THE
AIR FORCE IN SPACE
FISCAL YEAR 1962

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THE
AIR FORCE IN SPACE
FISCAL YEAR 1962

by

Carl Berger

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USAF Historical Division Liaison Office

June 1966

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FOREWORD

The Air Force in Space, Fiscal Year 1962, discusses the highlights of USAF policy and program planning to obtain support from the administration, Congress, and the Secretary of Defense for a larger role in national space activities. Also included are significant actions taken and milestones reached in individual projects sponsored or supported by the Air Force during the period between 1 July 1961 and 30 June 1962.

This historical monograph is the fifth in a series on USAF space activities prepared by the USAF Historical Division Liaison Office. The earlier studies include: An Air Force History of Space Activities, 1945-1959, from which was drawn a smaller study, The Threshold of Space, 1945-1959; The Air Force in Space, 1959-1960; and The Air Force in Space, Fiscal Year 1961.

Max Rosenberg

MAX ROSENBERG
Chief
USAF Historical Division
Liaison Office

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AFCHO PUBLICATIONS

Below is a selected list of AFCHO historical monographs which may be obtained on loan or for permanent retention. Copies may be obtained by calling Oxford 6-6565 or by forwarding a written request.

The Threshold of Space, 1945-1959. (S)

An Air Force History of Space Activities, 1945-1959. (C)

The Air Force in Space, 1959-1960. (S)

The Air Force in Space, Fiscal Year 1961. (S-RD)

USAF Counterinsurgency Doctrines and Capabilities, 1961-1962. (S-Noforn)

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USAF Command and Control Problems, 1958-1961. (S)

USAF Strategic Command and Control Systems, 1958-1963. (S-Noforn)

Command and Control for North American Air Defense, 1959-1963. (S-Noforn)

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I. THE AIR FORCE AND THE NATIONAL SPACE PROGRAM

(U) When the Soviet Union launched Maj. Yuri A. Gagarin into space on 12 April 1961, it provided dramatic proof that the Russians were substantially ahead of the United States in rocket and space technology. Gagarin's 108-minute orbital flight--the first in history--stimulated President John F. Kennedy to propose that the United States accelerate its own space programs and undertake to land an American on the moon before 1970. Kennedy's remarkable proposal was still being debated by the 87th Congress when the Russians launched their second cosmonaut, Maj. Gherman S. Titov, on 6 August 1961 and successfully recovered him 25 hours and 18 minutes later, after 17 orbits of the earth.

(U) The Gagarin-Titov flights formed some of the background against which the Air Force renewed a campaign to win a larger role in the U.S. space program.* As discussed elsewhere in this narrative, during fiscal year 1962 the Air Force campaign was partially successful. Nevertheless, its officials remained largely disappointed and frustrated by their inability to overcome two main obstacles to an expanded USAF space program: the American commitment to a "space for peace" policy, and the continuing skepticism of key defense officials toward many USAF space proposals.

(U) Concerning the first obstacle, in his State of the Union message on 10 January 1957, President Dwight D. Eisenhower had announced for the

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*For earlier background, see Carl Berger, The Air Force in Space, Fiscal Year 1961 (AFCHO, 1966).

first time U.S. willingness to accept an international agreement to control reliably "the development of missiles and satellites." A year later, on 12 January 1958, he had proposed to Soviet Premier Nikolai A. Bulganin that their two countries "agree that outer space should be used only for peaceful purposes." In April 1958 the President pursued the same concept when he submitted to Congress his plan for establishing the civilian National Aeronautics and Space Administration (NASA), which agency, he said, would emphasize "the concern of our nation that outer space be devoted to peaceful and scientific purposes." [1]

(U) Several months later Congress enacted the Eisenhower proposal into law and declared that American space activities "should be devoted to peaceful purposes for the benefit of mankind." Although Congress also authorized certain military activities in space to insure the nation's security, it was the "space for peace" theme that was emphasized by Eisenhower and his successor, Kennedy. It was apparent to USAF officials in 1958 that, as the peace policy was fully implemented, the major share of space funds would go to NASA. This quickly proved the case.* [2]

(C) In its attempts to hurdle the second obstacle, the Air Force repeatedly tried to convince officials in the Office of the Secretary of Defense (OSD) of the necessity for a military man-in-space capability.

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*NASA's space budget surpassed that of the Department of Defense (DOD) for the first time in fiscal year 1961 ($926.2 million vs $813.9 million). In fiscal year 1962 NASA's budget rose to $1.79 billion, DOD's to $1.29 billion. In 1963 the space agency budget made a dramatic gain, rising to $3.62 billion. DOD's 1963 space budget was $1.57 billion. (Senate Hearings before Cmte on Aeronautical and Space Sciences, 88th Cong, 2nd Sess, NASA 1965 Authorization, Pt 2, App A.)

In early 1962 Secretary of Defense Robert S. McNamara finally acknowledged that "an investigation" of the role of military man in space was important to national security. However, he added that the investigation would have to be an integral part of the combined NASA-DOD national space program. The Air Force, initially pleased by this encouraging attitude, later was nonplussed by the comments of Deputy Director of Defense Research and Engineering (DDR&E) John H. Rubel, who bluntly stated that "we cannot visualize or define now a military mission for a man in space." [3]

USAF Campaign Against the "Space for Peace" Policy

(U) Assignment to NASA of the space exploration mission troubled USAF officials almost from the moment that it was announced. However, because of Eisenhower's strong position on the matter, they felt that there was little choice but to go along during the final years of his administration. The election of Kennedy in November 1960 seemed to open up new prospects, and the Air Force decided that the time was ripe to initiate an aggressive information campaign to point up its established competence in space technology. This campaign had as its goal the winning of greater support from the incoming administration for an expanded USAF space program.

(U) Unfortunately, the campaign backfired during the winter of 1960-1961. The chairman of the House Committee on Science and Astronautics, Rep. Overton Brooks, complained about "reported rumblings of dissatisfaction in Air Force and industrial circles concerning the peaceful orientation of the National Space Program," and he criticized the reported "competition and duplication" between the Air Force and the space agency. In an

appearance before the Brooks committee, Gen. Thomas D. White, USAF Chief of Staff, assured its members that the Air Force had supported and would continue to support NASA's space activities.[4]

(U) The fact remained, however, that the very term "space for peace" tended—in the words of a former Air Force official, Richard Horner—to "raise the hair on the back of a few people's neck(s)." In July 1961 a Senate subcommittee discussed the subject with Gen. Bernard A. Schriever, commander of the Air Force Systems Command (AFSC). To a question on whether the military space program was adequately and properly supported, Schriever replied, "No sir, I think we have been inhibited in the space business through the 'space for peace' slogan. I think that there has been too arbitrary a division made between the Department of Defense and NASA in this area."[5]

(U) The committee, on the basis of this answer, asked Schriever for a written statement on "what the facts are." It was still being drafted when the Soviet Union launched a second man into orbit on 6 August. Titov's flight reaffirmed Soviet superiority in space technology and served to underscore USAF contentions that the American space program was in trouble.* Chairman Richard B. Russell of the Senate Armed Services Committee agreed that the situation was critical and remarked that a satellite of the size that carried Titov "could be utilized as a very dangerous weapon." Representative Brooks also concluded that the Russians "obviously now have the

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*Up to the time of the Titov flight, the United States had managed only two suborbital flights of 15 minutes duration each—the flights of Cmdr. Alan B. Shepard and Capt. Virgil I. Grissom on 5 May and 21 July 1961, respectively.

capability to send up manned satellites carrying bombs and other equipment for destroying other nations." [6]

(U) The Titov flight was still fresh in everyone's mind when General Schriever's statement for the Senate Preparedness Investigating Subcommittee--after being approved by Secretary of the Air Force Eugene Zuckert--was dispatched on 11 September 1961 to Sen. John Stennis. The AFSC commander declared that there was "an impending and expanding space threat" which endangered not only U.S. international prestige but its national security as well. As evidence of this threat, Schriever cited the frequency and payload size of the Soviet space launches. He said that although the U.S. space program was being expanded, past efforts had been conducted "under an unnecessary, self-imposed restriction--namely, the artificial division into 'space for peaceful purposes' and 'space for military uses,' when in fact no technical and little other distinction between the two exists." [7]

(U) The classification of space activities as either "peaceful" or "military" had imposed a great handicap on the United States. Schriever argued that it gave the Soviet Union: [8]

> ... a convenient focus for attack upon our vital programs.... The Soviets pursue their own space activities with no self-imposed encumbrances. They do not attempt to advise the world on the category of activity into which a particular Soviet space experiment might fit. They operate in space solely in the national interest of the U.S.S.R., unperturbed or unrestrained by world opinion as to whether a Soviet sputnik or other space vehicle has peaceful or military implications.

(U) Schriever noted that when the "Russian Air Force officer" had orbited over the nation's capital a few days earlier, the Soviet Union had not felt compelled to proclaim the peaceful nature of his journey.

He complained that while Moscow accused the United States of espionage and aggression "in launching our observation satellites, many in this country dismiss as having no military significance this latest Titov flight over our nation's capitol in a five-ton space ship which is quite capable of bearing military equipment and weapons." Schriever referred the subcommittee to a recent Air Force Scientific Advisory Board (SAB) report, which had recommended that "the sense of urgency that exists across the whole front of space projects should be injected into the manned military space program." If the SAB recommendations were followed, he said, and "if the artificial division between peaceful and military space programs is removed," the United States could surpass the Soviet Union in the decade ahead.[9]

(U) Senator Stennis' reaction to the Schriever statement was all that could be desired. Embracing its views, he proceeded to deliver a speech in the Senate on 26 September 1961 in which he repeated Schriever's words and arguments to warn the nation about the expanding Soviet space threat. A few days later, the Air Force learned that the senator planned to undertake a "detached and exhaustive" study of the military role in space during the impending congressional recess. Stennis also indicated there would be considerable debate when Congress reconvened "to determine whether the present division of responsibility between the military and NASA is proper in light of international developments." [10]

(U) To assist in the preparation of the study, the Air Force early in October thoroughly briefed a member of the subcommittee staff, Mr. Herbert Hodge. The congressional interest, together with the obvious concern of the nation about the implications of the Titov flight, led

Gen. Curtis E. LeMay, the new USAF Chief of Staff, to conclude that the legislators would shortly inquire deeply into the USAF-recommended space program as well as its relationship with NASA.[11]

(U) Although important congressional leaders had become more receptive to USAF's views, the "space for peace" theme was still being vigorously reasserted by President Kennedy. On 25 September 1961, in an address to the United Nations general assembly, the President proposed that the international body extend its charter "to the limits of man's exploration in the universe, reserving outer space for peaceful use, prohibiting weapons of mass destruction in space or celestial bodies, and opening the mysteries and benefits of space to every nation....As we extend the rule of law on Earth, so must we extend it to man's new domain: outer space." [12]

(U) Despite the President's policy reaffirmation, USAF leaders now began to speak out more forcefully for an expanded military space program. In an address to the American Ordnance Association in Detroit on 26 October, General LeMay warned of the possibility that the nation with maneuverable space vehicles and revolutionary armaments could control the world. Pointing to a "striking" parallel between "space today" and airpower during the first world war, LeMay added:[13]

> Looking back at the history of airpower, you will recall the first use of the airplane in World War I was for reconnaissance. For a time air operations were conducted politely and with chivalry. Opposing pilots waved and nodded to each other as they passed. Both sides had equal access to the sky.
>
> But once reconnaissance began changing the course of battles, the rules changed. It didn't take long before commanders realized that it was necessary to deny the opposition this aid from the sky.

> Soon opposing airmen were engaged in battle. First it was air-to-air bombs and small arms. Then they graduated to the machine gun. After this came bombers and aerospace had become another area of conflict.
>
> I think we will be very naive if we don't expect and prepare for the same trends in space.

(U) General Schriever also spoke out once again in opposition to the "space for peace" policy. At an American Rocket Society meeting in New York City, he declared that the artificial separation of space into peaceful and military categories had inhibited and would continue to inhibit USAF programs. He said that the ability to operate in space might well be the key to national survival and pointed to Russian boasts that the rockets used to launch Gagarin and Titov could just as easily have carried 100-megaton warheads. Such a possibility, he said, was "certainly within the technical state of the art." [14]

(U) These arguments, advanced at a time when the Soviet Union held a monopoly on manned orbital space flight, won adherents among top administration officials. Vice President Lyndon B. Johnson, chairman of the National Aeronautics and Space Council (NASC), commented that it was not useful to pretend that "arbitrary distinctions can or should be made between military and civilian space efforts." Even President Kennedy seemed to express a more positive view toward the military role in space. In an address to a Los Angeles group on 18 November, he declared that he did not believe that "we want to permit the Soviet Union to dominate space, with all that it might mean to our peace and security in the coming years." [15]

(U) This changing emphasis on the part of the administration, together with the increasing concern of members of Congress, seemed to

the Air Force to presage an expansion of its space role. Some concrete evidence of change came in December 1961, when the Air Force was authorized to accelerate the Dyna-Soar program.* Unfortunately, two months later the promise of a greater role in space was suddenly dissipated by a single, dramatic event: Lt. Col. John Glenn's successful Mercury orbital flight.

(U) The Glenn flight on 20 February 1962 abruptly ended the Soviet monopoly of manned orbital space flight, produced a great feeling of relief and euphoria throughout the nation, and brought a vast outpouring of international acclaim and good will to the United States, not only for the achievement but for the public manner in which it had been conducted. It also had the effect of reducing pressures on NASA and undermined Air Force hopes for achieving a larger role in the national space program. Delighted by the success of the Glenn flight and, later, by the flight of Cmdr. Scott Carpenter on 24 May 1962, Congress lost interest in pursuing a vigorous reexamination of the separation of responsibility for space activities between NASA and DOD.

(U) Thus, the situation reverted in large measure to what it had been. On 13 June 1962 Deputy Secretary of Defense Roswell L. Gilpatric told a Senate committee that while the Defense Department remained "very conscious of the need of taking out certain technological insurance," it continued to support the national objective "of the peaceful use for outer space."[16] Dr. Harold Brown, Director of Defense Research and Engineering, also stated specifically that OSD was "fully in accord with the language and intent of the Space Act." He added that "we have no

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*See Chapter III.

intention to preempt those areas which are the proper pursuit of the National Aeronautics and Space Administration, and as a sign of this their planned effort for the next year in space is very much larger than those within the Department of Defense." * 17

(U) On 14 June the President also commented on the civilian-military space program issue. Responding to a correspondent's question, Kennedy said that the existing "mix" between civilian and military space efforts--with NASA retaining the prime responsibility--"should continue." As a result of these policy statements, the Air Force campaign to win a larger role in space and to modify the "space for peace" policy came to an end, at least temporarily.[18]

USAF Support of the Lunar Project

(U) During the summer of 1961, following the President's announcement of the manned lunar landing project, the Air Force and NASA began a joint study of possible launch sites to support the program. In charge of the study were Maj. Gen. Leighton I. Davis, commander of the Air Force Missile Test Center+ and Dr. Kurt H. Debus, chief of NASA's launch operations at Cape Canaveral. After a month-long review of potential sites on both coasts, Davis and Debus in July 1961 recommended Cape Canaveral and proposed that the government acquire approximately 80,000 acres north of

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*These remarks were made in response to congressional queries concerning a New York Times article on 10 June 1962 which claimed DOD was planning to expand its military space program.

+Besides serving as the AFMTC commander, Davis was DOD's representative for coordinating all range support activities with NASA.

the existing base, already saturated with missile and space launch complexes.* [19]

(U) On 18 July the Aeronautics and Astronautics Coordinating Board (AACB), a joint DOD-NASA agency, and, shortly thereafter, top defense and space agency officials, reviewed the proposal. Since costs associated with the moon project at Cape Canaveral were easily identifiable, OSD proposed--and NASA agreed--that the space agency should seek congressional appropriations for land acquisition and for all improvements, facilities, equipment, and range support needed solely for the lunar expedition. NASA also agreed to accept and abide by the existing rules established by DOD "in their range-operator/range-user relationship at the AMR [Atlantic Missile Range]... unless changed by mutual agreement." [20]

(U) On 24 August Deputy Secretary Gilpatric and NASA Administrator James E. Webb formally agreed to these arrangements. The signed agreement stated that a single agency--the Air Force--would manage and direct all range operations to include range safety, launch scheduling, and other services. Air Force responsibilities, however, would exclude "technical test control of NASA launch control operations." The agreement also declared that, as agent for NASA, the Air Force would prepare and maintain a master plan of all facilities in the new area. NASA would be represented on the master planning board. The Air Force also would prepare design criteria for all land improvements and range support facilities, subject to NASA approval, and design, develop, and procure all

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*When detailed surveys were later completed, the specific amount of land sought totalled 72,644 acres.

communications, range instrumentation, etc., to support NASA activities.[21]

(U) USAF officials welcomed the assignment and, in fact, had already begun drafting plans for it. Through a strong supporting role, they hoped that the Air Force might eventually gain a "full partnership" with the space agency. As an additional step in this direction, on 4 August 1961 Secretary Zuckert proposed to OSD that the Air Force be designated DOD "executive agent" for NASA support. Deputy Secretary Gilpatric noted, however, that NASA's arrangements for the lunar mission were still in a formative stage and that the USAF proposal "might be premature or inappropriate." [22]

(U) Anticipating a favorable decision in the future, Headquarters USAF on 1 September directed General Schriever to develop as soon as possible an organization and procedures to insure effective support of the space agency's programs and authorized him to discuss these matters directly with the Associate Administrator of NASA, Dr. Robert C. Seamans, Jr. Within two weeks, such discussions had begun. All Air Staff agencies also were notified of Zuckert's desire that full support be given the space agency.[23]

(U) Meanwhile, Zuckert directed Dr. Brockway McMillan, the Assistant Secretary of the Air Force for Research and Development, to assume responsibility for developing NASA-DOD working relationships and appropriate directives. To obtain OSD guidance, McMillan met with DDR&E officials and they agreed that the Air Force possessed the bulk of the DOD resources needed to support NASA. They further noted that these resources would also be supporting high priority defense projects, and it would be essential to

clearly delineate "management responsibilities and interface procedures with NASA." McMillan subsequently met with NASA officials to discuss these subjects.[24]

(U) Following these talks, Secretary Zuckert on 28 December 1961 asked OSD to approve the creation of the Office of Deputy Commander, Manned Space Flight, Air Force Systems Command, manned by the three services, to plan for and provide support to NASA's lunar landing project. The proposal had been coordinated with NASA, and Zuckert requested authorization to establish the office without delay.[25]

(U) OSD did not act immediately on this proposal, apparently because it was then involved in drafting a directive on DOD support of NASA. On 24 February 1962--after it had coordinated with the services--OSD issued this directive. It stated that DOD would support NASA "in order to employ effectively the nation's total resources for the achievement of common civil and military space objectives." OSD retained responsibility for policy and program decisions in this area but assigned the Secretary of the Air Force responsibility for research, development, test, and engineering of systems "and for the detailed project level planning necessary" to implement such support. He also was made responsible for establishing and maintaining "contracts and management arrangements with NASA as are necessary to carry out such programs and projects." [26]

(U) While the draft OSD directive was being circulated prior to issuance, an AFSC task group appointed by General Schriever met with NASA officials to work out the details of an agreement on the organization

and mission of the proposed office of Deputy Commander. AFSC submitted these to Assistant Secretary McMillan, who approved them in early February, and the task group then issued a final report on 26 February. Several days later the USAF Vice Chief of Staff authorized AFSC to establish the new office. However, this authority was quickly withdrawn pending OSD approval. Secretary Zuckert on 28 March informed OSD of the plan to organize the new office under Maj. Gen. O.J. Ritland, who would be authorized to use the entire AFSC staff and to issue directives to pertinent field elements. Zuckert reported that NASA officials had agreed that such authority was needed to provide a clear focal point for relations between it and the Air Force.[27]

(U) OSD formally approved USAF's proposal on 6 April, and AFSC activated the new office on 1 May. NASA provided office space for Ritland's staff at its Washington headquarters, in close proximity to its Director of Manned Space Flight. On 23 May Ritland arrived to take over his new duties.[28]

Air Force-NASA Disagreements

(U) Several months prior to creation of the Ritland office, Air Force and NASA officials found themselves involved in a dispute over the interpretation of the Webb-Gilpatric agreement of 24 August 1961. The specific event which triggered the dispute was a USAF proposal to place a Titan III facility* on the southern portion of the land being purchased by NASA and to acquire an additional 10,900 acres to the north "to protect the full launch potential of the Atlantic Missile Range." Space agency officials

*See Chapter V.

at Cape Canaveral strongly objected to this proposal, as well as to a related plan to allow a certain amount of "overflight" of each other's facilities.[29]

(U) When USAF and space agency officials at the Cape were unable to resolve their disagreement, in early 1962 General Schriever and D. Brainerd Holmes, Director of NASA's Office of Manned Space Flight, joined the discussions. In late March, following these talks, NASA finally agreed to a Titan III site on the southern portion of the new land and to "limited overflight" as a basis for site master planning of AMR launch pads. But the space agency officials insisted that they retain a veto power over the Air Force "on the extent to which overflight will be used in siting, if operational disagreements exist." [30]

(U) The dispute came to the attention of a House subcommittee which, during hearings on 29 March, questioned Rubel and Seamans. Later, the two officials were asked to submit separate answers to 28 subcommittee questions concerning the Webb-Gilpatric agreement. The answers revealed that OSD-Air Force and the space agency were in substantial disagreement over the meaning of the Webb-Gilpatric agreement and AMR relationships.

(U) For example, OSD argued that the Air Force--as agent for NASA--retained responsibility for fulfilling lunar program requirements for range support and that the space agency "never had a complete 'right to site facilities'...." NASA, on the other hand, declared that it had never intended to relinquish its right to site launch facilities in the new area, and it disputed the OSD-Air Force statements concerning range operator-user relationships. NASA argued that since its funds were being

used for the manned lunar landing portion of the range, it was responsible to Congress. "Hence /NASA/ must approve planning and management decisions of the Air Force." [31]

(U) Disturbed by this public disagreement, Rubel asked Assistant Secretary McMillan to reexamine the range dispute. In mid-April 1962 McMillan filed a preliminary report with Secretary Zuckert in which he noted that the Titan III siting issue was only a part of "an overall NASA/DOD relationship problem." He said the dispute was being generated, to some extent, by both NASA and the Air Force "in hopes of establishing long range principles." On 18 April he reported to Rubel that the difficulties could not be solved at the "Davis-Debus level." He said the staffs of OSD-Air Force and NASA had taken "firm and conflicting positions on the authority and responsibility of the range commander" for the lunar project. To break the deadlock, he suggested formation of a headquarters-level working group to draw up a set of agreements on as many aspects of the interagency AMR relationships as possible. He recommended that General Ritland, as AFSC deputy commander for manned space flight, represent DOD. Rubel subsequently approved this recommendation.[32]

(U) Thereupon, Secretary Zuckert directed General Ritland to organize a working group to begin negotiations with NASA. The Ritland group initially met informally with NASA officials and, on 20 June, reported that the issues were so complicated that each should be treated individually and would require prolonged negotiation. At the end of the year these negotiations were under way; they were to continue for another six months before a new AMR agreement superseded the short-lived Webb-Gilpatric agreement.[13]

(U) Throughout this period, it should be noted, NASA officials were well aware of Air Force plans and hopes for achieving a larger role in the national space program. Thus, in a letter to Secretary Gilpatric in June 1962, NASA chief James Webb acknowledged that "people and interests concerned with both our military and civilian space program" had strong convictions that things could be done "differently or better, at least from their standpoints." However, he observed that NASA's programs represented presidential policy "to conduct the space effort with a civilian, peaceful, international orientation, as long as possible and to the fullest extent possible, but always to develop the technology and preserve the ability to move rapidly to a military emphasis should this be required." Webb expressed the view that NASA could transfer to the military services "with minimum delay" space systems under development, if they were required in the national interest.[35]

(U) But USAF officials remained skeptical about the feasibility and practicality of relying upon civilian-oriented space systems. Lt. Gen. James Ferguson, Deputy Chief of Staff for Research and Technology, expressed the Air Force view during an appearance before Congress in early 1962:[36]

> The characteristics of manned military space systems must necessarily be considerably different from manned space vehicles employed for scientific experimentation and exploration. These differences are related to such factors as launch response time, maneuverability in orbit, maneuverability during re-entry phase, precision recovery with conventional landing, vehicle reuse after minimum refurbishment, and weapon incorporation.

