold down costs and maintain an orderly progression.[6]

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~~(S//NF)~~ The question of a conventional booster inventory was easier to answer. NASA problems with shuttle development and the distinct possibility of further difficulties prompted all of DOD, despite submitting a transition plan two years earlier, to proceed cautiously. The shuttle had not even flown, much less proven, its reliability. Even when it did, four orbiters did not represent a robust launch capability, particularly if one was lost. Worse, a generic flaw could ground the entire fleet. DOD would, therefore, maintain an expendable launch structure centered largely on the Titan-III and Titan-34D. Ongoing planning called for being prepared for at least one Titan launch from each coast through 1990 in case that became necessary.[7]

(U) To NASA's credit, it solved any remaining problems with the tiles and liquid fueled engines and on 23 November 1980, a fully-tested and flight-ready *Columbia* rolled out of its Kennedy Space Center hanger. On 12 April 1981, twenty years to the day after Yuri Gagarin made his orbit of the earth, *Columbia*, flying the first Space Transportation System mission (STS-1) rode skyward on almost 8 million pounds of thrust. The launch and insertion into orbit went well. Because the primary objectives were to follow a planned flight profile and make a safe recovery, the orbiter had only a two-man crew, John Young and Robert Crippen, plus three non-deployable scientific and instrumentation payloads. Both men had pressures suits, ejection seats, and parachutes that made escape possible up to about 75,000 feet, though admittedly the chances of success at the higher altitudes were not good. NASA discontinued the ejection seats and parachutes after the first few missions.[8]

~~(TS//TK//NF)~~ Although the NRO was some time away from launching a payload on the shuttle, it still had a role in the early missions. [redacted]

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~~(TS//TK//NF)~~ Those two episodes must have been what motivated John Yardley, Associate NASA Administrator for Space Transportation Systems, to approach the NRO Director, Robert J. Hermann, in October 1979. The thermal tiles protecting against the heat of reentry would be a source of concern on the first missions no matter the improvements made to them. He asked Hermann for a list of intelligence [redacted]

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first shuttle mission ended on 14 April when *Columbia* touched down before an enormous throng at Edwards Air Force Base, California.[13]

(U) Despite *Columbia's* successful mission, DOD did not warm to the shuttle. The first launch came two years behind the original schedule and other delays were likely. The time between getting a payload on the shuttle manifest and actual launch was almost two years, though emergency requirements could reduce that delay. In July 1981, Secretary of the Air Force Verne Orr slipped Vandenberg's initial shuttle launch capability an additional fifteen months, to October 1985. He attributed the delay to inadequate planning and difficulties hiring qualified engineers in a flourishing California economy. That placed Vandenberg three years behind the original schedule and derailed NASA's initial plans for West Coast shuttle operations. Payloads destined for high inclination or polar orbits would continue launching from Vandenberg on expendable boosters.[14]

~~(S//NF)~~ All these considerations were enough for the NRO Advisory Board, an oversight group chaired by Eugene Fubini, to issue a blunt warning. Transition to the shuttle should continue, but with due vigilance. The NRO should maintain the option of using conventional launchers and carefully scrutinize early shuttle flights for problems that might jeopardize its payloads. Decisions already made should be reversed without hesitation at whatever the cost if necessary to protect national security programs.[15]

~~(TS//TK//NF)~~ [redacted] On 15 March 1982, Associate Deputy NASA Administer Philip E. Culbertson and Deputy NRO Director Donald L. Haas signed a memorandum of agreement (MOA) establishing new requirements. [redacted] the shuttle's control facility, would hold pre-launch exercises, [redacted][6] Appendix 24 contains that MOA.

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~~(TS//TK//NF)~~ Hans Mark, now Deputy NASA Administrator, took sharp exception to both the JSC complaints [redacted] Innovative flight and ground crews had successfully recovered Apollo 13 after an explosion partially disabled it on the way to the Moon. Mark further believed that:

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Mark's admonishment took hold [redacted] at least for a while.

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Figure 9-2. (U) NRO Director Edward C. Aldridge, Jr. (Image: UNCLASSIFIED)

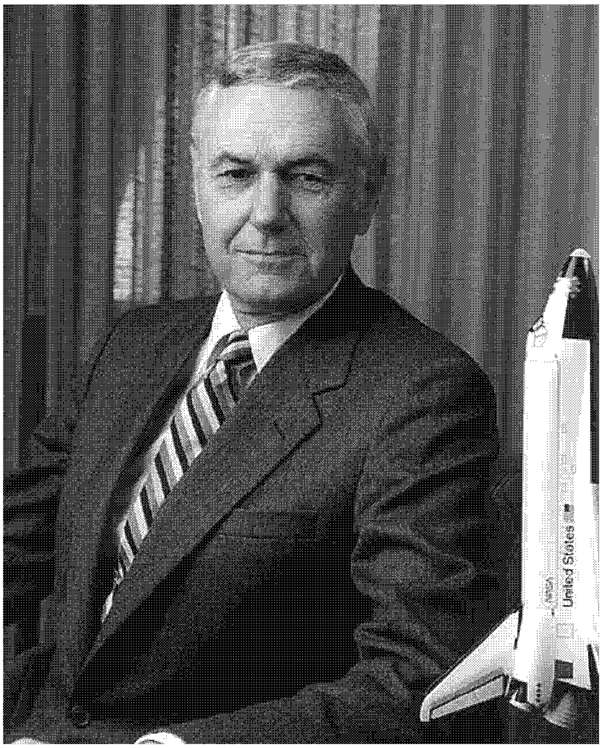

Figure 9-3. (U) NASA Administrator James Beggs. (Image: UNCLASSIFIED)

(U) On 4 July 1982, *Columbia,* flying mission STS-4, touched down at Edwards before a 750,000-strong crowd that included President Ronald Reagan. The mission had carried the shuttle's first deployed payload, an 800-pound Induction Environment Contamination Monitor. The very next day, *Challenger*, the second orbiter, arrived at Kennedy and shortly thereafter NASA declared that the shuttle had achieved an initial operating capability. *Columbia* then followed up with another successful flight in November 1982, deploying two civilian communications satellites.[19]

(U) The string of accomplishments led DOD in late 1982 to begin reevaluating its position vis-à-vis the shuttle. NRO Director Edward C. Aldridge recalls that the reevaluation was not all that popular. It certainly was not popular with him. He had previously testified before Congress in favor of an expendable backup even after the shuttle became operational. Moreover, DOD's long-standing skepticism about the shuttle had by no means dissipated.[20]

(U) Considerations other than shuttle performance drove the reevaluation and subsequent events. Early in his administration, Reagan had reaffirmed that all government payloads would transition to the shuttle as soon as practical. He restated the same in a speech following STS-4. His restatement coincided with DOD plans to acquire additional expendable launchers, but Congress was highly unlikely to fund the new boosters in the face of such strong support for the shuttle. In other words, DOD's hand was being forced.[21]

~~(S//NF)~~ In March 1983, Aldridge, in his overt role as Under Secretary of the Air Force, endorsed the results of that reevaluation. The shuttle had proven itself sufficiently for a complete transition of all DOD payloads, those of the NRO included, though in 1987 rather than 1985. To buy a little extra time in case something went wrong, he delayed implementing the new policy until *Challenger* returned safely from its first mission. Thus, when *Challenger* touched down on 9 April 1983, DOD was fully committed to using the Space Shuttle as its launch vehicle.[22]

~~(S//NF)~~ The commitment decision also meant a reassessment of conventional boosters. Backed by Secretary of Defense Casper Weinberger, Aldridge ordered Titan production terminated after the sixteenth vehicle. DOD also abandoned plans to buy long lead time parts for two additional vehicles. Available Titans would serve as needed until inventory exhaustion. The cancellation promised to save $380 million over three years.[23]

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~~(TS//TK//NF)~~ In a final note on the NRO and early shuttle missions, [redacted] By then, NASA had complete confidence in the tiles and, besides, orbiter crews had remote control cameras attached to the payload bay's extendable arm to examine them up close. Still, as late as September 1983, James Beggs, who followed Robert Frosch as NASA Administrator, expressed support [redacted] but that changed. In January 1984, [redacted]

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~~(TS//TK//NF)~~ [redacted] In June 1985, the NRO initiated action to rescind the 15 March 1982 MOA. In the aftermath of *Columbia's* 2 February 2003 breakup during atmospheric reentry, Beggs acknowledged that he and Mark had made a bad mistake [redacted] This will be covered in greater detail in a later chapter.[25]

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(U) Meanwhile, and even before declaring the shuttle operational, NASA began seriously planning its next significant space project to date. During his confirmation hearing Beggs had identified a Manned Space Station as that project. His statement should have surprised no one. NASA had long advertised the shuttle, its role as the launcher for other payloads aside, as the support vehicle to carry construction equipment aloft in achieving that goal. With the shuttle becoming a viable launch system NASA could move ahead with the station.[26]

~~(S//TK//NF)~~ The Space Station, the Shuttle, and Covert Reconnaissance

(U) NASA placed heavy reliance on a space station as its first increment in a near-earth architecture from which spacecraft could depart on lunar missions, or serve as a platform on which to construct large boosters for even longer journeys. That had been the plan virtually since NASA's inception, but Apollo's domination during the 1960s had delayed implementation. In the early 1970s, a time of financial retrenchment, Congress had refused to simultaneously fund the shuttle and a space station.

(U) Unfortunately for NASA, the early 1980s were also not a good time to propose big budget items. Money was tight, and had been for some time. The previous President, Jimmy Carter, had forbidden any new space program startups during his last year in office. The Reagan Administration vetoed a mission to Halley's Comet, cancelled another space science program, and, led by David Stockman, the Director of the Office of Management and Budget (OMB), cut NASA's FY 1982 budget by some $600 million.

‡ (U) In 1982, NASA changed shuttle numbering, making it more correct to refer to STS-6 as mission 31-B. Although the new numbering system remained in effect until 1988, the STS designations will be used in the manuscript text in the interest of simplicity and consistency.

The cut forced Beggs, before he got some funds restored for FY 1983, to consider sacrificing NASA's entire solar system exploration program to protect the shuttle and other space science endeavors.[27]

~~(S//NF)~~ Justifying a space station in such an environment would be difficult at best. Nevertheless, NASA moved ahead, attacking the problem in two ways: gaining the support of other government agencies and building a rational to sway Reagan. Either way, supporting national security was a powerful argument, so NASA's attention naturally turned to the Intelligence Community, DOD, and the NRO.

~~(S//NF)~~ NASA's attempt at gaining NRO support began during the second half of 1981. The initial NRO reaction was irritation. NASA seemed intent on a Space Station because it was technically feasible, not in response to legitimate scientific or national requirements. That unfortunate priority made it appear as if NASA was forging ahead with only limited input from DOD in general and the NRO in particular. If that continued, DOD and NRO requirements would not influence the station's design, but flow from that design. Only significant DOD and NRO involvement in planning could change that.[28]

~~(S//NF)~~ It was not as if a space station offered no benefit to the NRO, as a quick survey showed. A station in low-earth orbit could serve as a staging base to assemble collectors, conduct on-orbit checkouts and repairs, replenish consumables, and retrieve satellites. Unfortunately, those potential benefits did not help a station's case because the shuttle could satisfy every one of them far less expensively. Whereas individual shuttles could achieve the necessary inclination and altitude to assemble, launch, or recover satellites, a space station once launched has a single, fixed orbit where it would remain until deorbited. To service a significant number of satellites required two stations, one at low inclination, and the other at a much higher inclination. Given the expense, a second station was not even a remote possibility.[29]

~~(S//NF)~~ In May 1982, an internal NRO working group examined a station's other potential application—serving as a platform for covert collection payloads. The group's findings, based on two related documents, were not favorable. There was no overriding NRO requirement for a space station, and the NRO should not be placed in the position of justifying one. For security reasons, the NRO did not want a joint use station, especially one that included foreign participation. If at some point, the NRO needed a space station, it could construct its own using NASA's design, but that option lay many years in the future if at all.[30]

~~(S//NF)~~ Not to be outdone, NASA, in July 1982, contracted with civilian firms for studies of a station's potential benefits to science, commercial interests, and national security. DOD contributed $300,000 in funds and participated in the national security portion so as to exert influence in that area. The study's conclusions, delivered in November, were not found during research, but may have admonished NASA to be more receptive to the needs of potential customers. Whatever the reason, NASA thereafter assured everyone that the station's design had not begun, and that those offices weighing participation need not observe any constraints on their needs for system architecture or orbital geometry.[31]

~~(S//NF)~~ In December 1982, RADM E. A. Buckhalter, Jr., Director of the Intelligence Community Staff, apparently dissatisfied with earlier studies, took an additional step. He ordered each community member to assay the potential benefits a space station from a purely intelligence perspective. The study should concentrate on a station's unique capabilities and how those capabilities might be put to use. He asked the NRO, as the operator of spaceborne collectors, for its views.

~~(S//NF)~~ The responses, submitted the following March, did not change anything. Aldridge, speaking for the NRO, advised that advances in robotics had made a human presence unnecessary, and the station's potential to carry covert collection systems did not justify its immediate development. He left the door ajar by adding that should a space station win endorsement, the NRO would evaluate its use on a continuing basis.[32] The overall DOD position, as stated by the Under Secretary of Defense for Policy, Richard G. Stilwell, amounted to the same thing:

> THE STUDY CONCLUDED THAT AT THIS TIME THERE ARE NO CURRENTLY IDENTIFIABLE MISSION REQUIREMENTS WHICH COULD BE UNIQUELY SATISFIED BY A MANNED SPACE STATION. FURTHER, NO CURRENT REQUIREMENTS WERE FOUND WHERE A MANNED SPACE STATION WOULD PROVIDE A SIGNIFICANT IMPROVEMENT OVER ALTERNATIVE METHODS OF PERFORMING THE GIVEN TASK. OVER TIME, HOWEVER, THIS SITUATION MAY CHANGE.[33]

~~(S//NF)~~ Other responses were similar. The SIGINT Overhead Reconnaissance Subcommittee polled all the military services and several civilian government agencies in formulating its reply. No SIGINT requirements necessitated a space station. The shuttle could serve as a collection platform if a human presence became necessary. The Committee on Overhead Imaging Requirements and Exploitation could not identify any imaging requirements needing on-the-spot human judgment. Unmanned systems were adequate, but, echoing Aldridge and Stilwell, that conclusion would be reviewed in future years should a station gain approval. No one found a station's potential to assemble, service, and retrieve spacecraft to be persuasive.[34]

(U) All this work paid off in April 1983 when the National Security Council, at Presidential direction, issued National Security Study Directive Number 5-83, tasking ten governmental entities[§] to recommend how to proceed with a space station. Those tasked had three options:

1. FUND DEVELOPMENT WITH AN INITIAL INCREMENT OF $7.5 TO $9.0 BILLION.
2. UNDERTAKE A SLOWER DEVELOPMENT BASED ON EXPERIENCE GAINED FROM THE SHUTTLE.
3. DEFER ANY ACTION DUE TO UNCERTAINTIES OF COST, TECHNICAL RISK, AND REQUIREMENTS SATISFACTION.[35]

~~(S//NF)~~ All tasked agencies submitted position papers in August. Not surprisingly, NASA favored option one, but only the Arms Control and Disarmament Agency made the same choice. In contrast, six recommended option three. The available archival evidence on the other two opinions is contradictory. Defense Secretary Weinberger opted for option three due to the technical risk, but he also wanted to keep the focus on improving the shuttle now that DOD had committed to it as its launch vehicle. Acting Director of Central Intelligence (DCI) John McMahon made the same choice due to technical uncertainties, anticipated cost, and also wanting emphasis on the shuttle. In selecting option three, Stockman, notoriously tight-fisted with the national purse, flatly stated that the nation's present financial situation could not support a program of such magnitude. The National Academy of Sciences then delivered a devastating blow by stating that there were no scientific requirements for a space station either now or during the next twenty years. Small wonder that Beggs and Mark found nothing to be optimistic about in either the responses or their talks with high ranking officials.[36]

(U) That left swaying Reagan as the only avenue open to NASA. Beggs and Mark relentlessly lobbied for a space station based on the long-term economic advantages it would provide (i.e., jobs) and its role in maintaining American primacy in space. The argument was well tailored for a President dealing

§ (U) Those tasked were the Departments of State, Defense, and Commerce, NASA, DOD, the Intelligence Community, OMB, Arms Control and Disarmament Agency, Office of Science and Technology Policy, and the Office of the Vice President.

with an economy just emerging from a recession and who believed that America's proper role was as the world leader in virtually every sphere.

(U) It was probably during the last half of 1983 that Beggs detected the first faint outlines of hope. He had held several meetings with Reagan during the year in which they discussed the space station at length. The President, Beggs recalls, was not technically illiterate, but he was not well versed in science and technology. He was, however, intrigued by the very idea of such a grand project, its potential benefits to science, and the nation's ability to turn it into reality. Regardless of what others thought, the NASA Administrator believed that the President was coming over to NASA's side.[37]

(U) Beggs had it right. Reagan had an optimistic, almost non-judgmental, belief in America's supremacy and a grand project like a space station fit that mindset perfectly. He approved development on 24 January 1984. He announced his decision the following day during his State of the Union address with appeals to nationalism, the brotherhood of man, and the adventurous spirit harbored by all:

> AMERICANS HAVE ALWAYS BEEN GREATEST WHEN WE DARED TO BE GREAT. WE CAN REACH FOR GREATNESS AGAIN. WE CAN FOLLOW OUR DREAMS TO DISTANT STARS, LIVING AND WORKING IN SPACE FOR PEACEFUL, ECONOMIC, AND SCIENTIFIC GAIN. TONIGHT I AM DIRECTING NASA TO DEVELOP A PERMANENTLY MANNED SPACE STATION AND TO DO IT WITHIN A DECADE . . . WE WANT OUR FRIENDS TO HELP US MEET THIS CHALLENGE AND SHARE IN THE BENEFITS. NASA WILL INVITE OTHER COUNTRIES TO PARTICIPATE, SO WE CAN STRENGTHEN PEACE, BUILD PROSPERITY AND EXPAND FREEDOM FOR ALL WHO SHARE OUR GOALS.[38]

~~(S//NF)~~ The invitation extended to other nations ended whatever chances remained for an NRO payload, but that should not distract from NASA's overall achievement. In the face of entrenched and powerful opposition NASA had gained approval for a space platform destined to weigh a million pounds, cost billions, and dominate NASA for over a quarter century. The feat stands in tribute to a willingness to confront seemingly insurmountable odds and having faith in one's own programs and missions.[39]

~~(S//TK//NF)~~ Both Weinberger and McMahon had mentioned keeping the emphasis on the shuttle in their August 1983 position papers. That doubtlessly included better reliability and refined launch techniques, but there was another consideration. [redacted] (b)(1) (b)(3)

~~(S//TK//NF)~~ The idea was not new, having first been proposed some years earlier to remedy a projected collection shortfall. The Intelligence Community faced retirement of its last two film-based photographic reconnaissance satellites, Hexagon and Gambit, by the mid-1980s. [redacted] (b)(1) (b)(3) but the imagery's 240-foot resolution did not provide sufficient detail. The Intelligence Community needed something better.

~~(S//NF)~~ The NRO's hunt for something better began in 1978 with HASP (probably meaning either Hexagon Area Search Pallet or High Altitude Search Pallet) and WASP (Wide Area Search Pallet). HASP would employ existing Hexagon optics; WASP proposed a new optical system based on Hexagon technology. In both cases, the NRO would mount the systems on pallets and manifest them as classified cargo aboard selected shuttle missions. The shuttles, once in orbit, would open their payload bay doors and roll inverted, [redacted] At mission's end, shuttles would return

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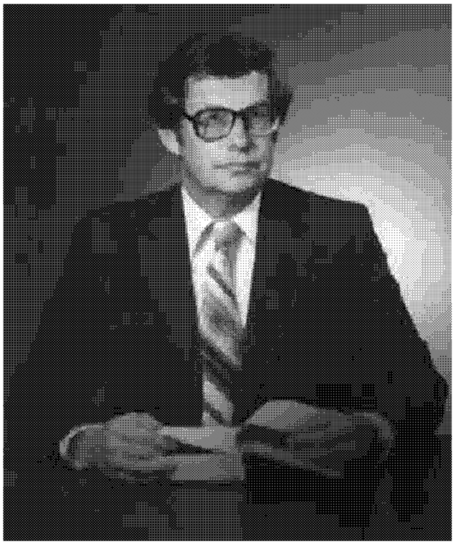

Figure 9-4. (U) NRO Director Dr. Robert J. Hermann. (Image: UNCLASSIFIED)

payloads and exposed film to earth. HASP/WASP, funded at $10 million during FY 1979, were NRO Program A (Air Force) endeavors, as was Hexagon.[40]

~~(S//NF)~~ The terms HASP and WASP appeared in only two documents, both dated December 1978, after which the former became Project Pathfinder and the latter, Project Zeus. Pathfinder would fly twice, a three to seven-day mission in 1981 and a fourteen-day mission in 1983, as an experimental payload to resolve management issues, test electrical interfaces with the shuttle, and identify tradeoffs. It would be the first NRO payload aboard the shuttle if brought to fruition on schedule. Zeus, an operational program, would follow in Pathfinder's wake. In a February 1979 congressional testimony, Hans Mark, then NRO Director, predicted that Zeus would be ready to fly three missions annually beginning in 1984.[41]

~~(S//NF)~~ The first bump in the road came two months later, when Mark testified before the House and Senate Select Committees on Intelligence concerning the FY 1980 budget. He and DCI Stansfield Turner supported Pathfinder/Zeus, but their coordinated statement, read by Mark, was not well received. If money became a problem, they were willing to [redacted] to save Pathfinder/Zeus. Both committees rejected the idea in no uncertain terms. Moreover, the Senate committee had reservations about Zeus, which despite its reliance on proven Hexagon technology was still projected to cost $500 million over six years. That made it an unattractive option. The Senate committee also wondered why the NRO planned to begin contract acquisition for Zeus even before Pathfinder made its first flight.[42]

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~~(S//NF)~~ Although the FY 1980 budget contained funds for Pathfinder, probably on the order of [redacted] part of the money apparently came from cuts made in Zeus. The funds allowed the NRO to open the Pathfinder contract acquisition competition late in 1979 [redacted] as the major subcontractor, but that was the high water mark for both Pathfinder and Zeus.[43]

~~(S//NF)~~ Robert Hermann, the new NRO director, folded Pathfinder and Zeus into a single entity, Project Damon, in January 1980. Damon was really Pathfinder with launches set for [redacted]

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[redacted] No Zeus follow-on graced the planning, only studies of such a possibility. Any decision about a follow-on probably rested heavily on how well Damon performed. Then, even that possibility vanished. Mark had seen it coming as early as August 1979—Damon did not enjoy widespread Congressional support, which made it vulnerable to funding cuts. That came to pass a year later when Congress refused to adequately fund Damon for FY 1981, killing what seemed to be a program needed to fulfill a valid Intelligence Community requirement.[44]

~~(S//NF)~~ As Damon struggled through its short, tenuous life, the NRO Program A Director, Brig. Gen. John Kulpa, circulated a questionnaire asking recipients to brainstorm other collection systems suitable [redacted] (b)(1) (b)(3) one possibility, [redacted] apparently received further consideration.

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(U) [redacted] demise left NASA to sponsor the first reconnaissance-like systems to fly on the shuttle. When *Columbia* lifted off on STS-2 in November 1981 it carried nine non-deployable payloads with a combined weight of almost 19,000 pounds. The Shuttle Imaging Radar-A (SIR-A), an unclassified synthetic aperture radar derived from NASA's earlier Seasat program, numbered among the payloads. The DOD-NASA coordinating structure had readily approved SIR-A, whose projected 133-foot resolution posed no problems.

(U) Once in orbit, the crew rolled *Columbia* onto its back, opened the cargo bay door, and began operations. SIR-A covered a 30-mile wide swath while operating at 1.275 GHz (L-band). It transmitted and received within a narrow 6 MHz bandwidth. Exploitation of the acquired imagery provided radar signatures of terrestrial features as well as information of value in mapping and geological surveys. NASA made SIR-A data available to the public and promised two improved radar imagers, SIR-B by 1984, and SIR-C at some later date.[47]

~~(S//NF)~~ In early 1982, and possibly in reaction to SIR-A's success, the Intelligence Community Staff and the CIA sponsored one more round of studies relative to covert shuttle payloads. This time, the objective was to supplement existing collectors. Participants included former NRO Deputy Director Charles Cook and former NASA Chief Scientist Milton Silveria.

[redacted] The only recommendation found in conjunction with these studies, that the NRO establish a project office to work with NASA on using

(b)(1)
(b)(3)

Figure 9-5. (U) Large Format Camera. (Image: UNCLASSIFIED)

the shuttle as a collection platform, was hardly revolutionary. Moreover, there is no evidence that the recommended office ever became a reality.[48]

(U) In the wake of the Intelligence Community's indecision about, or perhaps lack of real interest in, the shuttle, NASA followed up with two other unclassified reconnaissance-like payloads. One was the promised SIR-B. Although advertised as an upgraded version of SIR-A, the only obvious improvements were a 12 MHz bandwidth and a steerable, as opposed to a fixed, antenna. The other was an optical imager, the Large Format Camera (LFC) to assist in NASA's mapping mission. Neither system violated limits placed on NASA sensors, but there were still problems.[49]

~~(S//NF)~~ The LFC's pedigree was one such problem. NASA's press releases hailed the camera as a new instrument to provide worldwide cartographic and geologic data. The potential contributions were valid statements, but the LFC was an obsolescent variant of the Hexagon mapping camera, not a new instrument. As such, it had required BYEMAN-level security to protect the technological transfer and obscure its past association with the NRO. The NRO assigned responsibility for implementing that security plan to Itek, the camera's manufacturer. At NASA's request, Itek agreed to help with exposure settings and the Air Weather Service promised forecasts of cloud cover. Because NASA lacked requisite facilities, the NRO and the Defense Intelligence Agency worked out security measures allowing them to process the LFC's film. If the system worked as expected it would generate about 2,400 frames per mission with a best resolution on the order of 40 feet.[50]

~~(S//NF)~~ Combined, SIR-B and the LFC were a political problem, at least for the NRO. The shuttle mission carrying the two payloads would have an orbit inclined sufficiently to overfly parts of the Sino-Soviet bloc. Should there be constraints placed on their use and the release of collected data? No one had as yet taken an in-depth look at those questions. In December 1982, Col. Donald Cromer, the NRO Staff Director, signed out a memorandum recommending that Admiral Buckhalter sponsor an Intelligence Community-wide evaluation.[51]

~~(S//NF)~~ The assessment, completed in September 1983, saw no reason to delay or cancel either payload. NASA had extensively publicized both, so any foreign reaction would likely be minor. Besides, France and Japan planned to soon launch photographic satellites with capabilities similar to the LFC. Still, NASA should determine Moscow's position and assess the possible effects of an unfavorable Soviet reaction on key allies.[52]

~~(S//NF)~~ A separate [redacted] analysis, also made at Buckhalter's request, proved less sanguine, particularly (b)(3)
about the LFC and its resolution. Protests by communist nations and their sympathizers were a given, which might require some limitations of photographing those areas. Moreover, nations outside the Sino-Soviet bloc who did not want LFC pictures of their soil made available to adversarial states might demand restrictions on dissemination, another factor worth considering when setting imaging guidelines.[53]

(U) Despite [redacted] more pessimistic analysis, there were apparently few, if any, restrictions when (b)(3)
Columbia, flying STS-13, carried both SIR-B and the LFC aloft in October 1984. Both systems operated over foreign soil with the LFC's coverage plan encompassing over twenty nations, the Soviet Union and China among them. The two systems performed as advertised, with the LFC returning over 2,200 images (60 percent cloud free) that under magnification clearly showed individual houses. NASA held all LFC imagery, which contained items of intelligence value, for a month before public release, and then only after gaining permission from the appropriate agencies. Plans called for both imagers to make at least one more shuttle ride, but the LFC never flew again.[54]

(U) The LFC's demise came about for several reasons, mostly related to money. NASA had expected commercial interests to pay for flying the camera, but the few companies that took an interest shied away when told of the $20 million per mission price tag. Likewise, LFC imagery had virtually no appeal to the private sector. The single firm that purchased imagery for resale, Martel Laboratories, lost $60 thousand on the venture. Finding adequate payload bay space to accommodate the camera was getting more difficult as the number of shuttle missions steadily declined over time. NASA canceled the LFC in late 1986 and placed the one unit in permanent storage.[55]

(U) The imaging radar fared better, though the next mission experienced a lengthy delay, possibly because what was now called SIR-C/X-SAR represented a technological leap. The new radar used the same antenna to transmit in L, C, and X bands. Shuttle crews could vary the coverage width from 10-55 miles, the resolution from 33-650 feet, and the bandwidth from 10-40 MHz. More importantly, SIR-C/X-SAR, an international effort among NASA and its German and Italian counterparts, heralded space radar as a long-term part of NASA's earth observation program. In April 1994, *Endeavor*, flying STS-59 carried the 23,000-pound SIR-C/X-SAR into space.[56]

* * * * *

~~(S//NF)~~ Other than perhaps the Damon imaging system's brief life, installing covert collection payloads on the space station or the shuttle was never a serious possibility. Robotics had reached a level of sophistication where collection vehicles of any type needed only ground controllers to carry out their missions. Factoring in the added expense of protecting crews against a lethal environment made any other human involvement both superfluous and undesirable.

(U) That made the reluctant, politically-driven DOD decision in 1983 to commit payloads to the shuttle the truly significant NASA-related event of the period. Having already broken with the "fly before buy" policy in 1978 that commitment was a logical next step. What was not logical was a commitment when the shuttle was still far from proving itself a reliable means of accessing space. That did not promise a bright future for DOD's involvement with that vehicle. In fact, an unequivocal DOD commitment did not endure beyond a few months, much to the displeasure of NASA Administrator Beggs. An acrimonious period in NASA-NRO relations lay just over the horizon as DOD reassessed its position vis-à-vis the shuttle and NASA resisted any attempt by DOD to lessen its commitment to that vehicle. That period will be discussed in the next chapter.

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(U) Chapter Ten

(U) Reconsidering the Shuttle, 1983-1985

(U) When NRO Director Edward C. Aldridge, in his overt role as Under Secretary of the Air Force, committed all DOD payloads to the Space Shuttle in April 1983, he did so with little enthusiasm. The same can be said about his parallel decision to terminate procurement of additional expendable launchers. Strong political support for the shuttle, not confidence in the vehicle itself, drove both decisions.

(U) DOD's commitment was only four months old when officials began questioning the wisdom of that decision. As noted several times in this narrative, DOD and the NRO had never been enthralled with the shuttle, whose development had been long and troubled. Everyone expected problems with such a revolutionary, technically-advanced system and to its credit NASA systematically solved them as they arose. Nevertheless, skepticism about the shuttle still smoldered.

(U) The initial DOD policy vis-à-vis the shuttle, established in 1972, was to withhold commitment until it proved itself ("fly before buy"). When in 1978, DOD and the NRO, acting under congressional orders, committed or partially committed a number of payloads, "fly before buy" fell by the wayside even though the shuttle was still over two years from its first flight. Now, five years later, came total commitment when the shuttle, though declared operational, was still a long way from proving itself. That made total commitment a risky move and hence an open invitation to trouble, something Aldridge recognized.

(U) DOD Takes a Step Back

(U) Aldridge attributes his renewed misgivings about total commitment to events that occurred in the summer of 1983. That is surely true, but perhaps a fairer statement would be that those events only added to the growing list of shuttle problems. The list spanned the whole of shuttle operations, beginning with the fleet's final size.

(U) In February 1983, President Ronald Reagan, citing a lack of demand for shuttle services, turned down NASA's request for a fifth orbiter. He did, however, authorize \$350-\$435 million over the next four years to procure long lead time components and maintain a partial production capability. He also kept open the option for a fifth orbiter should demand increase. NASA Administrator James Beggs understandably did not like the decision, which kept the fleet at the bare minimum needed to support launches from both coasts. Still, he decided not to request another orbiter until conditions met the President's criterion of greater demand.[1]

(U) Elsewhere, the operational date for the Vandenberg shuttle launch facilities had slipped to October 1985, but some wondered if that date, three years behind schedule, would hold. Only days before DOD fully committed to the shuttle in early April 1983, the Inertial Upper Stage (IUS), designed to raise payloads from where the shuttle deployed them to operational altitudes, suffered a major anomaly that grounded it for a year. NASA had originally forecast that shuttles would lift 40,000 pounds into high inclination orbits, but then lowered the estimate to 32,000 pounds. DOD officials placed the true figure at no more than 28,000 pounds even with solid rocket boosters reinforced with Kevlar filament to increase their power and liquid fueled engines operating at 109 percent of rated power. If true, that made launching heavier payloads iffy propositions.[2]

(U) The shuttle's 700-mile cross-range capability fell far short of the 1,100 miles needed if a serious anomaly made landing back at Vandenberg necessary after one circuit in a polar or very high inclination orbit. This did not augur well for launches from the West Coast. Instead of a two-week turn around between launches, 6,000 ground personnel, known as "the standing army," needed more than two months to return a shuttle to flight. The extended turnaround time and the four-orbiter fleet had forced NASA to lower the shuttle sortie rate to between twenty and twenty-four per annum, but Aldridge had no confidence in those figures. He placed the true figure at perhaps twelve per year, with a little luck.[3]

(U) Costs were another problem area. The 1977 understanding on the price for shuttle launches, based on NASA's grossly inflated launch rate of fifty-five sorties per annum, pledged DOD to pay $12.2 million (in Fiscal Year [FY] 1975 dollars) per flight. By 1983, the price stood at $16 million, would increase to almost $30 million in 1986, and, depending on the launch rate, likely top $50 million later in the decade. If the last named figure proved accurate, expendable launchers would be at least competitive in price or perhaps the better option.[4]

(U) There was also the uncomfortable reality that DOD had committed to a very thin resource. The loss of even a single shuttle would both reduce the launch capability by 25 percent and force cancellation of West Coast operations. Worse, a generic design flaw would ground the whole fleet. In that case, DOD would have to rely on Titan-34s, whose procurement had just been cancelled, as its heavy lift booster. If that reliance continued long enough, the Titan inventory might be exhausted before the shuttles returned to operation, leaving an unacceptable gap in the nation's access to space.[5]

(U) Deeper yet, the shuttle was an incredibly complex machine with 2.5 million individual parts that pushed the very cutting edge of technology, which created its own set problems. *Columbia* suffered sixty-one anomalies; some admittedly minor, during STS-1, more than one for every hour in orbit. On STS-2, *Columbia* landed two days earlier than planned due to major problems with a liquid fuel cell. Further setbacks were inevitable and the much reduced flight schedule, if continued over the long term, would probably never permit completely routine operations. Former NASA Administrator Robert Frosch summed it up nicely in an interview with this author:

> My estimate was that if we built five or six shuttles and then flew the entire, extended total missions for twelve years, by the last flight they would have as many take offs and landings as [a] Boeing [aircraft] does before its first commercial flight with passengers. I figured that this is really an R&D [research and development] program, not an operations program. If we learn enough, we can turn it into an operations program.[6]

In other words, the shuttle would probably never have become a reliable launch vehicle.

(U) In late July 1983, Beggs detected a new upwelling of questions directed at DOD's sole dependence on the shuttle, as well he should have. Aldridge had come to believe that the inventory of negative considerations required that he act and act quickly. In his overt role as Under Secretary of the Air Force, and with support from Secretary of Defense Casper Weinberger, he ordered a fresh look at expendable

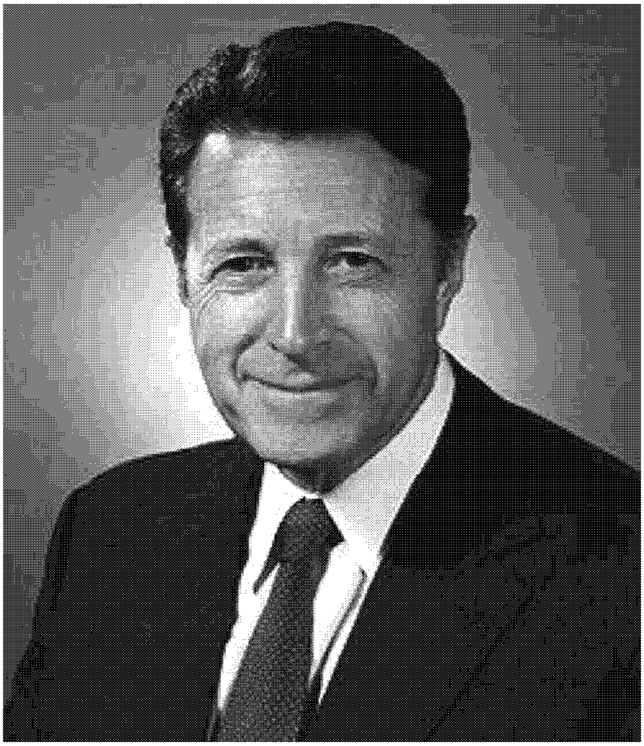

Figure 10-1. (U) Secretary of Defense Casper Weinberger.
(Image: UNCLASSIFIED)

launchers. In retrospect, Aldridge's initiative, although minor, marked the beginning of DOD's and the NRO's eventual abandonment of the shuttle, although nobody recognized that at the time.[7]

(U) By October, Aldridge had persuaded Congress to earmark $1 million in DOD's FY 1984 budget to solicit proposals for a new heavy-lift expendable launcher and $3-$5 million in FY 1985 (subsequently increased to $10 million) to begin procurement. The goal was to buy two boosters per year, probably improved Atlases or Titans, for five years. The first of the new boosters would be ready in 1988 or 1989, very near the projected time when the extant Titan-34 inventory would be depleted.[8]

~~(S//TK//NF)~~ In December, Aldridge, acting as NRO Director, made a significant decision regarding [redacted] (b)(1) (b)(3) Aldridge attributed the changes to saving money, which may well have been true, but he also had to ensure that the nation's premier [redacted] (b)(1) (b)(3) did not have its schedule disrupted by an unreliable Space Shuttle.[9]

~~(S//NF)~~ During that same month, Aldridge received support for his actions from an unexpected source, the President's Foreign Intelligence Advisory Board (PFIAB), chaired by Ambassador Anne Armstrong. The PFIAB, a civilian group that convened at intervals to address intelligence matters as directed by the President, on this occasion evaluated the NRO. PFIAB members examined a variety of issues ranging from diversions from the primary reconnaissance mission to cost control to external connections, such as with NASA. Armstrong signed the board's report on 23 December.

~~(S//NF)~~ The PFIAB concluded that the NRO was well managed, needing only a tune-up, not an overhaul. Relations with NASA that involved the shuttle were definitely in need of a tune-up. Board members found that:

> In the near future, the NRO will become totally dependent on the NASA Space Shuttle for its launchings. Connections between NASA and the NRO are difficult in part because the Administrator of NASA has no formal support responsibilities to the Director of Central Intelligence (DCI) or the Secretary of Defense (SecDef), yet he controls important assets that are now vital to the NRO mission.[10]

~~(S//NF)~~ Pressing further, the board questioned the shuttle's ability to adequately support missions vital to national security. When all costs were tallied:

> An enormous burden will fall on the NRO budget . . . . When that happens, a difficult choice will have to be made between flying substantially fewer missions and or increasing the NRO budget significantly. The alternative is to reverse that policy and continue to provide expendable launch vehicles for the NRO and other DOD satellites.

In purely operational terms:

> . . . exclusive dependence on the shuttle runs unacceptable risks. Prolonged grounding of the shuttle fleet in the wake of a possible accident, an anomaly, or terrorist attack could interrupt the timely flow of NRO satellites into space. The inability to launch a satellite could have drastic national security consequences.[11]

In other words, committing all DOD payloads to the shuttle had been a serious mistake.

~~(S//NF)~~ The PFIAB made eight recommendations overall, two of which were germane to this narrative:

1. As a matter of urgency, maintain an inventory of expendable launchers to complement the shuttle and serve as alternatives when economically advantageous.
2. Emphasize in writing that supporting the NRO should be NASA's highest priority.

