OPPORTUNITIES FOR POLICY HISTORIANS: THE EVOLUTION OF THE U.S. CIVILIAN SPACE PROGRAM

John Logsdon

One of the most attractive features to me of the U.S. space program as a subject for historical study is its relatively finite nature. While the National Aeronautics and Space Administration's (NASA's) probes and telescopes may be looking outward toward the perhaps limitless edges of the universe, the organization itself has had a life span of hardly a quarter of a century and for all of that time has been very self-conscious about the historical character of most of its activities. It is difficult in general for historians to reconstruct how events occurred and, even more, *why* they occurred; I submit that, while still difficult, it is comparatively easier to undertake such reconstructions for the United States space program, at least in its unclassified aspects, than for almost any other human enterprise of similar scope and historical magnitude. And to top it off, working on space history is one way for those of us without high technical competence to get close to what is (to me at least) the great adventure of my lifetime.

My interest, as a trained political scientist interested in what I call "policy history," is in understanding why governments undertake particular courses of action (which is how I define policy) and in analyzing the institutions and processes through which those courses of action are carried out. I spend little time on the equally fascinating history of technological developments *per se*. In what follows, I attempt to trace the evolution of U.S. civilian space policy and of the institutional framework through which that policy has been implemented. Most of this policy history is uncharted territory for the academic historian, although the 1957-1961 period is more adequately described than the two decades since then, and the groundwork for further analysis has been laid by NASA's continuing program of commissioned and in-house histories.

Government involvement with advanced science and technology has perhaps never been as intense as it has been in the space arena; there is much to record and to contemplate in this involvement. Hopefully, the account which follows can provide some clues to areas for fertile historical analysis.

Space Policy Principles: 1957-1962[1]

There were, of course, space activities within the United States prior to the 1958 launch of America's first satellite, *Explorer I*, on January 31st of that year. The military services, particularly the Air Force, had initiated

early satellite projects. The United States had agreed to launch a scientific satellite as part of the International Geophysical Year, and the Vanguard project had been authorized by President Eisenhower to meet the commitment. Vanguard was a second-priority project, explicitly forbidden from interfering with the requirements of the nation's crash missile programs, and did not achieve a successful launch until later in 1958. Even though it was carried out by the Office of Naval Research, it was predominantly a civilian program with limited scientific objectives.

During the 1950s, others recognized the potentials of space. They included individuals within the various armed services, particularly the Air Force, because space activity seemed a logical extension of its mission, and the Army, because in the Wernher von Braun rocket team at the Redstone Arsenal in Alabama it possessed one of the leading groups of rocket engineers in the world and needed to find missions to keep that team at work under Army direction. A few individuals within the civilian National Advisory Committee for Aeronautics (NACA) also were beginning to see that the organization's future might well lie in expanding its activities into space, although NACA leadership did not adopt this posture until after the initial Soviet satellite launch.

Indeed, it was the shock of the Soviet *Sputniks* in late 1957 that galvanized the U.S. debate on space policy and programs. That debate extended from the late 1957 period well into the early years of the Kennedy administration. The policy debate was often acrimonious, with a wide variety of perspectives represented and with strongly held institutional and personal positions. The principles which emerged from that debate and which are described below were not solely, indeed not predominately, the result of some "rational" analysis of the appropriate basis for U.S. space policy; like most other public policies in the United States, they represented negotiated compromises among conflicting interests. Hopefully, they also reflected some sense of the national interest in a new area of human activity.

A fundamental principle of U.S. space policy was that *activities in space could be justified not only by scientific payoff, military or intelligence applications, or potential economic or social benefits, but also by political objectives.* That the first three of these motivations were legitimate rationales for U.S. space activity was established early in the space policy debate. President Eisenhower turned to his newly-established President's Science Advisory Committee for counsel on the appropriate U.S. reaction to *Sputnik*, and those scientists included individuals who saw space as an exciting new arena for discovery. They recommended a program which focused on scientific learn; the science advisers were also

concerned that space science not divert money away from other fields of science, but rather be planned as a separate part of the overall national scientific effort. Since the beginning of the U.S. program, space science has competed, on one hand, with other types of space activities—particularly manned spaceflight—for funds within NASA and, on the other hand, with other areas of science for a share of the government science budget.

The national security community was quick to sense the potential of space as an important arena for military and intelligence activities, not primarily in terms of active military operations but rather in terms of using space technology to perform necessary military support functions, such as communications, navigation, and weather forecasting, and surveillance functions central to strategic intelligence. There was little question from the start that, when space offered a more efficient or a unique way of achieving a military objective, the Department of Defense (DoD) would be authorized to carry out military-oriented space projects. The debate in the early years arose about the limits of legitimate military objectives in space, since the most visionary among the military were suggesting "space planes," manned orbiting stations and lunar missions, strategic interplanetary forces, and other expensive and "far-out" projects as appropriate military undertakings.

The capability to operate in space was also recognized early on as having the potential to lead to applications with both social and economic benefits, and this potential was seen as a legitimate justification for exploratory programs to investigate various applications. In particular, the potentials of space technology for meteorological observation and for relaying communications were recognized as areas of early payoff, and rapidly pursued.