It was for these military requirements, which were not being met, that the Air Force continued to agitate for an expanded military space program.

II. USAF SPACE PLANNING

(S) Soviet space achievements and the President's decision to undertake a lunar expedition not only stimulated the USAF campaign to win a larger role in space, but also an internal planning effort which produced an official and comprehensive Air Force space plan. Its need was first suggested by Maj. Gen. William B. Keese, Director of Development Planning, who believed it would help clarify Air Force views on space objectives in light of the expanding American program and would assist in winning OSD support. On 21 July 1961 the Chief of Staff authorized General Keese to organize a task force to prepare the plan. Within a brief period General Keese had assembled a working group which included Air Staff and AFSC representatives. After six weeks of effort, they completed an 88-page document which General LeMay approved on 20 September as the Air Force Space Plan.[1]

The Air Force Space Plan

(S) The theme of the Air Force Space Plan was the need for a larger and more aggressive research and development effort to provide the technological foundation for expanded military space operations. The plan called for a greater research effort in such areas as guidance, aerospace propulsion, improved sensors, etc., and strongly recommended that Dyna-Soar development be revised and accelerated to go directly to manned orbital flight. The plan also urged establishment of a broad and accelerated bioastronautics program in cooperation with NASA, to provide data for future military space

operations, and suggested that NASA share with the Air Force the results of its earth orbital programs "in order to provide for early multi-manned testing of military subsystems in space for duration up to two weeks." It further recommended that studies and experiments be accelerated to select the configuration "for a manned, maneuverable, recoverable spacecraft and a long-duration military test space station." [2]

~~(S)~~ In other program areas, the Air Force Space Plan recommended (1) continuation of Midas, Discoverer, X-15, and Blue Scout "with their present emphasis;" (2) acquisition of a large, reliable, economical military space booster able to place 10,000 to 50,000 pounds of payload into a 300-mile orbit; (3) revision and expansion of the satellite inspector (Saint) effort to include demonstrations of unmanned techniques for rendezvous, inspection, docking, transfer of fuel, and satellite capture and neutralization; (4) investigation and demonstration of techniques for satellite interception and neutralization by nonorbiting vehicles as well as nonrendezvousing satellites; and (5) transfer of the space-based antiballistic missile (Bambi) project from the Advanced Research Projects Agency (ARPA) to the Air Force.* [3]

~~(S)~~ In early October 1961 Air Staff officials briefed Secretary Zuckert, who remarked that the plan would require periodic revision as conditions changed. It was subsequently distributed throughout the headquarters and a formal briefing was given to the bioastronautics group of the President's Science Advisory Committee and to Deputy DDR&E Rubel.

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*These several programs will be discussed separately in the following chapters.

Although commenting favorably on the presentation, Rubel indicated that he would not recommend formal OSD approval. Despite this, the Air Staff considered the document an important acquisition, having provided it a unified and official position on Air Force space objectives. Some months later, in accordance with Secretary Zuckert's suggestion, a new working group began an examination of necessary changes to the plan. This work was still under way at the close of the period.[4]

The Ferguson Task Force

(U) As a follow-up to the space plan, Headquarters USAF undertook to prepare a comprehensive programming document that outlined costs and schedules to achieve its space objectives, and on 4 December 1961 the Vice Chief of Staff named General Ferguson to head a temporary task force for this purpose. Initially, the task group concentrated on a defense of the fiscal year 1963 budget and an outline of the USAF space goals for fiscal year 1964.[5]

~~(S)~~ Ferguson organized eight panels to prepare the budget defense and the 1964 recommendations. Completed in early 1962, the work of these panels formed the basis for General Ferguson's presentations to several congressional committees in February. In summary, the task force proposed an increase of the USAF fiscal year 1963 space budget [redacted] (versus OSD's proposed budget of $826.2 million) and to $1.86 billion in fiscal year 1964 (versus OSD's proposed budget of $1.32 billion).[6]

(U) On 12 February Ferguson presented the Air Force case for an expanded military space program to the House Subcommittee on DOD appropriations. Referring to the Air Force Space Plan, he stated that the

prime objective was to exploit space "so as to retain U.S. military superiority and thus to insure the peaceful use of space." He reviewed relationships between the Air Force and NASA and said that both agencies agreed that their programs "must be mutually supporting rather than competitive." However, operational and other technological requirements were not common to both agencies, and the differences were of sufficient importance to warrant a separate and larger USAF space development effort.[7]

(U) Ferguson also told the committee that there was a military requirement to inspect foreign satellites, provide a defense against ballistic missile attack, and conduct surveillance and reconnaissance. He emphasized in particular the importance of getting a military man into space:[8]

> He is unique in his ability to make on-the-spot judgments. He can discriminate and select from alternatives which have not been anticipated. He is adaptable to rapidly changing situations. Thus, man's inclusion in military space systems will significantly increase the flexibility of the system, as well as increase the probability of mission success....

In subsequent testimony before the House Armed Services Committee, General Ferguson reiterated this testimony and specifically stated in answer to a question that the Air Force could use $250 million more than programmed by OSD for fiscal year 1963.[9]

McNamara and Space Budget Augmentation

(C) That USAF space expansion efforts appeared to be making some headway became evident on 22 February 1962, when Secretary McNamara forwarded to Secretary Zuckert a lengthy memorandum on the space program

in general and Dyna-Soar in particular.* It seemed to reflect a more sympathetic attitude and "noticeable liberalization," as General Ferguson remarked, of McNamara's previous views. He agreed, for example, that an investigation of the role of military man in space was important to national security and that military space performance specifications and design requirements might differ substantially "from nonmilitary applications." On the other hand, he said that in the absence of a clearly defined space mission, the Air Force should direct its efforts to the establishment "of the necessary technological base and experience on which to expand--with the shortest time lag--in the event a firm manned military space mission and requirements are established in the future." [10]

(C) Despite certain qualifications, McNamara's comments and policy statements were especially welcomed since they partially reflected the military space policy that the Air Force had so long advocated. On 12 March General Ferguson remarked that he was particularly encouraged by McNamara's statement on the need to move ahead in space technology, even though all missions were not clearly defined. "I feel," Ferguson wrote to General Schriever, "we should accelerate our efforts in the area of advanced technology with the expectation that our program will receive more favorable consideration by DOD." [11]

(U) In the weeks that followed the Air Force continued to press its case. Thus, in a speech at Worcester, Mass., on 28 March 1962, General LeMay vigorously argued that the United States could not afford to let a potential enemy secure "an ominous advantage" in space and he urged a step up in military space development in order to prevent "a fatal technological

*Discussed further in Chapter III.

surprise in the 1970's." In an evaluation of LeMay's speech, the Washington Post commented on 2 April that Air Force officials were somewhat in the same position as their Air Corps elders of the 1930's--"having supreme faith in the overwhelming need for military aerospace power but unable to demonstrate it." [12]

(S) The Post article evidently came to Secretary McNamara's attention because that same day, 2 April, during a conversation with LeMay, he offered to reconsider fiscal year 1963 funding of the USAF space program and asked for augmentation requirements and justifications. The Chief of Staff immediately directed General Ferguson to prepare a list of space projects for which additional resources should be requested.[13]

(S) Ferguson tackled the assignment by first reviewing the data compiled by his task force the previous January and February. He then put together a new package that called for an additional $400 million in supplemental fiscal year 1963 funding. Specifically, for currently approved systems, Ferguson wanted $37 million additional for Dyna-Soar, $25 million for Saint, $44 million for Midas, and $72 million for Titan III. For projects in the advanced system program, he recommended $45 million for a military orbital development system, $12 million for a non-orbiting satellite interception system, and $20 million for a military satellite communication system. Additional funds also were requested for several segments of the advanced technology program.[14]

(S) The Ferguson fund augmentation package was presented to the Systems Review Board on 5 April and accepted by it as "realistic." However, Dr. McMillan concluded that the package was padded and warned the

Air Staff that it would be a mistake to submit such a large request, particularly since it included projects previously rejected by OSD. In line with this advice, the Air Staff substantially pruned the package, eliminating "marginal" projects. Finally, on 16 May 1962 General LeMay forwarded to OSD his recommended augmentation of $252.9 million for fiscal year 1963. At the close of the period the Air Staff was still awaiting McNamara's response.* [15]

The Five-Year Space Program

(S) Meanwhile, during the spring of 1962 several events coalesced and led the Air Force to embark on an effort to prepare a five-year space program. In April an AFSC Space Technical Objectives Task Group—organized at Space Systems Division (SSD) under the direction of Lt. Gen. H.M. Estes,Jr.—undertook to produce a set of "time phased technical objectives which if attained will provide the USAF with the technological base required to implement the Air Force Space Plan." On 14 June General Estes briefed defense officials, including Rubel and Dr. L.L. Kavanau, OSD's Special Assistant for Space, on the group's preliminary findings. Afterward, Kavanau commented that OSD was preparing a five-year space program and he indicated the Air Force should do likewise. Secretary McNamara earlier had made a similar suggestion to the Chief of Staff.[16]

(S) Whereupon, on 26 June—a day after the Estes group completed its work and began briefing AFSC and Air Staff representatives on the results of its study—General LeMay directed General Ferguson to draft a five-year

*When the response came, it was largely negative. DDR&E informed LeMay on 20 August that it was difficult "to justify any blanket increase in funding for space programs at this time." (Memo, Brown to C/S USAF, 20 Aug 62, subj: FY 1963 Fund Augmentation for the Air Force Space Program.)

USAF space program. It was to contain a clear statement of Air Force objectives, a definition of the required technical objectives to achieve them, and an estimate of funds required. General Ferguson immediately began organizing a task group and asked key Air Staff and field command representatives to participate. An "action staff" would prepare the initial program drafts, drawing upon the Estes task group reports, after which an executive committee of general officers would review and approve the final version of the five-year space program. The first meeting of the task group was set for 5 July 1962.[17]

III. DYNA-SOAR

(U) During fiscal year 1962 the Air Force's hopes for getting a man into space rested largely on Dyna-Soar, a winged, hypersonic glider system. As currently planned, Dyna-Soar involved a three-step development. Step I called for the construction and testing of the space glider in suborbital flights, beginning in 1964. In Step II, scheduled for 1966, the Dyna-Soar would be launched into orbit and undertake controlled re-entry and landings. Finally, Step III would involve the development of Dyna-Soar military hardware based on the technology learned. At the beginning of the period, the Air Force was concentrating on developments leading to a demonstration of Step I suborbital capabilities, the only step thus far approved by OSD.[1]

(U) However, anticipating possible project acceleration, the Air Force had prepared a "standby" plan which called for merging Steps I and II into a single, continuous phase. This plan formed the basis of a proposa submitted to the Air Force in the spring of 1961 by Boeing, the prime Dyna-Soar contractor. Seeking to take advantage of the interest generated by the Gagarin orbital flight, Boeing recommended an accelerated effort (Project Streamline) which it said would save substantial development time and money and lead to earlier orbital flights.[2]

(S) Following AFSC's evaluation of the Boeing proposal, General Schriever on 1 August 1961 forwarded his recommendation to Headquarters USAF, urging approval. He said that Dyna-Soar could achieve piloted orbital flight during calendar year 1964, two-and-one-half years earlier

than planned, and that it was "an essential step to a timely operational military manned space system." Schriever noted that total costs would be less than the step-by-step approach, although funding requirements in fiscal year 1962 would be higher than programmed. The major unknown factor, he said, was the Dyna-Soar booster; he recommended that the Air Force adopt the proposed Phoenix A launch system.* Schriever added that the entire national booster program was currently under review by a DOD-NASA committee and that its recommendations would affect any final decision.[3]

(S) Following receipt of the Schriever recommendations and after being briefed on Project Streamline, the Air Staff agreed that Steps I and II should be merged into a single Dyna-Soar task—irrespective of final booster selection. At this point—early August 1961—NASA offered to provide the Air Force with Saturn C-1 boosters for launching Dyna-Soar. The Air Force studied this proposal for two months but finally rejected it, primarily because prospects for development of the Titan III appeared good.[4]

(S) Meanwhile, Secretary Zuckert provided the Air Staff with some guidance on the question of Dyna-Soar acceleration. At a meeting of the Designated Systems Management Group (DSMG),+ Zuckert directed the staff

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*A system based on a solid first-stage engine and a liquid second stage.

+Established 25 July 1961, the DSMG replaced the Air Force Ballistic Missile and Space Committee. The members included the Secretary and Under Secretary of the Air Force, the Assistant Secretaries of the Air Force for Financial Management, Materiel, and Research and Development, the General Counsel, the Chief and Vice Chief of Staff, the Deputy Chiefs of Staff for Operations, Research and Technology, and Systems and Logistics, the Comptroller, the Director of Missile and Satellite Systems, the Chairman of the Systems Review Board, and the Commander, Air Force Systems Command. Purpose of the DSMG was to assist the Secretary in managing the most important system programs of the Air Force (SAF Order 117.1, 25 Jul 61).

to continue the three-step approach pending a final determination of the role of Dyna-Soar in the manned, military space program. He said he believed action could be taken, within the current confines ($100 million) of the 1962 budget approved by OSD, to facilitate the transition of Step I to the Streamline approach. The Secretary also requested the Air Staff to take another look at alternate possibilities for achieving controlled manned space flight and submit its overall study results to him by October, with the role of Dyna-Soar clearly defined.[5]

(S) Pending completion of this new study, the Air Force on 13 September 1961 submitted its proposed 1963 budget to OSD. At the same time, it formally proposed eliminating the suborbital phase of Dyna-Soar and going directly into an orbital program of 18 flights, with a first-flight date of late 1964. On 22 September OSD tentatively rejected the proposal and informed the Air Force that Dyna-Soar plans should remain unchanged pending completion of the Zuckert-directed evaluation. For fiscal year 1963, Dyna-Soar funding was established at $125 million.[6]

"A Vehicle Looking for a Mission"

(S) During September 1961 representatives from AFSC, SAB, Rand, and the Mitre Corporation, working under the direction of General Estes, undertook the program review. Sharp differences of opinion soon appeared, especially between SSD and the Aeronautical Systems Division (ASD), at Wright-Patterson AFB, concerning the best approach to placing "military man usefully in space." A number of old and new approaches were suggested, including proposals that Dyna-Soar be terminated as a glider and reoriented to a lifting body design or that only Step I be accelerated or that Streamline be fully implemented.[7]

(S) The lack of agreement reflected the fact that the working members had difficulty deciding on a mission for man in space that was "clearly military, of urgent importance...and completely different from a NASA assignment." As one panel member expressed the basic problem: "The Dyna-Soar is a vehicle looking for a mission." On 28 September General Estes summarized the review effort in a report to General Schriever. After noting the difficulty in reaching a consensus, he urged that the overall man-in-space program be based, as previously recommended, on the Dyna-Soar Streamline proposal. The project should be reoriented, Estes said, "toward a specific, saleable, unquestioned military mission" which he saw as being "a manned space system for inspection and interceptor purposes." [8]

(U) Secretary McNamara, meanwhile, told USAF officials after a briefing at Boeing's West Coast plant that he was still not convinced that Dyna-Soar represented the best approach to assessing the role of military man in space. He asked the Air Force to review the total program and come up with specific recommendations. McNamara's skepticism was reflected in his subsequent decision not to release the $85.3 million add-on fiscal year 1962 funds which Congress had appropriated specifically for Dyna-Soar. In explaining why he thought that existing funds ($100 million) were sufficient, McNamara referred to the fact that Dyna-Soar was being reviewed and that it might be reoriented to produce more rapidly "the experience and technological capabilities relevant to presently unforseeable military needs." If a reorientation were feasible, he said, "proper scheduling of flights and use of launch vehicles should make it possible within the funds requested for fiscal year 1962." [9]

The Air Force White Paper

(S) The review by the Estes group brought Dyna-Soar back full circle to the Streamline proposal. During October 1961, AFSC prepared an abbreviated Dyna-Soar development plan based on the Streamline concept, which called for a "Phase Beta" study to determine approaches to design "a super-orbital vehicle." The plan also incorporated provisions for a supporting applied research and technological test program. The first unmanned Dyna-Soar orbital flight was scheduled for November 1964 and the first piloted flight in May 1965.[10]

(S) On 18 October McMillan noted his agreement to the plan but suggested that references to military applications be deemphasized in future briefings to OSD. Several days later Dr. Kavanau reviewed the plan and agreed that it was sensible to go directly to an orbital phase. AFSC subsequently drafted two alternative development plans for the DSMG. Plan "A" called for the first manned orbital flight in May 1965 as previously planned, with funding requirements of $100 million and $156 million in fiscal years 1962 and 1963. Plan "B" would delay the first manned flight until October 1965 and would require funding of $100 million and $125 million, respectively, during the same two-year period.[11]

(S) Following a presentation to the management group on 14 November 1961, Air Force Under Secretary Joseph V. Charyk asked that still another development plan be prepared--based on the Dyna-Soar/Titan III booster combination--with funding not necessarily tied to $100 million in 1962. He also asked the Air Staff to prepare a "White Paper" defining the military manned space mission and stressing the role of Dyna-Soar. Finally,

he directed a review of the proposed Titan III plan to insure that it would not be oriented specifically and solely to Dyna-Soar.[12]

(S) On 16 November the revised Dyna-Soar development plan and the White Paper were completed, reviewed, and then forwarded to Secretary McNamara the following day. The plan provided for an all-orbital Dyna-Soar program of 10 flights beginning in late 1964 and using Titan III boosters. Fiscal year 1962 and 1963 funding estimates were $112.4 and $179.4 million, respectively, less Titan III development costs. Total Dyna-Soar costs through fiscal year 1967 were estimated at $666.2 million. There was no mention of military subsystem or system development objectives.[13]

(C) The White Paper accompanying the plan contained a carefully prepared statement on the requirement for a manned military space capability. Citing the U.S. manned lunar landing undertaking and the Soviet's impressive man-in-space program, the Air Force declared that "if we concede that man can go into space for peaceful missions, we must admit that man can go into this same environment for military purposes." Therefore, the Air Force contended that "military requirements should be directed toward the development of certain fundamental capabilities in space which may later provide the basis for military systems required in the national defense."[14]

(C) The White Paper noted that the characteristics of military space vehicles and their ancillary equipment would differ significantly from those employed for scientific experiments. Dyna-Soar was specifically designed for quick launching, maneuverability during re-entry phase, precision recovery, and vehicle reuse--characteristics not of primary

interest in NASA's scientific endeavours. The Air Force noted that all groups familiar with the subject conceded that Dyna-Soar was "an appropriate initial step in any manned space effort and that it may well be capable of modification to meet a more demanding re-entry environment." [15]

(C) After reviewing the White Paper and the development plan and discussing them with Assistant Secretary McMillan, in early December 1961 Dr. Brown approved the shift to an accelerated orbital flight program. At the same time he authorized the Air Force to terminate work on the Titan II booster* and use Titan III in its place. Whereupon, on 8 December Charyk directed that a revised Dyna-Soar development plan incorporating these decisions be readied for the Designated Systems Management Group within 90 days. Funding levels for fiscal years 1962 and 1963 were set at the $100 million and $115 million level, respectively.[16]

(U) Pending completion of the new development plan, Headquarters USAF incorporated Brown's guidance into a system program directive which it issued on 27 December 1961. It specified that Titan IIIC would be the booster for Dyna-Soar and that only single orbit flights were contemplated. The directive called for AFSC to complete a new system package plan by March 1962.[17]

(C) Secretary McNamara formally approved the decision to accelerate Dyna-Soar on 22 February 1962. In his memorandum to Zuckert of that date, which provided guidance to the Air Force on the manned military space program, McNamara agreed that Dyna-Soar was an appropriate first step and he endorsed the principle of going directly to orbital flight. He asked the

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*Titan II had been approved as the Dyna-Soar booster in January 1961.

Air Force to submit a detailed development plan (already being drafted) and to redesignate Dyna-Soar as an experimental vehicle, thereby eliminating weapon system and military test connotations.[18]

Revised Program Planning

(C) Meanwhile, based on Brown-Charyk guidance of December 1961, AFSC had proceeded with a revised system package plan that could fit within the "tight" confines of the $100 and $115 million limits in fiscal years 1962 and 1963. By 15 March AFSC had completed a preliminary plan that showed the initial unmanned orbital flight would slip from late 1964 to May 1965, due to the restrictive funding. Even with this slippage, an additional $25 million would be needed in fiscal year 1963 to maintain the program in phase with the planned availability of Titan III.[19]

(C) The Air Staff recognized the funding difficulties but felt compelled to recommend to the DSMG that it stay with the $100/$115 million program. On 20 March 1962 Secretary Zuckert accepted this recommendation. At the same time he asked the Air Staff to compile detailed data on what was possible within the funding limitations and to supply reasons "why these fiscal restrictions make the program with present schedules exceptionally risky in meeting the most limited objectives."[20]

(S) On 11 April, after AFSC had compiled the requested data, General Schriever forwarded his views to Headquarters USAF. He again declared that the Dyna-Soar funding level was clearly inadequate and would not permit the Air Force to meet a schedule compatible with the development of Titan III and that an additional [redacted] would definitely be needed in fiscal year 1963. DDR&E was so notified later in the month.[21]

(C) On 23 April AFSC submitted the Dyna-Soar system program package plan to Air Force headquarters, along with a program summary and alternative funding proposals. Secretary Zuckert then asked McMillan to make a detailed review of the soundness of the proposed technical approach. In early May 1962, accompanied by several Air Staff representatives, McMillan visited the project office at Wright-Patterson AFB. Upon his return, McMillan recommended revisions to the package plan "to further augment technical confidence in the program," which increased Plan A program costs [redacted] million in fiscal year 1963 and Plan B costs to $135 million.[22]

(S) On 25 May 1962 McMillan forwarded a final system package plan to Brown, along with the program summary and funding and launch schedule alternatives. The plan called for the manufacture of eight gliders for flight test purposes, of which two would be aimed at demonstrating a multi-orbit capability. During the course of the flight program, about 750 specific functions would be measured and recorded aboard the glider and then telemetered to ground stations.[23]

(S) On 6 July Deputy Secretary of Defense Gilpatric informed the Air Force that OSD would support an increased expenditure of $20 million for Dyna-Soar, raising the resources to $135 million in 1963. Gilpatric directed that the add-on should be used toward achieving the following system developments: (1) a first Dyna-Soar drop from a B-52 mother ship in January 1965; (2) a first unmanned glider launched into orbit by Titan III in July 1965; and (3) a first piloted orbital flight in January 1966.[24]

(U) A few weeks earlier, in keeping with the momentarily expected reorientation and with McNamara's guidance of 22 February, the Air Force

had formally designated Dyna-Soar as the X-20 research test vehicle.[25] Thus, at the opening of the new fiscal year, Dyna-Soar had new program objectives, new nomenclature, and a slightly better fiscal outlook.