On 11 January 1984, Armstrong and selected board members discussed their report with the President, after which copies went to Weinberger and Director of Central Intelligence (DCI) William J. Casey for comment.[12]

~~(S//NF)~~ The two men had no problem with the first recommendation since the purchase of additional conventional boosters was already getting underway. The second recommendation got a much different reception, however. Neither the Defense Secretary nor the DCI wanted changes in NASA-NRO relations, particularly ones that meant closer involvement or interdependency. The National Aeronautics and Space Act of 1958 created NASA to manage the nation's civil space program and that, not supporting the NRO, should remain its focus. The NRO should maintain appropriate interfaces with other agencies, but be largely self-sufficient and certainly not overly reliant on anyone. If NASA wished to be helpful, it should elevate shuttle development to its highest priority. Weinberger and Casey also criticized NASA's structure and mission as not conducive to keeping secrets, a charge often levied over the years by those in the classified world. Their position echoed a statement, noted earlier in this narrative, that the fundamental problem in NASA-NRO interaction was the peacetime mission of one and the national security mission of the other.[13]

(U) His dislike for the PFIAB's second recommendation aside, Weinberger could only have been pleased by the call for more expendable launchers. On 23 January 1984, he made Aldridge's plans official DOD policy. He reaffirmed DOD's commitment to the shuttle, but present conditions required purchasing what he called "Commercial Expendable Launch Vehicles." He later changed "Commercial" to "Complementary" to reassure NASA that the new launchers were to be supplements to and not rivals of the shuttle.

(U) In March, DOD solicited proposals from civilian firms that might wish to compete for the acquisition contract. The basic specifications called for lifting 40,000 pounds into low-earth orbit or 10,000 pounds into geosynchronous orbit from the Kennedy Space Center. DOD planned to remove two payloads per year from the shuttle and place them on the new launchers. The initiative had the support of the military, the Intelligence Community, and the White House.[14]

(U) One place where purchasing additional boosters had no support whatsoever was at NASA. Beggs saw this as the first step toward DOD buying ever more vehicles and eventually leaving the shuttle entirely. Deputy NASA Administrator Hans Mark probably influenced such thinking. Aldridge believed that Mark, who remains to this day a personal friend, possessed a suspicious nature and, more to the point, his previous tenures as NRO Director and Secretary of the Air Force had made him fully aware of DOD's true attitude toward that vehicle.[15]

(U) Beggs met with Air Force Secretary Verne Orr, who represented DOD, in mid-April to iron out disagreements about the new launchers. The meeting seemed to go well because Orr came away believing that NASA understood and concurred with their purchase, at least in general. He then sent the NASA Administrator a letter summarizing their discussion.[16]

(U) It was strange that Orr thought they had reached any sort of understanding on expendable launchers. Beggs still believed that DOD, despite reassurances, was planning to leave the shuttle. During an oral interview, Beggs assured this author that he did not question Orr's integrity, but his background had not made him well qualified for the secretary's position, making him susceptible to manipulation by the Air Force staff. Whatever the reason, NASA could not afford to lose DOD's business. That would take away as many as one-third of the missions over the next decade, further drive up costs, and discourage civilian interests from using the shuttle. The reduced demand also meant no fifth orbiter and would erase the by now gossamer thin possibility that the shuttle might become economically viable. Beggs set out to both challenge, virtually point-by-point, any DOD move to abandon the shuttle and to insert NASA in the expendable launcher acquisition process.[17]

(U) The budding confrontation ushered in the most hostile period in NASA-NRO-DOD relations to that time. The period showed two sides of Beggs. At his best, he was a tenacious bureaucratic infighter determined to protect NASA's programs and interests, which he did with great skill. On the other hand, he was difficult to do business with and occasionally used intemperate language in his correspondence that offended some recipients. Beggs, a former defense contractor, to this day makes no apology for either the way he conducted himself or his choice of words. He believed, and still believes, that good business practices made it incumbent on him to let everyone know exactly where he stood on issues. On 18 May 1984, he sent somewhat differently worded letters to Weinberger and Orr to, in his own words, shock them into action. The letters were the opening broadside in what Aldridge humorously called a "friendly debate" over expendable launchers and, more accurately, the "bureaucratic space war."[18]

(U) The Bureaucratic Space War Gets Underway

~~(S//NF)~~ Beggs was confrontational in those letters. He protested in the strongest possible terms what he regarded as DOD intent to replace the shuttle as the prime launcher for national security payloads. Expendable launchers were, in his opinion, neither the most cost efficient nor effective way of assuring access to space. Access for national security purposes could be realized by orbiting payloads in excess of requirements, presumably aboard the shuttle, and leaving them in storage (i.e., dormant) until needed. The shuttle, he continued, remained the best choice, particularly after 1988 when, despite predictions of fees in excess of $50 million, he believed the cost-per-launch would be reasonable. If, however, DOD was determined to buy additional expendable launchers, they should be based on the shuttle's more advanced technology, not, as expected, on the Titan or Atlas. In a veiled reference, he accused Aldridge of reneging on his word by switching some [redacted] to expendable boosters.[19]

(b)(1)
(b)(3)

(U) Weinberger found Beggs' letter disturbing, but unconvincing. In all likelihood Orr, whose letter was even more unpleasant, felt much the same way. Weinberger asked the Air Force secretary to dispatch a "firm reply" on behalf of DOD. Orr's response, drafted by Deputy NRO Director Jimmie Hill, was nothing more than a forthright restatement of DOD's position. He expressed concern over any misunderstanding, reiterated DOD's commitment to the shuttle, and stated that expendable launchers would be used only as needed. That said, however, the decision to purchase additional launchers stood. DCI Casey later added his support to that position.[20]

(U) Beggs then followed up on his plan to insert NASA into the expendable launcher competition. If DOD wanted additional expendable launchers he would submit the SRB-X, designed by NASA engineers and based on the shuttle, for consideration. If it won the competition, NASA would then contract with civilian industry for its fabrication. Although Beggs did not mention it, an SRB-X triumph would give NASA domination of the entire launch process, just as relying only on the shuttle would do, and increase the production of shuttle-compatible parts, thereby reducing that program's costs.[21]

(U) Martin-Marietta, General Dynamics, and NASA submitted proposals by the 30 May deadline, but by then there was a serious problem. Eugene Sullivan, the Air Force General Counsel had already informed Aldridge that existing source selection statutes prohibited government agencies from competing directly with private industry for any contract. DOD could not even accept a proposal from NASA; much less enter it into the competition.[22]

(U) Aldridge accepted the General Counsel's ruling, but Beggs did not. At some point in late May or early June he drafted a bluntly-worded letter to Orr restating his case. Focusing only on Titans and Atlases as expendable launchers was too narrow of an approach. He believed NASA's SRB-X had much to offer and should be considered. He then upped the stakes by warning that excluding the SRB-X meant that he could not in good conscience support DOD's efforts to get the $1.5-$2 billion needed to purchase the new boosters.[23]

(U) Beggs never sent the letter, which was just as well given its tone, because he had been lobbying Congress for support and that approach bore fruit. In early June, eight prominent Congressmen, mostly associated with appropriations, advised Weinberger that the original solicitation had unfairly excluded NASA. It should be rewritten to allow a shuttle-derived vehicle to compete on an equal basis.[24]

(U) Thus directed, Aldridge, or at least his legal staff, came up with a compromise. The original solicitation was modified, as Congress wished, to permit NASA participation, though not in direct competition with civilian industry. A source selection committee would first judge the civilian proposals and select a winner. NASA's entry would remain sealed until February 1985, when it would be judged against the civilian winner as a "government sponsored alternative." The arrangement, though seemingly an exercise in legal gymnastics, satisfied the law, Congress, and Beggs. How Weinberger and Aldridge felt was not recorded.[25]

(U) In late 1984, an Air Force Systems Command selection board, acting on behalf of DOD, convened to evaluate the civilian proposals. The field was thinner than expected. Beggs and NASA had been working with Boeing and Thiokol to develop their own proposals based on the SRB-X or something similar, but the efforts foundered. NASA itself submitted the SRB-X proposal, which the board set aside to await later evaluation against the civilian winner. Two firms, General Dynamics and Martin-Marietta, remained in the civilian competition.[26]

(U) General Dynamics, as expected, offered a considerably scaled up version of its Atlas, consisting of four liquid fuel boosters, four strap-on solid fuel boosters, and a liquid fueled sustainer engine. Martin-Marietta, also as expected, proposed its Titan-34D, upgraded with larger solid rocket boosters, larger internal tanks to support longer burn times by the main stage liquid fueled engines, and a Centaur upper stage. Both the entries featured fairings enlarged to 16.5 feet in diameter, more than a foot greater than that of the shuttle's payload bay, and thus capable of carrying the largest DOD payloads. On 23 December, the acquisition contract, valued at just over $2.0 billion, went to Martin-Marietta for what became the Titan-IV. The next step was pitting the Titan-IV against the SRB-X in February.[27]

(U) A Notable Success

(b)(1)
(b)(3)

~~(S//TK//NF)~~ Martin-Marietta's victory in the civilian competition came as NASA and the NRO were in the midst of final preparations to launch the first NRO payload, the [redacted] on the shuttle. The launch had been scheduled for 1983, but trouble had intervened. On 4 April 1983, *Challenger* lifted off from Kennedy carrying one non-deployable and one deployable payload. The deployable payload was the first increment of NASA's Tracking and Data Relay Satellite System (TDRSS), known as TDRSS-A, [redacted]

(b)(1)
(b)(3)

(U) *Challenger's* crew successfully deployed TDRSS-A along with the attached IUS meant to propel the satellite to geosynchronous altitude. The 22,000 pound IUS ignited as planned, but shortly thereafter things went awry when a broken seal caused the exhaust nozzle to slew off-axis. The anomaly left it and TDRSS-A locked together and tumbling end-over-end in a 16,000 x 25,000 mile elliptical orbit.[28]

(U) Recovering the satellite rested with a team led by Ronald K. Browning, the TDRSS program manager, and George Harris, flight director at the TDRSS ground station at Las Cruses, New Mexico. The team jettisoned the IUS, stabilized TDRSS-A, and then set about correcting the orbit. That meant using one-pound maneuvering thrusters hardly bigger than a thimble to lift the 5,000 pound satellite's perigee some 9,000 miles. It took thirty-nine burns, called "micro-farts," totaling forty-four hours spread over two months, to raise the perigee to geosynchronous altitude, circularize the orbit, and ease the satellite into position off the east coast of Brazil. TDRSS-A's troubles were not yet over, however. During the next twenty months it suffered a number of system anomalies, perhaps the result of damage done by the IUS malfunction, leaving it only partially capable of executing its mission.[29]

* ~~(S//NF)~~ Known as [redacted] at the time.

(b)(1)
(b)(3)

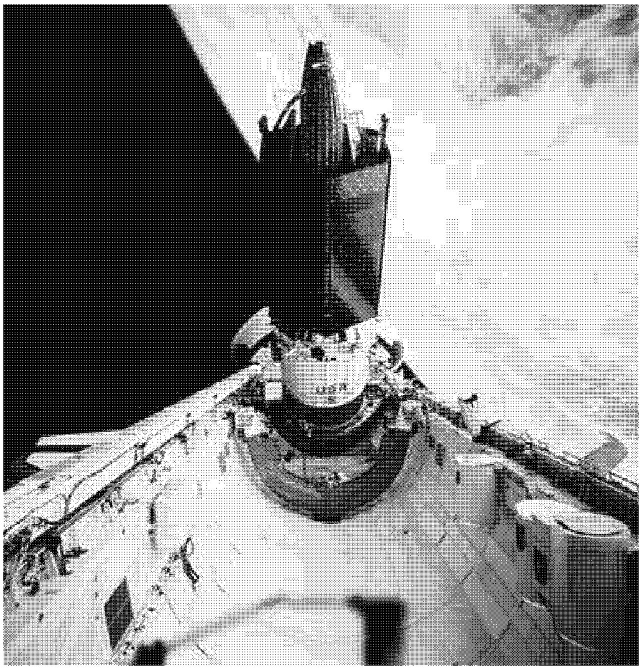

Figure 10-2. (U) TDRSS atop its IUS prior to ejection from the orbiter's bay. (Image: UNCLASSIFIED)

(b)(1)
(b)(3)

~~(S//TK//NF)~~ Salvaging TDRSS-A spoke well of the NASA personnel involved, but not of the IUS, whose troubled development by the Air Force had already left it two years behind schedule. This latest incident prompted the Air Force to ground the IUS and undertake a $144 million modification program. One of the grounding's immediate effects was to delay [redacted] (b)(1) (b)(3) something that Aldridge pointed out to Beggs.[30]

~~(S//TK//NF)~~ Unspecified problems further delayed the timetable, but the countdown clock finally reached zero at 2:50 PM EST, 24 January 1985, and *Discovery,* flying its second mission, roared aloft on STS-15. [redacted] (b)(1) (b)(3)

[redacted] (b)(1)

[redacted] (b)(1) (b)(3)

~~(S//NF)~~ The review, probably carried out by NRO Program A (Air Force) in conjunction with NASA, took about two months. The review found nothing fundamentally wrong with the umbrella policy, only a need to strengthen it. [redacted] Further, NASA must refer all inquiries to DOD, but DOD need respond only to (b)(1) written requests, and no one should comment on information gained by the media from other sources. Finally, Defense Secretary Weinberger should state his strong support for increased security in a "buck up" message to those involved in classified launches.[35] Appendix 25 contains the security review.

[redacted]

(b)(1)
(b)(3)

(U) The Bureaucratic Space War: Crisis and Resolution

(U) In the meantime, the dispute over expendable launchers, tempered the previous summer when NASA got permission to enter its SRB-X in the competition, returned to the front burner. The reheating probably began in September 1984 when Aldridge announced plans to use decommissioned Titan-II intercontinental ballistic missiles to launch smaller payloads. To Beggs, this was further evidence that DOD intended to leave the shuttle. NASA lobbied vigorously throughout the remainder of the year against any conventional boosters based on other than shuttle-derived technology.

(U) In early 1985, Beggs weighed in with two additional options. The government should cancel the upcoming Titan-SRB-X competition and adopt without competition another NASA design, the Shuttle Derived Vehicle-1 (SDV-1). Although he did not mention it, the SDV-1 offered the same advantages to NASA as did the SRB-X: domination of the nation's launch structure and reduction of shuttle costs through the increased production of compatible parts. If that was not agreeable, Beggs continued, put the entire expendable launcher issue on hold for one year while DOD and NASA made additional requirement studies.[37]

(U) Neither suggestion impressed Weinberger. Delaying the program for a year would adversely impact defense requirements without solving anything. It also meant losing the existing expendable launcher industrial base and limiting selection to a shuttle-derived vehicle, a reference to the SDV-1. The SDV-1, whose brief description in the documentation made it sound like an unmanned shuttle, was a credible design with almost twice the Titan's lifting power. It also promised to be more expensive than the Titan, take longer to develop, and, besides, there was no requirement for a booster that powerful. Even if the SDV-1 had been cheaper, easier to develop, and matched requirements, DOD would not have accepted it. It was simply too risky to rely entirely on the shuttle and the SDV-1 because they shared the same components, facilities, and industrial base. A major problem with one would almost certainly mean the same problem with the other. Prudence dictated avoiding that degree of commonality. And with that, the SDV-1 disappeared from the pages of history.[38]

(U) At about this point, probably in late January 1985, Beggs fell back into his redoubt—political hardball. The rejection of the SDV-1, Weinberger's refusal to delay the expendable launcher competition, and

† ~~(S//NF)~~ Known as [redacted] at the time.

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his perception that DOD still intended to abandon the shuttle meant that he could not support the Administration's national security launch strategy being prepared for presentation to Congress. Given NASA's considerable Congressional influence it was a threat not to be taken lightly. In fact, without a unified government position, Congress might delay the expendable launcher program by ordering the additional year of study, just as Beggs wanted. Worse, the entire program might be lost during the budgeting cycle.[39]

(U) Weinberger now realized that ending the dispute meant bringing in an adjudicator. He and DCI Casey asked National Security Advisor Robert McFarlane to assume that role. On 14 February, McFarlane met with Beggs, Aldridge, and possibly others, and in a surprisingly short time the two sides reached agreement. National Security Decision Directive (NSDD) 164, signed by Reagan on 25 February 1985, turned that agreement into policy.[40]

(U) NSDD 164 was a brief document, just over a page in length, but covered a lot of ground. Unlike many government documents, it's crisp, to-the-point prose made it easy to understand the main points by enumerating them without embellishments.

1. DOD will buy ten expendable launchers and launch them at a rate of two per year beginning in 1988.

2. A competitive decision between the Titan and the SRB-X will be made before 1 March.

3. DOD will use the shuttle as its primary launch vehicle by committing to at least one-third of its flights for the next decade.

4. DOD and NASA will jointly develop a pricing policy for DOD flights based on a fixed annual fee and a variable component that provides a positive incentive to use the shuttle.

5. The target rate is twenty-four shuttle launches annually.

6. DOD and NASA will jointly study the development of a second-generation space transportation system.

(U) NSDD 164 had something for everybody. DOD got its expendable launchers, though whether they would be Titan-IVs or SRB-Xs was yet to be decided, and the needed launch rate. NASA received yet another Presidential directive, as if one was needed, naming the shuttle as the nation's prime launch vehicle and a reaffirmation by DOD to use it. The mandated study of a follow-on shuttle suggested that the program or one similar had a future beyond the first four vehicles. Both sides came away satisfied; indeed, Beggs came away well satisfied.[41] Appendix 26 contains NSDD 164.

(U) A few days later, the selection board announced the results of the Titan-SRB-X competition. The SRB-X consisted of two shuttle solid rocket boosters with a third shuttle solid rocket booster between them. The central booster featured a Titan liquid-fueled second stage, a Centaur liquid-fueled third stage, and the payload faring atop everything. Oddly, given the availability of its major components, the SRB-X, like the SDV-1, required a long and costly developmental period. Odder still, it was a very poor design that, among other problems, made it uncontrollable in the early stages of flight. The Titan-IV was an easy winner. Aldridge, with evident pleasure, later called the competition a farce and an embarrassment to NASA's cadre of talented engineers. Beggs hinted at the same verdict when he lamented not having more aggressively pursued a civilian firm to do the design work rather than relying on internal NASA resources. For once, the NRO Director and the NASA Administrator agreed on something.[42]

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~~(S//TK//NF)~~ One outcome of events in 1983 and 1984 was a further delay in the NRO's transition schedule. [redacted] In 1987 there would be a pronounced trend toward transition, but conventional launchers were scheduled through 1991. That placed complete transition at least seven years behind that planned in 1980 and about four years behind that forecast in 1983 when DOD fully committed to the shuttle. Strangely, the schedule made no mention of the Titan-IV even though delivery was scheduled to begin in 1988. That may reflect plans to use up the Titan-34 inventory before switching to the newer booster. Table 10-1 summarizes the new NRO launch schedule.

(U) Three notable events marked the remainder of 1985. The first involved reconciliation, or at least an attempt at reconciliation. The battle over expendable launchers had been long and bitter, leaving behind bruised egos and resentment. Even twenty years later Aldridge has few kind words for Beggs and might find it uncomfortable to be in the same room with the former NASA Administrator. On the other hand, Beggs has a much different perspective. In an interview with this author, he professes

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to have liked Aldridge and being unaware of any animosity, though he questioned some of the NRO Director's management decisions.[43]

(U) Whatever the truth of their working relationship, Beggs chose to extend an olive branch. Policy at the time allowed a small number of outsiders to crew on shuttle missions if a case could be made that their presence sufficiently benefited national interests. As it turned out, "sufficiently benefited" was elastic enough for Beggs to offer a flight to a CIA analyst, but the Agency declined for unspecified reasons. Better luck came when Utah Senator Jacob Garn flew on STS-16 (April 1985) and Florida Representative William Nelson, originally assigned to STS-25, moved up to STS-24 (*Discovery*). Sharon Christa McAuliffe, a school teacher, would crew on STS-25 (*Challenger*). All three were manifested as payload specialists, but McAuliffe's true purpose was to conduct a spaceborne class to be televised into schoolrooms nationwide. None of the flights involved classified payloads, though STS-25's cargo included NASA's TDRSS-B relay satellite.[44]

(U) By happy coincidence, Aldridge had already made it clear that he wanted a shuttle mission to learn about spaceflight in ways that would improve his management practices. Beggs suspected that the NRO Director also wanted to satisfy a long-standing personal goal and in September 1985 offered him

Figure 10-1. (U) Publicity still, NRO Director Aldridge during shuttle crew training. (Image: UNCLASSIFIED)

the chance. Aldridge could crew as a payload specialist aboard a July 1986 mission, the first scheduled shuttle launch from Vandenberg. Again, no classified payload was involved. A thoroughly delighted Aldridge accepted and immediately began investigating ways to be useful after payload deployment. He eventually settled on night vision glasses to determine what was visible from space during periods of darkness. Delighted though Aldridge may have been, the offer obviously did not entirely overcome his poor opinion of Beggs making the reconciliation only partially successful.[45]

(U) The second event of note had to do with a new DOD payment schedule for shuttle services. Under the previous accord, signed in 1983, NASA charged a fixed price of $16 million, in FY 1975 dollars, per launch through FY 1985, escalating thereafter to $20.8 million, also in FY 1975 dollars. The agreement had not entirely satisfied either party. DOD had to provide a five year projection of its needs and give NASA a firm commitment nine months prior to launch, conditions difficult to satisfy with any consistency during normal times and totally incompatible with emergency requirements. From NASA's perspective, the charges fell short of satisfactory compensation for services rendered. The fixed cost of a shuttle flight was around $500 million. NASA had no means of recovering the fixed cost, but it needed to recoup a larger portion of the variable cost per launch, estimated by Beggs at $60 to $70 million.[46]

(U) The new accord, scheduled to take effect in FY 1989, had a compensation structure as directed by NSDD 164. DOD would pay a fixed fee of $270 million annually regardless of the number of launches, plus an additional $30 million per actual launch. DOD, the thinking went, having already expended $270 million, would then have greater incentive to use the shuttle to take advantage of the relatively small additional cost. The two payments combined would allow NASA to recover virtually all variable launch costs if DOD consigned eight or nine payloads per annum to the shuttle. Aldridge and the NASA Associate Administrator for Space Flight, Jesse W. Moore, signed the new pricing agreement in November 1985.[47] Appendix 27 contains that agreement.

(U) The last event of note came in December when the Justice Department indicted Beggs for fraud in connection with overbilling the government during his time as a defense contractor. Reagan, in an unusual gesture of confidence and loyalty, offered him the option of taking extended leave and returning after he answered the charges. The President's kindness moved Beggs, but he chose to resign. Clearing his name was going to take time and NASA needed a full-time administrator in the driver's seat. It took eighteen months, but Beggs did clear himself and even received a public apology from the Justice Department. Although his time at NASA was over, he maintains to this day an active interest in NASA and its programs.[48]

* * * * *

(U) DOD had been skeptical about the shuttle from the very beginning. Politics had driven both the 1978 payload commitment plan and total commitment five years later. Unfortunately, politics were poor criteria for making judgments more properly based on demonstrated performance and reliability. It probably surprised few that as the shuttle's problems—rising costs, reduced launch rate, less than expected performance, and limited number of orbiters—mounted, or at least became more apparent, DOD would rethink its commitment. The importance of maintaining assured access to space for national security payloads made that rethinking not only appropriate but vital. The same can be said for buying additional expendable launchers.

(U) The question hanging over the rethinking was whether DOD was merely taking prudent action to have a means of accessing space, as Weinberger and Aldridge contended, or secretly planning to abandon the shuttle, as Beggs believed. Assuring access to space is likely correct. Not one word in inter-DOD correspondence suggested otherwise and many references show continued planning to use the shuttle. Besides, Presidential directives locked everyone into using the shuttle at some poi (b)(1) (b)(3)

~~(S//TK//NF)~~ [redacted] but the tragic loss of *Challenger* in January 1986 would put everything on hold and usher in an unsettled period destined to bring DOD's uneasy relationship with the shuttle to a climax. [redacted] (b)(1) (b)(3)

(U) Chapter Eleven

~~(S//NF)~~ The Shuttle Issue Declines (1985-1988) While Landsat Rises (1980-1993)

~~(S//NF)~~ During the first half of the 1980s, the most significant issues involving the NRO and NASA numbered but two, the Space Shuttle and the Manned Space Station. The only NRO interaction with the space station was whether to mount covert reconnaissance payloads on it, a possibility briefly examined and quickly rejected. The NRO did promise to periodically review its decision as time passed, but that statement had more the feel of a balm to NASA's sensibilities than a realistic prospect.

~~(S//NF)~~ In contrast, the NRO's involvement with the shuttle grew following its first flight in 1981 and being declared operational the following year. The latter event placed DOD in a difficult position. National space policy obligated all governmental agencies to use the shuttle as their primary launch vehicle, but was it reliable enough for DOD to fully commit its payloads and do away with expendable launchers? DOD bowed to political reality by committing its payloads in April 1983 and cancelling further procurement of expendable launchers, but a growing list of shuttle problems led to a quick reversal. DOD's 1984 purchase of additional Titans boosters as backup launchers set off a testy exchange with NASA Administrator James Beggs, who wanted a full DOD commitment to the shuttle. NRO Director Edward C. Aldridge, acting in his overt role as Under Secretary of the Air Force, and Beggs arrived at a compromise in February 1985 that satisfied both sides, but not for long. Events would soon rule out compromises in favor of a final decision.

~~(S//NF)~~ The other NRO-NASA interaction of the 1980s and early 1990s concerned NASA's Landsat earth observation satellites. In 1973, NASA made its entry into space reconnaissance by volunteering Landsat to gather intelligence against staple food crops worldwide. The first three satellites carried out that collection, but the limited capability of their imaging systems constrained their contribution. By the early 1980s, however, Landsat's stock was on the rise.

~~(S//NF)~~ Sensors that promised much better resolution and more bands of multispectral imagery drove the upswing. The improved capability was enough to draw Landsat into a political controversy over whether to sell a ground terminal to the People's Republic of China. The questions surrounding the terminal were quickly resolved, but defining a larger role for Landsat in space reconnaissance proved difficult. What might have been a straightforward effort to better use a readily available collection asset ran into complex issues of cost-effectiveness, management responsibility, funding, and what Landsat had to offer. That said, Landsat was still a decidedly minor issue when compared to the Space Shuttle, the first subject dealt with in this chapter.

(U) A Difficult Period

~~(S//TK//NF)~~ A final decision by DOD vis-a-vis the shuttle took place during a difficult period for everyone involved in the nation's space program. Unbeknownst to all at the time that difficult period began on

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~~(S//TK//NF)~~ The next major setback, this one immediately recognized as such, took place five months later to the day. Twenty-eight January 1986 dawned sparkling clear and unusually cold at the Kennedy Space Center. At 11:38 AM EST, *Challenger*, flying STS-25, rode a column of flame and smoke skyward from launch pad 39-B. The second NASA Tracking and Data Relay Satellite System (TDRSS-B) rested in the orbiter's payload bay. TDRSS-B would join TDRSS-A, launched in 1983, in a geosynchronous constellation to support communications with future shuttle missions [redacted] (b)(1) (b)(3)

~~(S//TK//NF)~~ But it was not to be. Less than a second after liftoff, ground cameras recorded puffs of dense black smoke escaping from the aft field joint of the right solid rocket booster. About a minute later, a tongue of flame burst from the joint and quickly burned through the booster's aft support strut and breached the external liquid fuel tank. A rapid, almost explosive, burn of the released liquid oxygen and liquid hydrogen subjected the orbiter to aerodynamic forces far beyond its structural limits. *Challenger* shattered into numerous pieces and plunged into the Atlantic Ocean downrange. The seven crewmembers,[*] which included Sharon Christa McAuliffe, a teacher planning to conduct a spaceborne class for school children; Lt. Col. Ellison Onizuka, [redacted] (b)(1) (b)(3)

(U) Aldridge, then in New Mexico training as a shuttle payload specialist, watched the televised launch with the rest of his crew. A novice when it came to space flight, he half expected *Challenger* to soar out of the fireball and begin circling back for a landing. Only when he saw Robert L. Crippen, fellow crewmember and veteran of four previous shuttle flights, lower his head and stare at the floor did the full impact hit him. Silence endured until someone quietly remarked, "Well, I guess we had better go home (i.e., the Johnson Space Center [JSC] in Houston, Texas)." *Challenger* temporarily changed the rules allowing selected non-NASA personnel to serve as crewmembers and Aldridge never got the shuttle ride he so badly wanted.[4]

(U) Elsewhere, the reaction was immediate and profound. The disaster shocked the nation and plunged the shuttle program into crisis. NASA grounded the shuttle fleet until accident investigators pinpointed the cause and steps were taken to prevent a reoccurrence. On 3 February, only six days after the tragedy, President Ronald Reagan appointed a panel of distinguished aviators and astronauts, chaired by former Secretary of State William P. Rogers to carry out that investigation. The panel became known as the Rogers Commission.[5]

(U) The disaster happened at a time of high-level management changes at both the NRO and NASA. In March 1986, Reagan named Aldridge as Secretary of the Air Force, but permitted him to keep the NRO directorship. Aldridge's hands-off management style heavily influenced that decision. He chose his top lieutenants carefully, made them fully aware of their duties, gave them the authority they needed, and

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* (U) Francis R. (Dick) Scobee (Commander), Michael J. Smith (Pilot), Ellison S. Onizuka (Mission Specialist one), Judith A. Resnik (Mission Specialist Two), Ronald E. McNair (Mission Specialist Three), Sharon Christa McAuliffe (Payload Specialist One) [redacted] (b)(1) (b)(3) [redacted] (b)(1)

held them strictly accountable. One of his subordinates recalls Aldridge being a boss that people liked to work for. He held both offices until resigning from government service in December 1988.[6]

(U) The changes at NASA were more substantial. Only a month after *Challenger's* failure, NASA installed RADM Richard Truly as Associate Administrator for Space Flight. He brought with him an impressive resume that included 7,500 flying hours, being a crewmember-designate on the Manned Orbiting Laboratory before program cancellation, ground support duties with Skylab, and two shuttle missions, Space Transportation System (STS)-2 and STS-8. He served as Associate Administrator until 1989 during which time he earned his third star and retired from the Navy. He then became NASA Administrator, a position he held until 1992. Whether by fortuitous coincidence or foreknowledge of Rogers Commission deliberations, Truly's appointment anticipated the commission's later recommendation that more astronauts be placed in management billets.

(U) NASA also had to fill its top position. Recall that when James Beggs departed in December 1985 to answer fraud charges, he had resigned rather than take an extended leave of absence. He had done so in large measure because he did not want his newly appointed Deputy Administrator, William R. Graham, to serve as acting administrator during that absence. Beggs respected Graham's intelligence and overall ability, but he had never held a meaningful management position and his background in weapons development had not given him the experience needed for NASA's top job.[7]

(U) Instead, Beggs suggested that the White House approach James C. Fletcher, NASA Administrator during the early years of the shuttle program. Fletcher had no particular reason for returning, but Beggs believed that his strong sense of patriotism and a desire to help NASA in this time of trouble might induce him to do so. Fletcher accepted the appointment, but with reluctance. Beggs later came to believe that Fletcher was already in the early stages of the cancer destined to claim his life in December 1991.[8]

(U) Fletcher first had to confront an old controversy during his April confirmation hearing. By that time, investigators had tentatively attributed *Challenger's* loss to the failure of O-rings in the solid rocket booster's aft field joint to prevent the escape of hot gasses. In 1972, Fletcher, a Utah native, had overridden the solid rocket booster selection committee's recommendation by awarding the contract to Morton-Thiokol, a Utah-based firm. Now, fourteen years later, one of those boosters may have caused a fatal accident. Senator Al Gore (D. Tenn) vigorously opposed Fletcher's nomination, but only he voted against confirmation.[9]

(U) Fletcher's return was most beneficial in terms of interagency relations. Beggs had been difficult to deal with, focused narrowly on NASA's interests, and displayed little trust in either DOD or the NRO as reliable shuttle customers. Conversely, NRO executives who had dealt with Fletcher during his first tenure at NASA had found him easy to work with, and that had not changed. His broader view on issues and more accommodating way of doing business were welcome in a time of exceptional stress.[10]

~~(S//NF)~~ Meanwhile, the NRO, in a remarkable coincidence, had updated its launch schedule the same day *Challenger* was lost. That schedule made three points. First, the NRO still planned to transition its payload to the shuttle despite the delays and problems plaguing that program. DOD had been saying this all along despite having contracted for additional expendable launchers in 1984. Secondly, most NRO missions on the shuttle would be from Vandenberg, the only locale suitable for attaining polar or high inclination orbits, once the Air Force completed constructing shuttle launch facilities there. Thirdly, the shuttle would progressively assume more launch responsibilities, although some expendable boosters remained on the schedule at least until 1992. Table 11-1 contains the January 1986 NRO launch schedule.

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~~(S//NF)~~ Of course, that schedule did not survive *Challenger's* failure. The immediate issue faced by all customers was how long the shuttle fleet would remain grounded. If the standdown did not exceed three months, the impact would be minimal, but progressively longer periods meant more-and-more undesirable consequences. At eighteen months, the effect on DOD would be significant, including the loss of twenty-five payload slots over the next three years.[11]

~~(S//NF)~~ During early February, Aldridge and NRO Deputy Director Jimmie D. Hill entertained a number of alternatives to deal with the grounding. Possible courses of action included terminating all shuttle planning after [redacted] in favor of expendable launchers, temporarily mothballing the Vandenberg facilities, abandoning Vandenberg entirely and moving all shuttle activity to Kennedy, and doing away with satellite retrieval requirements to ease the shuttle's workload. Maintaining expendable launchers for the foreseeable future was now an absolute necessity.[12]

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(U) Most of what Aldridge and Hill discussed amounted to little more than brain storming since a great deal depended on how long the shuttle fleet stayed on the ground. In late March, Truly ventured NASA's first estimate of how long that might be. He already knew that the Rogers Commission intended to make recommendations that included reappraisal of the program's management structure, recertification of the entire shuttle design, fabrication of new solid rocket booster joints and a reassessment of launch and abort criteria. It was a formidable list, but Truly optimistically predicted that everything could be completed and the shuttle back in operation in about a year.[13]

~~(S//NF)~~ For customers, a one-year grounding meant an average launch delay of five months and loss of twenty-three payload slots over three years. DOD, and in particular the NRO, faced lesser consequences because they had priority based on national security. What priority could not do, however, was offset the effect of losing one orbiter, a quarter of the entire fleet, on the launch rate. NASA now projected the number of shuttle missions, formerly set at twenty-four annually, to be eighteen to twenty-four per year. Aldridge, for one, had no faith in the projection. Whatever the launch rate, DOD needed at least eleven each year to support its requirements.[14]

~~(S//TK//NF)~~ The launch rate, the relatively high percentage of missions required by DOD, and probably doubts about Truly's forecast ground time, triggered the first NRO response. Aldridge ordered all NRO payloads destined for orbits with inclinations [redacted] from Florida, manifested on the shuttle out of Kennedy. Satellites requiring higher inclination orbits would use expendable launchers out of Vandenberg. He made an exception for [redacted] He also did

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not wish to give the impression that DOD intended to abandon shuttle operations from California. At about the same time, he directed that [redacted] (b)(1) (b)(3)

~~(S//TK//NF)~~ Another crippling event in this most difficult period came on 18 April 1986, when a Titan-34, carrying the twentieth and last Hexagon imaging satellite, lifted off its Vandenberg launch pad. Nine seconds later, one of the solid rocket boosters ruptured and the entire Titan exploded. Following on the heels of the 25 August 1985 loss of a Titan-34 [redacted] it marked the second failure in as many flights. DOD immediately grounded the Titan and embarked on a $200-$225 million upgrade program. The Titan standdown, along with that of the shuttle, left the nation devoid of a heavy-lift booster. The situation presented particular difficulties for the NRO, [redacted] (b)(1) [redacted] and replace elderly spacecraft already trending toward failure.[1] (b)(3)

(U) More bad news came a week later when a NASA Nike-Orion upper atmosphere sounding rocket failed when the first stage refused to separate. Then, nine days after that, trouble struck again when the liquid fueled engines on a Delta-II booster carrying a NASA weather satellite autonomously shut down one minute into the flight. Although this was the first Delta failure in forty-three launches stretching back nine years, it too was grounded. The Delta's downtime turned out to be a mercifully brief four months, but during that period the nation had only one launch vehicle, the Atlas, with any meaningful lifting capability.[17]

(U) The bad tidings continued into May when Fletcher, in one of his first decisions after returning as Administrator, extended the shuttle's grounding to eighteen months. The additional delay and the possibility of more like it pushed Secretary of Defense Casper Weinberger toward making an important decision. He had been under pressure for some time to mothball the shuttle's Vandenberg launch facility then nearing completion. The three remaining orbiters could not support operations from both coasts. Even if the administration approved a replacement for *Challenger,* it would not be ready until the early 1990s. There was little reason to fund completion and maintenance of something that could not and would not be used for years.[18]

~~(S//TK//NF)~~ On 13 May, the Defense Secretary discussed the matter with Aldridge and Director of Central Intelligence (DCI) William J. Casey. Six days later, Aldridge reversed his earlier decision by informing that [redacted] would launch out of Kennedy thereby removing the last DOD shuttle payload assigned to Vandenberg. An East Coast launch could not achieve the optimum orbital inclination, but it promised a [redacted] years earlier than waiting to launch from the West Coast. (b)(1) (b)(3)

~~(S//NF)~~ Moving [redacted] to the East Coast permitted Weinberger to make the best decision open to him vis-à-vis Vandenberg. He ordered that, effective in the spring of 1987, the shuttle complex be placed in "an operational state consistent with cost effective management" (i.e. mothballed), a move expected to save some $700 million over the next several years. In October 1986, he made the mothballing effective that very month and projected that the site would reopen sometime in 1991, commensurate with the delivery of a replacement for *Challenger*. Until then, DOD would meet its launch requirements using shuttles and expendable launchers out of Kennedy and expendable launchers out of Vandenberg.[20]

(U) In early June 1986, the Rogers Commission released its report on the *Challenger* tragedy. Commission members confirmed what had been suspected: the rubber O-rings, robbed of flexibility by the cold weather had not entirely sealed the solid rocket booster's aft field joint, thereby allowing combustible gases to escape. The report additionally identified problems with the liquid-fueled engines and questioned not making Edwards Air Force Base, California, rather than Kennedy, the primary landing site to take advantage of the larger runway and better weather.[21]

(U) Commission members had some unpleasant words for both NASA and Morton-Thiokol decisionmakers. O-rings had suffered erosion and partial failures on several previous missions, but the damage was judged to be acceptable and nobody took corrective action. With regard to *Challenger*, Morton-Thiokol engineers had warned that cold O-rings posed a hazard. The temperature that morning had been about 28 degrees, 25 degrees lower than any previous launch. Concerned personnel recommended delaying the launch until temperatures warmed at least to the mid-50s, but were overruled.[22]

(U) The commission identified the basic flaw in the decisionmaking process as a combination of denial and gradual acceptance:

> THE SPACE SHUTTLE'S SOLID ROCKET BOOSTER PROBLEM BEGAN WITH THE FAULTY DESIGN OF THE JOINT AND INCREASED AS BOTH NASA AND CONTRACT MANAGEMENT FIRST FAILED TO RECOGNIZE THE PROBLEM, THEN FAILED TO FIX IT AND FINALLY TREATED IT AS AN ACCEPTABLE FLIGHT RISK.