The most vigorous area of debate in the early years of the U.S. space program was over whether strategic political objectives such as national prestige ought to be pursued through space activity. The Eisenhower administration explicitly rejected the idea of using large space technology projects to compete in symbolic, prestige-oriented accomplishments with the Soviet Union; Eisenhower insisted on a policy of "calm conservatism" with respect to the political uses of space technology. This policy was revised by President Kennedy in May 1961, with his commitment to a man landing on the Moon "before this decade is out." Kennedy was straightforward in his rationale for Apollo; as he said in the speech announcing his decision, "no single space project in this period will be more exciting, or more impressive to mankind." The memorandum prepared by Kennedy's advisers which recommended the lunar landing mission to

him was even more explicit, arguing that "our attainments [in space] are a major element in the international competition between the Soviet system and our own. The non-military, non-commercial, non-scientific but 'civilian' projects such as lunar and planetary exploration are, in this sense, part of the battle along the fluid front of the cold war."[2]

A second principle of U.S. space policy, also established by President Kennedy, was that *the United States should be preeminent in all areas of space activity, particularly so in those areas involving the demonstration of technological capability.*[3] In addition to reversing Eisenhower's policy of not undertaking space activities for political objectives, Kennedy also accepted the recommendation that the United States aim for across-the-board supremacy in the development of space capabilities. Apollo was just the capstone of this commitment to preeminence. At the same time as he approved the lunar mission, Kennedy also agreed to a general acceleration of the development of U.S. space technology in booster development, nuclear rocket propulsion, communication satellites, and meteorological satellites. The emphasis in this strategy was on technology development, rather than a program balanced among scientific exploration, socially useful applications, and major technology projects.

A third guiding principle for U.S. space activities was that *civilian and military space activities would be carried out in separate institutional structures.* In the early stages of the debate on space policy, the military tried to build a case for a single national space program under military control; a similar claim reemerged, in muted form, in the early months of the Kennedy administration. However, both Congress and President Eisenhower quickly became convinced that there should be an explicit and clear separation between the civilian space activities of government and those aimed at military objectives. This conviction was reflected in the Eisenhower administration's proposal for organizing the national space program sent to Congress in 1958, and it was never seriously questioned during congressional debate. Nor was President Kennedy receptive to the notion of integrating military and civilian space activities in a single agency, although such a suggestion was made as he assumed the presidency in 1961. As intelligence programs using space technology developed, they were carried out under yet another institutional framework, and as civilian space applications reached the operational stage, they were assigned to a mission agency within the government or transferred to the private sector. Further, NASA, as the civilian space agency, was limited to research and development work related to civilian applications of space technology; the R&D necessary for military and intelligence missions was carried out under the sponsorship of those agen-

cies, rather than using NASA as a single R&D agency for all government space programs. Thus, from the start, the principle of plural space programs rather than a single government program embodied in a single institutional structure was established.

The decision to carry out the government's space activities in a plural institutional context implied the need for some form of effective coordination among separate programs and for some means of developing either mutually consistent space policies for each program or a single integrated national space policy. A primary concern was whether space policy development required a distinct high-level mechanism reflecting its status as a presidential issue, or whether policy coordination could be accomplished through the normal operations of the Executive Office. Various mechanisms for program coordination between defense and civilian space activities were established because of the recognition that, if there were to be no central space agency, some such means were required to insure that there were no unwarranted duplications or overlaps in the various parts of the federal space effort.

A fourth space policy principle was that *NASA would be limited to research and development activities only; NASA would not operate space systems.** The notion that NASA was to be an R&D agency only was incorporated in its organic act, and whenever a question of whether NASA's mandate should be extended to include at least the early operation of a fully developed space applications system has been raised, the decision has been that NASA was required to transfer to some other entity any technology which had reached the operational stage.

A fifth principle of U.S. space policy was that *while the government would actively encourage private-sector uses of space technology, the government would also sponsor research in areas of potential commercial applications in space, both to accelerate the development of those applications and to prevent private monopolies based on space technology.* This policy took several years to evolve. The forcing issue was the desire of American Telephone and Telegraph (AT&T) to invest its own corporate funds in the development of a communications satellite, if only the government would agree to launch such a privately developed piece of hardware.[4] The government monopolized the capability required to launch payloads into orbit, and that capability had been developed at public expense. For this and other reasons, there was controversy from the

* This principle applies particularly to the space applications area. Space science is, almost by definition, exclusively an R&D activity. NASA has, to date, acted as the operational agency for launching nonmilitary payloads into space.

start over the notion of government assistance to a single corporation* in achieving, if not a monopoly, at least a strong initial advantage in the exploitation of space communications.

The Eisenhower administration was willing to leave research and development specifically related to civilian communications satellites to the private sector, but this policy was reversed in the early years of the Kennedy administration. Not only did the government take the initiative in establishing an entirely new entity, the Communications Satellite Corporation (COMSAT), to be the U.S. actor in operating international commercial space communications systems, but the President also authorized NASA to invest public money in communications satellite research and development, thereby helping firms other than AT&T to gain competence in this area without large commitments of their own resources.

A final principle of U.S. space policy was that, although the 1958 Act specified that NASA might "engage in a program of international cooperation," *international cooperation was second in priority to nationalistic objectives and was to be pursued in the context of broader U.S. domestic and foreign policy goals.* Both Presidents Eisenhower and Kennedy saw the potential for space being an arena of substantial international cooperation; this was one rationale offered for placing the U.S. effort primarily under civilian control. However, President Kennedy, by setting preeminence in space technology as a high-priority policy goal, implicitly relegated international cooperation to a lower priority than competitive, nationalistic motivations for the U.S. space program.

These six principles formed the policy framework within which at least the first decade of U.S. space activity took place. They were also the policy principles upon which an elaborate institutional structure for the national space program was developed. The main features of that structure are described below.

Institutional Evolution of the U.S. Space Program

Institutions are created, at least ideally, to embody a particular set of policy choices. As policies change, institutions either adapt, are modified by external forces, or become obsolete. Although the basic institutional structure of the U.S. space program has remained stable over the past two decades, there has been a good deal of organizational adaptation.

* Even one, like AT&T, which already had a virtual monopoly on long-distance transmission of voice and video communications.

