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SPACE PROGRAMS

1954 - 1966

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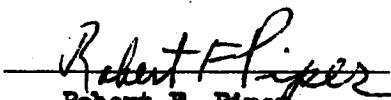
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INTRODUCTION

This abbreviated history has been prepared for the use of the commander and his staff. Its information is based on the following sources: the first section, "Programs" is an account of the evolution of Air Force space interests and activities which first appeared in USAF Space Chronology, 1958-1962, published by USAF Historical Division Liaison Office. The chronology section reports the progress and life span of various space programs conducted by AFEMD-SSD, based on division histories and documents in the history office files.

There are other AFEMD-SSD histories that report both the story of ballistic missile and space systems development but this volume attempts a summary of the most important programs since the origin of the space era in 1954. It is anticipated, hopefully, that this volume will be a practical source of information and SSD accomplishments in space systems development.


Robert F. Piper
Chief, History Division

PROGRAMS

Within a week after Sputnik--4 October 1957--AFBMD had forwarded estimates that approximately \$60 million would be required in new FY 1958 and 1959 funds to insure a six-month acceleration of WS 117L schedules. Conservatives within the Defense Department, principally Deputy Secretary Quarles, promptly damped such enthusiasm by calling the proposed acceleration unduly optimistic, and it was not until General Putt (DCS/D) personally carried the question to Secretary of Defense McElroy that any funding relief was granted. The approval actually encompassed a schedule first proposed in June 1957.

Concurrently, RAND and the Department of the Air Force urged the Thor-WS 117L expedient on OSD. Two special advisory groups created to consider steps for reviving United States prestige independently came to the same conclusion. Late in January 1958, therefore, the Air Force programmed a few Thor's to boost early WS 117L upper stages into orbit and contracted with Lockheed for the necessary vehicle modifications.

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Almost simultaneously, the Air Force submitted for DOD consideration a proposed 10-year space plan which included a vastly expanded WS 117L program, re-establishment and acceleration of BRATS, acceleration of work on hypersonic manned research vehicles, revitalization of the Dyna Soar, and a lunar landing program. Although the DOD Director of Guided Missiles, W. M. Holaday, considered the submission a proposal for ARPA endeavor, once that agency was formally established, the Air Force was actually seeking funds to support such a development program. In any event, there was OSD response.

Again in February, the Secretary of the Air Force asked for approval of a program acceleration based on expanded use of Thor-boosted satellites, but decisions were being delayed pending activation of ARPA. On 28 February, the first definitive replies arrived: ARPA Director Johnson rejected the Thor-WS 117L reconnaissance proposal but approved the combination of Thor boosters with Lockheed second stages for early WS 117L tests and as a mode of conducting biomedical experiments. Of the grander proposal for a long-term space program, nothing was heard. A portion of the program, rather more limited than in its original form, became the ARPA-sponsored lunar-shot

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program of March 1958. (The three authorized lunar shots were all failures, in August, October and November 1958, principally because the sponsors considerably underestimated the technical sophistication required in the undertaking.)

The principal obstacle to WS 117L acceleration remained funding.

Not until June 1958 were the various proposals and counterproposals reduced to an approved program. At that point, however, the basic Atlas-WS 117L effort received roughly 50 percent more money than originally allocated and the Thor-WS 117L phase received enough money to support the fabrication of the first 12 vehicles. The total effort was then under ARPA control, OSD having effected the shift in graduated fashion between February and June.

Although Dyna Soar had upped its funding from an annual \$3 million to fiscal 1959 funding of \$15 million by midway 1958 the USAF space program was but little advanced over its situation eight months earlier when Sputnik had first shaken national confidence. Apart from WS 117L, the Air Force had received from ARPA only a propaganda project (Score) involving orbiting a complete Atlas equipped with a recorder to broadcast a Christmas

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greeting to the world. Other assignments were either confined to research or, more generally, were limited to study effort. Moreover, in the general gathering together and reshuffling of programs that followed activation of ARPA, the Air Force lost to other agencies such projects as the 1,500,000 pound clustered rocket engine and a proposed weather satellite. Even more critical, the Air Force claim to space primacy had yet to be supported by the first Air Force space exploit; apart from the hastily and erroneously publicized Project Far Side shot, no USAF effort had put anything into space.

Additional complications arose with the activation of NASA, in the late months of 1958. Although the pure military space vehicles--the WS 117L programs--remained under Air Force technical control and ARPA management, NASA immediately abandoned the prohibition on using military boosters to support scientific space projects and automatically turned to the Thor vehicle as the most capable of the available boosters. Almost as quickly, NASA scheduled programs based on the use of the WS 117L upper stage (shortly to be known as Agena) in combination with both Thor and Atlas boosters.

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Of more critical importance to long-term Air Force plans was the loss of all manned satellite plans and proposals. The Man-In-Space program which had progressed, under Air Force auspices, to rather specific design proposals, became the hard core of NASA's Project Mercury. In somewhat similar fashion, several Air Force communications satellite proposals were largely entrusted to NASA, as were programs involving weather reconnaissance and geodetic mapping. BRATS, the pre-Sputnik hypersonic test proposal, had become HETS (hyper-environmental test system) by late 1958, but it too was developed by NASA--ultimately becoming Scout (NASA), with an Air Force version being designated Blue Scout. Throughout the space program spectrum it was necessary to develop new relationships with the space agency--relationships which were generally guided by a policy of Air Force deferral to NASA goals.

During the late months of 1958, ARPA segmented the original WS 117L program, creating in its stead three specialized projects which subsequently were named Sentry (later Samos), Midas, and Discoverer. Samos was the Atlas-Agena visual and electronic reconnaissance program, Midas the infrared attack-alarm system, and Discoverer the Thor-Agena program involving space engineering test functions, biomedical experimentation, development of recovery

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techniques, and associated military support activities. The military communications satellite programs--as separate from the NSAS managed "civilian" effort--became Notus (subsequently Advent), a project combining an Air Force vehicle development and an Army Signal Corps developed payload. Not until March 1959 did ARPA concede the validity of an Air Force requirement for a polar-orbit communications satellite (Steer) which satisfied strategic-air command and control needs.

One other policy change of considerable consequence came in March 1959: under the provisions of the Defense Reorganization Act passed the previous August, the Department of Defense put ARPA under the jurisdiction of DDR&E. Thereafter, in accumulative fashion, the policy-making responsibilities for military space activity shifted rapidly into DDR&E. By the end of 1959, ARPA had largely ceased to have any immediate influence over the course of Air Force space programs.

In the interim, USAF had made considerable technical progress. Score went aloft in December 1958, and though it was worth considerably more in publicity than in technology, it nevertheless proved an auspicious Air Force entry into space operations. In February 1959 the first Discoverer satellite

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went into orbit and six weeks later the Air Force made its first attempt to recover a space capsule. That attempt, following the 13 April 1959 launch of Discoverer 2, failed--as did 10 subsequent attempts extending into August 1960. Recovery of the Discoverer 13 capsule from the Pacific and air-capture of the Discoverer 14 capsule infused new life into what was to become the most reliable United States space system as well as that which scored the greatest number of launchings. In the course of the Discoverer program, both the Agena vehicle and the Thor booster became "standard," progressing through several configurations before emerging, in 1961-1962, as the "Standard Thor" and the Agena D. Additional enhancement of the potential and payload of Discoverer vehicles resulted, in 1962, from the decision to increase the thrust of the Thor by strapping on multiple solid-fuel rockets, thus creating "Thrust-Augmented-Thor," or TAT.

Discoverer represented an early and an important Air Force space achievement in that it was the first project to progress to multiple, almost routine launchings and retrievals. Perhaps more significant, the bulk of the Discoverer production program grew accordingly, expanding from the original 5-vehicle proposal of January 1958 to 10, 13, 15, 19, and then

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25 Discoverers by 30 April 1959. Shortly after the first complete test successes, in August 1960, a new production growth began. The approved total moved upward from 35 to 41, then to 44, 60, and 65 by July 1962. Of comparable or greater importance, DDR&E in October 1961 had authorized indefinite continuation of the Discoverer program to provide adequate numbers of satisfactory vehicles for a variety of space projects.

Along the main stream of reconnaissance satellite development, affairs took an unanticipated course. The first Samos launching did not occur until October 1960, and before that event the entire plan of the program had changed radically. As revised after ARPA's take-over, Samos was associated with but compartmented separately from Discover and Midas, although both (as well as a geodetic mapping satellite proposal dismissed early in 1959) derived from the original WS 117L program and relied entirely on upper stage vehicles developed in the course of the original WS 117L effort. A reasonably well funded exploration of the potential of recovery techniques in Samos began in the early months of 1959 but very nearly lapsed in the face of ARPA disapproval in June of that year. Essential disagreement arose between the Air Force intelligence community, which foresaw a need for

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early capsule recovery of high resolution reconnaissance film, and ARPA policy makers who thought the readout technique, involving radio transmissions to ground stations, was more promising. ARDC, which had custody of technical development, stridently defended the validity of the Air Force thesis--that both recovery and readout were essential and that the service could scarcely afford to discard the most promising of available reconnaissance approaches in favor of a technique with limited application in the near future.

The crux of the crisis that began in June 1959 was ARPA's decision to provide only about \$135 million of the \$168.5 million in fiscal 1960 funds the Air Force considered essential to minimum paced development of Samos. By cancelling work on the E-5 recovery subsystem, ARPA effectively insured that the funds limitation would have its chief effect in limiting recovery subsystem effort. Largely because of the determined protests of General Schriever and Air Force Under Secretary Charyk, ARPA in early September 1959 rescinded the prohibition on E-5 development and added 10 percent more to the Samos budget. The net effect, however, was generally unfortunate in that the Air Force had acquired responsibility for pushing E-5 development but was thoroughly underfunded for the task. Additional difficulties arose

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from failure of the fiscal 1960 budget to provide other than research and development funds for Samos, which then was entering a critical pre-production stage.

A further complication was Defense Secretary McElroy's 18 September decision to transfer Samos responsibility from ARPA to the Air Force--but only after completion and acceptance of a new development plan. Resubmission of an updated version of either the ARPA approach, emphasizing readout, or the Air Force compromise approach, based on a limited E-5 effort, became improbable virtually as soon as DDR&E replaced ARPA as the ultimate policy authority in space systems. Dr. Herbert York, DDR&E, and his chief advisors insisted that the chief emphasis of program development should shift entirely from readout to recovery. Their reasoning was based partly on apparent advantages of recovery over readout, and partly over the issue of the costs of the ground and processing stations for the readout subsystem. Such costs were becoming influential in program decisions as technical progress brought closer the day when construction of operational-configuration readout stations, presumably for SAC occupancy, would have to begin.

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In consequence of the distressing recovery failures then characterizing the Discoverer program, the DDR&E instructions to emphasize Samos recovery techniques were accompanied by directions to refine and enhance total system reliability--and against budget totals that provided no improvement over ARPA recommended ceilings.

Although protesting that the DDR&E philosophy would delay availability of an operational Samos, AFEMD nonetheless submitted in January 1960 a development plan based on a fiscal 1960 ceiling of \$159.9 million and a fiscal 1961 ceiling of [REDACTED]. To provide even this much, the Air Force had been obliged to limit Discoverer funding and to reduce markedly the reserve for Midas development. Although approval of the approach, through the Department of the Air Force level, had been registered by mid-February, it was not until late April that DDR&E reacted, and then with a conditioned approval and directed [REDACTED] funding levels. York's reservations were based on mistrust of Air Force technical optimism and, probably most important, his belief that the Air Force was unduly preoccupied with operational considerations at a time when the technical feasibility of Samos remained to be proven. In essence, York

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denied the applicability of the concurrency approach to Samos development.

Particularly, DDR&E was disturbed at Air Force plans to open an initial operational processing and distribution center at SAC headquarters by April 1960 and to construct a full operational facility there by October 1961.

The tenor of Samos activity took a new bend in May 1960, following disclosure of the U-2 incident and the subsequent decision to halt U-2 overflights. Almost immediately SAC, the intelligence community, and OSAF threw new force behind the Samos project. Two general courses were in highest favor, and they were not necessarily compatible: re-acceleration of the E-1 and E-2 readout systems with their associated ground facilities, and further shift of effort toward an early test of recovery techniques. (The fact that the Discoverer program had yet to produce a successful capsule recovery also weighed in the subsequent deliberations.)

On 10 June, President Eisenhower instructed the Secretary of Defense to re-evaluate the Samos program and to submit a briefing, together with a recommended course of action, for the National Security Council. Gates appointed a special ad hoc team to prepare the summation: Air Force Under

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Secretary Charyk, Deputy DDR&E John Rubel, and Presidential science advisor George Kistiakowsky. Concurrently, Congress added [REDACTED]

[REDACTED] DDR&E had apportioned to Samos for fiscal 1961 and the Senate called publicly for an acceleration of development.

In submitting a new development plan based on events and guidance of May and June, AFEMD expanded the proposed flight schedule to include 30 rather than 25 launchings and nearly tripled the proposed number of recovery subsystem tests. Even before the proposal received full consideration, DDR&E approved the early start of work on required launch stations.

The possibility that the result of such activity might be an accelerated Samos program conducted in the general fashion of other Air Force developments grew slighter in July and August. There were several contributors. Of considerable impact was a concerted Navy-Army recommendation to the Joint Chiefs that Samos should become a national rather than an Air Force program. A special advisory board (the Baker Group) drawn from DDR&E urged transfer of management responsibility to some agency immediately under the Secretary of Defense. The Scientific Advisory Board, OSAM and DDR&E jointly considered the advisability of creating entirely new management channels for Samos, under DOD control.

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This activity, and much that the Air Staff had independently directed, came to a point in the 25 August 1960 National Security Council meeting. The resulting decisions changed the complexion of Samos rather thoroughly. Emphasis was shifted to photographic recovery techniques, which were accorded a high national priority. Political uncertainties surrounding the first Samos launch, scheduled for September 1960, disappeared with Presidential approval of the launch. The Samos program was taken out of normal Air Force program structures and established under the direct control of the Secretary of the Air Force, with operational control residing in an Air Force general officers. No intermediate levels of review or approval were to exist between immediate program management authority and the secretary.

Measures to effectuate these decisions began within days of the 25 August decision. By December 1960, Samos had passed to the custody of a "Secretary of the Air Force Samos Project" organization on the west coast and a counterpart office, "Secretary of the Air Force Missiles and Satellites Office" in the Pentagon. Each reported directly to AF Under Secretary Charyk. Thereafter, Samos was conducted apart from the remainder of Air Force space programs.

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Midas, the infrared attack-alarm satellite which had begun as Subsystem G of Samos, had continued at a substantially slower pace and with equally as frequent program realignments during the 1958-1960 period when Samos was undergoing continuous reappraisal. When the separation of Samos, Midas, and Discoverer took place in the late months of 1958, Midas was continued initially at a funding rate approximating \$3 million per year, although AFBMD estimated that at least 10 times that much was needed to provide any appreciable development progress. While ARPA temporized, the Air Force provided half of the stated requirement on a month-by-month basis through February 1959.

After ARPA had re-evaluated Air Force proposals for the conduct of Midas, the agency confirmed the level-of-effort for fiscal 1959, setting the total funding at \$18 million for that period. Subsequent changes, toward the end of that fiscal year, raised the total to \$22.8 million, but the approved effort included only the Phase I program and long-lead-time items for Phase II. As was true of Samos, Midas difficulties stemmed in large part from the reluctance of ARPA and DDR&E officials to accept Air Force estimates of the need for early operational systems. AFBMD in July 1959 was proposing a 12-satellite network in a 2,000 mile orbit in lieu of a

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20-satellite network at 1,000 miles, but even this less costly effort required some \$54 million in fiscal 1960 funding for the Phase III (operational) program which DDR&E thought far too optimistic. In August 1959, therefore, DDR&E authorized the Air Force to expend only \$46.9 million in fiscal 1960, and that only in Phases I and II, as against an Air Force request for \$114 million (including \$60 million for Phase III operational items).

Both the Air Staff and the Scientific Advisory Board vigorously protested the reduced funding and the technical pessimism that prompted it, but to no effect. A variety of AFPMO-proposed alternatives to the fund-limited development program met opposition based largely on OSD reluctance to concede the technical feasibility of Midas as then constituted. Although the Air Force recovered Midas program responsibility from ARPA on 17 November 1959, OSD imposed financial strictures kept program funding at the ARPA-approved level through the remainder of fiscal 1960.

The failure of Atlas-Agena separation negated the first Midas test launch (26 February 1960) and payload malfunctions invalidated the second trial (24 May 1960). Lacking other means of verifying the technical adequacy

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of Midas instrumentation, the Air force in June proposed testing some elements of the Midas subsystems in Discoverers. DDR&E approved the proposal but refused additional funds. The flights took place on 20 December 1960 and 18 February 1961, providing data which reinforced Air Force convictions concerning the validity of Midas technology but failed to convince DDR&E.

In September 1960, a group of specialists from the President's Science Advisory Committee (Panofsky Panel) probed into the ultimately supported Air Force viewpoints on Midas technical feasibility, but the absence of confirming test data induced continuation of the program limitations. Fiscal 1961 funding settled, in April 1961, at a level of \$107.4 million, and plans to ask for a substantial increase for the following fiscal year were currently shelved pending accumulation of substantive technical data from test flights. Midas III, launched on 12 July 1961, returned data for five orbits and then went dead when the solar power system failed--which confirmed DDR&E opinions that both infrared subsystem effectiveness and total system reliability were too low to support early operational status. Against an Air Force estimate that a satisfactory Midas system could be operational in 1964, DDR&E raised new, more basic issues which essentially brought into

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question the entire Midas concept. First, said DDR&E chief Harold Brown, the effectiveness of Midas against solid-fuel intercontinental ballistic missiles was quite dubious, and second he questioned whether five to twenty minutes of advance warning was worth a \$500 million development program and \$100-\$200 million annual operating expense. The questionable sensitivity of the Midas system to submarine-launched missiles was another factor in the reconfirmation of decisions to keep Midas in a research and development status.

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Responding to these DDR&E views, the Air Force moved toward postponement of the operational program and further concentration on research and development, with emphasis on reliability and improved detection. In November 1961, when the results of a special DDR&E evaluation of Midas (Ruina Committee) became available, such a course virtually became inevitable. (Midas IV had functioned for more than 35 orbits following a 21 October 1961 launch but had not produced data contradictory of earlier findings.) AFSC therefore accepted the basic judgment of the Ruina Committee, that additional refinement was necessary in the total Midas system, and requested funding of approximately \$330 million for fiscal years 1962 and 1963 combined.

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Even that figure, however, was some \$35 million higher than the DDR&E recommendation.

Highly encouraging returns from Midas V, launched on 9 April 1962, reinforced a somewhat earlier Air Force opinion that the Midas techniques were sound and that discrimination was not the problem the Ruina Committee had thought. (Another failure in the power system after six orbits tended, however, to strengthen doubts concerning system reliability.) The Panofsky Panel, which reported to the President's science advisor a week after the Midas V launch, found a different meaning in the recent events and highlighted all the questions earlier posed by DDR&E: limited sensitivity, technical inadequacy, decreasing value with time, and defects in program management.

Although DDR&E did not accept uncritically all of the Panofsky Panel findings, the agency nonetheless began to lean toward a rigidly limited research and development effort within the earlier proposed \$290 million FY 1962-1963 ceiling. Air Force suggestions of early multiple-Midas tests, advocated at intervals during the summer of 1962, uniformly met rejection at the DDR&E level. A new blow to the program came late in July, with

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completion of a DDR&E review that highlighted earlier findings on the operational limitations and technical uncertainties of Midas.

Although the matter of discrimination effectiveness never quite vanished, Midas actions and decisions from July through September 1962 essentially revolved around the matter of requirements. The July DDR&E review (Skifter Committee) had emphasized the view point that the need for early warning would decrease with time. On 6 August, Defense Secretary McNamara generally endorsed that viewpoint in a directive reorienting the Midas program radically toward research and away from any implication of early operation. Although Secretary Zuckert, General LeMay, and General Schriever bitterly contested that judgment, they succeeded only in securing McNamara's agreement to a new and detailed analysis of all requirements for early warning. Thus Midas, in four years, had come full circle and was again being veighed against both feasibility and requirements criteria.

Apart from BRATS, which occupied its own special limbo during most of 1958, Dyna Soar was the only pre-1958 Air Force space system development that did not owe its origin to the WS 117L program. At the time that contractors were selected for the Phase I Dyna Soar effort, in June 1958, the Air Force

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believed its program to be on sound footings. Almost immediately, however, plans to conduct a thorough Phase I study ran afoul of Bureau of the Budget judgments that no requirement for Dyna Soar existed and ARPA attempts to acquire project custody. Not until April 1959 were both of these issues satisfactorily resolved and the funding requested a year earlier actually approved. Less than six months later, funding uncertainties again became prominent features of the Dyna Soar program; OSD in October 1959 cancelled all fiscal 1961 allocations. The rationale for the actions was the Air Force failure to define either a management structure for the program or a suitable booster development to support it. The problem of ARPA dominance having been disposed of earlier, the prospect of a transfer to NASA took its place. Nevertheless, by November 1959 Boeing had been selected as the experimental glider-vehicle contractor and Martin as the booster development contractor. The trend toward considering early Dyna Soar development to be primarily an aerodynamic research program rather than the first step in development of a military system gained velocity early in 1960, together with a continuation of the limited funding arrangements earlier apparent.

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Approval of the detailed configuration developed in Phase Alpha of the Dyna Soar effort and the concurrent release of funds for the start of actual development came in April 1960. By the end of the year, the Air Force had adopted the position that Dyna Soar represented the best current approach for investigating the usefulness of manned military space missions and had begun urging that early tests be aimed at attainment of an orbital capability. The DDR&E viewpoint, more conservative, was that technical and financial risks were too great to support such an approach. Some of the uncertainty arose from the fact that Dyna Soar plans were relatively well advanced before the definition of Titan III design had progressed much past initial consideration (August-October 1961). Additionally, starting in March 1961, an undercurrent of controversy at several levels resulted from a confrontation of aerodynamic-approach-to-space advocates with a group that favored a "ballistic approach"--essentially reliance on lifting body ballistic configurations. Opposed to the ballistic approach (which involved a manned satellite interceptor-inspector proposal as well as a lifting-body alternative to Dyna Soar) were groups who had enthusiastically supported early (1959-1961) proposals for the development of Aerospace Plane--a "one-stage-to-orbit"

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vehicle which would collect and condense free air during one phase of its climb and use the liquified oxygen with stored hydrogen to produce rocket thrust during its final climb to low orbit.

One of the critical problems the Air Force faced was deciding which--one or more--of the several potentially feasible approaches to manned military space operations should be supported. Each was an enormously expensive undertaking, and in view of the many other demanding requirements for resources, funds, and technical skills it was apparent that the Air Force could not hope to carry all, or even most, to the demonstration stage. In having a substantial background of design work, Dyna Soar had some advantage over most of the others, particularly over Aerospace Plane, which was based largely on still unproved theories. Additionally complicating the equation at the time was NASA's progress in Project Mercury and the space agency's proposed but still unapproved Gemini program; both were based on ballistic injection into orbit, and in theory at least the Mercury and Gemini vehicles were intended to provide inputs for the eventual creation of any required military space system. Differences of opinion with AFSC over which approach to manned military space systems should be supported were reflected upward through the Air Staff and into the OSD realm.

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SAB studies completed in the fall of 1961 brought the basic problem into sharp focus. The lifting-body approach would cost an estimated \$2 billion, a paced Dyna Soar effort about \$2.6 billion, and an accelerated Dyna Soar about \$2.8 billion. One SAB group (Sherwin Board) advocated the lifting body program, but the parent SAB (acting through another ad hoc committee) tended to favor Dyna Soar as a means of achieving early orbital capability for man. Without specifying a single system, but generally supporting the aerodynamic approach as providing needed maneuverability, SAC in October restated the basic Air Force need for manned orbital military mission potential.

One effect of the general situation of late 1961 was a slowing in the pace of Dyna Soar development. At the same time, the problem of refining Titan III design passed upwards from AFSC and eventually was assumed by DDR&E. Inasmuch as Titan III was closely tied to Dyna Soar (the Air Force had decided to revoke requirements for Dyna Soar boost by Saturn C), the prospect of meeting earlier stated flight test deadlines became less favorable.

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In December 1961, the OSAF clarified the program by associating Dyna Soar with Titan III and defining an orbital objective for the boost-glide vehicle. However, it was equally clear that a test and experimental vehicle was intended rather than a prototype weapon system. The DOD-approved objective was attainment of a technological basis for a subsequent decision on the military role of man in space. Funds then allocated to Dyna Soar were sufficient to carry through assembly of the basic glider and pay for modification of a B-52 to carry it aloft for initial tests. July 1965 remained the goal for first orbital flight. Designation of the orbital vehicle as the X-20, on 26 June 1962, and a clarification of the close relationship between NASA and the USAF in the objectives of the X-20 program tended to resolve other uncertainties. Nevertheless, in the process of deciding on a final configuration for the Titan III standard space launch vehicle, DDER&E developed a design incompatible with the X-20 configuration as it then existed. Whether compromises could be made, either in the proposed launch pattern of Dyna Soar or in the propulsive elements of the Titan III solid-rocket strap-on complement, constituted a new problem. Changing the Dyna Soar design sufficiently to accommodate to the Titan III characteristics seemed, in September 1962, the probable course.

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Aerospace Plan^f remained in the advanced technology program although consideration of a system development had not been entirely discarded.

Nevertheless, substantial strides in appreciation and treatment of the substantial technical problems inherent in Aerospace Plane were made during 1962 even though the program was not substantially funded (\$7.6 million) for the fiscal year.

BRATS, the ballistic re-entry test system with antecedents extending back to 1956, had fallen into disfavor in early 1957 because of its suggestion of lunar applications. Attempts to revive it as BMTS (Ballistic Missile Test System) were unsuccessful through much of 1958, but in the period from June to September of that year USAF and NACA (not yet NASA) agreed on a simplified vehicle which would satisfy several of their outstanding test requirements.

A formal agreement for cooperative development signaled the start of a new phase for the former lunar probe proposal. As reconstituted, it became Hyper Environment Test System (HETS) in Air Force usage, but NASA called it Scout, and the USAF project people later applied the name Blue Scout to their version.

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The first NASA launch, on 1 July 1960, was followed on 21 September by an initial Air Force Blue Scout firing that took an instrumented package 16,600 miles into space. Over the next two years, the basic rocket, generally in a four-stage configuration but sometimes with as many as five stages, served a multitude of "workhorse" functions for both NASA and the Air Force. Standardization actions begun in 1961 led to a basic configuration adaptable to a variety of missions. Although in some respects the reliability of Blue Scout was less than desired, launching programs involving 45 to 55 vehicles each year had been approved by October 1961. Through fiscal 1963, the program cost the Air Force approximately \$17 million.

Far more complex and enormously more costly than the small solid-rocket Blue Scout, but with a somewhat similar objective, was the large solid rocket program which, with marked fluctuations in emphasis and schedules, remained in the proposal stage through most of the 1960-1962 period. Air Force determination to provide large-booster capability against the ultimate emergence of a military requirement for a specific application had prompted extensive solid-fuel research as early as 1958. One program led ultimately toward the Titan III--a workhorse space booster incorporating a liquid-rocket

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"core" (modified Titan II) plus strap-on solid boosters. Combination of NASA and USAF general requirements, and attempts to find a compromise program objective acceptable to USAF, NASA, and DDR&E had also led, by late 1962, to a dual-size program involving the proposed development of a 156-inch-diameter and a 260-inch-diameter segmented solid motors. Application either to the NASA-managed lunar landing program or to still undefined military space missions had not been decided, and probably would not be until considerably more progress in both technology and clarification of boost requirements had been completed.

In the area of communications, a matter of consuming interest to the Air Force, again a situation involving several agencies with discrete requirements complicated the attainment of Air Force objectives. Although the Air Force provided a constant stream of studies, proposals, and recommendations in the entire period from 1958 through 1962, the main course of events was channeled through the Advent program with some attention to a passive communication technique, Westford (originally Needles).

Westford, the dispersion of dipoles in a pair of reflective belts in equatorial and polar orbits, encountered obstacles arising from political

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objections to the scattering of particles that might obstruct either astronomical observations or electronic emitters. Neither of the initial attempts (October 1961 and April 1962) to establish a temporary belt of dipoles succeeded, largely because of technical difficulties but also, in the latter attempt, because of the possible implications of misplacing the dipoles. Proposals for Westfor II, involving the use of individual Westford vehicles rather than piggyback flights on Midas satellites, were being considered late in 1962. The prospect of success for Westford II seemed much higher than for its predecessor.

Advent was the single survivor of a 1958 program which had originally included three approaches to the solution of Air Force communications problems. DER&E rules, in February 1960, that these should be subordinated to a single approach having as its goal the establishment of a 24-hour synchronous satellite adapted to microwave communications. Virtually the only element of the subsequent program that approximated either time or funding schedules was the Atlas-Agena launch vehicle. The communications package (developed by the Army Advent Management Agency) substantially outgrew its weight limitations and routinely drew more money from program sponsors than

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had been programmed. The Centaur upperstage vehicle intended to carry the eventual synchronous-orbit satellite to its place 23,000 miles from earth was plagued by slipping schedules, degraded thrust, and cost overruns. Cancellation, first of the Phase II and Phase III elements of Advent, and then in May 1962 of the satellite, effectively terminated the program.

Concurrently with the end of Advent activity, the Secretary of Defense assigned to the Air Force responsibility for the development, procurement, and launch of DOD communication satellites, and to the Army responsibility for the development and operation of the ground facilities, with both services reporting to the Defense Communications Agency. Immediately, the Air Force began work on a new 24-hour communication satellite as well as a random orbit system. Both, however, were designed for microwave communication and the Air Force continued to urge development of a system better suited to UHF channels.

/ Although there was concern for certain facets of specialized space technology, particularly the development of auxiliary nuclear power sources (Snapshot) and the creation of devices that could sense nuclear explosions in space (Vela Hotel), neither of these projects occupied a prominent place

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in the gamut of Air Force space programs. Similarly, from 1958 onward, the Air Force spent considerable effort in the attempt to create an effective counterweapon to ballistic missiles. The principal program, Bambi, was actually an ARPA project entrusted to the Air Force. Prospectively huge expenses and considerable technical uncertainty kept the project in a study status through 1962. SCWP--Space Counter Weapons Program--a rather more ambitious Air Force investigation of the same area, also remained in existence as a low-funding-level study.

