EVOLUTION OF THE U.S. MILITARY SPACE PROGRAM, 1945-1960: 
SOME KEY EVENTS IN STUDY, PLANNING, AND PROGRAM DEVELOPMENT

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September 1982
The Rand Paper Series

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This Paper traces the conceptual phase (roughly 1945 to 1956) of the military space program—the period in which major studies were undertaken that formed the basis of subsequent developments. Some of these early studies proved remarkably prescient, and a few are still worth reading today (e.g., the Rand Feed Back Studies of 1954). Little official or high level enthusiasm accompanied the early proposals flowing from the studies. In many ways, it was the personal enthusiasm of a few individuals which made the difference.

Naturally, such enthusiasm would probably have been to little avail, had not two other major events taken place: The U.S. decisions to pursue an aggressive ICBM program, spurred in 1954 by key ICBM development proposals stemming from The Rand Corporation and from SMEC (von Neumann Committee); and the roughly concurrent increased U.S. awareness of the USSR as a major power whose policies required the United States to develop new means of gathering intelligence and new tools for managing and operating military forces. This early period closes with the decision to pursue the WS 117L program, whose main progenitor was the Rand Feed Back study. A number of people associated with the Feed Back study played key roles in WS 117L and later.

[1] This paper reflects a version of a talk given in April 1982, at a Space Conference held under the sponsorship of the Fletcher School of Law and Diplomacy (Tufts University and Harvard University). The paper was reviewed for security issues by the Air Force Element at The Rand Corporation. It has been edited for inclusion in a publication reporting the Space Conference, to be put out by Archon Books of Hamden, Connecticut.
associated developments. The impetus given to satellite work by Rand studies of this era seems mostly forgotten now; but it is doubtful if the program could have obtained a running start without it.

The following years, 1957-1960, were critically important in the U.S. military space program. Once the decision to undertake the basic WS 117L program had been made, program proposals began to proliferate rapidly. This proliferation was spurred by the Soviet Sputnik launch in October of 1957. The U.S. military space program rapidly became very complex. At the same time, there was much "backing and filling" in the military space program. The thorny issues of program allocations to the military departments surfaced into full visibility. Many different organizational approaches to managing the space programs were proposed within the Air Force, Joint Staff, the Office of the Secretary of Defense, and at higher levels. The emergence of the Advanced Research Projects Agency (ARPA) as an overall manager of Department of Defense space programs took place. For a short time, ARPA managed the entire national space program while NASA was being established. Then program management again devolved to the individual services. Within the Air Force much controversy surrounded the issue of proper organization to manage programs. The full scope of the U.S. Air Force ambitions and goals did not prove achievable because of higher-level decisions. Nevertheless, the period essentially decided the basic shape of the subsequent years' programs; for those programs which survived, fundamental policy and developmental decisions were made, although many details changed.

This Paper does not cover every relevant space issue considered by the United States Government in the 1945-1960 period, since many early
deliberations remain still classified, at varying levels of classification, and the nature and background of some decisions is correspondingly obscured.

Early History and Origins--1945

Early space interests in the post-World War II United States were spurred by a May 1945 report in which von Braun discussed German views on prospects and potentials of satellites. Navy interest in the report was responsible partly for a request in December 1945 for study of satellite vehicle potential.

Air Force interest in and awareness of space was formalized in two reports in 1945. In November 1945, the Arnold Report concluded that the design of space ships "is all but practicable today." Later, in a December 1945 report, the Air Force discussed a proposal for "space vehicles, space bases, and persuasive devices ... therein."