IV. MILITARY ORBITAL DEVELOPMENT SYSTEM

(C) During fiscal year 1962 the Air Force received some encouragement from OSD to pursue investigations of a proposed manned military space station. In his 22 February memorandum on USAF's recommended military space program, which suggested there was a need for such a station, Secretary McNamara agreed "that a space laboratory to conduct sustained tests of military men and equipment under actual environmental conditions, impossible to duplicate on earth, would be most desirable." [1] The Air Staff considered this statement as official guidance and immediately undertook an intensive planning effort to identify and describe the technical requirements and proposed configuration of the space vehicle, which it hoped could be launched in 1966.

Early Space Station Planning

(U) The concept of an orbital space station was, of course, not unique to the Air Force, it being first introduced into scientific literature by the German theorist, Hermann Oberth. In his pioneering work on space flight published in 1923, Oberth suggested launching "observing stations" into orbit from which man would be able "to see fine detail on earth." He visualized it as having a number of useful functions, such as warning ships in the northern sea lanes of ice floes and serving as refueling stations for extraterrestrial flight. In case of war, Oberth said, the stations would have "strategic value."

(U) Oberth's ideas were adopted by the German rocket experts at Peenemunde, the research station on the Baltic where the V-2's of World War II--the first man-made objects to fly through space--were developed. Drawings of a large, manned space station, prepared by Peenemunde scientists and captured by American forces after Germany's collapse, were published in the United States in Life magazine on 23 July 1945.[2]

(U) Within what was then the Army Air Forces (AAF), certain officials became interested in the military implications of German space planning. This interest was reflected on 12 November 1945 in the final war report of Gen. H.H. Arnold, in which the commanding general of the AAF discussed the possible use of space weapons: "We must be ready to launch... from unexpected directions. This can be done with true space ships, capable of operating outside the earth's atmosphere. The design of such a ship is all but practicable today; research will unquestionably bring it into being within the foreseeable future." [3]

(U) During the early postwar years, scientists here and abroad began studying and writing papers on the construction, operation, and uses of space stations. The growing body of literature on this subject in particular, as well as on the general topic of manned space flight, stimulated a small group of USAF researchers to study potential military applications. One report of 2 January 1957, written by an official of the Wright Air Development Center (WADC), discussed the need for space vehicle research and described several possible projects, including manned space stations. In a follow-up study published in July 1957, WADC

planners listed booster requirements for launching various types of satellites and stations.[4]

(S) However, it was not until the first Soviet sputniks were fired into orbit in the fall of 1957 that the President and the Congress became receptive to major space development proposals. The Air Force, which undertook a study of ways to counter the impact of the Soviet achievements, by late December of that year had received a dozen unsolicited contractor proposals, several calling for the development and launching of manned space stations. One industry proposal suggested using "a large ferry-rocket vehicle and a manned earth-satellite terminal" with the last stage becoming the basic material for the orbiting station. Another contractor proposed construction of a four-man orbital station at an altitude of 400 miles, using Atlas missiles as building blocks.[5]

(S) In January 1958, in response to an OSD request, the Air Force submitted a package containing proposals and recommendations for an expedited U.S. satellite and space program. Among the listed projects was an Air Force "Manned Strategic Station." The Air Research and Development Command (ARDC)* in February incorporated a "USAF Space Research and Space Station" task as part of a proposed advanced system and space vehicle study. The task called for an exploratory system analysis and design study "of a general purpose space technology laboratory orbiting in the cislunar environment."[6]

(S) Air Force hopes of obtaining approval and support for its space proposals were thwarted, however, when NASA obtained primary responsibility

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*The predecessor to the Air Force Systems Command.

for space exploration. The Air Force could only pursue space development work directly in support of known military requirements and some studies that might have military implications. Thus, in a planning note of late 1959 that discussed hardware required to support an Air Force space program, the Directorate of Development Planning included a "manned orbital laboratory," to serve as a space crew training facility and as "a test bed for checking out space weapon systems."[7]

(S) Concerning the general usage of such a laboratory, Brig. Gen. Homer A. Boushey, Director of Advanced Technology, suggested (as had Oberth) that it could serve as an observation post and "a manned space patrol for peaceful purposes." But Boushey thought that an orbital platform could also be used for bombardment purposes. The military potential appeared such that the Air Force concluded that it should undertake additional studies. In June 1960 ARDC issued a study requirement (SR) for what it designated a military test space station (MTSS). The SR called for an investigation of a space laboratory concept to determine the ability of men and equipment to perform various USAF missions.[8]

(S) The first phase of this study was completed in late July 1961. The results were sufficiently encouraging for the Air Force to initiate a follow-on study of an advanced space station. During the summer of 1961 Headquarters USAF also established MTSS as an active project under the Director of Advanced Technology and asked OSD for an allocation of $5 million and the inclusion of the project in the fiscal year 1963 budget. However, when OSD budget guidelines were released in September the space station project was left unfunded.[9]

(S) The Air Force, in the meantime, had slowly reached the conclusion that a space station had become vital to its needs. As noted in the Space Plan of September 1961, acquisition of a space station was considered essential to evaluate operational hardward and concepts for "space command posts, permanent space surveillance stations, space resupply bases, permanent orbiting weapon delivery platforms, subsystems, and components." When he approved the Space Plan, General LeMay directed AFSC to initiate a design study and experimental investigation to select the configuration of a long-duration military test station.[10]

(C) OSD became aware of the Air Force proposal when Deputy DDR&E Rubel was briefed on the Space Plan shortly after its publication. The space station requirement also was discussed in the Air Force White Paper submitted to Secretary McNamara on 17 November 1961. The paper pointed out that the achievement of space rendezvous and developing docking and transfer techniques was already an important aspect of the U.S. lunar program. The ability to rendezvous, dock, and transfer men and supplies, it noted, would lead directly to a capability to establish an orbital test station. The Air Force argued that such a station or laboratory would be especially valuable for expediting military system evaluation in the actual space environment.[11]

(U) On 12 February 1962, while still awaiting McNamara's comments on the White Paper and the recommended Air Force space program, General Ferguson discussed the space station on Capitol Hill. He told a congressional committee that much of DOD's space activities would depend on testing of subsystems in "the true space environment" and consequently a test

station there was the only solution. "We are convinced," he said, "that a manned, military test space station should be undertaken as early as possible." Ferguson added that the Air Force was considering a proposal for a coordinated effort with NASA, possibly using the Gemini vehicle as the initial transport for the orbiting station.[12]

(U) It was not long afterward that the Air Force received Secretary McNamara's encouraging memorandum of 22 February, in which the defense chief expressed the view that there might be an advantage in developing a space station. McNamara specifically suggested that the Air Force consider the possible adaptation of Gemini and Dyna-Soar hardware and technology in the initial phase of development. This suggestion became one of the major guidelines for the Air Force as it proceeded with development planning.[13]

Planning the MODS

(S) In March 1962 Air Staff and AFSC representatives began drafting plans for the military orbital development system (MODS), a new name given to the project. On 26 March AFSC forwarded study data to Headquarters USAF which confirmed the technical feasibility of the concept and provided preliminary funding requirements. On 2 May Headquarters USAF issued Advanced Development Objective (ADO) 37 for the MODS, and in the latter part of the month, after further Air Staff coordination, AFSC submitted a proposed system package plan to the Pentagon.

(S) As briefed to the Systems Review Board on 4 June, MODS would consist of three basic elements--a station module (permanent test facility), a spacecraft (a basic Gemini vehicle attached to the module),

and the Titan III launch vehicle. The system would provide a shirtsleeve working environment for a four-man crew. AFSC recommended a 15-month Phase I study be initiated at once to allow an initial operational capability by mid-1966 and requested $14.7 million in fiscal year 1963 funds.[14]

(S) The Air Staff, however, had financial difficulties. Therefore, pending review and approval by OSD, it asked AFSC to identify any internal funds and manpower resources that could be reprogrammed. On 8 June AFSC listed several projects which would probably not be fully implemented (such as the mobile mid-range ballistic missile) and recommended reallocation of their funds. However, since Headquarters USAF was at this time still committed to these projects, it considered the feasibility of forwarding to OSD a program change proposal for a Phase I MODS study effort. There matters stood at the close of fiscal year 1962.[15]

V. TITAN III

(U) As previously noted, the Gagarin space flight of April 1961 had immediate repercussions on the U.S. space program. Not only was the event disturbing to American officials, but also the fact that the Soviet spacecraft weighed more than 10,000 pounds--far in excess of any the United States had launched. Reacting to this Russian success, the administration immediately embarked on the manned lunar landing expedition. It also initiated a comprehensive study aimed at acquiring a large standardized military space booster to serve as a "workhorse" for launching payloads of 5,000 to 25,000 pounds into low earth orbits.

(S) The concept of a standardized launch vehicle grew out of discussions held in the spring of 1961 between DOD and USAF officials and the Unmanned Spacecraft Panel of the Aeronautics and Astronautics Coordinating Board. Based on these talks, Deputy DDR&E Rubel proposed a "unified program concept" as a guide to future space program planning. He suggested that the United States could avoid an uneconomical diversion of its efforts by undertaking to develop standardized launch vehicles and spacecraft for use with a variety of payloads. Rubel's proposal became the starting point for a series of launch vehicle studies pursued by the Air Force, OSD, and NASA in the following months.[1]

The Search for a DC-3 of the Space Age

(S) In July 1961 a Large Launch Vehicle Planning Group (LLVPG) was organized under the direction of Dr. N.E. Golovin of NASA and Dr. Kavanau

of OSD for the purpose of defining large launch vehicles needed to support the lunar program. Its findings, which were not completed until October, were to be reported to Dr. Seamans of NASA and Rubel.[2]

(S) On 1 August Rubel and McMillan organized a second planning group, the Ad Hoc Committee for Standardized Workhorse Launch Vehicles, under Dr. O.F. Schuette, OSD. Its job was to examine alternate approaches for a workhorse booster able to orbit 10,000-pound payloads at 300-mile altitudes (later increased to cover payloads of 5,000 to 25,000 pounds in low earth orbit). The committee studied 11 combinations which might evolve into "the DC-3 of space transportation for a great many years to come." They ranged from the use of Centaur,* Titan II with various upper stages and/or strap-on solids, Phoenix, and Saturn C-1 to a completely new all-solid booster.[3]

(S) On 18 August the committee recommended that the Defense Department should rely on Atlas-Centaur for the period through 1965, develop an improved Titan II with strap-on solids and a high energy upper stage for post-1965 launchings, and accept NASA's offer of Saturn C-1 for Dyna-Soar.+ The Air Force, while generally endorsing these recommendations, was particularly partial to the Titan II-solid booster combination "as a standardized booster vehicle." On 15 September Rubel also voiced the view that a standardized workhorse vehicle based on Titan II had "attractive potential." He requested the Air Force to begin studies of this combination which, he said, "we should now call Titan III."[4]

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*Centaur is discussed in Chapter VII.

+As noted in Chapter II, the Air Force rejected this offer.

(S) McMillan promptly forwarded Rubel's request to LeMay with the injunction that it be treated "as a matter of extreme urgency" and that the results "be based on the utmost objectivity." USAF agencies, particularly SSD, quickly undertook an intensive study of the proposal, compiling data on its booster role, design, performance, reliability, development schedule, and estimated costs in several alternate configurations. In its report, completed early in October 1961, SSD proposed a first flight of a Titan III core in the summer of 1963 and of a Titan III with strap-on solids in June 1964.[5]

(S) On 9-11 October 1961 AFSC representatives briefed McMillan, Charyk, Rubel, and others on their findings. Rubel verbally gave the "go-ahead" in order to protect the development schedule, and on 13 October he formally directed the Air Force to initiate a Phase I study of "a family of launch vehicles based on the Titan III."[6]

Beginning the Phase I Study Effort

(C) The "most comprehensive advanced development planning effort ever undertaken by the Air Force," as Secretary McMillan later described it, now began. It would consume many months and involve the closest supervision of development planning by OSD officials that the Air Force had ever experienced. The reason for this close scrutiny was Secretary McNamara's decision to use Titan III as a test case in applying several organizational and management innovations which he hoped would reduce system development time and cost.[7]

(C) In his directive of 13 October, Rubel provided detailed guidance on how the Phase I study should be conducted. The principal preliminary

design objective, he said, was to define the scope of development in much greater detail than ever before and identify major areas of technical risk. Rubel directed the establishment of a strong program office to supervise all aspects--the booster, ground support equipment, and launch facilities. He also suggested that the Air Force set up appropriate management systems, such as PERT* accounting centers, and special accounting and auditing practices during the Phase I period. He further recommended that only contractors willing and able to establish, maintain, and use these procedures be allowed to participate. He established 1 February 1962 as the completion date for Phase I.[8]

(C) On 20 October Air Force headquarters instructed AFSC to move as rapidly as possible into Phase I. AFSC headquarters in turn passed the orders on to the Space Systems Division. Shortly thereafter, Col. Joseph B. Bleymaier was named as head of the 624A System Program Office at SSD, and he and a small staff immediately began work to meet the requirements set forth by Rubel.[+9]

(S) In mid-November 1961, while this activity was getting under way at SSD, top DOD and NASA officials met to review the overall national launch vehicle program, as proposed by the Golovin group. In October the group had recommended that the Titan III and the 120-inch diameter strap-on motors "should be developed by the Department of Defense to meet DOD and NASA needs, as appropriate in the payload range of 5,000 to 30,000 pounds low earth orbital equivalent." After reviewing the Golovin report,

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*Program Evaluation Review Techniques.

+The program office was officially established on 15 December 1961.

McNamara and Webb reaffirmed the policy (first enunciated in February 1961) of a single integrated national launch vehicle program. On the basis of this overall agreement, they decided to:[10]

(1) Cancel "parallel development" of very large 240-inch solid rocket motors as a backup for the space agency's liquid propelled Nova vehicle. This decision followed a successful first firing of the Saturn booster on 27 October 1961, during which its eight engines developed almost 1.3 million pounds of thrust.

(2) Continue advanced exploratory development of very large solid rocket engines by DOD (Air Force).*

(3) Consider modification of the Titan II as a potential space booster (designated Titan II½) for NASA's Mercury II (Gemini) program.

(4) Reconvene the Golovin group to re-study the long-term national launch vehicle program "with particular emphasis on the potential role of Titan III in that program."

(S) On 20 November the Golovin group met again and subsequently recommended that the Titan III "should be developed by DOD, providing that the Phase I study now underway confirms the technical feasibility and desirability of the system." This position was based on a technical study which included configuration mission forecasts, costs, and other factors, through 1970. The group estimated that there would be 523 DOD and 277 NASA launchings, plus 94 related directly to the lunar program. It expected that most of these would use Titan III.[11]

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*The large solid rocket development program is discussed in Chapter VI.

(C) On the basis of this latest recommendation, Rubel and Seamans on 5 December 1961 agreed that the Defense Department should proceed with development of a Titan III family, assuming technical feasibility was validated in Phase I, and that DOD should modify Titan II as the Gemini booster. McNamara and Webb approved these recommendations the next day.[12]

New OSD Guidance for Phase I

(C) Meanwhile, SSD had proceeded with the task of budget planning, organizing a management system, and soliciting preliminary (Phase I) studies from industry. It also drafted a Titan III procurement plan which was presented to General Schriever and top USAF officials on 30 November. They agreed that the best procurement approach would be to limit requests for proposals (RFP's) to those firms recommended by a source selection board and to award a cost-plus-fixed-fee contract.[13]

(C) However, on 1 December, after an OSD review of the procurement plan, Rubel directed the Air Force to hold up issuance of the RFP's, pending establishment of a complete PERT network that included OSD, the Air Force, and the contractors. He also asked the Air Force to use the services of an outside consultant agency, Operations Research, Inc., in formulating plans before and during the bid assessment period.[14]

(C) Reacting to Rubel's demands for a further refinement of management controls, USAF officials during December 1961 undertook a review of their existing procurement practices and made a number of changes. They agreed to establish a PERT network in accordance with Rubel's instructions, improve system specifications, and introduce contractor incentives. A briefing on the revised procurement approach was presented to Rubel and

other OSD officials on 20 January 1962. Afterward, Rubel authorized the Air Force to issue the revised requests for proposals, which now contained the incentive feature. All parties agreed that the requirement for PERT time-cost systems could be included in the final contract. On the basis of this understanding, the Air Force in early February released the RFP's for the Titan III booster and the guidance subsystem.[15]

(S) The refinement of its procurement procedures plus OSD's tardiness in releasing funds made impossible the completion of the Phase I study by 1 February, as previously requested by Rubel. Therefore, Secretary Zuckert established a new date--30 April--for the Air Force to complete Phase I and to submit a proposed system package plan.[16]

(C) During this period SSD had continued its work on the technical aspects of Titan III development. On 19 March 1962 the division briefed Charyk and Rubel on details of the proposed configurations, test characteristics, booster performance, and related aspects. Rubel then asked for a White Paper summarizing the technical approach and philosophy of the Titan III program. On 21 March Headquarters USAF forwarded this new requirement to AFSC. It asked that the paper place emphasis on the building block concept, the Phase I effort to establish early program definition before large sums of money were expended, and the considerations which led to AFSC's decisions on vehicle configurations, schedules, and performance as well as facility requirements.[17]

(C) At the above meeting, Rubel accepted the SSD proposal for two Titan III configurations--"A" and "C"--and a new upper stage called a "transtage." The "A" configuration was to consist of the basic Titan II

core plus the transtage and be capable of launching a 5,800-pound payload into a 100-mile orbit. The "C" configuration, consisting of the "A" vehicle plus two strap-on solid rockets, would place 25,000 pounds into low earth orbit. Rubel agreed to authorize additional funds to meet Air Force commitments during the transition from Phase I study to Phase II development.[18]

(C) Through the remainder of fiscal year 1962, OSD continued its intensive "management" of Titan III planning. Thus, on 3 April Rubel ordered an independent technical review and appraisal of the program by the Research Engineering Support Division, Institute of Defense Analysis, assisted by a technical group composed of OSD, USAF, and NASA representatives and outside consultants. In addition, on 5 April he asked the Air Force to prepare a "standardized launch vehicle requirement," defining and justifying the several proposed configurations based on mission payload needs. This would be used, he said, to assist Secretary McNamara in evaluating the proposed Titan III development.[19]

(U) Assistant Secretary McMillan responded to these new demands on 13 April, noting that the Air Force already was preparing two papers for OSD which would contain most of this information. They included a forecase of space payload launches and missions and the White Paper summarizing the technical approach and philosophy of the Titan III program. In addition, McMillan reported that the Air Force planned to issue a specific operational requirement (SOR) in early May.[20]

(C) The insistent OSD review of program details proved highly distasteful to responsible USAF officials. On 30 April General Schriever wrote General LeMay that the extent and amount of information required by

OSD and the nature of decisions being withheld were "unprecedented." The trend, he said, "is generating demands for large volumes of information and program data that is magnified at each succeeding organizational level. Decisions on matters that have never been previously reviewed are being withheld for inordinate lengths of time." [21]

(C) Schriever complained that the new OSD review committees were duplicating previous efforts of normal USAF and OSD units and that Space Systems Division, the Aerospace Corporation, and the contractors had already consumed 2,680 manhours to meet the demand for additional system data. If the trend continued, he declared, there would be no other choice but to recommend a sizable increase in AFSC manning and fundamental changes in its operating methods: [22]

> I view this situation with alarm particularly as it may affect the future. Although we have been able to furnish extremely detailed information on the design requirements for the Titan III prior to program approval, this is an unusual situation. Ordinarily we cannot provide such detailed information which is usually generated in the development program. If we are to be held to this overly conservative approach, I fear the timid will replace the bold and we will not be able to provide the advanced weapons the future of the nation demands.