The Air Force had always placed intensive, almost compulsive, attention on a man-in-space capability. It was impossible to build judgment-computers, and if military operations expanded into space, as events indicated they certainly would, man would be an indispensable ingredient of that expansion. The numerous experiments of the 1940-s and early 1950's--at the aeromedical laboratories at Wright-Patterson and Holloman and at the School of Aviation Medicine in Texas--wer pre-Sputnik activites aimed at this eventual goal. Immediately after Sputnik, the Air Force defined comprehensive plans for man in space, but these were taken over in short order by ARPA and NASA, following their establishment, And political expediency also forced Dyna Soar

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degradation from orbital to suborbital status. In the next few years, all that remained to the Air Force was experimentation, primarily of a bioastronautical nature, using its laboratory facilities, rocket probes, and "piggy-back" rides on ballistic missiles and Discoverers. This activity supported man in space technology effort but still kept the Air Force from direct participation in obtaining the capability.

In May 1961, following within weeks of the Russians' first orbiting man in space flight, the Air Force proposed National Space Program received Presidential approval. The principal objective, hopefully to be met by 1967, was to get men to the Moon and return them safely to Earth. This would require a large share of available R&D resources and capability--military and non-military--to insure success. Obviously a very likely and important byproduct, and one the Air Force envisioned in making its proposal, would be a military man in space capability. In the subsequently prepared USAF Space Plan of September 1961, which dovetailed into the National Space Program, man in space projects had a prominent part.

There were five major segments to the proposal. The first and most immediate was to upgrade Dyna Soar from a suborbital to an orbital test

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vehicle and hasten its development. A second involved expansion of the bioastronautics program, to be conducted jointly with or complementary to that of NASA. The third called for active participation of the Air Force in NASA's Apollo program (lunar expedition). Yet another featured the reorientation and expansion of Saint to include a manned capability for rendezvous, docking, and transfer. The final segment called for a broadened design study and experiment effort preliminary to the selection of configurations for manned spacecraft and long duration military test stations.

The next step, an all-important one, was to convince the Secretary of Defense and his technical advisors of the utter necessity for supporting NASA in the national space objective and, also, for obtaining man in space performance capabilities with characteristics peculiarly unique to military operations. This was done in the form of a recently popularized OSD, innovation, the White Paper. The White Paper on the Air Force Manned Military Space Program went to Secretary McNamara on 17 November 1961. It emphasized the requirements of both the national and military space programs, outlined a plan of mutual support between NASA and the services--the Army and Navy, as well as the Air Force--and listed specific project proposals. In the

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interim, while awaiting official OSD reaction, the Air Force in close coordination with DDR&E undertook to cement a well integrated and mutually supporting program with NASA and readied an expanded program of its own.

On 22 February 1962, McNamara made his long awaited reply to the White Paper. He conceded that an investigation of the role of "military man in space" was essential to the national security and should be conducted as an integral part of the national program. He observed, however, that clearly defined military manned space missions were still lacking. The logical and economical course of action, therefore, was to limit the current effort to gaining the technological base and experience to expand from, when and if firm missions became established.

The Secretary then directed a four-pronged approach to satisfy his limited objectives. As the Air Force had proposed, Dyna Soar could proceed directly to orbital flight. A comprehensive cooperative DOD-NASA program on manned rendezvous (using both Saint and Gemini) was also allowed, as was a similarly conducted effort on bioastronautics. The fourth major point was substantially although not completely in agreement with the Air Force's proposal. Recognizing the requirement for a space laboratory for sustained

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testing of military men and equipment in the actual environment, McNamara also recognized that its development depended upon data yet to be obtained in other portions of the program. He therefore restricted activity on the space laboratory (known as MODS - Military Orbital Development System) to the study of the basic "building blocks."

Thus, the Air Force acquired authorization to proceed toward a limited man in space program. Programming and funding requirements were submitted to OSD piecemeal in the form of program packages and program change proposals, in the Chief of Staff's fiscal 1963 fund augmentation request of May 1962, and in the Five-Year Space Program that Secretary Zuckert sent forward on 5 November 1962. The start of meaningful development, however, would have to await OSD approved decisions accompanied by the release of funds.

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GENERAL SPACE CHRONOLOGY

- 8 Feb 54 The Rand Corporation's "A Revised Development Program for Ballistic Missiles of Intercontinental Range" was published. The study indicated that an operational capability for the Atlas missile could be attained by the early 1960's if related performance requirements, increased funds, and higher priorities were assigned to the program.
- 10 Feb 54 Recommendations of Strategic Missile Evaluation Committee advised a reoriented and accelerated Atlas project. It was the committee's opinion that a beginning operational capability in long-range missiles could be attained within five to six years if proper management, funds, and priority were given to the program, and if missile performance characteristics were relaxed.
- 26 Feb 54 A contract to develop a sustainer rocket engine for the Atlas rocket was issued to North American Aviation Corp.
- 11 Mar 54 Trevor Gardner, Special Assistant to the Secretary of the Air Force for Research and Development, submitted a plan to accelerate development of an operational Atlas long range missile. The plan called for a preliminary operational capability (two launch sites and four operational missiles) by mid-1958 and an expanded capability comprising 20 launch sites by mid-1960.
- 19 Mar 54 AF Secretary Harold E. Talbott directed General Nathan F. Twining, AF Chief of Staff, to take all necessary steps to accelerate the Atlas project.
- 1 Jul 54 Western Development Division established at Inglewood, California, under the command of Brigadier General B. A. Schriever. The new organization was assigned full responsibility for accelerating the Atlas program.
- 8 Nov 54 Western Development Division was assigned responsibility to develop an intermediate range ballistic missile (Thor).
- 22 May 56 The AF awarded development of the 117L space system to Lockheed.
- 24 Jul 56 Air Force begins development of the Agena upper stage space vehicle.
- 21 May 57 ARDC General Orders No. 19, effective 1 June 57, redesignated Western Development Division, Headquarters ARDC, as Air Force Ballistic Missile Division.
- 4 Oct 57 The Soviets orbit Sputnik I.

6 Jan 58 Lockheed proposes to accelerate the 117L program by using Thor boosters and 117L (Agena) upper stages.

29 Jan 58 AFBMD issues a contract to Lockheed covering Thor-boosted test vehicles in the basic 117L configuration.

31 Jan 58 The Army launched into orbit Explorer I, the first US satellite placed in orbit. A Jupiter C missile was used as a booster.

3 Feb 58 President Eisenhower directed the highest and equal national priority be accorded development of the intercontinental and intermediate-range ballistic missiles (ICBM, IRBM) and the 117L military satellite system.

3 Feb 58 AF headquarters revealed tentative plans to use Thor boosters to orbit instrumented satellites in support of the 117L program.

7 Feb 58 DOD Directive 5105.15 assigned authority to the Advanced Research Projects Agency (ARPA) to assume responsibility for all DOD space programs during research and development phase.

12 Feb 58 AFBMD established a deputy commander for Military Space Systems.

27 Feb 58 ARPA assumed direction of the 117L program

28 Feb 58 ARPA stated its awareness of AF interest in developing a manned space flight capability.

3 Mar 58 OSD approved acceleration of the 117L program, including the launch of test vehicles using the Thor booster.

6 Mar 58 ARDC commander requested AFBMD assistance in preparing a development plan for a manned satellite test system.

31 Mar 58 AFBMD is instructed to prepare a development plan for a military space system program leading to a manned flight to the moon and return.

7 Apr 58 AFBMD published a "Lunar Probe Program Development Plan" for a series of three moon flights scheduled in the fall of 58.

25 Apr 58 AFBMD prepared a "USAF Manned Military Space Systems Development Plan," the first of seven such plans prepared during 58.

22 May 58 Biomedical experiments are added as a secondary objective in from three to five of the planned Thor boosted 117L flights.

28 May 58 AFBMD Man in Space development plan proposed use of an Atlas booster and Agena second stage to place a man in an 150 nautical mile orbit during October 60.

18 Jun 58 AFBMD began to identify positions and recruit personnel for a space program.

19 Jun 58 GOR 140 established an AF requirement for a satellite tracking and control system and a satellite defense system.

30 Jun 58 ARPA advised AFBMD that the OSD had assigned full responsibility for management of the 117L development program to ARPA.

Jul 58 AFBMD began preliminary arrangements to establish a special military unit equipped with C-119J aircraft and trained for aerial recovery of 117L data capsules returned from orbit.

11 Jul 58 ARPA requested AF headquarters to direct ARDC to prepare an abbreviated development plan for a communications satellite.

29 Jul 58 National Aeronautics and Space Act creates National Aeronautics and Space Council and the National Aeronautics and Space Administration (NASA).

1 Aug 58 6593rd Test Squadron (Special) organized at Hickam AFB, Hawaii.

5 Aug 58 Total number of Thor-117L vehicles on order is extended from 10 to 19.

17 Aug 58 The first Able-1 lunar probe vehicle is launched from AMR. The Thor booster exploded 74 seconds after launch.

26 Aug 58 Commander ARDC informed the AF Vice Chief of Staff, General C. E. LeMay, that because of increased AF interest in military space programs he had instructed AFBMD to establish and man an organizational element for space systems development.

10 Sep 58 ARPA separated Midas, the infrared attack alarm system, from the 117L program.

11 Oct 58 A second lunar probe, Pioneer I, was launched from AMR. Although the payload did not reach escape velocity it set a new altitude record of 71,700 statute miles.

22 Oct 58 ARPA informed the AF of its plans to develop a satellite communications system. The Army was to develop the communications payload and the AF the booster and satellite vehicle.

17 Nov 58 ARPA ordered design and construction of the first 117L launch complex at Point Arguello.

4 Dec 58 ARPA directed Thor - Sentry launches be managed as a separate program called Discoverer.

9 Dec 58 NASA requested AFMMD to procure, modify and launch nine Atlas Series D missiles for manned "Project Mercury" program.

18 Dec 58 Project Score, a complete four-ton Atlas with a communications repeater satellite, was placed into orbit broadcasting to the world a Christmas message from President Eisenhower.

28 Jan 59 ARDC assigned management of System 609A, "Blue Scout" test rocket, to AFMMD.

29 Feb 59 Discoverer I successfully boosted an Agena satellite into a polar orbit.

6 Apr 59 6594th Test Wing organized at Palo Alto, California.

25 Apr 59 Major General B. A. Schriever is promoted to Lieutenant General, relieved as commander AFMMD, and assigned as commander ARDC. Brigadier General O. J. Ritland is assigned commander AFMMD.

1 Jun 59 Operational control of the 6593rd Test Squadron (Special) was assigned to 6594th Test Wing. ARDC established 6594th Launch Squadron at Vandenberg AFB which was also assigned to the 6594th Test Wing.

9 Sep 59 The first Project Mercury test flight vehicle, an Atlas topped by a NASA developed flight capsule, was successfully launched from AMR in a ballistic trajectory.

21 Sep 59 OSD assigned all responsibility for developing and launching all military space boosters and associated systems integration to the Air Force.

17 Nov 59 Discoverer, Samos and Midas programs were approved for transfer from ARPA to AF management.

11 Mar 60 Thor Able-4 (Pioneer V) was launched from the AMR. A highly successful deep space probe revealed new and valuable scientific data and demonstrated feasibility of communications over interplanetary distances.

1 Jul 60 NASA's Scout 1 (basically the same vehicle as the AF's Blue Scout), carrying vehicle instrumentation, was successfully launched on a ballistic trajectory.

1 Jul 60 The government chartered non-profit Aerospace Corporation began replacing Space Technology Laboratories in furnishing technical staff assistance, advanced systems analysis, administrative and technical support services and general systems engineering and technical direction to AF space programs.

10 Aug 60 Discoverer XIII was launched from Vandenberg AFB, orbited and successfully recovered on 11 August after 17 passes. This was the first recovery of an orbiting payload from outer space.

18 Aug 60 Discoverer XIV was launched from Vandenberg AFB. After the 17th orbit the payload ejected on command to be recovered in mid-air over the Pacific by an AF crew flying a C-119 "Flying Box Car."

26 Aug 60 Discoverer program was increased to a total of 41 launches.

20 Oct 60 6565th Test Wing was organized at Vandenberg AFB and assigned to AFEMD.

Mar 61 General Thomas D. White awarded the MacKay Trophy for 1960 to the 6593rd Test Squadron (Special), Hickam AFB, Hawaii, for the squadron's work in recovery of Discoverer payloads returned from orbital space flights.

6 Mar 61 OSD assigned the AF exclusive responsibility for the development of military space systems and vehicles, and launching operations.

1 Apr 61 Effective date for establishing Air Force Systems Command, Deputy Commander for Aerospace Systems (DCAS), Space Systems Division (SSD), and Ballistic Systems Division (BSD).

1 May 61 AF Secretary E. M. Zuckert forwarded to the Secretary of Defense a proposal for a long term national space program.

25 May 61 President J. F. Kennedy announced that manned lunar exploration was a national space objective and that NASA would conduct the program.

15 Sep 61 Director of Defense Research and Engineering (DDR&E) asked the AF to study potential usefulness of Titan II as a core for a standardized space launch vehicle (Titan III).

13 Oct 61 DDR&E authorized the AF to begin early actions for development of the Titan III (modified Titan II with strap on solid boosters).

20 Oct 61 AF headquarters directed SSD to begin expedited actions leading to Phase I of the Titan III program.

18 Nov 61 DDR&E approved the start of Phase I of the Titan III program "subject to availability of funds."

12 Dec 61 SSD completed preliminary contractual arrangements for Phase I development of the Titan III program.

Mar 62 The AF and AEC Joint Working Group schedule the first orbital flight of a nuclear power unit during September 63.

MIDAS

MIDAS CHRONOLOGY

1956 - 1965

1 Mar 56 Lockheed proposal, "Pied Piper Development Plan," submitted in the 117L competition included recommendations for a capability to detect ballistic missile launchings by means of satellite-borne infrared sensors.

20 Mar 56 An Air Force evaluation board proposed Lockheed as the 117L competition winner.

22 May 56 Hq USAF authorized WDD to announce Lockheed as 117L winner.

6 Sep 56 Lockheed completed and submitted to the Air Force a "Preliminary Study of WS-117L Warning System Against ICBM Attack" which called for 15 polar-orbiting satellites at an altitude of 1,000 NM with communication links to in-construction BMEWS. If development began at once, a prototype system for satellite testing and evaluation could be available in four years.

29 Oct 56 Air Force awarded prime contract on 117L to Lockheed (Contract AFO4(647)-97), calling for work on three different payloads - one being an advanced version for infrared detection of ballistic missile launchings.

20 Dec 57 Preliminary design of 117L subsystem G (ICBM Attack Alarm System) in process and completed on this date.

30 Apr 58 NORAD expressed interest in development of infrared detection as an air defense attack alarm system. Hq USAF informed NORAD that it was seeking to accelerate the entire 117L program. (Ltr, Maj Gen M. S. Carter, C/S NORAD to C/S, USAF, subj: Alternate Means of Detection for ICBM, 30 Apr 58; ltr, Gen C. E. LeMay, VC/S, USAF to CINCNORAD.)

19 May 58 ARPA assumed management of 117L. (DOD Directive 3200.5)

10 Sep 58 ARPA directed separation of Subsystem G from 117L for reasons of budget justification and program management and requested preparation of a separate development plan. (Memo, R. Johnson, Dir/ARPA, to Cmdr, AFBMD, subj: Re-definition of 117L, 10 Sep 58.)

17-25 Sep 58 AFBMD issued a development plan, recommending acceleration of attack alarm system development. Fund requirements were estimated at \$45 million, \$55.3 million, and \$25.9 million in fiscal years 1958, 1959, and 1960. ARPA indicated agreement with the plan but lacked funds to support it.

25 Sep 58 ARPA imposed severe funding limitations on 117L, including the infrared subsystem. (Ltr, R. Johnson, Dir ARPA, to Cmdr, AFBMD, 25 Sep 58, subj: ARPA Ad Hoc Group on Project Sentry and Follow-on Program.)

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26 Sep 58 Hq USAF issued GOR 80-3, establishing a specific requirement for an infrared ICBM warning system.

10 Oct 58 AFBMD reported that Subsystem G funds would be exhausted by 17 October and that \$1.85 million was needed to continue through 15 December 1958. (Msg, WDZN-10-9-E, AFBMD to ARDC, 11 Oct 58.)

14-24 Oct 58 Hq USAF directed that development continue and that funds would be provided. On 22 October, Air Staff representatives met with ARPA and was sufficiently reassured that the project would continue. On 24 October, Hq USAF provided the required funds. (Msg, RDZGW-10-40-E, ARDC to AFBMD, 24 Oct 58.)

28 Oct 58 ARPA notified AFBMD that a directive would soon be issued continuing the infrared program, "formerly known as Subsystem G." The level of effort was to be kept at \$250,000 per month. (Msg, ARPA to Cmdr, AFBMD, 28 Oct 58.)

5 Nov 58 ARPA Order 38-59 redesignated Subsystem G as the Missile Defense Alarm System (MIDAS), made \$750,000 available for the three months between November 1958 and February 1959 and directed submission by 15 December of a development plan based on Thor boosted flight tests.

11 Dec 58 AFBMD informed Hq USAF that it needed \$9.3 million to continue MIDAS development between 15 Dec 58 and 15 Feb 59.

15 Dec 58 Hq USAF released \$1.5 million for 15 Dec-15 Jan period.

14 Jan 59 Hq USAF released \$1.5 million for 15 Jan - 15 Feb period. (Msg, 47654, USAF to ARDC, 14 Jan 59.)

30 Jan 59 AFBMD issued the MIDAS Development Plan for accelerating and expanding Subsystem G into a full-scale system effort. It contained three phases:

Phase I - 4 Atlas/Agena flights from Atlantic Missile Range between Nov 59 and May 60 at altitudes of 300-400 miles.

Phase II - 6 Atlas/Agena flights of the prototype system from VAFB between July 60 and May 61 in polar orbits at altitudes of 1,000 miles.

Phase III - Operational flights, beginning with two in July 61 and three per-month thereafter until the contemplated network of 20 satellites in polar orbit reporting to three ground stations was obtained. To achieve the objective schedule would require \$37.25 million in fiscal year 59 and \$99.9 million in fiscal year 60.

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- 21 Feb 59 Dr. H. F. York, DIR&E, determined that the MIDAS program was in general "highly desirable and authorized Phase I to proceed as expeditiously as possible." He disallowed work on Phase II and III, however, except for advance procurement of Atlas and Agena vehicles for Phase II. Dr. York allowed \$14.2 million for Phase I in fiscal year 59 (the amount requested in the Development Plan) plus \$2.6 million for the Phase II long lead items as opposed \$11.8 million requested for Phase II. York then requested SOD to supply \$6 million from emergency funds to make up the difference between what ARPA had on hand and what York had authorized. York took no action on Phase III for fiscal year 59 or on any aspect of the fiscal year 60 funding requests. (Memo, H. F. York, DIR&E, to SOD, 21 Feb 59, subj: FY-1959 Emergency Fund Allocation to ARPA for the Missile Defense Alarm Satellite (MIDAS) Project.)
- 20 May 59 Amendment 4, ARPA Order 38-59 fully funded the approved fiscal year 59 Phase I and the limited long-lead procurement on Phase II for a total of \$22.8 million.
- 10-16 Jul 59 With the start of a new fiscal year and no decisions, AFEMD and ADC appealed to Hq USAF for "vigorous and immediate action." However, the matter was beyond the scope of Air Staff authority. (Msg, WDWZM-7-2-E, AFEMD to Hq USAF, 10 Jul 59; Msg, ADLAN-W-5-76, ADC to Hq USAF, 16 Jul 59; Msg, 43, -900, Hq USAF to AFEMD, 16 Jul 59.)
- 15 Jul 59 AFEMD issued a new development plan. It proposed use of a 12-satellite network in a 2,000 mile orbit in lieu of the 20-satellite network at 1000-mile altitudes, thereby simplifying the system and easing schedule and cost problems. AFEMD asked ARPA to supply \$37 million and the Air Force \$77 million during fiscal year 60, of which \$60 million would be used for Phase I and II and the remaining \$54 million for Phase III.
- 11 Aug 59 Dr. York stated that Midas technical feasibility, especially lifetime and reliability aspects, had to be proved through actual demonstration before he could approve the entire plan. This could be done only at some point beyond Phase I, so York approved Phase II and allowed the use of ARPA's \$18 million and USAF's \$28.9 million for Phase I and II in fiscal year 60. Pending attainment of component reliability and lifetime objectives, York withheld release of funds and construction of facilities for Phase III. This effectively reoriented the program from system to component development and replaced the Air Force "concurrency" plans with a "fly before you buy" approach. (Memo, H. F. York, DIR&E, to Dir ARPA, 11 Aug 59, subj: Midas Program.)

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15 Sep 59

General Schriever, noting the urgent requirement for Midas and expressing confidence in overcoming any development problems, asked the Chief of Staff, General White, to intercede with York to allow the use of Air Force money for both the development and operational phases. Against a fiscal year 60 requirement of \$109.7 million, only \$46.9 million had been approved. General Schriever foresaw a delay of at least one year in the IOC at the current level of effort. (Ltr, LtGen B. A. Schriever, Cmdr, ARDC, to Gen T. D. White, C/S, 15 Sep 59, no subject.)

18 Sep 59

Secretary of Defense McElroy stated his intent of transferring responsibility for Midas from ARPA to the Air Force in the near future and asked for development, operations and logistic plans prior to such transfer. (Memo, N. McElroy, SOD, to JCS, 18 Sep 59, subj: Coordination of Satellite and Space Vehicle Operations.)

2 Oct 59

AFEMD submitted a brief outline development plan in response to ARPA's 26 August directive. The plan was based on an expenditure of \$46.9 million for fiscal year 60. (Msg, WDZSM-10-1-E, AFEMD to Hq USAF, 2 Oct 59.)

13 Oct 59

With prospects for increased funding in fiscal year 61, Hq USAF directed ARDC to prepare a development plan based on a Midas operational capability in 61. (Ltr, Gen C. E. LeMay, C/S, to Cmdr, ARDC, 13 Oct 59, no subject.)

Oct-Nov 59

Extended discussions on managerial, technical, and financial aspects at the DIR&E-OSAF level preparatory to effecting program transfer. Tenor of these discussions was that DIR&E was still doubtful of Midas technical feasibility and that Administration austerity policies allowed only \$261.6 million in fiscal year 61 for Discoverer-Samos-Midas programs (as against \$267 million in fiscal year 1960). (Memo for Record, Maj H. H. Howard, Dir/AT, 6 Nov 59, subj: Samos, Midas, and Discoverer Programs; ltr, BrigGen H. A. Bouskey, Dir/AT to DCS/D, 9 Nov 59, subj: Daily Information Item.)

6 Nov 59

The Air Force asked OSD to transfer Midas to the Air Force, promising to submit by 15 December the plans called for in McElroy's 18 September directive.

17 Nov 59

OSD transferred the Midas program responsibility to the Air Force. (Memo, T. S. Gates, Deputy SOD to FAF, 17 Nov 59, subj: Transfer of Midas program to the Department of the Air Force.)

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Mid-Dec 59

AFBMD briefed the Air Staff, AFPMC and DDR&E on two development plans, both dated 1 Dec 59. One, designated the "requirements" program would result in a January 1963 operational capability. It would require an additional \$20 million in fiscal 60 (for a total of \$68.9 million and \$89.1 million in fiscal 61 for development plus \$84 million in fiscal 60-61 production and construction funds. The second plan, based on York-Charyk guidance on funding, contained no scheduled operational date but would be in 1964 or later and would result in a flight-test stretch-out elimination of all back-up components and subsystems. (Midas Dev Plans, 1 Dec 59; Minutes of 42nd AFPMC meeting, 14 Dec 59.)

30 Jan-14 Feb 60

AFBMD's Midas Development Plan, dated 15 January 60, briefed to the Air Staff, OSAF and DDR&E. Because Samos and Discoverer possessed higher priority, these two were funded at minimum essential levels and the remainder of the combined ceiling figure was left for Midas. This left only \$31.1 million in fiscal 60 and \$41 million in fiscal 61 for Midas--an almost totally disruptive action. AFBMD therefore included an addendum to bring the plan up to a "minimum essential research and development program." This would require \$51.7 million and \$106.8 million respectively for fiscal years 60 and 61. This would cover development and completion of test flights by July 62. The Weapons Board and AFPMC both concurred in the "minimum essential" plan and the latter proposed to obtain the required \$20.6 million for fiscal 60 from OSD emergency funds.

AFBMD also presented the Midas development-operational plan, dated 15 January 60, as earlier directed. It was in fact an Air Force attempt for some degree of concurrency, with an IOC date of April 63. There would be joint use of certain ground facilities by both Midas and Samos. Implementing the plan would cost \$24 million in fiscal 60 and 61. (Minutes of the 45th AFPMC Meeting, 10 Feb 60.)

18 Feb 60

Dr. Charyk formally requested DDR&E approval of the 15 January Midas development plans and noted Air Force willingness to reprogram for the development-operational plan. (Memo, J. V. Charyk, U/SAF to SOD, 18 Feb 60, subj: Transfer of the Samos, Midas, and Discoverer Programs.)

26 Feb 60

Midas I (Atlas-Agena A) launched successfully from AMR but a malfunction at Atlas-Agena separation caused destruct system activation.

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20 Apr 60

Dr. York approved in principle the Midas development plan of 15 January 60 but ruled that finite funding would depend on the outcome of the Air Force air defense readjustments and congressional budgetary actions. Thus, for the first time since March 59, the Air Force had an officially approved Midas program plan. York took no action on the development-operational plan primarily because OSAF and OSD officials still had grave doubts on the reliability and lifetime of Midas satellite components. (Ltr, H. F. York, DDR&E to SAF, 20 Apr 60, subj: Samos, Midas and Discoverer Research and Development Programs.)

24 May 60

Midas II (Atlas-Agena A) launched from AMR into almost perfect circular orbit but malfunctions in payload subsystems forestalled collection of infrared data in the desired spectral region.

23 Jun 60

Because Midas III was not expected to be ready for launching before the end of February 61, the Air Force sought other means in the interim to obtain essential readings of the earth's radiation background. On 23 June 60, AFEMD presented a plan to the AFEMC in which radiometers would be placed in Discoverer satellites for polar launching during September and December 60. (Minutes of 51st AFEMC Meeting, 23 Jun 60.)

15 Jul 60

AFBMC approved AFEMD's proposal to conduct two radiometric launchings with Discoverer vehicles, scheduled to September and December 60. (Minutes of 54th AFBMC Meeting, 15 Jul 60.)

19 Aug 60

DDR&E approved the two radiometric flights but would not permit supplemental funding. (Memo, H. F. York, DDR&E to SAF, 19 Aug 60, subj: Midas Radiometric Flights.)

24 Oct 60

AFEMD issued a revised development plan, as directed 1 June. It tended to combine the previous development plan with the development-operational plan and more adequately emphasized the system development approach in lieu of vehicle development. The flight test program would consist of three series: Series II - flight test of satellite; Series III - flight test of vehicles in conjunction with ground-based system equipment, and Series IV - flight testing of the complete system prototypes. The test program would consist of 18 instead of the 1- scheduled flights to insure confidence and reliability and to evaluate alternate approaches. An operational capability would be attained in August 63. The program would require \$132.4 million in fiscal 61 in lieu of the \$106.8 programmed and \$196.9 million instead of \$112.5 million in fiscal 62.

2 Nov 60

The Weapons Board concurred in the Midas development plan of 24 October but proposed that the fiscal 61 addition of \$25.6 million be deferred until the following year. Thus the \$106.8 million programmed for fiscal 61 would remain unchanged and the \$196.9 million for fiscal 62 would be increased to \$222.5 million. (Rpt of Weapons Board Meeting 60-62, 2 Nov 60.)

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- 4 Nov 60 The AFEM&SC in general approved AFEMD's development plan and the Weapons Board plan of financing. It also called for deletion of all references to operational fundings or capabilities. The committee asked for a revised development plan based on the above guidance. (Minutes of 62nd AFEM&SC Meetings, 4 Nov 60.)
- 3 Jan 61 AFEMD issued a new development plan. It emphasized research and development, called for an additional Series III flight test, and proposed the flight testing of advanced sensors in a Series V. Required funding was \$132.4 million in fiscal 61 and \$220.8 million in fiscal 62.
- 10 Feb 61 AFEM&SC reviewed revised 3 January development plan. It directed that construction of a Midas tracking and control center be deferred until after at least one successful Midas flight. The committee also directed that the development plan be revised in accordance with currently budgeted figures of \$106.8 million and \$201 million (RDT&E) for fiscal 61 and 62 respectively. (The \$201 million figure included a \$60 million add-on which President Kennedy submitted to Congress in March). (Minutes of 67th AFEM&SC Meeting, 10 Feb 61.)
- 31 Mar 61 AFEMD revised and published Midas development plan in accordance with the 10 February program and funding guidance.
- 18 Apr 61 Hq USAF authorized AFSC to implement a Midas program based on \$107.4 million (a .6 million increase) for fiscal 61 and \$201.1 million for fiscal 62. AFCS could proceed with work statements and negotiations for fiscal 62 up to but not including commitment. It was the intent not to ask AFEM&SC or DDR&E for approval of the 31 March plan until technical data from a successful Series II flight became available. (Msg, 63001, Hq USAF to AFSC, 18 Apr 61; ltr, ColH. W. Gainer, Dep Ch, Space Systems Br, to DCS's, Deps et al, 19 Apr 61, subj: Midas Development Plan.)
- 12 Jul 61 Midas III (Atlas-Agena B), first of Series II, launched in near circular polar orbit of about 1,850 nautical miles. Payload readouts were obtained for five orbits, although one solar array failed to extend. Satellite attitude was unstable after first orbit.
- 29 Jul 61 DDR&E Harold Brown informed Secretary McNamara that formidable technical and operational problems (IR effectiveness, reliability etc.) still existed and that informed opinion believed an effective system could be obtained no earlier than 1965-66 (Air Force thought by 64). Brown also questioned the need for the 5-20 minutes of additional warning, Midas marginal efficacy against Soviet Minuteman or Polaris type missiles, and the cost (\$500 million more for development and \$100 to \$200 million per year to operate). He stated

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He stated that he would organize a task group to consider all facets of Midas and concluded "it is not anticipated that the results of this study will result in a termination of the program; however, it is possible that a substantial redirection of the R&D program might appear desirable." Meanwhile the program should continue as currently planned. (Memo, H. B. Brown, DDR&E, to SOD, 29 Jul 61, subj: Ballistic Missile Defense of Continental U. S.)