Early Studies--1946-1947

In 1946, the Navy proposed combined sponsorship of satellite programs to the Air Force. The Air Force, however, assigned a major satellite study to PROJECT RAND, which was completed in May 1946, as evidence of an independent Air Force program, rather than a joint Air Force-Navy program. In July 1946, the Navy assigned contracts to Aerojet, North American Aviation (NAA) and Martin for propulsion and vehicle engineering design work for satellites. These Navy design studies were completed in 1947. In March 1948, the RDB (Research and Development Board) established "technical feasibility" of earth satellite vehicles but claimed that no military scientific utility was yet shown. The RDB proposed that the Navy continue limited development
of engines and tanks. But in the summer of 1948, because of budget problems, the Navy relinquished immediate interests in satellite work. Nevertheless, this early post-war interest in satellites was reflected in December 1948, when the Annual Report of the Secretary of Defense noted research on "earth satellite vehicles."

**Results of the Early Studies**

The accomplishments and prescience of these early satellite studies were in many ways remarkable. The Navy work showed emphasis on hydrogen-oxygen propulsion, pressurized structural tanks, and single stage concepts. Both Martin and NAA developed reasonably detailed design and layout studies for satellite vehicles with substantial payloads (up to 2000 pounds). In addition, work on nuclear rocket and ramjet propulsion was undertaken.

The Air Force efforts reflected equally serious analysis. The Rand report contained thorough preliminary scientific and engineering analyses of satellite feasibility. Concepts studied included multistage vehicles, meteor problems, reentry considerations, scientific applications, detailed trajectory analyses, military uses for assisting missile guidance, and for reconnaissance, weather surveillance, and communications. The potential impact and significance of the satellite project were also assessed and highlighted.

In February 1947, Rand published a multivolume detailed study amplifying the 1946 work. Accordingly, in September 1947, USAF requested an AMC (Air Materiel Command) evaluation of the Rand reports of February 1947. The December 1947 response of AMC verified feasibility, but again had questions of utilization. Doubts were voiced that funding would become available at the appropriate level. AMC
suggested establishment of a satellite project to prepare specifications, requirements and scheduling. The agency noted that guided missile development had priority, but proposed starting on satellite component developments.

Formulation of USAF Policy, and More Intensive Studies--1948-1953

General Vandenberg's policy statement (January 1948) was the first clear service statement of space program interest ("USAF... has logical responsibility for satellite..."). The January 1948 policy was put into effect by authorizing Rand to do research and to let subcontracts in the field, even though the military worth of satellites was not yet fully recognized. The Air Force became the sole service authorized to expend funds on satellite vehicle studies.

In November 1950, Rand received support for further research to demonstrate the military utility of satellite reconnaissance. Two major Rand reports were issued in April 1951, concerning the utility of a satellite vehicle for reconnaissance, and the feasibility of weather reconnaissance from a satellite vehicle. These reports discussed "pioneer reconnaissance," with extensive earth coverage at resolution (utilizing TV) of between 40 and 200 feet, in a 1,000 pound payload and at a vehicle weight of 74,000 pounds. A new U.S. awareness of Soviet military potential--reflected in atomic weapons and related vehicle developments, for example--had posed new requirements for technical intelligence-gathering, so the Rand reports were published at an opportune time.

The U.S. Air Force, with RDB approval, authorized Rand to recommend development work in reconnaissance satellite programs--now known as Project Feed Back--in 1951. USAF reorganization (creation of ARDC,
etc.) brought more emphasis on research and development aspects of the USAF mission.

Project Feed Back Accomplishments

The USAF-Rand studies of the 1950s--Project Feed Back--produced a series of important results. In November 1951, the Air Force secured AEC cooperation on research into satellite nuclear power sources. In May 1953, the Air Force directed additional feasibility studies on a satellite nuclear power source, and requested the R&D command to begin active direction of the Feed Back program. By September 1953 Rand had recommended "letting a system design contract within one year, and proceeding to a full system development program."

ARDC endorsed that recommendation, and developed a unified management scheme. The Command established Project 409-40, "Satellite Component Study," and system number WS 117L was assigned.