The Titan III System Package Plan

(C) AFSC forwarded the proposed system package plan to Headquarters USAF on 30 April 1962. After the Systems Review Board and the DSMG approved it in early May, Secretary McMillan sent the plan to OSD. In a covering memorandum, McMillan said that in his judgment the proposed plan contained "realistic cost estimates, reasonable schedules, and a firm fix on

technical problems" to provide reliable hardware, as well as required production and launching facilities.[23]

(S) McMillan reviewed the considerable effort expended by the Air Force during Phase I that led to the package plan and noted particularly the continuing changes that resulted from the "new inputs of the DOD and the Air Force, as well as extensive engineering and managerial analyses." Concerning the higher program cost, McMillan attributed some of it to "refined estimates and better definition of engineering problems," others to new requirements such as placing launch facilities on both the Atlantic and Pacific missile ranges. Use of PERT management would also be costly. Through fiscal year 1967, the Air Force estimated Titan III development and testing costs would total $932.1 million. In fiscal year 1963 alone, the program would require $279 million--almost $100 million more than in the President's proposed budget.[24]

(C) On 16 May 1962, after OSD officials reviewed the plan, to the dismay of the Air Force, Rubel asked for more data. Although pleased with the effort that had gone into Phase I and the extent of the technical analyses, he stated that the proposed plan still did not contain adequate data in a form needed to assist the OSD review. Specifically, Rubel asked for more information and detail on program management, operations, system configuration and possible changes, civil engineering, the budget and financial plan, and mission forecasts.[25]

(S) USAF officials quickly became aware that the high program cost was the major stumbling block. Additional information, furnished on 21 May, still did not satisfy OSD and caused McMillan to have senior Air Staff

officials re-examine the proposed program in the light of a financial squeeze. He asked that they give special consideration to five principal areas: performance and mission capability, solid motor development, upper-stage configuration, guidance system requirements, and operational launch facility requirements at the Pacific Missile Range. The Air Staff completed the re-examination early in June and reaffirmed the Titan III program as presented in the package plan of May. It asked for an early OSD decision to begin Phase II development.[26]

(C) DDR&E remained unconvinced, and meetings between OSD and USAF officials on budget, management, and technical aspects continued throughout the month. On 28 June DDR&E provided McMillan with new guidance, primarily to minimize funding not only in fiscal year 1963 but in subsequent years. At the end of the period the Air Force began work on a program change proposal aimed at keeping costs down by reducing facility construction to a two-pad integrate-transfer-launch facility at the Atlantic Missile Range and eliminating the West Coast site.[27]

(C) The revised program would cost $225 million in fiscal year 1963, compared to the original estimate of $279 million. The revised schedule called for the first test flight of Titan IIIA in May 1964 and of Titan IIIC in January 1965.[28]

VI. LARGE SOLID ROCKET BOOSTERS

(U) While engaged in intensive Titan III planning the Air Force also was involved in advancing large solid propellant rocket technology. The immediate origin of this activity was President Kennedy's decision to embark on the manned lunar landing expedition. Specifically, he asked Congress for $62 million to begin development of very large solid rockets as backup to the liquid motors slated for the moon project. Both McNamara and Webb agreed that the Air Force should undertake this work but be responsive to NASA's requirements and schedules.[1]

(C) During the spring of 1961 SSD completed a preliminary development plan for a proposed 3,000,000-pound thrust solid propellant motor. In briefing the plan to Air Staff and OSD officials during late June and early July, SSD pointed out that before work could begin, NASA would have to provide its requirements on motor sizes and characteristics. However, pending receipt of these specifications, SSD on 24 July proposed an immediate start on 14 "interim" tasks aimed at advancing solid motor technology. These included accelerated test firing of large segmented motors already under development, demonstrations of thrust vector controls, evaluation of new casing and nozzle materials, etc.[2]

(U) Beginning on 26 July 1961 SSD officials briefed the Air Staff, OSD, and the Golovin group on its interim proposal. All found it acceptable and on 15 August McMillan asked DDR&E to release $15.65 million to begin the work. On 6 September Rubel authorized an expenditure of $13.65 million,

eliminating one task, and six days later OSD released the funds.[3]

(U) Meanwhile, at the request of the Golovin group, SSD submitted an estimate of development costs and schedules on four representative large motors (100-, 136-, 156-, and 200-inch diameters). According to SSD, the time between project initiation and feasibility demonstration would range from 26 to 48 months and the cost from $126 million to $365 million. The division passed these estimates to USAF officials and the Golovin group in early August, and the latter subsequently incorporated them into its large launch vehicle program study.[4]

(U) As noted earlier, the original intent of the program was to develop large solid rockets in tandem with NASA's liquid propellant motors until it became clear which was superior for the lunar mission. By October 1961 development of liquid rockets had progressed sufficiently to make that selection and the Golovin group then recommended discontinuance of the identical time-scale approach for solid motors.[5]

(U) McNamara and Webb agreed to do this, but they also concluded that DOD should continue to advance the technical development of very large solid rocket engines. They had in mind the dual objectives "of advancing knowledge and keeping open the possibility that the actual development of such engines might be called for on an accelerated basis at a future time, and in an economical manner paced by considering the availability of financial and manpower resources in the context of the totality of national space efforts."[6]

(U) Following the McNamara-Webb agreement, the Air Force revised its plans to provide for only limited development and static-test firing

of 156-inch diameter segmented motors and feasibility demonstrations of large, monolithic (unsegmented) motors of 240- to 300-inch diameters.* The Air Force estimated that the 156-inch motor was the practical limit for road or rail transportability of the individual segments. In the case of larger motors, their size precluded overland transportation and the Air Force planned to construct the demonstration units at the actual test sites.[7]

(U) Meanwhile, several contractors proceeded with test firings to demonstrate the potentialities of the large solid rocket. On 9 December 1961 the United Technology Corporation fired a 96-inch diameter motor which produced a thrust of 380,000 pounds over a burning time of approximately 80 seconds. Several months later, on 17 February 1962, the Aerojet General Corporation fired a 100-inch motor which produced 600,000 pounds of thrust for 90 seconds. It was the largest solid rocket fired to that time.[8]

NASA Requirements

(U) In mid-February 1962 NASA finally forwarded to OSD its long-awaited guidance on its large solid propellant motor requirements. Dr. Seamans informed Rubel that NASA--despite its decision to use liquid motors for the lunar mission--still had a strong interest in the technology of large solids and hoped to use them when their feasibility had been demonstrated. He said that NASA was specifically interested in

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*In its final report, the Golovin group recommended going ahead with development and production of large solid motors up to 300 inches in diameter and weighing 3,000,000 pounds. It said the initial emphasis should be to produce an early test firing of a "unitized" motor of at least 240 inches in diameter. (Summary Rport, NASA-DOD Large Launch Vehicle Planning Group, 24 September 1962, Vol I, p II-6.)

motors with thrust levels of about 2,500,000 and 5,000,000 pounds and burning times of approximately 115 seconds.[9]

(U) Seamans reported that NASA officials had reviewed the new technology required to establish the feasibility of the 240-inch motor and had concluded that DOD should undertake a program to demonstrate that a very large amount of propellant (2,000,000 pounds or more) could be cast into a single, nonsegmented motor and that the monolithic charge could be qualified, ignited, and burned properly. NASA also wanted to know if the inert components of the motor case and nozzle could be made in flight weight design, transported to the motor manufacturing plant, and assembled into a complete motor with adequate reliability, and the whole handled and shipped by water.[10]

(U) On 24 February 1962 DDR&E forwarded NASA's requirements to Assistant Secretary McMillan and requested a briefing on USAF plans to meet them. This was done on 9 March when, during a meeting of the AACB's launch vehicle panel, SSD briefed OSD, NASA, and USAF officials on its revised development plan for the 156-inch and 240-inch motors.[11]

(U) The proposed 156-inch rocket would produce at least 2,500,000 pounds of thrust with a 120-second burning time. The plan called for six full-scale tests between September 1963 and October 1964. Development would cost $16.5 million, plus $2.44 million for facility construction. In the case of the 240-inch motor, SSD recommended two full-scale firings in April and August 1964 with on-site fabrication at a new isolated test facility.[12]

(U) The launch vehicle panel (and its NASA representatives) concluded that the space agency would have to provide a more precise statement of program objectives and desired performance characteristics before the panel could properly evaluate the SSD plan. On 16 March 1962 NASA submitted the additional data. Accepting USAF's 156-inch proposal as an orderly backup effort, NASA said that it was well-timed to meet its potential needs. It urged, on the other hand, that the 240-inch motor development be accelerated to achieve an earlier demonstration of flight weight boosters, and it expressed concern about test facility availability and related problems.[13]

(C) On 28 March McMillan forwarded this latest guidance to the Chief of Staff and asked that an updated development plan be made available for review at the earliest possible date. Rubel, Seamans, and McMillan reviewed the revised plan on 18 April and agreed to a short Phase I study, to be completed by July 1962.[14]

Disagreement Over the 156-Inch Development

(U) On 27 April Seamans confirmed with Rubel his understanding of the agreements reached at the recent meeting. As he understood it, the Air Force would continue development of 120-inch motors, including selection of contractors for Titan III; would initiate a feasibility demonstration of a 156-inch motor generating 3,000,000 pounds of thrust at a fiscal year 1963 cost of $20 million; and would initiate feasibility demonstration of 260-inch (rather than 240-inch) motors generating 6,000,000 pounds of thrust, with 1963 expenditures also limited to $20 million. The schedule for the 156- and 260-inch motors would be such as to provide potential backup for NASA's advanced Saturn and Nova vehicles.[15]

(U) To McMillan, however, Seamans' statement seemed to contradict earlier NASA-DOD understandings. Early in May, during conversations with its officials, McMillan learned that NASA was thinking of several possible missions involving a cluster of four 156-inch motors plus NASA's C-5 upper stage to put about 236,000 pounds of payload into a 100-mile orbit. Similar calculations with four 260-inch motors indicated a capability to place approximately 450,000 pounds of payload in a 100-mile orbit or 198,000 pounds at escape velocity.[16]

(U) McMillan informed these officials that planning specific missions for solid rockets was contrary to the McNamara-Webb agreement of November 1961, which had cancelled development of large solid motors as backup to Saturn and Nova. He said that if NASA really wanted solids "as serious backup," it should state the contemplated missions in a formal notice to OSD so that a working level engineering group could review and make recommendations.[17]

(U) Briefed on the current situation, Rubel on 22 May 1962 notified Seamans that the two agencies were "still not together" on the course to pursue in the field of large solid rocket development. He noted DOD's willingness to develop 120-inch and 260-inch rockets, but it did not feel that the 156-inch motor would advance technology much since it was essentially the same as the 120-inch motor. Therefore, before DOD proceeded further, it wanted a formal statement from NASA and additional supporting data.[18]

(U) McNamara and Webb took up the issue in late May, at which time they reaffirmed their November agreement. They wanted the solid propellant technology program pursued with minimum commitment of funds for

large facilities and with maximum use of existing facilities. However, this statement by McNamara and Webb still did not clarify program objectives and allow the Air Force to begin actual development.[19]

(U) Consequently, in June NASA, OSD, and USAF officials held another series of conferences aimed at resolving the main issue of the extent and pace of 156-inch motor development. At the close of the fiscal year, although work continued on the several technological projects approved the previous September, the overall large solid rocket program remained in a state of suspended animation--awaiting final agreement on the 156-inch motor.[20]

VII. DEFENSE COMMUNICATION SATELLITES

(U) The only communication satellite development project in DOD at the beginning of fiscal year 1961 was the Army-managed Advent,* which called for launching satellites into synchronous orbits at an altitude 19,000 nautical miles above the equator. These satellites, whose velocity would make them appear stationary over certain points on earth, would be able to provide instantaneous 24-hour communications to all parts of the world except the polar regions. USAF's Advent responsibilities included developing the satellite (exclusive of microwave communication equipment) and launching it with an Atlas-Centaur combination.

(U) Early in the development program, however, a major problem arose with Centaur, the world's first hydrogen fueled space vehicle.+ Not only did development of the booster fall substantially behind the planned schedule, but it was discovered that Centaur would be unable to produce the thrust needed to lift the Advent satellite into the synchronous orbit. Also a financial problem arose with the satellite when the contractor (General Electric) reported a startling overrun of some $34 million. As a result of these difficulties, the entire Advent effort was floundering by the summer of 1961.[1]

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*The Army also was responsible for developing communication equipment for satellites and ground stations.

+Centaur's development, originally started by the Air Force, was turned over to NASA on 1 July 1959.

Advent in Trouble

(C) The Air Force had never been an Advent enthusiast, primarily because the system would not meet its requirements for strategic command and control communications in the north polar regions. In 1959 the Air Force had proposed a SAC command and control polar satellite system operating on UHF frequencies. In 1960, however, the plan was set aside in favor of the program that became Advent. In the fall of 1960 the Air Force tried to obtain approval for a somewhat modified UHF satellite system, but OSD rejected the proposal.[2]

(S) With Advent still in difficulty, the Air Force in August 1961 tried once again, this time proposing an interim passive satellite communication system. DDR&E rejected the proposal and directed the Air Force to limit activity in this area to applied research only* and concentrate its major support on Advent.[3]

(C) However, Advent's problems still lingered on, especially the critical one of the incompatibility between the weight of the satellite and Centaur's marginal lifting capacity. The entire development, Air Force Under Secretary Charyk commented to DDR&E on 3 October 1961, had reached "scandalous proportions." Calling for prompt corrective actions, Charyk urged DDR&E to halt immediately all work on the existing Advent configuration and seek a new development plan based on either a different booster or a modified payload.[4]

(C) OSD officials took no formal action until early November, when the Army requested an additional $41.58 million from the DOD emergency

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*See discussion of Project West Ford, pp 68-71.

fund to cover slippages and overruns during fiscal year 1962--a 58-percent increase above the $72 million budget. Disturbed by these ballooning costs, Dr. Brown ordered a study group, headed by James M. Bridges, Director of the Office of Electronics, DDR&E, to survey the entire program. The group subsequently devoted its investigation to the four contractors with the major financial troubles.[5]

(C) On 12 December 1961 the Bridges group reported to Brown that the estimated cost of Advent had increased steadily since the program began, rising from $140 million in February 1960 to $325 million in September 1961. The group attributed part of this to an increasing effort on an "operational" rather than an experimental system.* In addition, both the government (Army and Air Force) and its contractors had been guilty of "grossly underestimating" system costs and difficulties of development. The group believed that if the program were carried out as planned, it would require $129.7 million in fiscal year 1962 alone.[6]

(C) The report criticized ineffectual project management, noting that responsibility was split between the Army and Air Force. The Army's Advent Management Agency at Fort Monmouth, N.J., had insufficient control over the various contracts, especially the General Electric contract supervised by USAF's Space Systems Division. To correct this situation, it recommended that supervision of the contract be shifted to the Army and that it place resident teams, reporting directly to the Advent Management Agency, at all contractor plants.[7]

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*With the satellite system still in the development stage, the Army had proceeded with an elaborate system of operational ground facilities.

(C) Brown accepted most of these recommendations. On 26 December he asked the Army to study the impact of placing Advent teams in residence at each of the major contractors' plants. He also directed revision of certain contracts to impose a higher degree of performance and cost responsibility on the contractor. Finally, Brown called for a closer Air Force liaison with the Army by placing SSD officers at the Advent Management Agency.[8]

(C) General Schriever, who had long objected to Advent as "the wrong program" if the goal was to achieve an early satellite communication capability, was asked by the Air Staff to comment on the proposed management changes. On 23 January 1962 he told General LeMay that management changes were needed, but the Bridges proposals were not the right ones. Schriever strongly opposed placing Army teams in USAF contractor plants and pointed to OSD policy for support.[9]

(C) The Air Staff and OSAF agreed with this view. On 12 February Assistant Secretary McMillan informed OSD that, while the Air Force was anxious to improve the situation, it believed that placing Army teams in the contractor plants would be detrimental. Contractors would receive orders from two agencies, which would most likely promote rather than eliminate "confusion and delay." As a substitute, McMillan suggested that Army personnel be assigned directly to SSD where they could work through regular USAF contract management channels.[10]

(C) Brown rejected this counter proposal and expanded the Army's control over the satellite vehicle development. On 14 March, while the Army acted on these instructions, General Schriever again voiced his

dissatisfaction. In a letter to General LeMay, he pointed out that the Army practice of allocating funds to the Air Force on an incremental basis, usually once a month, was an improper procedure and completely inadequate to support sound development management. He also criticized the existing Advent management structure as being "thoroughly unsatisfactory" and claimed that difficulties were being compounded rather than solved with the arrival of Army personnel in USAF contractor plants.[11]

The Air Force Proposes a New Satellite Program

(C) Several months earlier, in connection with a communication requirement established by the Joint Chiefs of Staff (JCS), the Air Staff had directed Schriever to examine possible military satellite systems which could achieve an initial operational capability by 1963 and a fully operational system by August 1964. The JCS requirement stemmed from concern with the "Year of the Quiet Sun" (predicted for 1964) which was expected to produce a period of reduced solar activity and adversely affect long-distance radio communications.* The Defense Communications Agency (DCA) had studied the problem and drawn up a preliminary plan "for a Minimum Essential Satellite Communications System," as a possible solution. The agency would retain overall management but had recommended that the Air Force prepare a development plan.[12]

(S) On 18 January 1962 General Schriever established an AFSC study group to examine several approaches, including a medium-altitude satellite

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*Contrary to popular belief, propagation characteristics of the ionosphere are improved during active solar periods--except during periods of intense magnetic disturbances. As electron density increases in the ionosphere during active solar periods, the HF band opens up with more useable frequencies toward the higher end.

system similar to Telstar.* In mid-April the group reported to Schriever and McMillan the results of its investigation of a system that could provide essential communications "for positive command and control in hot war," in accordance with JCS requirements. To meet these and related requirements by 1964, the group suggested development of a simple active medium-altitude satellite, to be launched by existing boosters.[13]

(S) On 20 April McMillan commented in a memorandum to OSD that the proposed medium-altitude satellite system appeared to be superior to any synchronous system (such as Advent). In early May he forwarded the AFSC report to Dr. Brown, reaffirmed his earlier comment, and expressed the conviction that the medium-altitude system could meet DOD command and control requirements. He formally recommended that OSD give the Air Force responsibility and the go-ahead to develop the system.[14]

(S) But the Army at this time also submitted new proposals to OSD, calling for a drastically revised Advent program. The Army recommended eliminating the Atlas-Centaur booster,+ halting all work on the General Electric satellite, and initiating work on a new lightweight (500 pound) satellite. The revised program, the Army said, should remain under existing management. With the conflicting USAF and Army proposals in hand, Brown asked his staff for a White Paper summarizing the history of Advent.[15]

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*The Telstar commercial satellite was being built by American Telephone & Telegraph Co. On 27 June 1961 NASA agreed to make available at cost facilities and services for launching and tracking Telstar.

+Centaur originally was to be launched in January 1961 but, because of various problems, the date slipped more than a year to February 1962. Between that date and May 1962 NASA tried to launch the vehicle eight times but failed on each occasion. Finally, on 8 May, the first Centaur was launched--and exploded 56 seconds after liftoff.

(C) The White Paper was completed in mid-May and Brown forwarded it to McNamara with his recommendations. The document reviewed the complex management structure, the "very difficult interface" between the Army and Air Force, the cost overruns, the satellite weight difficulties, and Centaur's poor development record. It also described the several alternatives proposed to date. On the basis of the "stormy history" of Advent, as highlighted by the White Paper, Dr. Brown recommended that DOD undertake two separate developments--an unstablized random orbit medium-altitude satellite system and a stabilized synchronous system, both being launched with existing boosters. Advent would be drastically reduced and the Army's equipment and facilities used in ground tests to support the new programs. DCA would assume overall management responsibility and integrate the two systems into the DOD communication structure. The Army would retain responsibility for developing and operating the ground environment, while the Air Force would develop and operate the satellites.[16]

(C) On 23 May 1962 McNamara endorsed these recommendations and issued implementing directives to the three agencies. He specifically charged the Air Force with responsibility "for development, production and launch of all space devices necessary to establishment and progressive improvement of DOD communication satellite systems" under the "integrating direction" of DCA. With these directives, McNamara in effect killed Advent.[17]

(U) The Air Force did not lament Advent's passing, but at once busied itself with the task of planning, in coordination with DCA, the

management and development of the two systems. By the close of fiscal year 1962, the Air Staff had created a system staff office within the Directorate of Systems Acquisition and the Space Systems Division was establishing a counterpart at its level.[18]

Project West Ford

(U) The Air Force also had under way an experimental program involving a passive satellite communication system, known as Project West Ford. The concept called for launching into orbit millions of tiny copper dipoles that would reflect communication signals in the 3-centimeter range. If successful, such a system could not be jammed, destroyed, or "spoofed" in any way by an enemy.

(U) As the fiscal year began, the Air Force planned to launch in July a package containing about 350 million dipoles to form the communication belt. This aroused fears among astronomers around the world that the dipole filaments might seriously affect optical and radio astronomical observations. Their complaints led to a delay in the launching, while the Space Science Board of the National Academy of Sciences undertook an independent evaluation of the experiment. The board's conclusion, announced on 11 August, was that "the Project West Ford experiment will constitute no interference to optical or radio astronomy," since the belt would be barely detectable, "even by astronomers with advance information and upon the taking of special efforts for detection."[19]

(U) Based upon this evaluation, President Kennedy authorized a West Ford launching, but under certain limitations. He directed that there

be no follow-up launchings until the results of the first experiment had been thoroughly analyzed and evaluated and the Defense Department had taken steps to provide safeguards against harmful interference with space activity or with any branch of science.[20]

(U) Despite these restrictions, opposition from scientists in the United States and overseas continued. On 24 August some 1,000 of the world's leading astronomers--during a meeting of the International Astronomical Union at Berkeley, Calif.--adopted a resolution requesting a delay in the experiment "until the question of permanence [of the belt] is clearly settled in published scientific papers, with adequate time being allowed for their study." A month later the Soviet Academy of Sciences also protested publicly for the first time, declaring that the filaments might endanger orbiting Soviet cosmonauts.[21]

(C) As this growing opposition threatened to halt what it considered an essential experiment, the Air Force at the request of OSD prepared a White Paper on Project West Ford which summarized the history of the program and the reasons why it should be pursued. The Air Force argued that communications were all-important to the nation's defenses, both before and during an enemy attack. It pointed out that existing communications were extremely vulnerable. Moreover, the Soviet Union on 1 September 1961 had embarked upon an intensive atmospheric nuclear test program (breaking a three-year voluntary moratorium) and there was concern that the Russians were seeking to pinpoint the exact effects of nuclear explosions on radio and radar communications.* [22]

*USAF scientists at the Cambridge Research Laboratories for several years had studied the various disruptive effects of high altitude nuclear explosions on radar and radio communications. See AFCRL, Handbook of Geophysics (New York: McMillan, 1960).

(C) In late September the President's scientific adviser, Dr. Jerome Wiesner, formed a panel of distinguished astronomers, physicists, and mathematicians to review the technical questions involved in West Ford. The scientists examined technical data provided by Lincoln Laboratory of the Massachusetts Institute of Technology, the originator of the project. On 4 October, the panel declared, "After examining both the published data and more recent unpublished calculations, we are convinced that this experiment will not impair our ability to study the skies--either by visible or ultraviolet light or by the receipt of radio signals. We are also convinced that it will offer no additional hazard to manned space flight." [23]

(C) Supported by the panel's report, the administration again authorized the Air Force to launch the first West Ford experiment. On 21 October 1961 a package of dipoles was carried aloft aboard the Midas IV satellite--and then failed to show up on radar screens. Finally, after searching the skies for several days, the Millstone Hill (Mass.) UHF radar picked up five or six small clumps in orbit. On the basis of the data received, Lincoln Laboratory scientists concluded that there had been a mechanical malfunction which caused the dipoles to remain clustered together. This was all very anticlimactic, in view of the world-wide denunciations that had preceded the launching.[24]

(C) Planning for West Ford II, however, began immediately but under new guidelines. Under Secretary Charyk directed that a new device be devised to allow controlled ejection of the dipoles. Telemetry equipment also was to be incorporated to provide data on the package position, temperature, spin rate, tumble rate, and the extent of dipole dispensing.

Introduction of this new equipment displaced about one-third of the dipole fibers, reducing the weight of the material from 75 to 50 pounds and the number of individual dipoles from about 350 million to less than 250 million.[25]

(C) Early in 1962 the appearance of another factor affected West Ford II. USAF studies of the 21 October failure led to the conclusion that ejection of the package might have had an adverse effect on the Midas satellite, which proved to be extremely unstable.* The Air Force was faced with the prospect that "piggyback" rides would continue to interfere with the successful attainment of the primary (Midas) objectives. After further study, USAF officials decided not to carry a full West Ford package on any of the Series III Midas vehicles. This decision had the effect of delaying the launching of West Ford II for a year.+[26]

(C) The Air Force was able, however, during April to conduct a limited experiment by ejecting into orbit six 14-inch tin dipoles from the Midas V satellite. The purpose of the experiment was to measure the effects caused by solar pressure, air drag, and electrical drag on small objects in space so that scientists could predict how long the dipoles would remain aloft. Based on the radar data received, Lincoln Laboratory scientists concluded that the filaments were unaffected by the space environment and fears that they might shift into different and longer-lived orbits were unwarranted.[27]

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*See below, p 75.