18 Sep 61

AFSC stated that lack of approval of the 31 Mar 61 development plan and "holds on the TCC and Series IVB (system test configuration) satellite were causing a day-by-day schedule slippage since 1 July in both system testing and the IOC and making program planning extremely difficult. (Ltr, Col R. Nudenberg, Dir Sp Progs, AFSC, to C/S, 18 Sep 61, subj: Midas-31 March 1961 Development Plan.)

19 Sep 61

Hq USAF notified AFSC that DDR&E had formed the Ruina Committee to study the technical feasibility and future capabilities of IR detection, the reliability of the Midas system, and the method of use and value expected from Midas data. (Msg 63119, Hq USAF to AFSC, 19 Sep 61.)

18 Oct 61

Hq USAF informed AFSC that OSD, in its fiscal 63 budget review had reduced Midas R&D estimates from \$185 million to \$100 million and withheld approval of all operational aspects. Hq USAF wanted to know the impact on the program. AFSC replied that any IOC capability in 64 would be impossible and that much development and testing would have to be postponed or eliminated. AFSC asked for positive guidance as soon as possible. (Msg, 71413, Hq USAF to AFSC, 18 Oct 61.)

21 Oct 61

Midas IV launched into orbit with an apogee of 2,028 nautical miles and perigee of 1,895 nautical miles. Despite some attitude instability, payload data was obtained for 34 orbits before a solar array failure occurred.

14 Nov 61

Hq USAF learned Ruina Committee "draft" conclusions: Midas essential to SAC and other military and political requirements but that current program would not meet these requirements because of reliability and IR detection difficulties. Therefore, Midas should be reoriented, to include cancellation of Series IV prototype configuration and development of a "simplified" vehicle for random orbit, initiation of "advanced payloads" to obtain global warning against low-radiance rockets, and start a basic research and measurements program in support of both the "simplified" and "advanced" Midas development. (Ltr, Col J. J. Pellegrini, Midas Systo, to MajGen J. R. Holzapple, Asst DCS/S&L, 14 Nov 61, subj: Midas Ruina Committee Report (Rough Draft).)

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30 Nov 61

"Evaluation of Midas R&D Program" issued by the DDR&E Ad Hoc Group on Midas (Ruina Committee). Its findings were: Probably not effective against low-radiance rockets (solids); too complicated and unreliable; basic research and technology neglected; operational Midas not before 66 and perhaps later; program organization and management not equal to the size of its problems. Committee recommended drastic reorientation to design of simplified, reliable system, but withhold fabrication.

8 Dec 61

DDR&E formally forwarded a copy of the Ruina Report to the Air Force, noted its agreement with its contents, and directed the Air Force to "implement the recommendations" and submit a new development plan by 1 February 62. He also released an additional \$40 million--for a total of \$145 million in fiscal 62--but kept the remaining \$45 million in deferred status. (The \$201 million program had been reduced to \$190 million.) (Memo, H. B. Brown, DDR&E to SAF, 8 Dec 61, subj: Midas.)

28 Feb 62

AFSC representatives presented to the Senior Review Board their technical evaluation of the Ruina Report and recommended three development plan options for attaining an operational capability. The report was invalid in several particulars and, contrary to the report, the evaluation further showed that Midas was technically sound and that a simplified system could be operational before CY 66. AFSC recommended the third option--Plan C--which would emphasize R&D heavily and increase the number of flight tests - IOC in 1966. It would require \$330 million (against \$301 million originally budgeted) in fiscal 1962-63. The Senior Review Board also recommended Plan C approval and if the current ceiling of \$190 million in fiscal 62 and \$100 million in fiscal 63 was retained, Plan C should be adjusted accordingly. (Rpt of SRB Meeting, 62-21, 28 Feb 62.)

13-28 Mar 62

Series of discussions on Midas program held between Dr. McMillan, Air Force representatives and an ODDR&E group, leading to general agreement by DDR&E in the technical aspects of Plan C (\$335 million funding in FY 1962-63). The DDR&E representative informed the Air Force Dr. Brown was inclined to approve the reoriented program along the following lines: Deferral of construction at Ottumwa, Iowa; the Air Force would reprogram whatever funds would be required over and above the \$290 million required to support the reoriented program. (Memo, B. McMillan, ASAF (R&D), to VC/S, Hq USAF, 14 Mar 62, subj: Midas; Rpt of SRB Meeting 62-30, 28 Mar 62.)

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- 29 Mar 62 SSD published revised development plan, dated 29 Mar 62, which was responsive to directives of both DDR&E and AFSC. IOC of a simplified satellite would be between mid-65 and mid-66. Required funding was \$334 million in fiscal 62-63 against the currently programmed \$290 million.
- 2 Apr 62 AFSC formally submitted development plan to Hq USAF, noting that released funds of \$146 million would finance the program through mid-April 62. Thereafter, it required \$18.1 million for remainder of fiscal 62. (Ltr, Gen B. A. Schriever, Cmdr AFSC to VC/S, 2 Apr 62, subj: Letter of Transmittal, WS-329A (Midas) Development Plan.)
- 9 Apr 62 Midas V launched into orbit with apogee of 1,837 nautical miles and perigee of 1,510 nautical miles. There was a power malfunction on the 7th orbit but in the first 6 orbits great quantities of background data obtained and subsequent data reduction established feasibility of discrimination of rocket plumes against cloud background.
- 10 Apr 62 Dr. McMillan forwarded the 29 Mar 62 development to DDR&E for approval and at the same time requested immediate release of \$18.1 million to protect the program for balance of fiscal 62. (Memo, B. McMillan, ASAF (R&D), to DDR&E, 10 Apr 62, subj: Midas.)
- 16 Apr 62 The AICBM Panel (Panofsky Panel) of the President's Scientific Advisory Committee reported to Dr. J. B. Wiesner on its review of the Air Force's proposed reorientation in response to the Ruina Report. The Panel felt that Series IV flights were still conceived as operational prototypes; the sensors were not able to distinguish all missiles and that cloud interference was still a problem. (The Air Force said the actual evidence was to the contrary on both counts.) The value of early warning was decreasing and the Midas organization was still unsatisfactory. (Memo, W. K. H. Panofsky, AICBM Panel to J. B. Wiesner, Special Asst to the President for Science and Technology, 16 Apr 62, subj: Reoriented Midas Program.)
- 20 Apr 62 DDR&E noted his "general agreement" with the 29 March development plan as well as agreement with the points raised by the Panofsky Panel. He also deferred approval of the combined funding of \$334 million, although releasing the requested \$18.1 million. This brought the fiscal 62 approved funding to \$164.1 million as against the programmed \$190 million. (Memo, H. Brown, DDR&E to to ASAF(R&D), 20 Apr 62, subj: Midas Development Plan.)
- 28 May 62 Harold Brown, DDR&E, stated his view that if there was a limitation on Midas detection capability it was not clear whether a full-scale Midas development program even along the course proposed by the Ruina Committee was justified. (Memo, H. Brown, DDR&E to Service Secretaries, DASA, DCA, DIA, et al, 28 May 62, subj: Selective Review of Major Proposed Program changes.)

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8 Jun 62

AFSC issued a two-plan supplement to 29 March development plan in accordance with DDR&E's 20 April memorandum. Plan B supported Brown's request for a low-radiance capability and the use of the multi-satellite flight series (Series IV) for R&D. Plan B would require \$18.2 million additional in fiscal 64 and about \$14 million in subsequent years. AFSC recommended Plan B.

12 Jun 62

Secretary McNamara formed a group of eight under Dr. H. R. Skifter to study the importance of early warning, the implication of Soviet long-way-around launchings, and Midas growth potential. Shortly after, the C/S directed Directorate of Operational Requirements to prepare a similar study. (Msg DEF 91540, SOD to JCS, 12 Jun 62; memo, E. M. Zuckert, SAF to C/S, 13 Jun 62, no subject; ltr, Gen C. E. LeMay, C/S to SAF, 6 Jul 62, subj: Midas Program.)

25 Jun 62

Harold Brown remonstrated strongly over informal reports indicating that the Air Force was still preoccupied with an early IOC capability against Soviet Atlas type missiles. Despite the Midas V test results and other Titan II measurements, Brown still doubted whether USSR would have many of these and noted that answers to fundamental questions on low-radiation, high-noise background, and reliability were still lacking. He reaffirmed his position that Midas must "remain an R&D program oriented toward developing. . . techniques . . ." (Memo, H. Brown, DDR&E to ASAF(R&D), 25 Jun 62, subj: Midas System.)

3 Jul 62

Following a 29 June briefing on the 8 June supplement, Harold Brown indicated no significant disagreement, but on 3 July he directed that pending a more complete resolution of the Midas program, the level of effort should be reduced between July-September 62 to stay within the current \$100 million program for fiscal 63. (Msg, SSZMC-3-7-1, SSD to AFSC, 3 Jul 62; memo, H. Brown, DDR&E to SAF, 3 Jul 62, subj: Midas RDT&E Program.)

31 Jul 62

Dr. H. R. Skifter submitted to DDR&E the "Evaluation of Ballistic Missile Early Warning System," 10 Jul 62, prepared by his Ad Hoc Group on Ballistic Missile Warning. It recommended essentially that in view of Midas technical uncertainty and operational lateness, reliance should be placed on radar techniques for early warning during the 1962-66 period. (Memo, H. R. Skifter to H. Brown, 31 Jul 62, no subject.)

6 Aug 62

Secretary McNamara disapproved the 29 June PCP (see 3 Jul 62 item), attributing the reasons to late deployment (1966 at the earliest), the high cost (\$1 billion to complete and \$200-\$500 million to operate annually), the existence of

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other techniques to augment early warning capabilities, and the lessening worth of early warning in view of the strategic shift from manned aircraft to hardened missile sites. He thought that attainment of a technological capability in detection from satellites was highly desirable. He therefore directed the Air Force to:

- a. Drop all deployment plans.
- b. Reorganize program as an R&D effort to attain technological capability with emphasis on reliability, high detection probability, low false alarm rates, etc.
- c. Plan on a maximum of \$100 million in fiscal 63 and \$50 million thereafter.
- d. Submit a new development plan and PCP.

If Mr. Zuckert disagreed with the decision, he was asked to discuss it with McNamara before acting. (SOD Decision/Guidance 4.4.040, 6 Aug 62.)

13 Aug 62

General Schriever forwarded his views on McNamara's 6 August decision. He felt that Midas would add a necessary flexibility to our national defenses. Schriever strongly recommended that Mr. Zuckert urge McNamara reconsider his position and withhold a decision until the current Air Staff study on early warning requirement (due 15 August) and the new development plan were completed. (Ltr, Gen B. A. Schriever, Cmdr, AFSC to SAF, 13 Aug 62, subj: DOD Program Change.)

17 Aug 62

Secretary McNamara approved the Skifter Committee recommendations and directed the Air Force to take action on them. (Memo, R. S. McNamara, SOD to SAF, 17 Aug 62, subj: Warning Against Ballistic Missiles.)

22 Sep 62

Meeting on Midas with Secretary McNamara, Deputy Secretary R. L. Gilpatric, Dr. Brown, Dr. McMillan, General Schriever and other DDR&E, Air Staff, SSD, Lockheed, and Aerospace Corporation representatives in attendance. SSD presented the 8 June development plan, and its technical features were not challenged. Basically, the question of Midas future depended entirely on requirements. McNamara directed the preparation of a comprehensive study on early warning in qualitative and quantitative terms, systems to provide such warning, development plans, and cost estimates to gain the required capability. (Memo, B. M. McMillan, ASAF(R&D) to SAF, 25 Sep 62, no subject; Memo for Record, General B. A. Schriever, Cmdr, AFSC, 22 Sep 62, subj: Meeting with the Secretary of Defense, 22 Sep 62; Memo for Record, BrigGen R. D. Curtin, Dir/Adv Eng, 24 Sep 62, no subject.)

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25 Sep 62 In a postmortem meeting, Secretary Zuckert stated that extraordinary measures were required to prepare an Air Force position on early warning and directed formation of a special Air Staff group to do the work. Vice Chief of Staff McKee appointed LtGen D. A. Burchinal, DCS/P&P, to head the group. (461 SYSIO Activity Report, 27 Sep 62.)

27 Nov 62 The Air Force study on tactical warning was submitted to the Department of Defense. (Hist Rpt, 461 Dir, Jul - Dec 62.)

5 Dec 62 The DDR&E advised the Air Force that Midas funding for FY 63 should be planned toward a \$75 million ceiling, with \$35 million for FY 64, rather than the earlier plan for \$100 and \$50 million respectively. (Ltr, DDR&E to ASAF (R&D), 5 Dec 62, subj: FY 64 RDT&E Program.)

7 Dec 62 In replying to the 5 December DDR&E letter, Secretary Zuckert suggested that perhaps the Air Force Tactical Warning Study had not yet been reviewed by the Secretary of Defense. (Memo, Sec AF to SOD, 7 Dec 62, subj: Midas RDT&E Program.)

13 Dec 62 In answer to Secretary Zuckert's 7 December letter, the DDR&E advised that the Secretary of Defense had approved the budget changes of 5 December: reduction of program funding to \$75-\$35 million from \$100-\$50 million for the fiscal years 63 and 64. (Memo, DDR&E to Sec AF, 13 Dec 62, subj: Midas RDT&E Program; Hist Rpt, 461 Dir, Jul - Dec 62.)

17 Dec 62 Launch of a Midas vehicle was attempted on this date. After firm insistence by the Program Office over several months that the payload contractor follow strict quality assurance procedures and institute close management surveillance at the plant, the infrared sensing subsystem delivered for this flight test was by far the best in terms of low noise interference and high sensitivity ever delivered for Program 461. The Atlas 131D/Agna 1205 launch vehicle combination lost flight control at about 80 seconds after liftoff and assumed an angle of attack beyond aerodynamic loading limits, whereupon the booster broke up and exploded. (Hist Rpt, 461 Dir, Jul - Dec 62.)

19 Dec 62 Dr. J. V. Charyk, Air Force Under Secretary, asked for a reply from the DDR&E to the Air Force Tactical Warning Study. (Memo, SAFUS to DDR&E, 19 Dec 62, subj: Midas RDT&E Program, from Hist Rpt, 461 Dir, Jul - Dec 62.)

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28 Dec 62

R. L. Gilpatrick, Under Secretary of Defense, replied to Charyk's 19 December query by stating that the Department of Defense could not accept the recommendations of the Tactical Warning Study. Midas fund reductions were confirmed. (Memo, Under Sec of Def, to Sec AF, 28 Dec 62, subj: Midas, from Hist Rpt, 461 Dir, Jul - Dec 62.)

Jan 63

The Midas program began the new calendar year with a sharply reduced level of effort ordered by the Department of Defense. In the opinion of Roswell Gilpatrick, "... despite the fact that Midas can probably be made effective against ICBMs, and eventually, SLBMs its high cost and the existence of reliable and less costly alternatives combine to make it seem unwise to go forward with a high priority program such as you [the Air Force] recommend." The Department of Defense priorities were such that "... we must determine if the possible potential of the system can be, in fact, realized and realized at a cost that makes it competitive with other alternatives." Therefore, in addition to the reduction from the level of effort of 3 July 62 (the Air Force was then instructed to stay within a \$100 million ceiling for the fiscal year) on 31 December SSD was directed to reduce Midas financial support again, this time to a level of ~~1002~~ million for fiscal year 63. (Memo, Roswell Gilpatrick, Dep SOD, to SAF, 28 Dec 62, subj: Midas; ltr, Col Rodney Nudenberg, Asst Dep to Cmdr, Manned Space Flight, AFSC, to SSD, 31 Dec 62, subj: Program 461.)

Jan-Jun 63

The major program fund reduction of 28 December 62 and DOD program redirection resulted in an extensive stop work order to the prime contractor, Lockheed Missiles and Space Company (LMSC), reduction of numerous auxiliary program efforts, and on 4 February a partial termination of the LMSC contract. The revised program development plan provided for three experimental test series - radiometric flight test vehicles in lieu of the previously planned six development test series and the six system test series flight test vehicles. The revised development plan was approved by DOD on 12 April 63. In May, the decision was made to change the status of the payload contract from a sub-contract under the Lockheed prime contract to an associate contract. As a result of competition Aerojet-General Corporation, Azusa, California, was chosen as the payload associate contractor for the experimental test - radiometric series. When defined, the contract would be a cost-plus-incentive-fee contract, the incentive being cost and delivery. The cost would be approximately \$6 million including fee. (Hist Rpt, 461 Dir, Jan - Jun 63.)

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8 Jan 63

Air Force headquarters finally acknowledged the decision of the Secretary of Defense (embodied in the 28 December 62 letter from Gilpatrick) to reduce the scope of program 461 and limit funding to \$75 million for fiscal 63 and \$35 million for fiscal 64. SSD was directed to take certain specific actions to curtail and reorient the development program. Primary objectives were to be long life, high detection probability, low false alarm rate, and attitude stabilization. Full use was to be made of piggyback opportunities and cheap launch vehicles (cheaper than the Atlas-Agena combination, if possible). Therefore, AFSC was requested to submit a program change proposal and a revised development plan to Air Force headquarters no later than 1 February 63. (Ltr, AFRAE-S-1, SSD [Col J. Pellegrini] to Hq AFSC, 8 Jan 63, subj: Program 461.)

8 Mar 63

DDR&E approved SSD's Space Program Development Plan for the 461 program. Engineering effort would be applied to areas of sensor technology, attitude sensing and control power sources, communications and data link elements. The then current series of Atlas-Agena (SLV-3/01) flights were to end July 63. Four piggyback flights (aboard program 162 satellites) were scheduled through mid-64. These Atlas-Agena flights featuring radiometric sensor payloads were scheduled through the first half of 65. Thereafter an advanced flight test vehicle series was planned to begin April 66. These flights would use an SLV-2A booster (an advanced thrust augmented Thor), an Agena second stage, and the 461 orbital section. (Hist Rpt, Dep for Sys Mgt, 461 Dir, Jan - Jun 63.)

12 Apr 63

In a memo to the Assistant Secretary of the Air Force, Dr. Harold Brown (DDR&E) approved the 8 Mar 63, "Space Program Development Plan--Program 461." Beyond this approval Brown urged the Air Force to supplement the 461 R&D program with particular effort on the following points: (a) show how program 461 fitted into the total early warning environment; (b) investigate the possible use of program 461 other than for early warning--for example, to determine launch locations after the start of hostilities; (c) obtain the best estimate of payload life in orbit through cooperation with other space component reliability programs; and (d) maintain a close association with ARPA in regard to its detailed measurements program on background spacecraft and missile emanations. (Memo, H. Brown, DDR&E, to Asst SAF (R&D), 12 Apr 63, subj: Program 461.)

20 Apr 63

Action was initiated through Comptroller channels to release the balance (\$12.7 million) of fiscal 63 funds to continue the program as presently approved. Prior restrictions that had been placed on the program pending approval were removed. (Ltr, BrigGen R. D. Curtin, Dir of Adv Engrg, USAF, to Hq AFSC, 20 Apr 63, subj: Program 461.)

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May 63

During May a decision was made to change the status of the payload contract from a subcontract under Lockheed Missiles and Space Company to an associate contract. As a result of competition a contract was issued to the Astrionics Division of Aerojet General Corporation, Azusa, California. Work to define a cost-plus-incentive-fee contract valued at approximately \$6 million was underway. (Hist Rpt, Dep for Sys Mgt, 461 Dir, Jan - Jun 63.)

9 May 63

Flight VII, flight test vehicle 1206, was launched from Point Arguello. The satellite was placed in a 2,000 mile altitude, polar orbit. Payload system performance was excellent throughout the mission and vast quantities of high quality data were achieved. The system proved its ability to track missiles during flight. Nine cooperative targets were launched during the life of the flight: detection of Minuteman, Titan II, and Atlas E missiles were reported in real time to the Satellite Test Center and displayed on a standard digital display. The flight operated successfully for 46 days and decay of solar generated power ended the useful life of the payload on the 407th pass. (Hist Rpt, Dep for Sys Mgt, 461 Dir, Jan - Jun 63.)

12 Jun 63

Program 461 Flight VIII was launched from Point Arguello. The flight was terminated at approximately T plus 94 seconds due to failure of the booster hydraulic system. (Hist Rpt, Dep for Sys Mgt, 461 Dir, Jan - Jun 63.)

1 Jul 63

The 461 program office received an authorization of \$17.5 million for the first half of fiscal 64. One restriction placed on this money was that all of the SLV-3 money for fiscal 64 had to come out of this initial program authorization. (Hist Rpt, Dep for Sys Mgt, 461 Dir, Jan - Jun 63.)

3 Jul 63

In a personal message from General H. M. Estes, AFSC Vice Commander, to General B. I. Funk, Commander, SSD, the division was directed to undertake a complete re-evaluation of the 461 system and prepare a program plan for the best satellite-based infrared sensor system which would most significantly improve military capabilities. Also alternative plans showing the capabilities which reasonably could be expected from "lesser levels of system implementation" were to be prepared. Based on these related studies SSD was to recommend revisions to the 461 program leading to an operational system. The results of these analyses were to be presented at AFSC headquarters by 9 September. (Msg, DCMSF to SSD, SCGV-2-7-3, 3 Jul 63.)

18 Jul 63

Flight IX, Vehicle 1207, was successfully launched from Point Arguello. The satellite, placed in a 2,000 nautical mile orbit. The payload detected one cooperative launch

on orbit 66. The payload stopped operating during orbit 96 but certain telemetry signals were received through orbit 228. As in the previous successful launch, a program 861 propagation experiment and two tetrahedral satellites were ejected at orbital altitude. One of the tetrahedrons continued to operate satisfactorily through November 63. (Hist Rpt, Dep for Sys Mgt, 461 Dir, Jul - Dec 63.)

17 Sep 63

Negotiations were begun on the AF 04(695)-371 contract with Aerojet General Corporation, Astrionics Division, the payload associate contractor. This was a cost-plus-incentive-fee contract to supersede the letter contract issued 1 June 63; the initial contract cost was negotiated at \$7,237,787. This contract was definitized as of 31 Dec 63. (Hist Rpt, Dep for Sys Mgt, 461 Dir, Jul - Dec 63.)

13 Nov 63

AFSC headquarters informed SSD that, pending final decision on 461 objectives and funding level, program objectives should be diverted from that of radiometric experimentation to the development of an advanced detection payload capability against submarine launched and medium range ballistic missiles. (Msg, AFSC to SSD, MSFA 13-11-22, 13 Nov 63.)

15 Nov 63

Program 461 received direction from Air Force headquarters to reorient from a radiometric payload to a detector payload. This was to be accomplished within the approved funding level. Implementing technical directives were issued to Lockheed Missiles and Space Company and Aerojet General Corporation on 3 December 63. (Hist Rpt, Dep for Sys Mgt, 461 Dir, Jul-Dec 63.)

26 Nov 63

The DOD reduced the funding level on program 461 to \$10 million for fiscal 65. (Msg, Hq USAF to AFSC, AFRDDF 77471, 12 Dec 63.)

26 Nov 63

Negotiations began with Lockheed Missiles and Space Company on contract change notification #7 to the AF 04(695)-136 contract. Negotiations ended 17 December 63 with a contract total of \$5.9 million (\$5.6 million cost plus \$300,000 fee).

9 Dec 63

Program 461 radiometric unit (RM-5) was launched piggyback aboard a Program 162 flight. The payload failed to attain orbit. (Hist Rpt, Dep for Sys Mgt, 461 Dir, Jul - Dec 63.)

12 Dec 63

Air Force headquarters notified AFSC that DOD Subject Issue No. 331, dated 26 November 63, had reduced the funding level on program 461 to \$10 million for fiscal 65. Air Force headquarters requested an evaluation of the impact of this reduction on program 461. On the basis of informal discussions with DDR&E and "pending a final decision by the

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Secretary of Defense . . ." Air Force headquarters provided guidelines which were to be used in assessing the impact of the program reduction. The evaluation was to assume that: (a) the funding level for fiscal 65 would be \$10 million; (b) the \$17.5 million deferred in fiscal 64 would be released to the program for a total of \$35 million in fiscal 64; (c) program development objectives defined in November by the DDR&E in a \$70 million alternative plan for fiscal 65 were to be retained; (d) and the evaluation should be based on expectation of appreciable increases in the funding level for future years to accelerate attainment of program 461 development objectives. As an added guideline, AFSC headquarters instructed SSD to evaluate the effect on the program if funding for future years continued at the \$10 million rate. (Msg, CSAF to AFSC, AFRDWF 77471, 12 Dec 63; msg, AFSC to SSD, MSFA 13-12-34, 13 Dec 63.)

20 Dec 63

In accord with the message informing this headquarters of the probable program fund reduction, SSD prepared six alternate program fund proposals. (Hist Rpt, Dep for Sys Mgt, 461 Dir, Jul - Dec 63.)

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2 Apr 56 Western Development Division (WDD) of ARDC published the initial WS 117L Development Plan covering a reconnaissance satellite vehicle lifted into orbit by an Atlas booster.

2 Aug 56 WDD formally notified Lockheed Aircraft Corporation that the firm had won the competition for the WS 117L contract. (Ltr, MajGen B. A. Schriever, Cmdr, WDD, to Lockheed, 2 Aug 56, no subject.)

Mar-Nov 57 Specifications and design details of the WS 117L upper stage vehicle took shape. As a subcontractor to Lockheed, Bell Aircraft Corporation provided a refined XLR-81 upper stage rocket engine (originally intended for a "powered pod" missile associated with the B-58 bomber). (Wkly Diaries, Spec Proj Ofc, Bell Miss Ofc, AMC, 24 Mar-14 Nov 57.)

28 Oct 57 ARDC assembled a special Ad Hoc committee (Teller Committee) to consider possible USAF space contributions that would counter the effects of Sputnik I on world opinion. The committee recommended, in part, that Thor vehicles be used in combination with a makeshift second stage to orbit 200-300 pound satellites at an early date. (Rpt of Teller Ad Hoc Committee, 28 Oct 57.)

12 Nov 57 RAND recommended an early WS 117L system composed of a Thor booster coupled to a Vanguard (Aerobee) upper stage. (RAND Doc RM-2012, A Family of Recoverable Reconnaissance Satellites, 12 Nov 57.)

6 Jan 58 In response to a USAF request for program acceleration recommendations, Lockheed proposed a WS 117L test system composed of a Thor booster and the WS 117L upper stage. (WS 117L Dev Plan for Prog Acceleration, prepared by LMSD, 6 Jan 58.)

15 Jan 58 An Ad Hoc Advisory Group on Special Capabilities reported that the nation should exploit the "impressive potentialities of the IRBM boosters" and recommended start of a program emphasizing "minimum vehicle development effort . . ." The group concluded that an IRBM probably could launch a modified WS 117L vehicle by the late months of 59. (memo, H. J. Stewart, Chmn, Adv Com on Spec Capabilities, to Dir/GM, DOD, 15 Jan 58, subj: Satellite Plans of the Military Departments.)

23 Jan 58 General Boushey (Dep Dir R&D, DCS/D) advised the SAF that the Air Force was programming a few Thor boosters to launch early versions of the WS 117L Reconnaissance vehicle. The SAF agreed to expand Thor production by three missiles per month to support a space program. (Memo, BrigGen H. A. Boushey, Ofc DCS/D, to SAF, 23 Jan 58, subj: Air Force Aeronautics Development Program.)

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29 Jan 58 AFEMD issued Contract AF 04(647)-181 to LMSD covering Thor-boosted test vehicles in the basic WS 117L configuration.

14 Feb 58 Air Force Secretary Douglas asked OSD to approve a five-phase space program based on the use of Thor boosters combined with various upper stages. (Memo, J. H. Douglas, SAF, to SOD, 14 Feb 58, subj: Thor and WS-117L Program.)

24 Feb 58⁵⁸ OSD authorized WS 117L program acceleration "in principle" and indicated that ARPA would shortly assume management responsibility. (Memo, N. McElroy, SOD, to SAF, 24 Feb 58, subj: Air Force WS 117L Program.)

28 Feb 58⁵⁸ ARPA Director R. W. Johnson rejected the Air Force proposal to orbit an early Thor-WS-117L reconnaissance satellite but approved the combination of Thor boosters with Lockheed second stages for early test firings and biomedical experiments. (Memo, R. W. Johnson, Dir/ARPA, to SAF, 28 Feb 58, subj: Reconnaissance Satellites and Manned Space Exploration.)

19 Mar 58⁵⁸ ARPA assigned to AFEMD the task of launching three Thor boosted lunar shots and the President approved the ARPA program that included such shots. (Memo, R. W. Johnson, Dir/ARPA, to SOD, 19 Mar 59, subj: Proposed ARPA Projects; memo, Neil McElroy, SOD, to President, 19 Mar 58, subj: ARPA's Proposed Projects; memo, D. E. Eisenhower, Pres, to SOD, 24 Mar 58, subj:

17 May 58 DOD Directive 3200.5, 17 May, and ARPA Order 9-58, 30 June 58, had the effect of formally transferring all WS 117L programs to ARPA.

30 Jun 58

18 Jul 58 ARPA authorized USAF to procure long lead time items to support Thor-WS 117L firing schedule.

22 Jul 58 ARDC GO 38, effective 1 August, created an air recovery squadron to recover 117L capsules.

5 Aug 58 Thor-WS 117L vehicle procurement extension received ARPA approval, expanding the program from 10 to 19 vehicle tests.

4 Sep 58 ARPA Order 17-59 and three later amendments established a program covering 15 ARPA funded Thor-WS 117L flights.

4 Dec 58 ARPA Director Johnson advised SAF that the Thor-WS 117L program would be independently handled and managed under an FY 59 budget allocation of \$108 million, and that the program would be known as Discoverer. (Memo, R. W. Johnson, Dir ARPA, to SAF (R&D), 4 Dec 58, subj: WS-117L Program.)

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7 Dec 58 ARPA revised previous directions (25 November) concerning Discoverer payloads, authorizing 13 flights and including provision for one successful primate recovery in a total of three attempts. (Memo, R. W. Johnson, Dir ARPA, to SAFUS, 7 Dec 58, no subject.)

21 Jan 59 The first attempt to launch a Discoverer at Vandenberg AFB was aborted by premature firing of accessory rockets on the upper stage Agena vehicle. The Agena portion was severely damaged; the booster, rebuilt, was used in Discoverer 12 shot, one year later. (Discoverer file, SSEH.)