From a Project to a System--1954-1956

In early 1954, the Rand Corporation[2] and the von Neumann Committee proposed revisions of the ICBM program. These proposals started effort on the large boosters necessary for many versions of militarily useful satellites. The sudden emergence of new evidence on Soviet advances in defense technology in the preceding few years demonstrated that new intelligence means were of paramount importance if the accelerating Soviet programs were to be monitored. One result was the initiation of the U-2 program in 1954, which produced an operational

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system in 1956. At the time, the useful life of the U-2 was judged to be relatively short, as advances in Soviet air defense were considered likely before too long to deny "free" overflight. Improving the technical intelligence systems was a major goal, and satellites appeared to be one promising means for gaining critical information.

The milestone Rand satellite study report of March 1954 (the "Feed Back Report") refined the reconnaissance satellite studies. Satellites, the report concluded, were of vital strategic interest to the United States. Rand suggested a development program lasting seven years at a cost of $165 million to $330 million. A recommendation that the Air Force continue the program on a full-scale basis was the central point of the Project Feed Back Report.

Project Feed Back was a landmark study which discussed many operational aspects of the program not previously treated, such as development, scheduling, and cost estimates, as well as a host of technical and operational issues. For these reasons, the Feed Back studies formed a useful preliminary blueprint for the early space program. The studies are still worth reading today for their conceptual and planning foresight.

In May 1954, concurrent with the ICBM decisions, ARDC was directed to study the potential applications of Feed Back, and by March 1955, formal approval had been granted for development of a reconnaissance satellite system. The development charter paralleled Rand's conclusions and called for visual band reconnaissance, specialized data, and weather data to determine the status of a potential enemy's war making capability. An operational availability date of 1965 was specified.
By November 1955, Martin and Lockheed were conducting studies aimed at further definition of time and technology requirements for satellite developments, under the nickname of "Pied Piper." By early 1956 the program had been transferred from WADC to WDD under General Schriever, and the detailed outlines of the project were well established. Finally, on 29 October 1956, Lockheed was awarded the development contract for WS 117L. The military satellite program was now committed to development and test of actual satellites.

**Scientific Satellite Version of WS 117L?**

As early as 1954 and 1955, a number of Rand studies had stressed needs for an instrumented test vehicle for space research. In August 1954, Congress approved U.S. participation in the International Geophysical Year (IGY), and launchings of small satellite vehicles was recommended. As a result, in early 1955, the Army and Navy proposed a joint satellite effort--Project Orbiter.

However, in May 1955, NSC Directive 5520 directed that no missile intended for military purposes could be used for IGY satellites by the United States. The directive supported Eisenhower's "peaceful uses of space" concept.

Two potential satellites--Army-Navy Redstone and the Air Force Atlas--conflicted with the directive, so the Navy Viking-based system (Vanguard) had to be chosen.

NSC Directive 5520 notwithstanding, ARDC was requested in August 1955 to establish a scientific satellite program integrated with WS 117L, to satisfy IGY requirements. By January 1956 WDD proposed to orbit a 3,500 pound satellite by August 1958, capable of conducting a
number of specific scientific experiments, but because the satellite would have used an Atlas C booster, the program was not endorsed. In any event, the Atlas satellite (Project Score) was finally launched in December 1958, mainly for demonstrative purposes.

Other USAF Space-Oriented Projects Through 1956

These projects generally had their beginnings in the early period, but either fell by the wayside or were greatly modified as time went on.

Development and flights of the X series of research aircraft, destined to gather valuable "near-space" information, began with the 1944 contract to build the X-1, and led to the X-15.

Boost-glide vehicles were discussed by Rand in 1948. The Air Force finally contracted in 1954 with Bell for further study, and in May 1955 USAF proposed a hypersonic strategic bombardment system. In 1956 the Air Force requested Bell to study bomber systems (Robo) and reconnaissance systems (Brass Bell), and ARDC proposed a research vehicle system called Hywards. In 1957 studies were requested to consolidate these into one system (Dyna-Soar), to lead to global circumnavigation capabilities in three subsequent phases.