Whether the changes are adequate to current space policy directions is very much a live question today.

Separate Programs, Separate Structures

The policy decision with the most direct impact on the structure of the U.S. space program was that calling for institutional separation within the government of the civilian and military space activities. In the immediate post-*Sputnik* period, when it was evident that some accelerated response to the Soviet space accomplishments by the United States was required, there were a number of contenders for the job of managing the national effort. They included:

- a single agency for all government space programs managed by the military, either at the level of the Secretary of Defense or by one of the armed services, most likely the Air Force;
- a new cabinet-level department of science and technology which, among its other responsibilities, would have charge of the civilian space effort;
- adding space to the responsibilities of the Atomic Energy Commission;
- expanding the responsibility of the National Advisory Committee for Aeronautics to include a substantial component of space activities;
- creating a new civilian agency with a responsibility for government space activities, except those primarily associated with defense applications (which would be managed by DoD).

It is beyond the scope of this paper to detail the debate which led to the choice of creating a fundamentally new civilian space agency, although one arose around a core of technical capability transferred from NACA.[5] Once the decision to separate civil and military space activities was made, the claims by the Department of Defense and by the armed services that they were the appropriate managers of the national space program found limited political support either within Congress or in the public (outside of those constituencies with close connections to the military). The idea that the U.S. space program in its civilian aspects should be an open, unclassified effort was widely accepted among those concerned with shaping national space policy.

As the government agency concerned with aeronautics research, NACA mounted a campaign to have space added to its activities. However, NACA was an introspective, research-oriented agency with little orientation toward major technological enterprises. Further, it was

an agency managed by a committee, not by a single executive; this was an administrative arrangement strongly preferred by the scientific community as a means of insulating from "politics" government activities with strong scientific components. A similar form of organization had been accepted for the Atomic Energy Commission and had been proposed for the National Science Foundation, but was vetoed by President Truman. What President Eisenhower's administrative, budgetary, and policy advisors wanted was an agency responsive to the policy directions of the President, headed by a single individual responsible for implementing those policy directives, and with the capabilities for carrying out potentially major research and development activities. Those activities, it was thought, would be carried out within the aerospace industry under government contract rather than "in-house" with federal laboratories. They thus concluded that the creation of an essentially new federal structure for space, but one built around the NACA core of technical capability and research institutions, was the appropriate route to go.

In the National Aeronautics and Space Act of 1958, the primacy of civilian objectives in space was stated: "It is the policy of the United States that activities in space should be devoted to peaceful purposes for the benefit of all mankind"; and the responsibility for those activities was given to a civilian agency: "Such activities shall be the responsibility of and shall be directed by a civilian agency exercising control over aeronautical and space activities sponsored by the United States. . . ."

One area of controversy in the development of the 1958 Space Act was whether the new space agency should be responsible for all space R&D, including that ultimately to be used by the military for defense applications. The decision was to make explicit from the start the total separation of these two major categories of space activities, with NASA having no direct involvement in military work. Thus the Space Act also declared that the Department of Defense should have responsibility for "activities peculiar to or primarily associated with the development of weapons systems, military operations, or the defense of the United States (including the research and development necessary to make effective provisions for the defense of the United States)."

The formal separation of the civilian and military space activities into different institutional frameworks meant transferring to the new civilian space agency capabilities related to its mission but under military control and, particularly after NASA had been assigned the lunar landing mission, developing new capabilities required to carry out an active space

R&D effort. Within the Department of Defense there was a need to develop a space R&D and a space operations structure, and to determine the division of responsibility between the level of the Secretary of Defense and the various military services. Both the NASA buildup and the development of the initial military structure for space were accomplished by the early 1960s.

Within the first two years of its existence, NASA had transferred to it a number of facilities, programs, and people that had formerly been operating under military auspices. These included, from the Army, the von Braun rocket development team at Huntsville, Alabama, which became the core of the Marshall Space Flight Center, and the Jet Propulsion Laboratory at the California Institute of Technology. NASA was authorized to develop several new field centers related to its mission, including the Goddard Space Flight Center for science and applications programs and the Manned Spacecraft Center (later the Johnson Space Center) for manned programs, and to develop a civilian launch facility at Cape Canaveral, Florida (later the Kennedy Space Center).* These were added to the three former NACA centers: Langley, Lewis, and Ames. In addition, smaller NACA facilities at Wallops Island, Virginia, and Edwards Air Force Base in California came under NASA control. By 1962, NASA had in place an impressive institutional capability, one fully mobilized for meeting a broad set of national objectives in space.

This government institutional base for civilian space programs was reinforced by the development of an elaborate external network of organizations—industries, universities, and nonprofits—involved in carrying out the civilian space program under NASA contracts or grants. (As space activities matured, other government agencies, including the Departments of Agriculture, Commerce; Energy; Health, Education, and Welfare; and Interior also became involved in space-related activities.) At the peak of the Apollo program in fiscal year 1965, fully 94 percent of NASA's budget obligations went to external grants and contracts, and NASA's prime contractors in turn created a wide base of more specialized subcontractors. Of direct NASA procurements in that year, 79 percent went to business firms, 8 percent to educational institutions, 12 percent to other government agencies, and 1 percent to nonprofit organizations. This pattern has remained consistent over the years; in fiscal 1978, the same percentage (94%) of NASA's budget went to extramural procurement, and the distribution among performers was similar—business

* There was already a military launch facility at Cape Canaveral

(81%); educational institutions (12%); nonprofits (1%); and other government agencies (6%).