28 Feb 59 Discoverer I successfully entered orbit. No capsule was carried.

18 Mar 59 ARPA instructed the Air Force to continue production toward a total of 19 Thor-Discoverer boosters although only 13 flights currently were approved.

10 Apr 59 Amendment 4 to ARPA Order 17-19 directed incorporation of a restart capability in Agena vehicles, enlargement of Agena propellant tanks, and simplification of the guidance system. In consequence, the length of the Agena increased by six feet and was designated the Agena B configuration.

13 Apr 59 Discoverer 2, launched from Vandenberg, orbited but the recovery capsule was ejected at the wrong time, re-entering north of Norway. Search failed to locate the capsule.

20 May 59 Amendment 4 to ARPA Order 48-59 approved the Discoverer Development Plan of 30 April (25 vehicle program) and increased FY 59 funding totals from \$104.3 million to \$121.9 million.

3 Jun 59 Discoverer 3 failed to orbit, due to Agena malfunction.

25 Jun 59 Discoverer 4 failed to orbit due to inadequate second stage thrust.

20 Jul 59 Amendment 6 to ARPA Order 48-59 authorized procurement of 29 Discoverer vehicles and increased FY-59 program funding to a total of \$132.6 million.

13 Aug 59 Discoverer 5 went into orbit and ejected the recovery capsule, but because of battery failure the capsule was not recovered.

19 Aug 59 Discoverer 6 orbited but the recovery sequence was abnormal.

28 Aug 59 AFBMD delayed the Discoverer flight test program to complete a study of recovery failures. Lockheed created a special ground test program in support of the effort. (Msg, WDE-8-15-E, AFBMD to USAF, 28 Aug 59.)

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7 Nov 59 Discoverer 7 went into orbit but an auxiliary power failure prevented capsule recovery.

17 Nov 59 OSD transferred the Discoverer program to the Air Force, effective immediately, but instructed that changes in the approved program should be cleared with DDR&E. (Memo, T. S. Gates, Dep SOD, to SAF, 17 Nov 59, subj: Transfer of the Discoverer Development Program to the Department of the Air Force.)

20 Nov 59 Discoverer 8 went into orbit and the capsule separated, but Agena subsystem faults negated recovery attempts.

1 Dec 59 As a result of the failure of Discoverer 8, AFBMD again suspended flight tests to permit further analysis of difficulties. (Msg, RDRRB 27-11-31-E, ARDC to USAF, 1 Dec 59.)

15 Jan 60 AFBMD published a revised Discoverer Development Plan reflecting a 29-vehicle program.

4 Feb 60 Discoverer 9 failed to orbit because of a Thor instrumentation system malfunction and the failure of the umbilical connection.

19 Feb 60 Discoverer 10 was destroyed by the range officer 56 seconds after launch, upon the appearance of pitch oscillations.

27 Feb 60 OSD approved FY 60 Discoverer funding at the recommended level of \$71.1 million (RDT&E funds) and also authorized a contract for an additional 12 Thor-Discoverer vehicles at a production rate of two-per-month through May 61. Further, 10 ballistic missile configuration Thor's were to be reworked to a space launch configuration at a two-per-month rate from April through August 61. (Msg, 73993, USAF to AFBMD, 27 Feb 60.)

15 Apr 60 Discoverer 11 went into orbit but the recovery system again malfunctioned.

20 Apr 60 DDR&E approved extension of the Discoverer program to a total of 35 flights, the total to be funded within previously submitted estimates ~~SECRET~~ for FY 61). (Memo, H. F. York, DDR&E, to SAF, 20 Apr 60, subj: Samos, Midas and Discoverer Research and Development Programs.)

3 May 60 USAF accepted the first Agena B vehicle (the last Agena A had been delivered in March). (Rpt, Mil Sat Progress Rpt, 30 May 60.)

29 Jun 60 Erratic horizon scanner operation in Discoverer 12 caused nose-down Agena separation and failure of the Agena to enter orbit.

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Jul 60

Congress appropriated [REDACTED] for the FY 61 Discoverer program against a Presidential request for [REDACTED]. USAF recommended that the additional funds be held for application to pending program expansion plans. (Memo (draft), Dir Adv Tech to DDR&E, 19 Jul 60, subj: Establishing Staff Recommendations for the "Add-Ons")

10 Aug 60

Discoverer 13 launch, orbit, capsule separation, and capsule recovery operations were successful. Although air recovery did not succeed, the capsule was recovered from the sea 94 miles north of the predicted impact point.

18 Aug 60

A USAF C-119 successfully completed an air recovery of the capsule from Discoverer 14, constituting the first aerial retrieval of an orbited object.

26 Aug 60

USAF instructed AFBMD to change the Discoverer Development Plan to show an increase of six additional vehicles, to a total of 41. (Mag, AFDST-AT 70837, USAF to AFBMD, 26 Aug 60.)

13 Sep 60

Discoverer 15 was successfully launched but the capsule impacted far south of the recovery area and sank before it could be retrieved.

26 Oct 60

Discoverer 16, mounting the first Agena B, failed to enter orbit.

12 Nov-
7 Dec 60

Capsules from Discoverers 17 and 18 were recovered on air passes. The 7 December shot marked the longest period in orbit to date before recovery (48 passes).

27 Dec 60

USAF approved Change 2 to the January 60 Discoverer Development Plan, providing for a 41-vehicle program and revision of both schedules and funding.

23 Feb 61

SAF limited the effect of Change 2 by specifying approval of a 41-vehicle program within a funding level of [REDACTED] for FY 61 and [REDACTED] for FY 62. (Memo, L. S. Garlock, Asst SAF to C/B, 23 Feb 61, subj: Discoverer Development Plan.)

17 Feb 61

AFBMD launched the first Agena B with modifications to improve burning time and restart capability (Discoverer 20).

30 Mar 61

AFBMD launched the first Discoverer to be guided by an improved Bell Laboratories radio inertial system (Discoverer 22).

2 May 61

SSD submitted Change 3 to the January 60 Discoverer Development Plan. The change proposed an increase of three or more vehicles (to a total of 44), increased funding (to [REDACTED] FY 61 and [REDACTED] for FY 62).

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5 Jun 61 Hq USAF directs AFSC to study feasibility of standard Agenas, produced on competitive bids.

21 Jun 61 DDR&E undertook a review of the Discoverer program, concentrating on launch success and failures. (Memo, J. H. Rubel, Dep DDR&E, to SAFUS, 31 May 61, subj: Review of the Discoverer Program.)

30 Jun 61 SSD completed study of a standard Agena, concluding that one basic vehicle could serve all AF and NASA needs. SSD endorsed standardization on the premise of improved reliability and cost. (Summary prepared for BrigGen H. L. Evans, Asst V/Comdr SSD, 25 Oct 62.)

7 Sep 61 SAF approved Change 3 to Discoverer Development Plan (January 61) authorizing 44 launches and increasing funding levels as earlier requested. (Memo, J. V. Charyk, SAFUS, to C/S, 7 Sep 61, subj: Discoverer Development Plan.)

14 Sep 61 First air recovery of capsule by JC 130 (Discoverer 30).

27 Sep 61 Hq USAF directed AFSC to carry out Agena D (standardized) program. (Ltr, DCS/S&L to Comdr AFSC, 27 Sep 61, no subject.)

4 Oct 61 DDR&E authorized Phase I effort on standardized Agena.

27 Oct 61 DDR&E approved FY 62 funding of [REDACTED] for Discoverer and authorized indefinite continuation of the program to satisfy the need for a reliable vehicle for varied space projects. (Memo, H. Brown, DDR&E, to SAF, 27 Oct 61, subj: Approval of FY 62 RDT&E Program for Discoverer.)

8 Nov 61 Hq USAF directed AFSC to submit a change to the Discoverer Development Plan to show 15 launches during 62 and to show a level of effort program continuing through FY 64 at an annual rate of [REDACTED] (Msg, AFSDC-S-11, 76985, USAF to AFSC, 8 Nov 61.)

1 Dec 61 Under Secretary Charyk recommended the creation of an Agena D Program Directorate within SSD, the selection of a staff officers to serve as Agena D focal point within DCS/S&L, and authorization for direct communication with the Under Secretary on all program matters. Charyk emphasized the importance of Agena D success to the reduction of space program costs and the improvement of system reliability. (Memo, J. V. Charyk, SAFUS, to C/S, 1 Dec 61, subj: Standardized Agena D.)

12 Dec 61 Oscar I (standard amateur radio transmitter placed aboard an Agena) placed in orbit (Discoverer 36).

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11-25 Jan 62 An apparent shortage of Thor boosters in the Discoverer program caused USAF to have AFSC examine launch schedules and recommend changes. Charyk subsequently adjusted the Discoverer schedule to provide for 18 rather than 15 launches during 62. (Msg, 92722, USAF to AFSC, 12 Jan 62; msg, AFSDC-S-11, 95854, USAF to AFSC DCAS, 25 Jan 62.)

Feb 62 SSD asked Douglas Aircraft to define the performance and design of the Model DSV-2C Thor, an improved Thor plus three strap-on solid propellant motors. Preliminary studies indicated that the addition of the solid-rockets would increase lift-off thrust by 163,500 pounds and permit an increase of 300 pounds in the payload of Discoverer satellites. (SSD Hist Rpt, Std Launch Vehicle II, Jan - Jun 62.)

5 Feb 62 SSD forwarded Change 4 to the Discoverer Development Plan. The change involved an increase from 44 to 60 vehicles.
[REDACTED]

19 Mar 62 Charyk approved Change 4. (Memo, Ch, Disc Proj Ofc to DSMG Review Team 1, 30 Mar 62, subj: Current Status Rpt.)

6 Apr 62 DOD approved the transfer of [REDACTED] in FY 62 funds to the Discoverer program. [REDACTED] of the total was to support the Agena D. (Memo, R. M. Gilpatric, Dep SOD, to SAF, 6 Apr 62, subj: Utilization of Emergency Fund Transfer Authority.)

27 Apr 62 Under Secretary Charyk authorized the addition of five more launches to the approved Discoverer program for 63. (Msg, AFSDC-S-11, USAF to AFSC DCAS, 27 Apr 62.)

13 Jun 62 USAF added three more 62 launches to the authorized Discoverer program. (Msg, AFSDC-S-11, 97469, USAF to AFSC DCAS, 13 Jun 62.)

27 Jun 62 Discoverer 45, carrying the first Agena D, entered orbit. The capsule was air-recovered on pass 63.

30 Jun 62 Thiokol Chemical Corporation and Douglas Aircraft Company were under contract to develop and produce the Thrust Augmented Thor (TAT), with development costs estimated at [REDACTED]. Use of TAT would add [REDACTED] to the price of each Discoverer. Initial launch tests were scheduled for November-December 62, with a total of 10 launches through 63. (SSD Hist Rpt, Std Launch Veh II, Jan-Jun 62.)

10 Jul 62 SSD submitted Change 5 to the Discoverer Development Plan increasing the total of vehicles on order to 65 (from 60). (As of 27 June 62, 10 recoveries in 14 launches had been recorded in the previous 12 months.)

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[REDACTED]

13 Jul 62 USAF authorized the procurement of six additional Agena Ds for the Discoverer program and 16 more for NASA with production continuing through December 63. (Msg, AFSSV 66176, USAF to AFSC, 13 Jul 62.)

24 Nov 62 The last of the Agena B vehicles in the Discoverer program was launched. This mission was the first lasting as long as five days. Aerial recovery was successful on 29 November after capsule ejection on pass 81. (Hist Rpt, 162 Prog Ofc, Jul - Dec 62.)

4 Dec 62 The 57th launch of a Thor Discoverer successfully boosted an Agena satellite into orbit. The space capsule re-entry system performed satisfactorily but air recovery failed and the capsule was lost. (Hist Rpt, 162 Prog Ofc, Jul - Dec 62.)

4 Dec 62 Further expansion of Program 162 (Discoverer) was approved by the Under Secretary of the Air Force. Approved launch schedule totaled 23 launches in calendar year 63 (an increase from 18) and 18 additional launches were planned for calendar year 64. (Hist Rpt, 162 Prog Ofc, Jul - Dec 62; Msg, AFRAE-S-4 99514, Hq USAF to SSD, 4 Dec 62.)

31 Dec 62 Discoverer flight test summary:

<u>All of Calendar Year 62</u>	
Launched	25
Orbited	24
Recoverable	20
Air Recovered	16
<u>Program Totals--All Years</u>	
Launched	58
Orbited	46
Recovered	27 (23 air, 4 water)

28 Feb 63 The 60th Discoverer vehicle launched and the first launch of a Thrust Augmented Thor booster with a 162 payload. The flight was terminated by command, 125 seconds after launch, due to a misfire failure of one of the three solid booster motors. (Hist Rpt, Dep for Sys Mgt, 162 Dir, Jan-Jun 63.)

18 Mar 63 The second launch of a Thrust Augmented Thor and the 61st Discoverer flight. The booster performed successfully but the Agena did not attain orbit. This was also the first flight in which Bell Telephone Laboratories guidance equipment was carried aboard the second stage Agena. (Hist Rpt, Dep for Sys Mgt, 162 Dir, Jan-Jun 63.)

19 Apr 63 SSD was instructed to add six more Discoverer launches to the 39 remaining scheduled flights in the Discoverer program. (Hist Rpt, Dep for Sys Mgt, 162 Dir, Jan - Jun 63.)

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12 Jun 63

The first completely successful launch of a Thrust Augmented Thor vehicle. Discoverer 65 systems performed satisfactorily, the satellite was placed in orbit and successfully recovered in the air on the 65th pass. (Hist Rpt, Dep for Sys Mgt, 162 Dir, Jan - Jun 63.)

1 Jul 63

A successful Discoverer flight marked by a pioneer achievement of a sub-satellite launch from an orbiting Agena vehicle. The Agena, on its 74th pass launched a sub-satellite into a high elliptical orbit, where it was anticipated that it would sustain a useful functioning life for at least six months. Its primary objectives were to record data which would furnish a detailed map of the Van Allen radiation belt, obtain plasma measurements and changes. (Hist Rpt, Dep for Sys Mgt, 162 Dir, Jan - Jun 63.)

31 Dec 63

Discoverer flight test summary:

<u>All of Calendar Year 63</u>	
Launched	17
Orbited	13
Recovered	12
<u>Program Totals--All Years</u>	
Launched	75
Orbited	59
Recovered	39

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AGENA

Development of the Agena as a reliable second stage was significantly advanced by the Discoverer program. By 1963 the problems of orbital stability, engine restart, and command and control were solved; there remained a continual engineering effort to increase its reliability, improve performance of all its subsystems, and increase the precision of its guidance and control.

Jan - Jun 63

SSD Agena Directorate adopted significant engineering improvements; new battery design, improved inverter, flow coating of exposed circuitry, and a horizon scanner of advanced design. (Hist Rpt, Dep for Engrg, S-OLA Space Proj Dir, Jan - Jun 63.)

Jan - Jun 63

The Air Force Gemini Target Vehicle program was dependent on modifying the Agena spacecraft vehicle to meet particular demands of the target project. The existing XLR81-BA-9 Agena engine performed successfully on the three Agena flights during this period. Eleven Agena Ds with a slightly changed engine (YLR81-BA-11) were also flown successfully. This engine was again improved by adding a multi-start capability for use on the Gemini Agena Target Vehicle. In addition, every element of the Agena was subjected to thorough tests to insure utmost reliability of all systems. (Hist Rpt, Dep for Engrg, S-OLA Space Proj Dir, Jan - Jun 63.)

Jan - Jun 63

Lockheed, in addition to ground equipment modifications, performed costly launch services. A Pacific Missile Range launch services contract was negotiated for calendar year 63 at a cost of \$20.948 million. This contract would pay for space program, special projects and NASA launches. Between 1 January 63 and 30 Jun 63, 13 launches were conducted at an approximate cost of \$12,700,000. The Air Force also maintained a contract for Lockheed launch services at the Atlantic Missile Range from 1 January to 30 June which, despite substantial savings during the period, amounted to approximately \$12,156,000. (Hist Rpt, Dep for Engrg, Jan - Jun 63; ltr, LtCol L. D. Parsons, Jr., Ch Ops Div, SLV-III, to SSHAG, 5 Jul 62, subj: Conversion of AMR Complex 14 to an Atlas/Agena Configuration; msg, MSFA 12-6-23, AFSC DCMSF to SSD, 13 Jun 63.)

Jan - Jun 63

The basic R&D contract (AF 04-695-21) for the advanced Agena D was terminated and the last of the vehicles was launched during this period. A follow-on production contract (AF 04-695-68) assured an adequate supply of vehicles and additional vehicle production was assured by an Air Force-Lockheed contract (AF 04-695-194), effective July 63. (Hist Rpt, Dep for Engrg, Jan - Jun 63.)

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8 Jan 63

AFSC headquarters approved a reduction in the production of Agena vehicles from four to three vehicles per month. (Hist Rpt, Dep for Engrg, Jan - Jun 63.)

8 May 63

As required by AFSCM 375-1, a configuration management office was established within the S-01A Space Project Directorate. Configuration control management by this directorate required negotiation of memorandums of agreement with several program offices. As agreed, the program director would appoint a configuration control board to manage the "program peculiar equipment" and the directorate's configuration control office would administratively support the program offices and execute their directives. Lockheed was also requested to submit cost proposals for incorporation of configuration control activities into their booster vehicle contracts. (Hist Rpt, Dep for Engrg, Jan - Jun 63.)

17 Jun 63

In accordance with an Air Force/NASA Agreement, all NASA contracts (with one exception) administered by the S-01A directorates procurement division were transferred to the NASA Lewis Research Center. (Hist Rpt, Dep for Engrg, Jun-Jn 63.)

Jul - Dec 63

A program to develop and adopt Agena engineering improvements was continued. Among these improvements were development of a secondary propulsion system for the Gemini target vehicle and improvement of valves and components in the pressurization system. The "Command Destruct Optional Kit" was redesigned to assure reliable performance. High accuracy horizon sensors, under development, were scheduled for flight tests in late 1964. A promising high electrical chemical energy power source (approximately 140 watt hours per pound) was to be adopted as soon as production units became available in early fiscal 66. Continued emphasis was also given to finding an early solution to the problem of short duration but high electrical current depletions at the time of spacecraft-booster separation. (Hist Rpt, Dep for Engrg, Jul-Dec 63)

Jul - Dec 63

The Agena engine, XLR81-BA-11, sustained its record of excellent performance. Thirteen engines were flown during this period with successful engine operation on all flights. A program was under way to determine if the existing YLR81-BA-11 engine could be converted to operate with a high energy fuel (Hybaline/IRFNA). The XLR81-BA-13, a new engine similar to the standard Agena production unit except that it would possess a multi-restart capability, was nearing successful development for use in the Gemini Agena Target Vehicle program. (Hist Rpt, Dep for Engrg, Jul - Dec 63.)

Jul - Dec 63

Development of the Gemini Agena Target Vehicle remained on schedule. The Gemini program, conducted by NASA in close collaboration with the Air Force (SSD was responsible for procurement and engineering of the Titan II booster), was to perform two man earth orbital flights of extended duration, earth orbit rendezvous, docking with an unmanned target vehicle, and controlled return to a land surface. Specifically, SSD was to develop, produce and launch a Gemini target vehicle into the earth orbits required to demonstrate rendezvous and docking of the Gemini spacecraft with the target vehicle. Other main elements in the program were as follows: modification of AMR Complex 14 for Atlas-Gemini Agena Target Vehicle launches; development of ground equipment for checkout of the space vehicle; launch services; first stage booster procurement; development and procurement of special purpose booster adapter; development of a second stage orbital vehicle (Agena), interface with a docking adapter; and development and procurement of a shroud--an aerodynamic nose fairing--to be used in the ascent phase of flight and then jettisoned. Funding for the Agena TV program was estimated at \$103.555 million. Development, production and test of the Agena assembly and integration of the completed target vehicle up to 31 December cost \$29.9 million. \$1.4 million had been expended in engine procurement and \$2.2 million had been spent in Atlas booster procurement. Future funding requirements would mount rapidly as testing and hardware procurement accelerated and launch services were required. (Hist Rpt, Dep for Engrg, Jul-Dec 63.)

12 Jul 63

The 100th Agena space vehicle was launched on this date. Through the last half of calendar 63, 14 Agena D and one Agena B were successfully launched and injected into orbit. (Hist Rpt, Dep for Engrg, Jul - Dec 63.)

1 Oct 63

An Air Force developed space vehicle guidance system, produced by Bell Telephone Laboratories (BTL) performed satisfactorily to furnish precise first and second stage guidance for the flight of seven NASA Delta vehicles (Thor-Aerojet General second stage). The Bell Telephone Laboratories guidance was also used in the successful NASA Thor-Agena B launch on 28 September 62 which placed a Canadian "Alouette" satellite payload in orbit. Additional Thor-Agena B flights, originally scheduled during 63, were postponed to 64. In any case, the BTL command guidance system demonstrated a capacity for precise and reliable space vehicle guidance. (Hist Rpt, Dep for Engrg, Jul - Dec 63.)

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BLUE SCOUT

BLUE SCOUT

- 11 Apr 56 ARDC proposed to Hq USAF the development of a family of ballistic, orbital, and lunar research and test vehicles. The purpose was to furnish an economical booster for a 200 pound payload to orbital altitudes, using Aerobee and Sergeant stages. Second and third phase development would lead to much higher performance. (Hyper-Environment Test System Development Plan, 18 May 59.)
- 15 Mar 57 ARDC submitted a draft development plan for a test vehicle program (System 454L) designated Ballistic Weapons Research and Development Supporting Systems (BALWARDS). (Draft History, Evolution of Hyper-Environment Test System, No. 609A, undated. Hereafter cited as HETS Draft History.)
- 23 Apr 57 The ARDC development plan, approved by the Air Staff, was disapproved by Richard E. Horner, acting Assistant Secretary of the Air Force (R&D). He asked the Air Staff for a list of specific test requirements in support of future Air Force weapon systems which called for BALWARDS vehicles. This information was provided on 13 May. (HETS Draft History.)
- Jul 57 ARDC revamped its test rocket development plan and named the project Ballistic Research and Test System (BRATS) No. 609A. (HETS Draft History.)
- 3 Feb 58 The Air Staff advised ARDC that it would be unable to secure full authorization to proceed with BRATS, pending clarification of responsibilities and relationships with ARPA. (HETS Draft History.)
- 25 Feb 58 Mr. Horner refused an Air Staff request to seek approval from Mr. Holaday for a "go-ahead" on BRATS. (HETS Draft History.)
- May 58 Again attempting to gain program approval--its name had been changed to Ballistic Missile Test System (BMTS)--the Air Staff suggested a joint USAF/NACA effort, somewhat in the manner of the X-15 and earlier research aircraft undertakings. (HETS Draft History.)
- 4 Jun 58 Representatives of the Air Staff and NACA met to discuss a common research vehicle. NACA had been working on the design of a solid rocket test vehicle and the design and test objectives of the two vehicles were quite similar. (MFR; LtCol Keith G. Lindell, 4 Jun 58, subj: System 609A BMTS, 4 Jun 58.)

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16 Jun 58

Air Force and NACA personnel met again to discuss project requirements. NACA's specifications called for a 40" Aerojet first stage, an improved Sergeant second stage, and a Meteor third and fourth stage. Air Force representatives agreed that such a vehicle would meet their requirements. (MFR, LtCol Keith G. Lindell, 26 Jun 58, subj: BMTS Discussion With NACA.)

14 Oct 58

The Air Force and NASA (successor to NACA) signed a memorandum of understanding agreeing to cooperate in the development of a solid-rocket test vehicle. NASA would prepare the specifications to meet its requirements and solicit development bids. The Air Force would prepare a separate specification for modification of the test vehicle to meet its special needs and would contract separately for the work required. The two agencies also agreed to establish a joint team to coordinate their work.

3 Dec 58

Mr. Horner approved a program which would cost \$4.1 million in fiscal 59 and \$4 million in fiscal 60 to fund the project. The initial sum would pay for the guidance equipment, four vehicles, and the necessary modifications. (Memo, MajGen J. E. Smart, Asst VC/S to ASAF(RD), 25 Nov 58, subj: 609A.)

7 Feb 59

ARDC directed AFBMD to prepare a detailed plan for development of the solid propellant multi-stage vehicle, now called Blue Scout, to perform a wide range of space assignments. (ARDC Dir No. 609A, 5 Feb 59.)

8 May 59

At an Air Force/NASA committee meeting, the Air Force reported on its long range goals for use of 10 development-type Scout vehicles during fiscal 59 and 60. Objectives included geophysical experiments with high altitude probes by AFCRC; tests for AFSWC involving some high altitude linear accelerator experiments; test vehicle for Dyna Soar; tests for the AFCRC's Electronics Research Directorate; RADC radar antenna design and propagation; tests by AFSWC on nuclear effects; and special research tests in aeroelasticity by ARDC. An additional 25 Scouts would be needed by 61. Scouts would be launched from the Atlantic Missile Range. (Minutes, Air Force/NASA Committee Meeting on Scout Vehicle, 15 May 59.)

18 May 59

AFBMD completed and forwarded to USAF a new, detailed HETS development plan for System 609A.

9 Sep 59

Hq USAF officially approved the 18 May Development Plan. Formal approval included the stipulation that launch schedules be arranged to gain maximum advantage from the results of NASA Scout tests and maximum value from its experiments. (Ltr, Col J. L. Martin, Dep Dir/AT, USAF to Cmdr ARDC, 9 Sep 59, subj: Development Plan for System 609A.)

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15 Jan 60 The date for NASA's first Scout launch was again postponed. Development work schedule slippage eventually caused an additional six month delay in the launch program.

2 Feb 60 The Navy requested information from the Air Force on Scout boosters for launching Transit satellites. The Navy reported a requirement for 18 launches, beginning in November 60. (Msg 67411, Hq USAF to ARDC, 2 Feb 60; memo, Cmdr R. E. Freitag, Astro Officer, BuWeps to C/S, 2 Feb 60, no subject.)

24 Feb 60 WADD began action on development of a rocket emergency communication system based on Scout. The programmed fiscal 61 cost was \$3.95 million to cover eight test firings in the Jul-Dec 61 period. (Msg, RDZEX-30212-E, WADD to ARDC, 24 Feb 60.)

8 Mar 60 AFBMD informed WADD that action was being taken to include funds in the 609A fiscal 61 financial plan for vehicles for the rocket emergency communications system. (Msg, WDZJM 88, BMD to WADD, 8 Mar 60.)

1 Jul 60 NASA's Scout 1 was successfully launched and carried vehicle instrumentation on a ballistic trajectory. Operation of all systems in the vehicle was satisfactory. (House Rpt, 1963 NASA Authorization, Pt 4, p. 1830.)

21 Sep 60 In the first Air Force Blue Scout launch, from Atlantic Missile Range, an instrumented payload was boosted 16,600 miles above the earth in a 3½ hour flight. A radio malfunction limited the data received and the launch was considered only a partial success.

4 Dec 60 NASA's first attempt to launch a satellite using a Scout ended in failure at Wallops Island when the second stage failed to fire.

16 Feb 61 NASA successfully launched its first Scout-boosted satellite, which it named Explorer IX. The satellite payload weighed 80 pounds and included a 12-foot polka-dotted balloon inflated in orbit.

1 Jun 61 NASA and the Air Force submitted to DDR&E a joint "White Paper" that analyzed the management relationships characterizing both Scout and Blue Scout development and procurement. DDR&E had directed preparation of the paper. At the same time, of the first five Blue Scout launches, one launch failed, there was one partial success, and the remaining flights were successful.

15 Jun 61 After reviewing the NASA-Air Force "White Paper" on Scout-Blue Scout management, the Associate Administrator of NASA concluded that there should be no major change in the Scout/

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7 Jul 61 Dr. Joseph V. Charyk informed the SOD that the Navy was planning to buy Scouts for Transit launchings through NASA and was training launch crews. He reported the Air Force had trained crews for Scout and had built an outstanding record, and that the Navy plan was in conflict with DOD directives that assigned booster responsibility to USAF. He requested guidance. (Memo, J. V. Charyk, USAF to SOD, 7 Jul 61, no subject.)

29 Jul 61 Secretary McNamara informed the Navy that while it was responsible for the Transit payload, the Air Force would be responsible for launching and system integration. The Navy therefore was directed to suspend training of crews. The Secretary also informed the Air Force to be immediately responsive to Navy requests for support of Transit launches. (Memo, R. S. McNamara, SOD, to AS/N (R&D), 29 Jul 61, subj: Implementation of Transit Operations; memo, McNamara to USAF, 29 Jul 61, same subject.)

Aug 61 Meetings between ESD, SSD, and the 6565th Test Wing considered responsibilities to be assumed by SSD in support of Project Beanstalk (also called ERCS--Emergency Rocket Communication System). It was agreed that SSD would procure the motors through NASA and have technical direction of the booster vehicle effort, conducted by Chance Vought. SSD was also to have booster test responsibility, while the 6565th had the launch responsibility. Assignment to the 6565th of military personnel required for "Blue Suit" Beanstalk launches began shortly thereafter.

16 Apr 62 Hq USAF requested AFSC to provide it with information on Blue Scout reliability, noting that there had been five consecutive flight failures. (Ltr, USAF to Hq AFSC, 16 Apr 62, subj: Blue Scout Reliability.)

31 May 62 The first SLV-IC Blue Scout was successfully launched from PMR in support of ERCS (Beanstalk) program objectives.

4 Jun 62 AFSC directed that AMR Scout launch capabilities be limited to Blue Scout Junior and that SSD arrange for launch of all orbital Blue Scouts payloads from Wallops Island, if launch objectives required an East Coast site.

21 Jun 62 A NASA/DOD Scout System Organizational Agreement was signed which described the relationships, responsibility assignments, and delegation of authority between NASA and the Air Force in the Scout program. A joint operating agreement for conduct of Scout launchins at PMR was also signed by NASA and Air Force representatives.