Man-in-Space (MIS) proposals were based on early and mid-1950s space biology, balloon, and research craft experience. This background resulted in an ARDC proposal as early as February 1956 for a man-inhabited ICBM capsule. In December 1956 Avco and Martin submitted unsolicited proposals for a Manned Ballistic Rocket Research System, responsive to an Air Force Plan approved in May 1956. However, no funds were then available.

None of these projects had any substantial impact on the use of space for military purposes. The projects are indicative, nevertheless,
of the great diversity of space plans in the late 1950s. These plans were for the most part aborted or modified by policy decisions, funding constraints, or both.

**Events Affected Early Plans—1957**

Even though a military satellite program was under way in 1956, various advanced concepts were still being formulated by early contributors to the space program planning period, such as Rand. At the same time, events soon moved to upset and modify these early plans, and the space program of 1958-1960 differed significantly from that undertaken in 1956.

In 1956 Rand and others proposed three projects of potential military significance—the Advanced Reconnaissance System (ARS); the Man-in-Space (MIS) Project; and the ballistic Systems Research and Supporting System (BALWARDS). The latter, using Atlas, Aerobee, and Sergeant missiles, looked toward landings on the moon and flights in the vicinity of Venus and Mars. Both ARS and MIS were approved as possible projects. The Air Staff also approved BALWARDS. In May 1957 the Office of the Secretary of the Air Force deleted the interplanetary missions. BALWARDS instead became the near-space project known as the Ballistic Research and Test System (BRATS).

On October 4, 1957, newspapers of the world announced the 184-pound Russian Sputnik. National and international comments on the Soviet victory were not complimentary to the United States. Throughout the American press there was general condemnation of the partial measures, hit or miss planning and confused organization. A number of high-ranking U.S. officials attempted to belittle the Russian satellite, but at no level within the Air Force, the Department of Defense, or the
Administration had there been a statement of the ultimate objectives of an American space program.

A committee of distinguished scientists and Air Force officers, headed by Dr. Edward Teller, was formed by the Secretary of the Air Force to propose needed actions. The committee’s report, completed on 22 October 1957, recommended a unified program, but the result was a divided program that diffused rather than focused any expanded effort.

The first major organizational development came on 7 November 1957 when the President added to the existing organizational structure by appointing Dr. James R. Killian as Special Assistant for Science and Technology. On 10 December, General Putt announced the establishment of the Directorate of Astronautics, headed by Brigadier General Homer A. Boushey. The Department of Defense, however, reacted adversely to this action. By 13 December General Putt had canceled his memorandum of 10 December. Although the Air Force remained aware of the need for strong control of space projects, chances for approval for the necessary organization remained poor.

Emergence of New Organizations--1958

As part of the response to Sputnik, Secretary McElroy established the Advanced Research Projects Agency (ARPA) on 7 February 1958. The new office was headed by Roy W. Johnson, and was authorized to direct research and development projects within the Department of Defense. In practice, ARPA reassigned projects to the military departments, other government agencies, or civilian institutions.

On 7 January 1958 the Department of Defense had requested the three services to list their proposed space projects. The Department of Defense wanted this information mainly to assist ARPA in assigning
development missions among the Army, Navy, and Air Force. The Air Force interpreted the request quite differently, believing that the Department of Defense might approve a USAF space program. Two weeks later, the Air Force had assembled a program consisting of five major space systems, including Ballistic Test and Related Systems, manned hypersonic research, Dyna-Soar, the WS-117L Satellite System, and a Lunar Base System. These proposals were further divided into twenty-one major projects.

On 2 April, the President asked Congress to approve the establishment of a National Aeronautics and Space Administration (NASA) to conduct all space activities except those primarily associated with military requirements. On 20 July, the President signed the National Aeronautics and Space Act (Public Law 85-568) creating NASA. It had the effect of partitioning the space program into military and civilian segments, and was the culmination of an extensive debate within the White House on the relative merits of alternative plans.