As the development of government space activities during the 1960s and 1970s continued, the separation between the three components of government activity—civilian, military, and intelligence—became quite pronounced. The government developed and maintained separate and distinct institutional structures for each function, not only in terms of line agencies within the executive branch, but also in terms of policy review, budget development and review, and congressional oversight. There was coordination among the elements of the government space program, but it was limited in scope in comparison to the separate momentum developed by each element of the government space effort.

The NASA structure created by its first two administrators, Keith Glennan and James Webb, has remained basically unchanged during the past two decades. NASA Headquarters in Washington is responsible for policy development, overall management, and technical direction of the various components of the civilian space research program. Technical management of those specific projects is assigned to one of the various NASA field centers. NASA has adopted the "Air Force model" of agency-contractor relationships, in which most R&D work is performed outside the government by the aerospace industry. The government role is that of program and project initiator, technical monitor of contractor performance, and user of the results of the R&D efforts.

The set of field centers under NASA authority today is the same as it was during the early 1960s.* Because NASA is responsible for civilian space activities aimed at a number of different purposes, including science, applications, and development of technological capability, and because the responsibility for each of those missions is lodged in a different field center, one of NASA Headquarters' major responsibilities is allocating priorities and resources across the NASA institutional complex. The vitality of various field centers is closely related to the priority assigned to particular types of space activities under that center's control, and thus there is strong institutional motivation to compete for particular emphases within the overall NASA program.

It may be useful to mention the structure for space policy within Congress. After creating two temporary select committees to deal with space policy in early 1958, later that year Congress established two new

* Except for the brief period during which NASA also had an Electronics Research Center in Cambridge, Massachusetts.

standing committees to deal with civilian space matters. In the Senate this responsibility was given to the Committee on Aeronautical and Space Sciences; in the House, to the Committee on Science and Astronautics. Both of these committees derived their visibility and status within Congress from the importance of the programs they oversaw and their authority over those programs. As long as the civilian space program was a matter of high national priority with major budgetary supports, there was a corresponding degree of status in being involved with these two congressional committees. However, as the resources allocated to civilian space activity declined after Apollo, Congress viewed space activities as just one among various science and technology programs of government, and during the 1970s committee jurisdictions and names were modified to reflect this reality. Now NASA and the National Oceanic and Atmospheric Administration (NOAA) programs are reviewed in the Senate by the Subcommittee on Science, Technology, and Space of the Committee on Commerce, Science, and Transportation; there is no separate Senate space committee. In the House, the Committee on Science and Astronautics in 1974 was renamed the Committee on Science and Technology and its jurisdiction was broadened to cover most civilian science and technology activities, rather than being focused primarily on NASA efforts.*

In summary, then, the policy principle of separate civilian, military, and intelligence space programs has resulted in the development of separate and well-established institutional structures aimed at those three objectives. As the priority given to military applications of space has increased, the Department of Defense structure for carrying out those activities has become more elaborate. However, as the priority assigned to civilian space activities has changed, there has not been a corresponding modification of the basic NASA institutional structure or institutional style, although the size of the NASA work force and supporting network of contractors has diminished.

This institutional base offers the potential for rapid mobilization if the nation were to decide to accelerate the pace of its civilian space effort. The consequences of allowing the NASA and contractor institutional bases to shrink further are unclear. It may be a sound national investment to maintain a strong institutional capability within the government for civilian space development, even though that capability is not always being fully utilized. On the other hand, it may also be appropriate, as U.S.

* Military and intelligence space programs are authorized by other committees in both House and Senate; this reinforces the separate executive branch structures for the three components of the U.S. government space program.

activities in space mature, to shift more of the responsibility for program and project planning and development to the private sector, with a parallel diminution of government's institutional involvement.

In 1977–1978, under the direction of a National Security Council Policy Review Committee, a major review of the structure of the national space program was carried out. That review validated the fundamental principle of separating civilian and military space activities. It concluded that "our current direction set forth in the Space Act in 1958 is well-founded" and that "the United States will maintain current responsibility and management among the various space programs." [6]

Policy and Program Coordination Required

The decision to separate civilian, military, and intelligence space activities led naturally to the requirement for policy and program coordination among those separate programs. The type of policy coordination needed and mechanisms for coordination have been, and continue to be, controversial issues. The nature of coordination at the program level has been less problematic, and working-level cooperation between civilian and military space efforts has been the rule. However, occasional disputes have arisen over, for example, proposed civilian uses of technology developed for national security purposes.

During the 1958 debate on space policy, a major congressional concern was the relationship between military and civilian objectives in space and some broader set of national interests. Senate Majority Leader Lyndon Johnson, in particular, was convinced that space policy ought to be the subject of presidential attention; the Eisenhower administration was far less convinced that space policy deserved such high priority. Johnson wanted to effect high-level policy coordination by creating an Executive Office mechanism modeled on the National Security Council but dedicated specifically to aeronautical and space activities. The Eisenhower administration reluctantly accepted Johnson's notion as a price of getting the space legislation through Congress, and a National Aeronautics and Space Council was established by the Space Act of 1958. The Space Council was to be a high-level advisory body, chaired by the President and consisting of the heads of other agencies concerned with space activities and several nongovernment members.* It was to assist and advise the President in developing a comprehensive program of aeronautical and space

* These nongovernmental members were never appointed and the positions were eliminated when the Space Council was reorganized in 1961.

activities, in assigning specific space missions to various agencies, and in resolving differences among agencies over space policy and programs.

Although the Eisenhower administration agreed to the inclusion of the Space Council in the legislation setting up the national space effort, it never used the mechanism. Rather, space policy under Eisenhower was developed through National Security Council and Bureau of the Budget channels. Eisenhower believed that civilian and military functions in space development were "separate responsibilities requiring no coordinating body." [7] Thus, in 1960, he asked Congress to abolish the Space Council.