Morton Thiokol, Inc., the contractor, did not accept the implications of tests early in the program that the design had a serious and unanticipated flaw. NASA did not accept the judgment of its engineers that the design was unacceptable and as the joint problems grew in number and severity NASA minimized them in management briefings and reports. Thiokol's position was that "the condition is not desirable but is acceptable."[23]

(U) The Commission made twenty-seven recommendations in nine categories. These included redesigning the booster joints, reviewing the program management structure, bringing more astronauts into management to take advantage of their experience, observing greater margins of flight safety, establishing a sustainable mission rate, and providing crews a means to bail out at low altitude during controlled glides. None of this came as a surprise.[24]

(U) The report sent a ripple of concern through DOD. Officials believed that if NASA followed through on all the commission's recommendations the grounding would exceed the eighteen months predicted by Fletcher. Planning for an eighteen month standdown continued, but contingency preparations for both twenty-four and thirty months groundings got underway. The contingency preparations turned out to be prudent moves when Fletcher subsequently adopted most of the recommendations and pushed the shuttle's return to flight to sometime in early 1988, thereby extending the grounding to two years.[25]

(U) Then on 19 June, NASA cancelled its long-running program to adapt the Centaur upper stage to the shuttle because of its liquid fuels. Astronauts were uneasy with any liquid fuel in the payload bays and considered the Centaur's volatile, cryogenically-cooled fuels to be downright dangerous. Modifications carried out over the past several years to make the Centaur safer had been expensive and ineffective. The *Challenger* disaster and increased emphasis on safety margins finished off what was obviously a struggling program. Customers would have to rely on the less powerful, solid-fueled Inertial Upper Stage (IUS) to raise satellites from shuttle deployment to operational altitudes, yet another blow to the shuttle's lifting capability, already substantially lower than originally promised.[26]

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[redacted] (b)(1) (b)(3) Aldridge promised a decision by September 1986.[27]

~~(S//NF)~~ In August 1986, President Reagan, after some trepidation over the $2.8 billion price tag, approved a replacement orbiter, later named *Endeavor*, for delivery in May 1991. In that same month, he prohibited manifesting commercial and foreign payloads aboard shuttles unless they had shuttle-only configurations, national security missions, or foreign policy implications. The decision largely reserved future shuttle flights for DOD and NASA. It was against this background—no operational heavy lift booster, reduced shuttle lifting capability, mothballed launch facilities at Vandenberg, fewer missions, and a reduced customer base—that Aldridge and his staff began work on a schedule that would hopefully see DOD and the NRO through this period of crisis. The deliberations had an appropriate name, the DOD Launch Recovery Program.[28]

(U) Leaving the Shuttle

~~(S//NF)~~ No single archival document found during research detailed the recovery plan, but a reasonable approximation can be made using peripheral materials. DOD remained committed to the shuttle as its primary launch vehicle, as it must in view of high level political support. The Air Force would complete the Vandenberg facilities in due course, and whenever possible payloads would be configured to fly on both the shuttle and expendable launchers. [redacted] (b)(1) (b)(3)

~~(S//NF)~~ Beyond that, however, loyalty to the shuttle was growing progressively less evident. In fact, projections were that the NRO would require slightly more expendable launchers per year than it did shuttle flights. That made the extant inventory of seven Titan-34s, fifteen Atlases, two Deltas, and eleven Scouts inadequate even after factoring in the ten Titan-IVs purchased in 1984 and not yet delivered. Plans now called for converting two decommissioned Titan ICBMs into Titan-II medium lift launch vehicles in 1988, raising that number to four in 1989, and increasing Titan-IV production from two to three per year starting in 1990. In his summary report to Weinberger, Aldridge set the cost of the increased capability at [redacted] over five years, money Congress later appropriated.[30] (b)(1) (b)(3)

~~(S//NF)~~ Then a major policy change happened that most in DOD and the NRO had probably campaigned for and undoubtedly welcomed. In December 1986, Reagan, surely motivated by concerns about national security, signed National Security Decision Directive Number 254, "United States Space Strategy." The directive sharply decreased the shuttle's workload and, more importantly, took away its long-time status as a national program. Henceforth:

> The U. S. national space capability will be based on a balanced mix of launchers, consisting of the Space Transportation System (STS) and expendable launch vehicles (ELVs). . . . The security space sector will use both the STS and ELVs as determined by specific mission requirements. Selected critical payloads will be designed for dual-compatibility, i. e., capable of being launched on either the STS or the ELVs. Provisions will be made for additional ELV launch facilities needed to support the full range of orbits required by the national security missions.

And

> THE DEPARTMENT OF DEFENSE (DOD) WILL PROCURE ADDITIONAL ELVs TO MAINTAIN A BALANCED LAUNCH CAPABILITY AND PROVIDE ACCESS TO SPACE. THE DOD WILL IMPLEMENT PROCEDURES TO ASSURE PAYLOAD/LAUNCH VEHICLE COMPATIBILITY AND SCHEDULING, AND MAINTAIN A LAUNCH CAPABILITY FOR ELVs AT BOTH THE EAST AND WEST COAST LAUNCH SITES.[31]

The political ties that bound DOD and the NRO to the shuttle had been severed. Appendix 28 contains National Security Decision Directive Number 254.

(U) Soon afterward, Fletcher announced that NASA would shift some shuttle payloads to expendable launchers, beginning with two Titan-IVs and two Delta-IIs per year and two Titan-IVs and four Delta-IIs per annum thereafter. His motivation was basically the same that DOD and the NRO had harbored for years: to lessen dependency on a single launch system. Since NASA was prohibited from owning expendable launchers, it would have to purchase services from civilian industry. NASA and DOD also worked out a reciprocal pricing arrangement in case the latter had expendable launchers in excess of its needs. NASA would charge $115 million per shuttle flight; DOD would charge $93 million for a Titan-IV, $45.6 million for a Delta-II, and $24.6 for a Titan-II. Both agreed to pay for their planned flights in January prior to the fiscal year of the actual launches. Aldridge and NASA Deputy Administrator Dale Myers signed the enabling agreement on 7 October 1987.[32] Appendix 29 contains that agreement.

~~(S//NF)~~ The shuttle's fortunes continued to slide during 1987. First, NASA extended the shuttle's grounding to June 1988, making the standdown thirty months in duration. Then, NASA announced that the launch rate would be dramatically reduced over the next few years, later established at about six flights per annum. That was far too few to satisfy DOD and NRO requirements. Finally, the 400 or so modifications made to the shuttle in response to the Roger's Commission further reduced its lifting capability beyond the diminishment resulting from cancelling the Centaur upper stage.[33]

(U) In similar fashion, other events did not bode well for the shuttle. In January 1987, Weinberger canceled construction of the Air Force's Colorado-based control center for shuttle missions with DOD payloads. The decision surprised no one. By mid-1985, the Air Force had identified a looming money problem while in the buildup for the FY 1987 budget. Later in the year, the Air Force deleted all funding for the control center and held to that decision despite efforts to keep the project alive. DOD would have to rely on its covert facility at the NASA's Johnson Space Center (JSC) to handle shuttle missions. NASA estimated that the JSC could accommodate six to eight DOD missions per annum, enough to satisfy launch requirements until 1990, but not thereafter. The Manned Space Flight Engineer Program to train DOD personnel as shuttle payload specialists atrophied and was essentially over by the beginning of 1988.[34]

~~(S//NF)~~ The final break started on 16 September 1987 when Aldridge, acting as NRO Director, advised Congress that the shuttle's poor reliability could no longer be tolerated. He recommended that most of the remaining NRO satellites be switched to expendable launchers so as to maintain some sort of schedule. The satellites remaining on the shuttle were those previously mentioned minus [redacted] which had been switched to an expendable launcher. Other DOD satellites would follow a similar course. Aldridge did not mention completely abandoning the shuttle, but neither did he me (b)(1) lans of ever returning payloads to it.[35]

(b)(3)

~~(S//NF)~~ As its next order of business, DOD contracted with the civilian industry to reinstate a strong expendable launch vehicle production base. Using a billion dollars approved by Congress, DOD ordered the first of what became twenty-five Titan-IVs and twenty Delta-IIs and began modifying twelve Titan-IIs into medium-heavy lift boosters. Additional launch pads on both coasts would accommodate the increase. DOD would continue to launch non-NRO payloads on the shuttle at a decreased rate through FY 1995, but the NRO had no plans for it after FY 1990. From that point on, conventional boosters would execute the entire NRO launch mission, mainly from Vandenberg. As part of the disengagement, DOD terminated work on shuttle launch facilities at Vandenberg despite the $3 billion already invested. All these factors point to a final decision to completely abandon the shuttle having been made before the end of 1987, probably just after Aldridge's September letter to Congress.[36] See Table 11-2 for the NRO's launch schedule over the next several years.

~~(S//TK//NF)~~ The DOD and NRO plans to first reduce and then eliminate use of the shuttle understandably displeased some NASA staff, but Fletcher himself professed no ill will; in fact, quite the opposite. In a letter to DCI William Webster he thanked the entire Intelligence Community for its assistance during what had been trying times and offered NASA's support in any way possible. That spirit was evident when NASA matched individual shuttle performance with the requirements of the remaining NRO flights.[37]

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~~(S//NF)~~ A last noteworthy shuttle related event during 1987 was completion of a major review of the launch failures beginning with the Titan-34 in August 1985 and ending with the Delta-II eight months later. Investigators had earlier found no common thread, but five failures in such a short time and the jolt of having only three successful launches in the entire space program during 1986 fed conjecture about sabotage or perhaps a phantom sniper. In October of that year, the National Security Council (NSC) sought to end the speculation by ordering DOD to make an inquiry. Weinberger placed Aldridge in charge of the investigation. Aldridge asked Fletcher for assistance and received a welcome response. NASA gladly furnished whatever information it had and sent eight representatives to assist.[38]

~~(S//NF)~~ The inquiry had two parts, a joint NASA-DOD reassessment of what had caused the failures and [redacted] (b)(1) The final report, completed in August 1987, confirmed earlier findings. Two major anomalies in the liquid engine oxidizer system, either of which would have doomed the flight, had caused the August 1985 Titan-34 failure, and O-rings stiffened by the cold had felled *Challenger*. The 18 April 1986 Titan-34 explosion came about when flawed insulation in a solid rocket booster permitted the burning powder grain to breach the metal skin, aerodynamic forces had prevented the Nike-Orion's first stage from separating, and an electrical short circuit had shut down the Delta-II's fuel pumps. The [redacted] The five failures had (b)(1) been an unprecedented, almost unthinkable, run of bad luck.[39]

~~(S//NF)~~ The impending termination of NRO payloads on the shuttle took place just as an established NASA satellite program reentered the reconnaissance picture. Recall that in 1973 Fletcher, during his first tour as NASA administrator, had volunteered Landsat earth observation satellites to collect economic intelligence on the world's staple food crops. Landsat's contribution over the next decade was modest, but events conspired to make it both an international political issue and elevate, if only briefly, its status as a reconnaissance asset.

(U) Landsat in Ascendancy

~~(S//TK//NF)~~ Landsat-1, launched in July 1972, Landsat-2, launched in January 1975, and Landsat-3, launched in March 1978, had near-polar orbits that gave routine and repetitive access to virtually the entire globe. All three satellites carried the same optical systems, a return beam vidicon (a type of television camera) and a multispectral imager. The satellites recorded data onboard and periodically downlinked it to one of NASA's ground stations. Landsat's 250-foot resolution was too coarse for most intelligence purposes and even limited crop inventories to large fields, such as those in the Soviet Union. [redacted]

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(b)(3)

(U) Landsat stepped to the fore again in the late 1970s, not due to reconnaissance or any other space activity, but because of international politics. American relations with the Peoples Republic of China had improved following an early 1970s rapprochement in which the two nations vowed to restore diplomatic relations severed in 1949. However, restoration was contingent on Washington first loosening its ties with Taiwan, which Beijing considered a renegade Chinese province, not an independent nation.

(U) The deaths of Communist Party Chairman Mao Zedong and his Chief Deputy, Chou en Lai, in 1976 furthered the rapprochement by relaxing the iron hand of Marxist orthodoxy and allowing China to begin emerging from self-imposed isolation. Then in 1978 came the next breakthrough when the United States abrogated its defense treaty with Taiwan, satisfying Beijing's demand for looser ties. Restoring relations then made rapid progress. On 1 January 1979, the two nations announced the exchange of ambassadors and Premier Deng Xiaoping scheduled a state visit to Washington to coincide with the 1 March 1979 opening of both embassies.

~~(S//NF)~~ Robert Frosch, the NASA Administrator at the time, and unnamed NSC staff, saw a way to both further improve relations and give Landsat a boost. Several nations had by then purchased ground terminals to receive Landsat data directly; why not sell one to the Peoples Republic as a good will gesture? NASA senior managers did not believe anything would be compromised since Beijing, with no space capability of its own, had for years been secretly buying Landsat imagery through an American intermediary. Most of what China purchased focused on disputed areas along the Sino-Soviet border, not the United States. Deng's upcoming state visit would be a good time to announce the sale.[41]

~~(S//NF)~~ The proposal might have been approved without appreciable controversy had the ground terminal under consideration not been an upgraded model intended to support Landsat-4.† Landsat-4, scheduled for a 1982 launch, would have a multispectral imager just as before, but a Thematic Mapper would replace the return beam vidicon. The multispectral sensor would image in four bands with a 250-foot resolution, the same as on previous Landsats. The Thematic Mapper, however, proposed a 100-foot resolution in seven bands—blue, red, green, one near infrared, two short-wave infrared, and one long-wave infrared—making both the satellite and its ground terminal quantum improvements over their predecessors. The improvements raised the specter of imagery with quality sufficient for intelligence purposes, through China would continue secretly purchasing Landsat products if denied a terminal.[42]

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† (U) Referred to as Landsat-D in some correspondence.

[redacted] (b)(1) (b)(3)

~~(S//NF)~~ Because this was a matter between sovereign nations with important foreign policy implications, the issue went before President Carter. China got their terminal, but with restrictions that satisfied security concerns. The restrictions probably included a minimally equipped terminal at a fixed location (no mobility) with components applicable only to communication with Landsat. For sure, the United States meant to keep China's inventory of spare parts at a low level, avoid discussing anything in detail relative to either Landsat or TDRSS, and assure that American contractors had frequent access to the site.[45]

~~(S//NF)~~ Although the ground terminal controversy gave Landsat a moment in the spotlight, its stock as a collection asset did not really begin rising for a few more years. That rise accompanied the 16 July 1982 launch of Landsat-4. [redacted] (b)(1) (b)(3)

~~(S//TK//NF)~~ Elsewhere, others were looking to exploit Landsat's improved capabilities in a more traditional way. The Thematic Mapper captured some 13,000 square miles in each frame, enough to provide wide area coverage, though its 100-foot resolution compared poorly with that of Hexagon, the NRO's area coverage system. [redacted] (b)(1) (b)(3) There were also suggestions that Landsats in the 1990s should have resolutions as low as 10 feet, but there is no evidence of that getting beyond the speculation stage.[47]

~~(S//NF)~~ Despite the renewed interest, a longstanding cloud was hanging over Landsat. Recall that virtually from program inception, the Office of Management and Budget (OMB) had questioned whether its contribution was worth the cost. In 1974, Landsat had no funding beyond the second satellite and faced the very real threat of cancellation. The need for additional program justification was why Fletcher had offered Landsat as an intelligence collector. The question of return versus cost was still an issue when in March 1983, less than nine months after Landsat-4 went into orbit, Reagan announced the commercialization of two government satellite systems, one being Landsat.[48]

~~(S//NF)~~ The announcement found no favor within the Intelligence Community. The problem was not an anticipated imagery shortfall. By the 1990, at least four new spaceborne systems, mostly of foreign origin, could be exploited for both visual and multispectral imagery. Rather, the issue was reliability. Foreign sources put access at the mercy of international politics, and even dependency on a domestic civilian firm raised concerns. Some doubted that a civilianized Landsat could turn a profit in the face of foreign competition. The civilian firm awarded the contract would be obligated to provide a viable system through 1989, but a failed commercial venture left open the question of who would assume responsibility thereafter.[49]

Figure 11-1. (U) Thematic Imager photography of the Nevada nuclear test site. Note the "dimples" on the left side from the many underground nuclear tests. (Image: UNCLASSIFIED)

(U) The concerns voiced failed to sway Reagan. In September 1985, the Commerce Department (not NASA) signed an agreement turning responsibility for Landsat over to the Earth Observation Satellite (EOSAT) Company, a subsidiary of RCA and Hughes Aircraft Corporation. The terms were quite generous to the company. EOSAT would:

- (U) Provide Landsat products gratis to the government, but keep all revenue from other sales.
- (U) Operate Landsat-4 and Landsat-5 under a government subsidy until the launch of Landsat-6.
- (U) Use government funds to outfit Landsat-6 and Landsat-7 with Enhanced Thematic Mappers capable of a 50-foot resolution.
- (U) Launch Landsat-6 and Landsat-7 on the shuttle without charge
- (U) Have use of the Landsat control center at NASA's Goddard Space Center in Maryland.

The only identifiable advantage to the government was the addition of Landsat-7, which promised an operating system through a least 1992 rather than 1989.[50]

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[redacted]

(U) The Commerce Department and EOSAT encountered rough going almost as soon as the agreement binding them took effect. As predicted by some, a profitable market for Landsat products did not emerge. Landsat never generated more than $18 million in annual revenue, not all of it profit. Funding cuts ordered by the OMB delayed the 1987 launch of Landsat-6 for at least two years, forcing the government to maintain the operations subsidy longer than expected. The crisis came in early 1989 when the Commerce Department stated that it did not have funds sufficient to cover the subsidy for the remainder of the fiscal year. EOSAT countered that it must have the subsidy for the civilianized program to survive.[52]

~~(S//NF)~~ In May 1989, the National Space Council, a White House-level panel chaired by Vice President Dan Quayle, intervened. The council recommended maintaining the current arrangement with EOSAT, but only through Landsat-6. The new President, former DCI George H. W. Bush, agreed. The council then ordered DOD and the Commerce Department to jointly study the program's future beginning with Landsat-7. In their response, the two organizations favored a commercial Landsat and reached agreement on unnamed technological issues. What they could not agree on were the two most important issues, funding and collection priorities. The Commerce Department expected to retain its role as government manager if assisted by DOD funding. DOD was willing to pay a fair share, but only if its requirements had priority over all else. If honored, that would make Landsat largely a DOD asset.[53]

(U) Conflicting opinions continued through virtually all of 1990 as other agencies entered the picture. This period of indecision was an affordable luxury because a further delay in Landsat-6's launch, until

1991, kept the existing government-civilian management and subsidy structure in place. DOD continued its support of that structure. The Commerce Department, now certain that commercialization had failed and unsure that as a non-user of Landsat products it was an effective funding advocate, wanted out unless someone else paid for everything. The Interior Department, a user of Landsat products, offered to assume management, an idea that for reasons unstated failed to gain support. The Intelligence Community projected a growing requirement for Landsat data, but only if Landsat-7 had an increased number of spectral bands and the promised 50-foot resolution. The NRO at one point agreed to assume responsibility for the program, but for reasons unknown subsequently retracted the offer. Landsat now had more the appearance of a hot potato than a collection asset.[54]

~~(S//NF)~~ The impetus to get things moving came during budget discussions held in December 1990. By [redacted]

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(U) In 1992, NASA joined DOD as an equal manager in the post-Landsat-6 program. NASA did not relish the role due to concerns about funding. In fact, everyone worried about money, including Congress, which noted funding as a potential problem despite the Land Remote Sensing Policy Act of 1992. Even as it accepted Landsat and risked having to cut other programs to support it, DOD still preferred that the program remain under civilian management despite the failing commercialization venture. All of this put a question mark after Landsat's recent good fortune and did not augur well for its long term prospects.[56]

(U) Nevertheless, the program forged ahead with the September 1992 award of the Landsat-7 acquisition contract to the only competitor, Martin-Marietta (later, Lockheed-Martin). Landsat-7's specifications called for two sensors, an Enhanced Thematic Mapper and a High Resolution Multispectral Stereographic Imager (HRMSI). The former would be an upgraded version of the previous system with 8 multispectral bands capable of imaging a 120-mile wide swath with an 80-foot resolution. The HRMSI had planned for it five multispectral bands with a 17-foot resolution, coverage of a 35-mile wide swath when pointed vertically, stereographic rather than monographic imagery, and the ability to take oblique photographs. The oblique capability would allow for target revisits every two-three days as opposed to sixteen days for earlier models. DOD in particular placed great emphasis on the HRMSI to satisfy most multispectral requirements not adequately addressed in earlier Landsats.[57]

(U) After that, however, everything went into reverse. NASA, for reasons unstated, failed to adequately fund the HRMSI's ground segment in the FY 1994 budget despite offers of DOD assistance. In October 1993, a booster malfunction sent Landsat-6, the last satellite under civilian management, to a watery grave, leaving Landsat-4 and Landsat-5 to carry on the mission. Both were beyond their design lives and somewhat degraded. Finally, even DOD intervention could not secure funding for the HRMSI's ground segment, forcing its deletion from Landsat-7. DOD understandably lost interest in a program now largely stripped of the very capability it most wanted. In 1994, DOD, apparently with White House approval, transferred all its Landsat funds to NASA and withdrew, leaving NASA to descope Landsat-7's capabilities to more resemble those of earlier satellites.[58]

~~(S//NF)~~ When Landsat-7 launched in 1999, the program was under the joint direction of NASA, the United States Geological Survey, and the National Oceanic and Atmospheric Administration. Landsat-7 joined an old timer, Landsat-5, now in its fifteenth year and far beyond its design life, but still functioning. The newer Landsat carried a single sensor, the Enhanced Thematic Mapper Plus, to collect in seven spectral bands with a 100-foot resolution and a 50-foot resolution in the visual range. Though an improvement over all previous Landsats, its capabilities were less than originally planned. [redacted] (b)(1) (b)(3)

* * * * *

[redacted] (b)(1) (b)(3)

~~(S//NF)~~ The shadow hanging over Landsat today is program survival. The overarching question is the same as in years past: is it worth the money? The money issue may be why Landsat-5, a virtual Methuselah among satellites, is still in first-line duty. Sooner or later, however, both it and Landsat-7 will fail, leaving NASA with a reduced earth observation capability [redacted] (b)(1) (b)(3) Even if additional funding i[s] forthcoming and allows for follow on satellites, Landsat is probably doomed to repeatedly face the cost-versus-gain question.

~~(S//NF)~~ Landsat's future may be cloudy, but the NRO's relationship with the Space Shuttle was fast drawing to an end. Most of that relationship had been marked by cooperation, judicious planning, and deference to higher authority, but little enthusiasm, at least within DOD. Caution ruled DOD's policies, particularly as the 1980s progressed, the shuttle's problems mounted, and it became increasingly unreliable even as it became operational. Small wonder that Aldridge, concerned about assured access to space for national security payloads, began backing away from the shuttle in mid-1983 and moved to completely abandon it in late 1987, almost as soon as political considerations permitted him to do so. Only those few payloads configured for the shuttle remained on that vehicle and their launch would end the NRO's participation.

(U) That ending roughly coincided with the collapse of the Soviet Union and termination of the Cold War. World opinion now tolerated, if not exactly welcomed, spaceborne reconnaissance. That removed the main reasons why the NRO had been a state secret for over three decades. The NRO could shed part of its security blanket, make its existence public knowledge, and begin to interact more openly with NASA and other agencies. Acknowledging the "fact of" the NRO and the launch of the few remaining NRO payloads still consigned to the shuttle are treated in the next chapter.

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(U) Chapter Twelve

(U) THE END OF AN ERA, 1987-1995

~~(S//NF)~~ Even though the NRO decided to leave the Space Shuttle in favor of expendable boosters sometime in late 1987, the first indisputable archival evidence of that intent was dated 22 March 1988. On that date, NRO Director Edward C. Aldridge, in his role as Secretary of the Air Force, told a Senate committee that the shuttle's schedule and performance problems left no other choice.[1] The abandonment decision was, however, not the end of the story.

~~(S//NF)~~ The NRO still had to rely on the shuttle to launch [redacted] not amenable to conversion to expendable launches due to time and expense. There were also at least [redacted] totally obscure NRO payloads destined for the Shuttle before they too switched to expendable launchers.

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~~(S//NF)~~ Then, in April 1990, the Hubble Space Telescope, the best example ever of [redacted] rode the shuttle into orbit. The launch and insertion into orbit went smoothly, but a serious error during fabrication badly degraded Hubble's performance. Returning the ailing telescope to full capability ultimately involved the shuttle, an innovative NASA repair plan, [redacted]

~~(S//NF)~~ There were also significant political changes mainly triggered by the end of the Cold War. In late 1992 and early 1993, the NRO underwent a major internal restructuring and shed its outer layer of security by acknowledging the "fact of" its existence. The acknowledgment, in turn, had a trickledown effect that two years later affected NASA-NRO interaction. The return of the shuttle to operation, the remaining NRO payloads committed to it, the Hubble repair, and the end of the era of complete secrecy are among the items treated in this chapter.

(U) THE SHUTTLE RETURNS TO FLIGHT

~~(S//NF)~~ During the period of the shuttle fleet's grounding, the NRO carried out seven launches using Atlas and Titan boosters.* An April 1986 explosion of a Titan-34 destroyed the twentieth and last Hexagon imaging satellite. [redacted] Important as these launches were, the NRO badly needed to launch [redacted] payloads still manifested on the shuttle. NASA badly needed to restore the shuttle to a degree of respectably, reaffirm it could support construction and maintenance of the Manned Space Station, orbit the Hubble Space Telescope and launch other civilian and military payloads.

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(U) Returning the shuttle to flight had not been easy, but in May 1987, NASA Administrator James Fletcher announced that everything was on track for a June 1988 launch, but then came a bit of trouble. Morton-Thiokol, builder of the solid rocket boosters, conducted five test firings, the first coming on 27 May 1987. The solid rocket booster field joints, completely redesigned following the *Challenger* disaster, performed flawlessly each time, but problems with the booster's exhaust nozzle on the third test moved the estimated return to flight back to August 1988. The liquid fueled engines then failed one

* (U) The Titan returned to service in 1987 after a one year grounding.

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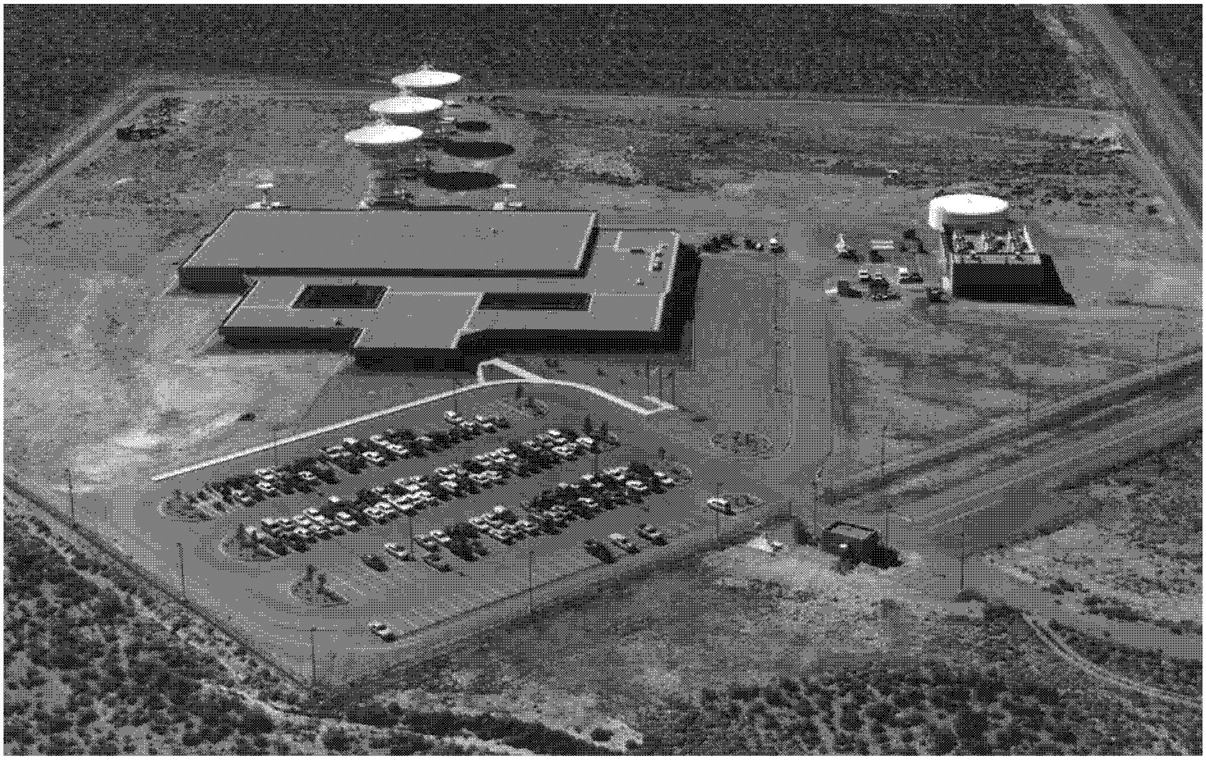

Figure 12-3. (U) TDRSS ground station shortly after it opened. (Image: UNCLASSIFIED)

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~~(S//NF)~~ On 13 March 1989, *Discovery* carried TDRSS-D aloft where it joined TDRSS-C and allowed NASA to demote the less robust TDRSS-A to reserve status. As of 2006, the first nine satellites, launched between 1983 and 2002, had suffered few system failures and all, TDRSS-A included, were still mission capable, although most had varying degrees of degradation. That is truly a remarkable record given the complexity of the satellites, the demands placed on them and the uncompromising environment they operate in.[7]

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~~(S//NF)~~ One other category of Shuttle-launched satellites, the Getaway Special (GAS) program, deserves mention. James Fletcher, NASA Administrator at the time, inaugurated the program in 1976 to extend shuttle launch services to other than the federal government, foreign nations, and large civilian corporations. The program over time attracted a diverse cliental that included high schools, colleges, and business interests, both foreign and domestic. Steven Spielberg, the movie director, purchased space for a California Institute of Technology payload. Shuttles carried GAS satellites, which weighed no more than 200 pounds, on a space available basis. NASA charged GAS customers between $3,000 and $10,000 per launch, depending on weight.[17]

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[redacted]

[redacted] (b)(1) (b)(3)

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~~(S//TK//NF)~~ [redacted] ending a two decade-long involvement that had disappointed both parties by neither achieving NASA's lofty goals nor satisfying DOD's more modest expectations. At least NASA could now use its residual capability to concentrate on scientific payloads and supporting the Manned Space Station. (b)(1) (b)(3)

(U) There is one last item about the NRO's and its two-decade relationship with the shuttle that merits comment. This narrative has focused on the senior executive levels where objectives regarding the shuttle were never truly in sync. DOD and NRO officials had to ensure access to space in the interest of national security. They were from the beginning cautious, skeptical, standoffish and beginning in 1983, increasingly reluctant to rely on it as their launch vehicle. NASA, on the other hand, needed a DOD commitment to the shuttle to help preserve the program and for a time fought a determined, sometimes bitter, battle to hold DOD to that commitment. Given the different objectives of the two sides, clashes were understandable, even inevitable.

(U) On the other hand, lower echelon professionals in DOD, the NRO, and NASA had a different experience with the shuttle. They worked with cutting edge technology that seemed on the verge of revolutionizing space travel, an exhilarating experience in itself, and were free of the responsibilities that burdened high level executives. The lower echelons also got along well together, worked as a team to solve numerous problems, and enjoyed high levels of camaraderie. One NRO participant, [redacted] remembers get togethers and launch parties far removed from the tensions so obvious at higher echelons.[20]

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(U) Hubble

~~(S//TK//NF)~~ Meanwhile, a long anticipated scientific payload, the Hubble Space Telescope, awaited its launch on the shuttle. Perkin-Elmer had delivered Hubble's optical assembly to NASA in 1984, about a year behind the original schedule set down in 1977. From there, the optics had gone to Lockheed for fitting into the overall spacecraft, a task finished in 1985. Hubble would have launched aboard *Atlantis* in late 1986 had it not been for *Challenger*. The shuttle's grounding forced NASA to warehouse the telescope for over four years at a cost of $7 million per month. By the time it arrived at the launch pad in 1990, Hubble's overall cost exceeded $1.5 billion, a nearly ten-fold cost overrun, although in fairness, the time spent in storage contributed significantly to that figure. The optical system, which included [redacted] consumed over four million man-hours of effort and accounted for $450 million of the total cost, or over six times its contract price.[21]

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(U) Hubble's turn came on 24 April 1990 when *Discovery* lifted the 25,000 pound instrument into a 380-mile orbit, the highest deployment altitude achieved by a shuttle to that date. The deployment went well, but then came a troublesome series of teething problems. The early anomalies included a balky antenna that prevented data transmission, the telescope being unable to find its first target, a slight vibration as the spacecraft passed from darkness into daylight, and an unexpected reaction of onboard electronics to the radiation zones surrounding the earth.[22]

(U) Despite these problems, on 20 May, Hubble, using the TDRSS constellation for data relay, downlinked a series of test pictures to NASA's New Mexico ground station, which retransmitted them to the Goddard Space Center. The first images brought joy to the scientific community, but joy soon turned to concern. The pictures, though much better than anything obtainable from terrestrial observatories, were not as sharp as they should have been. Concern then turned to dismay when ground controllers could not properly focus the optics. Something was seriously wrong.

(U) On 27 June, NASA officials attributed the focus problem to a spherical aberration, the technical name for an improperly shaped primary mirror. The error was almost infinitesimally small, on the order of .002 mm (a human hair is about 0.1 mm in diameter), spread over the mirror's 46-inch radius, but had significant consequences for an instrument as precise and demanding as Hubble. The Wide Field/Planetary Camera meant to capture very faint objects suffered the most degradation, thereby compromising efforts to probe the more distant reaches of the universe.[23]

(U) An investigation board, headed by Lew Allen, Director of the Jet Propulsion Laboratory, former Air Force Chief of Staff (1978-1982), and former NRO Program A Director (1971-1973), held both Perkin-Elmer and NASA responsible. The company's lower management had followed established procedures, which meant using a Reflective Null Converter, whose lasers could measure distances

[redacted] (b)(1) (b)(3)

accurately to within a few billionths of an inch, to certify that the mirror's shaping met specification. Unfortunately, the converter had been improperly installed.[24]

(U) The effect of the installation error came to light when other measurement devices detected signs that the grinding and polishing was taking too much off the mirror's outer regions. Perkin-Elmer's somewhat fragmented decisionmaking structure did not respond to the disquieting indicators, and high-level company officials had no idea that something might be going wrong. NASA's single on-site representative could not adequately monitor the situation and NASA's senior managers, who lacked the expertise to properly assay events, deferred most decisions to Perkin-Elmer. Nobody ordered an end-to-end test of the completed optical system due to the expense.[25]

(U) Whatever the bad publicity and embarrassment, Hubble had to be repaired if that was possible. NASA's solution was the Corrective Optics Space Telescope Axial Replacement (COSTAR), a set of lenses that when inserted into Hubble's optics would cancel out the spherical aberration. A Shuttle crew would insert COSTAR, along with an upgraded Wide Field/Planetary Camera, during the first scheduled maintenance mission to Hubble in late 1993.[26]

~~(TS//TK//NF)~~ Sometime in early 1992, telemetry from the telescope indicated another potential problem—one of its solar panels might be warped. If true, the panel could not be retracted so Hubble could fit in the shuttle's payload bay while undergoing repairs. [redacted] (b)(1) (b)(3)

(U) In December 1993, *Endeavor*, flying STS-61 eased into position near Hubble. Over the next week, the crew jettisoned the deformed solar panel, installed a new one, inserted COSTAR, and replaced the Wide Field/Planetary Camera. The repair job was completely successful. The telescope reached peak performance with photography of the heavens that fulfilled its great scientific promise and two decades later still dazzles the world.[28]

(U) COLUMBIA

~~(TS//TK//NF)~~ Hubble's successful refurbishment and [redacted] contribution to it greatly impressed Daniel S. Goldin, who succeeded Richard Truly as NASA Administrator in 1992. In 1994, He asked the Director of Central Intelligence (DCI), R. James Woolsey, to restore [redacted] of shuttle missions to roughly what it had been when terminated a decade earlier. [redacted] operations should:

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[redacted]

~~(TS//TK//NF)~~ Although it is outside the time parameters of this narrative, [redacted] On 2 February 2003, *Columbia,* flying STS-107, disintegrated during atmospheric reentry, killing all seven crewmembers and raining debris along a 200-mile-long stretch of Texas and Louisiana. The accident investigation board attributed the breakup to foam insulation separating from the external fuel tank soon after liftoff and damaging leading-edge thermal tiles near the left wing root. The compromised tiles allowed the searing heat of atmospheric reentry to penetrate and deform the wing until control was lost, or weaken the wing to the point of failure.[31]

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~~(TS//TK//NF)~~ [redacted]

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~~(TS//TK//NF)~~ As with *Challenger* seventeen years earlier, a number of "lessons learned" emerged from the *Columbia* tragedy. [redacted] (b)(1)

(U) Launch Services

(U) Elsewhere, the Air Force, acting as agent for DOD, and NASA negotiated two new pricing agreements for launch services, the fifth and sixth such accords since 1977. The fourth agreement, signed in December 1985, is scarcely mentioned in subsequent documentation, because it was voided after the loss a month later of *Challenger*. The fifth accord, agreed to in 1987, more resembles the third accord, signed in 1983. Reimbursement would be only for hardware, not payload integration and launch services. NASA was exempted from compensating the Air Force for range support. In dollar figures, the Air Force would charge NASA $93 million for Titan-IV, $25.6 million for Delta-II and $25.6 million for Titan-II launches. In return, DOD would pay NASA $115 million for a ride on the shuttle.[36]

(U) The most significant change from the 1985 pact was that DOD no longer had to make a large upfront deposit each year in exchange for a lower price on each launch. The $698 million advanced

§ (U) Ground Sample Distance is the term used to measure resolution in electro-optical imagery.

by DOD in 1985 for shuttle services, enough to partially defray costs on nine DOD launches, would be used for that purpose. Otherwise, the 1987 understanding was strictly *quid pro quo*. The agreement had a mid-1991 termination date.[37] Appendix 29 contains the 1987 accord.

~~(S//TK//NF)~~ In early 1990, the two agencies began developing their positions for the next pricing agreement, one that covered both the last two scheduled NRO launches and any other remaining DOD involvement with the shuttle. The new understanding, probably signed in June 1991 by NASA Administrator Richard Truly and Secretary of the Air Force Donald Rice, maintained many features of previous covenants. NASA had responsibility for the Shuttle. The Air Force, still the executive agent for DOD, managed the expendable launch vehicle inventory. DOD had already used money from the upfront payments made in late 1985 to defray the cost of five shuttle launches and still had enough to apply toward four more flights.[38]

(U) Conversely, the 1991 accord did away with the *quid pro quo* approach because DOD forecast only a few more launches on the shuttle. Each organization agreed to pay the other for hardware costs, just as before, but beginning in FY 1992 NASA would be billed for range support. Further, if either party required launches that exceeded a baseline figure, defined by DOD as eight Titan-IV launches and by NASA as twelve shuttle missions, the cost of launch services would be added to the bill. If all three charges—hardware, launch services and range support—applied; NASA would pay $151 million for a basic Titan-IV and $238 million if it had a Centaur upper stage. A shuttle launch would cost DOD $342 million, a far cry from what had been predicted in years past, but it came much closer to covering the true expense of a launch than anything contained in previous agreements.[39]

(U) Looking ahead to a time when neither the NRO nor DOD would avail themselves of shuttle services, the 1991 agreement provided for NASA's continuing access to expendable launchers. In FY 1994, NASA would begin funding launch services for as many as eleven missions, the most prominent being the 1995 Cassini Probe to the planet Saturn and a Comet Rendezvous and Flyby Mission the following year. The 1991 arrangement remained in place until 1999.[40] Appendix 30 contains an unsigned draft of the 1991 agreement, the only copy found during research.

(U) The End of Total Secrecy

(U) As the last DOD and NRO payloads launched on the Shuttle in the early 1990s, dramatic changes were buffeting the nation's space program. The Cold War that had dominated American foreign policy and heavily influenced domestic policy for over forty years ended with the collapse of the Soviet Union. That serendipitous turn of events promised a "peace dividend" in the form of reduced military spending and fostered demands from both government agencies and the public for greater openness in intelligence matters. The hyper-secretive NRO was not exempt from those demands.

(U) The problem for the NRO was that its existence being a state secret since its establishment three decades earlier. The international community's suspicion of any observation from space during the early 1960s, doubly so in the case of reconnaissance, and the exigencies of the Cold War had made extreme secrecy a prudent, even necessary, measure. All that had now changed. World opinion now accepted spaceborne reconnaissance, if only as a necessary evil, and the Soviet Union had fallen apart. It might be time to declassify the "fact of" the NRO. The idea had been circulating within the government circles for some time. NRO Director Hans Mark had proposed doing just that in 1979, but he had been too far ahead of prevailing opinion.