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- 30 Jun 62 As of the end of fiscal 61, the Air Force had spent \$14.339 million on Blue Scout. Authorized funding for fiscal 62 was \$.963 million. Fiscal 63 fund requirements were increased to \$2.25 million. (Financial Handbook, SSD, 30 Jun 62.)
- 9 Jul 62 AFSC reported that a review of the Scout program had disclosed three major problem areas, including low reliability, a decrease in the need for orbiting vehicles from Atlantic Missile Range (AMR), and increasing difficulty in funding and manning the required program. AFSC said it planned to limit launchings from AMR to Blue Scout Junior vehicles, and accordingly would not expand other Scout facilities. Future Scout orbital shots would be conducted Wallops Island or PMR. (Ltr, AFSC to Hq USAF to SSD, 19 Jul 62, subj: Revisions to Scout Program.)
- 22 Aug 62 An SLV-1D Blue Scout vehicle was launched from Pt Arguello by Air Force personnel of the 6595th Aerospace Test Wing. This was the first successful Air Force Scout to utilize the improved third stage (Antages II) motor. A near-nominal orbit was achieved in support of an Air Force program.
- 24 Sep 62 DDR&E expressed concern over the "apparent decrease of interest" in the Blue Scout launch vehicle. Rubel said that Blue Scout had been considered an important portion of the national launch vehicle inventory and requested "a thorough review of the Blue Scout program to show present experience and anticipated performance and cost based on various considerations of utilization . . ." (A comprehensive review and evaluation of the program went from SSD to AFSC, in response to the DDR&E inquiry, on 31 October.) (Memo, J. H. Rubel, Dep DDR&E, to Asst SAFRD, 24 Sep 62, subj: Blue Scout.)
- 29 Oct 62 BuWeps formally advised SSD that Program 435 (Transit) would require Scout vehicles (SLV-1D) for the operational system and also for follow-on engineering payloads through 69. A program for 32 additional vehicles was laid out. SSD responded with a plan and funds requirement schedule on 5 Dec 62.
- 9 Nov 62 Failure to appropriate funds for operational facilities led Hq USAF to freeze funds for booster vehicle hardware for the Beanstalk program (279). A stop-work order on these boosters was received from the 279 System Program Office at ESD on 9 November and effected by SSD on the same date.

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28 Nov 62

Notification was received that a major reorientation of Program 706 (Satellite Inspector) had been directed. In line with such reorientation, Blue Scout booster support for the program was cancelled. The boosters originally planned for Program 706 will be reassigned to other DOD programs.

18 Dec 62

An SLV-D, launched by "Blue Suit" personnel from Point Arguello successfully placed the Transit 5A payload into orbit. This was the first Scout-launched Transit and the first Air Force SLV-1D to use the new ALGOL IIA first stage motor. This motor improvement, together with the improved third stage motor results in a 75 per cent increase in payload capability for a 400 nm orbit.

Jan 63

Management of the SLV-1 program was eased by the adoption of certain improved procurement procedures. As a result of a Spares Conference held on 10 January, a series of agreements between the NASA Spares Coordinator at the PMR and 6595th Aerospace Wing supply personnel resolved, at least in part, problems in the SLV-I supply system. A NADA/DOD Scout Coordinating Committee Meeting was held at the Chance Vought plant at Dallas, Texas. NASA agreed to permit the SLV-I program office direct procurement of pre-flight planning on follow-on programs. NASA also presented a funding summary of the fiscal 63 program which indicated an overrun of \$1.293 million for the DOD portion of the program. (Hist Rpt, Dep for Engrg, SLV-I, Jan - Jun 63.)

25 Jan 63

The plan to acquire a Program 279 (Beanstalk) final operational capability, by placing eleven SLV-IC vehicles with communication payloads in sites in Nebraska, was cancelled. However, the interim operational capability development plan was continued and SLV-IC vehicles were placed on sites located in Nebraska.

Apr 63

Although an SLV-1C was successfully launched on 12 March from the PMR, subsequent launches during April were not successful. On 5 April launch of a SLV-1A vehicle at Point Arguello went well until failure of the control system during the third stage coast phase aborted the mission. Again, on 26 April, a third stage malfunction of vehicle 121 resulted in what was described as "catastrophic failure" of the vehicle. It was later determined that the probable cause of failure was an inadvertent activation of the vehicle destruct system due to shorting or spurious radio frequency source which triggered the destruct action.

May 63

A succession of SLV-1 failures was interrupted by a 17 May successful launch from the Pacific Missile Range. On 21 May another SLV-1 was launched successfully from Wallops Island carrying a NASA payload.

29 Jul 63

An SLV-1A planning group published a program plan which, if implemented, would standardize the four stage solid propellant research test rocket vehicle and increase its reliability to a minimum of 70 percent and, hopefully, ultimately reach 90 percent. The plan contained the following basic elements: the system would be incorporated into the Air Force inventory on an operational basis within 18 months after go-ahead; it would carry on its work without interfering with the currently operating space program; and a program office type of organization would be established to carry out the undertaking. Thus a well developed plan was available for such time as the Secretary of the Air Force would announce selection of the SLV-1A Space Booster System for acquisition and management under AF 375 Series Regulations. (Staff Study and Prog Plan prep by SLV-1A Planning Group, 29 Jul 63.)

27 Sep 63

Technical difficulties continued to harass the Blue Scout rocket. On this date a launch from Point Arguello was marred by failure of the third stage motor. Assiduous effort to improve reliability on a short term basis was possibly responsible for a moderately successful Program 279 Blue Scout launch from Vandenberg AFB on 17 December, and NASA successfully launched an air density balloon payload from the same location on 19 December. Meanwhile, the plan to elevate SLV-1A to an Air Force booster system by means of significant improvements in reliability and standardization awaited Air Force headquarters action.

14 Oct 63

A high level meeting was held on this date between representatives of NASA and the Air Force to discuss a plan of action to improve Blue Scout reliability and initiate program of standardization.

TITAN III

TITAN III

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1957

As early as October-November it became apparent that the United States could not hope to match the weight-in-orbit achievements of the Soviet Union with boosters then in development. Of the four ballistic missiles suitable for space-booster applications--Atlas, Titan, Thor, Jupiter--only Atlas and Titan had any promise for "medium weight" or "high orbit" assignments. Even these were not capable of putting more than 5,900 pounds into a 300 mile orbit.

1958-1961

During this period plans for development of large boosters were largely taken over by NASA. When NASA acquired the manned space mission, the Air Force was left with little but a firm conviction that large boosters must ultimately be developed for military space applications. Between these years the Air Force had no authorization to develop high-thrust boosters.

1 May 61

Two months after the assignment of almost all military space functions to the Air Force and the resultant realignment of Air Force commands, the Air Force submitted to the Secretary of Defense a proposal for a national space program. Included in the varied recommendations--which covered much more than military space missions--were proposals for the start of a large booster development program. There was little hope for the Atlas-Centaur vehicle and the Air Force had little confidence in the military usefulness of the Saturn. Instead the Air Force proposed solid segmented rocket units for the first stages topped by single-engine liquid-fuel upper stage as a suitable booster. Similar vehicles had earlier been examined in the "Phoenix" studies. They promised payload capacities ranging from 4,400 pounds to 700,000 pounds in low orbit.

25 May 61

The President announced that NASA would be assigned a national space effort to land on the moon. This did not dampen Air Force interest in developing a high thrust booster, on the contrary there developed an intensified concern for boosters that bridged the gap between the Atlas-Agena and rockets of one million pound thrust.

31 May 61

Defense Secretary McNamara told Congress that DOD was considering the use of Titan II in conjunction with a high thrust upper stage as a follow-on to Atlas-Agena.

1 Aug 61

DOD formed an Ad Hoc Committee for Standardized Workhorse Launch Vehicle Selection to consider the merits of (1) Titan II with four Centaur rockets, (2) Titan II with a fluorine-hydrazine upper stage, and (3) Phoenix A. (Memo, J. H. Rubel, Dep/DDR&E to Ad Hoc Committee, 1 Aug 61, no subject.)

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- 18 Aug 61 The Workhorse Launch Vehicle Committee reported to Rubel that no currently planned or proposed launch vehicle held promise of becoming a "space age DC-3," but recommended that (1) Atlas-Centaur be used for the period through 65; (2) Titan II with strap-on solid rockets and a high-energy upper stage be used for the post-65 period, and (3) Saturn C-1 be used for early Dyna Soar launches. Air Force Assistant Secretary (R&D) McMillan, a sponsor of the group, urged AF Under Secretary Charyk to endorse the "Titan II plus strap-on" requirements. (Rpt, Ad Hoc Committee for Standardized Workhorse Launch Vehicle, 18 Aug 61; memo, B. McMillan, Asst SAF(R&D), to SAF-US, 18 Aug 61, subj: Standardized Space Booster Program.)
- 15 Sep-9 Oct 61 On the basis of a requirement originating with DDR&E, AFSC undertook a special supplemental study of the potential of the Titan II-strap-on-booster concept. (Memo, J. H. Rubel, Dep DDR&E, to SAF-RD, 15 Sep 61, subj: Request for Studies of Titan II as a Standardized Space Launch Vehicle.)
- 11 Oct 61 J. H. Rubel, Deputy DDR&E, was impressed with the Air Force plan to develop Titan III and agreed to recommend that the plan be approved by the joint DOD-NASA Large Launch Vehicle Planning Group. (Ltr, Col H. W. Gainer, Asst to DCS/S&L, to DCS/S&L, 13 Oct 61, subj: Titan III as Standardized Launch Vehicle.)
- 13 Oct 61 DDR&E authorized the Air Force to begin early actions leading toward accelerated development of Titan III. Funds were promised as requirements were validated. (Memo, J. H. Rubel, Dep DDR&E, to SAF(R&D), 13 Oct 61, subj: Titan III Launch Vehicle Family.)
- 17-18 Oct 61 Air Force headquarters forwarded to the DOD fund requirements for development of Titan III. It was estimated \$12.58 million would support Phase I definition studies to be completed by February 62. (Memo, B. McMillan, Asst SAF(R&D), to DDR&E, 18 Oct 61, subj: Proposal for Initiation of Projects to Protect Titan III Schedules; memo, MajGen J. R. Holzapple, Dep DCS/S&L (Sys), to Asst SAF(R&D), 17 Oct 61, same subject.)
- 20 Oct 61 Air Force headquarters instructed AFSC to undertake "expedited" actions leading to Phase I of the Titan III program. (Msg, AFSDC-5-8, 71987, USAF to AFSC, 20 Oct 61; msg, SCGN 20-10-31, AFSC to SSD, 20 Oct 61.)

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- Nov 61
The Large Launch Vehicle Planning Group (Golovin Committee) recommended immediate development of Titan III based on its prospects as the most satisfactory vehicle yet proposed to meet the nation's post 63 requirements. (Rpt, Launch Vehicle Data Summary, prep by DOD-NASA LLVPG, Nov 61.)
- 1 Nov 61
SSD appointed its first Titan III source selection board for procurement of solid propellant motors. (Ltr, MajGen R. E. Greer, V/Comdr, SSD, to AFSC, 1 Nov 61, subj: Titan III Solid Motor Development.)
- 3 Nov 61
Assistant SAF(R&D) McMillan advised Secretary of the Air Force E. M. Zuckert that Titan III development would also serve as a project for demonstrating cost reduction, organizational and management innovations. (Memo, B. McMillan, Asst SAF(R&D), to SAF, 3 Nov 61, subj: Titan III Launch Vehicle Family.)
- 17 Nov 61
Secretariat and administrator level representatives from the DOD, NASA and Air Force agreed to reconvene the Golovin Committee (LLVPG) to consider the implications of Titan III development. (Ltr, R. S. McNamara, SOD, to Adm/NASA, 17 Nov 61, no subject.)
- 18 Nov 61
DDR&E approved the start of Phase I of the Titan III program "subject to the availability of funds." On the \$15 million initially requested for FY 62, DDR&E authorized the release of \$1.15 in the 624A area. The approved study involved development of a "ruggedized" Titan II plus solid boosters having a diameter of 120 inches. With a third stage, Titan III would be capable of handling payloads ranging from 5,000 to 25,000 pounds. (Memo, H. Brown, DDR&E, to SAF, 18 Nov 61, subj: Approval of FY 1962 RDT&E Programs Related to Titan III; Rpt, Program 624A Management Philosophy and Technical Approach, prep by SSD, 9 Jun 62.)
- 11 Dec 61
SSD received \$2 million of the \$12.58 million necessary to support Titan III through Phase I. Actions were taken to award Phase I contracts immediately. (History of Titan III, 1961-1963, prep by SSD, Jun 64.)
- 23 Dec 61
DDR&E released an additional \$6.5 million necessary to support Phase I study. This money was not received at SSD until 15 January 62. (Memo, H. Brown, DDR&E, to SAF, 23 Dec 61, subj: Approval of FY 62 RDT&E Programs Related to Titan III.)

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- 17 Jan 62 Assistant Secretary of the Air Force (Materiel) J. S. Imirie in a summary report to DDR&E advised that continued funding delays had postponed completion of Phase I to 30 April. Early Titan III planning called for completion of Phase I by 1 February. (Memo, J. S. Imirie, Asst SAF(Mat), to DDR&E, 17 Jan 62, subj: Titan III Funding and Delay.)
- 19 Mar 62 Under Secretary J. V. Charyk and J. H. Rubel, Deputy DDR&E, approved preliminary Titan III design, elimination of Agena D upper stage and development of a new transtage, and further study of Centaur as the Titan III upper stage. They also requested Air Force preparation of a "White Paper" which would report the philosophy and technical approach applied in the Titan III program. (Memo, J. V. Charyk, SAFUS, to Asst SOD and DDR&E, 27 Mar 62, subj: Titan III Space Launch Vehicle.)
- 3 Apr 62 DDR&E established a technical group under the Institute for Defense Analyses to furnish an independent appraisal of Titan III's Phase I accomplishments. (Mag, 75769, USAF to AFSC, 3 Apr 62; memo, J. H. Rubel, Dep DDR&E, to Asst SAF(R&D), 3 Apr 62, subj: Titan III Technical Evaluation of Phase I Effort.)
- 7 Apr 62 A Titan III source selection board recommended United Technology Corporation as developer of solid fuel boosters.
- 3 May 62 Formal completion of Phase I and presentation of the Titan III Proposed System Package Plan to the Systems Review Board. The plan called for Titan II core, two strap-on solid booster motors, 17 test flights, "ITL" facilities at both the Atlantic and Pacific Missile Ranges and "Blue Suit" capability at both ranges for a total development cost of \$1.113 billion. (Rpt of SRB Mtg 62-40, 2 May 62; Minutes of 40th DSMG Mtg, 3 May 62.)
- 4 May 62 The Institute for Defense Analyses (Brady Committee) forwarded a generally favorable Titan III review report to DDR&E. (Rpt, Tech Rpt 62-8, "Technical Review of Phase I of Titan III (624A) Standardized Space Launch Vehicle," 4 May 62.)
- 16 May 62 J. H. Rubel directed the Air Force to supplement the Titan III proposed development plan (forwarded to DDR&E 7 May) by additional technical information and reasons supporting the requirement for "ITL" launch complexes at both the Atlantic and Pacific missile ranges. (Memo, J. H. Rubel, to Asst SAF(R&D), 16 May 62, subj: DDR&E Initial Evaluation of Proposed System Package Plan for Program 624A.)

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- 23 May 62 DDR&E released \$2.56 million to carry Titan III extension of Phase I studies through 15 June. (Memo, H. Brown, DDR&E, to SAF, 23 May 62.)
- 28 Jun 62 DDR&E asked the Air Force to include five items in the pending Program Change Proposal for Titan III: (1) deferment of the "blue suit" capability until the completion of Phase II, (2) use of a modified Titan II guidance system with minimum modification in lieu of a new system, (3) optimization of the upper stage for 24-hour orbit, (4) primary development of a five-segment solid motor, and (5) construction of only a two-pad IRL at the Atlantic Missile Range and none at Pacific Missile Range during the Phase II program. Although technical in content, the instructions had the effect of markedly reducing prospective costs. (Memo, H. Brown, DDR&E, to SAF(R&D), 28 Jun 62, subj: Titan III.)
- 13 Jul 62 The Air Force and DDR&E agreed on the scope and details of Titan III program changes. (Memo, Col H. W. Gainer, Ofc DCS/S&L, to SAF, 16 Jul 62, subj: PCP's for Titan III Space Booster, and Large Solid Propellant Motor.)
- 19 Jul 62 Secretary of the Air Force Zuckert signed the Titan III Program Change Proposal. (PCP 6440909.4-1, 19 Jul 62.)
- 19 Jul 62 Between the April submission of the Titan III package plan and the July approval of a PCP, Titan III contractors had been retained through "level of effort" funding which preserved a technical competence for the future but contributed little to the program. Continuation of this situation would place the entire effort in peril. (Ltr, Col H. W. Gainer, Ofc DCS/S&L, to Dir/Sys Acq DCS/S&L, 19 Jul 62, subj: S&L/SSA Objectives and Problems.)
- 16 Aug 62 As recommended by DDR&E the Secretary of Defense approved full scale development of the Titan III standardized launch vehicle system contingent on the adoption of certain innovations: limit on engineering changes, use of incentive contracts and improved management techniques. A revised program package was to be submitted to DDR&E by 15 October. The SOD also stipulated that his approval did not authorize the release of funds; such release would follow the negotiation of definitive contracts and the receipt of DDR&E approval. (Prgm Change, SOD Decis/Guid, 6.44.09.09.4, approved by R. S. McNamara, SOD, 16 Aug 62.)
- 20 Aug 62 The DOD announced selection of Martin Marietta Corporation as systems integration contractor for Titan III and that development-production contract negotiations were underway with United Technology Corporation and Aerojet General Corporation. It was also announced that approval had been given to use of a modified Titan II AC Spark Plug guidance system in the Titan III booster. (DOD OPA Rel, 20 Aug 62.)

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- 4 Sep 62 An additional \$15 million, allocated to the Titan III program, was received by SSD. In accordance with plan, it was anticipated the money would be used to support limited preliminary Phase II actions. DDR&E objected to this plan, however, on the ground that no money was to be expended for Phase II actions until DDR&E had approved Phase II definitive incentive contracts. (History of Titan III, 1961-1963, prep by SSD, Jun 64.)
- 11 Sep 62 DDR&E denied an Air Force request for an additional \$17.9 million to carry Titan III into Phase II activity prior to final approval of definitized contracts. (Memo, J. H. Rubel for H. Brown, DDR&E to SAF, 11 Sep 62, subj: Release of Additional Funds for Titan III.)
- 27 Sep 62 SSD proposed a plan which would permit termination of Phase I contracts on 31 October and an orderly transition to Phase II development by 1 December 62. (Memo for Record, Col J. S. Bleymaier, 624 Prog SPD, 27 Sep 62.)
- 1 Dec 62 Beginning of Titan III, Phase II, system hardware development. (System Prog Dir for Titan III Space Booster, Prog 624A, 15 Oct 62, issued by Hq USAF.)
- 23 Feb 63 First firing of a Titan III solid motor at United Technology Center. A single center segment successfully met its test objectives. (History of Titan III, prep by SSD, Jun 64.)
- 13 Jun 63 The Corps of Engineers awarded a contract for construction of Titan III "ITL" launch installations at the Atlantic Missile Range to C. H. Leavell and Peter Kiewit and Sons, joint venture contractors, at a bid cost of \$12,678,873. (Msg, DWFB-14-6-59-E, 6555th ATW, to Hq USAF and SSD, 14 Jun 63.)
- 15 Jul 63 Secretary of Defense McNamara stated that "the development of the Titan III launch vehicle should be continued in accordance with approved plans." (History of Titan III, prep by SSD, Jun 64.)
- 20 Jul 63 The first full scale five segment firing of a 120-inch solid propellant motor. All test objectives were met: the motor exerted a thrust of 940,000 pounds, operated for 110.8 seconds, and thrust vector control operated satisfactorily. (Ltr, BrigGen J. S. Bleymaier, 624A SPD, to LtGen D. L. Putt (Ret), United Aircraft Corp, 23 Jul 63, subj: Five Segment Solid Rocket Motor Firing.)

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10 Dec 63

The Department of Defense announced cancellation of the Dyna Soar (X-20) program. Although assumption (planning only) of the Manned Orbital Laboratory (MOL) program in effect substituted a new mission for the cancelled X-20, timing of the two programs required a revision of the Titan III test schedule. Four launches which had been assigned to Dyna Soar were reassigned to other mission objectives. Operational planning was also affected by a probable reduction in the total number of Titan III launches by four to six per year. (Ltr, LtCol F. B. Hennessy, Asst for Rqmts, 624A Prog Ofc, to LtCol E. A. Doty, Resources and Program Control, 624A Prog Ofc, 24 Jan 64, subj: Titan III Semi-annual History.)

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GEMINI

Jul - Dec 62

SSD contracted for a Gemini launching system, signing definitive contracts with Martin-Marietta, producer of the Titan II booster, and Aerojet-General, manufacturer-developer of the Titan II propulsion system. The Gemini directorate also monitored progress in the development of design, tooling and fabrication of hardware and modification of Launch Complex 19 at the Atlantic Missile Range. Program funding established by NASA for the fiscal year was set at \$58.8 million (as of October). (Hist Rpt, Dep for Engrg, Jul - Dec 62.)

27 Jul 62

J. H. Rubel, Deputy DDR&E, and Robert C. Seamans, Jr., Associate Administrator of NASA, agreed on Gemini program arrangements. Mercury operational procedures covering network support, flight control and monitoring were applied to the Gemini program. The DOD Representative for Project Mercury and the Deputy Commander for Manned Space Flight in AFSC would extend their Mercury collaboration to the Gemini program. NASA retained its prerogative of selecting and training astronauts as future programs required. Finally, arrangements previously worked out which established a single line of communication and command from SSD to the Gemini Project Office were adjudged satisfactory and continued in effect. (Memo, Rubel and Seamans, to SOD Operational and Management Plan for Accomplishing the Gemini (Formerly Mercury Mark II) Program.)

1 Oct 62

SSD prepared and distributed a Development Plan for Gemini Launch Vehicle System, an updated revision of a plan first published 23 March 62. The revised plan called for two-man flights extending to 14 days; earth orbit rendezvous and docking with a target vehicle; controlled land recoveries; and simplified space-craft and launch vehicle countdown, procedures, and techniques. The vehicle would consist of a modified man-rated Titan II booster and the Gemini space-craft. SSD was to support the Gemini program by developing the vehicle and launching the system. Aerospace Corporation would provide systems engineering and technical direction. The plan as projected called for procurement of 15 launch vehicles with the first flight scheduled for December 63, the second for March 64, and subsequent flights every other month. (Dev Plan for Gemini Launch Vehicle Sys, 1 Oct 62, prep by SSD.)

9 Jan 63

The first Gemini booster vehicle was erected on the new Martin vertical test facility at Baltimore. Functional tests of the booster systems were started immediately. (Hist Rpt, Gemini Prog Ofc, Jan-Jun 63.)

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11 Jan 63

This date marked the beginning of a Gemini pilot safety development patterned on a similar effort for the Mercury program. An important part of this undertaking was development of a highly reliable malfunction detection system and renewed emphasis on high quality workmanship in the design and production of all booster and spacecraft components. (Hist Rpt, Gemini Prog Ofc, Jan - Jun 63.)

21 Jan 63

On this date the SOD and the Administrator of NASA jointly established the Gemini Program Planning Board. The board was created to insure that the Gemini Program was "planned, executed, and utilized in the overall national interest, in accordance with policy direction from the Secretary and Administrator, so as to avoid duplication of effort in the field of manned space flight and to insure maximum attainment of objectives of value to both the Department of Defense (DOD) and the NASA." (Technical Dev Plan For DOD/NASA Gemini Experiments 631A, dtd 23 Sep 63, prep by SSD.)

18 Mar 63

By direction of General B. A. Schriever, Commander AFSC, and D. Brainerd Holmes, Deputy Associate Administrator for Manned Space Flight, NASA, a Joint Ad Hoc Study Group was established to recommend to the Gemini planning board the extent and method of DOD participation in the Gemini program. This participation was based on the 21 January DOD/NASA Agreement which stated that "the DOD will participate in the development, pilot training, preflight checkout, launch operations and flight operations of the Gemini Program to assist NASA and to meet the ODO objectives." The first meeting of the study group was held at Manned Spacecraft Center in Houston on 25 March 63. The group was to present its interim report to the Gemini planning board on 8 April and the final report on 22 April 63. (Ltr, Enclosures, D. B. Holmes, Dir of Manned Space Flight NASA, to Dr. R. R. Gilruth, Dir NASA Manned Spacecraft Center, Houston, Tex, 18 Mar 63, no subject.)

6 May 63

On this date the NASA/DOD Joint Ad Hoc Study Group concerning Air Force participation in the Gemini Program issued its final report. The group recommended, among other things, the establishment of an Air Force field office at Houston, Texas, during the summer of 63. (Hist Rpt, Gemini Prog Ofc, Jan - Jun 63.)

15 May 63

NASA Manned Space Flight Center Directed an extension of the Gemini launch schedule which significantly affected production and contractual aspects of the program. Fifteen flight tests, scheduled to end May 66, were extended to final test date of October 67, and other adjustments in delivery dates were made in the program. The plan to begin fiscal 64 with definitive cost-plus-incentive-fee contracts with

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15 May 63

definitive cost-plus-incentive-fee contracts with Martin and Aerojet General were of necessity cancelled and the two firms were issued letter contracts to cover their Gemini work. (Msg, G 5-011C, NASA MSC to Hq SSD, 15 May 63.)

13 Jun 63

NASA agreed to the following revised Gemini expenditures and budget plan:

(In Millions)

<u>Through FY 63</u>	<u>FY 64</u>	<u>FY 65</u>	<u>FY 66</u>	<u>FY 67</u>	<u>FY 68</u>	<u>Total</u>
84.4	58.	35.9	27.1	20.8	5.	231.2

(Hist Rpt, Gemini Prog Ofc, Jan-Jun 63.)

20 Jun 63

Secretary McNamara instructed the Secretary of the AF to submit, "The program for in-flight military experiments to the DDR&E for review and approval." Furthermore, the secretary was to take the necessary action to "establish the procedure necessary to implement and fund this experimental program." McNamara also approved establishing an AF field office at the MSC, Houston, Texas for "providing the overall Management of the Department of Defense participation in the Gemini program." The DOD also agreed to bear the cost involved in correcting Titan II's longitudinal oscillation and combustion instability problems for the Gemini program. Every effort was to be made to assure a well integrated and planned program. (Memo, R. S. McNamara, SOD, to SAF, 20 Jun 63, subj: Recommendation of the Gemini Program Planning Board.)

16 Aug 63

AFSC headquarters authorized SSD to establish a field office at Houston, Texas, effective 25 August 63. The initial manpower authorizations, based on the recommendations of the Ad Hoc Study Group, was set at 13-11 officers and two civilian secretaries. The mission of the field office was to develop a coordinated experimental program that would contribute to the solution or evaluation of defense problems and that would, at the same time, assist NASA in the Gemini program. (SO G-98, Hq AFSC, 16 Aug 63.)

23 Sep 63

SSD published a "Technical Development Plan for DOD/NASA Gemini Experiments 631A," which declared that it was a logical step in the policy of joint DOD/NASA experimentation and mutual assistance as specified in the NASA and DOD Gemini agreement. The agreement to develop and implement the plan went into effect on 21 January 63. There were 22 experiments--13 Air Force and nine Navy, to be performed in support of potential future space systems in the mission areas of reconnaissance and surveillance of land, sea surface and under sea areas; satellite inspection, interception and negation, ballistic missile and satellite warning and defense; space rescue, and sea-state measurements. (Technical Development Plan for DOD/NASA Gemini Experiments 631A, dtd Sep 63, prep by SSD.)

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GEMINI TARGET VEHICLE PROGRAM

Dec 61 - Jan 62

The exact working relationship between NASA and the Air Force concerning management activity of the Atlas-Agena rendezvous target vehicle portion of the Gemini program remained uncertain. It was tentatively agreed that SSD would deal directly with NASA's Manned Spacecraft Center. (History of the Space Systems Division--January--June 1962, Vol 2, Feb 63, prep by SSD Hist Div.)

19 Mar 62

Major General Ritland, Commander of SSD, requested General Schriever to clarify the lines of authority involved in managing the SSD Gemini and Gemini Target Vehicle programs. The arrangement to maintain an SSD/Manned Spacecraft Center line of contact was threatened by NASA's insistence that SSD deal through the Marshall Space Flight Center on all Gemini and target vehicle matters. (Ltr, Col R. A. Berg, Asst V/Comdr SSD, to Hq AFSC, 9 Apr 62, subj: SSD-NASA Relationships on the Gemini Program; Msg, SCGN 10-4-19, Hq AFSC to SSD, 10 Apr 62; ltr, LtGen H. M. Estes, Jr., Comdr SSD to Gen B. A. Schriever, Comdr AFSC, 16 May 62, subj: SSD-NASA Management Relationships on the Gemini Program.)

COMM SAT

COMMUNICATION SATELLITES

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Although RAND had suggested the possibility of a communication satellite, specifically a 24-hour synchronous orbit satellite, as early as February 47, the idea received little attention and no support in the following decade. Following Sputnik and the establishment of ARPA, work got under way on active communication satellites.

11 Jul 58

At ARPA's request, Hq USAF directed ARDC to prepare an abbreviated development plan for a communication satellite. (Ltr, BrigGen H. A. Boushey, Dep Dir R&D to Cmdr ARDC, 11 Jul 58, subj: Communications and Navigation Satellites.)

26 Aug 58

ARDC issued an abbreviated development plan calling for three or four satellites in a 24-hour equatorial orbit to be preceded by a satellite relay system. This was planned as a five phase program with a high capacity, broad band width operational system available in 1961. The fifth phase was modernization of the system in 1965-70 as new techniques were devised.

30 Sep 58

The Air Force outlined its long distance communication requirements and submitted the development plan to ARPA. (Memo, R. E. Horner, ASAF (R&D) to Dir/ARPA, 30 Sep 58, no subject.)

Oct 58

ARPA established an ad hoc panel of representatives from the three services and ARPA to assist in formulating a communication satellite program covering technical possibilities, military requirements, and funding. (Msg, 42978, Hq USAF to Cmdr ARDC, 9 Oct 58.)

22 Oct 58

ARPA notified the Air Force of its current plans, based on the ad hoc panel recommendations. There would be a dual program with an interim relay satellite in 1960, and a more sophisticated 24-hour satellite in 62. ARPA also announced that the communications payload would be developed by the Army Signal Corps and the booster and satellite vehicle by the Air Force. ARPA stated it would soon direct ARDC and the Signal Corps to prepare a joint development plan. (Memo, R. W. Johnson, Dir ARPA to ASAF (R&D), 22 Oct 58, subj: Strategic Communications System.)