+The first West Ford successful launching took place in May 1963.

VIII. MIDAS

(S) During fiscal year 1962 the Air Force repeatedly urged OSD to approve accelerated satellite development and flight testing to obtain an early operational missile defense alarm system (Midas). As in previous years, however, OSD insisted on a more deliberate approach. The Air Force was unable to convince OSD officials that the Midas infrared (IR) detection techniques would be sufficiently reliable and able to detect both low- and high-radiance missile emissions. The record of unsuccessful Midas launchings did not help matters. Prior to July 1961 only two Midas satellites had been launched (on 26 February and 24 May 1960); the second achieved orbit but provided only limited infrared data. A third successful launch was conducted on 12 July 1961; however, IR data collection ceased after the satellite's fifth orbital pass because of a power failure.[1]

Is Midas Worth the Effort?

(S) On 29 July 1961 Dr. Brown reviewed the Midas situation at great length for Secretary McNamara. He reported that formidable technical and operational problems still remained in the areas of infrared detection and reliability but that scientists could solve them over a long time span. He estimated that an effective system might be obtained by 1965-1966, although the Air Force believed it could achieve a limited operational capability in 1964.[2]

(S) Brown stated that Midas, at best, would provide an additional 5-20 minutes of warning of a liquid propelled ICBM attack and would be marginal against Soviet Minuteman or submarine-launched Polaris types of missiles. He estimated a cost of about $500 million to complete research and development, another $500 million to complete an operational system, and operating expenses ranging from $100 million to $200 million annually. The primary question appeared to be: Was the extra 5-20 minutes of warning worth the expense and effort? [3]

(S) Brown conceded that the additional warning to alert aircraft was worth something, but the question was how much. He also conceded that there was greater certainty of providing warning with Midas plus the ballistic missile early warning system (BMEWS) than with the latter alone. However, this raised the question of when and how the United States would respond to an enemy attack. If the United States would not retaliate even on receiving warning from the above systems--as was being contemplated--and if the number of additional aircraft alerted by Midas was small, then earlier warning would be of little value.[4]

(S) The Air Force counterarguments--strongly supported by the North American Air Defense Command (NORAD)--were that early warning was essential to insure a credible deterrence and the survival of the counter force and defense forces. The Air Force pointed out that with 10 minutes of warning, 14 percent of the SAC force could become airborne; with 14 minutes, 66 percent.[5]

(S) Brown informed McNamara that he planned to form a task force to examine in detail Midas technical capabilities and the usefulness of

early warning. He conjectured that the results of the study would not lead to termination, but he suggested the possibility that "a substantial reduction of the R&D program might appear desirable." To head the Midas study group, Brown chose Dr. J.P. Ruina of the Advanced Research Projects Agency (ARPA). Two USAF representatives were selected to serve under Dr. Ruina along with other governmental and outside members.[6]

(S) The Ruina group was the latest of a long list of ad hoc committees which had studied Midas and, the Air Force felt, delayed its development. On 5 September 1961 the Space Systems Division observed that despite past scientific reviews--which it said had found no technical problems to preclude successful development--there continued to be serious doubts "in the minds of certain people regarding the technical feasibility and operational capability of Midas." The division proposed that the Air Force establish an in-house group to prepare a report which could dispel expected criticism. However, at Dr. Charyk's suggestion, this step was postponed pending completion of the Ruina study.[7]

(S) A few weeks later General Schriever reported to General LeMay on actions that AFSC, Strategic Air Command (SAC), Air Defense Command (ADC), and the Office of Civilian Defense Mobilization (responsible for the protection of the civil populace in the event of a Soviet attack) had under way to defend Midas. These included a reassessment of the military and national requirements for Midas and validation of the system's technical and operational feasibility. He reported SSD's view that Midas was technically feasible and that steps were being taken to simplify the system

for improved reliability. He concluded, however, that "complete satisfaction can only be achieved by a conclusive demonstration of system feasibility through an orbital flight test that detects and reports the launch of a ballistic missile and has a reasonable orbital life." [8]

(S) That the Air Force was far from the successful demonstration was seen on 21 October 1961, when Midas IV achieved a near circular polar orbit at an altitude of approximately 2,200 nautical miles. The satellite was extremely unstable, although SSD obtained some useful data through the 54th orbit (for nearly seven days), when the main power source failed.* [9]

The Ruina Report

(S) The Ruina group began its evaluation of Midas in late September 1961. In October USAF officials presented their case to the group. They emphasized that there had been no lessening of the Soviet threat or the need for detection of enemy missile launchings and urged an accelerated effort to achieve early operational capability. But even as the Air Force took this position, OSD deleted all nondevelopment funds for fiscal year 1963 and withheld approval of an operational system. Although AFSC, SAC, and ADC promptly protested, the Air Staff decided not to reclama the decision until the Ruina recommendations were received. [10]

(S) On 30 November 1961 the Ruina group completed the evaluation. A major conclusion was that Midas could probably detect high radiance, liquid propelled missiles, but gaps in knowledge of target and background

*Midas IV also carried the West Ford package discussed in the previous chapter.

radiation made this less than certain. The group thought that Midas would be unable to detect solid missiles of the Minuteman and Polaris class. It also found that the existing Midas design was too complicated for reliable operation. Finally, the group claimed that USAF preoccupation with an early operational capability had contributed to the neglect of the research and development on which to base an effective operational system.[11]

(S) The Ruina group agreed, nevertheless, that there were good reasons for continuing Midas. It suggested that an operational system could meet significant military and political needs and that "a simplified Midas" might have a good chance of achieving an acceptable level of reliability. The group therefore recommended drastic reorientation toward a simpler Midas and a larger research and measurements effort. It also recommended that until there was full confidence in the system's capabilities, schedules, and cost estimates, no thought be given to an operational capability.[12]

(S) On 8 December Brown forwarded the Ruina report to Secretary Zuckert, noting that he agreed with its conclusions and recommendations. He directed the Air Force to implement the recommendations and asked for a revised development plan by 1 February 1962. Meanwhile, he would hold in deferred status $45 million of the fiscal year 1962 allocation.[13]

(S) The conclusions and recommendations of the Ruina report and its harsh criticism of the existing Midas effort disturbed top USAF officials, and on 22 December General LeMay directed AFSC to prepare a response to the "serious allegations." He also directed the Air Staff

to prepare some convincing arguments that would support the urgent requirement for a Midas warning system. Finally, to cover the eventuality that Secretary Zuckert might decide not to challenge the report or that the Air Force would still be overruled, LeMay directed the preparation of a development plan based on the Ruina recommendations.[14]

(S) On 29 December USAF headquarters forwarded detailed guidance to AFSC and asked for several alternate development plans--one reflecting the Ruina recommendations and two others containing specific initial operational capability dates and oriented toward an operational "go-ahead." The Space Systems Division promptly formed a special advisory group headed by Dr. Clark Millikan to analyze the Ruina study.[15]

(S) Pending completion of the analysis and development plans, Gen. F.H. Smith, Vice Chief of Staff, on 11 January 1962 asked Secretary Zuckert to defer action on DDR&E's 8 December directive. After a five-page review of current conditions, General Smith concluded[16]

> The need for warning of Soviet ICBM surprise attack exists today--and will grow more compelling as this Soviet ICBM threat steadily increades. The present BMEWS warning system, initially adequate to the threat, can now be overflown, underflow, skirted, jammed, or removed. The proposed Midas system can offset these inherent limitations and provide added credibility, reliability, more warning time, plus an intelligence readout. Additionally, Midas can strengthen the free world posture of deterrence, bolster U.S. resolve, and provide the U.N. with a tangible, effective arms control measure.

The Secretary agreed to withhold action pending receipt of AFSC's evaluation.

(S) AFSC completed its report, based on the review of the Millikan group, on 15 February and forwarded it to the Air Staff 13 days later.

Systems Command officials felt that the Ruina report was invalid for a number of reasons. The Ruina group had misunderstood the scope of Midas research under way and was unaware of the amount and content of the actual test data available. Also, according to AFSC officials, the report's cloud background clutter analysis--a key factor in the Ruina Group's doubts about the feasibility of the infrared payload--was in error. In addition, they felt the report's reliability estimates had failed to take into account advances being made in system reliability.[17]

(S) According to AFSC's evaluation, the Midas program was technically sound and a simplified system (being worked on) could be operational before 1966. It submitted three development plans for consideration: Plan A called for an IOC in 1964 and would require substantially increased financial support; Plan B called for an IOC in 1965, with funding somewhat less; and Plan C, which AFSC considered partly responsive to the Ruina report, emphasized research and development and a larger number of test flights. Plan C would cost approximately $330 million during fiscal years 1962-1963 and would lead to an IOC in 1966. General Schriever strongly recommended adoption of Plan C.[18]

(S) The Systems Review Board indorsed both AFSC's evaluation and Schriever's recommendation. The Designated Systems Management Group took up the matter on 2 March, after which Secretary Zuckert directed McMillan to discuss informally with Ruina the Air Force's position and criticism of the group's report. Zuckert also asked the Air Staff to study the funding aspects of Plan C.[19]

(S) On 12 March McMillan and Air Staff officials met with Dr. Ruina and other OSD officials. At the conclusion of the discussions, OSD asked

the Air Force to submit a revised Midas plan and to conduct further informal discussions with the DDR&E technical staff. These meetings were held during the next several weeks and led Brown to accept tentatively USAF's proposed technical approach as contained in Plan C.[20]

(S) On this basis the Space Systems Division completed a revised Midas development plan on 29 March 1962. The primary objective would be to launch as many satellites as possible to establish system feasibility and reliability and to get an early start on design fabrication of a simplified vehicle. The plan called for an IOC between mid-1965 and mid-1966. Funding requirements were estimated at $334 million in fiscal years 1962-1963 (versus the existing programmed amount of $290 million).[21]

(S) During the spring of 1962, while the Air Staff reviewed the plan, the first important results in the test flight program were obtained from Midas V, launched into polar orbit on 9 April. Although there was a power malfunction on the seventh orbit, SSD had obtained great quantities of background information during the first six passes and reduction of this data confirmed the ability of Midas to discriminate between rocket plumes and the cloud background.[22]

(S) The day after this successful launch, McMillan forwarded the 29 March development plan to DDR&E and asked for immediate release of $18.1 million in order to protect the schedule for the balance of the fiscal year. Brown quickly approved release of the funds, but he cautioned the Air Force that this action did not constitute approval of the development plan, which he still had under review.[23]

New Doubts About Midas

(S) Not only did Brown have his own staff review the 29 March development plan, but he also requested the assistance of a special panel of the President's Science Advisory Committee. This panel was headed by Dr. W.K.H. Panofsky, who had reviewed Midas in September 1960 and concluded at the time that the basic concept was sound. Such was not his position on this occasion. The Panofsky panel noted that proposed flights were still conceived as evaluations of operational prototypes and expressed doubts about the system's ability to detect any but liquid oxygen/kerosene fueled missiles. Moreover, it foresaw only limited success for Midas and declared that the value of early warning was decreasing. The panel recommended that Brown should make his decision in light of these findings. Dr. Wiesner, the President's scientific adviser, endorsed both the conclusions and recommendations.[24]

(S) On 20 April Brown took up with McMillan his previous "general agreement" on the 29 March plan and the Panofsky panel conclusions. He also noted that recent IR measurements, made during the first Titan II launch on 16 March, indicated that Midas' performance against advanced liquid ICBM's might be marginal. As a consequence, he directed the Air Force to examine the most logical and expeditious way of introducing improved detection payloads which were effective against low-radiance missiles. Pending this action, he would withhold approval of the Midas flight test program and defer construction of the planned data readout center at Ottumwa, Iowa. Since the flight test program would not involve operational prototype satellites, there was no need for the center.[25]

(S) The Panofsky report and Brown's guidance distressed the Air Force but it had little choice except to comply. The Air Staff dispatched instructions to AFSC on 30 April to prepare a revised development plan. Meanwhile, Dr. Brown added to the general gloom when he commented—in connection with an OSD review of major program change proposals—that the apparent inability of Midas to detect low-radiance missiles raised doubts whether a full-scale development was justified, even along the lines proposed by the Ruina group.[26]

(S) The Air Force nevertheless still considered Midas an essential "hard-core" item, and it determined to continue to push for an operational system. On 8 June 1962 AFSC published two new plans in accordance with Brown's instructions. Both emphasized the vital importance of Midas to national defense and the need to support it accordingly. Plan A reaffirme objectives of the 29 March plan but provided for increased IR measurement research and testing. Plan B supported Brown's request that the Air Force develop a low-radiance detection capability and called for a multi-satellite flight series to support an accelerated research program. If a "go-ahead" were given before 1 July, AFSC estimated the Air Force could still achieve a Midas IOC by late 1965. The Systems Command urged adoptic of Plan B, a recommendation subsequently endorsed by the Systems Review Board and the DSMG.[27]

(S) On 12 June, however, Secretary McNamara informed Zuckert that he was personally ordering still another "full-scale study of the Midas program." He formed a study group under Dr. H.R. Skifter to review the importance of early warning, the implications of a Soviet capability to

launch missiles "the long way around," and the growth potential of Midas. Brown, meanwhile, remonstrated the Air Force about reports that he had received indicating continued USAF preoccupation with an early IOC against Soviet Atlas-type missiles. He felt that the Russians would not have many of these and said that answers to basic questions about low-radiance, high-noise background and reliability were still lacking. He reaffirmed his view that Midas "must remain an R&D program oriented toward developing... techniques." [28]

(S) On 28 June McMillan forwarded to OSD a Plan B supplement to the 29 March development plan, which he said would meet DDR&E's requirement for early flight testing of low-radiance detection payloads. To support these flights, the Air Force submitted a program change proposal asking for $169.2 million in fiscal year 1963 and $200.4 million in fiscal year 1964. Five weeks after the start of the new fiscal year, OSD on 6 August disapproved the PCP and directed the Air Force to drop all deployment plans and reduce the Midas to a limited R&D program. McNamara listed as reasons for the decision: (1) the expected late deployment of Midas; (2) the expected high cost of about $1 billion to complete development and deployment, plus annual operating expenses; (3) the existence of other techniques to augment early warning capabilities;* and (4) the lessening worth of early warning in view of the increasing strategic shift from manned aircraft to hardened missile sites.[29]

(S) Thus, during the summer of 1962, USAF hopes for a space-based early warning system to detect enemy ICBM launchings faded into the distant future.

*Such as over-the-horizon radar detection techniques.

IX. BIOASTRONAUTICS

(S) During the year the Air Force sought approval for a proposed bioastronautics orbital space program aimed at acquiring data on the effects of prolonged weightlessness and space radiation on the human organism. The projected research was based on an AFSC plan submitted to the Air Force headquarters by General Schriever on 16 May 1961. Schriever noted that the Soviet Union was far ahead of the United States in obtaining biological information on outer space conditions, having orbited five separate animal payloads (three recovered) and the world's first man in space. The United States, on the other hand, had had 38 successful orbital flights, none of which carried animal passengers.[1]

(S) The Air Staff agreed on the need for a bioastronautics orbital research program and, on 16 August, submitted the plan to OSD and asked for $41.9 million in fiscal years 1963-1964 to cover a series of six chimpanzee launchings using Atlas-Agena boosters. The Air Force would place the animals in both circular (1,500 to 3,000 nautical miles) and elliptic orbits (up to 10,800 nautical miles) to measure effects of radiation in and beyond the Van Allen belts and the long-term effects of weightlessness.[2]

Bioastronautics Research Responsibility

(U) USAF's proposal raised questions within OSD on the proper agency to conduct the research. Deputy DDR&E Rubel felt that the proposal related closely to the manned lunar landing project and therefore NASA

should fund and be responsible for it. In September 1961 Rubel and Dr. Kavanau, DDR&E's special assistant for space, met with NASA officials to discuss not only the specific USAF proposal but also the general questions of management and funding for governmental bioastronautics research.[3]

(U) The management question in particular proved to be thorny. Both agencies agreed that the Air Force possessed the nation's outstanding capability—in terms of professional personnel and modern facilities—to conduct aerospace biological research, but they differed on how best to utilize this important and scarce national resource. Although not completely accepting the USAF position that with adequate funding it could meet all of NASA's bioastronautics research requirements, OSD did argue that the Air Force and other services needed to be assigned a definite and sustaining mission. As Rubel stated the OSD case, "We just don't want to be in a posture where...we have got facilities...and we have got people and every now and then NASA decides that maybe they will give them something to do, so we use them on a task-by-task kind of basis."[4]

(U) NASA, on the other hand, argued that since it had primary responsibility for the manned lunar landing mission, its own internal life science capability (together with a separate research laboratory) was essential in order to train personnel to monitor and control the work assigned to other organizations. Dr. Hugh Dryden, Deputy Administrator of NASA, stated that the space agency could not and would not delegate complete responsibility to DOD. He added that NASA was quite willing to make maximum use of DOD's superior biomedical research resources, and he promised to do nothing to diminish the effectiveness of those resources.

Thus, there remained the question of a specific arrangement that both agencies could support.[5]

(U) While these discussions continued through the latter weeks of 1961, the Air Force learned on 21 November that OSD had rejected its request for funds to support the bioastronautics orbital flight program. Although a reclama failed to bring approval, USAF officials drew some comfort during this period from the first U.S. orbital flight of a primate, the chimp "Enos," trained by the 6571st Aeromedical Field Laboratory, Holloman AFB, N. Mex. Launched on 28 November aboard Mercury-Atlas 5, Enos performed several psychomotor duties during two orbits of the earth and was then successfully recovered. His flight paved the way for the launching of Colonel Glenn on 20 February 1962.[6]

(U) During the early months of 1962, NASA and OSD officials conferred frequently, seeking a "mechanism of cooperation" in bioastronautics, which finally led to a tentative agreement on 8 March. Under its terms, NASA would use DOD capabilities but retain overall responsibility and the right to specify the work to be done. NASA and DOD would formulate research and development plans jointly, and the Air Force would be the responsible DOD management agency for executing these plans. Funding would be a NASA responsibility.[7]

(U) On 30 March McMillan informed DDR&E that he agreed "in principle and substance" with the draft except for certain minor language changes. The Air Force subsequently invited NASA to initiate a joint project based on the original AFSC bioastronautics orbital space plan, and on 10 April

Charyk and Seamans discussed such a "collaborative effort." Additional meetings ultimately led to a proposed "memorandum of understanding" which Seamans forwarded to Charyk on 28 May. It called for six orbital launchings to obtain basic information on the biological effects of space flights of 3 to 14 days in duration. The two agencies would apportion the cost equally.[8]

(U) AFSC reviewed the proposed memorandum and found it unacceptable because it failed to recognize sufficiently USAF's bioastronautics capability both in selecting experiments and reporting results. AFSC revised the memorandum, as did the Air Staff before forwarding it to Charyk on 28 June. The memorandum now called for a joint NASA-DOD program which would make use of design and engineering "already accomplished by the Air Force, and existing technology in launch vehicles, space vehicles, and recovery operations." NASA and the Air Force would jointly select experiments, with the former responsible for funding experimental development, spacecraft and life support system development, and the cost of launch vehicles. The Air Force would pay for system engineering, launch and recovery, tracking and control, and data acquisition and reduction.[9]

The Webb-McNamara Bioastronautics Agreement

(U) Charyk sent the twice-revised memorandum of understanding to DDR&E for comment. This led in July 1962 to a meeting between Secretary McNamara and Administrator Webb, who quickly reached agreement on the overall question of DOD-NASA bioastronautics research. They agreed that the Defense Department would not fund any joint research and that

responsibility would stay within NASA. The space agency would use DOD bioastronautics resources to the maximum extent possible and would not attempt to duplicate them. DOD would charge NASA only the incremental costs of DOD's effort and not prorated overhead costs. The Webb-McNamara bioastronautics agreement of July 1962 left the Air Force entirely in a supporting role and its resources available to NASA on an open-call basis.[10]

X. SPACE DETECTION AND TRACKING SYSTEM

(C) An important element of U.S. defenses was the space detection and tracking system (Spadats). It consisted of a number of optical and electronic sensors operated by the Air Force, Navy, and civilian agencies which fed observation data into a central processing facility. This center identified and charted all man-made objects in space and kept a comprehensive log on each of them. North American Air Defense Command had operational control over Spadats and the Spadats Center at Ent AFB, Colo. ADC's 1st Aerospace Surveillance and Control Squadron formally took over operation of the center from AFSC on 1 July 1961. That portion of the detection and tracking system operated by the Air Force, along with the research and development effort to improve it, was grouped under Project Spacetrack. The Navy's portion was known as Spasur.[1]

(S) Although ADC was reasonably satisfied with the operation of the Ent data center, it was concerned over the lack of a backup facility should the computer fail. Consequently, on 31 July, ADC suggested to Air Force headquarters that it designate a similar computer at the Electronic System Division's Hanscom Field development facility as backup. Both computers would use the same programming format. The Air Staff agreed to the proposal and directed AFSC to make the Hanscom computer available to ADC on this basis. By the spring of 1962, ADC personnel were on round-the-clock duty at Hanscom.[2]

(S) Under its Project Spacetrack, the Air Force had proposed a number of measures to tie together and improve the operation of the existing sensors while undertaking development of several advanced detection and tracking systems. Early in fiscal year 1962, the Air Force requested OSD to release $30 million for this work. DDR&E, however, on 21 August released only $8.9 million to carry out improvements to the existing radars but withheld approval for the development of the new sensors. The funds released by DDR&E covered plans to (1) integrate the PSP-49 radar at Moorestown, N.J., and BMEWS into the Spadats system, (2) modify the Shemya, Alaska, tracking radar and afford it a better target discrimination capability, (3) add an additional tracking radar to the existing site in Turkey, and (4) procure an electro-optical sensor. When completed in 1964 at Cloudcroft, N. Mex., the optical sensor would provide coverage at altitudes between 3,000 and 30,000 miles and be the first major sensor designed and built specifically for far-space surveillance.[3]

Development of a Phased Array Radar

(S) A major development recommendation that the Air Force had proposed for Spadats was a large volumetric, electronically steerable phased array radar, which could detect and track hundreds of satellites simultaneously at ranges up to 3,000 miles. NORAD and ADC had frequently cited the need for such an advanced radar capability, pointing to the steadily increasing satellite population and the amount of orbiting "space junk." Consequently, the Air Force continued to press OSD for a go-ahead on the phased array radar.[4]

(S) DDR&E, however, withheld a decision for several months in late 1961 until it had evaluated NORAD's requirements for space surveillance. Finally, on 27 November, it authorized the Air Force to begin work on a single-faced volumetric radar but not incorporating the full complement of radiating elements. OSD released $8.43 million, restricted total costs to $30 million, and directed USAF to submit a development plan.[5]

(S) Following DDR&E's approval, AFSC prepared work statements, briefed bidders on the proposed development, and by 9 February 1962 had received several proposals. A few days later, however, Dr. Brown altered his earlier guidance to allow a slightly expanded capability in the radar. This, he thought, could be done within the $30 million cost restriction.[6]

(S) Brown's additional guidance was forwarded to AFSC for incorporation into the development plan. AFSC completed the revised plan in mid-March, and the Air Staff forwarded it to OSD on the 30th. Pending DDR&E's approval, the Air Force on 2 April announced selection of Bendix Aviation Corporation to construct the new facility at Eglin AFB, Fla. The actual contract signing, however, did not take place until 29 June 1962, after receipt of Dr. Brown's authorization. Under terms of the contract, Bendix expected to turn over the phased array radar to the Air Force in April 1965.[7]

Aerospace Surveillance and Warning, 1966

(U) On 21 May 1962 General LeMay authorized Air Staff issuance of an overall specific operational requirement for space detection and surveillance. SOR 197, dated 24 May, called for development of a system able to provide users--primarily SAC, NORAD, and ADC--with data on all objects in

space, "and to do so with sufficient accuracy, timeliness, and capacity to satisfy military needs...during peace, limited war, or general war." [8]

(S) As the Air Force reviewed current U.S. space surveillance warning and control systems, it had many gaps and weaknesses: [9]

Facility/System	Detection	Tracking	Identification
BMEWS	A limited capability at Thule and Clear with manual display, NORAD	Yes, but limited to Site 1	By area of origin and operator correlation of targets with known trajectories (ephemerides) as furnished by the Spadats Center
East-West Fence (Navy system)	Marginal for objects in near polar orbits between altitudes of 100 and 3,000 NM, with inclination angles above 32°	No	By correlation with known ephemerides
Laredo Tracker	No	Yes	No
Trinidad Tracker	No	Yes	No
Shemya FSP-17	Some Soviet launches	Yes	Only by point of origin of observed launches
Turkey FSP-17	Some Soviet launches	No	Only by point of origin of observed launches
Cooperating Scientific sensors	No	Yes, with varying degrees of effectiveness	No, except as intelligence inputs
Spadats Central Data Facility	No	No	By comparison of known ephemerides with those of unknown objects

Thus it was obvious that the United States during the next two or three years would have only a marginal capability for detecting noncooperating objects in orbit. BMEWS radars would provide detection of Soviet vehicles

launched to the north, but little coverage on re-entry angles. The FSP-17's would be able to cover only a relatively small portion of Soviet territory. Both the FSP-17's and BMEWS possessed limited capability to detect orbiting objects. Major improvements would have to await completion of the new sensor subsystems—the phased array radar, the optical surveillance sensor at Cloudcroft, etc.[10]

XI. OTHER USAF SPACE UNDERTAKINGS

(U) In addition to the major projects described in the preceding pages, the Air Force conducted a number of other important space tasks, including the much-studied satellite inspector, the ICBM interceptor, and the highly successful Discoverer. The Air Force also participated in or supported in varying degree several joint, other service, and NASA projects during fiscal year 1962.