(U) A decade later, however, proponents of declassification had every reason to believe that the tide now ran in their favor. In addition to the impact of a changed world, the NRO's existence had been public knowledge since the early 1970s when a letter embossed with its logo ended up in Unclassified archival material. In 1987, fellow Congressmen forced Representative George E. Brown Jr. (D. Cal) off the House Intelligence Committee after he deliberately named the NRO in a floor debate to protest the continuing secrecy. The Senate Select Committee on Intelligence, among others, now regarded the NRO's deep cover as an anachronism that complicated its external relationships.[41]

(U) More cautious individuals countered by noting the difference between public *knowledge* and official *acknowledgement*. The former still left the government with the capability to answer unofficial inquiries with official, if increasingly implausible, denials or, if need be, silence. The latter would take away that capability, expose the agency to greater scrutiny, open it to freedom of information act requests, complicate relations with foreign nations hosting NRO ground stations, and ease the pressure on cleared personnel to keep secrets.[42]

(U) Both sides in the argument had valid points, so in February 1992, DCI Robert Gates appointed a committee to make recommendations concerning the NRO's organizational structure and examining its relationship with the rest of the Intelligence Community. Robert Fuhrman, former Chief Executive Officer of Lockheed, chaired the panel whose membership included distinguished representatives from civilian industry and retired senior military officers formerly associated with intelligence. On 20 March, the panel presented its recommendations to Gates. Those recommendations, if adopted, ensured that the NRO never again operated as in the past, either internally or externally.[43]

(U) The Fuhrman Committee recommended, *inter alia*, that:

- The "fact of" the NRO be officially acknowledged, but virtually all other information about the organization remain classified.
- The NRO's alphabetized internal structure—Programs A (Air Force), B (CIA), and C (Navy)—in effect since the early 1960s, be phased out.
- The NRO's new internal structure be functional, rather than program, oriented around two major directorates, imagery and signals.
- Program offices report directly to the directors of imagery or signals.
- NRO assets and personnel distributed throughout the National Capitol Region be centralized at one location.[44]

(U) Although some of the Fuhrman Panel's recommendations raised eyebrows, the ones listed above did not. Gates had long favored declassifying the "fact of" the NRO; NRO Director Martin Faga agreed with all the recommendations. On a personal level, Faga had recently undergone the embarrassment of having to play dumb when both his sons, neither of whom had codeword clearances, independently identified him as the NRO Director. On a professional level, he was particularly pleased with the proposed internal structure and other than suggesting some minor tweaking accepted the other recommendations as written. Within ten days, DOD, the National Security Council and the President had blessed the report. With regard to declassifying the "fact of" the NRO, the Senate Select Committee on Intelligence pressed for a September announcement, threatening to unilaterally make the revelation if that timetable was not met.[45]

(U) On 18 September 1992, Deputy Secretary of Defense Donald Atwood acknowledged the NRO in a press release that covered less than a page. The NRO, the release read, is:

> . . . . AN AGENCY OF THE SECRETARY OF DEFENSE AND FUNDED THROUGH A PROGRAM KNOWN AS THE NATIONAL RECONNAISSANCE PROGRAM (NRP) . . . TO MEET US GOVERNMENT INTELLIGENCE NEEDS THROUGH SPACE BORNE AND AIRBORNE RECONNAISSANCE.
>
> THE MISSION OF THE NRO IS TO ENSURE THAT THE US HAS THE TECHNOLOGY AND SPACE BORNE AND AIRBORNE ASSETS NEEDED TO ACQUIRE INTELLIGENCE WORLDWIDE, INCLUDING TO SUPPORT SUCH FUNCTIONS AS ARMS CONTROL AGREEMENTS, INDICATIONS AND WARNING AND THE PLANNING AND CONDUCT OF MILITARY OPERATIONS.
>
> THE SECRETARY OF DEFENSE HAS THE ULTIMATE RESPONSIBILITY, WHICH IS EXERCISED IN CONCERT WITH THE DIRECTOR OF CENTRAL INTELLIGENCE, FOR MANAGEMENT AND OPERATION OF THE NRO AND THE DIRECTOR OF THE NRO REPORTS DIRECTLY TO THE SECRETARY. THE DIRECTOR OF CENTRAL INTELLIGENCE ESTABLISHES THE COLLECTION PRIORITIES . . . APPROVES SECURITY POLICY GUIDANCE, APPROVES ALONG WITH THE SECRETARY OF DEFENSE THE NRP BUDGET, AND GUIDES AND PARTICIPATES IN THE FORMULATION OF THE NRP THROUGH THE DIRECTOR OF THE NRO.
>
> THE DIRECTOR OF THE NRO IS MARTIN C. FAGA. THE DEPUTY DIRECTOR OF THE NRO IS JIMMIE D. HILL.[46]

Virtually all else about the NRO, in particular the technologies underlying its systems and details about its many collection missions, remained closely guarded secrets.

(U) Placing the NRO's internal structure on a functional rather than a program basis took a bit longer, but the transition began on 1 January 1993. At about the same time, the organization purchased a sizable plot of land near Chantilly, Virginia, about thirty miles west of Washington. Construction of a new headquarters complex to bring the scattered NRO elements together under one roof began in 1993 or 1994.

~~(S//NF)~~ At about the same time that the NRO emerged into the light, it entered into the last major cooperative agreement with NASA during the period covered by this history. Since the first weather satellites in the early 1960, NASA had launched a number of vehicles dedicated to earth observation. The two programs prominently mentioned in this narrative were Landsat and Seasat. In the 1980s, NASA began planning the next step in earth observations and in 1991, established a program office to manage what later became known as "Mission to Planet Earth."[47]

(U) "Mission to Planet Earth" planned a diverse array of assets to gather data. Indeed, it was to be a "full court press" using satellites, aircraft, and a world-wide network of ground stations. Collection objectives included atmospheric carbon dioxide, cloud cover, soil moisture, land and sea temperatures, solar radiation, glaciers, polar ice packs, atmospheric ozone, freeze/thaw cycles, plate tectonics, magnetic fields, hydrology, and much more. When combined, the collected data would be used to treat the earth as a single, integrated system to better understand the effects that one part of the global ecosphere had on the others. This, in turn, would inform and direct those making important decisions as to the planet's preservation.[48]

~~(S//NF)~~ The collection effort required a bewildering array of advanced technologies and, as it had in the past, NASA turned to the NRO for assistance in the spaceborne segment. In mid-1992, Faga and Goldin signed a Memorandum of Agreement (MOA) outlining the NRO's support. [redacted]

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Figure 12-8. (U) From left: NRO Director Martin C. Faga, NASA Administrator Daniel S. Goldin, and NRO Director Jeffrey K. Harris. (Images: UNCLASSIFIED)

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[redacted] The MOA was brief, only five pages, and closely resembled similar agreements in the past.[49] Appendix 31 contains an unsigned draft copy of the MOA, the only one found during research.

(U) Then, in late 1994, NRO Director Jeffrey Harris and Goldin jointly requested an Unclassified Memorandum of Understanding (MOU) to bring the "fact of," and only the "fact of," their association into the open. The two executives probably signed the brief and generally worded memorandum in the spring of 1995. The accord established, *inter alia*, a coordinating and management structure, highlighted joint efforts to translate technological developments and research tools into operational systems, and, given that specific activities remained classified, made the NRO responsible for security. In many ways, the memorandum simply restated the policies and practices of the previous thirty-four years, which suggested that both parties were satisfied with how those policies and practices had worked.[50] Appendix 32 contains a late draft of the MOU, the only one found during research.

* * * * *

(U) Both parties benefited from the end of their engagement over the Shuttle, although the NRO profited the most. The NRO was now free of an entanglement that had upset its launch schedule and clouded relations with NASA's senior management, particularly as the 1980s progressed. The NRO was also free of the political forces that seemed intent on wedding the nation's entire launch capability to an expensive and unreliable vehicle. The national security sector could now use whatever combination of Shuttles and expendable launchers that best met its needs, something the NRO had favored since early 1984 and may well have favored for some time before that. NASA could, in turn, now focus on using the Shuttle to support construction and maintenance of a manned space station, its primary mission all along.

~~(S//TK//NF)~~ The big success story of the period, [redacted]

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(U) Declassifying the "fact of" the NRO was the right decision made at the right time. Recommendations to do so in the interest making it easier to do business with other agencies had been in circulation for twenty years. By the early 1990s, the Soviet Union had collapsed and there were no significant domestic or international penalties to be paid, the original reasons from secrecy no longer existed. Besides, its existence had been an open secret for two decades.

(U) One ramification from declassifying the NRO's existence was the effect it had on relations with NASA. Even though it took until 1995, it was probably inevitable that the two organizations would also declassification the "fact of" their collaboration. The relationship had all along been required by the National Space Act of 1958 and reasonably informed personnel could have surmised the "fact of" their collaboration, although it never seemed to attract the same public attention as did the "fact of" the NRO.

(U) The following chapter, a brief summary notes some of the high and low points and lessons learned during thirty-four years of secret interaction dating back to 1961.

(U) Chapter Thirteen

(U) Concluding Remarks

~~(S//TK//NF)~~ The issues and programs that required the NRO and NASA to work together were numerous, but many are not covered in this narrative because they were inadequately documented or lacked any documentation at all. For example, the Fiscal Year (FY) 2006 Air Force/NASA/NRO cooperative plan lists twenty-six diverse points of interaction with another twenty under consideration. Some of those points—[redacted] earth observations, and expendable launch vehicles—will be familiar to those who have perused this history; others—war gaming, modeling, and simulation—will not. Taking the FY 2006 plan as a model, suggests that the 1961-1995 interaction between the two organizations was similarly varied and wide ranging.[1]

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~~(S//NF)~~ The lack of documentation was most obvious in the area of technology. With minor exceptions, technological transfers were always from the NRO to NASA, making it seem that the latter reaped nearly all of the benefits. That was neither true nor fair to NASA. NASA carried out a lot of important scientific work relative to space and did basic experimentation from which the NRO, the Air Force, and civilian industry profited. This activity did not, however, find its way into the archives, making it impossible relate a wide range of activities for which NASA deserves credit.

~~(S//NF)~~ Still, the span of activities covered herein was sufficiently expansive to make a point-by-point summary both impractical and unnecessary. Better to place major events into somewhat flexible categories, note the central issue(s), and the lessons that can be learned from them. Those categories—cultural differences, conflict resolution, program justification, and technological transfer and sharing—are by no means unique to the NRO and NASA. Indeed, all can be found to varying degrees in the interaction between all large governmental organizations, both civilian and military.

(U) Cultural Differences

(U) This is the most apparent of the categories. NASA was by legal statutes and its own inclinations an above board entity whose many beneficial programs made it a goodwill ambassador for the United States. It also served as a public symbol of America's technological prowess, a particularly important role during the early days of the space age and the "space race" with the Soviet Union. Everyone in NASA from the administrator on down can be justifiably proud of those accomplishments.

(U) Not surprisingly, NASA relished publicity as a means of getting its message out to the world and garnering public support. As of this writing, NASA has about forty Unclassified books, ranging from impressive "coffee table" collections of photography to more serious works, in various stages of production.[2] In addition, there are magazines, journals, vast numbers of pamphlets and brochures, a NASA television channel, and NASA internet sites. Publicity has kept NASA in the public eye and helped justify some of its more expensive endeavors, in particular manned programs.

(U) NASA had, and still has, a large population of technicians, scientists and engineers many of whom had little appreciation of security and have at most only entry level security clearances, not the codeword kind that governed NRO-NASA interaction. Combined, the openness, penchant for publicity, a staff somewhat indifferent to security requirements, and a majority of employees unwitting of the NRO connection sometimes challenged NASA's ability to keep secrets and operate within the boundaries set by security.

(U) The NRO's world could hardly have been more different. If NASA was the brass band marching down the middle of Main Street, the NRO was for three decades a vague image lurking in the darkest shadows and only dimly perceived. Security and keeping secrets were virtually acts of faith for its personnel and, in fact, secrecy was central to its culture. Thus came about a built-in divide: openness at NASA and complete secrecy at the NRO. Yet whatever the risk of compromising the nation's most secret intelligence collector, the provisions of NASA's founding document, the National Aeronautics and Space Act of 1958, made cooperation with the NRO, as part of the defense establishment, mandatory.

~~(S//NF)~~ The available evidence shows that the defense establishment had issues with NASA's relaxed attitude toward security from an early date. The problem burst onto the scene in the mid-1960s when NASA began planning for what became the Landsat earth observation satellites. Those plans contained initiatives and ideas that seemed to encroach on the NRO's mission and threaten to compromise the level of American technology. This did not please the national security establishment. The 1965 negotiations that placed limits on the sensors to be carried on Landsat satellites and the September 1966 establishment of a coordination and mission approval structure were in direct response to the problem.

~~(S//NF)~~ NASA came into better alignment with security standards in the late 1960s, but the problem persisted. Since most NASA personnel were unwitting of the NRO, much less its connection with their own organization, individuals and offices in all innocence sometimes crossed the ill-defined line separating the acceptable from the unacceptable. Unauthorized acquisition contracts, information released to the general public without first gaining approval, and the strange case of [redacted] (b)(1) (b)(3) that can be laid squarely at NASA's feet, though there may have been. Indeed, the problem with NASA and its openness will to some degree remain a fixture in NASA-NRO relations.

(U) Conflict Resolution

~~(S//NF)~~ Conflicts between the two agencies in large measure arose from the difficulty in coordinating NASA's above board, peaceful mission with the NRO's national security mission. NASA was, and will always be, at a disadvantage in disagreements over programs with national security implications. The security establishment may someday have to cite national security to end a dispute that otherwise defies resolution, but that is unlikely. It would be a measure of last resort and NASA, despite resolutely defending its programs, has never taken unreasonable positions. In fact, nothing in the evidentiary base for this history suggests that playing the national security trump card ever received any consideration whatever the disagreements. Creating mission coordination and approval structures, negotiating around problems, and crafting well thought out compromises were the preferred ways of doing business.

~~(S//NF)~~ Whatever the disadvantage it labored under, NASA had to protect and advance its interests. Doing so took a number of forms. In the mid-1960s, NASA Associate Administrator Robert Seamans took a conciliatory attitude when he negotiated constraints on the sensors to be used in earth observations that did not really impede the program. He also gained at least a tacit understanding that those constraints would be relaxed over time. A decade later, Deputy Administrator George Low made shrewd use of evidence when he won permission to release absolute altimetry obtained by Geodynamic Experimental Ocean Satellite No. 3 (GEOS-3) and the Seasat synthetic aperture radar satellite despite strong DOD opposition. A decade after that, Administrator James Beggs won Presidential approval for the Manned Space Station despite virtually no support outside NASA and played political hardball in arriving at a remarkably favorable agreement on DOD's use of the shuttle.

(U) The lesson to be drawn from the above is that talented executives can at least partially offset a disadvantaged position by being patient and believing in and defending their programs using a number of tactics, including occasionally "going to the mat." Though some questioned NASA's tactics in protecting its programs, in particular the shuttle, NASA can be well satisfied with how well it did over the years.

(U) Program Justification

~~(S//NF)~~ In the 1960s, NASA had largely stayed clear of matters related to reconnaissance and national security. It could do so because the Apollo moon landing program dominated the agency and left it with little money for other projects. That was changing even as the first astronauts walked on the moon in 1969. The forecast end of the Apollo program meant that NASA could diversify, but the drawdown of the Vietnam War, which promised a "peace dividend;" funding for an array of new social programs; and declining interest in space made it a bad time to initiate new programs. NASA found it particularly difficult to secure funding for programs that were long term, expensive, or of questionable value. In this more challenging environment NASA began using support of national security as a part of program justification. The Space Shuttle, Landsat, and, later, the Manned Space Station were the main programs involved.

~~(S//NF)~~ Administrator James Fletcher's 1973 proposal to use Landsat to collect economic intelligence on staple food crops worldwide knowingly crossed the line into reconnaissance. It placed NASA's public persona at some risk if word of that leaked out; the same risk applied to Landsat. Nations that appreciated Landsat and used its products might withdraw the welcome mat and demand restrictions on imaging their sovereign soil. That would put the United States in the embarrassing position of having to defend itself and NASA before an international community still not entirely at ease with observations from space.

~~(S//NF)~~ Nevertheless, Fletcher had sufficient reason for doing what he did. Landsat did not have a lot of support within budgetary circles because of persistent questions about the program's worth. When he made his recommendation, funding extended only through the second satellite and program cancellation loomed as a real possibility. The [redacted] that arose out of Fletcher's proposal was an effort to save the program, which it may well have done given Landsat's sometimes perilous existence in later years.

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~~(S//NF)~~ Moreover, offering Landsat as a reconnaissance asset was not that radical a move because the program was already headed in that direction. Corona and Gambit had figured in crop analysis as early as 1966, and the expectation was that NASA's earth observation satellites would be put to the same use once they became available. [redacted]

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~~(S//NF)~~ To be fair, being tied to the shuttle did harm to the NRO constellation of collectors, but not lasting harm. Improvements over the years now permitted reconnaissance satellites to operate beyond their design lives and no on orbit collector failed during this time, although quite a few were degraded. Still, there is a lesson to be learned from this episode. The early 1970s DOD decision to base its commitment on demonstrated reliability was correct, but it could not withstand the political pressure generated by the shuttle's many high-level supporters. Thus, politics emerged as a major influence on the selection of launch vehicles, and that is a poor foundation on which to base access to space.

(U) Technological Transfers and Shared Assets

~~(S//NF)~~ The technological transfers during this period were, with minor exceptions, always from the NRO to NASA. The two major instances of this, the Samos to Lunar Orbiters and, more importantly, the [redacted] Hubble Space Telescope were carried out efficiently and under security that obscured both the technology and the NRO's participation. Hubble had problems after its launch, but none of them stemmed from the transfer. In fact, [redacted] could well serve as a model for similar actions in the future.

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~~(S//NF)~~ That said, however, transfers needed to be carried out at the proper time and in the proper way. Advanced systems, even those with similar missions, often had different and very precise technical requirements that made it difficult to adapt hardware for use elsewhere because it is too inflexible. [redacted]

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~~(S//NF)~~ Technological transfers were, therefore, best accomplished by transferring the technology at a point and in a form that allowed the receiving organization to make the necessary modifications without undue delays or expense. Generally, that was in the form of basic technology—blueprints, engineering concepts, etc—rather than systems and components. The Samos to Lunar Orbiter and the [redacted] Hubble transfers obviously accomplished that. In the case of the former, the modifications included a greatly improved data relay system and two lenses suited for lunar reconnaissance. In the latter case, Hubble and [redacted]

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(U) To reiterate a point made relative to NASA-NRO interaction on the shuttle, this history focused almost exclusively on key personnel and major issues at the policymaking levels of both organizations. The archival evidence and those interviewed left no other choice. As such, it dealt with disagreements that in some cases created discord, but only at the highest levels. There is no evidence that any of the disagreements affected subordinate levels where NRO and NASA representatives worked in harmony. Indeed, the only serious problem discernable at the lower levels involved security breaches, unfortunate events that can happen anywhere and at any time.

(U) With the notable exception of the Space Shuttle, NASA-NRO interaction during the years of secrecy was a success story. Working together, the two organization avoided duplication of effort, cut costs, assisted each other's missions, made improvements in space-related technology, advanced the cause of science, resolved disputes, and supported national security. That was exactly what the framers of the National Aeronautics and Space Act of 1958 had in mind when they mandated cooperation between NASA and the defense establishment. Given that the 1958 legislation is still on the books, the benefits that have accrued, and the span of programs currently involving the two organizations, a NASA-NRO working relationship is clearly a permanent fixture.

(U) Chronology of NASA-NRO Interaction, 1961-1995

1957

October: (U) Soviet Union launches Sputnik, the first artificial earth satellite, ushering in the space age and the space race.

1958

January: (U) United States launches its first satellite, Explorer-1, aboard Army Jupiter-C booster.

February: (U) Corona begins work on a film-return photo reconnaissance satellite. Its public name is Discoverer.

February: (U) Samos concentrates on electronically returning images from space.

July: (U) The National Aeronautics and Space Act of 1958 becomes law.

October: (U) NASA created to manage all space programs not of a military nature.

1959

January: (U) Discoverer-1 ends in failure, as do the next eleven flights.

Unknown: (U) NASA acquires several military space programs, their associated facilities, and the nation's meteorological satellite program.

1960

May: (U) Soviets shoot down Francis Gary Powers' U-2, ending overflights of the Soviet Union.

June: (U) GRAB/DYNO, a Signals Intelligence (SIGINT) collector, becomes the world's first reconnaissance satellite.

Mid-year: (U) NASA acquires the Army Ballistic Missile Agency despite intense opposition.

August: (U) Discoverer-13 returns its recovery vehicle, which did not carry film.

August: (U) Discoverer-14 becomes the first completely successful mission by returning its reentry vehicle, which did carry film.

1961

January: (U) Samos satellite electronically returns imagery from earth orbit during its only mission.

April: (U) Yuri Gagarin becomes the first human to orbit the earth.

April: (U) President Kennedy commits the nation to landing a man on the moon and returning him to earth by the end of the decade (Project Apollo).

April: (U) NASA representatives inquire about Samos technology to support an unnamed program, undoubtedly Apollo.

September: (U) NRO is created to manage all satellites and aircraft programs that overfly denied areas.

December: (U) NASA inaugurates Project Gemini.

1962

May: (U) The President's Foreign Intelligence Advisory Board (PFIAB) Chairman, James Killian, recommends a complete review of policies governing satellite reconnaissance.

May: (U) Kennedy signs National Security Action Memorandum (NSAM) 156, ordering the review Killian recommended.

June: (U) The NSAM 156 Committee presents its review and attendant recommendations to Kennedy.

Late: (U) DOD and NASA representatives discuss lunar reconnaissance requirements.

1963

May: (U) NASA lays out plans for both manned and unmanned lunar reconnaissance.

July: (U) NASA, NRO, and CIA representatives visit Eastman Kodak to inquire using the Samos camera system to locate lunar landing sites for Apollo.

August: (U) DOD, CIA, and NASA sign an agreement authorizing use of NRO optical technology in support of Apollo.

September: (U) NASA establishes a Lunar Orbiter Program Office.

December: (U) Boeing and Eastman Kodak win the contract for five unmanned Lunar Orbiters that incorporate Samos technology.

December: (U) DOD cancels DynaSoar, a precursor to the Space Shuttle.

December: (U) First mention of the Air Force's Manned Orbiting Laboratory (MOL), which will secretly contain the NRO's Dorian high resolution optical system. Dorian was also known as the KH-10.

1964

February: (U) NASA agrees to let the NRO handle all classified contracts associated with the Lunar Orbiters.

April: (U) The NRO agrees to transfer its state-of-the-art optical technology to NASA's Lunar Mapping and Survey System (LM&SS), a backup program should the Lunar Orbiters fail. Project Upward will provide BYEMAN security.

May: (U) NASA and Boeing contract for five Lunar Orbiters.

September: (U) NASA turns down offer to include experiments on the MOL.

December: (U) Quill, an experimental NRO synthetic aperture radar (SAR) imaging satellite electronic returns radar imagery during its only mission.

Unknown: (U) NASA inaugurates the Apollo Applications Program.

1965

March: (U) NASA agrees to put experiments aboard the MOL to head off questions about Skylab being a duplication of effort.

April: (U) NASA announces plans for earth observations as part of Apollo Applications Program.

April-May: (U) DOD and the NRO protest NASA's earth observation plans for proposing systems that could compromise sensitive technology.

July: (U) NASA accepts a 66-foot resolution limit on imaging sensors to be used in earth observations.

August: (U) President Johnson approves the MOL and its Dorian system.

August: (U) As a security measure, the military services are prohibited from working with NASA except through the NRO.

Fall: (U) Early Gambit (KH-7) optics confirmed for use in the LM&SS program.

Unknown: (U) NASA backs out of the MOL program except for providing the Gemini B that will ferry crews to and from the spacecraft and some auxiliary equipment. It does so because there is no longer a threat to Skylab.

Unknown: (U) NASA begins design studies of what became the Hubble Space Telescope.

1966

January: (U) DOD and NASA establish the Manned Space Flight Policy Committee (MSFPC) to oversee manned programs and coordinate NRO-NASA activities.

May: (U) NSAM 156 Committee reconvened to update the guidance protecting the nation's satellite reconnaissance programs.

June: (U) Boeing delivered Lunar Orbiter-1.

June: (U) NASA inquires if the Dorian optics can perform celestial observations on a non-interference basis and gets a negative answer.

August: (U) Lunar Orbiter-1 launches.

September: (U) DOD/NASA agreement establishes the Survey Applications Coordinating Committee (SAAC) subordinate to the MSFPC.

November: (U) Lunar Orbiter-2 launches.

December: (U) Opinion in NASA is divided on whether the first two Lunar Orbiters have located enough lunar landing sites.

1967

February: (U) Lunar Orbiter-3 launches.

May: (U) Lunar Orbiter-4 launches.

June: (U) NASA contracts with Lockheed for concept study of what became the Landsat earth observations satellite.

June: (U) Further study shows that the Lunar Orbiters have certified sufficient lunar landing sites.

Summer: (U) NASA commits to unmanned satellites as the primary collectors for its earth observation program.

July: (U) Under pressure from DOD, NASA begins a concerted effort to submit the appropriate items to the MSFPC and SACC for coordination and approval.

August: (U) Lunar Orbiter-5 launches.

August: (U) NASA cancels the LM&SS and Project Upward.

December: (U) An updated DOD-NASA coordinating and decisionmaking structure supersedes the one agreed to on 26 September 1966.

1968

April: ~~(S//NF)~~ The NRO and the White House concur with Apollo-6, an unmanned earth orbit mission, photographing the earth with a Mauer camera.

July: ~~(S//NF)~~ The NRO consigns the Itek (-9) camera to NASA for earth observations.

[redacted] (b)(1)
(b)(3)

December: (U) The second Orbiting Astronomical Observatory (OAO-II) rides an Atlas-Agena booster into orbit where it provides proof of concept of a space telescope.

1969

June: (U) Nixon cancels MOL and Dorian due to repeated delays, large cost overruns, and lack of utility.

July: (U) Apollo-11 crew lands on the moon and returns safely to earth marking the apex on the program.

October: (U) NRO Director John McLucas slightly loosens the restrictions on NASA's imaging systems.

October: ~~(S//TK//NF)~~ The NRO and NASA begin discussions on transferring surplus Corona spacecraft for use in earth observations.

* ~~(S//NF)~~ Known as [redacted]1 at the time. (b)(1)
(b)(3)

1970

February: ~~(S//TK//NF)~~ The NRO formally offers NASA surplus Corona spacecraft; NASA declines because it is turning to electronically downlinking imagery.

February: (U) NASA and the Air Force, as DOD representative, sign an Unclassified agreement pledging cooperation on Space Shuttle matters.

March: (U) NASA inquires about transferring excess U-2s from NRO Program D to boost its airborne collection capability.

April: (U) NRO agrees to transfer some Dorian hardware to NASA.

June: ~~(S//TK//NF)~~ NRO and White House concur with Apollo-13 flying an earth observation mission if it cannot depart on a lunar trajectory. All subsequent Apollo missions received the same concurrence.

Summer: (U) General Electric wins the acquisition contract for Landsat, the first earth observation satellite.

Fall: (U) The NRO, using the Air Force as cover, agrees to loan two U-2Cs to NASA.

Unknown: (U) NASA sizes the shuttle's payload bay to accommodate the largest American spacecraft, the Hexagon photo reconnaissance satellite.

1971

January: ~~(S//TK//NF)~~ NASA requests permission to fly a camera with a 30-foot resolution on Skylab.

April: (U) NASA takes delivery of two NRO U-2Cs.

June: (U) A NASA sponsored study finds the shuttle to be cost effective by flying twenty-five to thirty missions annually, well below the projected number of launches. Few outside NASA believe it.

September: ~~(S//TK//NF)~~ The 156 Committee approves a camera with a 30-foot resolution on Skylab.

September: (U) Congress informs NASA that it will fund either the Space Shuttle or the Manned Space Station, but not both. The shuttle has priority since it vital to constructing and maintaining the space station.

September: ~~(S//NF)~~ NASA study shows that the shuttle can save the NRO $3.47-$5.31 billion over thirteen years. Similar NRO and Air Force assessments strongly disagree.

1972

January: (U) President Nixon approves shuttle development and designates it as a national carrier to be used in time by all as their primary launch vehicle.

February: (U) DOD decides not to commit payloads to the shuttle until it proves its reliability ("fly before buy").

March: (U) The Executive Committee of the National Reconnaissance Program rejects downgrading the "fact of" the NRO and satellite reconnaissance to collateral Secret.

July: (U) A Delta booster sends NASA's Landsat-1 into a near-polar orbit.

August: (U) NASA awards the shuttle acquisition contracts.

(b)(1)
(b)(3)

September: (U) DOD begins tentative planning on utilizing the shuttle.

December: ~~(S//TK//NF)~~ NASA first explores using [redacted] for Hubble.

Unknown: (U) The National Security Council (NSC) rejects declassifying the "fact of" photographic satellite reconnaissance.

1973

February: ~~(S//NF)~~ The 156 Committee puts sensitive areas off limits to Skylab photography.

Early in year: (U) DOD Space Transportation System Users Committee formed.

April: [redacted] (b)(1)

May: (U) A Saturn-V booster propels Skylab into orbit, but it is damaged during the launch.

[redacted] (b)(1) (b)(3)

June: [redacted] (b)(1)

[redacted] (b)(1) (b)(3)

September: (U) Nixon downgrades the "fact of" photographic reconnaissance satellites and selected imagery to collateral Secret.

September: ~~(S//NF)~~ NASA administrator Fletcher proposes that Landsat collect economic intelligence on staple crops worldwide.

Unknown: (U) NASA envisions both a "Space Tug" and an Inertial Upper Stage (IUS) to boost satellites from shuttle deployment altitudes to operational altitudes.

1974

February: ~~(S//TK//NF)~~ The NRO performs a for-information-only cost analysis of launching four reconnaissance payloads on the shuttle.

February: (U) The shuttle passes its preliminary design review.

Early in year: (U) Hubble becomes a line item in NASA's budget.

Early in year: (U) NASA plans for Hubble's launch in 1980.

(b)(1)
(b)(3)

Early in year: (U) Congress refuses to fund Hubble with a 120-inch aperture.

May: (U) NASA reduces Hubble's aperture to [redacted] to save money.

[redacted]

May: (U) [redacted]

May: (U) Fabrication of the first shuttle orbiter begins.

[redacted] (b)(1) (b)(3)

December: ~~(S//TK//NF)~~ [redacted]

Unknown: (U) Initial operating capability (IOC) of shuttle launch facility at Vandenberg Air Force Base, California, slips one year, to late 1982, even though construction will not begin until 1979.

1975

January: (U) Landsat-2 launched earlier than previously planned to support [redacted]

[redacted] (b)(1) (b)(3) (b)(1)

March: ~~(S//TK//NF)~~ NRO Director Plummer issues the first instructions on transitioning NRO payloads to the Shuttle. The instructions are for information only.

Summer: (U) NASA enters into an agreement with the Netherlands to develop and fly an Infrared Astronomical Satellite (IRAS). The United Kingdom joins a year later.

Summer: ~~(S//TK//NF)~~ NASA and the NRO reach agreement on the specifications and operations of the former's Seasat SAR satellite.

July: (U) NASA funds an Eastman Kodak study of using electro-optical technology in Hubble.

August: (U) NASA and DOD establish the Program Review Board and two subordinate committees to coordinate and approve selected NASA space programs. This replaces the structure in place since 1967.

August: (U) The NSC establishes the Space Policy Committee to oversee the nation's space programs.

[redacted] (b)(1)

December: ~~(S//NF)~~ DOD issues its first schedule for transiting all payloads, minus those of the NRO, to the Shuttle. The plan does not imply commitment.

[redacted] (b)(1) (b)(3)

Unknown: ~~(S//TK//NF)~~ NRO transition costs associated with putting payloads on the Shuttle far exceed that expected.

1976

January: ~~(S//NF)~~ The NASA-DOD coordinating structure begins looking into the problem of IRAS [redacted] (b)(1) (b)(3)

February: (U) The Payload Accommodation Working Group, a multi-agency panel, is established to work shuttle transition issues.

March: ~~(S//NF)~~ NASA releases twenty-twenty-five Unclassified reports on the electronic data [redacted] (b)(1) (b)(3)

March: ~~(S//TK//NF)~~ NASA begins investigating what [redacted] will benefit Hubble.

April: ~~(S//TK//NF)~~ Program Review Board finds that Hubble's [redacted]

Summer: ~~(S//TK//NF)~~ NASA and the NRO endorse a security plan [redacted]

September: ~~(S//NF)~~ Space Policy Committee recommends allowing Landsat imaging systems to have a 33-foot resolution, but cannot agree on declassifying the "fact of" satellite reconnaissance.

September: (U) The *Enterprise* orbiter rolls out of the Rockwell International Plant.

[redacted] (b)(1) (b)(3)

1977

January: (U) DOD and NASA sign an Unclassified agreement on shuttle management.

January: (U) DOD and NASA sign an Unclassified agreement on shuttle charges.

March: (U) Competitors submit proposals for Hubble acquisition contracts.

July: (U) Lockheed and Perkin-Elmer win the major Hubble acquisition contracts.

August: (U) *Enterprise* begins glide tests.

October: (U) NASA approves the Hubble acquisition contracts to begin in FY 1978.

October: ~~(S//TK//NF)~~ Hubble security measures revised at the NRO's insistence.

Fall: ~~(S//NF)~~ DOD approves the IRAS mission if the satellite does not "stare" at non-celestial objects and NASA keeps the master data file.

† ~~(S//NF)~~ Known as [redacted] at the time. (b)(1) (b)(3)

December: ~~(S//NF)~~ DOD and NASA adopted interim measures to integrate classified missions into NASA's Johnson Space Center launch structure, but a separate DOD facility is envisioned.

December: (U) President Carter approves a 4-orbiter shuttle fleet.

Unknown: (U) NASA projects Hubble's launch in 1983.

Unknown: (U) NASA cancels the "Space Tug" and awards the IUS acquisition contract to Boeing Aerospace.

1978

[redacted] (b)(1) (b)(3)

February: ~~(S//TK//NF)~~ The NRO tentatively identifies six systems for launch of the shuttle and sets the backup expendable launch inventory at eleven vehicles.

March: (U) NASA and others defeat an attempt to halt construction of a shuttle launch facility at Vandenberg.

April: ~~(S//NF)~~ President Carter signs the nation's first comprehensive space plan approving NASA imaging sensors with a 33-foot resolution, confirming the shuttle as a national carrier, and downgrading the "fact of" satellite reconnaissance to collateral Confidential.

June: (U) An Atlas booster launches NASA's Seasat SAR satellite. It fails after only forty-two days in orbit.

[redacted] (b)(1)

Summer: (U) Congress directs DOD to submit a plan for transitioning its payloads to the shuttle.

September: (U) Carter makes the "fact of" photographic space reconnaissance public knowledge.

December: ~~(S//TK//NF)~~ DOD submits plan to transition twelve payloads to the Shuttle, half of them belong to the NRO. Complete transition will be in 1985.

December: (U) Trouble with the shuttle's liquid-fueled engines pushes the first orbital flight back to December 1980.

[redacted] (b)(1)

Unknown: ~~(S//TK//NF)~~ The NRO initiates two programs, later combined into one, Damon, to use Hexagon technology for a wide area imaging system that will ride on the shuttle.

1979

January: ~~(S//NF)~~ NRO director Hans Mark initiates a program to train payload specialists to handle classified DOD payloads on the shuttle.

January: (U) Construction begins on Vandenberg shuttle facility with IOC set for late 1983, a further slip of one year.

Early in year: ~~(S//TK//NF)~~ Mark recommends Program B's [redacted] for development, but Carter overrules him by selecting Program A's [redacted]

(b)(1)
(b)(3)

June: (U) Vandenberg shuttle facility's IOC slipped to June 1984.

October: ~~(S//NF)~~ Fiscal Year (FY) 1980 budget funds construction a separate facility to eventually control all DOD Shuttle missions, including those of the NRO.

[redacted]

(b)(1)
(b)(3)

Late in year: (U) Mark fails to get the "fact of" the NRO declassified.

1980

[redacted]

(b)(1)

[redacted]

(b)(1)

(b)(1)
(b)(3)

1981

April: ~~(TS//TK//NF)~~ *Columbia* launches on the first Space Transportation System Mission (STS-1). [redacted]

July: (U) The Vandenberg shuttle facility's IOC slips a further fifteen months to October 1985.

October: ~~(S//TK//NF)~~ NASA approaches the NRO about putting covert collectors on its planned Manned Space Station.

[redacted]

(b)(1)
(b)(3)

November: (U) *Columbia* carries NASA's Shuttle Imaging Radar-A (SIR-A), a SAR system, aloft on STS-2.

1982

[redacted]

(b)(1)
(b)(3)

April: ~~(TS//TK//NF)~~ Hans Mark, now NASA Deputy Director, [redacted]

May: ~~(S//TK//NF)~~ The NRO finds no requirements for covert collectors on the Manned Space Station.

June: (U) *Columbia* flies STS-4. NASA declares that the shuttle has achieved IOC.

‡ ~~(S//NF)~~ Known as [redacted] at the time.

(b)(1)
(b)(3)

December: (U) DOD begins reevaluating its schedule for transitioning to the shuttle.

1983

February: (U) President Reagan confirms a 4-orbiter shuttle fleet.

March: ~~(S//TK//NF)~~ The IUS suffers a partial failure launching TDRSS-A, delaying the first NRO payload launch on the shuttle by over a year.

March: (U) Vandenberg shuttle facility to reach IOC in October 1985, three years behind the original schedule.

March: ~~(S//NF)~~ DOD cannot identify any payloads or missions that need to be on the Manned Space Station.

March: ~~(S//TK//NF)~~ The Intelligence Community cannot identify any need for payloads on the Manned Space Station.

April: (U) DOD commits its payloads to the shuttle and cancels expendable launcher purchases, though for reasons other than faith in the vehicle itself.

Summer: (U) DOD begins rethinking its recent commitment to the Shuttle.

October: (U) DOD receives funds to solicit proposals for ten additional heavy-lift expendable launchers.

December: ~~(S//TK//NF)~~ The PFIAB sharply criticizes the NRO's reliance on the shuttle.

[redacted] (b)(1)

1984

[redacted] (b)(1) (b)(3)

January: (U) Reagan approves NASA's Manned Space Station.

March: (U) DOD solicits proposals for ten heavy-lift expendable launchers.

May: (U) NASA Administrator James Beggs accuses DOD of planning to abandon the shuttle despite reassurances to the contrary.

[redacted] (b)(1) (b)(3)

Spring: (U) NASA announces it will enter a shuttle-based design, the SRB-X, in the competition for the additional expendable launchers.

May: (U) DOD rules that NASA cannot enter its SRB-X because it will put the government in direct competition with civilian industry, which is illegal.

June: (U) DOD compromises by allowing NASA to enter its SRB-X as a "government sponsored alternative" to whichever design wins the civilian competition.

October: ~~(S//TK//NF)~~ *Columbia*, flying STS-13, carries SIR-B, an improved SAR, and the Hexagon-based Large Format Camera aloft on what was the latter's only flight.

December: (U) Martin-Marietta's Titan-IV wins the civilian competition for ten heavy lift conventional boosters.

[redacted] (b)(1)

December: ~~(S//TK//NF)~~ Complete NRO payload transition to the Shuttle now estimated in 1992.

1985

January: (U) Beggs asks DOD to procure a new shuttle-based design, the Shuttle Derived Vehicle, without competition or delay buying additional expendable launchers for a year. Secretary of Defense Casper Weinberger denies both requests.

January: (U) Beggs warns that he cannot support the national launch strategy due to DOD's position on the shuttle and expendable launchers.

[redacted] (b)(1)
(b)(3)

February: (U) Beggs and Aldridge reach a compromise on the shuttle. The former pledges twenty-four launches per year, while the latter reaffirms DOD's intent to use that vehicle. DOD will still buy additional expendable launchers as backups.

February: (U) Titan-IV selected over NASA's SRB-X as the new heavy-lift booster.

[redacted] (b)(1)

June: ~~(TS//TK//NF)~~ [redacted] (b)(1)
(b)(3)

August: ~~(S//TK//NF)~~ Titan-34 [redacted] fails four minutes into flight.

September: (U) Aldridge accepts offer to fly on the shuttle as a payload specialist.

November: (U) DOD and NASA renegotiate the charges for a shuttle launch, resulting fixed and variable fees.

December: (U) Beggs resigns from NASA to answer charges of fraud perpetrated while a defense contractor. He clears his name but it took time.

1986

January: (U) *Challenger* explodes shortly after liftoff, killing all seven crewmembers, destroying TDRSS-B, and grounding the shuttle fleet.