On 3 July 1958, the National Security Council (NSC) submitted to the President a policy statement on outer space. The NSC noted that Russian superiority in astronautics would create an imbalance of power in favor of the Communist bloc. There were immediate military requirements for weather, communication, and other applications of satellites for additional purposes, such as maintenance and supply depots for outer space vehicles, and as reconnaissance stations. The notion of space systems providing support for operational forces received the beginnings of high level official sanction in this NSC sanction. The President signed this paper on 18 August and by midsummer 1958 the Administration had established a space policy that called officially for
dual civilian and military space programs. That policy remains in
effect today.

The Emerging Role of ARPA in Defense Department Space Activities

The policies of ARPA became clearer during the spring of 1958.
Johnson, with the approval of Secretary McElroy, would organize and
operate the agency as a "fourth service" or possibly as a "special task
force" within the Department of Defense.

Johnson's authority was further increased when the President
determined that ARPA would control civilian as well as military space
projects until NASA began functioning. Between 7 February and 1 October
1958, ARPA served as the "national" space agency. Many of the NASA
plans depended ultimately on the programs undertaken by ARPA.

In the spring of 1958, Johnson transferred to ARPA several Air
Force proposals including Space Track, a 1,500,000-pound-thrust single-
chamber engine, reactor propulsion, the Advanced Reconnaissance System,
and the three-phased satellite for man in space, along with others from
the Army and Navy.

By then, ARPA had organized its space projects into four large
programs which were titled Missile Defense Against ICBM, Military
Reconnaissance Satellites, Developments for Application to Space
Technology, and Advanced Research for Scientific Purposes.

On 28 July the President decided to emphasize the civilian space
program, giving NASA such nonmilitary projects as lunar probes and
scientific satellites initiated by ARPA, along with Project Vanguard.
Executive Order No. 10783 began this transfer immediately after the
activation of NASA on 1 October. Under this arrangement, NASA assumed
responsibility for advanced research for scientific purposes, and for
developments for application to space technology. NASA also got projects pertaining to man in space (redesignated Project Mercury), special engines, satellite tracking, communications, meteorology, and navigation.

In September 1958, ARPA had redefined the Advanced Reconnaissance System into separate projects, with new designations. The reconnaissance aspect was renamed Sentry. The vehicle tests, biomedical flights, and recovery experiments were grouped together as Discoverer. The infrared sensing system became Midas. In the last months of 1958, ARPA assigned these three projects to Air Force organizations.


In the spring of 1959, significant organizational changes were made in the space program. On 13 April 1959, Headquarters USAF gave the Directorate of Advanced Technology authority to coordinate within the Air Staff all USAF space activities, including those conducted for ARPA and NASA.

ARPA recommended in June a Mercury Task Force to assist NASA, and the Secretary of Defense proposed to reassign operating responsibilities for several projects, including Midas and Sentry--the latter soon to be redesignated as Samos. Service views were varied. The Army and Navy wanted a Mercury Task Force and a Defense Astronautical Agency to control the space systems. The Air Force objected to both.

Transfer of Space Activities to the Services

In September the Secretary of Defense disapproved the proposed Defense Astronautical Agency and a Mercury Task Force. As a substitute he designated Major General Donald N. Yates, USAF, Atlantic Missile
Range commander, to direct military support for the project. Secretary McElroy reversed his established policy on ARPA, and reassigned the military space program among the three services. Under this arrangement, Midas and Samos went to the Air Force. Transit, a more recently planned navigational project, went to the Navy. A Notus family of four communication satellites went to the Army.

The actual transfer of Samos and Midas occurred in late November 1959. ARPA also relinquished Project Discoverer to the Air Force, as a separate action.

