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WDD-AFBMD-SSD

SPACE PROGRAMS

1954 - 1966

SEP 1966

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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 AFBMD-SSD, based on division histories and documents in the history office files.

There are other AFBMD-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.

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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 schedie 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.

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

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

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.

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--ultimatelly becomeing 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

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 [illegible] 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

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 routing 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

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

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

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.

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, AFBMD 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

denied the applicability of the concurrency appnoach 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

Secretary Charyk, Deputy DDR&E John Rubel, and Presidential science advisor George Kistiakowsky. Concurrently, Congress added [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, AFBMD expanded the proposed flight schedule to include 30 rather than 25 launchings and nearly tripled the proposed number of recover- 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, OSAF and DDR&E jointly considered the advisability of creating entirely new management channels for Samos, under DOD control.

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 officer. 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.

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

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 promted it, but to no effect. A variety of AFBMD-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

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 concurrently 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

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.

Note - Over + above this is mentioned BEMEWS

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.

Even that fibure, 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.

Althought 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

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 weighed 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

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.

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"

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.

[redacted]

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 prividing 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.

[redacted]

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, DDR&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.

Aerospace Plane 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.

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