February: (U) NASA Associate Administrator Richard Truly predicts the shuttle will return to service in one year.

April: (U) Titan-34 explodes seconds after launch, taking the last Hexagon imaging satellite with it. The Titans are grounded.

May: (U) James Fletcher begins his second tenure as NASA Administrator.

May: (U) Fletcher extends shuttle grounding to eighteen months.

June: (U) Presidential commission issues its report on *Challenger* disaster.

October: (U) Shuttle launch facility at Vandenberg mothballed.

December: (U) President Reagan cancels the shuttle's status as a national carrier.

1987

January: (U) DOD cancels construction of the operations center in Colorado meant to control all DOD payloads manifested on the shuttle.

Early: (U) Training payload specialists to handle classified shuttle payloads atrophies and is cancelled in 1988.

April: (U) Titan-34s returns to service.

May: (U) NASA announces that the shuttle will return to service in June 1988.

September: ~~(S//TK//NF)~~ The NRO begins pulling payloads off the shuttle due to its unreliability and lack of performance. Five NRO payloads will still use the shuttle.

September: ~~(S//TK//NF)~~ Schedule shows that the last NRO shuttle payload will launch in FY 1990.

Unknown: (U) DOD cancels the Vandenberg shuttle facility.

1988

March: ~~(S//TK//NF)~~ NRO confirms abandonment of the shuttle after five more launches.

[redacted] (b)(1) (b)(3)

1989

[redacted] (b)(1) (b)(3)

1990

April: (U) *Discovery* carries Hubble into orbit. The telescope has a manufacturing flaw in its primary mirror.

[redacted] (b)(1)

1991

[redacted] (b)(1)

1992

[redacted] (b)(1)

July: ~~(S//TK//NF)~~ NASA and the NRO sign classified agreement covering the latter's participation in the former's "Mission to Planet Earth."

September: (U) DOD declassifies the "fact of" the NRO.

[redacted] (b)(1)

(b)(1)
(b)(3)

1993

January: (U) NRO begins transition from a program to a functional internal structure.

December: ~~(TS//TK//NF)~~ *Endeavor's* crew, flying STS-61 [redacted] repairs Hubble.

1994

April: (U) *Endeavor* carries SIR-C aloft, a further improved SAR, a decade after the flight of SIR-B.

[redacted] (b)(1)
(b)(3)

1995

Spring: (U) Joint NRO-NASA statement declassifies the "fact of" their relationship.

(U) Programs and Missions

(U) *Apollo*[*]: The United State's moon landing program (1961-1972).

(U) *Apollo Application Program:* Effort to extend Apollo's mission into areas other than just a moon landing (1965-1972).

(U) *Applications Technology Satellites*: Experimental communications satellites with a variety of missions (1966-1977).

(U) **Corona**: BYEMAN designation for the world's first film-return reconnaissance satellite system (1960-1972). Also known by the TALENT KEYHOLE designations of KH-4, Mission 1000, Mission 1100, and Mission 9000.

~~(S//NF)~~ [redacted] BYEMAN designation for the world's first electro-optical, near-real-time imaging reconnaissance satellite system, formerly known as [redacted] (1976-Present). Also known by the TALENT KEYHOLE designations of KH-11, [redacted] (b)(1) (b)(3)

~~(S//TK//NF)~~ **Damon:** The final BYEMAN name for a failed attempt to develop a Hexagon-based area search imaging system for use on the Space Shuttle (1980).

(U) *Discoverer:* NASA multi-mission program that provided cover for Corona during its early years.

(U) **Dorian:** BYEMAN name for a failed program to secretly mount a reconnaissance imaging system in the Air Force's Manned Orbiting Laboratory (1965-1969). Also known by the TALENT KEYHOLE designation of KH-10.

[redacted] (b)(1) (b)(3)

(U) DynaSoar[†]: Cancelled Air Force space glider and precursor to the Space Shuttle (1959-1963).

(U) *ER-2:* NASA's later designation for the U-2s secretly acquired from the NRO (1982-Present).

(U) *Explorer*: Satellite program that included the United States' first earth orbiting satellite (1958-Present).

(U) **Gambit:** BYEMAN name for a high resolution film-return reconnaissance satellite system (1963-1984). Also known by the TALENT KEYHOLE designations of KH-7, KH-8, and Mission 4300.

[redacted] (b)(1) (b)(3)

(U) *Gemini:* NASA's Two-man follow-on to the Mercury program (1965-1966).

(U) *Geodynamic Experimental Ocean Satellites:* Satellites to measure the earth's geoid, including detecting undersea gravitational anomalies (1965-1975).

(U) *Get Away Special:* Program to extend the Space Shuttle's services to a wider user community (1981-2003).

* (U) NASA's programs and missions are in *italics*. NRO programs and missions are in **boldface**.

† (U) DynaSoar was an Air Force project.

[redacted] (b)(1) (b)(3)

~~(S//NF)~~ **Grab/Dyno:** BYEMAN name for a Signals Intelligence (SIGINT) collector and the world's first reconnaissance satellite (1960-Unknown). Later known by the BYEMAN designation of **Poppy** and TALENT KEYHOLE designation of Mission 7100.

~~(S//TK//NF)~~ **High Altitude Search Pallet:** Early name for a program to develop a Hexagon-based area search imaging system for use on the Space Shuttle (1978).

~~(S//TK//NF)~~ **Hexador:** Rejected proposal to mate Hexagon spacecraft with the Dorian imaging system (1969-1970).

(U) **Hexagon:** BYEMAN name for an area search, film return reconnaissance satellite (1971-1986). Also known by its TALENT KEYHOLE designations of KH-9 and Mission 1200.

(U) *Infrared Astronomical Satellite:* Telescope-equipped satellite to map the celestial sphere in the infrared spectrum (1982).

[redacted] (b)(1) (b)(3)

~~(S//NF)~~ [redacted] BYEMAN name for a low altitude SIGINT collecting system, formally known as **Farrah** (1982-Present). Also known by its TALENT KEYHOLE designation of Mission 7300. (b)(1) (b)(3)

(U) *Landsat:* NASA's premier earth observation satellites (1972-Present).

(U) **Lanyard:** A failed film-return reconnaissance satellite system (early 1960s). Also known by its TALENT KEYHOLE designations of KH-5 and Mission 8000.

(U) [redacted] NASA program to collect economic intelligence against the world's staple crops (1975-Present). (b)(1) (b)(3)

(U) *Lunar Mapping and Survey System:* Manned backup for the Lunar Orbiters if they failed to locate Apollo landing sites. Never used (1964-1967).

(U) *Lunar Orbiters:* Unmanned satellites that were part of Lunar Reconnaissance (1963-1967).

(U) *Lunar Reconnaissance Program:* Imaging the moon's surface from low-lunar orbit to identify landing sites for Apollo (1963-1967).

(U) **Manned Orbiting Laboratory:** See Dorian.

[redacted] (b)(1) (b)(3)

(U) *Mercury:* The United States' first manned orbiting spacecraft program (1961-1963).

(U) *Mission to Planet Earth:* Earth observation program to monitor and protect the planetary environment (1992-Present).

[redacted] (b)(1) (b)(3)

~~(S//TK//NF)~~ **Percheron:** BYEMAN name for a rejected proposal to use Gambit optics for earth observation (1967).

~~(S//TK//NF)~~ **Pathfinder:** The second BYEMAN name for an abortive attempt to develop a Hexagon-based area search imaging system for use on the Space Shuttle (1979).

[redacted] (b)(1) (b)(3)

(U) **Quill:** BYEMAN name for a one-of-a-kind prototype SAR reconnaissance satellite that flew one mission (1964).

(U) *Ranger:* Spacecraft designed to image the lunar surface until the moment of impact.

(U) **Samos:** BYEMAN name for a prototype satellite that electronic downlinked images during the only mission it flew (1961).

(U) *Seasat:* Short-lived ocean monitoring satellite outfitted with a SAR (1978).

(U) *Shuttle Imaging Radar:* Three Unclassified SARs that flew on the Space Shuttle (1984-1992).

~~(S//TK//NF)~~ **Shuttle Infrared Imaging System:** Rejected proposal to put an infrared imaging reconnaissance system on the Space Shuttle (1983).

(U) *Skylab:* The United States' first manned space station (1973-1974).

(U) *Space Transportation System:* (U) Official name of the Space Shuttle Program (1971-2011).

(U) *Surveyor*: Soft landing spacecraft to photograph the lunar surface and test its load bearing capability (1966-1968).

[redacted] (b)(1) (b)(3)

(U) *Tiros*: World's first weather satellite (1960-1967).

[redacted] (b)(1) (b)(3)

(b)(1)
(b)(3)

[redacted]

(U) **Upward:** BYEMAN subcompartment to conceal the NRO's involvement in the Lunar Mapping and Survey System (1964-1967).

~~(S//TK//NF)~~ **Wide Area Search Pallet:** Early name for a program to use Hexagon-based technology to develop an area search imager for use on the Space Shuttle (1978).

(U) **Zeus**: Another BYEMAN name for a failed program to use Hexagon-based technology to develop an area search imaging system for use on the Space Shuttle (1979).

(U) Glossary of Abbreviations and Acronyms

(U) ABMA	(U) Army Ballistic Missile Agency
(U) ACDA	(U) Arms Control and Disarmament Agency
(U) ADF-E	(U) Aerospace Data Facility-East
(U) ADF-SW	(U) Aerospace Data Facility-Southwest
(U) AFSCF	(U) Air Force Satellite Control Facility
(U) ASSET	(U) Aerothermodynamic/elastic Structural Systems Environmental Tests
(U) ATS	(U) Applications Technology Satellite
(U) CIA	(U) Central Intelligence Agency
(U) COMINT	(U) Communications Intelligence
(U) COSTAR	(U) Corrective Optics Space Telescope Axial Replacement
[redacted]	(b)(1) (b)(3)
(U) DCI	(U) Director of Central Intelligence
(U) DD/R&E	(U) Director of Defense Research and Engineering
(U) DMSP	(U) Defense Meteorological Satellite Program
(U) DOD	(U) Department of Defense
(U) E-1	(U) Samos camera system
(U) ELINT	(U) Electronic Intelligence
(U) EOSAT	(U) Earth Observation Satellite
(U) EREP	(U) Earth Resources Experimental Package
(U) ExCom	(U) Executive Committee of the National Reconnaissance Program
(U) FY	(U) Fiscal Year
(U) GAO	(U) General Accounting Office
(U) GAS	(U) Getaway Special
(U) GEOS	(U) Geodynamic Experimental Ocean Satellite
(U) GHz	(U) Gigahertz
(U) GRAB	(U) Global Radiation and Background
~~(S//TK//NF)~~ HASP	~~(S//TK//NF)~~ High Altitude Search Pallet or Hexagon Area Search Pallet
(U) HRMSI	(U) High Resolution Multispectral Stereographic Imager
(U) ICBM	(U) Intercontinental Ballistic Missile
(U) IMINT	(U) Imagery Intelligence

(U) IRAS	(U) Infrared Astronomical Satellite
(U) IUS	(U) Inertial Upper Stage
(U) JSC	(U) Johnson Space Center
~~(S//TK//NF)~~ [redacted]	
(U) LEM	(U) Lunar Excursion Module
(U) LFC	(U) Large Format Camera
(U) LM&SS	(U) Lunar Mapping and Survey System
(U) MHz	(U) Megahertz
(U) MIT	(U) Massachusetts Institute of Technology
(U) MOA	(U) Memorandum of Agreement
(U) MOL	(U) Manned Orbiting Laboratory
(U) MOU	(U) Memorandum of Understanding
(U) MSFPC	(U) Manned Space Flight Policy Committee
(U) NACA	(U) National Advisory Committee for Aeronautics
(U) NASA	(U) National Aeronautics and Space Administration
(U) NATO	(U) North Atlantic Treaty Organization
(U) NERSP	(U) NASA Earth Resources Survey Program
(U) NPIC	(U) National Photographic Interpretation Center
(U) NRO	(U) National Reconnaissance Office
(U) NRP	(U) National Reconnaissance Program
(U) NSA	(U) National Security Agency
(U) NSAM	(U) National Security Action Memorandum
(U) NSC	(U) National Security Council
(U) NSCA	(U) National Security Council Action
(U) NSDD	(U) National Security Decision Directive
(U) OAO	(U) Orbiting Astronomical Observatory
(U) OCV	(U) Orbiting Control Vehicle
(U) OMB	(U) Office of Management and Budget
(U) PD/NSC	(U) Presidential Directive/National Security Council
(U) PFIAB	(U) President's Foreign Intelligence Advisory Board
(U) PHOTINT	(U) Photographic Intelligence
(U) PRIME	(U) Precision Recovery Including Maneuvering Entry
(U) PSI	(U) Pounds per square inch
(U) RCA	(U) Radio Corporation of America

(b)(1)
(b)(3)

(U) SACC	(U) Survey Applications Coordinating Committee
(U) SALT	(U) Strategic Arms Limitation Talks
(U) SAR	(U) Synthetic Aperture Radar
~~(TS//TK//NF)~~ [redacted]	
(U) SDV	(U) Shuttle Derived Vehicle
(U) SIGINT	(U) Signals Intelligence
(U) SIR	(U) Shuttle Imaging Radar
(U) SIRIS	(U) Shuttle Infrared Imaging System
(U) SLBM	(U) Submarine Launched Ballistic Missile
(U) SMALSAT	(U) Small Satellite
(U) STS	(U) Space Transportation System
(U) TDRSS	(U) Tracking and Data Relay Satellite System
(U) TRW	(U) Thompson-Ramo-Wooldridge
(U) UHF	(U) Ultra High Frequency
(U) USAF	(U) United States Air Force
(U) VHF	(U) Very High Frequency
~~(S//TK//NF)~~ WASP	~~(S//TK//NF)~~ Wide Area Search Pallet
(U) ZOE	(U) Zone of Exclusion

(b)(1)
(b)(3)

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SUPPLEMENTAL AGREEMENT

on

NASA RECONNAISSANCE PROGRAMS

Reference: DOD/CIA-NASA Agreement on NASA Reconnaissance Programs, dated 28 August 1963 (BYE-6789-63)

This agreement supplements the referenced agreement to replace paragraph 2 with the following:

"2. To carry out these arrangements, the following procedure will normally be employed:

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BROCKWAY McMILLAN	ROBERT C. SEAMANS, Jr.
Director	Associate Administrator
(S) National Reconnaissance Office	National Aeronautics and Space Administration

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DOD-NASA Coordination of the Earth Resources Survey Program

1. General Objective

The general objective of the NASA Earth Resources Survey Program (NERSP) is to exploit the potential for economic, scientific, and politic benefits through the use of remote sensing devices installed in earth-orbiting spacecraft. (See report of NSAM 156 Ad Hoc Committee dated 11 July, 1966 — Top Secret-Byeman.)

2. Scope

The NASA program may be divided into two phases:

a. Research, Development, and Feasibility Phase Conducted by NASA

(1) Determine those natural and cultural resource data and changing conditions on earth and in the surrounding atmosphere which can best be acquired or observed from spacecraft.

(2) Test and develop the best combination of observational procedures, instruments, subsystems, and interpretative techniques for th acquisition or observation and study of terrestrial natural and cultural resource data and conditions from spacecraft, both for practical applications on earth and in preparation for similar surveys on the moon and the nearer planets.

(3) Determine how the increased frequency and synoptic covera uniquely afforded by spacecraft observations can aid the study of time variant and relatively unchanging phenomena on the surface of the earth and in the surrounding atmosphere.

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(4) Develop improved methods of displaying and disseminating space-acquired natural and cultural resource data on a global basis suitable for utilization by scientific and technical activities, both government and non-government.

(5) Determine which natural and cultural resource data can be most effectively and economically obtained and changing earth conditions observed by manned spacecraft, unmanned satellites, interrogation of surface sensors, or the means currently being used.

b. Operational Phase Conducted by the User Activities

Gather natural and cultural resource data and observe changing earth conditions with spaceborne instruments in an operational repetitive manner for use by scientific and technical activities, both government and non-government.

3. Control Measures

NASA recognizes the necessity of conducting this program in such a manner as to continue to avoid open challenges to satellite observation activity; specifically, to avoid placing the U. S. space reconnaissance program in jeopardy. To this end, NASA proposes that the program go forwa under a special NASA-DOD coordinating and monitoring mechanism, governed by a set of guidelines and ground rules acceptable to the Secretary of State, the Secretary of Defense, and the Director of Central Intelligence, the Director of the Office of Science and Technology, and the Administrato of NASA.

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Any matters which cannot be resolved at the Manned Space Flight Policy Committee (MSFPC) level will be referred to the Secretary of Defense and the Administrator of NASA for further action. (The NSAM 156 Ad Hoc Committee will remain available for consultation concerning possib political or security issues which might arise.)

4. NASA-DOD Coordination Organization

Matters of common interest and the interactions between NASA and the DOD (as executive agency for the NRP) in connection with the NASA Earth Resources Survey Program (NERSP) will be dealt with on three levels:

(1) The joint NASA-DOD Manned Space Flight Policy Committee (MSFPC), now in existence.

(2) A joint NASA-DOD project level committee, with three members from each Agency, to be established and to be designated the Surve Applications Coordinating Committee (SACC); this Committee will be co-chaired by designated NASA and DOD members; an Executive Secretary will be furnished by NASA.

(3) Normal bi-lateral staff contacts between properly cleared individuals of NASA and the NRO (including individual members of SACC).

5. Functions of the MSFPC Related to NERSP

a. Monitor the program to insure that it is conducted within the agreed guidelines and ground rules, and is in accord with the intent of the July 11, 1966, Report of the NSAM 156 Ad Hoc Committee.

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b. When the requirement for improved sensor capabilities in the NERSP has been established by a user agency, and as the known state-of-the-art advances and sensors of improved performances become operational in the NRP, review the limiting criteria governing the use of sensors in the NERSP and, if appropriate, make suitable recommendations to move the prescribed threshold of performance toward more precise ground resolution.

c. Resolve any differences which cannot be resolved at a lower level.

d. Identify and, if necessary, refer to higher authority for guidance any proposed space observation activities by NASA which could be politically sensitive or otherwise cause problems involving the NRP.

6. Functions of the SACC

a. Monitor the program on the project and technical level to insure observance of guidelines and ground rules.

b. Review all studies, experiment plans, work statements, project contracts, etc., for security considerations, overloading of available industrial capacity in the area of advanced state-of-the-art in remote sensors, avoidance of unnecessary duplication in hardware development and production and data acquisition, and responsiveness to the requirements and interests of user agencies and activities of the government.

c. Formulate detailed procedures for the utilization of data made available from DOD programs and for the processing and use of such data in NERSP.

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d. Keep the Deputy Administrator, NASA, and the Director, NRO, informed of reconnaissance-related activities of NASA that fall within the currently established threshold of sensitive sensor performance.

7. Specific Guidelines, Criteria, and Ground Rules for the Conduct of NERSP

a. Activities of interest to NRO

An activity is defined as the expenditure of NASA research and development money with a university or industry, or the transfer of money to another organization to be used in this way. The activities to be brought to the attention of the MSFPC/SACC are those involving the study, design, development, fabrication, or test of reconnaissance-like sensors (as defined below), or significant components thereof, for use in orbital systems, and studies of the use of such sensors in orbital systems.

b. Reconnaissance-like sensors

A reconnaissance-like sensor is currently defined to be an image forming sensor having an angular resolution of .1 milliradian or finer, or an optical or infrared image forming system with a physical aperture greater than 30 cm. and an optical figure controlled to better than 1/4 wave length. Until revised downward, these criteria will define the sensitive sensor performance threshold.

c. Related activities of interest to NRO

(1) RFP's, requests for program recommendations, and plans fo: symposia or conferences where the subject matter is or could evolve into a activity of interest as defined in 7.a. and 7.b. above, will be coordinat

with the MSFPC/SACC prior to finalization and issuance. However, in the case of working meetings or conferences for on-going program coordinatior it will be sufficient to inform these coordinating agencies prior to the event.

(2) Any plans for missions involving reconnaissance-like sens in polar or near polar orbits will be coordinated with the MSFPC/SACC ear in the conceptual phase. It is understood that in the early stages of NERSP, NASA will be flying low inclination orbits to observe test sites i the United States, but later will require polar orbits.

(3) Regardless of application, the MSFPC/SACC will be kept informed (including the furnishing of copies of Work Statements, 1122's, when appropriate) concerning any NASA activities involving the developmen or test of pointing, tracking, and stabilizing techniques or systems in which the pointing accuracy is better than 20 microradians or the unstabilized rate is less than 20 microradians per second. MSFPC/SACC wi also be kept informed regarding the development or test of recording medi for use with reconnaissance-like sensors.

d. Any development and/or procurement of reconnaissance-like sens by NASA will be carried out through the NRO, as provided in the DOD/CIA-N Agreement on NASA Reconnaissance Programs, dated August 28, 1963.

e. The initiation of new NASA programs which essentially duplicat equipment capabilities or operations of the NRO, or vice versa, will not be allowed to occur unless, after a thorough consideration of each specifi

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program by the MSFPC/SACC, it is determined that some overriding consideration in the national interest warrants such duplication. To this end, proposed NASA programs involving reconnaissance-like sensors will be coordinated with the MSFPC/SACC to determine whether:

(1) They involve development of systems, sensors, techniques, or related equipment closely duplicating those already developed or being developed by the NRO;

(2) They involve development of systems, sensors, techniques, or related equipment to collect data which can be collected by NRO systems already operational or in development, and made available to NASA in a form usable in the NERSP;

(3) They involve development of systems, sensors, techniques, or related equipment to ccollect data (such as mapping and charting data) which have already been collected, in whole or part, by the NRO and which can be made available to NASA in a form usable in the NERSP.

f. Regular review of NRP product will be made by representatives of SACC for the purpose of determining if detailed analyses should be made by cleared NASA personnel as a guide for NERSP planning. Should a detailed NASA review indicate that broader dissemination would be desirable, it will be the responsibility of NASA to request action by the Director of Central Intelligence to permit the use of information and/or photography at a lower classification level by NASA personnel not possessing special security clearances. The SACC will keep the MSFPC apprised of all such requests.

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g. The SACC shall be responsible for bringing to the attention of ie MSFPC, prior to initiation, all programs which are either specifically :tivities of interest (as defined in a. above) or are potentially :tivities of interest because of the latitude which will be allowed to ontractors or other government agencies. Programs which are of potential iterest to the NRO for any of the reasons enumerated under c. above will so be brought before the MSFPC.

h. The DOD members of the SACC, with the assistance of the NRO aff, will be responsible for keeping the NASA SACC members informed, by ans of formal briefings, informal discussions, and pertinent reports and cuments, of NRP activities related to satellite reconnaissance which are rtinent to the SACC and MSFPC functions.

i. When a NASA activity involving reconnaissance-like sensors or lated equipment is brought before the SACC, an attempt will be made to termine whether the objectives of the proposed program can be met by a mitation to sensors which fall outside the definition of reconnaissance-ke sensors. If it is determined that such sensors can be substituted, SA will undertake to modify its program accordingly. However, in all ses the SACC will review the program for the factors listed in 7.c. above i report any significant findings to the MSFPC.

j. If an activity of interest has been reviewed as in 7.i. above, i it has been determined that the objectives of the program cannot be met cept with reconnaissance-like sensors, the program will be submitted via

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ıe DOD members of the SACC to the NRO to determine: (1) whether an ‹isting system, sensor, or related equipment will meet the needs of the :ogram or whether a new development is needed, and (2) the security .mitations which must be imposed upon the use of the sensor in the program. ıese determinations will be reported to the SACC for appropriate action or ›r reference to the MSFPC together with the recommendations of the SACC.

k. Where a new development of a reconnaissance-like sensor is :eded, and if NASA accepts the security requirements as feasible, a :tailed agreement between NASA and the NRO will be drawn up to be signed the Deputy Administrator, NASA, and the Director, NRO, covering studies, ıalysis, development, and/or acquisition of the sensor in accordance with ıe DOD/CIA-NASA Agreement of August 28, 1963.

l. In the event that NASA considers the security levels recommended the NRO under 7.j. above to be such as would seriously inhibit its ›ility to conduct a useful program and, further, that NASA considers it in the national interest to conduct the program, the SACC will prepare .d forward a brief of the pertinent facts for consideration by the MSFPC.

m. In the event that a proposal by NASA does not require the use reconnaissance-like sensors but is of possible concern to the NRO because any of the factors listed under 7.c. above, the SACC will review and ıalyze the program, and report its findings and recommendations to the MSFPC.

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DOD-NASA Coordination of the Earth Resources Survey Program 10

Approved:

John S. Foster, Jr.
Director of Defense Research and Engineering
Department of Defense

Date 26 SEP 1966

Robert C. Seamans, Jr.
Deputy Administrator
National Aeronautics and Space Administration

Date SEP 23 1966

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ANNEX A TO:

MEMORANDUM OF UNDERSTANDING BETWEEN THE DEPARTMENT OF DEFENSE AND NATIONAL AERONAUTICS AND SPACE ADMINISTRATION CONCERNING THE MANNED SPACE FLIGHT PROGRAMS OF THE TWO AGENCIES OF DECEMBER 20, 1967.

1. Purpose

This Annex describes the management of NASA activities of concern to the National Reconnaissance Program that are of mutual interest to NASA and the Department of Defense. This Annex supersedes the agreement on DOD-NASA Coordination of the Earth Resources Survey Program of September 26, 1966.

2. Policy

A critical function of the Manned Space Flight Policy Committee is to provide a means for policy-level discussion, analysis, and resolution of highly classified or sensitive matters of mutual interest. It is recognized that the NASA program must be conducted in such a manner as to avoid open challenges to satellite observation activity; specifically, to avoid placing the U. S. space reconnaissance program in jeopardy. This policy is expressed in the Report of the NSAM 156 Committee on "Political and Security Aspects of Non-Military Applications of Satellite Earth-Sensing", dated July 11, 1966 (TOP SECRET - BYE-54112-66).

3. Organization

a. The overall responsibility for coordination and monitoring of NASA activities of concern to the NRP and to the DOD as its executive agent has been assigned to the MSFPC within a framework of special guidelines and ground rules acceptable to the Secretary of State, the Secretary of Defense, the Director of Central Intelligence, the Administrator of NASA and the Director of the Office of Science and Technology. Issues not resolved by the Committee are referred to the Secretary of Defense and the Administrator of NASA.

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b. The Co-Chairmen of the MSFPC have established a sub-committee, designated the Survey Applications Coordinating Committee and reporting directly to the MSFPC, to provide for detailed and continuing review, coordination, monitoring, and control of NASA activities that relate to the NRP.

The MSFPC will make such additional specific assignments to the SACC, in the form of recorded action items or joint memoranda, as are required for the conduct of the ongoing program. The MSFPC will receive regular reports from the SACC on the status of its activities.

c. Questions not resolved at the SACC level, or outside of its scope but of policy significance, will be referred to the MSFPC through the Executive Coordinators.

d. In addition, normal bilateral staff contacts between properly cleared individuals (including members of SACC) continue to be encouraged for day-to-day exchanges of information and advice.

4. Survey Applications Coordinating Committee

a. The Co-Chairmen of the MSFPC appoint three members from each agency, designate one member from each agency to act as Co-Chairmen, and appoint an Executive Secretary to SACC from NASA. The SACC meets upon call of its Co-Chairmen and pursuant to an agenda: minutes are kept and reviewed regularly by the membership of the MSFPC for their information.

b. The SACC uses the following definitions

1) A reconnaissance-like sensor is currently defined to be an image forming sensor having an angular resolution of .1 milliradian or finer, or an optical or infrared image forming system with a physical aperture greater than 30 cm and an optical figure controlled to better than 1/4 wave length. Until revised, these criteria will define the sensitive sensor performance threshold.

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2) An activity of interest to the NRO is defined as the expenditure of NASA research and development money with a university or industry, or the transfer of money to another organization to be used in this way, that involves the study, design, development, fabrication, or test of reconnaissance-like sensors, or significant components thereof, for use in orbital systems, and studies of the use of such sensors in orbital systems.

3) Pointing, tracking, and stabilizing techniques or systems of interest to the NRO are defined as those in which the pointing accuracy is better than 20 microradians or the unstabilized rate is less than 20 microradians per second.

4) Recording media of interest to the NRO are defined as those for use with reconnaissance-like sensors.

c. The functions of SACC are to:

1) Monitor the NASA program on the project and technical level to insure observance of established guidelines and ground rules.

2) Review such NASA activities as studies, experiment plans, work statements, or contracts for considerations of: security; overloading of available industrial capacity in the area of advanced state-of-the-art remote sensors; and unnecessary duplication in hardware development and production or data acquisition.

3) Formulate and recommend procedures for the processing and use of data made available to NASA from the NRP.

4) Report to the MSFPC on any reconnaissance-related activities and problems of mutual NASA-DOD interest.

d. The SACC has the following specific responsibilities:

1) To review all activities of interest prior to their implementation, and, prior to finalization and

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issuance, all RFP's, requests for program recommendations, and plans for symposia or conferences that might include or evolve into an activity of interest. (However, in the case of working meetings or conferences for on-going program coordination, it is sufficient that SACC be informed prior to the event.)

2) To review, early in the conceptual phase, any plans for missions involving reconnaissance-like sensors.

3) To be informed (through review of work statements, 1122's, and other appropriate means) of all NASA activities involving development or test of pointing systems and recording media of interest to the NRO.

4) To review proposed NASA programs involving reconnaissance-like sensors to determine whether:

a) They involve development of systems, sensors, techniques, or related equipment closely duplicating those already developed or being developed for the NRP;

b) They involve development of systems, sensors, techniques, or related equipment to collect data which can be or have been collected by NRO systems (either operational or in development) and which can be made available to NASA in a useable form;

c) Their objectives can be met by the substitution of sensors which fall outside the definition of reconnaissance-like sensors.

5) To forward to the NRO all cases where it has been determined that NASA objectives can only be met with reconnaissance-like sensors. (The NRO determines whether existing systems, sensors, or related equipment can meet the objectives or whether a new development is necessary; and determines the security limitations applicable thereto.)

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6) To review representative NRP data as a guide for NASA planning.

7) To be currently informed of NRP activities pertinent to the NASA program.

5. NASA Program Guidelines

a. NASA programs which essentially duplicate equipment capabilities or operations of the NRO are not to be initiated unless overriding considerations in the national interest warrant such duplication.

b. Development, procurement, or acquisition, of reconnaissance like sensors for NASA programs agreed upon by the MSFPC is undertaken only after a detailed agreement between the NRO and NASA has been executed within the sense of the DOD/CIA-NASA Agreement on NASA Reconnaissance Programs of August 28, 1963 (BYE-6789-63) as amended (BYE-22502-64).

c. Security limitations or technical thresholds imposed by NRO upon proposed or approved NASA activities are reviewed by the MSFPC as requested by NASA.

John Foster Jr.
John S. Foster, Jr.
Director
Defense Research and Engineering

Date: 2/12/68

Homer E. Newell
Homer E. Newell
Associate Administrator
National Aeronautics and Space Administration

Date: 27 Feb 68

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TERMS OF INTERFACE

BETWEEN

NASA AND NRO

FOR

TECHNOLOGY, HARDWARE, AND FACILITIES

1. Purpose

The purpose of these Terms of Interface is to:

a. Set forth the policy, organization, and procedures which govern the interactions between NASA and the NRO in their individual development of spacecraft to accomplish their respective missions.

b. Provide guidance on how specific NRO capabilities ar[e] to be made available to NASA.

2. Background

Both NASA and NRO spacecraft development depend to a significant degree on a common technologic base available in industry. Part of this base has been developed by NASA, part by the NRO. The security needs of the NRO demand that the existence of and level of certain technologic capabilitie[s] be kept from general knowledge. Some of these NRO capabilities can significantly assist the NASA development of th[e] Large Space Telescope (LST) and spacecraft for providing dat[a] on earth resources. The national interest would be well ser[ved] by an arrangement which makes the relevant NRO technology available for these NASA developments while preserving the security of the NRO and its capabilities.

3. Policy

a. Recognizing the utility of certain NRO technology i[n] the NASA development of the LST and earth resource satellite[s]

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the NRO will create procedures through which such technology can be made available to NASA while maintaining the integrit of the BYEMAN security system.

b. The NRO will brief NASA personnel into the BYEMAN security system as merited by specific needs.

c. The NRO technology will be made available for NASA developments by communication between NRO and NASA personnel The NASA personnel will apply the information in making deci on the course of NASA developments without compromising the or its capabilities.

d. The NRO and NASA will have no joint contracts for st or hardware since there is no technical, schedule, or cost advantage apparent at this time or in the foreseeable future

e. The Director, NRO, will hold the authority for implementing, modifying or terminating any or all interactions un these Terms of Interface.

4. Organization

a. One individual on the NRO Staff will be identified b the Director, NRO, as the Principal Coordinator for NASA-NRC interactions. He will be responsible for coordinating and approving all interactions, including briefings.

b. One individual in NASA, in SAFSP, and in CIA will be identified by their respective Directors as Coordinators to work with the Principal Coordinator.

5. Procedures

a. Requests for BYEMAN briefings for NASA personnel wil be initiated by any Coordinator and forwarded by him to the Principal Coordinator for approval or disapproval. If apprc the briefing will be given by the Principal Coordinator or a Coordinator he may designate.

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b. As part of the BYEMAN briefing, NASA personnel will be exposed to BYEMAN working situations so that the necessar security conditions are understood.

c. Contact between briefed NASA personnel and the NRO personnel can be initiated by individuals in either group with the concurrence of the appropriate Coordinator. The Coordinator, with the concurrence of the Principal Coordinat can permit recurring contacts between specific individuals o a specific subject without approval each time beyond the fir time.

d. Contact between briefed NASA personnel and NRO contr personnel on NRO technology can be initiated by the BYEMAN briefed NASA personnel through the NASA Coordinator. The Principal Coordinator shall approve such contracts; he can authorize recurring contacts between specific individuals on a specific subject without approval each time beyond the fir time.

e. Contact between NRO personnel and NASA contractors, and contact between NRO contractors and NASA contractors do not require Coordinator approval. Such contacts will be han through existing BYEMAN procedures.

f. Written communications between NRO and NASA personne shall be sent through the Coordinators; the transfer of comm cations from NASA to the NRO, or vice versa, will take place between the Principal Coordinator and the NASA Coordinator.

g. Requests to use NRO developed technology, hardware, facilities for NASA developments can be initiated by either BYEMAN briefed NASA personnel or NRO contractors who are als working for or proposing work to NASA. NASA personnel shall forward their requests to the Principal Coordinator through NASA Coordinator. The Contractors shall forward their reque to the Principal Coordinator through the SAFSP or CIA Coordi as appropriate. The Principal Coordinator shall recommend approval or disapproval of the request to the Director, NRO,

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taking into account information from the NRO Program Office whose technology, hardware, or facilities are involved.

h. [redacted] (b)(1) (b)(3)

i. A regularly scheduled review shall be held between t Principal Coordinator and the NASA Coordinator to update procedures as necessary, and to identify solutions to specific security problems that will arise from time to time.

j. [redacted] (b)(1) (b)(3)

6. <u>Guidance on Release to NASA of Specific NRO Technology, Hardware, and Facilities</u>

a. [redacted] (b)(1) (b)(3)

b. The listings shall identify whether or not each iten of technology, hardware, or facility is BYEMAN, unclassifiec or in a transitory category. Normally, items categorized as BYEMAN would not be available for NASA use. Those items deemed as unclassified would be totally available to NASA without attribution to prior NRO involvement. Those items in a transitory category will require careful security consideration so that NRO involvement would remain protected while enabling the use of the item to NASA.

c. [redacted] shall work with tl (b)(1) (b)(3) respective contractors so that the contractors will underst

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the nature of the NASA-NRO interface and that those items which are held as unclassified or released to the unclassifi category from a transitory category shall be handled by the contractor in a totally unclassified manner. An example of this category would be for a contractor to bring out unclass: fied drawings which were developed in the BYEMAN areas rathe: than declassifying BYEMAN drawings per se.

d. Unclassified technology, hardware and facilities wil be made known to NASA immediately upon implementation of the: Terms of Interface. New items shall be made known to NASA a: they are decompartmented from the BYEMAN category.

e. Past procedures will be followed with respect to new developments made by either NASA or NRO in advanced technolo; as the need to know arises and within appropriate security classification.

f. As a general rule, NRO contractor capabilities and facilities shall be made available to NASA providing that appropriate security requirements are satisfied.

7. These procedures will be jointly reviewed every six montl by appropriate NASA-NRO personnel. NRO will advise ODDR&E o the Terms of Interface so as not to conflict with other form interface procedures between DOD and NASA.

J. W. Plummer Director National Reconnaissance Office	James C. Fletcher Administrator National Aeronautics and Space Administration

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MEMORANDUM OF AGREEMENT

CONDUCT OF INTELLIGENCE AND CIVIL

SPACE PROGRAMS

The undersigned have reviewed the relationships betwee the space programs of the National Reconnaissance Office an the National Aeronautics and Space Administration in light program progress to date in both the classified and civil arenas and the current assessment of the present and future policy environment for remote sensing of the earth from spa The undersigned have agreed to the following objectives, gu lines and mechanisms for the coordination of the respective intelligence and civil space programs.

Objectives

With the growing sophistication of space science and technology, the military, intelligence, scientific, and civ applications programs require careful continuing coordinati in order to:

a. Assure that inadvertent disclosures of techno in one program do not jeopardize the effectiveness of other programs.

b. Assure that data and information release poli recognize nationally approved program objectives, legal and statutory requirements and national security considerations.

c. Assure that individual agency plans and progr from the outset are formulated and managed to avoid conflic between civil and military activities.

d. Assure that appropriate use is made by both t civil and military communities of technology, data and info mation generated by each other's programs.

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Management Guidelines

a. The earth-oriented data acquisition programs NASA will be conducted in a manner designed to maximize the economic and political benefits and to minimize internatior political repercussions.

b. If it is decided to study or employ NRO class technology in the civil space program, that technology will remain protected under the NRO security procedures until a specific determination is made for release to the public dc

c. Independently developed technology in the civ program will be reviewed to determine if its public release would compromise classified program capabilities and/or lim tions.

Coordinating Mechanism

a. Program Review Board

A Program Review Board is hereby established posed of the DDR&E, the Deputy Administrator of NASA, the D Director of Science and Technology, CIA, representing the D and the Director of the NRO to oversee the relationship bet the classified and civil space programs. The Board members is limited to the named principals.

b. Within the framework of established national the Board is charged with:

(1) Resolving interagency program policy iss

(2) Coordinating on a continuing basis the e oriented programs of the member agencies.

(3) Recommending to the agency heads involve changes in program direction as may mutually be agreed upon

(4) Reporting to the agency heads on issues resolved by the Board.

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c. The Board will meet at least quarterly as wel as at the request of any member.

d. The Board will establish and supervise two in agency groups to report regularly to the Board; these are:

(1) A Technology Review Committee, chaired b a senior DOD official, to maintain a current assessment of the civil and military technology flow into the public doma coordinate the development, transfer and public release of technologies; and to refer to the Board issues and problems resolved at the Committee level.

(2) A Data and Information Release Committee chaired by a senior NASA official, to maintain a current ov view of policies and procedures relating to earth-oriented science and applications data and information release, to review and resolve where possible conflicts between agencie and refer unresolved issues to the Board.

e. In its consideration of issues, the Board wil coordinate with the appropriate interested Executive agenci and organizations.

f. Unresolved interagency issues relating to nat policy interpretation or implementation, or recommended cha to national policy, will be referred to the appropriate Nat Security Council mechanism for consideration.