As early as 1958 the Air Force Chief of Staff had commented on the desirability of issuing preliminary long-range concepts for space operations through the medium of an Air Force Objective Series (AFOS) paper. By July 1959, AFMD had readied a development plan for what it termed the "Flag national survival communication satellite," the operational follow-on of the ARPA development program. SAC immediately supported the plan and suggested that the system offered an excellent opportunity to exploit space for peaceful purposes, with industry using the system for commercial interests. The Satellite Communications Act of 1962 and NSC Action Memorandum 338 subsequently specified the interactions between commercial and Defense Department users of satellite communications systems, as earlier envisioned by SAC.

Space Systems for Defensive Roles

During 1959-60 the Air Force took some tentative steps toward Aerospace Defense Systems, via weapon system development for ballistic missile defense. Deputy Secretary of Defense Gates in effect spurred this action when in October 1959 he indicated that he might soon approve production of Nike Zeus. Air Force studies of ballistic missile defense
had investigated three possible modes of destroying ballistic missiles: destruction during the boost (powered) phase; destruction during midcourse flight; and destruction during terminal reentry. The Air Force, with ARPA concurrence, concentrated on what appeared to be a most attractive systems concept—destruction of enemy ballistic missiles in their boost phase. This concept had an ARPA designation of BAMBI (Ballistic Missile Boost Intercept).

Convair's SPAD (Space Patrol Active Defense) concept, based on a satellite equipped with infrared sensors, was initially emphasized. The plan was broadened after Ramo-Woolridge submitted a variation of this idea, call the Random Barrage System (RBS).

The Air Force hoped to define a system and the component development necessary to start proving the feasibility of the total system concept, with the ultimate objective being to have an operational satellite system available by 1967.

Study of defensive measures against hostile satellites had begun earlier, in 1956, under ARDC sponsorship. In 1958, ARPA had assumed responsibility, but continued ARDC as project supervisor. The steadily advancing space technology appeared to some a threat in the form of Soviet "bombs in orbit," possible by 1964. A capability to inspect and, if necessary, destroy any hostile satellite therefore seemed desirable or essential in the near future.

In August 1959, AFRMD, in cooperation with WADC, submitted a preliminary development plan for such a new special space defensive system.

Dr. Herbert York approved the start of a program to demonstrate engineering feasibility of a co-orbital satellite system on 16 June
1960. Work on the prototype system was to be restricted to development, but not flight testing, of critical subsystems. Subsequent direction was that all systems emphasis focus on inspection functions, a step related to the President's "Space for Peace" program. Such a plan went to the Secretary of Defense on 21 July 1960, and gained approval a month later.

The Dyna-Soar Years

The Air Force and the aircraft industry had long conducted studies on the feasibility of hypersonic (Mach 5 and above) orbital flight with a manned vehicle employing boost-glide principles. These studies had been carried out earlier under such project names as Robo, Brass Bell, Bomi, and Hywards, finally culminating in Project Dyna-Soar (Dynamic Soaring). By the fall of 1958 the Air Force emphasized suborbital performance (for the specific purpose, presumably, of keeping management authority within the Air Force and away from ARPA).

By April 1959, Dr. York (DDR&E) had directed that the primary objective of Dyna-Soar I was to be the exploration of hypersonic flight at velocities up to 22,000 feet per second with a vehicle that was manned, maneuverable, launched by a booster already in production or under development, and capable of controlled landings. Secondary objectives were to be achievement of an orbital capability, and provision for installing and testing military subsystems.

By fall 1959 a three-phase development plan called successively for fabrication and testing of a full-size, 5,000-mile-range glider, initially to be airdropped from a B-52 and later ground-launched with a Titan A booster. Later tests were to extend glider tests to global range and orbital velocity, using a larger booster. Finally, advanced systems were to be developed by 1967.
By November 1959 Under Secretary of the Air Force Dr. J. Charyk wanted to be sure that the critical aerodynamic, structural, and materials problems so important to the success of Dyna-Soar had been carefully considered, and allowed only a Phase Alpha to proceed. Phase Alpha results were received from Boeing in late March 1960. On April 22, Dr. York approved the start of Dyna-Soar development and released the required Fiscal Year 1960 funds. The plan was for an unmanned ground launching of a Dyna-Soar test vehicle to occur in late 1963, followed by a manned launching a year later.