This proposal was sidetracked by Lyndon Johnson. When Kennedy won the 1960 election, with Johnson as his Vice President, the new President was convinced to keep the Space Council, but to change the legislation so it would be chaired by the Vice President. During the Kennedy administration, the Space Council hired its first staff members and played an active role in developing the national policies which led to the Apollo program and the administration's position on communication satellites. During the rest of the 1960s, under the Johnson and Nixon administrations, the Space Council continued to exist, but at the margins of most space policy debates. It developed a relatively large (for the Executive Office) staff under the leadership of Vice Presidents Hubert Humphrey and Spiro Agnew. However, as the priority assigned to civilian space programs continued to decrease and as the separate space activities of the government pretty much went their own ways, the Space Council became rather a moribund institution, and in 1973, President Nixon proposed its dissolution. Congress raised no objection and the Space Council went out of existence.

Without a central policy coordinating mechanism during the 1970s, stresses among various government space activities developed. Several of these were the results of disagreements between NASA and DoD over the appropriate national security constraints to be applied to civilian space efforts, particularly in the Earth-observation area. NASA-DoD relationships with respect to the Space Shuttle program have been another area of controversy. It was these stresses, more than any other single influence, that led to the Carter administration review of national space policy begun in 1977.

A major result of that review was the reestablishment of a presidential-level policy review process for space. This process exists in the form of a Policy Review Committee (Space), operating under National Security Council auspices, but chaired by the Director of the Office of Science and Technology Policy. This committee provides a forum for all involved federal agencies (including departments such as Interior and

Agriculture) to air their views on space policy, to advise the president on proposed changes in national space policy, to resolve disputes among agencies, and to provide for rapid referral of space policy issues to the president for decision when required. Unlike the Space Council, the Policy Review Committee (Space) does not have a standing professional staff structure. Rather, it is a recognition of the need to formalize the channels of interaction among the various components of government space activity rather than have policy and program disputes settled through the budgetary review process or other means of interagency coordination.

The structures for coordination among military and civilian space efforts at the program level have had a rather different history than those for policy level coordination. The 1958 Space Act created a mechanism for coordination at this level, the Civilian Military Liaison Committee (CMLC), but that statutory committee, like the Space Council, was a congressionally-imposed structure and was seldom used. Rather NASA and DoD set up a number of working-level groups on issues of interest to both agencies as the early years of the space program passed. The CMLC was eventually abolished and replaced by a non-statutory Aeronautics and Astronautics Coordinating Board (AACB), which formalized the contacts between NASA and DoD at the working level. The AACB was established by a 1960 NASA-DoD agreement and was given responsibility for coordinating NASA and DoD activities so as to "avoid undesirable duplication and . . . achieve efficient utilization of available resources" and undertake "the coordination of activities in areas of common interest." The early years of the AACB were quite productive in terms of data exchanges and creating an awareness of what the other agency's plans were; the AACB continues to exist today as the primary mechanism for addressing major program issues of interest to DoD and NASA in space. However, as the separate NASA and defense programs became more institutionalized in the 1960s and 1970s, there has been a tendency for coordination between the programs to be defensive in character, i.e., aimed at protecting each agency's own programs and "turf."

Putting Research Results into Operation

In the 1958 debate over space activities, the notion of operational civilian space systems did not receive much attention. The Space Act gave NASA the responsibility for most aeronautical and space activities but defined those activities as: (1) "research into . . . problems of flight within and outside the Earth's atmosphere"; (2) "the development, the construction, testing and operation for research purposes of aeronautical

and space vehicles"; and (3) "such other activities as may be required for the exploration of space." This language seemed to limit NASA to R&D activities, and that was the general understanding of the agency's mission at the time.

In one area, providing launch services to a variety of customers including other government agencies, COMSAT and other private sector firms, and other countries, NASA has gone beyond R&D to a clearly operational role. Restriction to R&D has had little impact on NASA's efforts in space science and exploration or technology development, but it has had a definite impact in the space applications area.

Limiting NASA to the R&D part of the job of bringing space applications into being means that other users of space technology are necessarily involved in the total application effort. NASA has developed an orientation towards "technology push" efforts rather than a tradition of close coupling with potential users of space technology who would exercise "demand pull" on the development of space applications. While NASA has almost from its start included "technology transfer" functions in its organization, many observers think that NASA has so far done an inadequate job of marketing its technological capabilities to potential users of space application systems.

While an emphasis on developing and demonstrating new technical capabilities is often necessary to convince potential users of their value, especially in situations where no preexisting user community exists, most observers believe that NASA, particularly in its early years, put more stress on pushing the technological frontier in space applications than on developing technology either in response to user demand or in anticipation of the kinds of demands likely to arise as new capabilities became known. In addition, NASA has a history of emphasizing the development of constantly more sophisticated technology in its application programs rather than concentrating on bringing an adequate applications system into early operation. This is at least in some measure a reflection of the institutional reality that, once NASA completes R&D for an applications program, it must transfer that program to some user outside of the agency. There is an organizational tendency to attempt to hold on to programs, even if that means prolonging the R&D phase beyond the socially optimum point.* Since the early 1970s, NASA appears to have put a higher priority on developing closer relationships with potential users of

* There may be, of course, technical and managerial as well as institutional reasons why the development of a space application may take longer than originally hoped for. Some also suggest that there have been instances of premature shifts from R&D to operational status in space applications.

space technology, particularly in the remote sensing and advanced satellite communications areas.