5 Nov 58

ARPA requested preparation of a development plan for a 24-hour communication satellite by 10 Dec 58. (Memo, R. W. Johnson, Dir/ARPA to ARDC, 5 Nov 58, subj: 24-Hour Communication Satellite.)

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8 Dec 58

Communication Satellite Development Plan issued. Basically it called for the development of a 24-hour satellite with the Air Force and Army splitting up the job--over Air Force protests that the arrangement would not work and that the program omitted SAC's most urgent requirement--as well as an interim delayed relay satellite. Appended as Annex D was the Air Force's urgent requirement--a 6-hour polar orbited satellite to allow communication with SAC airborne forces--but only as a recommendation.

10 Dec 58

The Air Force refused to concur in the development plan unless its requirement was included. General Schriever, at the ARPA program review meeting, stated that the program management structure selected by ARPA contained serious inherent problems. (Ltr, LtGen S. E. Anderson, Cmdr ARDC to DCS/D, 8 Dec 58, subj: Joint Army Air Force Communications Development Program; memo, LtGen R. C. Wilson, DCS/D to ASAF (R&D), 9 Dec 58, subj: Communications Satellite; Memo for Record, Maj H. C. Howard, 17 Dec 58, subj: Communications Satellite.)

20 Jan 59

ARPA Order 54-59 and 55-59 issued to the ARDC and Army Signal Corps on their respective roles in developing the delayed repeater interim system and the 24-hour equatorial system, the latter with a first-flight date of 62.

6 Mar 59

ARPA stated that it would develop the polar-orbit satellite to meet the Air Force's urgent requirements and asked for a full development and funding plan as soon as possible. (Memo, R. W. Johnson, Dir/ARPA to Cmdr, ARDC, 6 Mar 59, subj: Satellite Communications in Polar Regions for SAC.)

22 May 59

Amendment 1, Order 54-59 issued by ARPA, described the current development program and asked for a new development plan:

SAC Polar Satellite (Steer): single voice, ground-to-air and air-to-ground capability in the UHF band. Ready by 60-61.

Advanced Polar Satellite (Tackle): global satellite, including multi-channel capability with microwave components. Four would be launched from Western Test Range into 5,600 nautical mile polar orbits by Atlas-Agena B beginning July 61 and one every other month thereafter.

24-Hour Global Satellite (Decree): a broad band point-to-point microwave system in equatorial orbit at 22,000 miles. Seven to be launched from Eastern Test Range with Atlas-Centaur, beginning March 62 and one every other month thereafter.

Payloads and ground communication complex for Tackle and Decree were to be developed by the Signal Corps; aircraft equipment for all three projects and the Steer payload were to be developed by WADC; system engineering to be contracted to a private firm; and overall technical direction by ARPA. Fiscal 59 funding totalled \$8.6 million.

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27 Jul 59

AFBMD issued the National Survival Communications Satellite (Flag) Development Plan. It was presented as the Air Force operational follow-on to ARPA's communication satellite program.

28 Aug 59

Hq USAF notified ARDC, AFBMD, and SAC that DDR&E would review the entire ARPA active communication satellite program from a requirement and technical standpoint. The above organizations were to prepare material for a 17 September meeting. (Msg, 68749, Hq USAF to SAC, ARDC, AFBMD, 28 Aug 59; msg, 71978, Hq USAF to SAC, ARDC, AFBMD, 9 Sep 59.)

21 Jan 60

Dr. Charyk informed Dr. York of his concern over rumors on an impending Steer cancellation order and noted its urgent requirement. He requested that research and development responsibility and currently programmed funds be assigned to the Air Force to satisfy these requirements and at the same time advance the objectives of the Decree project. (Memo, J. V. Charyk, ASAF (R&D) to DDR&E, 21 Jan 60, subj: Satellite Communications Systems--Project Steer.)

29 Feb 60

Amendment 4, Order 54 issued by ARPA as an interim directive while awaiting JCS comments and Secretary of Defense approval. It cancelled the three-project program, combining all into a single Advent 24-hour satellite employing microwave frequencies. It was expected that some polar-orbiting satellites would initially be used with UHF frequencies, thereby meeting SAC requirements as a fall-out. The launching schedule was revised as follows: 4 Atlas-Agena Bs from Pacific Missile Range into a 5,600 nm polar orbit, between September 61 and June 62; then 10 Atlas-Centaurs from Atlantic Missile Range into synchronous orbits, between February 62 and September 63. Estimated program funding was \$140 million consisting of: Fiscal 60, \$26.4 million; 61, \$32 million; 62, \$41.6 million; 63, \$40 million. There was no change in management responsibility, as had been earlier indicated, and ARDC was to prepare a development plan within 30 days.

1 Apr 60

AFBMD issued a development plan in response to the 29 February amendment.

8 Apr 60

ARPA said that the AFBMD communications satellite development plan was "not responsive to the ARPA requirements." All UHF work was to be phased out as well as immediate development of ground-to-air and air-to-ground microwave capabilities. ARPA recognized Air Force strenuous objections to these changes but added that it was up to the Air Force to handle this through "other means and channels." (Memo for Record, Col G. B. Munroe, Ch, Policy Div, Asst/AT, 12 Apr 60, subj: Communications Satellite.)

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4 May 60

Briefing on the two development plans given to ARPA, DDR&E, Army, Navy and USAF representatives. The both plans met all ARPA instructions except that one eliminated four Atlas-Agena launches that were considered to cost more than they were worth. Thus the second plan would include just Atlas-Centaur launchings and program costs would decrease from \$191.67 million to \$163.6 million. (Ltr, LtCol C. Arnold, AFEMD to AFEMD Liaison Office, 2 May 60, subj: Transmittal of Advent Program Development Plans.)

9 Jun 60

After weeks of study the Air Staff forwarded a draft SAF-SOD memorandum to the Secretary of the Air Force that requested reinstatement of UHF development and continuation of Air Force management of the communication satellite program (strongly rumored to be reassigned to the Army). (Ltr, Maj Gen H. W. Grant, Dir/C&E to SAF, 9 Jun 60, subj: Satellite Communications Systems.)

15 Sep 60

The Secretary of Defense directed the transfer of administrative and technical responsibility for Advent to the Army, who would conduct the program on the basis of the 14 September management plan and the 11 July ARPA program directive as amended. Total program costs were still estimated at \$174 million dollars--including \$42 million programmed for fiscal 61 and \$107 million required in fiscal 62-64. Completion of R&D to demonstrate feasibility of a 24-hour satellite microwave system (surface-to-surface only) was estimated for December 63 and called for the 3 Atlas-Agena and 7 Atlas Centaur launchings. In a second directive, the Secretary of Defense informed the Army and Air Force of their Advent responsibilities, as outlined the previous day. (Memo, J. H. Douglas, Actg SOD to S/A, 15 Sep 60, subj: Transfer of the Courier and Advent Programs; memo, Douglas to SAF and S/A, 15 Sep 60, subj: Program Management for Advent.)

29 Sep 60

Hq USAF notified ARDC of the recent responsibility transfer for Advent to the Army and added, "In discharging the Air Force responsibilities it is important that the fullest cooperation be maintained between the Air Force agencies and appropriate Army Commanders." (Ltr, MajGen M. C. Demler, Actg DCS/D to Cmdr, ARDC, 29 Sep 60, subj: Program Management of Advent.)

1 Mar 61

After studying proposals to obtain minimum essential communication systems, the Weapons Board recommended, among others, continued effort to reorient Advent from a microwave to a UHF satellite. (Min of Wpns Bd Mtg 61-15, 1 Mar 61.)

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6 Apr 61

Secretary McNamara forwarded copies of a White Paper dealing with Advent management to the Army and Air Force and asked for comments by 15 April on the recommendations it contained. There were four: (1) retain and improve the current structure, (2) same as above but with STL as technical advisor in lieu of Aerospace, (3) shift contract administration for the final stage vehicle from the Air Force to the Army, and (4) shift all system management to the Air Force except for the payload and ground communication equipment. These alternatives were based on real or imagined problems arising between the Army and Air Force over conduct of various phases of the program. The White Paper favored the third alternative and listed the fourth as its second choice. (Memo, R. S. McNamara, SOD to SAF and S/A, 6 Apr 61, no subject.)

29 May 61

Secretary McNamara announced that in view of other studies under way on simplifying booster and spacecraft combinations, had decided to take no action at this time on the White Paper recommendations listed in his 6 April memorandum. He asked, however, for full cooperation in getting on with the Advent program. (Memo, R. S. McNamara to SAF, S/A, S/N, 29 May 61, subj: Management of Advent Communication Satellite Project.)

2 & 16 Jun 61

Noting that Advent would be delayed and that there was an approaching period of intense sunspot activity the Assistant Secretary of the Air Force (R&D) reported that the Defense Communications Agency and DDR&E wanted to know if the Air Force could build a simple communications satellite for the 63-65 period. AFSC was requested to make an in-house study of the problem. (Memo, H. Davis, Dep/Res, ASAF (R&D) to C/S, 16 Jun 61, subj: Satellite Communications Satellite Feasibility Study.)

21 Aug 61

AFSC plan for a minimum risk, minimum development of a communications satellite system forwarded to the Hq USAF, DCA, and DDR&E. (Memo, H. Davis, Dep/Res to DDR&E, 21 Aug 61, subj: Military Communication Satellite System; ltr, Col L. J. Gossick, Ch, Sp Sys to Air Staff offices, 22 Aug 61, subj: Military Communication Satellite Systems.)

3 Oct 61

Dr. Charyk presented his views on Advent to DDR&E. He said Centaur was in a bad way but the Army continued to develop Advent as if there was no Centaur problem. Charyk said a substantial portion of Army's Advent work was a complete waste and had reached "scandalous proportions." He advised halting current development and devising a new program at once. (Memo, J. V. Charyk, U/SAF to DDR&E, 3 Oct 61, subj: Advent Program.)

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- 14 Mar 62 Changes in certain management practices and opinions of various authorities had not basically improved the Advent program. General Schriever reiterated his continued dissatisfaction with Advent technical, funding, and managerial conditions. He said that Army teams now at Air Force plants (in accordance with Dr. Brown's directive of 26 December 61) resulted in contractors receiving two sets of orders. "All of this leads to a chaotic situation at best" and he asked for OSAF discussions with its Army counterpart. (Ltr, Gen B. A. Schriever, Cmdr, AFSC to C/S, 14 Mar 62, subj: Advent Program.)
- 27 Apr 62 In anticipation of new directives reorienting the satellite communication program the Army directed SSD to terminate immediately final stage vehicle development for Phase II and III and reduce effort on Phase I. (Msg, PAM-4-27-263, Advent Mgmt Agency to SSD, 27 Apr 62.)
- 22 May 62 Dr Brown, in the form of a White Paper, furnished McNamara with a comprehensive review of the communication satellite program, current funding, technical, and management problems, and alternative courses of action with the pro and con for each. He recommended that (a) two separate programs be started--one for an unstabilized, random orbit, medium altitude satellite and the other for a stabilized, synchronous orbital satellite with both using existing boosters; (b) Advent be drastically reduced and its equipment and facilities be used in ground tests in support of the two new programs; (c) DCA be made responsible for the programs and the task of integrating development and operation of the two into the communication system; (d) the Army have responsibility for developing and operating the ground environment; (e) the Air Force have responsibility for development and operation of the satellites. (Memo, H. Brown, DDR&E, to SOD, 22 May 62, subj: DOD Communications Satellite Program.)
- 23 May 62 Secretary McNamara issued three directives--one each to DCA, the Air Force, and the Army--with their contents basically in accord with the White Paper recommendations. In addition McNamara approved DCA's minimum essential satellite communication system requirement, pending since 5 September 61. This was the end of the road for the controversial Advent program. (Memo, R. S. McNamara, SOD to DCA, 23 May 62, subj: DOD Communications Satellite Program; memo, McNamara to SAF, 23 May 62, subj: DOD Communications Satellite Program.)
- 26 May 62 Dr. Brown directed the Army to terminate immediately Advent contracts on the payload and P&V, except for specific aspects. (Memo, H. Brown, DDR&E to AS/A(R&D), 26 May 62, subj: Advent Program.)

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14 Jun 62 Major General R. M. Montgomery, Assistant Vice Chief of Staff, submitted an interim report to Dr. Charyk on actions to date in starting the new program. Primarily they consisted of top-and working-level meetings with DCA and studies on the contemplated Air Force internal organization. (Ltr, MajGen R. M. Montgomery, Asst VC/S to U/SAF, 14 Jun 62, subj: DOD Communications Satellite Program.)

5 Jul 62 Secretary McNamara issued specific instructions on DCA, Air Force, and Army responsibilities, functions, personnel support, etc. In a separate directive to the two service secretaries, McNamara emphasized that he wanted their programs "carried out under your close personal supervision." (Memo, R. S. McNamara, SOD to Dir/DCA, SAF, & S/A, 5 Jul 62, subj: Defense Communications Satellite Program.)

2 Aug 62 DDR&E's Defense Communication Satellite Committee issued a report providing program and cost guidance. For the Random Orbit satellite, contract date should 1 Jan 63, first launch during the first half of 64, and operational capability in early 65. Fiscal 63 funding would be \$25 million. The Synchronous Satellite program should be on contract during the first quarter of 63, a first launch during the first half of 65, and it should be operational by 67. Fiscal 63 funding would be \$10 million. (Msg, 72247, Hq USAF to AFSC, 6 Aug 62.)

1 Oct 62 The Air Force made its first formal funding request, for \$2.276 million in fiscal 63 funds, to pay for Aerospace Corp technical support to SSD and to start an RFP to obtain a source to develop light weight traveling wave tubes. DDR&E had verbally agreed to this on 14 September. (Memo, B. McMillan, ASAF(R&D) to DDR&E, 1 Oct 62, subj: DOD Communications Satellite Program Funding.)

8 Oct 62 Secretary Zuckert assigned "designated system" labels to the medium-altitude, random orbit satellite and synchronous, stabilized satellite programs and placed them under his direct management. (Memo, E. M. Zuckert, SAF to C/S, 8 Oct 62, subj: Defense Communication Satellite Program.)

19 Oct 62 SSD was informed that the communications program was to be two programs: the medium altitude random orbit communications satellite system, designated 369 Program, and a synchronous, stabilized communications satellite system, designated the 814 Program. (Msg, MSFA 18-10-44, Hq AFSC to SSD, 19 Oct 62.)

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26 Nov 62

SSD published a Proposed System Package Plan for Program 814 which would provide a capability for point-to-point military voice and teletype communications via stabilized active repeater satellites in synchronous equatorial orbit. (PSPP, 26 Nov 62, prep by SSD.)

4 Dec

SSD was instructed to begin a program definition phase for Program 369. Heretofore it had been understood that the DDR&E planned to pass the Phase I program definition approach to contracting because of project urgency. (Hist Rpt, 369 and 814 Program Ofc, Jul - Dec 62.)

5 Dec 62

The DDR&E approved a revised Technical Development Plan for Program 369 and instructed the Army and the Air Force to "... proceed immediately with the release of requests for proposals and other actions necessary to the prompt initiation of program definition phase activities for the ... System, including surface environment, in accordance with the referenced memoranda, subject to the availability of funds." (Memo, DDR&E to SA, SN, SAF, Chmn JCS, and Dir, DCA, 5 Dec 62, subj: Defense Communications Satellite Program.)

19 Dec 62

The Air Force strongly reiterated its view, shared by the Army, that the Defense Communications Agency (DCA) should not manage any portion of communications satellite development programs. The Air Force position was that "... the DCA is not required to, and will not participate in, the management of the Air Force program but will review the program on a continuous basis to insure that general program requirements are being fulfilled and that the interface problems between the Army and the Air Force are satisfactorily resolved. The Air Force must be delegated complete responsibility and authority for the management of the development, procurement, launch, injection into and control of orbit of the space components." (Memo, Col H. B. Kucheman, Jr., Dep, Programs 369 and 814, to Gen B. I. Funk, 19 Dec 62, subj: DCA/Army/Air Force Assignment of Responsibility.)

11 Jan 63

Authority to issue requests for proposals for Program 369 was granted to SSD. (Hist Rpt, Dep for Prog 369 and 814, Jan - Jun 63.)

Jan-Feb 63

On 21 January a system source selection board for Program 369 was convened at SSD and 24 January requests for proposals were mailed to selected industrial firms. On 7 February the requirements of the program were somewhat altered as a result of command discussions with DDR&E. The Air Force was advised to drop the solid state repeater experiment and retain the "needles" project in the program. At the same time, development of the traveling wave tube amplifier, an essential component of the satellite system, was continued. (Hist Rpt, Dep for Prog 369 and 814, Jan - Jun 63.)

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20 Feb 63 Positive responses to SSD's requests for proposals to develop the traveling wave tube amplifier were received from Eitel-McCullough; General Electric; Hughes Aircraft; Microwave Electronics; Radio Corporation of America, Electric Tube Division; and Sperry Rand. (Dep for Prog 369 and 814 (SSW), Wkly Activity Summary, Wk Ending 23 Feb 63.)

7 Mar 63 DDR&E directed deferral of support for the synchronous altitude communications satellite (Program 814) until fiscal 65 and an immediate reduction in the "overhead burden of the entire defense communications satellite program." It was also essential that a "... nucleus of key personnel be created to retain the capability to initiate increased activity in this area when desired ...". (Memo, J. H. Rubel, Dep DDR&E, to Asst SAF (R&D), 3 Jan 63, subj: Deferral of Support for the Synchronous Altitude Application of Communications Satellite Until FY 65 and the Immediate Reduction in Overhead Burden on the Entire Defense Communications Satellite Program.)

7 May 63 The Watkins-Johnson cost plus performance incentive fee contract for development of a 2.5 watt traveling wave tube amplifier--target cost and fee had been set at \$2,489,888 for performance from 1 November 62 to 1 September 66--was transferred from contract administration of the Army to the Air Force. (Rpt, Program 369 Launch and Orbital Operations Plan, Jun 63; Hist Rpt, Dep for Prog 369 and 814, Jul - Dec 63.)

10 May 63 Eitel-McCullough, Inc., San Carlos, California, was selected as the second source for a traveling wave tube amplifier. (Hist Rpt, Dep for 369 and 814, Jan - Jun 63.)

10 Jun 63 Negotiations with Eitel-McCullough were concluded for development of a 2.5 watt traveling wave tube amplifier. The incentive contract, priced at \$1,679,116 included the target fee of \$111,026 to be paid in monthly installments based on completion of work through the life of the contract to 10 January 1966. (Hist Rpt, Dep for Prog 369 and 814, Jul - Dec 63.)

Jul 63 During July, the two satellite and dispenser contractors, Missile and Space Division of General Electric Company and Western Development Laboratories of Philco Corporation, continued with design studies in accordance with the terms and conditions of the Program Definition Phase (Phase 1B) of their contracts, which had been awarded on 1 June 63. On 15-16 July 63, a team of SSD and Aerospace personnel, including members of the Systems Source Selection Board for Program 369, visited the plant facilities of each contractor to determine what progress had been made and to answer questions raised by the contractors. (Hist Rpt, Dep for Prog 369 and 814, Jul - Dec 63.)

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1 Jul 63

The SSD program office received a fiscal 64 program and budget authorization of \$6.20 million. As of 1 January 63, a total of \$5.31 million had been initiated and \$4.96 million had been committed. Program go-ahead and the release of additional fiscal 64 funds were scheduled for October 63, but neither was authorized by the end of the fiscal year. (Hist Rpt, Dep for Prog 369 and 814, Jul - Dec 63.)

12 Jul

In a personal letter to the Chairman of the Senate DOD Appropriations Sub-Committee, the Secretary of Defense made a strong plea for restoration of the \$44.6 million reduction that had been levied on the Defense Communication Satellite Program by the DOD Appropriations Act of 1964 passed by the House of Representatives 26 June 64. (His request was somewhat successful in that \$23 million was subsequently restored to the program for fiscal 64. (Ltr, Sec of Defense McNamara to the Hon Richard B. Russell, Chmn Defense Sub-Committee, Committee on Appropriations, US Senate, 12 Jul 63.)

26 Jul 63

DDR&E issued a memorandum for the Assistant Secretary of the Air Force and the Director of the Defense Communications Agency on the subject of reorienting the medium altitude system. This memorandum directed that for the sustaining effort (Phase 1C) the satellite and dispenser contractors should be instructed to modify their designs so that the original spin stabilized satellite could be converted to one employing the gravity gradient concept of stabilization with an absolute minimum number of changes. (Memo, DDR&E to the Asst SAF(R&D) and Dir DCA, 26 Jul 63, subj: Reorientation of the Medium Altitude System, Defense Communications Satellite Program.)

12-15 Aug 63

The plan for gravity gradient stabilization for communication satellites was presented to various government agencies in accordance with the 26 July DDR&E memorandum. The plan recommended completion of the program definition phase and selection of a Phase II contractor for the spin stabilized approach, then adoption of the "phase in" approach for conversion to the gravity gradient configuration. (Rpt, Analysis of the Impact of a Program Definition Phase on Program 369, 1 Nov 63, Vol II; Hist Rpt, Dep for Prog 369 and 814, Jul - Dec 63.)

9 Sep 63

SSD requested guidance from AFSC headquarters prior to 28 September, the date that would end the program definition Phase I work of Philco and General Electric. (Hist Rpt, Dep for Prog 369 and 814, Jul - Dec 63.)

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- 27 Sep 63 Because the DOD delayed announcing award of a Phase II contract for Program 369, it was necessary to obtain authority for USAF headquarters to extend the Phase 1C sustaining effort for both satellite and dispenser contractors from 28 September to 12 October 63. Air Force headquarters authorized extension of both fixed price contracts for a period not to exceed two weeks "...at the current funding level." (Msg, AFRDDD 98090, CSAF USAF to AFSC, 27 Sep 63; Hist Rpt, Dep for Prog 369 and 814, Jul - Dec 63.)
- 12 Oct 63 In the absence of a contract go-ahead from the DOD, it was again necessary to request an extension of the Phase 1C effort. This time, authority was granted by Air Force headquarters for a 30-day extension for both contractors. Funding was not to exceed \$100,000 for the 30-day period for each contractor. (Msg, AFRDDD 62155, CSAF USAF to AFSC, 11 Oct 63.)
- 12 Nov 63 Air Force headquarters authorized SSD to extend the Phase 1C contracts with both General Electric and Philco for an additional two weeks. (Msg, AFRDDD 70280, CSAF USAF to AFSC, 12 Nov 63.)
- 26 Nov 63 The Secretary of Defense approved a revised amount of \$55 million fiscal 65 funds for Program 369. This called for (a) programming a first launch slip of approximately two months from February 65 to April 65; and (b) programming a stretchout of two months in the early launches by providing 12 weeks intervals between launches 1, 2, and 3. (Doc, Subject/Issue Consideration FY 65 Budget, Subject/Issue: 6.34.09.-86.4 Program 369 - Air Force, 26 Nov 63.)
- 27 Nov 63 Air Force headquarters authorized extension of the Philco Corporation contract for an additional 60 days commencing 25 November 63. SSD was directed to terminate the Phase 1C contract with General Electric Company as soon as possible. The USAF message specifically stated that "...this authorization does not constitute Phase II (development) approval." (Msg, AFRDDD 73755, CSAF USAF to AFSC, 27 Nov 63; Hist Rpt Dep for Prog 369 and 814, Jul - Dec 63.)
- 5 Dec 63 The DOD published a Subject/Issue Consideration for fiscal 65 budget which established funding levels for Program 369. It was indicated the Deputy Secretary of Defense approved the second of three alternative plans which allowed for the integration to a greater degree of gravity gradient stabilization satellites into the system after spin stabilized satellite design had been verified (3 launches). Specifically, the plan called for: (a) cutting fiscal 65 funding to a minimum but retaining three early launches to validate the spin stabilized design; (b) programming two launches in 66

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to supplement the spinning satellites and five launches in 67 to complete the limited system with either spinning or gravity gradient stabilized satellites. It was stipulated, however, that "... no funding is included to establish a gravity gradient development." The ground system would be limited to essential terminals and control elements including those needed to support NASA's Symcom III launch and to make use of commercial satellites in case of emergency. This reorientation of the program would cause a slippage of approximately one year in the establishment of the systems. (Doc, Sub/Issue Consideration FY 65 Budget, Sub/Issue: Medium Altitude Communications Satellite System - Army, Air Force and DCA, 5 Dec 65.)

26 Dec 63

Air Force headquarters approved SSD's request for an increase of \$350,000 in Program 369 funding to permit an increased level of contractor participation during the Program Definition Phase sustaining period which was to extend through 25 January 64. (Msg, AFRDDD 80476, CSAF USAF to AFSC, 26 Dec 63.)

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SOLIDS

LARGE SOLID FUEL ROCKETS

1954-1958

The Air Force had been interested in vehicle application of solid fuel rockets since World War II. The slow development of solid fuel rockets, however, precluded their use in the ballistic missile program during the 1954-58 period. The inherent advantages of solids over complex liquid fuel propulsion systems led the Air Force, in 1958, to accelerate development of large size solid rocket motors, an effort which eventually culminated in the Minuteman ballistic missile.

1959-1960

Rapid progress in solid propellant development and increasing need for boosters of vastly higher thrust led the Air Force, in March 59, to solicit industry for a contractor to demonstrate a one-million-pound-thrust solid motor with a 20-second burning time. Aerojet-General was tentatively selected but to insure against duplication of NASA's large rocket development program (NASA had taken over the Air Force one million pound liquid fuel rocket development late in 1958) work statements were redrawn and a new invitation to bid was issued in October 1959. Finally, on 5 August 1960, Aerojet-General was awarded the demonstration contract. At approximately the same time a contract covering problems associated with development of "massive" solid motors was awarded to Grand Central Rocket Company, Redlands, California. United Technology Corporation, under contract to NASA for research in segmented motor state-of-the-art, undertook further research on its own. In addition, STL and Aerospace Corporation completed (1961) the "Phoenix Study," a broad investigation of the application of solid motors to space booster use.

1961

Additional incentives to large solid development came in the spring of 1961. On 3 June Aerojet-General static-fired a single segment, 100-inch diameter motor which delivered 450,000 pounds of thrust for 45 seconds. The achievement supported the view that a large solid motor with performance comparable to that of a clustered-engine liquid-fueled Saturn could be made available earlier than Saturn and probably at less cost. Motivated by the possibility that large solid rockets might, in fact, be the best means of achieving a manned lunar landing, the Air Force and NASA through 61 attempted to work out a development program which would meet the needs of both agencies.

Apr. 62

SSD submitted to the Air Force and DOD a proposed program for large solid rocket development. By this time it was clear that the major barrier to program approval was a basic disagreement between the DOD and NASA on the scope and goals of the total program.

26 Jun 62
 USAF concluded that NASA still wanted both 156- and 260-inch demonstrations and that DDR&E opposed the 156-inch program as scheduled. Reports indicated that NASA's primary interest was in the 260-inch rocket and that NASA might be satisfied with the DDR&E suggestion of an intensified advanced technology project in the 156-inch program. (Ltr, Col H. W. Gainer, Ofc DCS/S&L to DCS/S&L, 26 Jun 62, no subject; MFR, 26 Jun 62, subj: Large Solid Rocket Motor Development.)

10 Jul 62
 The Air Force Systems Command cited the general agreement on the 260-inch motor, dating from April, noted informal recommendations to revise this program, and asked for specific guidance and direction. (Msg, MSFA-10-7-9, AFSC to USAF, 10 Jul 62.)

19 Jul 62
 Air Force Secretary Zuckert approved a program change proposal based on 13 July agreements between DDR&E and the Air Force. The 156-inch effort, as revised, contemplated test, evaluation, and development only to the semi-prototype stage; the 260-inch program became a technical feasibility demonstration; supporting technical development work was still a part of the over-all program, as were studies of the economic and industrial engineering aspects of the large solid motor endeavor. Proposed funding changes reduced the total estimated program cost from \$247 million to \$241 million; FY 62 contemplated only the \$13.65 million already released; FY 63 was estimated at \$40 million; FY 64 was a predicted \$90 million; and FY 65 was set at a hopeful \$98 million. Given DOD approval in July 62, the program target dates became September 62 for contractor selection, 156-inch demonstration firings between August 63 and May 64, and 260-inch firings between March 64 and July 65. (Memo, Col H. W. Gainer, Ofc DCS/S&L to SAF, 16 Jul 62, subj: PCP's for Titan III Space Booster, and Large Solid Propellant Motor; DD Form 1355-1 (Program Change), Program 623A, 19 Jul 62.)

2 Aug 62
 DDR&E asked Air Force to prepare alternate plans for the large solid program covering the span from research without any firings to an actual demonstration of both the 156-inch and 260-inch motors (DDR&E had verbally asked for such plans on 25 July). (Ltr, Rubel to SAFRD, 2 Aug 62, no subject; ltr, Col Gainer to AFSC and SSD, 3 Aug 62, subj: Large Solid Rocket Motor.)

17 Aug 62
 Colonel L. R. Ayres, 623A Program Director presented an alternative to the April development plan to NASA and defense department officials. The new plan was based on ground rules which specified that the program not be related to any particular vehicle application or schedule, extensive new facilities would be avoided and major commitments to any one contractor were also to be avoided. Emphasis was to

be placed on solution of problems and advancement of the state-of-the-art in 156- and 260-inch solid motors. (MFR, Col L. R. Ayres, Dir 623A Prog, 23 Aug 62, subj: Presentation of an Alternative Large Solid Motor Program to Dr. McMillan, Asst Secretary of Air Force (R&D), and Mr. Tom Dixon, Dep Associate Administrator, NASA.)

Sep 62

A "White Paper" jointly prepared at the top levels of NASA and the defense department outlined four alternative approaches to the large solid rocket motor program, one of which was similar to the August program as presented, the other three being governed by the Noava schedule in accordance with NASA positions already taken. No Air Force agency participated in preparing or coordinating this paper, which was submitted for decision by the SOD and the Administrator of NASA. No one in the program office was aware of the existence of this paper until early in November. (Rpt, Alternate Programs for Very Large Solid Propellant Rocket Motors, Sep 62, prep by William Cohen, NASA, and O. R. Schuette, DDR&E; Hist Rpt, 623A Prog Ofc, Jul - Dec 62.)