Questions on Space Systems, and the 1960 U-2 Incident

The reliability, life, complexity, and priority of several Samos and Midas subsystems were continuous issues. Some Defense Department officials and Administration scientific advisors doubted that many of the tests would succeed, and envisioned substantial savings by using less sophisticated equipment and subsystems requiring more modest ground facilities. A "fly before you buy" view took hold.

When Gary Powers' U-2 was downed over the Soviet Union on 1 May 1960, Congress became intimately involved in Samos-Midas progress, calling for rapid development of both space systems, voting sums far in excess of the Administration's requests for Fiscal Year 1961. Even so, uncertainties and indecision on the technical and budgetary aspects of Samos and Midas continued to affect planned operational dates for the two space systems.

The Air Force, in view of its responsibilities for the Samos and Midas programs, called for the Strategic Air Command to operate the Samos system and provide support to Continental Air Defense Command and
North American Air Defense Command (NORAD) in the operation of Midas. On 14 March 1960, the Secretary of Defense forwarded both plans to JCS and asked for an early reply. The Joint Staff accepted the plans, but argued that NORAD should not exercise operational control of Midas. Army and Navy planners favored a joint organization specifically for military space operations. Processing the dissemination of Samos-derived data by an Air Force command (SAC) were seen by these planners as inconsistent with development of a joint organization. The Air Force planners protested the exclusion of NORAD, arguing that a breach of American-Canadian agreements would result.

At the end of June 1960, after Gates reemphasized use of existing commands for military space operations, the issue could be settled only after numerous other Samos and Midas-related problems were resolved. Conflicting decisions and indecision marked the Samos-Midas-Discoverer program during Fiscal Year 1960. Few people were aware of the complex bureaucratic background largely responsible for the piecemeal approach to important programs. Virtually every phase of the projects remained in a constant state of flux. Divergences of view arose continually between civilian and military experts in the technical area, between the Secretary of Defense and the Air Force in funding, and between the Air Force and other services in the operational areas.

**The Status of Space Systems in 1960**

Much effort had gone into Air Force space programs by 1960, but major changes were soon to occur. The Samos program was radically revised, and the Bambi and Dyna-Soar programs were canceled. The communications satellite programs were restructured in many ways. Only the Midas program was to carry on as a major national effort largely
along the lines of plans originally contemplated. The other surviving programs reflected changes of detail, and to varying degrees, in goals, concepts, management structure, and visibility.

**Overall Impressions of the Period--1945-1960**

Many of the conceptual applications of satellite vehicles were not only conceived, but also explored in some depth, during 1945-1960. The implications of the availability of satellite vehicles—as instruments of national prestige, tools of politics and diplomacy, and new capabilities for scientific research—were considered and debated. The technological advances needed to support these visions also developed, although with varying degrees of success.

Following this early period, a significant shift of emphasis occurred, which persists today. Current technology exceeds in nearly all respects the wildest dreams of twenty-five to thirty years ago, but national goals for this technology are no clearer today than in the 1950s. In the near term, technology is capable of supporting missions and operations for which national space policy is unprepared, and for which no farseeing national space plan exists. In short, technological capabilities may not be fully exploited because no coherent national space program allows rational decisions on whether or how new ventures should be undertaken.

In addition, a significant portion of the nation's ability to respond quickly to emerging needs and developing opportunities seems to have been eroded. The pace of development of early space programs and such programs as the U-2 and the aircraft later to become the SR-71—the latter in many ways still the world's most advanced aircraft—seems almost impossible by today's standards. Much of the change must be
attributed to the organizational and management environment within which today's programs operate. This being so, such erosion can be reversed if the will to do so exists.