Satellite Inspector

(S) For several years prior to fiscal year 1962, the Air Force had studied a proposed satellite inspector (Saint) system which would examine unidentified objects in space and determine their characteristics, capabilities, or intent. In July 1960 the Air Force completed a development plan for the system, submitted it to OSD, and received $8.15 million to begin design studies. DDR&E subsequently authorized the Air Force to begin hardware development on four prototype vehicles that would demonstrate conceptual feasibility, but reduced fiscal year 1962 funding to $26 million ($4.1 million less than asked). The Air Force selected Radio Corporation of America (RCA) as the final stage vehicle contractor.[1]

(S) During the summer of 1961 the Air Force also awarded contracts to Convair and Lockheed for the Atlas and Agena boosters required to orbit the satellite vehicle. In addition, it submitted to OSD its fiscal year 1963 funding requirement totalling $47.3 million to continue the

four-shot feasibility demonstrations (with a scheduled first launching in March 1963), support system analyses, fund long lead-time development of components, and begin development of an operational system. DDR&E, however, directed the Air Force to plan for $40 million and limit its efforts to research and development alone.[2]

(S) Dissatisfied with the stretched-out schedule that the financial limitation imposed, and concerned by Soviet progress, the Air Force prepared new plans for an 8- and 12-shot program which it felt essential for an early operational inspection capability. These plans, together with the substantially higher cost estimates, were submitted to the DSMG in October 1961. However, Secretary Zuckert deferred a decision pending an examination of the possible relationship between Saint and NASA's Gemini. He asked the Air Staff to organize a team to examine with NASA Saint-Gemini compatibility.[3]

(S) Late in 1961 fiscal difficulties surfaced which threatened to delay development and flight tests. AFSC attributed the basic causes to contractor cost increases for the final stage vehicle and the restrictive $26 million ceiling in fiscal year 1962. It stated that an additional $4.6 million was needed to maintain schedules. The Air Staff instructed AFSC to eliminate the $4.6 million requirement by deferring procurement of the second-stage booster. At the same time, it directed AFSC to review possibilities of getting back to the original launch schedule and called for a critical evaluation of contractual methods and administration.[4]

(S) The DSMG reviewed AFSC's findings and several different four-shot plans in January-February 1962. It directed the Systems Command to

institute improved management procedures and reconfirmed the $26 million ceiling pending completion of the Saint-Gemini interrelationship study. A preliminary Air Force-NASA study report became available in early March. Its major conclusion was that military and scientific rendezvous requirements differed substantially. Saint operations would have to succeed against all uncooperative satellites and permit rapid data sensing and transmission to earth, whereas Gemini had no such requirement. In addition, Gemini missions involved orbital flights of two weeks or more before returning to earth, while Saint required no more than one reliable orbit and would not be recovered. The study group identified several areas of possible subsystem compatibility and General Schriever and Dr. Seamans agreed to coordinate work on such equipment. In general, however, they agreed that "a joint program is not warranted and...exchange of funds is not appropriate." [5]

(S) With a joint program unlikely, Secretary Zuckert asked the Air Staff on 23 March to submit a new development plan increasing the number of launchings from four to six to assure a successful demonstration of the satellite inspection concept. On 12 April DDR&E officials reviewed the proposed program expansion, which McMillan later reported would boost 1962 funding requirements to $65 million. McMillan also recommended that OSD accelerate and broaden the work to include more sensors in the final-stage vehicle, a "neutralization system," if desired, and improved subsystems for longer on-orbit life and maneuverability.[6]

(S) On 28 June 1962 Dr. Brown replied that while he agreed with many features of the proposed expansion, including the six launchings,

he could not approve the overall plan. To his knowledge, there was no intelligence pointing to a need for an early system capability in satellite inspection or negation. Brown reaffirmed previous OSD guidance that "this program should proceed only at an orderly pace on a strictly R&D basis." [7]

(S) To General LeMay, Brown's decision was "totally inconsistent" with the urgency that Secretary McNamara had expressed to the JCS. In a letter to Secretary Zuckert, the Chief of Staff reported: [8]

> ...In discussing the recommendations of the President's committee dealing with the satellite program as it pertains to current disarmament negotiations, Secretary McNamara stated emphatically his belief that several things would have to be done militarily; specifically, "the Air Force would have to get on with the Saint program." He noted suspected developments by the Soviets in the AICBM field and stated we may soon be faced with a Soviet anti-satellite capability. He expressed his concern that as soon as the Soviets achieve a capability to shoot down our satellites, they will openly attack the legality of our reconnaissance satellites. Right now they have no capability to do anything about them. Dr. Brown's memorandum specifically prevents us from developing a negation capability for the system, although Secretary McNamara stated we must be able to say "if you shoot down one of ours, we will shoot down one of yours."

(S) General LeMay asked the Secretary to bring this inconsistency to McNamara's attention. As additional support for USAF's concern, the Chief of Staff forwarded an Air Staff paper discussing the impact of Brown's decision on the satellite inspector. Pointing to DDR&E's consistent philosophy of "fly-before-you-buy," the Air Staff observed that it "may have merit from a purely fiscal standpoint, but...(it) has consistently precluded operational considerations...and in our opinion has delayed the acquisition of a military capability in space." [9]

(S) The fact was, however, that Brown had not entirely ignored the need for some kind of satellite interception capability. As early as July 1961 he had suggested to Secretary McNamara the possibility of a cheap type of nonnuclear-equipped interceptor that would be launched into the path of a hostile satellite. Brown had in mind a modification of the Army's Nike-Zeus. After reviewing this proposal, in the spring of 1962 McNamara authorized $7 million in emergency funds and directed the Army to incorporate an antisatellite capability (to an altitude of 200 miles) at its Zeus facilities on Kwajelein.[10]

(S) The Air Force also had studied the possibility of a cross course interceptor, launched either from the ground or from a B-52, and in February 1962 issued an advanced development objective for such a system. In early 1962 additional studies were begun which led in time to a proposed satellite interceptor based on a ground-launched Thor booster. These studies were under way at the close of the period.[11]

Missile Interception

(S) In addition to Saint, the Air Force during the year continued to search for a space-based ballistic missile defense system, designated ballistic missile boost intercept (Bambi). This concept called for intercepting enemy ICBM's in their boost phase by first observing and tracking them from satellites and then launching small intercepting rockets, also from satellites.[12]

(S) During 1960-1961 several contractors, working under USAF supervision, had pursued studies of the Bambi concept with funds provided by the Advanced Research Projects Agency. Confident that no insoluble

technical difficulties would appear, the Air Force in July 1961 sought OSD funding support for feasibility demonstrations in fiscal year 1963. When OSD rejected this proposal, ADC and NORAD expressed their concern in view of the lack of any kind of antimissile capability.[13] In December 1961 ADC prepared a qualitative operational requirement for an interceptor system, declaring that the gravity of the Soviet ballistic missile threat justified highly accelerated development. However, OSD was unconvinced that the proposed system was feasible and it continued to withhold approval.

(S) In March 1962, to speed a decision, the Air Force asked AFSC to review the current study effort and to recommend changes and augmentations. AFSC completed its review in June and reported that the existing data on the Bambi concept was insufficient to either affirm or deny technical feasibility. AFSC also found that cost effectiveness would be a major obstacle. It estimated that to obtain a .94 kill probability against liquid ICBM's, Bambi operations would cost $8.7 billion annually. Against solid missiles, the cost would be substantially higher.[14]

(S) In brief, AFSC's analysis disclosed that economic considerations alone could dictate whether to continue or abandon the work. At the close of fiscal year 1962, the Air Staff was studying AFSC's recommendation that Bambi studies be redirected to refine cost estimates, a factor which obviously would play a major role in any decision.[15]

Standardized Agena

(C) One of the workhorse vehicles in the U.S. space program was the Agena B upper-stage booster. When paired with Thor or Atlas, the

Agena was able to place 2,500 and 5,000 pounds, respectively, into 100-mile earth orbits. Because of its importance to many NASA and DOD space launchings, the Air Force in early 1961 initiated a study to obtain a standardized version (subsequently designated Agena D) and eliminate the need for "custom built" individual Agenas. The goal was a reliable and easy-to-handle vehicle procured at a fixed price, thus saving substantial sums of money.[16]

(C) In September 1961, on the basis of the study, Dr. Charyk asked DDR&E approval to proceed with development. He proposed to use funds already programmed for Agena procurement, with the idea that future savings would amortize development costs [redacted] OSD officials, after reviewing the plan, agreed that the idea was "certainly attractive." On 4 October Rubel formally approved the undertaking but limited initial action to a Phase I study. This requirement, however, was later dropped, allowing the Air Force to proceed directly into fabrication with a delivery goal of January 1963 for the first flight article.[17] After it appeared that the work could proceed more rapidly and delivery accelerated by six months, Charyk on 7 November authorized the expedited development and directed AFSC to appoint a full-time Agena D program director. On 6 December the Air Force submitted its planned schedule to DDR&E and reported the first Agena D would be used in a Discoverer flight about June 1962. The Air Force also reported that it had informed the Army, Navy, and NASA to plan an orderly phase-in of Agena D into their space projects.[18]

(S) During the first half of 1962 the Air Force reached all Agena D development milestones on schedule. On 16 April the contractor delivered

the first flight article to the Air Force and on 27 June 1962 the first Thor-Agena D combination successfully launched a Discoverer payload into polar orbit. All flight objectives were successfully met.[19]

Standardized Atlas

(C) In addition to standardizing the Agena, the Air Force during January 1962 began similar action with the Atlas space booster. Space Systems Division drafted a development plan which it forwarded to Air Force headquarters on 12 April. Secretary Zuckert approved it only eight days later and authorized AFSC to begin contract negotiations with General Dynamics/Astronautics.[20]

(C) On 2 May the Air Force presented the development plan to DDR&E. Although favorably impressed, DDR&E asked for more detailed design specifications and configuration data. After further study and coordination with NASA, AFSC submitted the additional data to the Air Staff in late June 1962. It noted that the best features of the Atlas D, E and F models would be incorporated into the standardized booster, with thrust increased from 154,000 to 165,000 pounds.[21]

(U) The Air Staff approved the development at the close of the period and DDR&E later authorized a $78 million contract to acquire the standardized version, designated Atlas SLV-III. Under terms of the contract, General Dynamics/Astronautics would design and develop the SLV-III and be responsible for modifying launch sites at the Atlantic and Pacific Missile Ranges.[22]

Discoverer and the Thrust-Augmented Thor (TAT)

(C) Discoverer during fiscal year 1962 experienced its greatest activity since the first successful satellite was launched in February

1959. The Air Force launched 20 Discoverer vehicles during the year and only four failed to enter polar orbit. Twelve of the 16 satellites were successfully recovered, 10 in the air by a C-119 or C-130 and 2 from the sea by USAF pararescue teams.[23]

(C) In recognition of the remarkable success to date and the continued need for reliable test vehicles to support other space activities, DDR&E in October 1961 approved the full amount [redacted] requested by the Air Force for fiscal year 1962. DDR&E also suggested the desirability "to continue the Discoverer series on an indefinite basis." As a consequence, the Air Force recommended an increase in the overall flight program from 44 to 60 through fiscal year 1963. DDR&E provided a portion of the additional fiscal requirements to cover the expansion from OSD emergency funds and the Air Force obtained the remainder through internal reprogramming.[24]

(C) In an important related action, the Space Systems Division in February 1962 asked the Douglas Aircraft Company, the Thor contractor, to study ways of increasing the vehicle's performance. Douglas immediately began studies to obtain additional booster thrust by strapping three solid propellant rocket motors onto the Thor. It eventually settled on three Thiokol Sergeant solid motors which would provide an additional 163,500 pounds of thrust and enable Thor-Agena to place an extra 500 pounds of payload into a 300-mile orbit. At the close of the fiscal year, the Air Force authorized Douglas and Thiokol Chemical to develop and produce the thrust-augmented Thor (TAT). The initial test launchings were set for November 1962; development costs were estimated at $3.35 million.[25]

Blue Scout

(S) On 1 November 1961 the Air Force launched a solid propellant Blue Scout vehicle (D-8) from Cape Canaveral and brought to an end the development phase of its 609A hyper-environmental test system at a cost of $15.8 million. The final test vehicle, which carried a payload to check out airborne and ground-based components of the worldwide Mercury tracking and communication network, unfortunately became erratic 30 seconds after liftoff and was destroyed. The failure was attributed to improper system wiring.[26]

(S) Completion of the Blue Scout test phase was followed by an applications program which would eventually involve the launching of some 27 USAF, Navy, and NASA probes and satellites. During the remainder of fiscal year 1962 the Air Force launched four more Blue Scouts, three of them from Pt. Arguello, carrying various experiments. Only one of these launchings, however, was successful. The disturbingly low reliability of Blue Scout led AFSC to investigate the entire system and, at the close of the period, these studies were under way.[27]

(U) Earlier, the Air Force had coordinated its launch plans and research programs with NASA, which had the responsibility for all Scout vehicle procurement. Together with space agency representatives, the Air Force in mid-1961 conducted a system analysis, experiment by experiment and shot by shot, of the proposed USAF-NASA environmental science research programs. The results of this analysis, together with necessary adjustments, were agreed upon by representatives of both agencies and confirmed on 19 July by AACB's Unmanned Spacecraft Panel. On 1 September

the two organizations formally agreed on the conduct of the Scout program.[28]

(U) Since it expected to be a heavy user of Scout, the Air Force during the period pushed the idea of transferring procurement responsibility from the space agency. After months of discussion, on 21 June 1962 the Air Force and NASA signed two agreements governing Scout management and launch operations. One created a Scout Vehicle System Organization, composed of USAF and NASA representatives, to develop, procure, and operate a standard Scout vehicle system. The second agreement covered joint NASA-DOD Scout launch operational procedures at the Pacific Missile Range.[29]

Aerospace Plane Propulsion

(C) For several years Air Force scientists had studied the feasibility of a manned aerospace plane that would take off from the ground like a conventional aircraft, fly directly into orbit, de-orbit at will, and land at a conventional airfield. In 1960 the Air Staff published an advanced development objective establishing a firm requirement for extended studies and experimentation. However, after OSD disapproved a request for fiscal year 1962 funds, the Air Force sought authorization for a $1 million advanced technology study in the areas of aerospace plane propulsion, aerodynamics, and materials.[30]

(S) Pending OSD's decision, the Air Force in July 1961 reprogrammed $1.8 million to begin work. Also, accepting a SAB recommendation, the Air Staff directed AFSC to prepare separate development plans covering

critical aerospace plane components. The Air Force believed that it would be easier to obtain financial support for component development, while OSD would likely reject a full system approach. By September 1961 AFSC had completed six developments plans for what was designated as the 651 advanced technology program. These covered research or development of an air separator (later renamed an air collector and enrichment subsystem), a Mach 8 ramjet, an advanced liquid air cycle engine, a supersonic combustion ramjet, a turbo accelerator, and advanced structures.[31]

(S) To support these projects during fiscal year 1962, the Air Force requested $34.9 million, but OSD approved only $9 million with $8 million to come from USAF resources. The same type of cutback occurred when the Air Force requested $90 million (later reduced to $40 million) to support fiscal year 1963 activities and OSD limited it to $19 million. By June 1962 only $7.6 million, the bulk coming from USAF administrative reserves, had been provided to support aerospace plane component research and development.[32]

(C) Meanwhile, on 15 March DDR&E authorized the Air Force to undertake its proposed study, which was designated the Recoverable Orbital Launch Study (ROLS). With its grant of $2 million, DDR&E said, the study's objective should be to provide design information and guidance "for related applied research and advanced technology programs." He suggested that the Air Force also seek NASA's participation. This was done and, at the close of the year, a joint USAF-NASA group was being organized.[33]

Other USAF-Supported Military-Civilian Space Programs

Snapshot

(U) The Air Force during the year prepared a flight test plan, designated Snapshot, in support of AEC's systems for nuclear auxilliary

power (Snap) development program. The plan called for four orbital shots--two involving the Snap 2 nuclear reactor unit which could generate 3 kilowatts of power, and two with the Snap 10A that generated 500 kilowatts.[34]

(U) In connection with the launch program, the Air Staff on 2 August 1961 directed the Systems Command to incorporate ion engines aboard Snapshot vehicles in order to test the advantages of using electrical propulsion equipment in flight. It directed that the ion engine flight tests not interfere with the primary Snapshot objectives; however, they were given precedent over other scientific experiments or secondary payloads which might use the flights.[35]

(S) The Air Force originally estimated Snapshot requirements at $10 million in fiscal year 1962. After several months elapsed and OSD had released no funds, Secretary McMillan notified DDR&E on 8 September 1961 that unless resources were immediately made available, work stoppages would occur on several contracts, impairing DOD's commitment to the AEC. Shortly thereafter, DDR&E authorized $3 million, but with the understanding that the Air Force would reprogram the remaining $7 million. Headquarters USAF took this action in December.[36]

(S) In January 1962 AFSC and AEC officials approved a charter for a Snapshot joint working group, to be chaired alternatively by the Space Systems Division and AEC representatives. This group had the task of coordinating the activities of all government agencies and contractors. The commission would provide flight-ready Snap packages, and the Air Force would assume responsibility for the launch vehicle, integration, launching, and related services.[37]

(C) During February the Air Force learned that the AEC was experiencing technical difficulties with both Snap 2 and Snap 10A, causing a slippage in the launch schedule. After a series of meetings between representatives of the two agencies, the flight dates of the Snap 10A were rescheduled to September 1963 and January 1964 and the Snap 2 units to March and June 1965. At the close of fiscal year 1962, the Air Force had under study the effects on its funding plans.[38]

Mercury

(U) The Air Force provided boosters and considerable other direct support to NASA's Project Mercury before and during four successful orbital flights in fiscal year 1962. The first of these--Mercury-Atlas 4 on 13 September 1961--was a one-orbit unmanned flight with successful capsule recovery. On 29 November the chimp, Enos, also was successfully launched aboard Mercury-Atlas 5 and recovered from the sea after two orbits. On 20 February 1962 came the first American manned orbital flight with Colonel Glenn aboard Mercury-Atlas 6. Three months later, on 24 May, the three-orbital flight of Cmdr. Scott Carpenter aboard Mercury-Atlas 7 culminated the year's flight activity. Air Force expenditures in support of Mercury came to $20.6 million, of which NASA reimbursed all but $3.25 million.[39]

Vela Hotel

(S) The Air Force was a direct participant in Vela Hotel, an ARPA-sponsored project to develop a system capable of detecting "secret" high-altitude nuclear detonations. During the year the Air Force flew four separate Vela Hotel instrument packages piggyback aboard Discoverer

vehicles--on 30 August, 17 September, 5 November, and 12 December 1961. These instruments measured space conditions, including x-rays and the intensity of electrons at high altitudes. At year's end, planning was under way to conduct five autonomous Vela Hotel launchings beginning in early fiscal year 1964 using the Atlas-Agena.[40]

Transit

(S) The Navy's Transit project goal was development and deployment of a satellite-based navigational system to assist primarily the Polaris fleet and, eventually, all ships and aircraft. On 15 November 1961 the Air Force successfully launched Transit IVB into orbit with a Thor-Able-Star. The satellite's basic payload was a Transit research and altitude control (TRAAC) system, which worked well. It also carried a Snap radio-isotope package similar to one flown in June aboard Transit IVA. On 24 January 1962 the Air Force also launched the Navy's Composite I, a 5-in-1 satellite package which was to make numerous scientific measurements. However, because of a malfunction in the Thor-Able-Star booster, the satellite failed to orbit.[41]

Anna

(U) The purpose of Project Anna, a tri-service geodetic satellite under Navy management, was to acquire data on the geometrical shape of the earth, its gravitational field, and the precise location of major land masses. An optical device developed by the Air Force Cambridge Research Laboratories was one of three experiments incorporated into the satellite to test methods of compiling this geodetic data. On 10 May 19

the Air Force launched the first Anna satellite from Cape Canaveral, using the Thor-Able-Star. Unfortunately, the second stage failed to ignite and the satellite plunged into the sea about 800 miles downrange. At the close of the year, work was under way to prepare another Anna satellite for an autumn launching.[42]

NOTES

Chapter I

1. Hearings before the Select Cmte on Astronautics and Space Exploration, 85th Cong, 2nd Sess, pp 3-5.

2. Public Law 85-568, 85th Cong, H.R. 12576, 29 Jul 58.

3. Memo (C), McNamara to Zuckert, 22 Feb 62, subj: Air Force Manned Mil Space Prog, in OSAF 163-62; Stmt by John H. Rubel, Dep Dir, DDR&E, quoted in Missiles & Rockets, 5 Mar 62.