2 Nov 62

An agreement between the Secretary of Defense and the Administrator of NASA was concluded on this date. The Administrator of NASA accepted the first alternate plan in the September DOD-NASA White Paper. It would advance technology in solid rockets but not on a schedule that would provide a back-up to the Noava program. (Ltr, R. C. Seamans, Assoc Admin NASA, to R. S. McNamara, SOD, 2 Nov 62, no subject, with attached McNamara to Webb ltr of 30 Oct 62 and Webb's 2 Nov 62 countersignature.)

18 Nov 62

Program guidance, based on the 2 November 62 Webb-McNamara agreement, was forwarded from the DDR&E to the Secretary of the Air Force. A generalized program to advance the state-of-the-art short of full scale firings, acquisition of new facilities, or commitment to one contractor was authorized under the following tentative funding levels: (millions)

FY 63	64	65	66	67	68
\$25.7	\$34.3	\$42.0	\$47.0	\$50.0	\$50.0

(Memo, Harold Brown, DDR&E, to SAF, 19 Nov 62, subj: Large Solid Propellant Motor (Program 623A).)

23 Nov 62

DDR&E guidance of 18 November was forwarded to AFSC with a request for a Proposed System Package Program by 15 Jan 63. NASA coordination was required on the program. (Ltr, Col H. W. Gainer, Ch Booster Sys Staff Ofc, Hq USAF, to Hq AFSC, 23 Nov 62, subj: Large Solid Motor Program.)

18 Dec 62 NASA coordination was obtained on the new Proposed System Package Program for 623A. (PSPP, 623A, 1 Feb 63.)

26 Dec 62 By the close of 62 the proposed 623A development plan had been approved through command headquarters and coordinated by NASA, but was awaiting Air Force headquarters and DOD approval. (Msg, AFVCS-DSMG 64115, Hq USAF to Hq AFSC, 26 Dec 62.)

4 Jan 63 The DSMG approved the proposed system package plan for 623A and the plan was then forwarded to DIR&E for his approval. On this same date a plan covering the initial two years effort through the firing of half-length 260-inch motors was presented to Dr. L. Kavanau and Dr. O. F. Schuette of the DIR&E staff. Some minor changes were suggested by Kavanau to assure wider industry participation but the technical content or objectives of the program were not altered. (Staff Summary Sheet, BrigGen R. D. Curtin, Dir of Advanced Engineering, Hq USAF, to members of the Air Staff, 4 Jan 63.)

7 Jan 63 Air Force plans for the contractual 623A development were as follows: Bid Package One; dual sources were to be selected for demonstration firings of 260-inch sub-length solid motors. This work was to be funded by \$14 million in FY 63 and \$24 million in FY 64. Bid Package Two; one static motor firing of a two center segment 156-inch motor delivering approximately three million pounds of thrust for about 50 seconds. This work was to be funded at \$2.9 million in FY 63 and \$1 million in FY 64 and be awarded to a successful bidder of the first package contract. Bid Package Three; static firing of a million pounds thrust 156-inch diameter single segment motor with a movable nozzle. This was to be funded at \$4.05 million in FY 63 and \$2.85 million in FY 64. Bid Package Four; static firing of two one million pound thrust 156-inch diameter single segment motors. In addition to these bid packages there were eight other related projects which were designated as appropriate for separate contractual action. (Ltr (AFRAF-MD-1), Col H. W. Gainer, Ch, Booster Sys Staff Ofc, Hq USAF, to AFSPM, no date, subj: Class D&F, Program 623A; atch.)

14 Mar 63 J. H. Rubel, Deputy DIR&E, informed the Secretary of the Air Force that on 19 January 63, \$14 million was released to the Air Force for the large solid propellant program along with authority to proceed with the first bid package of the program. In addition, it was noted that subsequent to 19 January the Air Force revised its development plan to permit wider industry participation. The overall program with these changes was "now satisfactory and may be implemented in full." It was anticipated that the revised system

package plan which delineated the fiscal 65-66 program and included provision for full length firings would be submitted in April 63. Meanwhile, release of \$11.7 million of deferred fiscal 63 funds remained contingent on the completion of the current proposal evaluation and contractor selection. (Memo, J. H. Rubel, Dep DDR&E to SAF, 14 Mar 63, subj: Large Solid Motor Program (623A)).

28 Mar 63

On this date source selection board findings were presented to the Assistant Secretary of the Air Force (R&D). The two selected contractors, against the advice of the Air Force, planned to purchase and develop on-water test sites in Florida and Georgia. Aerojet partially purchased and assumed an option to buy approximately 74,000 acres in Dade County, Florida and Thiokol acquired an option to buy 14,000 acres of land in Camden County, Georgia. It was the intent of the Air Force at the conclusion of the sub-scale 260-inch feasibility firing to select only one contractor for a follow on full scale 260-inch solid motor demonstration firing by late calendar year 64 or early 65. One contractor would obviously be left out in the cold. (White Paper, 31 Mar 63, subj: Large Solid Motor Program, prep by AF.)

1 Apr 63

The Assistant Secretary of the Air Force (R&D) approved the findings of the 623A Large Solid Motor Source Selection Board for bid packages one through four. Thiokol Chemical Corporation was awarded bid packages one, two and three; Aerojet General was selected as the second source for bid package one; and Lockheed Propulsion Corporation was awarded bid package four. The secretary also declared his intention to "invite the presidents of both Aerojet General Corporation and Thiokol Chemical Corporation to this Headquarters for personal discussions to clearly acquaint them with the risks they assume in building the new water site facilities."

2 May 63

The Air Staff confirmed SSD's view that creating a national facility for production and test of 260-inch large solid motors was premature. Adequate and expendable industry and government owned facilities existed to support 156-inch diameter and smaller motor requirements. The lack of facilities for large solid motor effort would be met by the insistence of the contractors, Aerojet and Thiokol, to invest their own funds in on-water site facilities adequate to complete their contracts. Realistically, there was no clearly established need to develop the 156-inch or 260-inch diameter motor in support of the Air Force, DOD or NASA vehicle requirements. Only one contractor would be selected for the full scale 260-inch motor demonstration. There was also always the possibility of program cancellation. Therefore it was considered unwise to proceed with such a facility before the future of large solid motors was firmly established. (Ltr, Air Staff (Maj C. P. Burtner, AFSSV-PD), to SAF, 2 May 63, subj: National Government-Owned Large Solid Propellant Motor Fabrication & Test Facility.)

Jun 63

A cost plus incentive contract, (AF 04-695-350) for bid package one was negotiated with Aerojet General Corporation. The corporation agreed to develop and fire two 260-inch solid propellant motors for a total cost of \$18,725,000, of which \$1,225,000 was the fee based on graded performance. A cost plus incentive fee contract (AF 04-695-351) for package one was also negotiated with Thiokol Chemical Company for the same development at a cost of \$19,205,000, including an incentive fee of \$1,256,450 based on contract performance. Thiokol was also awarded cost plus incentive fee contracts for bid packages two and three; the former contract (AF 04-695-351) was valued at \$3,674,025 including an incentive fee of \$240,357; the latter contract (AF 04-695-363) was valued at \$5,040,960 including an incentive fee of \$320,960. The fourth bid package was awarded to Lockheed Propulsion Company at a contract value of \$5,998,750, including an incentive fee of \$398,750. (Hist Rpt, 623A SPO, Jan - Jun 63; Exhibit "C" to Contract AF 04-695-350; Exhibit "C" to Contract AF 04-695-363; and Exhibit "C" to Contract AF 04-695-364.)

25 Jun 63

The ink had hardly dried on cost plus incentive fee contracts negotiated with Aerojet, Thiokol and Lockheed for development of large solid propellant motors when funding exigencies required a reexamination of the entire large solid propellant budgetary program. The DOD appeared to be considering a minimum fiscal 64 program of \$16 million based on elimination of the 260-inch development portion of the over-all program. (MFR, Col H. W. Robbins, Dir 623A SPO, 25 Jun 63, subj: Proposed Cut-Back, Program 623A.)

22 Jul 63

Drastic reduction in 623A funds seriously affected the large scale development effort undertaken in good faith by Aerojet General and Thiokol. All incentive fee contracts had been negotiated, written, reviewed, and were ready for the contractor's signature. All of the \$14 million fiscal 63 funds were committed on 13 May 63. An additional \$11.7 million, originally included in fiscal 63 funds, was to be added instead to the fiscal 64 funds of \$34.3 million for a total of \$46 million. A program authorization for \$16 million in fiscal 64 funds was received on 1 July and the release of previously deferred money was not indicated. As of 22 July no fiscal 64 program funding had been directly allocated. Despite the uncertainty of the program, SSD recommended, "Arrangements be expeditiously consummated with the contractors for contract signature and subsequent contract review of your headquarters/AFSS/. By that time the future of 623A will be clarified and appropriate action taken." (Msg, SSSS 22-7-29, SSD to AFSC, 22 Jul 63.)

9 Aug 63

DDR&E directed the Air Force to proceed with the 623A program "...within the budgetary limitations." Therefore the 260-inch motor development, sub-length firings were to be deferred until fiscal 65. Other phases of the program relating to 156-inch motor and a supporting program to advance the state-of-the-art in such areas as thrust vector control, nozzle fabrication and motor ignition "may be supported under the reduced program." (Memo, H. Brown, DDR&E, to SAF (R&D), 9 Aug 63, subj: Large Solid Booster Program (623A), Program Element Number 6.26.09.30.4)

18 Aug 63

Basically, the Air Force was confronted with four unpalatable alternatives in meeting the problem presented by the gross reduction in fiscal 64 funds: (1) continue with the planned program if \$30 million could be found; (2) continue the planned development schedule, increase fiscal 64 funding from \$16 million to \$34 million, and defer some elements of the program to fiscal 65; (3) accept fiscal 64 fund reduction to \$16 million and adjust all aspects of the program accordingly; (4) cancel the 260-inch effort at a cost of \$2.6 million, lose \$6 million already spent on the program, and accept the probability of contractor claims for facilities investments which might well cost the government an additional \$7 million. (Paper, Partial Draft of Air Staff/DOD Memo for H. Brown, DDR&E, 18 Aug 63, no subject.)

28 Aug 63

There was some unexpected and favorable indicators that the fiscal 64 road block was about to be lifted. During the third week in August Air Force headquarters released a public announcement that the 260-inch motor contracts were awarded to Aerojet General and Thiokol. It was probable the DOD decided to fund the program in fiscal 64 in accordance with alternative No. 2 offered in the Air Staff solid propellant policy paper dated 18 August 63. Nevertheless, SSD cautioned 623A contractors that 64 funds still remained at \$16 million "...until such time as specific approval and funding are provided for a higher program level." (Msg, MSFA 27-8-69, Hq AFSC to SSD, 27 Aug 63.)

9 Sep 63

In response to a 21 August 63 request from the AFSC Vice Commander, renewed on 27 August, SSD completed "Program 623A FY 64 Funding Impact Study." The study sought to analyze the impact on the program of a \$16 million fiscal 64 fund ceiling and to answer questions raised by the necessity of establishing program priorities, eliminating important projects, determining when available 64 money would run out, and how much additional money would be required to maintain alternative programs. SSD recommended reestablishing the program as originally scheduled and negotiated which would require the fiscal 64 \$16 million plus an additional

\$18 million, and \$12 million in fiscal 65. Thus, in addition to the \$14 million budgeted in fiscal 63, the amount necessary to restore and successfully complete the solid motor development program would total \$60 million. (Prog 623A FY 64 Funding Impact Study, 9 Sep 63, prep by SSD.)

5 Nov 63

The DOD revealed its plan for completing the fiscally harassed large solid motor program. The plan set the fiscal 64 funding total at \$30.9 million. This would bring the cost of the program for fiscal 63 and 64 to \$44.9 million. However, because the 260-inch solid motor was a development of primary future interest to NASA, and the 156-inch size was of primary interest to the DOD, NASA was invited to support development of the 260-inch motor in fiscal 65 and beyond. Although funds available to the Air Force permitted full support to both 260-inch and 156-inch programs through fiscal 64, it was specifically proposed that NASA budget for completion of the sub-length 260-inch motor development in fiscal 65 and "for any follow-on 260-inch motor effort in future years." This cost was estimated at \$13.6 million in fiscal 65, but if a full-length 260-inch motor follow-on program were included it would increase fiscal 65 program costs to \$30 million. The Air Force would, at NASA's request, continue to manage the 260-inch development program but the DOD felt "... by concentrating our limited funds in this area (156-inch motor) we will be better able to provide the technology for future military requirements." (Ltr, H. Brown, DDR&E, to R. C. Seamans, Jr., Assoc Admn NASA, 5 Nov 63, no subject.)

12 Nov 63

SSD was distressed by DOD action to discontinue its support of the 260-inch large solid motor program in favor of NASA support and, if the agency desired, management of the program. SSD did not object to NASA funding although the development plan was predicated on management continuity and adequate funding until the program was completed. The division did object to the unrealistic, completely inadequate funding schedule put forward as the basis for NASA take over of the program, and to the disruption of a carefully planned NASA-Air Force arrangement for program coordination. Of greater concern to SSD, however, was DDR&E assertion that the 156-inch program would be supported at a level of \$12 million in the fiscal 65 budget; even on an austere basis \$18.2 million would be required if the program was to be continued at its planned level. (Ltr, BrigGen J. S. Bleymaier, 623A SPD, to MajGen Ritland, AFSC, 12 Nov 63, subj: FY 65 Funding of Program 623A; ltr, MajGen B.I. Funk, Cmdr SSD, to LtGen H. M. Estes, V/Cmdr AFSC, 4 Dec 63, subj: Program 623A Funding FY 65.)

30 Nov 63

The DOD formally approved a change in the 623A program which, in effect, deleted the 260-inch large motor development from DOD funding, established 64 funding support at a level of \$30.9 million, and reduced fiscal 65 funds to \$12 million for the 156-inch technology support program. NASA would be requested to fund the 260-inch program through fiscal 65 at a level of \$13.6 million. (PC, 6.34.09.30.4, 30 Nov 63.)

13 Dec 63

SSD received from AFSC headquarters a purchase authorization in the amount of \$14,870,000 to support the large solid motor development program through the balance of the fiscal year. This brought total funding for fiscal 64 to \$30.87 million. (PA 64R-SSD-23, AFSC to SSD, 13 Dec 63.)

20 Dec 63

SSD notified Thiokol and Aerojet General, developers of the 260-inch solid motor, that actions had been initiated to fund their contract through third quarter fiscal 64, which would permit the contractors to conduct their programs as originally scheduled and negotiated. However, the contractors were cautioned that "no schedule delays, technical problems, or estimated cost increases can be attributed to prior program funding rate as contended by the contractors." (Msg, SSB 20-12-37, SSD to Thiokol Chemical Corp, 20 Dec 63; msg, SSB 20-12-38, SSD to Aerojet General Corp, 20 Dec 63.)

31 Dec 63

As of this date SSD had received \$30.87 million in fiscal 64 funds for the large solid motor development program. All major contracts (packages one through four) had been funded through the third quarter of fiscal 64. Funding for the fourth quarter was delayed pending results of steel case hydrotests. There was a high probability, despite a current one to two per cent overrun on contract packages on to four, of meeting target costs. Also, as of this date, it remained uncertain whether NASA would assume funding and management responsibility for the 260-inch motor effort beginning in fiscal 65. But irrespective of NASA's decision, retainment of DOD/SSD management was recommended. This was based on potential military applications for 50,000 pound payloads and on the high reliability of single motor boosters. For example, a significant increase in reliability would be possible at low cost by using a short length 260-inch motor with a Saturn IV-B upper stage. The total weight of such a vehicle combination would be approximately 2.1 million pounds. Such a two motor booster would thus not only significantly reduce the probability of malfunction but be capable of injecting 52,870 pounds of payload into a 100 nautical mile orbit. (Paper, Program 623A, Status as of 2 January 1964, prep by SSD's 623A Prog Ofc.)

AF MAN IN SPACE

AIR FORCE MAN IN SPACE ACTIVITY (1955 - 1960)

1955-1957

Early as 1955 the Air Force received proposals from industry for development of manned research satellites and the idea of projecting boost glide vehicles to orbital speed was considered. In 56 the Air Research and Development Command (ARDC) proposed a feasibility study of a "Manned Ballistic Rocket Research System." Major aircraft companies and other interested organizations were briefed on the study and urged to conduct independent investigations of the problem--mainly because ARDC was without funds to support this avenue of research. AVCO Corporation was encouraged to study the problem of a manned research satellite. Rand Corporation, a strong proponent of reconnaissance satellite systems since 47, reported on space vehicles for other than reconnaissance purposes. In May 56 the corporation offered a concept for a "Lunar Instrument Carrier," and later in the year briefed the proposal to various Air Force organizations. Rand continued its space studies and in May 57 presented to its military advisory group concepts on "Space Flight and the Air Force" and, in November 57, published a projection of an over-all space program with anticipated performance characteristics of combinations of various existing ballistic missiles that could be used as space boosters. In April 56, Western Development Division - Ramo-Wooldridge began a study of using ballistic missiles as boosters. Results were presented to the Scientific Advisory Board in a meeting held at Rand in the latter part of July 57. At the same meeting a RADC group presented a briefing on "Space Technology: Key to Advanced Weapon Systems." The studies included an investigation of manned space flight, an area later stimulated by the sensational 4 October 57 launch of Sputnik I. Thereafter interest in space rapidly evolved into concrete Air Force planning for development of a manned space system. (USAF Manned Military Space System Development Plan, 25 Apr 58, prep by AFBMD, I-I-3, Vol I.)

28 Jun 55

A committee, appointed by SAF D. A. Quarles, to recommend the best method of furnishing the United States with a satellite between the dates of June and December 58, was briefed at Western Development Division. The Atlas project was reviewed and the potential of Atlas as a booster vehicle in a selected satellite system was presented. The committee was advised that WDD was qualified to manage the program if so directed but that such a program would interfere, to some extent, with the high priority of the Atlas development effort. (Memo, Col C. H. Terhune, Dep Cmdr Tech Opns, WDD, to BrigGen B. A. Schriever, Cmdr WDD, 28 Jun 55, subj: Visit of DOD Satellite Committee, 28 Jun 55.)

29 Jul 55

The President announced that the United States, as part of its International Geophysical Year contributions, would attempt to launch a number of 21 pound satellites without the use of military missiles. The project, named Vanguard, although organized in the Department of Defense under Navy management, would be completely removed from military significance. (Bowen, The Threshold of Space, Sep 60, published by the Air Force Historical Liaison Ofc, p. 10.)

Apr 56

The Army Ballistic Missile Agency requested that the Department of Defense grant permission to use its Jupiter C missile to launch a satellite, "in view of Vanguard delays and increasing evidence that the Soviets would be first in space--an event certain to inflict 'serious damage' to the prestige of the United States." The Army's proposal was rejected by the DOD, presumably in line with the policy announced by the President on 29 July 55, that the United States would remain strictly within its IGY satellite commitment without using military missiles, thus clearly demonstrating United States intent to explore space for peaceful purposes. (Bowen, Threshold of Space, pp, 10-11.)

May 56

Rand Corporation issued a series of reports on the feasibility of a lunar instrument carrier, based on use of an Atlas booster. (Early BMD-ARDC General Space Chronology, 11 Feb 59, prep by AFBMD Hist Ofc.)

3 Oct 56

WDD released a short study report entitled, "Ballistic Missiles, Satellites and Space Vehicles." The paper recommended a detailed survey of technical developments which might anticipate "logical extensions of our present ballistic missile and satellite programs." Advanced systems were foreseen in the next 20 years which might well furnish equipment and technology for manned exploration of space including voyages to the moon and near by planets. The paper also recommended that the Air Force plan an orderly development of space programs aimed at these far reaching but reasonable long term objectives. (Paper, Ballistic Missiles, Satellites and Space Vehicles, 1956 to 1976, dtd 3 Oct 56, prep by Col L. D. Ely, Asst for Tech Groups, Tech Operations, WDD.)

Nov 56

An ARDC Guided Missile and Space Vehicle Committee report, based primarily on WDD-Ramo-Wooldridge sources, contained a technological forecast (1955-70) and program recommendations for ballistic missiles, satellite reconnaissance systems, recoverable satellites, manned interplanetary space exploration, and related facilities, funds and manpower requirements. It was estimated that program costs would reach \$800 million by fiscal year 61 and continue at a level of \$500 million a year until 70, then soar to \$1.9 billion in 1971. (Early BMD-ARDC General Space Chronology, 11 Feb 59.)

5 Feb 57 The Air Force authorized Ramo-Wooldridge (Guided Missile Research Division) to begin a study of second generation ballistic missiles and space vehicles. (Early BMD-ARDC General Space Chronology, 11 Feb 59.)

29 Jul 57 AFBMD, among other matters, presented to the Scientific Advisory Board Ad Hoc Committee, meeting at Rand Corporation, a summary of follow on ballistic missile weapon systems and advanced space programs which it was prepared to undertake. These programs included development of high thrust space vehicles capable of earth orbital and lunar flights. (AFBMD Presentation to the SAB Ad Hoc Committee to Study Advanced Weapons Technology and Environment, 29 Jul 57, prep by AFBMD.)

20 Sep 57 First fully successful test flight of Thor intermediate range ballistic missile. (AF Ballistic Missiles Program Status Report.)

4 Oct 57 Sputnik I launched by the Soviet Union.

9 Oct 57 The SAB Ad Hoc Committee published its review of "problems of national defense in cis-lunar space." The committee urged the development of missiles for their use as space boosters and the Air Force, said the committee, should plan on reaching the moon. The committee further advised that AFBMD should be a permanent organization responsible for developing a space technology and space systems. (Rpt of the Scientific Advisory Board Ad Hoc Committee to Study Advanced Weapons Technology and Environment, 9 Oct 57.)

5 Nov 57 The Air Force briefed the Armed Forces Policy Council on a reconnaissance satellite program and possible combinations of vehicles that could be used for "cold war and scientific programs." The Air Force recommended using the available intermediate range ballistic missile as a booster to hasten launching an orbital system as early as March 58. If approved this program would require an additional six Thors and \$12 million to cover additional costs. (Ltr, Col R. J. Nunziato, Asst for Spec Prog, DCS/Dev, Hq USAF, to SAFRD, 12 Nov 57, subj: Outer Space Vehicle.)

7 Nov 57 Use of Thor boosters was suggested as a means of demonstrating an early space capability. Hq USAF requested that ARDC conduct an engineering study on which, within 30 - 45 days, a "decision can be based as to the feasibility, capability and cost of such a program." (Msg, 11-033, ARDC to AFBMD, 13 Nov 57.)

12 Nov 57 Assistant SAF(R&D) R. E. Horner requested the DOD approve a space program that would furnish an early demonstration of space capability and "provide important development test vehicles leading to larger reconnaissance and scientific satellites." Three Thor missiles could be made available in a relatively short period of time to orbit a recoverable animal satellite prior to 1 July 58. Thor, the secretary also suggested, would be a practical vehicle to furnish the Air Force satellites with specific military capabilities. (Memo, Asst SAF (R&D), R. E. Horner, to SOD, 12 Nov 57, subj: Outer Space Vehicle.)

13 Nov 57 Major General B. A. Schriever, Commander of AFMMD, directed preparation of a plan for a 10 - 15 year program leading to development of man carrying vehicle systems for space exploration. (Memo, Col L. D. Ely, Dir Tech Divs, Weapon Systems, AFMMD, to Col C. H. Terhune, Dep Cmdr, Weapon Systems, AFMMD, 13 Dec 57, subj: Manned Space Flight Program; Cmdrs Reference Book, Chronology of Man in Space Effort, 23 Mar 59, prep by AFMMD.)

20 Nov 57 Air Force headquarters affirmed the necessity for the Air Force to acquire recognized competence in "astronautics and space technology." Therefore ARDC was instructed to prepare by 1 December 57 an astronautics program with estimates of its funding requirements. The plan was to review those space programs already underway and make a projection of development in astronautics and space technology over the next five years. (Msg, 11-055, Cmdr ARDC, to Cmdr AFMMD, 20 Nov 57.)

6 Dec 57 The Air Force Scientific Advisory Board Ad Hoc Committee on Space Technology recommended, because "Sputnik and the Russian ICBM capability have created a national emergency," acceleration of specific military programs and a vigorous space program with the immediate goal of landings on the moon. (Rpt, SAF Ad Hoc Committee on Space Technology, 6 Dec 57.)

9 Dec 57 AVCO Corporation proposed development of a manned satellite system to the Air Force. The basic elements of the proposal included a Titan rocket to boost a manned satellite into a 110 nautical mile earth orbit. The satellite would be spherical capsule containing instrumentation and a life support system capable of sustaining one man for three or four days. Re-entry would be by means of a stainless steel cloth parachute which would lower the capsule safely through re-entry deceleration. AFMMD was not convinced that this was the best approach to the manned re-entry problem. It felt that it would be wiser to "ask for bids and put it [development] on an open competitive basis." (Memo, Col L. D. Ely, to Col C. H. Terhune, 17 Dec 57, subj: AVCO Proposal for Manned Satellite.)

10 Dec 57

Lieutenant General D. L. Putt, Deputy Chief of Staff Development at Air Force headquarters, announced establishment of the Directorate of Astronautics, to be headed by Brigadier General Homer A. Boushey. There was, however, an adverse Department of Defense reaction to this action. The Secretary of Defense objected to the use of the term "astronautics" and William Holaday, Defense Director of Guided Missiles, publicly stated the Air Force "wanted to grasp the lime light and establish a position." Just three days later General Putt directed that the organizational change be cancelled. (Bowen, Threshold of Space, p. 20.)

17 Dec 57

First successful flight test of Series A Atlas missile. (AF Ballistic Missiles Program Status Report.)

18 Dec 57

Major General B. A. Schriever again offered a well defined astronautics program at an estimated cost of \$16 million in fiscal 58 and \$112 million in 59. In addition, \$10 million in 58 and \$20 million 59 would be needed to procure Thor hardware and acquire a Thor space launch complex. Furthermore, said Schriever, although use of all resources qualified to participate in the program was endorsed it was ". . . imperative that the total Air Force effort in the ballistic missile and space field must be managed by one agency and that agency must be the Air Force Ballistic Missile Division." Schriever also proposed creation of a research and development command committee, chaired by the missile division, to formulate and recommend technical development in space technology. "The committee would meet periodically and make recommendations to the commander, AFBMD, for formulation of the Air Force program." (Ltr, MajGen B. A. Schriever, Cmdr AFBMD, to LtGen S. E. Anderson, Cmdr ARDC, 18 Dec 57, subj: Proposal for Future Air Force Ballistic Missile and Space Technology Development.)

27 Dec 57

An appraisal of ARDC research and engineering resources revealed that the command was well prepared to undertake immediate development of a manned space program. The ballistic missile division possessed the resources to embark on vehicle development and command headquarters was ready with a ". . . fairly comprehensive program laid out in support of the manned aspects of space flight." In specific terms this involved support from the School of Aviation Medicine, the Aeromedical Laboratory at Wright Air Development Center (WADC), and the Aeromedical Field Laboratory at AFMDC. (Memo, Col L. D. Ely, to Col L. D. Ely, to Col C. H. Terhune, 30 Dec 57, subj: Telephone Call from General Flickinger and Visit of Colonel Karstens, School of Aviation Medicine.)

30 Dec 57

ARDC completed a 15 year plan for astronautics research and technical development. From this effort was distilled a five year astronautics program which, on this date, was presented to Air Force headquarters. (Ltr, BrigGen M. C. Demler, D/Comdr, R&D, Hq ARDC, to Comdr AFBMD, 30 Dec 57, no subject.)

3 Jan 58

AFBMD's recommendation for a strong astronautics program, forwarded to LtGeneral D. L. Putt, Deputy Chief of Staff, Development, at Air Force headquarters, included the following specific proposals: (1) Thor plus a Vanguard second stage would be used as a basic booster to provide a vehicle with recoverable data capsule; (2) develop a recoverable animal carrying satellite using rhesus monkeys; four flights during fiscal 59; (3) lunar impact missions could be attempted with a high probability of success by adding a Vanguard second and third stages to the Thor; four vehicles should be planned for this mission beginning during the last quarter of 58; (4) and four vehicles should be assigned the mission of circumlunar flight. Total cost of these programs was estimated at \$26.8 million during fiscal 58, and \$30.4 million in fiscal 59 including ground equipment and tests. Thor production would have to be increased by two units per month if the entire astronautics program were adopted as proposed. (Msg, WDG-1-2, Comdr AFBMD, to Comdr ARDC, 3 Jan 58.)

9 Jan 58

The first clarification to emerge from the nation's amorphous space policies was revealed on 15 November 57 when SOD McElroy told a press conference he was thinking of centralizing control of space research and development in a special agency. This was the first public announcement of the future birth of ARPA--the Advanced Research Projects Agency. Confirmation of this intent was stated in the President's State-of-the-Union message to Congress on 9 January 58, when he said that McElroy "has already decided to concentrate into one organization all the anti-missile and satellite technology undertaken within the DOD." (History, Hq ARDC, 1 Jan - 31 Dec 58, Vol 1, prep by ARDC Hist Div, p. 7.)

16 Jan 58

The first rough draft of a development plan for the Air Force space weapons development and technology program was completed by the ballistic missile division, oriented to meet five basic requirements: reconnaissance, communications, manned space flight, technical development and experimental support. The program's fiscal 58 needs were estimated as follows: astronautics, \$16 million; additional Thor hardware and launch complex for the program, \$10 million. (Memo, Col C. H. Tenhune, Dep Comdr, Weapon Sys, AFBMD, to Comdr ARDC, 16 Jan 58, subj: AF Astronautics Development Program.)

22 Jan 57

Lt General S. E. Anderson, Commander ARDC, outlined the command concept of the missile division's space mission in answering General Schriever's proposals of 18 December 57. Said Anderson: "It is our intention to make maximum use of the peculiar talents of your Division while at the same time bringing capabilities of all elements of the Command to bear upon the problems in this area." Therefore it was the view of the commander that the division should concentrate on "...the development and model improvements . . . of certain scheduled space systems to include both planning and management associated therewith." In application this policy meant that the division would in "certain instances perform technical developments in astronautics." The Deputy Commander for Research and Development at Command Headquarters was to retain over-all responsibility for formulation of the Astronautics Technical Development Program. (Ltr, Anderson to Schriever, 22 Jan 58, subj: Proposal for Future Air Force Ballistic Missile and Space Technology Development.)