The first test of NASA's bias towards continuing R&D in applications was in weather satellites. In the early 1960s, NASA's initial meteorological satellite program, which had been transferred from DoD, was called Tiros. As the agency in charge of space R&D, NASA regarded Tiros as only the first step in weather satellite development and wanted to go immediately to the creation of an advanced meteorological satellite called Nimbus. The Weather Bureau within the Department of Commerce, a potential user agency, had another point of view. Even this initial weather satellite would markedly improve its services, and the Weather Bureau wanted NASA to focus on Tiros rather than initiate a new weather satellite program. However, it took several years and substantial bureaucratic conflict before NASA was willing to shift its emphasis away from the advanced Nimbus development program back to completing Tiros and bringing it to an operational state.[8] Eventually, NASA worked out an effective agreement with the Weather Bureau both to support ongoing meteorological satellite activities and to continue R&D on advanced sensors relevant to meteorological applications.

The complex history of the use of satellites for remote sensing of land and ocean areas demonstrates the institutional problems stemming from, among other sources, NASA's focus on R&D and its lack of close links with potential users of operational space systems. The debate over the appropriate development pace and management structure for the Landsat system has extended over a decade. A presidential decision to assign the operational responsibility for remote-sensing programs to NOAA has provided only a partial resolution of the institutional aspects of that debate.

A major issue as arrangements for operational land remote sensing have been debated over the past decade is whether NASA's charter ought to be revised to extend its authority to the operation of space applications systems. The presidential directive of November 1979 ended this debate with the decision to keep NASA as an R&D agency in remote sensing and to assign civilian Earth observation operations within the government to NOAA, even though there were other claimants, such as the Departments of Interior and Agriculture, to a share of the operational remote-sensing role. Throughout the Landsat program, NASA has emphasized the experimental nature of the early remote-sensing satellites. While it has worked with potential users to make them aware of possible applications of *Landsat* data to their programs, it has also proposed more advanced sensors for orbital evaluation in later *Landsat* satellites. But it has not given priority attention to developing the ground segment, including

associated data management and information processing and dissemination systems, required for early deployment of a first-generation operational remote-sensing system.

Public Sector-Private Sector Relations

NASA's relationships as an R&D agency for space with other potential users of space applications are relatively underdeveloped; this is particularly the case when those users are not other government agencies, but rather private sector, profit-oriented firms. The appropriate division of responsibility between public and private organizations for research and development oriented towards commercial applications for space technology has been problematic since the start of the space age.* The area in which this issue initially surfaced is communications satellite research. The Eisenhower administration recognized that communication via satellite was an area of potential major economic payoff and decided, in keeping with its general pro-business orientation, that communications-satellite research should be left to those interested in making a profit in the area. Others, however, feared that allowing only private entities to develop the technology of space communications meant in effect giving a virtual monopoly in that area to the corporation with the most resources available to invest in communications satellite research, AT&T. From the perspective of those interested in preventing monopoly power in new areas of human activity, such a development was not desirable. The situation was further clouded by the recognition that, even if AT&T or another private entity developed a communications satellite using its own funds, it would have to depend on a launch capability developed with public money to place that satellite into orbit. Thus the Kennedy administration reversed the Eisenhower policy of leaving communications satellite research to the private sector; President Kennedy authorized NASA to conduct a vigorous program of research in the communications satellite area.

In 1961 and 1962, as an initial space communications capability approached reality, there were those who thought that the government should not only be involved in communications satellite R&D and make the results of that research available to a variety of potential private sector firms for commercialization, but also that the government itself should

* Of course, this problem is not limited to the space sector. The issue of federal policies affecting private-sector innovation, including direct support of civilian R&D, has been a subject of much recent discussion within both the executive branch and the Congress.

take advantage of that research and undertake the operational satellite communications role, returning the eventual profits to the Treasury. The advocates of this position were not able to gather majority support in the 1962 debate over communications satellite policy. With the creation of a new institution, the Communications Satellite Corporation—which had some aspects of public control, but was fundamentally a new private enterprise—the notion that the government should go into the communications satellite business itself disappeared.[9]

The precedent established during the communications satellite debate was that developing new applications of space technology with commercial potential and nurturing them to operational status is a mixed private sector-public sector responsibility, with the appropriate division of roles to be determined on an ad hoc basis for each area of applications; the goal, however, is eventual private sector operation of space applications systems. In each area in which a space application has reached or approached maturity, such as point-to-point communications and some applications of remote sensing, business structures have emerged which operate as commercial enterprises related to that application. The government has continued to fund research in other areas of space applications with potential commercial utility, including space transportation, materials processing, and other aspects of remote sensing, with the hope of discovering whether there are indeed profitable opportunities for private sector involvement in those areas, and demonstrating to potential operators what those opportunities are. It may be that continued government willingness to push the applications of space technology and to bear the costs and risks of the research, development, and demonstration phases of commercializing those applications is the only way for them to become reality, at least in the short to midterm.

One area of policy and institutional controversy during the Nixon and Ford administrations was advanced communications. In 1973, NASA was ordered to end its communications R&D efforts, on the grounds that the space communications business was far enough advanced so that it should be totally a private sector responsibility. The consequence of this decision was that the U.S. private sector concentrated on only those aspects of space communications which had the promise of early commercial payoff. Other governments have provided R&D support for advanced space communications development, leading to increasing international competition with U.S. firms for sales of advanced communication satellites. This situation led the Carter administration in 1978 to decide that the potential economic and social benefits of communications satellites for both private and public sector use were not being adequately

tended to by private sector R&D. The Carter administration reestablished a NASA research effort in the advanced space communications area and charged the National Telecommunications and Information Administration of the Department of Commerce with assisting in market aggregation and possible development of domestic and international public satellite communication services.

From "Preeminence" to "Leadership"

In 1961, John Kennedy committed the United States to a policy of "preeminence" in all areas of space activity. The notion that the United States should maintain a position of "leadership" in space activity has been repeated by each chief executive since Kennedy.