4. Carl Berger, The Air Force in Space Fiscal Year 1961, (AFCHO, 1966), pp 30-31.

5. Stmt by Richard E. Horner, in House Hearings before Subcmte on Manned Space Flt, 87th Cong, 2nd Sess, 1963 NASA Authorization, Pt 2, p 423; Ltr (U), Schriever to LeMay, 7 Sep 61, no subj, in OSAF 29-61, vol 3.

6. N.Y. Times, 7 Aug 61.

7. Ltr (U), Schriever to Sen John Stennis, Chmn, Senate Preparedness Investigating Subcmte, 11 Sep 61, in OSAF 29-61.

8. Ibid.

9. Ibid.

10. Cong Record, Vol 107, Pt 16, p 21252; Memo (U), Maj Gen P.H. Hoisington, Jr., Dep Dir, Legislative Liaison, Hq USAF, to Asst Vice C/S USAF, 29 Sep 61, subj: Senate Preparedness Invest & Subcmte Study on Mil Aspects of Space, in OSAF 29-61, vol 4.

11. Memo (U), LeMay to Gen F.H. Smith, Vice C/S USAF, 1 Nov 61, no subj, in OSAF 29-61, vol 5.

12. N.Y. Times, 26 Sep 61.

13. LeMay's speech is reprinted in Air Force Info Policy Ltr, Sup No 100, Jan 62, pp 9-14.

14. Washington Post, 13 Oct 61.

15. Kennedy's remarks are quoted in Air Force Info Policy Ltr, Sup No 110 (undated), pp 10-11.

16. Stmt by Roswell Gilpatric, in Senate Hearings before Cmte on Aeronautical and Space Sciences, 87th Cong, 2nd Sess, NASA Authorization for FY 1963, p 25.

17. Stmt by Dr. Harold Brown, Senate Hearings above, p 342.

18. N.Y. Times, 15 Jun 62.

19. House Hearings before the Subcmte on Manned Space Flt, Cmte on Science and Astronautics, 87th Cong, 2nd Sess, Pt 2 (No 2), 1963 NASA Authorization, pp 257-58, 623, 643.

20. Ibid., pp 630-31.

21. Agreement (U) between DOD and NASA Relating to the Launch Site for the Manned Lunar Landing Prog, 24 Aug 61, in OSAF 29-61, vol 3.

22. Rprt (U) of SRB Mtg 61-1, 2 Aug 61; Memos (U), Zuckert to SOD, 4 Aug 61, subj: Air Force Recommendations for DOD Participation in the Manned Lunar Landing Prog; Memo (U), Gilpatric to Zuckert, 15 Aug 61, same subj, in OSAF 29-61, vol 3; Hist (S) of AFSC, Jan-Jun 62, Vol I, p 68.

23. Msg (U) 98876, USAF to AFSC, 1 Sep 61; Ltr (U), Maj Gen R.M. Montgomery, Asst Vice C/S USAF to Deputies, et al, 8 Sep 61, subj: Air Force Spt of NASA Manned Lunar Prog, in OSAF 466-61; Hist (S) of AFSC, Jan-Jun 62, Vol I, p 68.

24. Memo (U), McMillan to Gen Counsel, OSD, 3 Nov 61, subj: Plng for Spt of NASA Prog, in OSAF 466-61.

25. Ltr (U), Zuckert to McNamara, 28 Dec 61, no subj, in OSAF 29-61, vol 5.

26. DOD Directive 5030.18 (U), 24 Feb 62, subj: DOD Spt of Natl Aeronautics and Space Adm.

27. Ltr (U), Gen Smith, Vice C/S USAF to AFSC, 2 Mar 62, subj: AFSC Dep Comdr/Manned Space Flt; Ltr (U), Zuckert to McNamara, 28 Mar 62, no subj, in Space Div files.

28. Memo (U), Gilpatric to Zuckert, 6 Apr 62, no subj; AFSC Monthly Status Rprt (C), AF Spt of NASA May 1962, in Space Div files.

29. Ltr (U), Schriever to Seamans, 14 Mar 62, subj: Siting of New Launch Facilities at AMR, in Space Div files.

30. Ltr (U), Seamans to Schriever, 16 Mar 62, no subj; Ltr (U), Schriever to Seamans, 28 Mar 62, no subj, in Space Div files.

31. House Hearings before Subcmte on Manned Space Flt, 87th Cong, 2nd Sess, 1963 NASA Authorization, Pt 2, pp 644-655.

32. Memos (U), Rubel to McMillan, 7 Apr 62, subj: DOD/NASA Relationships at AMR; McMillan to Zuckert, 16 Apr 62, subj: AMR; McMillan to Rubel, 18 Apr 62, subj: DOD/NASA Relationships at AMR, in OSAF 482-62.

33. Memo (U), Rubel to McMillan, 18 May 62, subj: DOD/NASA Relationship at AMR; Ltr, Ritland to SAF, 20 Jun 62, subj as above, in OSAF 482-62.

34. Ltr (U), Webb to Gilpatric, 8 Jun 62, no subj, in Space Div files.

35. Ibid.

36. Stmt by Lt Gen James Ferguson, in House Hearings before Subcmte on Appropriations, 87th Cong, 2nd Sess, 1963 DOD Appropriations, Pt 2, pp 476-77ff.

Chapter II

1. Air Force Space Plan (S), Sep 61; Decision, AFC 4/17C, 21 Sep 61, subj: Review of USAF Space Plan, in OSAF 29-61.

2. Air Force Space Plan (S), Sep 61, pp 83-88, in OSAF 29-61.

3. Ibid.

4. Rprt (S) of Space Panel Mtg 61-3, 9 Oct 61, subj: USAF Space Plan; Ltrs (S), Lt Gen James Ferguson, DCS/R&T to Brig Gen G.T. McHugh, Air Force Aide to the President, 31 May 62, no subj, in Space Div files.

5. Ltr (U), Gen Smith, Vice C/S USAF to D/Legis Liaison, et al, 4 Dec 61, subj: USAF Space Prog FY 1963-64, in OSAF 29-61; Hist (S-RD), D/Dev Plng, Jul-Dec 61, pp 37-38.

6. Rprts (S), Space Panel Mtgs 62-2, 5 Feb 62, subj: Defense of FY 63 Space Prog; Mtg 62-6, 2 Mar 62, subj: FY 64 Space Prog, in Space Div files.

7. Stmt by Lt Gen James Ferguson, in House Hearings before Subcmte on Appropriations, 87th Cong, 2nd Sess, DOD 1963 Appropriations, Pt 2, pp 476ff.

8. Ibid., p 484.

9. Ltr (U), Maj Gen J.B. Merrill, D/Budget to D/Prog, Mar 62, subj: AF Space Prog, FY 64, in Space Div files.

10. Memo (C), McNamara to Zuckert, 22 Feb 62, subj: Air Force Manned Mil Space Prog, in OSAF 163-62.

11. Ltr (C), Ferguson to Schriever, 12 Mar 62, no subj, in Dyna-Soar Proj Off files.

12. Gen LeMay's remarks are quoted in Rprt (U) of the SAB Ad Hoc Cmte on Manned Mil Space Prog, 14 Jul 61; see also Address by LeMay at Assumption College, Worcester, Mass, 28 Mar 62; DOD News Release No 451-62; Washington Post, 2 Apr 62.

13. Rprt (S) of Space Panel Mtg 62-19, 18 Apr 62, subj: FY Funding for Space Activities, in Space Div files.

14. Rprt (S) of SRB Mtg 62-32, 5 Apr 62.

15. Memo (S), LeMay to OSD, 16 May 62, subj: FY 63 Fund Augment for the Space Prog, in OSAF 55-62, vol 3.

16. App I, A Chronology of the Air Force Five Year Space Program, in Carter SAB Study 5.3.41; Hist, SSD, Jul-Dec 62, Vol I, Pt 1, pp 9-10.

17. Ltr (S), Ferguson to Gen Bogart, et al, 29 Jul 62, subj: Five Year USAF Space Plan; Msg (S), 62268, USAF to SAC, et al, 29 Jun 62, in Space Div files.

Chapter III

1. Berger, p 51.

2. Ibid.

3. Ltr (S), Schriever to LeMay, 1 Aug 61, subj: Acceleration of Dyna-Soar Prog, in DS Proj Ofc files.

4. Rprt (S) of SRB Mtg 61-2, 4 Aug 61; Ltrs (S), R.C. Seamans, Jr., NASA to McMillan, no subj, 9 Aug 61; McMillan to Seamans, no subj, 12 Oct 61, in DS Proj Ofc files.

5. Ltr (S), Gen Smith, Vice C/S USAF to Gen Schriever, 18 Aug 61, subj: Accel of Dyna-Soar Prog; Ltr (S), Col T.H. Runyon, Ex Secy, DSMG to DCS/S&L, 5 Sep 61, subj: DSMG Mtg on Dyna-Soar, in DS Proj Ofc files.

6. Ltr (S), LeMay to Zuckert, 12 Sep 62, subj: AF Space Prog Proposals, Tab C, in OSAF 55-62, vol 4.

7. Ltr (S), Lt Gen H.M. Estes, Jr., Dep Comdr for Aerospace Systems, AFSC to Gen Schriever, 28 Sep 61, no subj, in DS Proj Ofc files.

8. Ibid.

9. Memo (U), Charyk to LeMay, 28 Sep 61, subj: West Coast Trip by Sec McNamara, in DS Proj Ofc files; DOD News Release No 1220-61, 27 Oct 61.

10. Clarence J. Geiger, Hist of the X-20A Dyna-Soar (ASD, Oct 1963), Vol I, pp 87-88.

11. Ibid.; Mins (S), 17th DSMG Mtg, 14 Oct 61; USAF Space Programs, 1945-1962, Vol I, Tab I-22 (hereinafter referred to as USAF Space Programs, 1945-1962).

12. Ibid.

13. Memo (S), Charyk to SOD, 17 Nov 61, subj: Air Force Manned Mil Space Prog, with atchs, in DS Proj Ofc files.

14. White Paper (C) on the AF Manned Mil Space Prog, 16 Nov 61, pp 2-3, in DS Proj Ofc files.

15. Ibid., pp 8-9.

16. Memo (C), Charyk to LeMay, 8 Dec 61, subj: Dyna-Soar Prog; Msgs (C) 85081, USAF to AFSC, 11 Dec 61; 85379, USAF to AFSC, 12 Dec 61, in DS Proj Ofc files.

17. Sys Prog Directive No 4 (U), 27 Dec 61, in DS Proj Ofc files; N.Y. Times, 27 Dec 61.

18. Memo (C), McNamara to Zuckert, 22 Feb 62, subj: AF Manned Mil Space Prog, in DS Proj Ofc files.

19. Hist (S), D/Sys Acq, Jan-Jun 62, pp 161-62.

20. Memo (C), Ex Secy, DSMG to DCS/S&L, 20 Mar 62, subj: 34th DSMG Mtg.

21. Ltr (S), Schriever to Hq USAF, 11 Apr 62, subj: Dyna-Soar Presto Redline Rprt, in DS Proj Ofc files.

22. Rprt (C) of X-20 Sys Ofc, 14 May 62, in DS Proj Ofc files; Hist, D/Sys Acq, Jan-Jun 62, p 165.

23. Memo (S), McMillan to DDR&E, 25 May 62, subj: Dyna-Soar Prog; Ltr (S) LeMay to SAF, 12 Sep 62, subj: Air Force Space Prog Proposals, Tab C, in OSAF 55-62, vol 4.

24. Memo (C), Gilpatric to SAF, 6 Jul 62, subj: Prog Change, SOD Decision/ Guidance, in OSAF 55-62, vol 4.

25. DOD News Release No. 1057-62, 26 Jun 1962.

Chapter IV

1. Ltr (C), McNamara to Zuckert, 22 Feb 62, subj: AF Manned Mil Space Prog, in OSAF 1963-62

2. Oberth is quoted in Willy Ley, Rockets, Missiles and Space Travel (NY, 1959), pp 365-66; Life, 23 Jul 45; House Rprt No 67, 87th Cong, 1st Sess, A Chronology of Missile and Astronautic Events, p 8.

3. "General Arnold's Third Report," The War Reports of General of the Army George C. Marshall, General of the Army H.H. Arnold, and Fleet Admiral Earnest J. King (Phil and NY, 1947), p 463.

4. Col C.D. Gasser, WADC, "An Approach to Space Endeavor in Relationship to Current and Future Capabilities of the U.S. Air Force," 2 Jan 57; WADC Technical Note 57-225, An Estimate of Future Space Vehicle Evolution Based Upon a Projected Technical Capability, July 1957. Pertinent articles on space stations included: H.B. Ketchum, "A Preliminary Survey of the Constructional Features of Space Stations," J. of Space Flight, Oct 62, pp 1-4; Wernher von Braun, "The Early Steps of the Realization of the Space Station," J. of Br. Interplanetary Society, Jan 63, pp 23-24.

5. Ltr (S), Col N.C. Appold, Asst to Dep Comdr, Weapon Sys, ARDC, to Dir R&D, Hq USAF, 26 Dec 57, subj: Initial Rprt on Unsolicited, Sputnik-Generated Contractor Proposals; House Hearings before Select Cmte on Astronautics, 85th Cong, 2nd Sess, pp 613-14ff.

6. Memo (S), R.E. Horner, SAF (R&D) to William Holaday, D/Guided Msl, OSD, 24 Jan 58, subj: AF Astronautics Dev Prog; Project 7969, List of Advanced System & Space Vehicle Studies, Hq ARDC, 18 Mar 58, in AFCHO files.

7. D/Dev Plng Note 59-9 (S), "The Air Force in Space," Oct 59 in AFCHO files.

8. See Boushey's remarks in Man in Space; The United States Air Force Program for Developing the Spacecraft Crew, ed., Lt Col K.F. Gantz (NY, 1959), p 241; Hist, D/Adv Tech, Jul-Dec 61, p 37.

9. Hist (S), D/Adv Tech, Jul-Dec 61, pp 38-39; Ltr (S), LeMay to SAFS, 12 Sep 62, subj: AF Space Prog Proposals, Tab L, in OSAF 55-67, vol 4.

10. Air Force Space Plan (S), Sep 61, in OSAF 29-61; AFC 4/17C (S), 21 Sep 61, in Booster Systo files; Hist (S), D/Adv Tech, Jul-Dec 61, pp 38-39.

11. White Paper (C) on the AF Manned Mil Space Prog, 16 Nov 61, pp 5, 13, in DS Proj Ofc files.

12. Stmt by Gen Ferguson, in House Hearings before Subcmte on Appn, 87th Cong, 2nd Sess, 1963 DOD Appropriations, Pt 2, pp 484-85.

13. Memo (C), McNamara to Zuckert, 22 Feb 62, subj: AF Manned Mil Space Prog, in OSAF 163-62.

14. Ltr (S), Col C. Palfrey, Jr., Chmn, Adv Sys Wkg Gp to Chmn, Space Panel, 20 Apr 62, subj: MODS; Ltr (S), Gen Keese to AFSC, 2 May 62, subj: ADO No 37 for MODS, in Sp Div files; Rprt of SRB Mtg 62-51, 4 Jun 62, subj: MODS.

15. Rprt (S) of SRB Mtg 62-51, 4 Jun 62, subj: Mil Orbital Dev Sys; Prog Rprt (S) for Week Ending 8 Jun 62, in Space Div files; Ltr (S), D/Dev Plng to AFSC, 13 Jun 62, subj: MODS Prog Actions, in Space Div files.

Chapter V

1. Memo (U), Rubel to McMillan, 15 May 61, subj: Req for USAF Studies Relative to Space Progs, in Booster Systo files.

2. Summary Rprt (S) of Large Launch Vehicle Plng Gp, Vol I, 24 Sep 62, p I-1.

3. Rprt (S), Ad Hoc Cmte for Standardized Workhorse Launch Vehicle, 18 Aug 61 in Booster Systo files.

4. Memos (S), McMillan to Charyk, 18 Aug 61, subj: Standardized Space Booster Prog; Rubel to McMillan, 15 Sep 61, subj: Request for Studies of Titan II as Standardized Space Launch Vehicle, in Booster Systo files.

5. Memo (S), McMillan to LeMay, 18 Sep 61, subj: Request for Studies of Titan II as a Standardized Space Launch vehicle; Ltr (S), Maj Gen O.J. Ritland, SSD to Schriever, 4 Oct 61, subj: Titan III, in Booster Systo files.

6. Memo (S), Rubel to McMillan, 13 Oct 61, subj: Titan III Launch Vehicle Family, in OSAF 29-61, vol 4.

7. Memos (C), McMillan to Zuckert, 3 Nov 61, subj: Titan III Launch Vehicle Family; McMillan to DDR&E, 7 May 62, subj: Standardized Space Launch System, in OSAF 29-61, vol 4.

8. Memo (C), Rubel to McMillan, 13 Oct 61, subj: Titan III Launch Vehicle Family, in OSAF 29-61, vol 4.

9. Msg (C) 71987, USAF to AFSC, 20 Oct 61; Robert F. Piper, Hist of Titan III, 1961-1963 (SSD, Jun 64), p 41.

10. Summary Rprt (S) of Large Launch Vehicle Plng Gp, Vol I, 24 Sep 62, p II-1; Ltr, McNamara to Webb, 17 Nov 61, no subj, in Booster Systo files.

11. Rprt (S), National Launch Vehicle Data Summary, Nov 61, in Booster Systo files.

12. Memo (C), Rubel & Seamans to SOD and NASA, 5 Dec 61, subj: Recommendation Relative to Titan III and Titan II½, in OSAF 29-61, vol 5; Hist (S), D/Sys Acq, Jul-Dec 61, p 160.

13. Piper, op cit., p 42.

14. Memos (C), Asst SecAF Joseph Imirie to C/S USAF, 4 Dec 61, subj: Titan III; Rubel to Asst Secys of AF (Materiel and R&D), 6 Dec 61, subj: Plng for Titan III Phase I Efforts, in Booster Systo files.

15. Memo (C), Rubel to Asst Secys AF (Materiel and R&D), 24 Jan 62, subj: Response to USAF Request for Approval of Titan III RFP for Solid Motor, in Booster Systo files; Hist, D/Systems Acq, Jan-Jun 62, p 155.

16. Ltr (S), Col T.H. Runyon, Exec Secy, DSMG to DCS/S&L, 1 Feb 62, subj: 25th DSMG Mtg.

17. Msg (C) 71559, USAF to AFSC, 21 Mar 62; Memo (C), Charyk to Rubel, 27 Mar 62, subj: Titan III Space Launch Vehicle, in Booster Systo files.

18. Piper, op cit., p 118.

19. Memos (C), Rubel to McMillan, 3 Apr 62, subj: Titan III Technical Evaluation of Phase I; McMillan to Chief of Staff, 3 Apr 62, subj above; DDR&E to McMillan, 5 Apr 62, subj: Titan III General Specifications, in Booster Systo files.

20. Memo (FOUO), McMillan to DDR&E, 13 Apr 62, subj: Titan III General Specifications, in Booster Systo files.

21. Ltr (C), Schriever to LeMay, 30 Apr 62, no subj, in Booster Systo files.

22. Ibid.

23. Memo (C), McMillan to DDR&E, 7 May 62, subj: Standardized Space Launch System, in Booster Systo files.

24. Ibid.

25. Memo (C), Rubel to McMillan, 16 May 62, subj: DDR&E Initial Evaluation of Proposed System Package Plan for Prog 624A, in Booster Systo files.

26. Memo (S), McMillan to Chief of Staff, 28 May 62, subj: Titan III, in Booster Systo files; Mins (S) of 43rd Mtg, DSMG, 8 Jun 62.

27. Memo (C), Brown to McMillan, 28 Jun 62, subj: Titan III; Program Change, R&D for Titan III Space Booster (Prog 624A), revised and signed by Zuckert 19 Jul 62, in Booster Systo files.

28. Ibid.

Chapter VI

1. Berger, p 59.

2. Ltr (C), Col L.F. Ayres, SSD to Asst DCS/Systems & Logistics, 24 Jul 61, subj: Proposal for Immed Initiation of Projs Spt Large Solid Prop Motor Dev Prog, in Booster Systo files.

3. Memo (U), L.L. Kavanau, Special Asst (Space) to Rubel, 2 Aug 61, subj: Large Solid Motor Dev Prog; Ltr (U), McMillan to DDR&E, 15 Aug 61, subj: Proposal for Immed Initiation of Proj Spt Large Solid Prop Dev Prog; Memo (U), Rubel to SAF, 6 Sep 61, subj: App'l of FY 62 RDT&E Prog, in Booster Systo files.

4. Rprt (U), Estimated Dev Costs and Dev Schedules for Four Sizes of Large Solid Rockets, prep by SSD, 25 Aug 61, in Booster Systo files; Hist, D/Systems Acq, Jul-Dec 61, p 155.

5. Ltr (U), McNamara to Webb, 17 Nov 61, no subj, in Booster Systo files.

6. Ibid.

7. Abbrev Dev Plan (C) for Large Solid Prop Motors, Prog 623A, 22 Dec 61; Hist (S), D/Systems Acq, Jul-Dec 61, pp 157-58.

8. Rprt of NASA to House Cmte on Science and Astronautics, 88th Cong, 1st Sess, Astronomical and Aeronautical Events, p 17.

9. Ltr (U), R.C. Seamans, Jr., NASA to J.H. Rubel, Dep Dir DDR&E, 16 Feb 62, no subj, in Booster Systo files.

10. Ibid.

11. Memo (U), Rubel to McMillan , 24 Feb 62, subj: Large Solid Rocket Technology Prog; Msg (U) 64672, USAF to AFSC, 27 Feb 62; Dev Plan for Large Solid Propellant Motor, 2 Mar 62, prep by SSD; Mins (U), 10th Mtg of Launch Vehicle Panel, AACB, 9 Mar 62, in Booster Systo files.

12. Ibid.

13. NASA Schedule and Performance Guidelines (U), 16 Mar 62, in Booster Systo files.

14. Memo (C), McMillan to C/S USAF, 28 Mar 62, subj: Large Solid Motor Dev Prog; ASSS (C), Col H.W. Gainer, DCS/Systems & Logistics to Asst SAF (R&D), 19 Apr 62, subj: Plng and Funding for Large Solid Propel Motor Dev, 19 Apr 62, in Booster Systo files.

15. Ltr (U), Seamans to Rubel, 27 Apr 62, no subj, in Booster Systo files.

16. Memo (U), McMillan to Dep DDR&E, 10 May 62, subj: Large Solid Prop Motor Demonstration Prog; PCP 6340930.4-1, Large Solid Prop Motor (Prog 623A), 19 Jul 62, in Booster Systo files.

17. Ibid.

18. Ltr (U), Rubel to Seamans, 22 May 62, no subj: Memo, Rubel to McMillan, 22 May 62, subj: Large Solid Prop Motors, in Booster Systo files.