James R. Schlesinger	William E. Colby	James C. Fletcher
Secretary of Defense	Director, Central Intelligence	Administrator, NAS

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THE WHITE HOUSE

WASHINGTON

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May 11, 1978

Presidential Directive/NSC-37

TO: The Vice President
The Secretary of State
The Secretary of Defense
The Secretary of Interior
The Secretary of Agriculture
The Secretary of Commerce
The Director, Office of Management and Budget
Assistant to the President for National Security Affairs
Assistant to the President for Domestic Affairs
Director, Arms Control and Disarmament Agency
Chairman, Joint Chiefs of Staff
Director of Central Intelligence
Administrator, National Aeronautics and Space Administration
Director, Office of Science and Technology Policy

SUBJECT: National Space Policy (U)

This directive establishes national policies which shall guide the conduct of United States activities in and related to the space programs and activities discussed below. The objectives of these policies are (1) to advance the interests of the United States through the exploration and use of space and (2) to cooperate with other nations in maintaining the freedom of space for all activities which enhance the security and welfare of mankind. ~~(C)~~

1. The United States space program shall be conducted in accordance with the following basic principles. (U)

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a. Commitment to the principles of the exploration and use of outer space by all nations for peaceful purposes and for the benefit of all mankind. "Peaceful purposes" allow for military and intelligence-related activities in pursuit of national security and other goals. ~~(C)~~

b. The exploration and use of outer space in support of the national well-being and policies of the United States. (U)

c. Rejection of any claims to sovereignty over outer space or over celestial bodies, or any portion thereof, and rejection of any limitations on the fundamental right to acquire data from space. (U)

d. The space systems of any nation are national property and have the right of passage through and operations in space without interference. Purposeful interference with operational space systems shall be viewed as an infringement upon sovereign rights. (U)

e. The United States will pursue activities in space in support of its right of self-defense. (U)

f. The United States will maintain a national intelligence space program. ~~(C)~~

g. The United States will pursue space activities to increase scientific knowledge, develop useful civil applications of space technology, and maintain United States leadership in space. (U)

h. The United States will conduct international cooperative space-related activities that are beneficial to the United States scientifically, politically, economically, and/or militarily. (U)

i. The United States will develop and operate on a global basis active and passive remote sensing operations in support of civil, military, and national intelligence objectives. Such operations will occur under conditions which protect classified technology, deny sensitive data, and promote acceptance and legitimacy of such activities. ~~(C)~~

j. The United States will maintain current responsiblity and management relationships among the

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sectors focused on civil, defense, and national intelligence objectives. ~~(C)~~

k. Close coordination, cooperation, and information exchange will be maintained among the space sectors to avoid unnecessary duplication and to allow maximum cross-utilization, in compliance with security and policy guidance, of all capabilities. (U)

2. The United States will conduct those activities in space which are necessary to national defense. The military space program shall support such functions as command and control, communications, navigation, environmental monitoring, warning, tactical intelligence, targeting, ocean and battlefield surveillance, and space defense. In addition, defense space programs shall contribute to the satisfaction of national intelligence requirements. The following policies shall govern the conduct of the military space programs. ~~(C)~~

a. Security. The military space program, including dissemination of data, shall be conducted in accordance with Executive Orders and applicable directives for protection of national security information and commensurate with both the missions performed and the security measures necessary to protect related (national intelligence) space activities. ~~(C)~~

b. Emergency Utilization of Civil Systems. The Secretary of Defense will establish a program for identifying, modifying and integrating, as needed, civil and commercial resources into military operations, or for denying their use to an enemy, during national emergencies declared by the President while, to the maximum extent possible, retaining their utility to the United States. ~~(C)~~

c. Survivability. Survivability of space systems, including all system elements, will be pursued commensurate with the planned need in crisis and war, the threat, and the availability of other assets to perform the mission. Identified deficiencies will be eliminated and an aggressive, long-term program will be applied to provide more assured survivability through evolutionary changes to space systems. For critical missions, a distributed system architecture shall be considered for reducing single, critical nodes, including highly survivable emergency systems of limited capability for use in times of

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crisis and to back up the first line systems in case of system failure or attack. Civil systems (e.g., communications) used for critical military functions shall have a level of survivability commensurate with their planned use in national emergencies. ~~(S)~~

d. Anti-Satellite Capability. In accordance with applicable executive directives, the United States shall seek a verifiable ban on anti-satellite capabilities, excluding electronic warfare. DoD shall vigorously pursue development of an anti-satellite capability, but will not carry to production those elements which are included in any treaty with the Soviets. Beyond that, some R&D should be continued as a hedge against Soviet breakout. The progress of ASAT arms control negotiations will be reviewed annually to determine if negotiations with the Soviet Union continue to be fruitful relative to the threat posed by Soviet actions in space, and consequently to determine if the U.S. ASAT efforts are still adequate. The space defense program shall include an integrated attack warning, notification, verification, and contingency reaction capability which can effectively detect and react to threats to U.S. space systems. ~~(TS)~~

3. The United States foreign intelligence program shall include a space program to acquire information and data required for the formulation and execution of foreign, military, and economic policies; to support the planning for and conduct of military operations; to provide warning; to support crisis management; and to monitor treaties. The following policies shall govern the conduct of this program. ~~(S)~~

a. Protection of Sensitive Information. The nature, the attributable collected information, and the operational details of intelligence space activities will be classified, and as necessary to protect sensitive aspects, will be controlled in special compartmented security channels. Collected information that cannot be attributed to space systems will be classified according to its content. Security restrictions on intelligence space satellite products will be selectively relaxed by the DCI to implement the following changes to permit wider use of space-derived intelligence information. ~~(S)~~

-- The fact that the United States conducts satellite reconnaissance for intelligence purposes, without disclosing the generic type of activity, will be classified

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CONFIDENTIAL (Exempt from the General Declassification Schedule) and handled outside the special security control system. ~~(C)~~

-- The existing special product controls will be used sparingly, and then only for those products and data that reveal sensitive aspects of the program as determined by the DCI. ~~(S)~~

-- For SIGINT, the special space-related product control system shall not be used when the DCI determines that the intelligence is protected by appropriate classification or the more general special intelligence control system. ~~(TS)~~

-- Operational aspects of intelligence space activities shall be afforded strict security protection within a special access program system as determined by the DCI. ~~(S)~~

-- Strict control over public statements and background concerning space reconnaissance will be maintained. ~~(C)~~

-- Further changes to the space intelligence security policy can be authorized only by the President. ~~(C)~~

b. Support of Military Operational Requirements. Support of military operational requirements is a major space intelligence mission. National space intelligence assets shall provide appropriate support to deployed military operational forces in balance with their primary mission capabilities. In order to ensure a proper balance between the national and tactical missions of these assets, there will be military involvement in the requirements, tasking, exploitation, and dissemination functions and in the development program. The Secretary of Defense will, together with the Director of Central Intelligence, ensure that there is no unnecessary overlap between national foreign intelligence programs and Department of Defense intelligence programs, and the Secretary of Defense will provide the Director of Central Intelligence all information necessary for this purpose. ~~(S)~~

c. Interactions with Civil Community. Selected space-related products and technology shall be made available to civil agencies within appropriate security

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constraints. The Intelligence Community may provide radio frequency (RF) mapping and surveys for the civil community under appropriate security controls. ~~(TS)~~

d. Survivability. The national intelligence program shall be configured to operate in a hostile environment. The guidance set forth in subparagraph 2c. shall be aggressively pursued by the intelligence community. ~~(S)~~

4. The United States shall conduct civil space programs to increase the body of scientific knowledge about the earth and the universe; to develop and operate civil applications of space technology; to maintain United States leadership in space science, applications, and technology; and to further United States domestic and foreign policy objectives. The following policies shall govern the conduct of the civil space program. (U)

a. The United States shall encourage domestic commercial exploitation of space capabilities and systems for economic benefit and to promote the technological position of the United States, except that all United States earth-oriented remote sensing satellites will require United States Government authorization and supervision or regulation. (U)

b. Federal civil earth imaging from space, at resolutions at or better than ten meters, will be permitted under controls and when such needs are justified and assessed in relation to civil benefits, national security, and foreign policy. Appropriate controls on other forms of remote earth sensing will be established. Expanded civil use of intelligence space data and technology within appropriate security constraints is encouraged. ~~(C)~~

c. Data and results from the civil space programs will be provided the widest practical dissemination, except where specific exceptions defined by legislation, Executive Order, or directive apply. (U)

d. United States federal or private space systems identified as critical to the national defense may be equipped at DoD expense for use in national emergencies or to deny their use by an enemy in times of national emergency declared by the President. Implementation will occur as described in subparagraph 2b. The fact of or the details of such measures may be classified. ~~(C)~~

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e. Terrestrially-oriented federal or private radio frequency (RF) surveys in space are prohibited except through or in coordination with the Director of Central Intelligence under appropriate security controls. ~~(TS)~~

f. The United States will develop, manage, and operate the Shuttle-based Space Transportation System through NASA in cooperation with the DoD to service all authorized space users--domestic and foreign, commercial and governmental--and will provide launch priority and necessary security to military and intelligence missions while recognizing the essentially open character of the civil space program. Mission control is the responsibility of the mission agency. Military and intelligence programs may use the Shuttle Orbiters as dedicated mission vehicles. ~~(C)~~

5. The NSC Policy Review Committee shall meet when appropriate to provide a forum to all federal agencies for their policy views; to review and advise on proposed changes to national space policy; to resolve issues referred to the Committee; and to provide for orderly and rapid referral of open issues to the President for decision as necessary. The PRC will meet at the call of the Chairman for these purposes, and when so convened, will be chaired by the Director, Office of Science and Technology Policy. (U)

Interagency coordinating mechanisms will be employed to review and coordinate pertinent issues and projects, make evaluations, and implement policy decisions where appropriate. Special areas of interest include security and political risks involved with technology transfer and federal and private space operations involving remote sensing and communications. Unresolved policy issues will be forwarded to the PRC for review and resolution. ~~(C)~~

Jimmy Carter

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~~(S)~~ NATIONAL RECONNAISSAN
WASHINGTON, D.C

THE NRO STAFF

1 November 1977

MEMORANDUM FOR PROGRAM A (LT COLONEL STORCH)
PROGRAM B (MR. FRED N. EVANS)
NASA (MR. KEATHLEY/MR. KELLER)
PERKIN ELMER (MR. DELUCA)

SUBJECT: Security Plan for STP

Attached is the formal BYEMAN security plan for the Space Telescope Program. It has been signed by both the DNRO and the Deputy Administrator of NASA.

Please recall that *both* contractor appendices are valid and applicable even though only one contractor was selected. Many of the controlling provisions relative to both NASA and the NRO are found only in Appendix B, the EKC plan. (Note paragraph II of the overall plan.)

Thank you very much for your help in this effort.

DAVID A. MESSNER
Captain, USAF
Assistant Deputy Director
for Policy

1 Attachment
Security Plan w/2 Appendices
(BYE-17484-77, BIF 007-0325-76C,
BYE-12665/77A)

cc: SS-3 [redacted]
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JOINT NASA-NRO SECURITY PLAN
FOR USE OF NRO CONTROLLED RESOURCES
ON THE SPACE TELESCOPE PROGRAM

I. OBJECTIVE

The objective of this plan is to outline ground rules for the use of NRO assets in support of the unclassified NASA Space Telescope Program while insuring minimum impact to the National Reconnaissance Program and BYEMAN security.

II. BACKGROUND

The NRO has been working with NASA and the various contractors to develop detailed BYEMAN security plans to meet the above objective. These security plans are included as Appendices A and B to this plan. Each contractor's situation with respect to BYEMAN facilities, projects and past experience is unique. The appendices are tailored to each unique condition, yet establish basic procedures applicable to all.

III. FACILITIES

NRO facilities will be made available for NASA use only if security constraints are satisfied and if there is no interference with the NRP. Rent-free, non-interference use authorization was provided to the contractor by the appropriate NRO program office prior to the submission of the STP proposal to NASA. The appropriate NRO program office must be advised by the contractor prior to any white inspections.

There will be no identification of any BYEMAN program to explain the existence of facilities, and appropriate security measures must be taken not to expose BYEMAN programs to non-accessed visitors.

To facilitate coordination of general day-to-day business with the contractor, it will be necessary to

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brief some of the permanently based NASA contractor representatives. This action will be addressed after the contract is awarded.

For purposes of developing their unclassified response to NASA's RFP, each contractor assumed as available only the NRP-owned equipment and facilities already identified as unclassified and available for use.

All other equipment and facilities deemed necessary to the design, development, and test of the Optical Telescope Assembly were bid as new purchases or construction.

The NRO and NASA prepared a detailed classified inventory of existing facilities and equipment that contractors would be permitted to use for the OTA project. NASA used this classified inventory during the proposal evaluation process to establish the "most probable cost to the Government" of the proposals; The facilities and equipment bid as new purchases or construction were reduced as appropriate by items from the approved classified inventory.

IV. SECURITY

After contract award, the winning contractor must adhere to the approved security plan (Appendix A or B as appropriate). Classified visits must be kept to a minimum and must have prior NRO approval. BYEMAN information will not be accessible to non-briefed individuals under any circumstances.

NRO

Since the ST Program is an unclassified program it is critical that the NRO take every step necessary to protect BYEMAN security and the NRP. NASA briefings to government agencies (Congress, GAO, etc.) which include BYEMAN information must have prior approval by the NRO and an NRO representative will be at the briefings.

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BYEMAN ACCESSES

BYEMAN accesses for the ST Program will be kept to a minimum. They will be granted in those cases where they enhance BYEMAN security and/or are essential to the ST Program.

AUTHORITY

The DNRO will be the final authority on all BYEMAN issues related to the ST Program.

V. CONTRACT ADMINISTRATION

NASA will not assign contract administrative functions to DCAS. These functions will be the responsibility of a NASA Contracts and Property Administration Officer, Detachment A of DCAA will be used by NASA for audit purposes.

VI. PUBLIC INFORMATION - POST CONTRACT AWARD

Guidance on ST Program Public Release, after an OTA contractor is selected, will be as directed by NASA. However, such guidance will not be detrimental to the National Reconnaissance Program, the NRO, or BYEMAN security. NASA ST Program guidance does not relieve any contractor of its NRO contractual requirements to protect BYEMAN experience, capability or hardware.

A. M. Lovelace — Hans Mark

SEP 2 9 1977

Alan M. Lovelace
Deputy Administrator
National Aeronautics and Space Administration

Hans M. Mark
Director
National Reconnaissance Office

21 October 1977

Appendix A: Perkin-Elmer Security Plan, PM 1596-X-B-1, BIF 0070325-76-C

Appendix B: Eastman Kodak Security Plan, BYE 12665/77

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SECURITY GUIDE, NASA EARTH RESOURCES PROGRAM

To preclude compromise of Byeman Project IDEALIST during NASA use of U-2C aircraft, it is necessary to implement the following security guidelines:

a. The fact that a covert U-2 fleet exists is Byeman Top Secret. Further, the fact that two distinct models, i.e., U-2C and U-2R, were developed is Secret - Limdis. Any reference made in writing or print regarding this type of aircraft, as used by NASA, should disclose only that it is a "U-2" aircraft. However, if a specific inquiry is received regarding the model designation of the aircraft, NASA may respond that it is a "U-2C."

b. All U-2 aircraft history is classified and will not be discussed by NASA, except that which has already been officially released. All inquiries regarding other aspects of U-2 aircraft history will be referred to OSDPA.

c. Access to the U-2 Flight Manual must be restricted to those individuals with functional need-to-know, and the content is not releasable to foreign nationals. Duplication of this Flight Manual or any portion thereof is not authorized. The Flight Manual must be safeguarded in containers approved for classified information and destroyed accordingly.

d. Maximum performance data and special operational characteristics of the U-2 are restricted to protect like information on operational fleet capabilities, and will not be disclosed publicly by NASA. A list of what NASA may publicly disclose about U-2 performance characteristics is attached to this memorandum.

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e. Static display of U-2s on loan to NASA is authorized providing all classified components/sensors are removed.

f. All inquiries concerning matters of interest to the USAF will be referred to OSDPA. NASA may answer only questions applicable to the NASA Earth resources project. NASA, likewise, will not supply answers to questions regarding former or current non-NASA operations of aircraft of this type. These topics can be referred to OSDPA.

g. NASA will prepare a planned response to possible queries regarding NASA association with CIA during Francis Powers' operation of the U-2 aircraft. The proposed response will be approved by CIA/AF/IGJ/OSDPA to insure that all are knowledgeable.

h. NASA will prepare an unclassified scenario of planned initial information release to the public on use of the U-2 aircraft in connection with NASA's Earth Resources program. This summary of information will be reviewed by HQ USAF (AF/IGJ) prior to its dissemination.

i. Communications generated by NASA concerning the Earth Resources Program will not make reference to Director, Program D, NRO/CIA or contractor facilities currently supporting USAF/CIA operations unless transmitted and controlled under the Byeman system.

j. NASA will provide the names and full identification data on individuals selected as contract U-2 pilots to HQ USAF (AF/IGJ). None of the U-2 pilots formerly utilized in covert operational activities with project IDEALIST will be considered. Each pilot will require a Top Secret clearance granted by NASA. In order to preclude inadvertent

BYE-12255-71
Atch 1, Pg 2 of 3

disclosure of protected information on the U-2, it is likewise necessary that any other individuals assigned duties which require a need-to-know the full operational capabilities of the U-2 have a minimum clearance of Secret.

k. NASA will obtain the concurrence of the NRO staff prior to requesting IDEALIST clearances on any persons participating in the Earth Resources Program.

l. NASA will not operate the U-2 aircraft outside the United States without prior approval by the NRO.

BYE-12255-71
Atch 1, pg 3 of 3

IDEALIST

The following unclassified characteristics of U-2 Earth Resources aircraft can be released publicly:

a. Type of aircraft ------------------ U-2
(See paragraph a of Security Guide)

b. Engine ---------------------------- Pratt Whitney J75-P-13

c. Wing Span ------------------------- 80'

d. Length ---------------------------- 49'7"

e. Height ---------------------------- 13'

f. Maximum gross take-off Weight ----- 22,000 lbs

g. Ceiling --------------------------- Above 70,000 ft

(Suggest operational altitude be disclosed in lieu of ceiling.)

h. Range ----------------------------- Beyond 3,000 mi

i. Speed ----------------------------- 430 mph

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Addendum 1

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NSAM 156 COMMITTEE
THE SKYLAB EARTH TERRAIN CAMERA
AND A REVIEW OF RECENT TRENDS

The Problem

The National Aeronautics and Space Administration has requested authorization to employ in Skylab an earth terrain camera having a ground resolution of between 10 and 20 meters. This resolution exceeds the 20-meter limitation set in 1966 for unclassified space programs.

The NSAM 156 Committee has considered:

--Whether NASA's request should be approved; and

--Whether such approval, if recommended, should be regarded as an exception to the 1966 limitation or whether this action should be regarded as a general revision of the limitation.

In considering these questions, the Committee has also reviewed recent trends bearing on international acceptance of satellite reconnaissance and other types of observations of the earth by spacecraft.

Recommendations

1. NASA should be authorized to employ--and release photographs acquired by--the proposed earth terrain camera. Prior to the launching of Skylab, present procedures should be followed with respect to precluding photography of sensitive areas, and present screening procedures should be followed prior to any release of photography acquired by Skylab. In addition, use of the camera should be subject to review by the 40 Committee of international factors existing immediately prior to the launch. Since this camera was not mentioned in the Skylab announcement of flight opportunity and since adverse reaction might be occasioned if plans to use the camera were not announced on a timely basis, NASA should take such routine steps as may be necessary to make known the fact that, barring technical difficulties, the camera is planned as part of Skylab's equipment.

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2. The foregoing authorization should be regarded as an exception to the present 20-meter limitation rather than a general revision of the limitation. This recommendation is based on the understanding that, except for Skylab, the 20-meter limitation does not hinder NASA's current programs or forward planning. The recommendation also reflects the view that a general revision might best be undertaken after the initial acquisition and release of space-acquired data about earth resources (as for example by ERTS-A in 1972) has provided a firmer basis for assessing international aspects. In connection with this recommendation, it will be recalled that, as noted in the NSAM 156 Committee's 1966 report, any party at interest can at any time request the Committee to review possible political or security issues which might arise from particular non-military plans, programs, or other related activities concerned with space-based remote sensing.

3. Technical coordination by NASA and DOD of classified and unclassified programs should be continued within the framework of the Manned Spaceflight Policy Committee and its technical arm, the Survey Applications Coordinating Committee. It is understood that these arrangements, which were established pursuant to the 1966 deliberations of the NSAM 156 Committee, have been found useful by both NASA and DOD.

Discussion

1. Skylab

a. Applicability of the 20-meter limitation. The need for some limitation of civilian space capabilities for observing the earth arises from the continuing importance of protecting classified U.S. programs, avoiding the risk of a confrontation with the Soviet Union, and avoiding arousing concern on the part of third countries.

Although the 20-meter limitation set in 1966 has served these purposes, there was no special reason for setting the limit specifically at 20 meters. Moreover, the NSAM 156 Committee noted at that time that the line of sensitivity could probably recede as both technological and political security considerations became less acute (although such a reduction of the security margin could not go on indefinitely).

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The proposed Skylab earth terrain camera, which will be earth-oriented for a total of some 70 hours, is expected--under the best operating conditions--to provide photography having a ground resolution of around 30 feet, that is, slightly under 10 meters. Barring technical or operational difficulties, Skylab would thus provide the highest quality space-acquired photography of the earth yet released.*

Photography of this quality should afford an adequate margin from the standpoint of technical and political considerations affecting the continuing viability of classified U.S. programs. There is agreement that no problem would be raised from the standpoint of the security of classified programs.

However, since Skylab is not to be launched until 1973, it would be desirable to arrive at a final decision on use of the proposed camera in the light of international conditions closer to the time of the launch. The following developments in the interim could provide an improved basis for confirming the judgment that use of the Skylab camera will not have adverse effects:

--Initial data from NASA's ERTS-A experiment should be available prior to the Skylab launching. Although these data will be of relatively low resolution, they will provide a further opportunity to check international reaction.

--In addition, NASA's use of the U-2 may in a general sense contribute to international awareness of the usefulness of photography for earth resource surveys. The initial use of the U-2 to simulate ERTS will result in photographic data from U.S. test areas in the 100-foot ground resolution class. However, for other specific investigations such as disaster assessment, ground truth extrapolations, sensor-signature research, or cartographic research, unclassified U-2 photography of the U.S. will become available in a wide variety of resolution classes extending in some cases to the order of a few feet. Since overflight by aircraft for such purposes would be subject to the control exercised by other countries over their airspace, release of photography of the U.S. of this quality should not arouse sensitivities abroad.

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*For purposes of comparison: the widely circulated photographs of the earth acquired by Gemini and Apollo space flights have a ground resolut on the order of 250-300 feet.

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Apart from a special check of the international situation prior to the launching of Skylab, present procedures should be followed to identify sensitive areas which should not be photographed, and to screen Skylab photography prior to release.

Assuming that we are correct in believing that use of the proposed Skylab camera will not have adverse international effects, positive benefits resulting from its use would include not only the relevance of the data acquired to measuring the utility of space-based earth resources surveys but also the bridge that this step might provide to public acceptance of higher quality data.

b. General revision of the 20-meter limitation. The NSAM 156 Committee has been advised that at this time, except for Skylab, the 1966 limitation does not hinder NASA's programs or forward planninc It will, of course, be desirable to undertake a general review of the limitation to provide a firm basis for decisions on future NASA program This might best be undertaken on the basis of at least some actual experience with foreign reaction to earth resources data which will be acquired through NASA's present programs, beginning with the launch of ERTS-A in 1972.

c. Continuing coordination. Pursuant to the 1966 deliberations of the NSAM 156 Committee, the NASA-DOD Manned Spacefligh Policy Committee and its technical arm, the Survey Activities Coordinating Committee, were established to effect improved coordinatio on technical problems. In this connection, NASA and DOD have adopted as a working assumption the view that at a future time public disclosur of imagery down to 5 meters ground resolution may be possible. From the standpoint of political sensitivities, such an approach would presumably place greater emphasis on managing the release of data than on constraining acquisition of data. It is understood that if technica discussions between NASA and DOD should reach the stage where firm planning or programming decisions are required, specific recommendation will be brought to the attention of the NSAM 156 Committee.

2. Review of Current Trends.

a. Soviet attitudes. The 1966 report of this Committee called attention to the generally favorable evolution of Soviet attitudes toward satellite reconnaissance. This trend has continued.

Soviet interest in satellite reconnaissance remains strong, and the Soviet Union probably perceives satellite reconnaissanc as the means of maintaining a degree of parity in strategic intelligenc between itself and the U.S. The Soviet Union is not likely unilateral

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4th page of report BYE-17399/71

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to declare that it is pursuing this activity, but it is improbable that the Soviet Union would jeopardize its own efforts by raising internationally political or legal challenges to U.S. programs.

In SALT, the Soviet Union has emphasized reliance on those national means of verification which are legal. Soviet representatives have not defined explicitly what they regard as legal. The terms of the draft agreement have purposely not expressed in detail the extent of the "national means" to be employed. This question has been retained at low key by both the Soviet Union and the U.S. There is, however, no reason to doubt that reconnaissance satellites fall within the category of acceptable national capabilities and would be viewed as a basic element on which a strategic arms limitation agreement would necessarily rest. In a more general sense, the SALT discussions provide a firm basis for concluding that the Soviet Union accepts mutual observation by satellite as an unofficially acknowledged fact of life.

Publicly, the Soviet Union has placed increasing emphasis on the use of spacecraft--particularly manned spacecraft--for scientifically and economically useful observations of the earth and has clearly acknowledged its own activities in this field. For example:

--During the 1970 session of the Scientific and Technical Sub-Committee of the U.N. Outer Space Committee, A.A. Blagonravov reported on Soviet plans for launching a manned laboratory (subsequently designated SALYUT) and noted that it would provide an excellent means of studying territorial resources from space, that it would replace about ten separate artifical satellites of the present type, and that it would be able to observe the earth's surface constantly. He noted that even though the laboratory had not yet been launched, the information which was gradually being assembled was of real value for many countries, especially the developing countries.

--In a Pravda article following the launching of SALYUT and SOYUZ-10, Blagonravov pursued this line and cited the following case: "Everyone knows very well, for example, the photograph of the earth obtained from the Zond-5 automatic station. On it Africa is clearly visible, with only a very small cloud covering. By analyzing the photograph, scientists have built up a geobotanical map of this continent... It turned out to be considerably more accurate than a map which was based on the data of hundreds of expeditions which have explored Africa for dozens of years."

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The January 1971 agreement between NASA and the Soviet Academy of Sciences to cooperate in surveys of the natural environment seals public acceptance by the Soviet Union of this type of non-military observation activity. The August 1971 recommendations of the Joint (NASA-Soviet Academy of Sciences) Working Group on the Natural Environment envisage extensive cooperation, including the use of photography and other sensors and exchange of raw data. During the August meeting of this group Soviet scientists were informally advised of NASA's plans for employing the proposed earth terrain camera on Skylab. It is reported that no adverse reaction was apparent.

The generally satisfactory character of these developments does not lead to the conclusion that we should be less wary of steps which might provoke a confrontation with the Soviet Union on this issue. However, under foreseeable circumstances, such a confrontation is improbable. As long as there is mutual interest in pursuing earth observations from space and no major one-sided military, political, or economic advantage appears to favor the U.S., this favorable situation is likely to obtain.

b. Third Country Attitudes. There is now a fairly high degree of unofficial but authoritative recognition of the fact that reconnaissance satellites are in use by the U.S. and Soviet Union. For example, regarding the U.S. effort, the 1969/70 Yearbook on World Armaments and Disarmament published by the Stockholm Internationa Peace Research Institute states:

> "As a result of the development of reconnaissance satellites, Western estimates of Soviet launchers deployed are now probably rather reliable. For example, the cameras carried in reconnaissance satellites are reported to be capable of a revolution of less than 1 foot... Estimates of how many missile silos are under construction or how many submarines have been launched and are in the water, based on satellite reconnaissance, are likely to be quite reliable."

Third countries have not as yet posed any major challenge to such activities and have voiced little criticism of them. This may be in part because they have not viewed their own interests as adversel affected. It may also reflect to some extent their recognition that progress toward limiting the arms race between the super-powers--an objective in which a number of third countries have expressed an interes will depend partly on such capabilities. Finally, they may be resigned to the fact that efforts in the U.N. or elsewhere to curb reconnaissanc activities would not, in the final analysis, be effective if opposed by the U.S. and Soviet Union.

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Third country interest in the use of satellites for earth resource surveys has intensified since the President, in his address of September 18, 1969, before the United Nations General Assembly, pledged that the U.S. effort in this field "will be dedicated to produce information not only for the United States but also for the world community."

Subsequently:

--The General Assembly endorsed cooperation in this field;

--Information about the practical potential and the techniques of remote sensing by aircraft and spacecraft has been more widely disseminated (for example, representatives of some 56 countries and international organizations attended a NASA workshop in May of this year); and

--Proposals for experiments have been received from scientists of some 26 countries

Such developments stand witness to significant interest in and acceptance (in principle) of the use of satellites for earth resource surveys. However, they do not mean that all international hurdles have been cleared.

Within the U.N. Outer Space Committee (and probably more generally within the U.N.), the experimental character of the earth resources survey program is understood, and the need for at least some experimental results has been accepted as a prerequisit to consideration of the kind of international "framework" or ground rules within which earth resource surveys by satellite might best proceed.*

At the same time, concern has been expressed about U.S.-Soviet domination of this field, about the need for assuring access to data, about protecting national sovereignty over natural resources, and about precluding the chance that space-launching count might gain special economic advantages through this route. Moreover, it remains possible (perhaps likely) that the political and military authorities of some third countries have not as yet focussed on all aspects of this matter and may find themselves disturbed by its implications when they do.

*Acceptance of this approach is reflected in the decision of the (Jul 1971 meeting of the U.N. Outer Space Committee's Scientific and Techn Sub-Committee that its proposed working group in this field should no commence its substantive deliberations until some experimental data a available.

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From the standpoint of the particular interests of the NSAM 156 Committee, it would be desirable for the United States to establish a more detailed policy basis for handling political and legal questions related to earth resource surveys by spacecraf The evidence to date--that is, the evidence provided, in particular, by discussions in the U.N.--suggests that any such questions will probably be directed at earth resources surveys as such rather than all (or other) types of observations of the earth from space. It would, however, be desirable to examine carefully what policy determinations may be needed to ensure continuation of the present trend toward acceptance of earth resources surveys by spacecraft.*

Finally, as regards third country attitudes, there is now such widespread acceptance of--and dependence on--weather reporting by satellite that it is improbable that any questions raised about other types of observations of the earth from space would take the form of a general challenge to all such observations.

c. Chinese Attitudes. At this juncture, the "third count: of perhaps the greatest interest is the People's Republic of China. The NSAM 156 Committee has not previously given separate consideratic to what China's attitudes toward reconnaissance satellites might be. China's entry into the United Nations would, of course, afford it a voice in U.N. consideration of space activities. Moreover, as a space-launching nation, China would be a logical candidate for membership in the U.N. Outer Space Committee. Consequently, it woulc be desirable to give timely consideration to whether presently available information suggests any tentative conclusions about the way in which China might approach international questions related to observation of the earth from space.

*The Committee notes that such policy issues are to be considered in connection with NSSM 72.

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NRP-STS TRANSITION POLICY

For planning and programming purposes, it is intended hat the NRP transition to the STS as soon as practicable fter it becomes operational. However, it is essential that e ensure the capability to accomplish the NRP mission during nd after transition. This means that we must have a viable apability to deploy our collection systems at all times and nsure adequate security provisions to protect our resources nd intentions. In addition, special attention must be given o simplicity, commonality and low cost approaches for evelopment, modifications and operation of NRP satellites in ssociation with the STS.

With these primary objectives in mind, the following xpanded transition policy has been developed and is furnished or guidance in conducting STS transition activities:

a. NRO-NASA agreements will be established to ssure that we have the necessary control over those operaions which can adversely affect the capability to reliably eploy our systems. This includes all the required STS tasks or system integration and ground and mission operations.

b. Current NRP management principles and practices ill apply during both the transition period and operational hases of the STS. Maintaining NRP security will be of paraount concern in the integration of NRP systems to the STS. asic BYEMAN security practices and techniques will apply uring the transition to, and operations with, the Shuttle. pecial attention must be given to identifying STS interface ecurity problems during the planning process.

c. When feasible the transition of NRP space ystems will occur at the time of system block changes. The RO must strive to ensure STS and IUS designs and design hanges provide adequate capability to support present NRP atellite requirements and include sufficient flexibility and argin for growth configurations.

d. No NRP spacecraft will be designed in a Space uttle-only configuration prior to the demonstrated capability d reliable operation of the STS.

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e. All new NRP systems or major block changes to isting systems which enter design subsequent to FY 76 will designed in a modular configuration (provided the addi- onal weight capability of the Space Shuttle would be vantageous to mission accomplishment) so that when the ace Shuttle has demonstrated its reliability, improvement dules can be added to the NRP spacecraft. This will allow to take maximum advantage of the increased Space Shuttle pability.

f. If future NRP satellite requirements would cessitate significant STS design changes, DNRO review and proval will be required.

g. The NRO will ensure an ELV backup capability til the Space Shuttle has demonstrated a high probability successful launch support to the NRP.

h. The need to provide a quick reaction capability ring crises, when the importance of overhead reconnaissance uld increase and the Shuttle may be neutralized, requires at consideration be given to use of alternate launch means a backup to the Shuttle.

i. Functional interfaces with the STS will be nited to those which satisfy basic STS program requirements those which are necessary to ensure a reliable deployment the satellite system. Payload command, control, telemetry nitoring and analysis of anomalies will remain the respon- bility of NRP mission ground stations, the SCF, and/or atever appropriately secure ground-based control mechanism designed for STS launch. (This guidance is not intended prohibit checkout and analysis of payloads while in the biter bay by automatic pre-stored command and software thods, if such testing offers significant advantages.)

j. Wherever feasible the NRO will make use of isting or programmed resources. Provided mission accomplish- nt (including security) is not adversely affected, the aring of NASA resources at JSC and KSC and the DoD facilities Vandenberg AFB will be pursued. NRP payloads may share S orbiter missions with other DoD payloads, provided appro- iate security arrangements are undertaken. Mission sharing rangements will be implemented only after operational control l security requirements are satisfied.

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k. The NRO will exercise direct control of the NRP payloads during all phases of the STS operation, except for agreed upon safety overrides. This means that the NRO will maintain approval authority for STS mission planning, scheduling and operations of NRP satellites. No agreement which abridges this authority will be entered into without the express approval of the DNRO.

l. NRP system transition plans and exploitation studies on future potential applications using the STS should be coordinated with appropriately cleared NASA program personnel and must be coordinated with the NRO Staff.

m. The Office of the Secretary of the Air Force, Office of Space Systems (NRO Staff) will serve as the NRP interface between NASA Headquarters and the DOD-level STS planning community. The Office of the Secretary of the Air Force, Office of Special Projects (Program A) will serve as the field level interface between NASA Centers, Space and Missile Systems Organization offices, NRP payload program offices, and participating BYEMAN contractors.

These guidelines will remain effective until superseded by later direction.

Charles W. Cook

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TRANSITION PLAN FOR DEFENSE AND INTELLIGENCE SATELLITES TO THE SPACE TRANSPORTATION SYSTEM

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Introduction.

This report describes the plans for transition from expendable launch hicles to the Space Transportation System (Space Shuttle) for satellite ,tems operated by the Department of Defense (Air Force and Navy) and the National Reconnaissance Office. Currently the Department of fense operates eight satellite systems: Four communications satellite ;tems, one indications and warning satellite system, one meterological tellite system, and two satellite systems used for navigation, positioning d targeting. In addition, five new satellite systems are in the proposal ige. The National Reconnaissance Office also operates eight satellite ;tems. These include three imaging satellite systems and five electronic elligence satellite systems. [redacted] Thus, a total of sixteen satellite systems currently in operation for purposes of national security with six more in proposal stage. (b)(1) (b)(3)

Out of the sixteen satellite systems, four of the older ones will be ased out in the next few years and will therefore never be launched using Shuttle. The remaining twelve satellite systems will be modified so that ey can be launched using the Shuttle for first flights ranging from 1982 to 86. The transition plans for each of the twelve satellite systems have en very thoroughly examined. As a result, it has been determined that ere are two systems for which the conversion date to the Shuttle could be celerated at relatively modest cost and low risk (P-989 program satellite om 1985 to 1983 at an added cost of $9M and Defense Support Program tellite (DSP) from 1983 to 1982 at an added cost of $68M). The transition tes of two other satellite systems could be moved forward but further tensive study is needed to assess both the costs and the risks [redacted] Finally, it is possible at the transition to the Shuttle of the [redacted] satellite could be celerated, but this complicated issue deserves more detailed study. The maining seven satellite systems have Shuttle transition dates that cannot moved. (b)(1) (b)(3)

Summarizing then, of the sixteen systems currently flying, four will be ased out before the Shuttle becomes completely operational and twelve ll be modified so that they can fly on the Shuttle. The time schedules of e of the twelve satellite systems that will fly on the Shuttle could be celerated with some added cost and some attendant risk so that transition the Shuttle could occur sooner. These results are summarized in Tables 1 d 2.

In addition to the satellite systems currently flying, it is important to cognize that much effort is being expended on designing new satellite

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stems that will be optimized for the Shuttle. The six satellite systems w under development will all, in one way or another, take unique vantage of the capabilities of the Shuttle. Furthermore, the Shuttle itself ll be used as a platform for operations of military value and for various fense oriented research and development programs. In looking at the ans for Shuttle employment by the Department of Defense, these efforts ay be even more important because of the leverage they have in termining the future.

From the very beginning there has been a commitment by the epartment of Defense to use the Shuttle once it is available. The fact that e Shuttle payload bay, when it was designed in 1970, was sized to commodate the HEXAGON spacecraft illustrates this point in the best ssible way. The posture for the transition to the Shuttle has generally en conservative because of the importance of satellite systems to national curity. Two points have generally been considered as important in veloping plans for the transition period between the phase-out of the pendable launch vehicles and the advent of the Shuttle.

1. All spacecraft that will be flown during this period are dual capable the sense they can be either launched on an expendable launch vehicle or the Shuttle.

2. An expendable launch vehicle backup capability will be maintained case the Shuttle does not meet its projected schedule. This backup pability is also important in view of the uncertainty about the initial uttle performance.

In order to judge whether a given transition plan for a satellite system appropriate, it is necessary to understand the effect of a potential gap in e data provided by the system on national security. Obviously, some tellite systems are more critical than others. Roughly speaking, those tellites dealing with Strategic Indications and Warning, Communications telligence and Strategic Arms Treaty Verification have been placed at the ghest level of priority. Navigation satellites, weather observation satel-tes and some communications satellites are somewhat less important on e average. Satellites which tend to be the sole source of data collected e more important than those which form just one portion of a data llection system. Priority judgments of this kind must then be combined ith an assessment of the technical risks. Generally, a more conservative ansition approach has been adopted on high priority and/or high technical sk programs. These factors should be kept in mind when examining the ansition plans for individual spacecraft systems in Section III.

In assessing the increased risks entailed in the Shuttle transition eriod, two other factors were considered. One deals with the technical nanges that must be made to a spacecraft system in order that it can fly afely on the Shuttle. The launch environment of the Shuttle is somewhat arsher than that experienced in currently used expendable launch vehicles.

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be done before actual measurements of the Shuttle environment are ailable, which will accordingly increase the program risks. The second ctor is the technical progress made in the Shuttle program. Uncertainties troduced by technical problems with the main engine and programmatic lays that may arise in the preparation of the West Coast Launch Facility, Vandenberg AFB and a classified control facility need to be considered. more detailed assessment of these risks will be provided in the following ctions.

Technical Factors.

There are a number of important technical factors that need to be nsidered in planning the transition of spacecraft to the Shuttle. Many of ese are common to all of the spacecraft systems included in this report d it may thus be useful to look at them across the board. There are bstantial long term benefits that will accrue from the use of the Shuttle. owever, it is important to recognize that these are long term benefits, and at in the near term, the introduction of the Shuttle will cause problems at need to be overcome and will probably also incur some added costs. nere is no doubt that the benefits will eventually outweigh the drawbacks d it is for this reason that a strong commitment to using the Shuttle has en made by the Department of Defense.