As other countries in Europe, Asia, and South America develop independent space capabilities and as the Soviet Union continues an extremely active space effort, the meanings for the 1980s of the terms "leadership" and "preeminence" are less than clear. One possibility is for the United States to compete with other nations across the board in all areas of space activity, from the development of large, permanent manned structures in orbit, through various types of space applications, to exploration of the cosmos. Another option is to focus U.S. space priorities in areas of high national payoff (which would include international leadership in those areas). Another option is to view application activities in space as competitors with Earth-bound enterprises, and to undertake them only when they are the most efficient means of meeting broader national objectives.

The initial impact of the commitment to across-the-board preeminence was to create in NASA an agency with the structure, institutional relationships, and organizational culture needed to carry out a high priority, nationally mobilized effort in the development of large scale technology. NASA, at least in formal terms, remains today an organization designed for such purposes, but the meaning of a national commitment to leadership in space activities is much less clear than it was during the peak of the Apollo program in the mid 1960s. As space activities have matured, and as they promise to become even more a routine part of a variety of government and private sector activities over the coming decade, a major institutional issue is whether a single central space agency with the desire and structure for carrying out an integrated, high-priority national space effort in the civilian sector is an anomaly.

The International Context: Collaboration or Competition?

During the 1960s, NASA developed international cooperative programs which were clearly secondary in priority to using space technology

as a demonstration of national technical resources. Almost all of NASA's international activities were scientific in character* and were carried out under policy guidelines which kept them limited in scope, including the notions that cooperation had to be based on mutual scientific benefit and that there would be no exchange of funds between the United States and its partners in international space activities.[10] This limited concept of international cooperation was broadened during the 1970s to the applications area, as a number of nations became interested in the Landsat program, building their own ground stations or otherwise receiving Landsat data, and for the first time paying NASA a fee for access to the remote-sensing satellites. Other applications efforts had international dimensions; for example, the Applications Technology Satellite and Communications Technology Satellite programs demonstrated some of the uses of communications satellites for education and health care in both developing and industrialized countries.

Also during the 1970s, there was limited use of international cooperation in space technology to serve what were explicitly foreign policy goals. The leading example was U.S.-USSR cooperation in the Apollo-Soyuz Test Project. Increasingly, the potential of space as a tool of our foreign assistance program and as a means of demonstrating our concern for the developing countries has led to assistance programs related to the utilization of remote-sensing data for a variety of third and fourth-world countries.

During the same time period, there was the beginning of cooperation with our major industrial partners (and potential competitors) in space technology development. The European Space Agency assumed the responsibility for developing the Spacelab, which is to be flown on the Space Shuttle as a base for orbital scientific experiments requiring the presence of human experimenters. The relationships with other industrial countries with respect to space technology are, however, somewhat ambivalent, because of possible economic returns on a substantial scale from space activities and because of the desire of the United States to either maintain or establish a competitive advantage in such areas of future economic payoffs.

As other major nations develop advanced space technology, the mixture between international competition and international collaboration in space should be a dynamic one. Competition between U.S. and European

---

* A major exception was the set of international agreements required to establish a global tracking network.

launch vehicles for payloads in the 1980s is just one example. A number of issues being debated in international forums could affect U.S. civilian space activities in the coming decades. Examples are the actions of the World Administrative Radio Conferences in allocating frequencies (and potentially slots in geosynchronous orbit) and the debate in the United Nations on a Moon Treaty.

The Soviet Union, West Germany, France, Japan, Brazil—and indeed a number of other countries—are allocating significant resources to space R&D. In coming years, the U.S. civilian space program will function in a quite different international context than has been the case. The institutional implications of this changed context—for example, how to relate space activities to foreign policy objectives and how to carry out the diplomacy required to support our space objectives—require examination.

Current Space Policy Principles

This section will examine the current status of space policy from the perspective of its relation to the present institutional structure of the national space effort just described. The purpose of this examination is to identify those areas of institutional stress which will condition the ability of the United States to carry out whatever objectives for space it chooses in the 1980s and beyond.

The space policy principles of the 1957–1962 period described earlier represented a consensus arrived at after vigorous debate and under the competitive stimulus of Soviet space accomplishments. The sense of urgency that led to this consensus, which included setting a challenging goal as a central theme of the U.S. national space program, has been largely missing in the 10-year debate on appropriate principles to guide U.S. efforts in space in the post-Apollo period. That policy debate, indeed, still continues. Although some interim principles of U.S. space policy in 1980 are specified below, they do not command the kind of broad support among interested parties that the earlier set of policy principles did. A number of views on the appropriate pace and direction of U.S. space activities and of the policy principles which should underpin those activities are still represented in the policy debate.

The Carter administration articulated a U.S. space policy for the 1980s, but challenges to this policy concept have arisen from key members of both the Senate and the House, from various aerospace industry groups and representatives of the aerospace profession, and from the rapidly growing network of interest groups which focus on space policy.[11] The

likely policy stance of the Reagan administration is, at the time of writing, still very unclear. Lacking any consensus on space policy, the U.S. civilian space effort is continuing largely on the momentum established by the Apollo project and the other high intensity activities of the 1960s and continued during the 1970s with the development of a new technological capability for space operations in the form of the Space Transportation System.

At issue in the current space policy debate are such questions as:

- Should long-term goals for space be articulated, or should the U.S. civilian space program be primarily an evolutionary undertaking?
- Is there a need for a commitment to a major new technological enterprise, such as the development of a permanent manned orbital facility, to serve as a focal point for the next decade in space, as Apollo did in the 1960s and the Space Shuttle in the 1970s?
- What role should men (and women) play in future activities in space?
- How aggressively should the government support the development and demonstration of potential applications of space technology to provide benefits on Earth?