22-24 Jan 58

ARDC convened a committee to prepare a final planning draft of an Air Force Astronautics Program for presentation to Mr. W. M. Holaday, DOD Director of Guided Missiles. The Air Force proposed five year space program included development of research and test vehicles, satellite reconnaissance systems, a lunar based intelligence system, defense systems, logistic requirements of lunar transport, and strategic communications. If the program were accepted in its entirety, \$1.156 billion in initial funding would be needed in fiscal 59. (Memo, Col L. D. Ely, Dir. Tech Div, to Col C. H. Terhune, AFEMD, 28 Jan 58, subj: Trip Report.)

31 Jan 58

The Air Force invited the National Advisory Committee for Aeronautics (NACA) to participate in "a research vehicle program to explore and solve the problems of manned space flight." Inasmuch as both NACA and the Air Force were well along in their investigations of the best approach to be taken in the design of a manned orbiting research vehicle it was suggested that, "These efforts should be joined at once and brought promptly to a conclusion." Accordingly NACA was invited to collaborate with ARDC on an overall evaluation of relevant space plans and projects and any program resulting from the joint evaluation would be, it was suggested, "managed and funded along the lines of the X-15 effort." Specific guide lines were furnished the Advisory Committee to facilitate its response to the Air Force request. (Ltr, LtGen D. L. Putt, DCS/D, Hq USAF, to Dr. H. L. Dryden, Dir NACA, 31 Jan 58, no subject.)

31 Jan 58

Air Force headquarters instructed ARDC, in collaboration with NACA to ". . . expedite the evaluation of existing or planned projects, appropriate available proposals and other competitive proposals with a view to providing an experimental system capable of an early flight of a manned vehicle making an orbit of the earth." It was important to determine whether the objective of a manned space flight could be accomplished more readily under the Dyna Soar program or by means of an orbiting satellite. (Ltr, LtGen D. L. Putt, DCS/D, Hq USAF, to Cmdr, ARDC, 31 Jan 58, subj: Advanced Hypersonic Research Aircraft.)

31 Jan 58

ARDC headquarters directed the Wright Air Development Center to "investigate and evaluate" the quickest way to put a man in space and recover him. Since the crux of the problem was the obvious lack of large high performance booster, the center requested the assistance of AFBMD in finding a solution to the problem. (Chronological Space History, 58, prep by AFBMD.)

Feb 58

The National Advisory Committee for Aeronautics informed the Air Force that it was working on the design of a space capsule and would coordinate on the Air Force space program late in March when the design work was scheduled for completion. (DF, LtCol C. C. Strathy, Ch Research and Tgt Sys Div, Dir of Sys Plans, Dep Cmdr for Weapon Sys, to Asst for M&E, Dep Cmdr for Weapon Sys, Hq ARDC, 25 Feb 58, subj: Man in Space; Outline History of Man-In-Space, R&D Program, 10 Nov 59, prep by Col J. L. Martin, Hq USAF.)

3 Feb 58

Experimental preliminary steps to a manned space program were directed by Air Force headquarters. The development command was assigned authority to develop a recoverable satellite and the first launch date was set for October 58. The command was also instructed to conduct a moon impact program although the authority to conduct such a program had not yet been granted. Necessary planning action would be taken in order to ". . . expedite the program immediately upon approval from the Department of Defense." (Ltr, BrigGen H. A. Boushey, DCS/D, Hq USAF, to Cmdr ARDC, 3 Feb 58, subj: Astronautics Program.)

7 Feb 58

The DOD established the Advanced Research Projects Agency (ARPA) to direct and conduct space research leading toward operational systems. In pursuit of these objectives the agency was authorized management of projects which would be conducted by military departments and it was also empowered to contract directly with individuals, private business organizations, scientific institutions and public agencies. (DOD Dir 5105.15, 7 Feb 58, subj: Department of Defense Advanced Research Projects Agency.)

10 Feb 58

ARDC headquarters forwarded further instructions to the missile division as a guide to planning for a space program. The research command was to proceed, when DOD approval was obtained, with development of a ballistic research and test system (WS 609A, later called Blue Scout), specifically designed to satisfy most research flight test requirements. In addition, the Thor missile was to be used as a booster for (1) "Able" re-entry tests; (2) recoverable satellites; (3) and moon impact. The latter program was not yet fully approved but planning actions were authorized to "expedite this project immediately upon receipt of DOD approval" and \$1 million had been set aside to cover initial project costs. (Msg, RDX-2-1-E, Hq ARDC to AFEMD, 10 Feb 58.)

11 Feb 58

The Secretary of the Air Force forwarded to the Secretary of Defense, recommendations which "should be undertaken promptly by the Air Force." Other than the first project, converting Thor into an intercontinental range weapon by adding a second stage, the recommendations concerned the following space proposals: (1) develop and orbit a satellite equipped with weather survey instrumentation; (2) develop a recoverable satellite equipped to carry a variety of payloads which might be ejected from orbit; (3) develop a Thor-Hustler second stage (later called Agena) capable of carrying a 300 pound highly instrumented payload; (4) and use a Thor plus two Vanguard upper stages to impact the moon. Said the secretary: "In addition to the scientific data that can be obtained from such a flight, the United States could make a major international psychological gain by beating the Russians to the moon. I urge that this Air Force approach be used." (Memo, SAF J. H. Douglas to SOD, 14 Feb 58, subj: Thor and WS 117L Program.)

24 Feb 58

Wright Air Development Center and Air Force Missile Development Center recommended industrial sources and provided the money to study and design a life support system for sustaining a man in orbital flight for 24 hours and for study, design and fabrication of orbital capsules equipped to carry and sustain the life of an animal passenger. WADC issued a purchase request valued at \$445,954 for procurement of the study. (Chronological Space Hist, 58.)

26 Feb 58

Air Force headquarters again affirmed its strong support of a program to demonstrate at the earliest possible date a "capability to launch a satellite and to follow as soon thereafter as practicable with a shot to the moon." The research command was directed to "take all actions necessary to be in position to accomplish both projects at the earliest time feasible." (Msg, AFCVC 56978, Hq USAF to ARDC, 26 Feb 58.)

28 Feb 58

ARPA Director Mr. R. W. Johnson declared the Air Force had a "... long term development responsibility for manned space flight capability with the primary objective of accomplishing satellite flight as soon as technology permits." The Air Force was told to develop a Thor booster with a suitable second stage vehicle, "as an available device for experimental flights with laboratory animals." Provision for the recovery of the orbiting animals in "furtherance of the objective of manned flight" was also authorized. (Memo, R. W. Johnson, Dir, ARPA, to SAF 28 Feb 58, subj: Reconnaissance Satellites and Manned Space Exploration.)

3 Mar 58

The SOD approved acceleration of the 117L military satellite system, including test vehicles launched with the Thor booster--a series of orbital experiments that were also considered preliminary to a man in space program. The ballistic missile division was instructed to submit a complete development plan and fiscal estimate by 15 March 58 for review and approval. (Msg, AFVC 57197, Hq USAF to Hq ARDC, 3 Mar 58.)

5 Mar 58

The Office of the SOD, in the first significant forward step to accelerate development of a space capability, reiterated the space role of the Air Force by stating that in addition to its missile programs the Air Force was responsible for the 117L system and "has a recognized long term development responsibility for manned space flight capability with the primary objective of accomplishing satellite flight as soon as technology permits." Furthermore, the Air Force was told it was to carry forward and accelerate the Atlas 117L project "under the highest national priority in order to attain an initial operational capability in the earliest possible date." But the proposed interim system using a Thor booster combined with a second stage and recoverable capsule "should not be pursued." The DOD did agree that a Thor booster with a suitable second stage "may be the most promptly and readily available device for experimental flights with laboratory animals" and development of such hardware including a system for recovery of animals was authorized. (Msg 03-014, Cmdr ARDC, to Cmdr AFBMD, 5 Mar 58.)

8 Mar 58

AFBMD proposed an over-all space objective about which all other experimental projects would be oriented. This goal was briefly stated as "Manned Space Flight to the Moon and Return." To achieve this ultimate accomplishment many other space projects and programs would be necessary. The final goal would furnish an objective and a means to develop an integrated space program instead of isolated space ventures whose value might be unrelated to any national purpose. Admittedly, achieving this goal would require much preliminary work and completion of the following programs:

Instrumented Satellite Flights and Return
 Animals in Satellite Orbit and Return
 Biomedical Experiments in Satellite Flights
 Man in Satellite Orbit and Return
 Instruments Around Moon and Return
 Animal Around Moon and Return
 Instrumented Hard Landing On Moon
 Soft Landing of Instruments on Moon and Return
 Animal Soft Landing on Moon and Return
 Man Around Moon and Return
 Manned Landing on the Moon and Return

(Memo, Col L. D. Ely, to Col C. H. Terhune, 8 Mar 58, subj: Meeting with Hq ARDC Biomedical and Behavioral Science Panels, 10-12 March.)

10-12 Mar 58

Meeting at AFBMD of command representatives to study man in space. ARDC headquarters proposed development of a vehicle within a weight limitation of 2,700 - 3,000 pounds to contain a man, a life support system with a capacity to remain aloft for 48 hours, telemetry-communications, and a recovery system. AFBMD proposed development of means to reach a more distant goal, "Man on the Moon and Return." By the second day general agreement on program objectives had been reached. Technical recommendations included selection of an improved thrust Thor with a fluorine-hydrazine second stage, 2,700-3,000 pound spacecraft and a General Electric guidance system. As then planned the complete experimental and test program would require approximately 30 Thor boosters, 8 to 12 Vanguard second stages and about 20 fluorine-hydrazine second stages for testing and advanced phases of the program. By the third day an abbreviated draft development plan had been completed. The conference was pervaded by a strong sense of urgency, motivated by the dramatic Air Force mission to get a man in space at the earliest possible time. Approval of an accelerated program was anticipated and contractor selection was scheduled to begin on or about 10 April 58. (Memo, Col C. H. Terhune, Dep Cmdr, Tech Operations, to Maj Gen B. A. Schriever, Cmdr, AFBMD, 25 Mar 58, subj: Man in Space Meetint at AFBMD, 10-12 March 58.)

14 Mar 58

ARDC submitted to Air Force headquarters a Man-In-Space abbreviated development plan. (Chronological Space Hist, 58, prep by AFBMD.)

19 Mar 58

AF Under Secretary M. A. MacIntyre submitted to ARPA the fiscal 59 budget requirements of the Air Force man in space program. The budget was set at \$133 million if the program was to meet its mid-60 operational date. A series of space related projects was proposed if it was decided to delay the man in space program to some more future date. (1) Development of small animal carrying capsules for use in the 117L program starting November 58 - \$16 million. (2) Construction of launch pad assembly buildings and instrumentation modifications - \$5 million. (3) Design of man size capsule, second stage booster; development, procurement, test of support test vehicles - \$30 million. (4) Fabrication of a small number of capsules, second stages, test and procurement of capsules, second stages, boosters and support test vehicles leading to the earliest possible manned space flight - \$67 million. (Memo, Under Secretary of the Air Force, M. A. MacIntyre, to Dir ARPA, 19 Mar 58, subj: Air Force Man-In-Space Program.)

31 Mar 58

Major General B. A. Schriever, Commander AFMMD, directed the preparation of a development for a full scale manned military space systems program. The goal of the program was to achieve a manned flight to the moon and return. (Chronological Space Hist, 58.)

2 Apr 58

President Eisenhower sent to Congress a detailed recommendation for a national space program. The President, basing his recommendation on a (26 March) report of his Science Advisory Committee, said that such a program would develop space technology essential to our defense, enhance our national prestige, and furnish the nation new opportunities for scientific observation and experiment. The Congress was therefore advised that a National Aeronautics and Space Administration be created to furnish, "a civilian setting for administration of space functions [which] will emphasize the concern of our nation that outer space be devoted to peaceful and scientific purposes." (History, Hq ARDC, 1 Jan - 31 Dec 58, p. 13; Max Rosenberg, The Air Force in Space, 1959-1960, dtd Jun 62, USAF Hist Div Liaison Ofc, p. 3.

8 Apr 58

ARDC informed the National Advisory Committee for Aeronautics that it had initiated a 30 day effort at the ballistic missile division to prepare a detailed development for an "extended manned space vehicle program of which man in space at the earliest practicable date is an integral part." The advisory committee was invited to participate in the preparation of the plan and to advise the Air Force of their anticipated action. (Msg, 04-9-01, Cmdr, ARDC, to Cmdr AFMMD, 9 Apr 58.)

23 Apr 58

The Air Force launched a research test rocket which carried a mouse in the re-entry vehicle. This was the first small beginning of a research program to determine the requirements of a space life support system. (Msg, SAFIS-3C 47151, SAF to AFEMD, 29 Apr 58.)

25 Apr 58

AFEMD published the first development plan for an Air Force Manned Military Space Systems Program. The objective was to ". . . achieve an early capability to land a man on the moon and return him safely to earth." The program represented a reasonable level of accomplishment with a minimum of time and money and called for start of a high priority program (similar to that enjoyed by ballistic missiles) characterized by "concurrency" and single Air Force agency management. The complete program would be carried out in four phases leading from orbital flights to manned lunar landing and return. (USAF Manned Military Space System Development Plan, 25 Apr 58, prep by AFEMD.)

28 Apr 58

The director of ARPA expressed an interest in "the early recovery of a small chimpanzee from orbit as a prelude to man in space." Such a flight not only would have significant scientific value but a considerable amount of psychological value as well. AFEMD was requested to analyze the value of developing a small capsule for a chimpanzee orbital flight test in addition to the man-sized capsule and to estimate the cost and possible timing of such a program. (Msg 04-29-01, Hq ARDC, to Cmr, AFEMD, 29 Apr 58.)

30 Apr 58

An AVCO-Convair contractor team submitted to the Air Force a proposal to develop and mount a one man spacecraft on an Atlas booster. The spacecraft would rely on a steel mesh drag chute for deceleration and recovery. AFEMD did not feel that the proposal possessed a great deal of merit although the use of Atlas as a booster was a useful suggestion. (Memo, Col J. D. Lowe, AFEMD, to Col H. Evans, AFEMD, 16 May 58, no subject.)

2 May 58

AFEMD published its second Man-In-Space Development Plan. This plan concentrated on the first phase of the over-all manned lunar program, designated "Man-In-Space-Soonest." During this phase of project development the launch vehicles would be a Thor-Vanguard combination for instrumented tests, and a Thor-Vanguard combination for instrumented tests, and a Thor-fluorine second stage combination for the manned flights. This plan, if approved, would place a man in a 150 nautical mile orbit by October 60 at an approximate cost of \$120 million. (USAF Manned Military Space System Development Plan, 2 May 58, prep by AFEMD.)

15 May 58

On instructions from command headquarters, AFBMD prepared several funding alternatives to meet the amount of money that might be realistically budgeted for the manned space program. These were sorted out at four levels: (a) \$100 million fiscal 59 appropriation which reduced the test program for Thor-Vanguard vehicles but maintained the October 60 date for the first manned space flight; (b) a \$90 million program for the same number of vehicles but postponing the first manned flight from October 60 to April 61; (c) a \$90 million high risk effort incurred by deleting four more vehicles from the program and retaining the October 60 launch date; (d) a \$75 million program with the same number of vehicles as (c) but delaying the first manned flight date to October 61. (Memo, Col C. H. Terhune, Dep Cmdr, Tech Operations, AFBMD, to MajGen B. A. Schriever, Cmdr AFBMD, 15 May 58, subj: Revisions to the Man-In-Space Development Plan.)

19 May 58

AFBMD completed its third Man-In-Space Development Plan which was similar to the other two plans except it contained additional fiscal 59 funding alternatives; i.e., \$100 million; \$90 million; \$75 million or \$67 million. It was clearly apparent that a major stumbling block to Air Force manned space program approval was its high cost, particularly for development of a new fluorine second stage. (Commander's Reference Book, "Chronology of Man-In-Space Effort," 23 Mar 59.)

20-21 May 58

AFBMD briefed Man-In-Space-Soonest at command, Air Force headquarters, and secretariat levels. The command was assured that adequate funding, "somewhere between seventy-five and one hundred million dollars" would be allocated the program for fiscal year 59. The briefing to MacIntyre and Horner evoked a specific suggestion that an ICBM be used as booster in lieu of developing a second stage for the Thor. The division was allowed two weeks to prepare a plan using an Atlas booster and bring it to Washington for secretarial review. (Memo, Col H. L. Evans, Asst Dep Cmdr, Space Sys, to Col C. H. Terhune, 23 May 58, subj: Trip Report.)

28 May 58

AFBMD completed its fourth Man-In-Space Development Plan, which, in the form of charts rather than a formal publication, proposed use of the Atlas booster plus a second stage consisting of a Lockheed Hustler (second stage of the 117L, later called Agena) to place a man in a 150 nautical mile orbit during October 60. Cost was estimated at \$106.11 million for fiscal 59. This plan was briefed at all decision levels in Washington. (Chronological Space Hist, 58.)

31 May 58

Washington discussion of the Air Force Man-In-Space proposal continued to ferment without any sign of the approval necessary to start the program. ARPA indicated general agreement with the plan and the National Security Council Planning Board displayed a "feeling of great urgency to achieve animal flights in space with safe return and to achieve the Man-In-Space Soonest at the earliest possible date." Other than this nebulous progress the Air Force man in space effort was no nearer realization. (Memo, Col H. L. Evans, Asst Dep Cmdr, Space Sys, to Col C. H. Terhjne, 31 May 58, subj: Trip Report.)

Jun 58

The Air Force obtained ARPA approval to proceed with study contracts on space life support systems. Two three month contracts totaling \$740,000 were awarded to North American Aviation and General Electric for life support system development. (Rpt, Comparison of NASA Manned Space Program and USAF Manned Military Space Proposal, 25 Feb 60, prep by AFBMD.)

15 Jun 58

A draft revision of the Man-In-Space Soonest development plan was prepared. This plan proposed use of an Atlas booster to place a man in 115 nautical mile orbit during April 60. In event the performance was not up to lifting the required payload weight, a 117L or a Vanguard second stage would be added. Costs were estimated at \$99.3 million for Atlas alone, \$105 million with a Vanguard second stage (AJ 10), and \$139.51 million if a 117L vehicle were used as the second stage. (Chronological Space Hist, 58.)

16-26 Jun 58

AFBMD presented its fifth Man-In-Space Soonest development plan to Washington decision levels in the Air Force and Office of the Secretary of Defense. (Chronological Space Hist, 58.)

19 Jun 58

ARPA had not yet directed a "go ahead" for the man in space program. However, Air Force headquarters considered it a certainty that direction of an Atlas boosted manned space flight would be given to the Air Force at an early date, that funds for the project would probably total \$66 million and that a series of Thor boosted, instrument and animal capsule flights would precede the Atlas full sized instrumented capsule, chimpanzee, and manned shots. Additional funds would be obtained from re-programming. AFBMD was advised that while waiting for an authoritative "go ahead" it should continue preparation of work statements for industry competition and contractor selection so they might be coordinated with ARPA and the National Advisory Committee for Aeronautics. (Ltr, MajGen J. E. Smart, Asst V/CS, to LtGen S. E. Anderson, Cmdr ARDC, 19 Jun 58, no subject, quoted in Msg, RDZGW-6-33-K, Hq ARDC to Hq AFBMD, 27 Jun 58.)

24 Jun 58

Inasmuch as availability of basic booster units threatened to limit selection of the most desirable space programs the Secretary of the Air Force authorized an increase in production of Thor, Atlas, and 117L second stage (Agena) vehicles. (Memo, SAF to C/S USAF, 24 Jun 58, no subject.)

24 Jul 58

AFBMD published its sixth Manned Military Space System Development plan which proposed a single Atlas booster, but with a back-up program for a second stage (either 117L or AJ 10), to place a man in a 150 nautical mile orbit in June 60. The cost of this plan was estimated at \$106.66 million for fiscal 59. (Chronological Space Hist, 58.)

24 Jul 58

Major General B. A. Schriever, AFBMD Commander, recommended slipping the target date for the first manned flight from April to May 60 because of continued delay in approving the Man-In-Space program. The division had fully prepared all elements of the development effort and was ready for immediate contractual action after program approval and commitment of funds. To forestall further slippage Schriever made the following recommendations: level of \$106.6 million for fiscal 59; grant \$31.92 million immediately for the first quarter commitment; remainder of second quarters funds, \$21.85 million, be released by 1 October and the third and fourth quarter funds of \$52.89 million be available by 1 January 59. Finally, the program should be assigned a priority commensurate with the urgency of the man in space mission. (Ltr, Schriever to Anderson, 24 Jul 58, subj: Actions Required for Man-In-Space Soonest Program.)

24-25 Jul 58

AFBMD presented a series of man in space Washington briefings at command, Air Force staff and secretariat, and ARPA levels. The ARPA director Roy Johnson said the following: (a) the man in space program would not be approved at this time; (b) it appeared that \$50 million would be an optimistic estimate of program funding until the Space Council, authorized by recent legislation, was organized and working, an event that was not probable before Thanksgiving; (c) planning anything over a \$50 million program, the maximum likely to be approved under any circumstances, was wasted effort; (d) statements of prominent scientists had convinced the White House there was no currently valid reason for man in space; (e) when the Space Council became a viable organization, man in space would probably become a joint effort of ARPA and The National Advisory Committee for Aeronautics (NACA); (f) NACA (the National Aeronautics and Space Act creating the National Aeronautics and Space Administration was to become law on 29 July 58) was already thinking of an independent but very similar space program that would cost about \$40 million in fiscal 59. Hope for an Air Force man in space program appeared to be dim. (MFR, Col J. D. Lowe, Ch, Space Sys Div, AFBMD, 30 Jul 58, subj: MISS Briefing to Hq ARDC, Hq USAF, the Secretary of the Air Force and ARPA on 24-25 Jul 58.)

29 Jul 58

The President signed the law by which the National Advisory Committee for Aeronautics (NACA) would be succeeded by the National Aeronautics and Space Administration with an expanded role of peaceful exploitation of space. The new agency would have custody of all space programs except those clearly oriented toward military objectives.

29 Jul 58

Despite mounting evidence that the Air Force would not be assigned management of any national lunar program, it continued to press for a manned space program. On this date there was a meeting of Dr. Dryden, NACA; Mr. Roy Johnson, ARPA; and SOD Neil McElroy but future management of a manned space program was not resolved and it appeared that resolution would only be attained at the Presidential level. It was assumed, however, that the Air Force would have at least \$50 million in 59 funds to further its space program. (MFR, Col J. D. Lowe, AFBMD, 29 Jul 58, subj: Man-In-Space Program, cited in Chronological Space Hist, 58.)

30 Jul 58

Air Force headquarters informed ARDC that the Man-In-Space Program was to be funded at fiscal 59 level of \$50 million. ARDC was also requested to answer the question: Why should the military furnish the first man in space? (Msg, AFDAT 53918, Hq USAF to Cmdr ARDC, 30 Jul 58, cited in Chronological Space Hist, 58.)

30 Jul 58

The military services and particularly the Air Force found their space prospects disheartening. Through fiscal 58 all space programs had been managed by the DOD through the ARPA. The new fiscal year offered little hope for change and, on 29 July, the President ordered transfer to NASA of non-military space programs such as lunar probes, scientific satellites, and the Vanguard project. (Bowen, The Threshold of Space, p. 28.)

2 Aug 58

The first successful flight test of a Series B Atlas missile. This was also the first successful staging of a long-range missile. (AF Ballistic Missiles Program Status Report.)

11 Aug 58

General Schriever observed that AFBMD and prepared a series of man in space programs without discernible progress toward an approved effort. Nevertheless, AFBMD was currently preparing an abbreviated development plan based on a fiscal 59 level of \$40 million. In all probability uncertainty in space decisions would prevail until high level civilian and military management relationships and certain national policy questions were settled. (Msg, AFBMD to ARDC, 11 Aug 58, cited in Chronological Space Hist, 58.)

Sep 58

The future of military space programs seemed to hinge on settling areas of interest between ARPA and the new NASA agency. It also was probable that no final over-all space program would be adopted until there had been a complete re-examination of the nation's space objectives and goals. In addition the DOD was required to transfer some \$117 million in fiscal 59 funds to NASA of which \$58.8 million was Air Force money. Thus it appeared that of the various proposed programs already within NASA's legitimate area of interest it might well take over the man in space program primarily because it had the money to undertake its development. In respect to the lunar probe program, the Air Force had to wait for further direction before proceeding further. The large booster (one million pound thrust) authorized for Air Force development was transferred to the civilian space agency. The Air Force would continue development of the 117L system under the direction of ARPA. (Memo, Col C. R. Roderick, Committee Liaison Div, Ofc of Legislative Liaison, to Asst Dir, Legislative Liaison, Sep 58, no subject.)

11 Sep 58

AFBMD published the seventh Manned Military Space System Development Plan. The word "Soonest" was conspicuously absent from the title. The plan contained no startling innovations but reduced the program to fit fiscal 59 anticipated expenditures of \$40 million with no second stage backup. The first manned flight was scheduled for December 60. (Ltr, BrigGen O. J. Ritland, V/Comdr, AFBMD, to Comdr, ARDC, 15 Sep 58, subj: Man-In-Space Program.)

8 Oct 58

A NASA Space Task Group was organized to direct and conduct Project Mercury. (J. M. Grimwood, Project Mercury, a Chronology, 63, NASA MSC Publication HR-1.)

23 Oct 58

The first of a series of meetings between the Space Task Group and AFBMD representatives was held to define support required by the civilian space agency. The scope of the manned space effort, its booster requirements, procurement procedures, launch schedules and facilities, were defined. AFBMD also needed to define the extent of its own role in the Mercury program. Control of booster procurement, scheduling use of scarce ground and launch facilities in the face of possible interference with ballistic missile development, and the desire to use the existing AFBMD/STL management structure in carrying out the support role were some of the questions and policies to be resolved. (Rpt, AFBMD Support, Project Mercury, Dec 60, prep by AFBMD Space Div (WDZ).)

29-30 Oct 58

A second Space Task Group - Air Force Ballistic Missile Division meeting, held at Langley Research Center, continued the task of developing a coordinated Project Mercury effort. The space agency offered a tentative launch and test program and the missile division assisted in preparing a development

plan. Schedules, operating procedures, funding and general allocation of responsibilities were discussed but the meeting was not marked by any major agreements. (Rpt, AFBMD Support, Proj Mercury, Dec 60, prep by AFBMD Space Div (WDZ).

25 Nov 58

AFBMD received its first specific request from the civilian space agency to support a "preliminary research program leading to manned space flight." The division was requested to procure "... one Atlas C ballistic missile booster. This request was a forerunner of a support effort for a program "requiring approximately thirteen (13) ballistic missile boosters of the Thor and Atlas class." The space agency would procure the payload, scheduled for May 59 delivery. The missile division was to furnish detailed plans, subject to the approval of NASA, for the design, construction and launching of this vehicle. One million dollars was immediately transferred to the Air Force with more money to be supplied as it was requested. (Msg, no cite number, Hq NASA, to Cmdr, AFBMD, 25 Nov 58.)

28 Nov 58

First successful full-range Atlas flight, 5,506 nautical miles down range. (AF Ballistic Missiles Program Status Report.)

1 Dec 58

While the probability of the ballistic missile division developing a military manned space system was rapidly diminishing, an accelerating military and civilian demand for space boosters and launching facilities was threatening to saturate the division's resources. Except for certain strictly military applications it was plain the Air Force would play mainly a supporting role in the nation's space program, supplying boosters and launch facilities to the civilian space agency and ARPA. On this date there were approximately 11 scheduled programs, several only in the planning stage. One of the firm programs was the civilian agency's man in space which was scheduled to launch its first experimental Atlas C payload in May 59 and start a series of nine Atlas D launches beginning December 59. (Ltr, Col L. D. Ely, Asst Dep Cmdr, Military Space Sys, AFBMD, to Col C. H. Terhune, 1 Dec 58, subj: Atlas Boosters for Space Projects.)

8 Dec 58

NASA ordered nine more Atlas boosters from the missile division for the Mercury Program. (NASA Order HS-36, Msg, Hq NASA to AFBMD, 8 Dec 58.)

18 Dec 58

Projecg Score, Atlas rocket placed in orbit carrying communications equipment which relayed President Eisenhower's Christmas message to the world from outer space. (AF Ballistic Missiles Program Status Report.)

19-20 Jan 59

One of the most important Project Mercury meetings between NASA and AFMMD, at which a series of agreements was approved controlling administrative arrangements and procedural channels essential to coordinated, efficient management of the joining phases of the program. Cost of the Atlas booster was set at \$3.5 million, Space Technology Laboratories systems engineering and technical direction of the Air Force Ballistic Missile Division's part in the program was agreed upon, revision of program requirements was accomplished, regular technical and management meetings were arranged, and the missile division promised to prepare a development plan for the first Mercury booster (HS-24) by February 59. (Ref file, AFMMD Support, Proj Mercury, Dec 60.)

14 May 59

NASA instructed the missile division to combine its first order for an Atlas booster (HS-24) with a later order for nine Atlas boosters. This action would also combine fund allocations of \$2,761,000 for the first booster and \$6 million for the nine boosters to a fund total of \$8,761,000 for Mercury booster procurement. Therefore, the missile division was requested to prepare a development and funding plan covering the amended HS-36 order and forward the plan to NASA by 15 June 59. (Msg, no cite number, NASA to AFMMD, 14 May 59.)

28 Jul 59

First successful Series D Atlas missile flight test. (Air Force Ballistic Missiles Program Status Report.)

17 Oct 60

The Air Force no longer seriously entertained the prospect of a separate military man in space program at this time. AFMMD became deeply involved in support activity for the civilian space agency, especially developing and supplying hardware for the Mercury program. As of this date, AFMMD participation included the following: providing 16 Atlas D boosters modified to accept Mercury capsules and adapters, to be provided by the space agency, and a modified guidance structure, an installed abort system to insure pilot safety, and telemetry. AFMMD also furnished launch facilities at the Atlantic Missile Range Complex 14, and one-half of Hangar J and the necessary modifications thereto as requested and made necessary by booster requirements. Such work included installation of capsule umbilical and checkout cabling, telemetry, communications, and data transfer equipment required by the payload. AFMMD also provided the guidance site and use of the range Atlas guidance computer (Mod III) for powered trajectory guidance and the special computations requested by the space agency. The missile division and several Air Force contractors provided, as of this date, 401 military and civilian personnel to the program. Much of the cost of this support activity was reimbursed by NASA but some was not. Air Force personnel

costs, military and civilian; office space and equipment;
and normal base support functions were provided at Air Force
expense. (Msg, WDGP 17-10-5, AFEMD to Hq ARDC, 17 Oct 60.)