A. Benefits.

The operation of the Shuttle will be dominated by the presence of an. Each flight will be manned and this fact will change the way we do ings in very fundamental ways. The recent historical evidence is that ost spacecraft which fail experience failures right after launch. Very obably it is the launch environment that is the source of most of these ilures. The Shuttle will make it possible for mission specialists to check it spacecraft before they are deployed from the Shuttle, thus hopefully iminating the launch environment as a cause of trouble. Once they are eployed, the spacecraft can fly in parallel with the Shuttle for a while and in be checked out to see whether they are operating properly. Should oblems be turned up in this procedure, it might be possible to either fix ie spacecraft on orbit, or to retrieve the spacecraft and land with it, so iat it can be repaired and refurbished on the ground. In either case, the acecraft needs to be designed to accomplish these operations. This is ssentially what is meant by "Shuttle" unique designs of space systems. In ie future, the ability to do the things that have just been listed will be esigned into a spacecraft at the very beginning. For example, a modular esign will probably become common so that assembly of spacecraft on orbit ecomes possible. The replacement of failed modules is another possibility iat needs to be considered. The testing of such modules or various single omponents and groups of components on orbit will become possible in the ctual space environment before they are flown. These subsystems could be iounted on the Long Duration Exposure Facility (LDEF) or the Space Test ack on various Shuttle flights and they could then be retrieved after the est is completed. Finally, there is the possibility of developing manned perations on orbit outside the Shuttle. There is every reason to believe hat Extravehicular Activity (EVA) will become very common and that this vill make possible the erection of large structures in space. Perhaps the irst practical application of space construction is the assembly of large ntennas on orbit for ELINT purposes.

There is no doubt that doing the <u>same</u> things that we now do with xpendable launch vehicles using the Shuttle will be less costly. The fact is, owever, that the Shuttle will add an entirely new dimension to our perations in space. The exploitation of these new capabilities will cost noney and thus, strict cost comparisons between what we are doing today nd what we will be doing five years from now when we have the Shuttle, re just not possible. We can certainly make some estimates but they are ot the equivalent of cost benefit analyses since fundamentally different hings are being compared.

B. Problems.

The advent of the Shuttle will also cause some significant problems. 'he current Shuttle development schedules will not provide a good experinental definition of the flight environment that will be experienced by the nore fragile satellites of the Defense establishment until late in 1979. Although tests on the ground will make it possible to make estimates, it vould be desirable to have actual flight data to factor into the design of the nost important spacecraft. To minimize the cost and schedule impact on hese important spacecraft, schedules have been adjusted in such a way that lata from the flight environment is available prior to hardware design. The ncertainties in the flight environment and the recent Shuttle main engine levelopment problems which have caused the first orbital flight test to be lelayed have caused the introduction of additional risk in various satellite ransition schedules.

Cost is a second factor that needs to be carefully considered. Schedules have been established to permit cost savings through the transtion of a given spacecraft to the Shuttle at the same time as a planned pacecraft upgrade (spacecraft block change) whenever possible. By doing his, one can save at least one requalification procedure for that particular pacecraft. Even though it is desirable from the standpoint of cost effectiveness to have block changes coincide with the Shuttle transition, his is not always possible. The upgrading of spacecraft, together with the ransition, is not consistent with operational requirements in every case. Therefore, additional costs will be incurred for the second requalification procedure.

There are some instances in which insertion into low earth orbit of a pacecraft using an expendable launch vehicle turns out to be less expensive ıan a Shuttle ride. This is true, for example, [redacted] where the accounting is currently done in such a way that no harge is levied on the user for the launch costs. Once the Shuttle is ıtroduced this situation will change since all users will be charged for the ıunch costs according to the NASA formula.

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Military construction and the funding thereof is another problem which ıust be considered in developing the transition plan to the Shuttle. A umber of spacecraft in the intelligence and the Defense Department rograms must be launched from the facilities at the Western Test Range /andenberg Air Force Base). These facilities must be available before the ıunches for such payloads can be scheduled on the Shuttle. This requireıent, of course, stems from the basic orbital mechanics which will be escribed in the discussion of transition plans for individual vehicles which ›llows. In several cases it will be seen that the availability of the launch acilities at Vandenberg Air Force Base is the pacing item in the Shuttle ·ansition schedule.

Military construction is also required to provide secure and reliable ıission control facilities for the Shuttle. It is very clear that special :ecautions need to be taken in mission control to maintain the security equirements and the redundancy of very high priority National Reconnaisance Program and Defense Department classified missions. This will equire the construction or modification of certain facilities. The schedule ›r the construction of these facilities will not be a pacing item since the Controlled Mode" operation at the Johnson Space Center will be available ıtil a secure mission control facility is built for Intelligence and Defense ıissions. The requirements for such a mission control center will be ıtlined later on in this paper.

Perhaps the most important factor which could delay transition of a ımber of spacecraft to the Shuttle is the performance of the orbiter itself. he Shuttle main engines have still not performed according to their design ›ecifications, and tests to see whether they will actually work as planned ·e still to be conducted. It is possible, therefore, that the first flights of ıe Shuttle will be carried out with considerably degraded performance hich will, in turn, make it impossible to fly some of the heavier payloads. he orbiter also is experiencing weight problems which will add to the fficulties that may be encountered in launching some of the heavier efense Department payloads. If it turns out that the main engines never erform according to the original plans, or if the orbiter weight problems annot be solved, then modifications of the solid booster system may ecome necessary in order to meet the payload requirements. In that case, unch pad modifications will have to be added in order to handle larger or lditional solid boosters. Should this contingency come to pass, further ›nstruction funds will be required.

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C. Shuttle Mission Operations.

Another important issue that affects the transition to the Shuttle is ıe conduct of Shuttle mission operations for the Defense Department ·ograms in which security and military operational requirements are ıctors. Mission operations include the planning, preparation and the ›ntrol of the Shuttle flights. These operations must be conducted in a :cure environment for classified flights in order to protect the purpose of ıe mission, the capabilities of the spacecraft and the operations on orbit. ot only is a secure mission operations system required to protect payloads ıat are being transitioned to the Shuttle, but also to provide an opportunity › fully exploit the Shuttle for expanded military and intelligence applica-ons. It is conceivable that the Shuttle itself will be used as a platform for ilitary operations of various kinds and that operation of such a platform ust clearly be carried out in a secure environment.

The ability to carry out high priority military and intelligence missions ust not be dependent on factors having to do with weather, power outages, ıbotage, and other unforeseen contingencies. Thus redundancy becomes an nportant requirement. A redundant mission control center will eventually ecome necessary once Shuttle operations become routine. There are issions that simply cannot be postponed even if an accident or some other nergency causes a shut down at the Johnson Space Center. In the long :rm, the redundancy factor is probably more important than security ›nsiderations. The Air Force and NASA have considered a number of ›proaches for the conduct of intelligence and Defense Department missions ;ing various existing control facilities. The objective has been to employ ıcilities and equipment to meet the operational requirements of the efense community at the lowest cost within appropriate security con-:raints. The approaches investigated have included dedicated and shared ıcilities. The alternatives have been narrowed down to two leading ›tions:

1. A shared "Controlled Mode" at NASA's Johnson Space Center at ouston, Texas. This operating method will be used in the beginning ·obably with some compromise of security requirements.

2. A modification to the Air Force Satellite Test Center at Sunnyvale, alifornia. This is an existing facility which was originally intended to ›ntrol the Manned Orbiting Laboratory. It has all the necessary facilities ›r developing a Shuttle mission control center that meets the most ringent security standards.

The "Controlled Mode" was developed to permit simultaneous classi-ed and unclassified operations to be conducted at the Johnson Space enter. The configuration includes a mixture of dedicated and shared ıcilities, equipment, computers and personnel. This option would cost the efense Department approximately $93M to implement in order to support ıe first classified Defense Department missions in 1982. The Sunnyvale

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ite is presently the control center for many of the Defense Department pacecraft planning and operations. It is a secure facility with secure data .nes and communications to the launch centers. Preliminary Air Force stimates show that it would cost approximately $107M to augment this enter to support Defense Department Shuttle operations in FY 84. This ost includes $15M for a short term contingency capability at the Johnson pace Center for classified programs beginning in 1982 to protect the ability o conduct early classified missions from Johnson Space Center.

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The open environment at Johnson Space Center poses a unique security roblem. The current Shuttle traffic model shows a classified payload aunch in 1982 and one in 1983. Because the classified traffic increases ubstantially in 1984 it is imperative that plans for a permanent secure nission operations center be developed.

). Expendable Launch Vehicles

The essential philosophy of the Department of Defense with respect to xpendable launch vehicles has been to maintain a conservative backup osition to support operationally critical Defense and Intelligence missions. 'he idea is to maintain a stable of expendable launch vehicles with ubsystem fabrication and complete vehicle assembly keyed to the development schedule milestones of the Space Shuttle. The expendable launch ehicles currently in use are shown in Figure 1. It is important to recognize hat the situation for Titan launch vehicles is quite different from that for ttlas and Thor rockets. In the case of the Atlas and the Thor which are efurbished intercontinental and intermediate range ballistic missiles, there re vehicles available in storage so that additional production is not equired. The maintenance of Thor and Atlas backup vehicles therefore is ot a large cost item.

In the case of the Titan rocket, a production line must be maintained n order to build the necessary backup vehicle inventory. It could be argued hat the cheaper option would be to build the required number of Titan ehicles rapidly and then close the production line. The difficulty with this pproach is that if the Shuttle does, in fact, remain on schedule, then more ehicles would be built than we actually need. Should the Shuttle schedule lip substantially, then it is quite possible that we will not have produced nough Titan vehicles to meet our requirements. Therefore, there could be time period in which we lose the capability to launch any of our heavy ayloads. The current plan avoids this problem by phasing production of the Titan vehicles with the Shuttle schedule milestones in such a way that only hose Titans that are really needed are actually assembled. Thus, a speedup of the Shuttle schedule would not change the current Titan acquisition plan. All that would happen is that fewer Titan vehicles would actually be assembled as the milestones are successfully passed. The situation is illustrated in Table 3 which shows the total cost for expendable launch vehicles on a year by year basis and the money that could be saved as Shuttle milestones are successfully passed and the transition to the Shuttle is accelerated.

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A more rapid transition to the Shuttle could change the situation in ıe case of the Atlas launch vehicles because fewer would be required. An xtremely optimistic Shuttle transition schedule would mean that we may se five fewer Atlas's than currently planned. Even in this accelerated ansition, only minor if any cost savings may be secured because flights on ıe Atlas will still be required through 1984 for the [redacted] (b)(1) (b)(3) here would also be no savings in the vehicle procurement portion of the rogram since the Atlas vehicles that are being used already exist. In fact, epending on the ability or inability to share launches with other payloads, ıuttle launch costs may exceed any projected savings. Thus, there is robably no advantage to speeding up the Shuttle transition schedule for ıose spacecraft launched with Atlas rockets if cost is the only considera-on.

A final word should be said with respect to Scout launch vehicles. The urrent NASA plan is to eliminate the capability to use Scout vehicles after ıe Shuttle becomes operational. The Scout is an excellent rocket for the eployment of small satellites and it can be launched from a number of ifferent sites around the country. Therefore it may be advantageous to etain the flexibility to put small satellites in orbit with the low cost Scout ehicles. Currently, each Scout launch rocket costs approximately $5M and ıis is well below the prorated cost that may be incurred in various Shuttle ıunches for satellites of interest to the Department of Defense. Thus, it ıay be important to reconsider the decision to phase out the Scout launch ehicles after the Shuttle is in operation.

I. Satellite System Descriptions.

A. National Reconnaissance Program (NRP)

The shuttle transition policy for the National Reconnaissance Program s set forth in March 1975 consisted of three major provisions:

(1) All National Reconnaissance Program satellites which enter inal production prior to 1980 were to be "dual compatible," that is, they ere to be designed to be either launched from a Shuttle or from an xpendable Launch Vehicles.

(2) All interfaces between National Reconnaissance Program pacecraft and the Shuttle were to be kept as simple as possible during the ransition period. Thus, the Shuttle was to be used only as a booster and ther unique properties of the Shuttle would not be considered in the design f the spacecraft. However, all new systems or block change systems which nter design subsequent to FY 76 would be designed in a modular configu-ation, providing that the additional weight capability of the Shuttle would e advantageous to the accomplishment of the missions.

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(2) Expendable Launch Vehicles for backup would be retained ıntil the Shuttle demonstrated the reliability and the weight carrying ability o launch National Reconnaissance Program spacecraft.

This transition policy has become more aggressive during the last 18 nonths as systems concepts have been developed for the post 1979 time ›eriod, and as the Shuttle program has matured. The current Shuttle ransition policy of the National Reconnaissance Program can be stated as ollows:

(1) Transition all spacecraft to the Shuttle as soon as prudent isk judgments and cost factors will permit.

(2) New spacecraft designs scheduled to enter production after he Shuttle is successfully demonstrated will exploit fully the unique ›roperties of the Shuttle.

(3) Extensive studies will be conducted to examine the new eatures inherent in the Shuttle and how these can be exploited to enhance he National Reconnaissance Program missions.

(4) Expendable Launch Vehicles will be maintained in case ›huttle development schedules are not met. This will be accomplished by leveloping and maintaining a schedule for the acquisition of the backup aunch vehicles which is keyed to the Shuttle performance milestones.

The current Shuttle transition policy is aggressive for the moment but ⁄ill most likely become more aggressive as we are better able to assess the echnical risk and envision the unique capabilities of the Shuttle.

The following pages discuss each satellite system, the current tran- ition plan, the possibilities of accelerating that transition, and conclude ⁄ith a recommendation for each system.

GAMBIT

This satellite is a low earth orbit, high resolution, film imaging ystem. The GAMBIT spacecraft is in the 10,000 pound class and is launched rom Vandenberg AFB into a near polar orbit by a TITAN IIIB Expendable ‚aunch Vehicle..

The FY 79 budget terminates regular flights of GAMBIT, adds a nedium resolution broad area search capability, and assigns the system to a ackup role for [redacted] and HEXAGON through 1985. There are five pacecraft already built or in production and the necessary launch vehicles ave been purchased. Since the program is to end in 1985, no formal ransition plan has been developed. If GAMBIT becomes the only user of the (b)(1) (b)(3)

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TAN IIID launch complex it would be prudent to consider transitioning for uttle launch, since the cost of the already purchased Expendable Launch hicles would be offset by the cost of maintaining the launch complex.

It is recommended that no transition plan for GAMBIT to the Shuttle developed at this time.

HEXAGON

This satellite is a low earth orbit, medium resolution broad area search m imaging system. The HEXAGON spacecraft is in the 25,000 pound class d is launched from Vandenberg AFB into a near polar orbit by a TITAN D.

The current transition plan calls for minimum spacecraft modification accommodate Shuttle launch while retaining compatibility with the Titan D backup vehicle. No Shuttle-unique capabilities are planned. It is likely at the HEXAGON program will be phased out in the 1985 time frame since e current program calls for [redacted] to be operating then. In ldition, HEXAGON must be launched from Vandenberg AFB and it is likely at the program will be phased out before the full lift capability from ındenberg is validated.

Thus, although there is a transition plan for HEXAGON, it is unlikely at it will be executed. Transition of HEXAGON to the Shuttle is not commended.

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This satellite is a medium to low earth orbit, medium resolution, ectro-optical near-real time imaging system. [redacted]

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FUTURE PROGRAMS

In addition to the systems described above, several studies are being ıducted to determine the feasibility and desirability of acquiring recon- ssance payloads to be operated on the Shuttle orbiter. Thus we are here :aking of transitioning capabilities to the Shuttle vehicle itself, not rely launching systems via the Shuttle.

(1) WASP (Wide Angle Search Payload). This payload is a panoramic nera mounted on a standard Shuttle pallet to conduct wide area search otography as is now done with HEXAGON. It would be entirely integrated o the Shuttle and would use the HEXAGON panoramic camera techno- ;y, but not HEXAGON hardware. On an average mission, it is estimated ıt a panoramic camera of this kind could image two and one half million ıare miles of territory (compared to fourteen million for HEXAGON). e payload, weighing approximately 7000 pounds and requiring about 12 et of the Shuttle payload bay is substantially smaller than HEXAGON. e WASP payload could be flown several times a year, sharing a ride on dicated National Reconnaissance Program Shuttle flights. This concept is tremely attractive as a means to augment the [redacted]

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(2) GAMBIT Shuttle Payload. The Shuttle can use the photographic aging and film handling/storage portion of the GAMBIT satellite in a lletized mode. This option would allow for the packaging of a system ıich could be used on many of the Shuttle missions. GAMBIT hardware ould return high resolution stereo imagery from selected Shuttle missions, ould maintain a back-up capability for other imaging systems and would ovide additional acquisition of high resolution photographic imagery, a ajor consideration if [redacted] is substantially postponed.

(3) [redacted]

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(S) [redacted] Studies of a [redacted] (b)(1) (b)(3)
stem are being initiated. This spacecraft would be completely Shuttle ptimized and would be designed to take maximum advantage of the pabilities of the Space Shuttle.

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Defense Department Programs.

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DEFENSE SATELLITE COMMUNICATIONS SYSTEM (DSCS)

The system consists of four satellites and two spares in geosynchro-us orbit to provide long haul, secure communications. The DSCS II acecraft is in the 1500 pound class and the DSCS III spacecraft is in the 00 pound class. The DSCS satellites are launched in pairs on a Titan-IIIC Titan-34D/IUS from Cape Canaveral.

unched on Titan IIIC's; flights 8 and 9 to be launched on Titan 34D/IUS's; ıd flight 10 to be launched on the Shuttle from Cape Canaveral in late)82. Flight 10 would be the first launch of the operational DSCS III ıtellites. The DSCS III production spacecraft are to be launched in pairs ;ing the Shuttle/IUS. To assure the continuity of long haul communications ›verage, the DSCS III's retain the capability for launch on an Expendable aunch Vehicle should the Shuttle schedule slip.

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Although it is possible to advance the first DSCS Shuttle launch from .te 1982 to early 1981, there are increased risks in the DSCS III develop- .ent program and significant additional costs. The earlier Shuttle launch)uld be accomplished using a DSCS II spacecraft and the second DSCS III evelopmental model. If this plan were adopted and the first DSCS III evelopmental model suffered a launch failure, the DSCS III production ecision, DSARC III, would have to be delayed; thus increasing the possi- .lity of a shortage of on orbit satellites. Also, $52M in additional funds, to ıake the DSCS II spacecraft Shuttle compatible and to launch the DSCS /DSCS III combination, would be needed in FY 79-81. Other options ıvolving Shuttle launches of single spacecraft have been rejected as not eing cost effective.

Based on the cost to accelerate the DSCS Shuttle transition from 1982 › 1981, an earlier transition is not recommended.

AIR FORCE SATELLITE COMMUNICATIONS SYSTEM (AFSATCOM)

This system consists of transponder packages (AFSATCOM I) mounted n the Satellite Data System and Fleet Satellite Communications space- raft. No dedicated launches are conducted for the AFSATCOM program. he follow-on to AFSATCOM is the Strategic Satellite System.

FLEET SATELLITE COMMUNICATION (FLTSATCOM) AND LEASAT

FLTSATCOM is a Navy communications satellite which services many ifferent users. Launch into geosynchronous orbit is presently from Cape anaveral using an Atlas rocket. The final of the five FLTSATCOM atellites will be launched in 1981 and this program will not transition to the huttle.

FLTSATCOM will be replaced by LEASAT - a commercially developed nd launched system which will be leased by the Navy on-orbit. It is very kely that this satellite will be Shuttle launched by the commercial evelopers although the DOD has no control over the launch method. EASAT replaces the General Purpose Satellite Communications System GPSCS) concept, at least for the near term. Should DOD proceed at some ater date with GPSCS or some derivative thereof, it will be completely huttle optimized since initial launch would be in the mid or late 1980's.

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Control System 18 BYE-13131-78

DEFENSE SUPPORT PROGRAM (DSP)

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This satellite system consists of three spacecraft in geosynchronous ·bit to provide attack warning of missile launches from denied areas and ıbmarines. The DSP spacecraft is in the 2,500 pound class and is launched ·om Cape Canaveral using a Titan IIIC or Titan IIID/Inertial Upper Stage US) to boost it into geosynchronous orbit.

The current Shuttle transition plan calls for Vehicles 10 and 11 to be .unched on Titan IIIC's, Vehicles 12 and 13 to be launched on Titan ID/IUS's, and upgrade Vehicle 5 to be launched from Cape Canaveral on the ıuttle in late 1983. Four spacecraft have been retrofitted to smooth and ›eed up the DSP Shuttle transition. Vehicles 12 and 13 were retrofitted for itan IIID/IUS compatibility, and Vehicles 5 and 6 for Shuttle compatibility. ensor improvements have also been incorporated. The Shuttle compati-lity retrofit required substantial structural improvements and contamina-on protection. The Shuttle compatible spacecraft is in the 3,500 pound ass. The Titan IIID/IUS will remain as the backup launch vehicle and DSP ›acecraft after Vehicle 5 will be compatible with both Shuttle and Titan ID/IUS.

It is possible to advance the first DSP Shuttle launch from late 1983 to te 1982 by launching DSP Vehicle 5 in place of Vehicle 13. Due to the ‹pected on-orbit spacecraft lifetime and the mid-1980 performance needs, ehicle 13 would be retrofitted at a cost of $68M for Shuttle compatibility ıd sensor improvements. Although the cost to accelerate the transition is 58M; this alternative has an acceptable risk factor and provides improved SP sensor capabilities earlier. Accordingly, it is recommended that ansition to the Shuttle be accomplished in late 1982 with the Vehicle 5 unch.

GLOBAL POSITIONING SYSTEM (GPS)

This system, when operational, will consist of 24 satellites in three fferent 63° inclination, 10,900 NM altitude, circular orbits. The develop-ent models of the GPS spacecraft are now flying. The GPS satellite is in ıe 1,000 pound class and is launched from Vandenberg AFB using a furbished Atlas E/F rocket.

The current Shuttle transition plan calls for the development phase ehicles (1 through 12 and the Navigational Technology Satellite III) to be unched on Atlas E/F's and the operational phase vehicles (1,500 pound ass) to be launched on the Shuttle from Cape Canaveral, starting in late)83. The operational satellites are scheduled to be launched in pairs and e candidates to share the remaining portionof the Shuttle payload bay with her programs. No expendable backup vehicle is planned for the GPS ogram.

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Although it is possible to advance the first GPS Shuttle launch from e 1983 to 1982; the costs, schedule risks, non-competitive procurements juired and future growth limitations are of concern. An earlier transition ıld be accomplished by limiting operational spacecraft design changes to ;rades of the development phase spacecraft bus for Shuttle compatibility. second option would be to launch the last four development phase ellites on the Shuttle while continuing to optimize the operational phase ıcecraft for the Shuttle. In both cases the near term costs are greater ın $5M in FY 80 and $25M in FY 81. If the operational spacecraft design re limited to an upgrade of the development spacecraft, a non-competi- e procurement would be required to support a 1982 launch date. In this :ion, the ability to accommodate future mission improvements or piggy- :k payloads would be very limited.

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Since the Full Scale Engineering Development (DSARC II) decision on S is not scheduled until February 1979, an earlier GPS Shuttle transition ıot recommended.

DEFENSE METEOROLOGICAL SUPPORT PROGRAM (DMSP)

This satellite system consists of two satellites in 450 NM altitude cular, sun-synchronous polar orbit to provide images of the earth's cloud ver and weather pattern to support strategic and tactical operations. The ISP spacecraft is in the 1,100 pound class and is launched from ıdenberg AFB, California on a refurbished THOR rocket.

The current Shuttle transition plan calls for Vehicles F-4 through F-10 be launched on THOR's and F-11 to be launched on the Shuttle from ıdenberg AFB in December 1984. Vehicle F-11 would be a Shuttle :imized spacecraft design in the 2,500 pound class, and would include ıer mission and nuclear hardening improvements. No expendable backup ›ability is planned for DMSP.

Although it is possible to advance the first DMSP Shuttle launch date, : potential loss of mission coverage, the non-competitive procurement juired, and near term costs are all of concern. The following three :ions would permit an earlier DMSP Shuttle launch date.

a. Modify a current vehicle to fly on the Shuttle from Cape naveral and use the Inertial Upper Stage to maneuver the vehicle from a ' inclination to a polar orbit.

b. Speed up the Shuttle-optimized spacecraft development and nch from Vandenberg AFB.

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c. Make one of the current vehicles compatible with the Space uttle; fly it on the Shuttle out of Vandenberg AFB; and continue the uttle-optimized spacecraft development.

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The first option would give the earliest possible launch date - in mid-82. However, this requires that a spacecraft be removed from inventory retrofit, increasing the possibility of gaps in data coverage. The second tion would require a non-competitive contract with the current spacecraft pplier (RCA) to meet the compressed schedule. The third option requires odifying and flying a current vehicle from Vandenberg AFB on the Shuttle an additional cost of $35M spread over the next three years.

It is recommended that DMSP stay with the current Shuttle transition te and plan for a Shuttle optimized spacecraft.

TRANSIT

TRANSIT is an extremely small (200 pound) navigation beacon satel-e. It is presently launched into 600 nm polar orbit from Vandenberg AFB th the small SCOUT rocket. Several TRANSITs are in orbit and eight are ailable for launch. These eight satellites will keep the program going rough 1990.

The current transition plan calls for an early Shuttle launch beginning 1982. Technical problems are minimal. TRANSIT will be an ideal filler many Shuttle payloads. No change to this plan is recommended.

CLIPPER BOW

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The present program calls for CLIPPER BOW to be compatible for inch by a backup TITAN 34D. Full Shuttle optimization can be program-d if the CLIPPER BOW program is not approved for another year. By the e that hardware development would then begin there would be sufficient perience with the Shuttle to justify a Shuttle-only launch and full Shuttle timization including perhaps modular construction and on-orbit assembly.

The current program with a view towards moving to complete Shuttle timization is recommended.

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RESEARCH AND DEVELOPMENT

(1) SPACE TEST PROGRAM (STP).

The current STP Shuttle transition plan calls for each STP mission, :er the Shuttle IOC at each launch site, to be shuttle optimized. The first .pe Canaveral Shuttle launch is for the [redacted] In dition to the spacecraft above, the Space Test Program also has some ıys on the Shuttle recoverable Long Duration Exposure Facility (LDEF), ıich is scheduled to fly on one of the Orbital Flight Tests (OFT) during 79 or 1980. (b)(1) (b)(3)

There are many things that research and development programs can do capitalize on the Space Shuttle. A number of these have been /estigated, including the use of Space Lab for Defense Department periments. The possibility of purchasing a Space Lab, dedicated to :fense Department operations, has also been considered. At the present ne, the idea has been rejected since there is currently not enough work to ıtify an entire Space Lab. Presently, defense experimenters would lease ace on a NASA Space Lab to perform their work.

Shuttle sortie operations, without a Space Lab, have also been nsidered. The principle element of this work is the development of mmon support equipment, both manned and unmanned, that could be used these flights. Specifically, the Standard Test Rack (STR) is an outgrowth this work, as is the Manned Aerospace Support Equipment (MASE).

The current schedule for development of the common support equip-ent supports first use in a Shuttle flight in late 1983. This work could be celerated so that this equipment would be ready for research and velopment payloads much sooner. An additional $19.5M is required for a oderately accelerated schedule, advancing the procurement about 1.5 ars. Of this amount, $1M is needed in FY 79, $10.2M in 80 and $4.5M in . This will permit a Shuttle flight about a year earlier (late 1982). ınding for a more rapid schedule acceleration, to support a flight about six onths earlier than that above, would cost an additional $3M in FY 79, $3M 80, $13.6M in 81 and $7M in the out years.

This work should be speeded up so that various items of common pport equipment for research and development are available as soon as ıssible.

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(2) LOW ALTITUDE SATELLITE STUDY OF IONOSPHERIC IRREGULARITIES (LASSII).

LASSII is an example of an advanced research program which could :e full advantage of the unique nature of the Shuttle. If the program is proved it would be flown in the early 1980s to coincide with the solar .ximum.

LASSII consists of a sensor package mounted on the Shuttle and a mplimentary package and transmitting beacon on a small free flying :ellite deployed from the Shuttle. The system would provide the first pability to characterize the ionospheric state and effects which lead to :ve propagation disturbances - an extremely important consideration for :al DOD Communications programs. The small satellites would be covered, refurbished and reutilized. The variety of orbits and the ability recover the satellite make this a truly cost-effective program for the uttle.

The selection of sensors and the experiments to be conducted under e LASSII program have been jointly concluded between the Naval esearch Laboratory and the Air Force Geophysical Laboratory in collabotion with non-DOD agencies and university participants.

FUTURE SPACE SYSTEMS

All future Air Force systems are planned to be Shuttle optimized and have their initial launch on the Shuttle. This includes all Space Test ogram launches that are scheduled after the Shuttle IOC at each launch te.

(1) STRATEGIC SATELLITE SYSTEM (SSS).

This system is planned to consist of four spacecraft in five times nchronous (110,000nm) polar orbit to provide secure strategic communiations to support the Single Integrated Operations Plan and subsequent rce management. The SSS spacecraft are in the 2000 pound class and the rst launch is scheduled on the Shuttle from Cape Canaveral in 1984.

(2) GENERAL PURPOSE SATELLITE COMMUNICATIONS SYSTEM GPSCS).

This system consists of four spacecraft and two spares in geoynchronous orbit, to provide communication for command and control of actical forces. The GPSCS spacecraft, which are in the 2500 pound class, re launched in pairs. The first launch is scheduled on the Shuttle in 1986.

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(3) NATO PHASE IV COMMUNICATIONS SATELLITE.

NATO is finalizing plans for the NATO Phase IV communications acecraft to replenish the existing NATO III satellites as they fail. The w spacecraft will be shuttle optimized and launched on the Shuttle from ıpe Canaveral during the mid-1980s.

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ETR - CAPE CANAVERAL
WTR - VANDENBERG AFB

SHUTTLE TRANSITION

NRO SYSTEMS

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SATELLITE SYSTEM	ORBIT LAUNCH SITE	LAUNCH VEHICLE	CURRENT SHUTTLE TRANSITION DATE	ACCELERATED SHUTTLE TRANSITION DATE	COST DELTA ($ MILLIONS)
IMAGING SYSTEMS					
GAMBIT	POLAR LOW EARTH WTR	T111B	NOT TRANSITIONING	NO CHANGE	
HEXAGON	POLAR LOW EARTH WTR	T111D	NOT TRANSITIONING	NO CHANGE	
[redacted]					
SIGNAL INTELLIGENCE SYSTEMS					
[redacted]					
NEW CONCEPTS					
WASP	LOW EARTH WTR/ETR	SHUTTLE	WHEN DEVELOPED	N/A	
[redacted]					

TABLE 1

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EXEMPT FROM GDS OF E.O. 11652
EXEMPTION CATEGORY: 3
DECLASSIFY ON: 31 DEC 2008

SHUTTLE TRANSITION

DOD SYSTEMS

ETR - CAPE CANAVERAL
WTR - VANDENBERG AFB

SATELLITE SYSTEM	ORBIT LAUNCH SITE	LAUNCH VEHICLE	CURRENT SHUTTLE TRANSITION DATE	ACCELERATED SHUTTLE TRANSITION DATE	COST DELTA ($ MILLIONS)
			COMMUNICATIONS		
				NO CHANGE	
DEFENSE SAT COMM SYSTEM	SYNC-X ETR	T111C OR T34D/IUS	1982	NO CHANGE	
AFSATCOM SYSTEM I	MULTIPLE ORBITS ON HOST S/C	N/A	NOT TRANSITIONING	N/A	
FLTSATCOM	GEOSYNC ETR	ATLAS CENTAUR	NOT TRANSITIONING	NO CHANGE	
			OTHER		
DEFENSE SUPPORT PROGRAM (I & W)	SYNC-X ETR	T111C OR T34D/IUS	1983	1982	+ 68
GLOBAL POSITIONING SYSTEM (NAV)	12-HOUR CIRCULAR WTR	ATLAS E/F	1983 AT ETR	NO CHANGE	
DEFENSE MET SAT PROG (WEATHER)	450 NM SUN SYNC WTR	THOR	1984	NO CHANGE	
TRANSIT (NAV)	POLAR 600 NM WTR	SCOUT	1982	NO CHANGE	
			NEW CONCEPTS		
STRATEGIC SAT SYS (COMM)	5X SYNC-X ETR	SHUTTLE	FIRST LAUNCH /1984	N/A	
GENERAL PURP SAT COMM SYS (COMM)	SYNC-X ETR	SHUTTLE	FIRST LAUNCH//1986	N/A	
NATO IV (COMM)	SYNC-X ETR	SHUTTLE	FIRST LAUNCH/1984	N/A	
SPACE TEST	EXPERIMENT	SHUTTLE	1981 ETR/1984 WTR	N/A	+ 41

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TABLE 2

..OD has purchased its backup ELVs as shown by the funding profile. The NRP can eliminate some funding for backup ELVs, if the shuttle meets its performance milestones. For instance: If a decision to terminate all ELV backup is made immediately after the 1st orbiter flight, a total of $181 M need not be funded. Five significant Shuttle milestones and associated funding savings are shown.

	FY 78	FY 79	FY 80	FY 81	FY 82	FY 83	FY 84
..V BACKUP FUNDING PROFILE							
NRP	[redacted]						
DOD	61	5	5	4	3	0	0 →
TOTAL	[redacted]						
..IMUM SAVINGS POSSIBLE-KEYED ..O SHUTTLE MILESTONES							
FIRST ORBITER FLIGHT (Oct 79)			181 →	→	→	→	→
ETR OPERATING (June 80)				143 →	→	→	→
SIX MONTHS OF OPS (Dec 80)					78 →	→	→
FIRST DOD R&D FLT (Mar 81)					58 →	→	→
DOD OPS FLIGHT (June 82)						20 →	→
..ELERATED TRANSITION ADDITIONAL SAVINGS						40 (1 Titan)	

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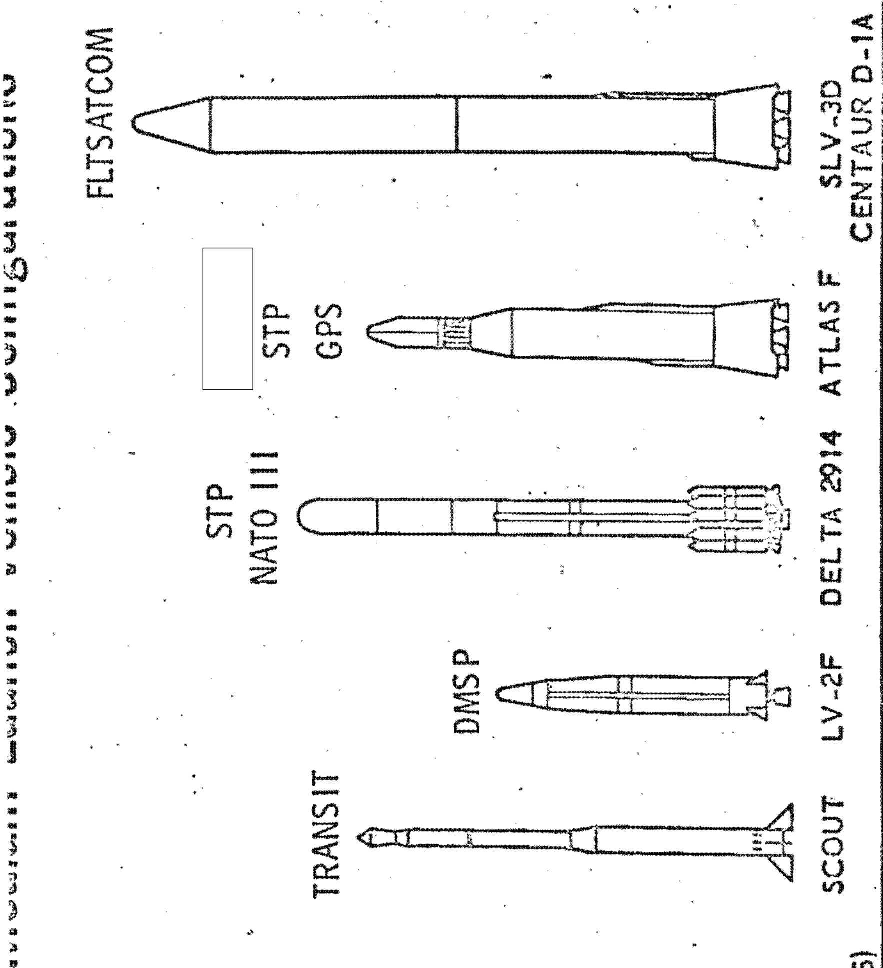

PAYLOAD (LBS)	SCOUT	LV-2F	DELTA 2914	ATLAS F	SLV-3D CENTAUR D-1A
100 N MI CIRC ETR	405	NA	NA	NA	11,400
100 N MI CIRC WTR	325	575	NA	3600	NA
SYNCH APOGEE	NA	NA	1550	NA	4200
SYNCH EQ (ANM)	NA	NA	730	NA	2000

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FIGURE 1

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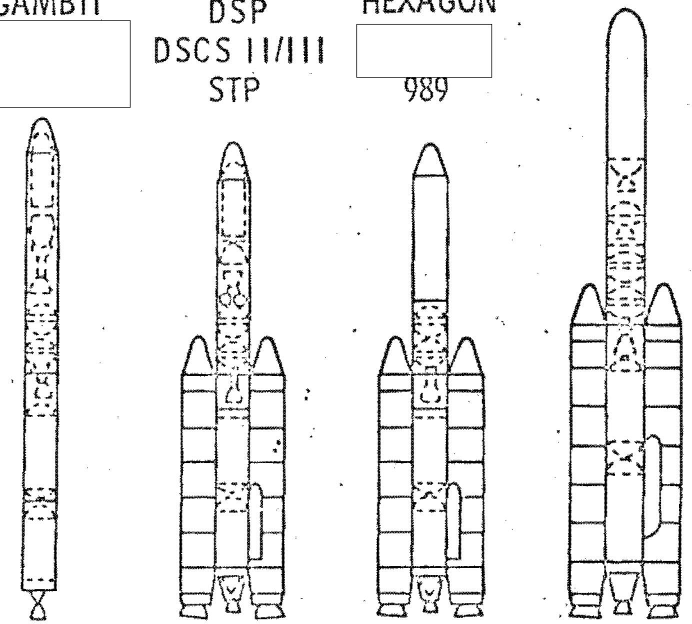
Titan III Configurations



PAYLOAD	T III-B AGENA	T III-C	T III-D	T-III 34D IUS
90°/100 N MI (WTR)	8,200	22,500	24,600	27,000
100 N MI (ETR)	9,900	29,200	30,600	34,000
SYNC EQ	970	3,600	-	4,200

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FIGURE 1 (CONT'D)

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MEMORANDUM OF AGREEMENT

The transfer of certain surplus hardware and equipment (listed in Atch 1) from SAFSP's GAMBIT program to NASA will result in a considerable savings to the U.S. Government. Therefore, it is agreed that this transfer of equipment will occur subject to the following stipulations:

1. NASA agrees not to reveal any details regarding how or from whom it acquired any of the transferred hardware and equipment. SAFSP wishes to avoid non Byeman cleared personnel approaching the SAFSP organization with requests for surplus hardware and equipment. Future NASA requests for assistance must be routed through appropriate NASA channels and relayed through Byeman cleared personnel. If asked where it got the hardware and equipment, NASA will reply that the items were surplus from a classified DoD program.

2. The effective date of the transfer will be 5 October 1984.

3. Approximately 3,300 pieces of hardware, test equipment, handling fixtures, tooling, and spare parts will be transferred. Two SRVs will be included in the transfer. A DD Form 1149 will be used to transfer all of the items. DCAS will be listed on the DD Form 1149 as a cutout, so that the items are not traceable back to SAFSP.

4. After the transfer has been completed, NASA assumes disposition responsibility for all items with the exception of the spare SRV. In the event of program cancellation, NASA is responsible for disposing of all items with the exception of the two SRVs.

5. After mission completion, SAFSP agrees to allow NASA to retain the flight SRV for historical display purposes.

6. SAFSP wishes to retain the spare SRV. Therefore, NASA agrees to return the spare SRV to SAFSP within thirty days of launching the primary SRV. If the spare SRV is not at General Electric's Chestnut Street facility NASA agrees to ship it there at NASA's expense. SAFSP will instruct General Electric to ship the spare SRV to a designated location at SAFSP's expense. In the event of program cancellation, NASA agrees to return both SRVs to SAFSP. NASA agrees to ship, at NASA's expense, both SRVs to General Electric's Chestnut Street facility within thirty days after program cancellation. SAFSP will instruct General Electric to ship, at SAFSP's expense, both SRVs to a designated location.

7. NASA assumes responsibility for all costs associated with the transfer. With the exception of the shipping costs discussed in stipulation 6, NASA agrees that SAFSP will bear no cost liability whatsoever.

8. NASA acknowledges DoD's plans to deactivate the 6594th Test Group at Hickam AFB after recovery of HEXAGON vehicle 20 in 1987.

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9. NASA agrees not to disseminate any details of this MOA to individuals who were not immediately involved in the generation of this agreement.