19. Ltr (U), Rubel to SAFRD, 2 Aug 62, subj: Large Solid Rocket Motors, in Booster Systo files.

20. Ltr (U), Col H.W. Gainer, Booster Systo to Asst DCS/Systems & Logistics, 26 Jun 62, subj: Dev in the Large Solid Propellant Motor Prog, in Booster Systo files.

Chapter VII

1. House Hearings before Subcmte on Space Sciences, 87th Cong, 2nd Sess, Project Advent--Military Communications Satellite Program, Aug 62.

2. Berger, p 84.

3. Memos (S), H. Davis, Dep/Res OSAF, to DDR&E, 21 Aug 61, subj: Mil Comm Sat System; Davis to Gen Keese, D/Dev Plng, 24 Oct 61, subj: Proposed ADO for a Comm Sat, in OSAF 29-61, vols 3, 4.

4. Memo (C), Charyk to DDR&E, 3 Oct 61, subj: Advent Prog, in Comm Systo files.

5. Rprt (C), Advent Prog Survey (Bridges Rprt), 12 Dec 61, prep by DDR&E, in Comm Systo files.

6. Ibid.

7. Ibid.

8. Memo (C), Brown to Sec/Army, 26 Dec 61, subj: Advent Prog, in Comm Systo files.

9. Ltrs (C), Schriever to LeMay, 16 Jan 62, subj: Mil Comm Active Sat Sys, in OSAF 1056-61, vol 1; Schriever to LeMay, 23 Jan 62, subj: Advent Prog, in Comm Systo files.

10. Memo (C), McMillan to DDR&E, 12 Feb 62, subj: Advent Prog, in Comm Systo files.

11. Ltr (C), Schriever to LeMay, 14 Mar 62, subj: Advent, in Comm Systo files.

12. Hist (TS), D/Plans, Jul-Dec 61, pp 128-29; Rprt of Mil Ops Subcmte of House Cmte on Govt Ops, 88th Cong, 2nd Sess, Satellite Communications, p 156.

13. Rprt (S) of AFSC Study Group on National Mil Comm Sat System, Apr 62, in Comm Systo files; Rprt of SRB Mtg 62-39, 26 Apr 62.

14. Memos (S), McMillan to Brown, 20 Apr 62, subj: Plng for Sat Comms; McMillan to Brown, 8 May 62, subj: National Mil Comm Sat System, in Comm Systo files.

15. Air Force Space Programs, p D-22; Memo (C), Brown to OSD, 22 May 62, subj: DOD Comm Sat Prog, in Comm Systo files.

16. Ibid.

17. Memos (C), McNamara to SAF, 23 May 62, subj: DOD Comm Sat Prog; McNamara 6o DCA, 23 May 62, subj as above, in OSAF 1056-62, vol 1.

18. Ltr (U), Maj Gen R.M. Montgomery, Asst Vice C/S USAF to Charyk, 14 Jun 62, subj: DOD Comm Sat Prog, in Comm Systo files; Hist (S), D/Sys Acq, Jan-Jun 62, pp 22-23.

19. N.Y. Times, 30 Jul 61; Rprt of Space Sciences Board, NAS, 11 Aug 61, in House Hearings before Subcmte on Govt Ops, 88th Cong, 2nd Sess, Satellite Communications, 1964, Pt I, pp 550-51.

20. Ltr (U), L.B. Johnson, Vice President to SOD, 10 Aug 61, no subj, in OSAF 180-61.

21. N.Y. Times, 25 Aug 61; Washington Post, 22 Sep 61.

22. Ltr (C), J.H. Rubel, to J.D. Wiesner, Special Asst to President for Science and Technology, 20 Sep 61, no subj, in Comm Systo files.

23. House Hearings before Subcmte on Govt Ops, 88th Cong, 2nd Sess, Satellite Communications, 1964, Pt I, pp 550-51; N.Y. Times, 6 Oct 61.

24. Status Rprt (C), Project West Ford, 1 Mar 62, prep by M.I.T. Lincoln Lab, in OSAF 156-62; Washington Star, 31 Oct 61.

25. Msg (C) 62-0690, USAF to AFSC, 1 Feb 62; Status Rprt (C), Project West Ford, 1 Mar 62, prep by M.I.T. Lincoln Lab, in OSAF 156-62.

26. Ltr (C), Charyk to Wiesner, 2 Feb 62, no subj, in OSAF 156-62; Msg LL-DO-1-7 Lincoln Lab to Charyk, 7 May 62.

27. Ltr (C), Charyk to Wiesner, 17 Aug 62, no subj, in OSAF 156-62.

Chapter VIII

1. Ltr (S), Maj Gen William Keese, D/Dev Plng to Gen Ferguson, 22 Jan 62, subj: Midas Prog, in Space Div Read files.

2. Memo (S), Brown to SOD, 29 Jul 61, subj: Bal Msl Def of Continental U.S., in Midas Systo files.

3. Ibid.

4. Ibid.

5. Rprt (S) of SRB Mtg 61-45, 20 Dec 61, subj: Midas Dev Plan, 1962, in Midas Systo files.

6. Memo (S), Brown to SOD, 29 Jul 61, subj: Bal Msl Def of Continental U.S. in Midas Systo files.

7. Msgs (S) SSZ 59-1, SSD to USAF (SAB), 5 Sep 61; 62495, SAB to SSD, 15 Sep 61.

8. Ltr (S), Schriever to LeMay, 28 Sep 61, subj: Midas, in Midas Systo files.

9. Ltr (S), Gen Keese to Ferguson, 22 Jan 62, subj: Midas Prog, in Space Div files.

10. Msgs (S) 71413, USAF to AFSC, 18 Oct 61; SSZM-24-10-32, SSD to USAF, 24 Oct 61; AD CCR 2406, ADC to USAF, 31 Oct 61; Hist Summary (S), NORAD/ADC, Jan-Jun 62, pp 36-37.

11. Rprt (S), Evaluation of Midas R&D Prog, prep by DDR&E Ad Hoc Group on Midas, 30 Nov 61, in OSAF 156-62.

12. Ibid.

13. Memo (S), Brown to Zuckert, 8 Dec 61, subj: Midas, in OSAF 180-61.

14. AFC 1/24 (S), 26 Dec 61, subj: Review of Midas Prog, in Midas Systo files.

15. Ltr (S), Maj Gen J.R. Holzapple, Asst DCS/Sys & Log to AFSC, 29 Dec 61, subj: Midas, in Systo files.

16. Ltr (S), Gen F.H. Smith, Jr., Vice C/S USAF to SAF, 11 Jan 62, subj: Midas Prog, in OSAF 156-62.

17. AFSC Comments (S) on the Tech Aspects of "Evaluation of Midas R&D Prog by the DDR&E Ad Hoc Group on Midas," 15 Feb 62, in OSAF 156-62; Rprt (S) of SRB Mtg 62-21, 28 Feb 62, subj: Midas Prog, in Midas Systo files.

18. Ibid.

19. Ltr (S), Schriever to Vice C/S USAF, 2 Mar 62, subj: Midas; Mins (S), 33rd Mtg of DSMG, 2 Mar 62, subj: Midas, in OSAF 154-62.

20. Memo for Record (S), Col T.H. Runyon, Exec Secy, DSMG, 13 Mar 62, subj: Midas; Memo (S), McMillan to Gen Smith, 14 Mar 62, subj: Midas, in Midas Systo files.

21. Mins (S), 37th Mtg of DSMG, 30 Mar 62; Ltr, Schriever to Gen Smith, 2 Apr 62, subj: Ltr of Transmittal, WS-239A (Midas), Dev Plan, in Midas Systo files.

22. Air Force Space Programs, Tab B-21.

23. Ibid.; Memo (S), McMillan to Brown, 10 Apr 62, subj: Midas; Ltr (S), Chr Midas Systo to Maj Gen J.R. Holzapple, 17 Apr 62, subj: Midas Dev Plan, in Midas Systo files.

24. Memo (S), Dr. W.K. H. Panofsky, AICBM Panel, Science Adv Cmte to Dr. J.B. Wiesner, 16 Apr 62, subj: Reoriented Midas Prog; Ltr (S), Wiesner to Brown, 20 Apr 62, no subj, in OSAF 156-62.

25. Memo (S), Brown to McMillan, 20 Apr 62, subj: Midas Dev Plan, in Midas Systo files.

26. Ltr (S), Gen Holzapple to AFSC, 30 Apr 62, subj: Midas Dev Plan; Memo (S), Brown to Secys Army, Navy, et al, 28 May 62, subj: Selective Review of Major PCPs, in Comm Systo files.

27. Air Force Space Programs, Tab B-23; Rprt (S) of SRB Mtg 62-54, 13 Jun 62; Mins (S), 45th Mtg of DSMG, 20 Jun 62, in Midas Systo files.

28. Memo (S), Zuckert to LeMay, 13 Jun 62, subj: Midas SOR; Brown to McMillan, 25 Jun 62, subj: Midas System, in Midas Systo files.

29. Memo (S), McMillan to DDR&E, 28 Jun 62, subj: Midas; Memo, N.E. Harlan, Asst SAF (Fin Mgt) to Asst SOD (Compt), 29 Jun 62, subj: Midas; SOD Decision/Guidance 4.4.040, 6 Aug 62, in Midas Systo files.

Chapter IX

1. Ltr (S), Schriever to Hq USAF, 16 May 61, subj: Bioastro Dev Plan, in Space Div files.

2. Ltr (S), LeMay to SAFS, 12 Sep 62, subj: AF Space Prog Proposals, Tab E, in OSAF 55-62, vol 4.

3. Hearings before House Subcmte on Manned Space Flt, 87th Cong, 2nd Sess, 1963 NASA Authorization, p 730.

4. Ibid., p 741.

5. Ibid., pp 738-43.

6. Ltr (S), LeMay to SAFS, 12 Sep 62, subj: AF Space Prog Proposals, Tab E, in OSAF 55-62, vol 4; Project Mercury, A Chronology (NASA SP 4001), pp 153-54.

7. Memos (U), Rubel to McNamara, 5 Mar 62, subj: Bioastro Coop with NASA; Brown to McMillan, 9 Mar 62, subj: DOD-NASA Agreement on Bioastro RDT&E Support of MLLP, in OSAF 55-62, vol 1.

8. Memo (U), McMillan to Brown, 30 Mar 62, subj: DOD-NASA Agreement, in OSAF 55-62, vol 1; Ltrs (U), Seamans to Charyk, 27 Apr 62, no subj; Seamans to Charyk, 28 May 62, no subj; Memo for Record (U), Maj F.E. Cole, D/Advanced Tech, 8 Jun 62, subj: Mtg on Space Prog 698AA, 7 Jun 62, in Space Div files.

9. Memo (U), Maj Gen J.F. Whisenand, Asst DCS/Res & Tech, to Charyk, 28 Jun 62, subj: Memo of Understanding, Joint AF/NASA Bioastro Prog, in Space Div files; Ltr (S), LeMay to SAFS, 12 Sep 62, subj: AF Space Prog Proposals, Tab E, in OSAF 55-62, vol 4.

10. Memo (U), Rubel to Charyk, 23 Jul 62, subj: Joint AF/NASA Bioastro Prog (697AA), in OSAF 55-62, vol 2.

Chapter X

1. Berger, p 76.

2. Msg (S) 60316, USAF to AFSC, 8 Sep 61; Hist (S-RD), D/Sys Acq, Jul-Dec 61, p 81; Hist, ADC, Jul-Dec 61, pp 106-07.

3. Hist (S-RD), D/Sys Acq, Jan-Jun 62, p 66; Hist Summary (S), NORAD/CONAD, Jan-Jun 62, p 30.

4. Memo (S), Asst DCS/Plans to D/System Acq, 1 Nov 61, subj: Increase in Number of Orbiting Objects, in Spdats Ofc files.

5. Memo (S), DDR&E to SAF, 27 Nov 61, subj: Approved FY 62 RDT&E Prog for 496L, in Spadats Ofc files; Msg (S) 83909, USAF to AFSC, 6 Dec 61.

6. Memo (S), Brown to McMillan, 20 Feb 62, subj: Spadats Phased Array Radar, in OSAF 55-62, vol 1; Msg (S) 62265, USAF to AFSC/RADC/ESD, 16 Feb 62; 64673, USAF to AFSC, 27 Feb 62.

7. Tech Dev Plan (S) for the Spadats Radar, 496L, 20 Mar 62; Memo, Dep SAFRD (Davis) to DDR&E, 30 Mar 62, subj: Spadats Phased Array Radar; Memo (S), DDR&E to McMillan, 29 May 62, subj: Approval of Dev Plan for Spadats, in OSAF 55-62; vol 1; Hist Summary (S), NORAD/CONAD, Jan-Jun 62, p 30.

8. Memo (S), DDR&E to SAF, 28 May 62, subj: Selective Review of PCPs; Air Force Space Programs, Tab O-21.

9. SOR 197 for an Aerospace Surveillance and Warning System (S), 24 May 62, in Spadats Ofc files.

10. Ibid.

Chapter XI

1. Berger, p 69.

2. Summary of Past Actions in the WS-621A Prog (S), 7 Feb 62, prep by Exec Secy, DSMG, in OSAF 2050-62; Ltr, LeMay to SAFS, 12 Sep 62, subj: AF Space Prog Proposals, Tab A, in OSAF 55-62, vol 4.

3. Ibid.; Msg (S) 96923, USAF to AFSC, 25 Aug 61; Memo (S), McMillan to C/S USAF, 27 Oct 61, subj: Program 621A, in OSAF 29-61, vol 4; Hist, D/Systems Acq, Jul-Dec 61, p 127.

4. Summary (S), 5 Jan 62, subj: WS-621A (Satellite Inspector), prep by System Review Bd, in OSAF 2050-62.

5. Summary of Past Actions in the WS-621A Program (S), 19 Mar 62, prep by Exec Secy, DSMG, in OSAF 2050-62; Memo (S), Secy DSMG to DCS/Systems and Logistics, 10 Jan 62, subj: 31st DSMG Mtg, in 621A Proj Ofc files; SRB Mtg 62-28 (S), 22 Mar 62, subj: 621A/Gemini Relationships.

6. Mins (S), 25th DSMG Mtg, 23 Mar 62; Memo, McMillan to DDR&E, 24 Apr 62, subj: Sat Inspection Prog, in 621A Proj Ofc files.

7. Memo (S), Brown McMillan, 28 Jun 62, subj: Sat Inspection Prog, in OSAF 2050-62.

8. Ltr (S), LeMay to SAFS, Jul 62, subj: Recent SecDef Action on WS-621A Prog, in OSAF 2050-62.

9. Ibid.

10. Memo (S), Brown to SOD, 29 Jul 61; subj: Bal Msl Def of Cont U.S., in The Air Force in Space, Tab K; Memo (S), Brown to Secys, Army, Navy, AF, et al, 28 May 62, subj: Selective Review of Maj Proposed Prog Changes, in Comm Systo files.

11. Memos (S), Chief, Ops Anal to Vice C/S USAF, 5 Feb 62, subj: Def Against Mil Orbiting System; Chief, 621A Systo to Gen Holzapple, 20 Mar 62, subj: Sat Inspector (WS-621A), in Comm Systo files; Ltr (S), Maj Gen R.M. Montgomery, Asst Vice C/S USAF to SAF (R&D), 20 Mar 62, subj: Anti-Satellite Prog, in OSAF 55-62, vol 1.

12. Berger, p 72; USAF Current Status Rprt (S), May 62, p 9-43.

13. Ltr (S), Gen Ferguson, DCS/R&T to Vice Chief, 25 Jan 62, subj: AICBM Prog, in Space Div files.

14. Ltr (S), Lt Gen R.H. Terrill, Vice Comdr, ADC to Hq USAF, 20 Dec 61, subj: QOR for an Orbital Interceptor Sys; Ltr (S), Maj Gen C.H. Mitchell, Vice Comdr AFSC to Hq USAF, 1 May 62, subj: Recomm for an Optimum SCWP Prog, in Space Div files; The Air Force in Space, Tab L-7.

15. Ltr (S), Maj Gen C.H. Mitchell, Vice Comdr, AFSC to Hq USAF, 27 Jun 62, subj: Recom for an Optimum SCWP Prog, in Space Div files; The Air Force in Space, Tab L-7.

16. Memo (C), Charyk to DDR&E, 8 Sep 61, subj: Agena B Standardization, in OSAF 29-61, vol 4.

17. Ibid.; Memos (C), Rubel to McMillan, 4 Oct 61, subj: Standardized Agena; Charyk to DDR&E, 31 Oct 61, subj: Standardized Agena, in OSAF 29-61, vol 4.

18. Memos (S), Charyk to C/S USAF, 1 Dec 61, subj: Standardized Agena D; Charyk to DDR&E, 6 Dec 61, subj: Agena D Prog, in OSAF 29-61, vol 5.

19. Program Change (S), form 1355-1, USAF Space Program, Oct 62, Agena D. in Space Div files; Memo (S), Rubel and Semans to SecDef and Admin NASA, 8 Jun 62, subj: DOD/NASA Agena D Agreement, in Space Div files; Hist, D/Systems Acq, Jan-Jun 62, p 171.

20. Msg (C) 81261, USAF to AFSC, 20 Apr 62.

21. Memo for Record (C), Lt Col D.H, Keefee, Atlas Space Booster Proj Officer, 2 May 62, subj: Standardized Atlas Space Booster Presentation; Rprt of SRB Mtg 62-56, 28 Jun 62.

22. Hist (S) of SSD, Jan-Jun 62, Vol I, p 30.

23. Hist (S-RD), D/Sys Acq, Jul-Dec 61, pp 177-78; Hist (S-RD), Jan-Jun 62, pp 171-73.

24. Memo (C), Brown to SAF, 27 Oct 61, subj: Approval of FY 62 RDT&E Prog for Discoverer; Msg (C) 76985, USAF to AFSC, 8 Nov 61; Memo (C), Gilpatric to SAF, 6 Apr 62, subj: Util of Emergency Fund Transfer Authority; 622A Prog Rprt, 11 Jun 62, in Disc Proj Ofc files.

25. Hist (S) of SSD, Jan-Jun 62, vol I, p 29; The Air Force in Space, Tab C-12.

26. Ibid., Tab H-10.

27. Ltr (S), Hq USAF to AFSC, 16 Apr 62, subj: Blue Scout Reliability; Ltr (S), Col R. Nudenberg, Asst Dep to Comdr for Manned Space Flt AFSC, to Hq USAF, 9 Jul 62, subj: Revisions to Scout Prog, in OSAF 55-62, vol 3; Annual Prog Rprt, AFSC, FY 1962, pp 23-24.

28. Memo (U), McMillan to Rubel, 19 Sep 61, subj: AF Environmental Res Prog Using Rockets & Satellites, in OSAF 29-61, vol 3.

29. AFSC Monthly Status Rprt (C), Air Force Support of NASA, Jun 62, p 1, in Space Div files; Memo (C), McNamara to Charyk, 29 Jul 61, subj: Scout Prog, in OSAF 29-61, vol 3.

30. Berger, p 94.

31. Msg (S) 92457, USAF to AFSC, 9 Aug 61; The Air Force in Space, Tab J-4; Hist (S), D/Adv Technology, Jul-Dec 61, pp 16-17.

32. Ltr (S), LeMay to SAFS, 12 Sep 62, subj: AF Space Prog Proposals, Tab E, in OSAF 55-62, vol 4; The Air Force in Space, Tab J-4.

33. Memo (C), Rubel to SAF, 15 Mar 62, subj: Recoverable Orbital Launch System (ROLS), in OSAF 993-62; Hist (S), D/Adv Technology, Jan-Jun 62, pp 20-21.

34. Berger, p 97.

35. Development Dir No AT-2 for Advanced Tech Prog (698P), Hq USAF, 2 Aug 61; Hist (S), D/Adv Technology, Jul-Dec 61, p 22.

36. Memo (S), McMillan to DDR&E, 8 Sep 61, subj: Funds Release-Snapshot, in OSAF 29-61; Ltr (S), LeMay to SAF, 12 Sep 62, subj: AF Space Prog Proposals, Tab G, in OSAF 55-62, vol 4; Hist (S), D/Adv Technology, Jul-Dec 61, p 22.

37. Hist (S) of SSD, Jan-Jun 62, Vol I, p 40.

38. Hist (S), D/Adv Technology, Jan-Jun 62, pp 33-34.

39. Hist (S-RD), D/Sys Acq, Jul-Dec 61, p 25; Summary Rprt (U) of DOD Support of Proj Mercury, Jul 59-Jun 63, p 57.

40. Stmt by Secy McNamara in House Hearings before Subcmte on Appropriations, 87th Cong, 2nd Sess, 1963 DOD Appropriations, Pt 2, pp 112-13.

41. Berger, p 100; Hist (S-RD), D/Sys Acq, Jul-Dec 61, pp 15-16; Jan-Jun 62, pp 23-24.

42. House Hearings before Subcmte on Space Sciences, 87th Cong, 2nd Sess, Project Anna-Geodetic Sat System, May 1962; Hist, D/Res, Jul-Dec 61, pp 21-22; Jan-Jun 62, pp 23-24.

GLOSSARY

AACB	Astronautics and Aeronautics Coordinating Board
ADC	Air Defense Command
AEC	Atomic Energy Commission
AFSC	Air Force Systems Command
AMR	Atlantic Missile Range
Anna	Army, Navy, Air Force (Geodetic Satellite Project)
App	Appendix
ARDC	Air Research and Development Command
ARPA	Advanced Research Projects Agency
ASD	Aeronautical Systems Division
Bambi	Ballistic Missile Boost Intercept
BM	Ballistic Missile
BMEWS	Ballistic Missile Early Warning System
CONAD	Continental Air Defense Command
DCA	Defense Communications Agency
DDR&E	Directorate of Defense Research and Engineering
Dev	Development
DOD	Department of Defense
DSMG	Designated Systems Management Group
ICBM	Intercontinental Ballistic Missile
IOC	Initial Operational Capability
IR	Infrared
JCS	Joint Chiefs of Staff
Jt	Joint
Midas	Missile Defense Alarm SystemN
Min	Minutes
MODS	Military Orbital Development System
MTSS	Military Test Space Station
NASA	National Aeronautics and Space Administration
NASC	National Aeronautics and Space Council
NORAD	North American Air Defense Command
OSD	Office of the Secretary of Defense

G L O S S A R Y (Cont'd)

PERT	Program Evaluation Review Techniques
Prelim	Preliminary
PMR	Pacific Missile Range
Prog	Program
RCA	Radio Corporation of America
RFP	Request for Proposal
Recon	Reconnaissance
ROLS	Recoverable Orbital Launch Study
SAB	Scientific Advisory Board
SAC	Strategic Air Command
SAF	Secretary of the Air Force
Saint	Satellite Inspector
Sat	Satellite
Secy	Secretary
Snap	System for Nuclear Auxiliary Power
SOR	Specific Operational Requirement
Spadats	Space Detection and Tracking System
Spasur	Space Surveillance
SR	Study Requirement
SSD	Space Systems Division
Stmt	Statement
Subcmte	Subcommittee
Sys	Systems
Systo	Systems Office
TAT	Thrust-Augmented Thor
UHF	Ultra High Frequency
USAF	United States Air Force
WADC	Wright Air Development Center

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