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[redacted]

SAMUEL W. KELLER
NASA Deputy Associate Administrator
for Space Science and Applications

LARRY E. CRESS
Director, SAFSP-7

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THE SECRETARY OF DEFENSE

THE WHITE HOUSE

WASHINGTON

February 25, 1985

MEMORANDUM FOR THE VICE PRESIDENT
THE SECRETARY OF STATE
THE SECRETARY OF DEFENSE
THE SECRETARY OF COMMERCE
THE SECRETARY OF TRANSPORTATION
THE DIRECTOR, OFFICE OF MANAGEMENT AND BUDGET
THE DIRECTOR OF CENTRAL INTELLIGENCE
THE CHAIRMAN, JOINT CHIEFS OF STAFF
THE DIRECTOR, ARMS CONTROL AND DISARMAMENT AGENCY
THE DIRECTOR, OFFICE OF SCIENCE AND TECHNOLOGY POLICY
THE ADMINISTRATOR, NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
THE ASSISTANT TO THE PRESIDENT FOR POLICY DEVELOPMENT

SUBJECT: National Security Launch Strategy

The President has signed the attached NSDD on this subject.

Robert C. McFarlane

Robert C. McFarlane

Attachment
NSDD, National Security Launch Strategy
NSDD-164

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W103

THE WHITE HOUSE

WASHINGTON

February 25, 1985

NATIONAL SECURITY DECISION
DIRECTIVE NUMBER 164

National Security Launch Strategy

NSDD 144, National Space Strategy, states that the Space Transportation System (STS) will continue as the primary space launch system for both national security and civil government missions. It also directs DoD to pursue an improved assured launch capability that will be complementary to the STS. This NSDD provides a launch strategy to implement these two provisions, as well as initiate a study to look toward the future development of a second-generation space transportation system.

The National Aeronautics and Space Administration (NASA) and the Department of Defense (DoD) will work together to insure that the STS is fully operational and cost-effective at a flight rate sufficient to meet justified needs. (The target rate is 24 flights per year.)

The Air Force will buy ten expendable launch vehicles (ELVs) and will launch them at a rate of approximately two per year during the period 1988-92. A competitive decision will be made between a Titan derivative vehicle and the SRB-X before March 1, 1985.

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. NASA and DoD will jointly develop a pricing policy for DoD flights that provides a positive incentive for flying on the Shuttle. The pricing policy will be based upon the principle that an agreed reimbursement rate per flight will be comprised of a fixed and variable component. This will result in an annual fixed fee and a charge per flight at marginal or incremental costs. NASA will propose a pricing policy based upon this principle by April 15, 1985.

DoD and NASA will jointly study the development of a second-generation space transportation system - making use of manned and unmanned systems to meet the requirements of all users. A full range of options will be studied, including Shuttle-derived technologies and others. It would be anticipated that NASA would be responsible for systems management of civil manned systems and DoD would be responsible for

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systems management of unmanned systems. DoD and NASA will jointly define the terms of reference of this effort for issuance as a National Security Study Directive (NSSD).

Any disagreements regarding implementation of this Strategy should be referred first to the Assistant to the President for National Security Affairs and subsequently, if necessary, to the President for resolution.

Ronald Reagan

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THE WHITE HOUSE

WASHINGTON

UNCLASSIFIED
~~CONFIDENTIAL~~ ATTACHMENT

December 27, 1986

MEMORANDUM FOR THE VICE PRESIDENT
THE SECRETARY OF STATE
THE SECRETARY OF THE TREASURY
THE SECRETARY OF DEFENSE
THE ATTORNEY GENERAL
THE SECRETARY OF COMMERCE
THE SECRETARY OF TRANSPORTATION
THE DIRECTOR, OFFICE OF MANAGEMENT AND BUDGET
THE DIRECTOR OF CENTRAL INTELLIGENCE
THE ASSISTANT TO THE PRESIDENT FOR POLICY DEVELOPMENT
THE ASSISTANT TO THE PRESIDENT AND CABINET SECRETARY
THE CHAIRMAN, COUNCIL OF ECONOMIC ADVISERS
THE CHAIRMAN, JOINT CHIEFS OF STAFF
THE DIRECTOR, OFFICE OF SCIENCE AND TECHNOLOGY POLICY
THE ADMINISTRATOR, NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

SUBJECT: United States Space Launch Strategy (U)

The President has signed the attached National Security Decision Directive on United States Space Launch Strategy. (U)

Alton G. Keel

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SS		✓
SS-1		✓
SS-2		
SS-3		
SS-4		✓
SS-5		✓
SS-6		
SS-7		✓
SS-8		
[redacted]		

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Attachment
NSDD 254

UNCLASSIFIED
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NATIONAL SECURITY COUNCIL
WASHINGTON, D.C. 20506

~~CONFIDENTIAL~~

December 27, 1986

NATIONAL SECURITY DECISION
DIRECTIVE NUMBER 254

UNITED STATES SPACE LAUNCH STRATEGY (U)

Introduction

This directive establishes U.S. national policy for restoration of the capability to launch satellites and missions into space to support U.S. national security, civil, and commercial goals using space. It is essential that U.S. space launch operations be reconstituted as efficiently as possible consistent with available funding and safety concerns; and that the reconstituted U.S. space launch assets provide a balanced, robust, flexible space launch capability which can function independently of failures in any single launch vehicle system, allow a return to regularly scheduled launch operations, meet continuing requirements, help make up for lost launch opportunities and reassert global space leadership. (U)

This directive supersedes NSDD 254. Previous directives which include NSDDs 42, 80, 94, 144, and 181 remain valid but are modified accordingly. (U)

National Space Launch Capability

The U.S. national space launch capability will be based on a balanced mix of launchers, consisting of the Space Transportation System (STS) and expendable launch vehicles (ELVs). The elements of this mix will be defined to best support the mission needs of the national security, civil government and commercial sectors of U.S. space activities. Critical mission needs will be supported, whenever necessary, by both the STS and ELVs so as to provide added assurance that payloads can be launched regardless of specific launch vehicle availabilities. (U)

a. National Security Space Transportation. The national security space sector will use both the STS and ELVs as determined by specific mission requirements. Selected critical payloads will be designed for dual-compatibility, i.e., capable of being launched by either the STS or the ELVs. Provision will be made for additional ELV launch facilities needed to support the full range of orbits required by the national security missions. ~~(C)~~

Implementation: The Department of Defense (DOD) will procure additional ELVs to maintain a balanced launch capability and to provide access to space. The DOD will implement procedures to assure payload/launch vehicle compatibility and scheduling, and

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maintain a launch capability for ELVs at both the East and West Coast launch sites. DOD and NASA will jointly establish a revised price for national security missions that use the STS. (U)

b. Civil Government Space Transportation. The unique STS (Shuttle) capability to provide manned access to space will be exploited in those areas that offer the greatest national return. The STS fleet will maintain the Nation's capability to support critical programs requiring manned presence and other unique STS capabilities. NASA will use the Shuttle where the unique capabilities of the STS are required to support civil research and development programs. (U)

Implementation: NASA will procure STS structural spares and other necessary lost equipment needed to sustain the existing three-orbiter fleet and will do so in an expeditious and cost-effective manner. Funding for procurement of a replacement fourth orbiter will begin in FY 1987 based on an OMB-approved program. NASA will establish sustainable STS flight rates to provide for planning and budgeting of Government space programs. The recommendations of the President's Commission on the Space Shuttle Challenger Accident will be considered and incorporated as appropriate. The STS will be phased out from providing launch services for commercial and foreign payloads that do not require a manned presence or the unique capabilities of the STS. NASA will not maintain an ELV adjunct to the STS. If there is a need for additional NASA capacity for government launches, then NASA is authorized to contract for necessary ELV launch services. (U)

c. Commercial Space Transportation. The principles and policy of domestic exploitation of space for commercial purposes are enunciated in NSDD 94, dated May 16, 1983. Those principles and policies remain valid. (U)

Implementation: NASA shall no longer provide launch services for commercial and foreign payloads unless those spacecraft have unique, specific reasons to be launched aboard the Shuttle. Those reasons are: the spacecraft must be man-tended or the spacecraft is important for national security or foreign policy purposes. Satellite manufacturers whose spacecraft do not meet those criteria will be provided as realistic an appraisal as possible by NASA of when they could be scheduled on the Shuttle launch manifest prior to the 1995 commercial contract mandatory termination date. (U)

Ronald Reagan

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TABLE A-1

NASA STANDARD SERVICE PRICE FOR DOD SHUTTLE LAUNCHES
(MILLIONS OF FY90$)

SHUTTLE STANDARD SERVICE COST ELEMENTS	CURRENT BEST ESTIMATE *
REDESIGNED SOLID ROCKET MOTOR	39.6
SOLID ROCKET BOOSTER	18.5
EXTERNAL TANK	37.5
SPACE SHUTTLE MAIN ENGINE	14.7
ORBITER/GFE	17.6
LOGISTICS OPERATIONS	16.2
INTEGRATION/FLIGHT OPS	69.0
PROPELLANTS	1.6
CONTRACT ADMINISTRATION	2.1
NETWORK SUPPORT **	5.8
ESMC RANGE SUPPORT	2.7
ECO CEILING @ 9%	20.3
DOD STANDARD SERVICE PRICE PER FLIGHT	245.6
LAUNCH OPERATIONS	59.2
RESEARCH & PROGRAM MANAGEMENT	29.4
ECO CEILING @ 9%	8.0
TOTAL COST PER FLIGHT + ECO's	342.2

* BASED ON CURRENT BEST ESTIMATE FOR FLIGHTS IN THE FY96-FY97 TIME PERIOD (REF: NASA FY92 CONGRESSIONAL BUDGET & FLIGHT RATE)

** SUPPORT OF A SHUTTLE LAUNCH THROUGH ONE FLIGHT DAY

FILE NAME - A:\HQA91-30.WK1 910514.0945

TABLE A-II

DOD PRICE FOR NASA TITAN IV LAUNCHES
(MILLIONS OF FY90$)

GENERIC TITAN IV COST ELEMENTS	CURRENT BEST ESTIMATE NUS	CURRENT BEST ESTIMATE CENTAUR
HARDWARE		
BOOSTER	89.3	89.3
UPPER STAGE		43.5
PROPELLANTS (INCLUDING AP SURCHARGES)	4.7	4.9
INCENTIVE/AWARD FEE	3.7	8.6
ENGINEERING CHANGE ORDERS (ECO's)	9.8	14.6
AEROSPACE	2.0	3.0
RISK	9.2	11.6
(SUBTOTAL)	(118.7)	(175.5)
INTEGRATION (FIRST TIME)		
INTEGRATION	16.3	39.3
ENGINEERING	3.8	5.4
ENGINEERING CHANGE ORDERS (ECO's)	2.4	5.9
AEROSPACE	0.5	1.0
RISK	0.9	2.2
(SUBTOTAL)	(24.0)	(53.8)
LAUNCH SERVICES		
LAUNCH OPERATIONS*	22.2	23.6
RANGE SUPPORT	8.4	8.4
ENGINEERING CHANGE ORDERS (ECO's)	0.3	0.5
(SUBTOTAL EXCLUDING LAUNCH OPS)*	(8.7)	(8.9)
TOTAL DOD COST CONTENT & PROPOSED PRICE PER FLIGHT*	151.4	238.2

* LAUNCH OPS COSTS WILL NOT BE CHARGED IF NASA LAUNCH FALLS WITHIN DOD's BASELINE CAPABILITIES

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TABLE A-III

SHUTTLE & TITAN-IV LAUNCH PAYMENT SCHEDULES

USAF PAYMENT SCHEDULE FOR SHUTTLE LAUNCHES:

	L-3	L-2	L-1	L-O = FISCAL YEAR OF LAUNCH
STANDARD SERVICES	10%	25%	65%	0%
OPTIONAL SERVICES	*AS REQUIRED*			

NASA PAYMENT SCHEDULE FOR TITAN IV LAUNCHES:

	L-4	L-3	L-2	L-1	L-0	L+1
TITAN IV/NUS or IUS		33%	33%	34%	0%	
TITAN IV/CENTAUR	25%	25%	25%	25%	0%	
INTEGRATION						
FIRST TIME	10%	20%	30%	30%	10%	
NUS (RECURRING)				35%	65%	
CENTAUR (RECURRING)			20%	50%	30%	
SPECIAL CASE/CASSINI & CRAF						
(LAUNCH VEHICLE "REPLACEMENT" PLAN)						
TITAN IV/CENTAUR			25%	25%	25%	25%
INTEGRATION	10%	20%	30%	30%	10%	

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MEMORANDUM OF AGREEMENT

BETWEEN THE

NATIONAL RECONNAISSANCE OFFICE

AND THE

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

ON THE

MISSION TO PLANET EARTH

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CONTROL SYSTEM

1.0 PURPOSE

This Memorandum of Agreement (MOA) defines the relationship between the National Reconnaissance Office (NRO) and the National Aeronautics and Space Administration (NASA) with respect to NASA's Mission to Planet Earth activities, establishes the policies and security infrastructure, and identifies organizational responsibilities for the sharing of technical information and specific technologies.

2.0 SCOPE

This MOA is the fundamental document governing the relationship between the NRO and NASA for activities related to the Mission to Planet Earth, including the Earth Observing System and its components. This MOA does not replace or supplement existing agreements, written or otherwise, between NASA and the NRO for other programs or activities. A Security Plan and Interface Working Group Charter are annexes to this MOA. In addition, the MOA may be supplemented by other annexes for specific technology or program activities.

3.0 DEFINITIONS

3.1 NATIONAL RECONNAISSANCE OFFICE (NRO): The covert, national-level organization responsible for the research, development, procurement, launch, and operation of all U.S. overhead reconnaissance systems for collection of foreign intelligence from denied areas. The NRO is the management agency for the National Reconnaissance Program (NRP).

3.2 NATIONAL AERONAUTICS AND SPACE ADMINISTRATION (NASA): Conducts a vigorous overt research program that addresses all aspects of aeronautics and space flight, including advanced technologies, exploration, science and applications, and the launch program for civil space payloads.

3.3 TECHNOLOGY TRANSFER: The actual exchange of technical information and services between the NRO and NASA, including specific technologies (hardware and/or software), processes, architectures, concepts, management techniques, and contracting and project management support.

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3.4 MISSION TO PLANET EARTH PROGRAM: NASA's contribution to the U.S. Global Change Research Program. Mission to Planet Earth, which includes the Earth Observing System (EOS) and Earth Probes, is an integrated, comprehensive program, designed to use space-based and ground-based resources to reduce the scientific uncertainties associated with global change. It is intended to increase the understanding of the Earth system to a sufficient level to enable sound policy decisions.

3.5 INTERFACE WORKING GROUP (IWG): The formal interface organization of representatives from the NRO and NASA, chartered to develop and manage technology transfer, security, and administrative actions between the NRO and NASA for space technology and applications as described in this MOA. Activities and membership of the IWG will be governed by an IWG Charter prepared as an annex to this MOA. Executive Co-Chairmen of the IWG are the Deputy Director of the NRO (DDNRO) and the Associate Administrator for Space Science and Applications, NASA.

(b)(1)
(b)(3)

3.6 [redacted]

4.0 BACKGROUND

Since its inception in 1958, NASA has conducted a vigorous program of research and development in the full spectrum of activities in aeronautics and space. The Office of Space Science and Applications (OSSA) is the NASA organization responsible for planning, directing, executing, archiving, and evaluating that part of the overall NASA program which exploits the unique characteristics of space to understand the universe, to use remote sensing to determine how the Earth works as an integrated system, to solve practical problems on Earth, and to provide the

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ANNEX A

BYEMAN SECURITY PLAN

FOR THE CONTROL OF INFORMATION

BETWEEN

THE NATIONAL RECONNAISSANCE OFFICE

AND

THE NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

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1.0 PURPOSE

As required by the Memorandum of Agreement (MOA) between the National Reconnaissance Office (NRO) and the National Aeronautics and Space Administration (NASA), this Security Plan provides the basic philosophy, policies, and procedures for the protection of classified information and relationships that result from the technology sharing between the NRO and NASA with respect to NASA's Mission to Planet Earth. The provisions of this Security Plan are binding upon all NASA involvement with the NRO and its program offices and contractors, under the terms of this MOA. This annex does not replace or supplement existing agreements, written or otherwise, between NASA and the NRO for other programs or activities.

2.0 SCOPE

This document governs the NRO-NASA BYEMAN security relationship primarily for technology exchange related to the Mission to Planet Earth, including the Earth Observing System and its components. It may be supplemented by other Security Plans for specific programs or activities. Other, non-BYEMAN classified information will be handled according to applicable security directives.

3.0 BACKGROUND

The NRO is a covert national-level organization streamlined management structure and is responsible f research, development, acquisition and operation of U overhead reconnaissance systems for the collection of intelligence from denied areas.

Chg Sec

Since its inception in 1958, NASA has conducted overt program of research and development in the full activities in aeronautics and space flight. The NASA Office of Space Science and Applications (OSSA) is responsible for planning, directing, executing, archiving, and evaluating that part of the overall NASA program which uses the unique characteristics of space to understand the universe, to use remote sensing to determine how the Earth works as an integrated system, to solve practical problems on Earth, and to provide the scientific research foundation for extending human presence into the solar system. OSSA is the NASA organization which is primarily interested in the technology of the NRO, as well as the projects under the Mission to Planet Earth.

4.0 SPECIAL SECURITY PROCEDURES FOR PROTECTION OF NRO INFORMATION

In order to provide the proper level of protection required for information regarding NRO satellite research and development, system design, operations and contractor activities, a special compartmented control system--the BYEMAN Control System--was developed by the Director of Central Intelligence. The BYEMAN system is designed to treat the special security concerns of both the sensitive collection source (i.e. the satellite system), and the contractor activities. Access to BYEMAN information can be acquired only through a positive determination of current eligibility and need-to-know by an individual authorized to do so by the Director, NRO (DNRO). NASA requests for BYEMAN access are submitted directly to the NRO security staff.

Access to BYEMAN information is gained by possession of one or more of the following types of access authorizations:

4.1 PROJECT: Protects details of individual National Reconnaissance Program (NRP) programs. Example: ALPHA (a fictitious project name).

4.2 STUDY: Protects details of individual research and development projects. Example: XXXXX.

4.3 BYECOM: Enables administrative access for non-program specific support functions.

5.0 NRO CONTRACT SECURITY

To protect all aspects of the NRP activities, the actual contract document between the NRO and the contractor is classified at the BYEMAN level. The purpose of classifying the contract BYEMAN is to keep the existence of the contract, and the products of the contracts covert and protected by BYEMAN security. In some circumstances, the NRO may elect to release the products of some contracts at a non-BYEMAN level. NASA involvement in these contracts must also be covert and must protect the covertness of the contract. Several unique security requirements normally result from this covert contract:

- The existence of the contract must remain covert and controlled by the BYEMAN control system.

- The contractor is to protect, at the BYEMAN level, all information, hardware, and facilities involved with the contract.

- The contractor is not to reveal in any way, except at the BYEMAN level, an association with the customer, the purpose or magnitude of the contract, or the contractor's involvement in intelligence activities.

Any approved visits of NASA personnel to NRO contractors must be performed in such a way as to conceal the affiliation of the visitors. Each NRO contractor has established visit procedures that allow the affiliation of the visitor to remain concealed. Government visitors are required to conceal their government affiliation by using forms of identification which are not revealing (such as driver's license instead of Government ID cards) and to enter "self" as the organization they are representing. Once inside the secure area, the security level is to be established at the BYEMAN level and the visitors may be identified as being from NASA. (At some contractors where the NASA and NRO areas are in close proximity or the NASA personnel are already known to be affiliated with NASA, visit procedures may be modified to accommodate these circumstances.) NASA visitors will be given a briefing on the proper procedures by either the NRO security staff or NRO Program Office prior to their first visit.

As described above, not only is the contractor required to protect what is being built and the type of work being performed, but also he must protect the "fact of" the existence of a contract. It follows that the contractor cannot acknowledge any details of the NRO work that would expose these activities. Any discussion of NRO activities at a non-BYEMAN level defeats this objective and may be a breach of security. The contractor is not authorized to release any information unless approved in advance by the sponsoring NRO Program Office.

However, it is NRO policy to support NASA and avoid duplication of effort. The NRO allows contractors to consider incorporating NRO experience, information, and resources in proposals to NASA whenever it is essential to respond effectively to NASA procurement-related documents. An NRO contractor, who wishes to respond to a NASA procurement-related request, should use BYEMAN channels to request the sponsoring NRO program office to resolve the constraint.

BYEMAN research and development activities may indicate the direction the U.S. is heading and indicate the type/mission of possible future satellite programs. Before any BYEMAN technology can be decompartmented, a suitable cover story for the origin of the work (including funding, sponsoring agency, and purpose) must be developed by the NRO. These cover stories will be included as appendices to this Security Plan.

6.0 VISIT AND INTERFACE CONTROLS

Access to operational and contractor facilities and activities is centrally controlled by the NRO security staff. In the case of NASA visits to, or interfaces with, contractors, all such contacts are cleared with and controlled by the NRO security staff who will coordinate with the managing NRO Program Office. Once an annex to the MOA is approved, further visits in direct connection with an annex may be coordinated directly with the sponsoring NRO Program Office.

7.0 ELECTRICAL COMMUNICATION

A Special Operation Communications (SOCOMM) network links NRO contractors with the NRO Program Offices and each other to provide secure data and teletype capability for the exchange of BYEMAN information. When visiting NRO locations, certification of NASA visitors will be passed by the NRO using this network. The Special Security Officer (SSO) network will not be used for certifications to the NRO facilities.

8.0 [redacted] AND XXXXX ACCESSES (b)(1) (b)(3)

[redacted]

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9.0 SECURITY OF NRO-NASA RELATIONSHIP

To protect the NRO mission, the interaction between the NRO and NASA, relative to the operation of NRO technology transfer, must be conducted at the BYEMAN/[redacted] or BYEMAN/XXXXX level. Since many Air Force organizations commonly interact with NASA, the mere fact that NASA and SAF/SS have some type of working relationship is unclassified. However, the Office of the Assistant Secretary of the Air Force for Space (SAF/SS) mission is merely a cover for the NRO mission and cannot be used to justify the level of involvement between the two organizations. This allows individuals in NASA to give a location or phone number for the individual they are visiting in SAF/SS, but no more information other than "meeting." It is not classified that the two organizations are interacting, but the subject matter and extent of the interaction are to remain within BYEMAN channels unless excepted by other agreements (for instance, LANDSAT.) NASA interaction, under the terms of this MOA, with other intelligence agencies will normally be at the XXXXX level.

NRO and NASA individuals should report to their respective security officers any incident or procedure which may denote a security deficiency or weakness in the security of either organization. Generally, the security officers of NRO and NASA should exchange information which may impact the security of the relationship, such as eligibility, security violations of accessed individuals, counter-intelligence, and foreign travel information.

10.0 PHILOSOPHY OF TECHNOLOGY TRANSFER

10.1 General

There are several situations that may occur as a result of the technology transfer between the NRO and NASA. The first, and most straightforward, is the situation wherein NASA wishes to pursue some BYEMAN-derived NRO technology which the NRO agrees can be transferred out of the BYEMAN system and which can

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be protected at a security classification level NASA and the NRO agree is appropriate. This would normally be technology not inherently NRO mission-revealing, and would not represent much of an advance in the state-of-the-art from that available commercially or through other government contracts. In this case an annex to the NRO-NASA MOA would be signed, and the transfer would take effect.

Variations on this situation would be where the technology is a significant advance in the state-of-the-art or where the contractor is not known to be developing such technology except at a BYEMAN level. This would require that a suitable cover story be developed to explain the contractor's expertise or technology advance so as to cover the NRO or contractor involvement. These cover stories have to be custom tailored for each situation. A Security Plan must be developed, an agreement reached on procedures for the protection of NRO sources and methods, and an annex to the MOA signed before this type of transfer can take place.

Another situation is where the NRO technology is inherently revealing of an application that could include intelligence collection (such as large antennas), or where the NRO will continue to develop/use this technology for its own applications. This case could result in either (1) an adequate cover story being developed to explain the origin of the technology and subsequent pursuit by NASA at another mutually agreed upon security level, or (2) pursuit by the NRO at the BYEMAN level with funding from NASA. A Security Plan must be developed, an agreement reached on procedures for the protection of NRO sources and methods, and an annex to the MOA signed before this type of transfer can take place.

Certain engineering information from operating satellite systems, provided to NASA by the NRO, could reveal the capability or operational status of these systems. Therefore, this information must be protected at the BYEMAN level. Under no circumstances is BYEMAN information to be decompartmented until the DNRO approves the decompartmentation and release.

10.2 Foreign Technology Transfer

Transfer of any U.S. technology to foreign activities is subject to applicable U.S. laws and regulations. In addition, per the MOA, any subsequent transfer of BYEMAN-derived technology by NASA to foreign entities must be approved by the DNRO.

Foreign technology entrusted to NASA by foreign participants in the Mission to Planet Earth must not be improperly disclosed by the NRO.

11.0 BYEMAN/TK COMPARTMENTATION GUIDE

The following compartmentation table should be used as a guide to determine whether the BYEMAN (B) or Talent Keyhole (TK) system is the appropriate control system to use for the information indicated. Where an item is shown under both categories, the item can be handled in <u>either</u> system; joint protection (i.e. the use of both B and TK channels) is <u>not</u> required, although there will be cases where the use of joint channels is necessary for some other reason. Wherever practicable in the table below, TK should be the system of choice. Where TS/S is listed, the classification depends on the sensitivity and amount of detail. The intent of the following compartmentation table is to provide guidelines to NASA and NRO Security Officers to apply to general categories of information. Any ambiguity or question in applying these guidelines should be referred to NRO Security for resolution. Individual classification guides for specific technologies or satellite systems which have particular sensitivities will supplement this general guide.

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TABLE 1 COMPARTMENTATION GUIDE

INFORMATION REVEALING	Minimum Classification and Required Caveat (Where more than one, is either/or) (N/A = not applicable) BYEMAN	TK
1-1 Existence of the National Reconnaissance Office or its abbreviation "NRO"	S	S
a. NRO staff element overt identity (SAF/SS)	S	S
b. General, non-specific acknowledgement of interagency (CIA, NASA, etc.) participation in NRO.	S	S
c. NRO organization from NFIB to NRO headquarters staff	S	S
d. NRO detailed organization, below NRO staff level (including program offices and their covers)	S	N/A
e. Location of the NRO or any program office	S	S
1-2 Existence of the National Reconnaissance Program or its abbreviation "NRP"	S	S
1-3 The relationship of SAF/SS to any intelligence organization, function, or activity. (For example, a message addressed to SAF/SS from NSA.)	S	S
1-4 Satellite system development, research	TS/S	N/A

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and conceptual studies		
1-5 Satellite system operation, command and control	TS/S	N/A
1-6 Mission Ground Station (MGS)		
a. Physical access to NRO MGS	TS	N/A
b. Communications with dedicated MGS	TS/S	N/A
c. Communications with non-dedicated MGS on NRO matters	TS/S	N/A
d. Dedicated mission ground station-location and overt identity	TS	N/A
1-7 Physical access to NRP operational support facilities	TS	N/A
1-8 Industrial and contract relationships and data		
a. Overall NRO modus operandi with regard to project security and/or covert contracting and procurement techniques	S	N/A
b. Identification of covert contractors with specific projects.	TS/S	N/A
c. Access to covert contractor facilities	TS/S	N/A
d. Individual contractor covert contracting methods and techniques.	S/Study No.	N/A
1-9 Funding and Budget Information		
a. Total NRP budget for a major program	TS	N/A

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b. Individual program line item for a current year	S	N/A
c. Program cost data	S	N/A
1-10 Relationship of NRO and NASA		
a. Existence of MOA between NRO (or SAF/SS) and NASA	S	S
b. Existence of a working relationship between SAF/SS and NASA (without details)	Unclassified	
c. "Fact of" technology transfer (sharing) between SAF/SS and NASA	S	S
d. Details of technology transfer between the NRO and NASA	TS/S or Study No./ [redacted]	N/A

(b)(1)
(b)(3)

1-11 Access (Access/codewords and study numbers will not be identified over any non-secure communications such as commercial telephone lines.)

a. The access/codeword [redacted]	S/[redacted] or XXXXX	N/A
b. Any SAF/SS, NASA, NRO XXXXX study no.	S	N/A

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ANNEX B

CHARTER OF THE

NATIONAL RECONNAISSANCE OFFICE

AND THE

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

INTERFACE WORKING GROUP

ON THE

MISSION TO PLANET EARTH

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PREAMBLE

The National Reconnaissance Office (NRO) has for more than a quarter of a century been chartered with the collection of intelligence of denied areas from space. To accomplish its mission, the NRO has developed new and innovative technologies and designed, built, launched, and operated a variety of sophisticated satellites under the protection of the BYEMAN control system.

Since its inception in 1958, the National Aeronautics and Space Administration (NASA) has conducted a vigorous program of research and development in the full spectrum of activities in aeronautics and space. The NASA Office of Space Science and Applications (OSSA) is responsible for planning, directing, executing, archiving, and evaluating that part of the overall NASA program which uses the unique characteristics of space to understand the universe, to use remote sensing to determine how the Earth works as an integrated system, to solve practical problems on Earth, and to provide the scientific research foundation for extending human presence into the solar system.

OSSA is the NASA organization which is responsible for the Mission to Planet Earth and is interested in the technology of the NRO. This Charter provides the vehicle through which NASA and the NRO may share knowledge of each other's technologies, coordinate research programs of mutual benefit, and directly transfer technology or technology programs while protecting the special security of the NRO.

1.0 CHARTER

In July 1992, the Director of the NRO and the Administrator of NASA, signed a Memorandum of Agreement (MOA) between their respective organizations that "defines the relationship between the National Reconnaissance Office (NRO) and the National Aeronautics and Space Administration (NASA) with respect to NASA's Mission to Planet Earth activities, establishes the policies and security infrastructure, and identifies

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organizational responsibilities for technology sharing." The NRO/NASA Interface Working Group (IWG) is hereby chartered as the official organizational interface between the NRO and the NASA for Mission to Planet Earth activities. As such, the IWG is tasked with ensuring the implementation of the terms and conditions of the MOA, its protocols, and its annexes.

2.0 APPROVAL

The Deputy Director of the NRO and the NASA Associate Administrator for OSSA, as representatives of their respective organizations and as Executive Co-Chairmen of the IWG, will by their signatures approve this Charter and all future modifications thereto.

3.0 MEMBERSHIP

The membership of the IWG shall be drawn from the NRO and NASA. The IWG shall consist of no more than seven members from the NRO, seven members from NASA, and an Executive Secretary from the NRO.

3.1 Executive Co-Chairmen. The Deputy Director of the NRO (DDNRO) and the NASA Associate Administrator for OSSA shall serve as Executive Co-Chairmen to oversee activities of the IWG.

3.2 Executive Secretary. The Executive Co-Chairmen will select an Executive Secretary from the NRO.

3.3 Chairmanship. The IWG shall be jointly chaired by one co-chairman each from the NRO and OSSA, as appointed by the respective Executive Co-Chairmen. The IWG co-chairmen will be responsible for the day-to-day operation of the IWG.

3.4 List of Members. Appendix A is the list of current IWG members.

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4.0 FUNCTIONS

The IWG is the official organizational conduit between the NRO and NASA for the purposes of Mission to Planet Earth activities. In this capacity, the IWG has the following functions:

4.1 The IWG is charged with implementing the terms and provisions of the MOA, its protocols and its annexes.

4.2 The IWG shall ensure that security protection is the principal concern in all technology transfers and NRO/NASA interactions.

4.3 The IWG shall establish and maintain streamlined procedures for two-way technology sharing between the NRO and NASA.

4.4 The work of the IWG will be reported to the Executive Co-Chairmen via the official minutes, which shall be drafted by the Executive Secretary and approved by the IWG co-chairmen following each IWG meeting.

4.5 The IWG shall ensure program office representation and participation in the two-way technology sharing process.

4.6 The IWG shall develop all proposed annexes to the MOA and forward them to the Executive Co-Chairmen for approval.

4.7 The IWG shall maintain a current status of work performed and technology transferred under the terms of this MOA.

4.8 The IWG co-chairmen shall coordinate the responses of the constituent organizations to any Congressional inquiries concerning joint NRO/NASA activities under the terms of this MOA.

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5.0 AUTHORITY AND LIMITATION

5.1 The IWG is empowered to represent the constituent organizations in implementing the provisions of the MOA.

5.2 The IWG is not empowered to commit or expend funds nor to commit either or both constituent organizations to contractual obligations or binding agreements with other government organizations. Each constituent organization is responsible for funding its respective participation in the IWG. Additional funding agreements between the NRO and NASA, under the terms of this MOA, will be described in approved annexes.

6.0 EXECUTION

By their signatures below, the Executive Co-Chairmen charter the IWG and commit their respective organizations to support the IWG and this charter.

J.D. HILL	L. A. FISK
Executive Co-Chairman	Executive Co-Chairman

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COORDINATION SHEET

	TO	ACTION	SIGNATURE, DATE		TO	ACTION	SIGNATURE, DATE
1	**SI**	Coord	copy provided	14	**LCH**	Info	copy provided
2	**IM**	Coord	copy provided	15	**OS**	Coord	copy provided
3	**P&A**	Coord	copy provided	16	**CI**		
4	**MS&O**			17	**COMP**	Info	copy provided
5	**COM**	Coord	/s/ BGen Scanlan 3/8/95	18	**OSO**		
6	**TECH**	Coord		19	**CO**		
7	**DSPO**	Info	copy provided	20	**IG**		
8	**OSA**	Coord	copy provided	21	**GC**		
9				22	**ER**	Info	copy provided
10				23	**COS**	Info	copy provided
11				24	**DDMS**		
12				25	**DDNRO**		
13				26	**DNRO**		

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SUBJECT	DATE
Memorandum of Understanding (MOU) NRO-NASA	20 Mar 95

SUMMARY

(b)(1)
(b)(3)

ACTION REQUIRED: Mr Harris--Sign Mr Hill--Coord ADM Dantone--Coord

PROBLEM: D/NRO AND A/NASA requested a top-level, unclassified NRO-NASA MOU to openly demonstrate ongoing cooperative efforts.

BACKGROUND: Sep 92 BYEMAN-level MOU exists between NRO and NASA to specifically address Mission To Planet Earth (MTPE). This new top-level MOU does not supersede the MTPE MOU nor preclude additional focused agreements. To expedite coordination/approval of this MOU, it closely tracks the recently (Oct 94) signed NRO-DOE MOU (atch 2).

DISCUSSION: As part of overall declassification efforts, MOU essentially declassifies working relationship between NRO and NASA. Explicit reference to future relay service requirements and to a plan for national relay services, acknowledges NRO interest in (use of) comm relays.

RECOMMENDATION: Mr Harris sign MOU (atch 1).

Approve ____________ Disapprove ____________ Other ____________

Atch
. NRO-NASA MOU
2. NRO-DOE MOU

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MEMORANDUM OF UNDERSTANDING
BETWEEN
THE NATIONAL RECONNAISSANCE OFFICE
AND
THE NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
FOR COLLABORATION
IN ALL ASPECTS OF
SYSTEMS DEVELOPMENT, SYSTEMS OPERATIONS,
RESEARCH AND TECHNOLOGY

I. PURPOSE

This memorandum of understanding (MOU) formalizes an agreement between the National Reconnaissance Office (NRO) and the National Aeronautics and Space Administration (NASA) for collaboration in systems development, systems operations, research and technology.

This MOU establishes mechanisms for exchanging expertise to enhance capabilities of both organizations, and avoiding inappropriate and costly duplication of effort. Furthermore, it establishes a framework for collaboration on mutually beneficial technologies to extract the greatest potential from dual-use technologies.

II. REFERENCE

Memorandum of Agreement Between the National Reconnaissance Office and the National Aeronautics and Space Administration (U), September 1992. (Classified)

III. BACKGROUND

The National Aeronautics and Space Administration's (NASA's) mission is to explore, use, and enable the development of space for human enterprise; advance appropriate scientific knowledge and understanding; and research, develop, verify, and transfer advanced aeronautics, space, and related technologies. The National Aeronautics and Space Administration conducts vigorous programs that address all aspects of aeronautics and space flight, including advanced technologies, exploration, science and applications, space communications, and a launch program for civil space payloads.

The National Reconnaissance Office ensures the Nation has the technology and capabilities to acquire superior intelligence worldwide. The NRO accomplishes this

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mission through research and development, acquisition, and operation of spaceborne and airborne data collection systems. Established in the early 1960's, the NRO is an agency of the Department of Defense with the Secretary having ultimate responsibility in concert with the Director of Central Intelligence.

IV. POLICY

a. The NASA and the NRO shall ensure that they inform the other of appropriate ongoing technology developments of mutual interest within each organization.

b. Both organizations shall seek technical advice and counsel from the other in appropriate areas of systems development, systems operations, and scientific and technical investigation. Each organization shall provide the appropriate technical expertise necessary to assist in joint investigations. Details of any exchanges and assistance shall be established directly by those responsible for the interaction. Direct exchanges between respective, appropriately-cleared program office personnel is encouraged to enhance efficiency and effectiveness of collaborations.

c. Both organizations shall periodically review their research and development programs to identify redundancies and consolidate their efforts in order to minimize cost and maximize efficiencies through cooperative joint ventures.

d. Both organizations shall consider collaborative efforts in potential areas of dual-use technology.

e. Both organizations shall explore joint use of the test programs, the operational resources, and the facilities of each respective organization.

f. The NASA and the NRO shall jointly develop a methodology for the migration of successful technology developments and research tools into operational systems. In particular, ongoing efforts to jointly address future requirements for relay services and develop a joint strategic plan for national relay services should be directed at achieving an initiative go-ahead decision by CY2000.

g. The NRO recognizes significant, unique, and promising areas of new technology research at NASA that may be applicable to the NRO's mission. It shall provide, and NASA shall consider, recommendations to NASA to promote continued development of those technologies which support the NRO mission.

h. The NRO shall provide guidance (such as Annex A to the September 1992 MOA) to the NASA concerning the security classification of technology applications within the

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NASA which are under the mission purview of the NRO.

i. Furthermore, both organizations shall examine joint funding of collaborative work.

V. COORDINATION AND MANAGEMENT

a. Jointly-chaired Interface Working Groups will be formed (such as are addressed in Annex B to the September 1992 MOA) to oversee all joint efforts addressed under this MOA. Designated officials from NASA and NRO shall periodically review and provide further guidance for interaction and joint activities.

b. A regularly scheduled review of R&D investigations shall be established to ensure a full opportunity for the NASA and the NRO to exchange data on topics of mutual interest. The forum shall serve as the initial springboard for joint activities between the two organizations. This review shall also provide an opportunity for each organization to formulate suggested areas of investigation.

c. Both organizations shall coordinate security classification guides on collaborative projects and any NASA projects involving NRO assistance. Both organizations shall ensure that appropriate security is maintained with regards to work being conducted explicitly for the other.

d. Matters related to activities conducted under this MOU concerning release of information to the public, including requests under the Freedom of Information Act, will be coordinated between both organizations.

e. This MOU shall not be used as a basis to obligate or commit funds or as a basis for the transfer of funds. Details of the levels of support to be furnished by one organization to the other with respect to funding, technical expertise, and other assistance shall be developed in specific interagency agreements, subject to the availability of funds.

f. The Associate Deputy Administrator (Technical), or designee, will have overall responsibility for the conduct of this MOU within the NASA.

g. The Director of the National Reconnaissance Office, or designee, shall have overall responsibility for the conduct of this MOU within the NRO.

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VI. ADMINISTRATIVE GUIDELINES

a. Policies regarding patents and other intellectual property rights associated with technical interaction shall be established on a case-by-case basis consistent with security classification guidance, employee and contractor property interests, and subject to any statutory requirements of either organization. ~~as~~

This MOU will be reviewed at least every two years by the NASA and the NRO.

b. This memorandum of understanding may be amended by written agreement between the NASA and the NRO. This MOU may be terminated by mutual written agreement of the NASA and the NRO or by six months written notice by either office.

c. This MOU shall become effective upon the signature of both parties. It shall remain in effect until terminated.

Jeffrey K. Harris, Director
National Reconnaissance Office

Daniel S. Goldin, Administrator
National Aeronautics and
Space Administration

Date: ____________________

Date: ____________________

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