A key element of the original space policy was that certain types of space activities, particularly large-scale demonstrations of technological capability, would be undertaken for what were fundamentally political motivations. This policy, as was mentioned earlier, was established by President Kennedy and was a reversal of the set of justifications for space programs accepted by the Eisenhower administration. It appears as if the United States has returned to that original set of justifications, which saw the development of space technology only as a means, not as an end in itself. The Carter administration in its space policy statement, noting that "more and more, space is becoming a place to work," suggested that "*activities will be pursued in space when it appears that national objectives can most efficiently be met through space activities.*" [12]

This policy principle is applicable most directly to the economic, social, and military applications of space technology. It recognizes the rapidly maturing state of space capabilities and suggests that space programs are increasingly recognized as means to some desirable end, not ends in themselves. Not only does current policy reject the notion of space as an arena for symbolic political competition, but it also indicates that there may be limits on the investment of resources in space activities aimed at scientific returns. The same space policy statement, while emphasizing U.S. commitment to a space science and exploration program

which "retains the challenge and excitement" of new discoveries, also notes the need for "short-term flexibility to impose fiscal constraints" when necessary. The combination of *a priori* requirements for cost-effectiveness and the recognition that general budget constraints are important determinants of the level of government investment in space activities underpin a much more limited concept of the importance of space activities on the national agenda than was the case under the space policy of 1961.

It should be noted that the concept of a "lowered profile" for the U.S. space program did not originate with the presidency of Jimmy Carter. The Carter space policy was to a large degree, a continuation of that adopted during the immediate post-Apollo period by Richard Nixon, who noted in 1970 that "what we do in space from here on must become a normal and regular part of our national life and must therefore be planned in conjunction with all of the other undertakings which are also important to us." [13] In 1972, the Nixon administration did make a commitment to the Space Shuttle, a major technology development program, but that decision, to a large degree, was made without relating it to any overriding sense of policy objectives; there was a generalized notion that a less expensive and more flexible capability for routine space operations was likely to be a rewarding investment of national resources.[14] The Shuttle decision had few parallels with the decision to go to the Moon a decade earlier; it was a commitment to technological development without a clear link to an overriding political or other policy justification. The Carter administration rejected an Apollo-like commitment to another major space technology project, suggesting that "it is neither feasible nor necessary at this time to commit the United States to a high-challenge space engineering initiative comparable to Apollo."[15]

The earlier space policy of the United States stressed preeminence, particularly in its implementation by large scale technological enterprises, as an overriding policy goal. This principle has been replaced by one which stresses *balance among scientific exploration, applications of space technology, and technology development.* Within this balanced strategy there is an emphasis on Earth-oriented applications of space technology, whether they be social, economic, or military in nature. This emphasis on balance among various types of space activities is also one that stems from earlier administrations. In the same 1970 statement mentioned above, Richard Nixon had noted "many critical problems here on this planet make high priority demands on our attention and resources. By no means should we allow our space program to stagnate. But—with the entire future and the entire universe before us—we should not try to do

everything at once. Our approach to space must be bold—but it must also be balanced."[16]

More specifically, the United States has given increased priority over the past decade to demonstrated and potential military applications of space technology. A "growth sector" over the past decade has been research, development, demonstration, and operation of space-based military systems for carrying out essential military support functions such as communications, command, and control; early warning; strategic surveillance; navigation; and weather forecasting. An expanded list of military applications in space is now under consideration and may be more likely to gain political and budgetary support than any of the contending applications of space technology for civilian purposes.

One principle of U.S. space policy established in the late 1950s has remained valid in the current situation. That principle is that *civilian, military, and intelligence space activities will be carried out in separate institutional structures.* A recent presidential review confirmed the current management relations in the government's space effort; and thus NASA, DoD, the intelligence community, and NOAA each remain responsible for different parts of the government space program. However, with the maturing of space technology developed under these various programs and with the emphasis on increased efficiency and resource conservation, there is *more emphasis than before on transfer of technology among the various government space programs and on jointly-funded and jointly-managed programs serving multiple objectives.*

The emphasis on technology-sharing and joint programs will place increased demands on mechanisms for program as well as policy coordination. Because it is in the nature of most large-scale bureaucratic organizations to resist sharing resources and to prefer individually managed programs, and because military and intelligence programs can "hide" technology behind security classifications, the kind of presidential and congressional pressure now being exerted on the national space effort to support the idea of resource-sharing is probably necessary, if the twin principles of maintaining the separation between programs and attempting to carry out truly national efforts are to be successful.

Another policy principle stemming from the beginning of the U.S. space program which remains unaltered is that *NASA is limited to research and development activities only and will not operate space systems.** NASA's role as an R&D-only agency was revalidated during the

* As mentioned earlier, an exception to this principle is NASA's operational role as a provider of launch services. This role is likely to be reexamined as the Space Shuttle reaches routine operational status.

consideration of national policy on remote sensing in 1979. Among others, the NASA leadership believed that the agency could best continue to make a contribution to the national space program by restricting itself to R&D activities. A consequence of this policy principle in a period in which various applications of space technology, particularly in the land and ocean observation areas, approach operational status is that some other entity, either public or private, must be assigned responsibility for the operation of space applications systems. Currently, the responsibility within government for Earth observation from space has been assigned to a single agency, NOAA, rather than spreading it among several federal agencies or creating a new government agency with specific responsibilities for Earth observations. In coming years, NOAA may well become as much of a space agency as NASA is today, even though NASA will continue to do the research leading towards operational space applications, including related ground segments, and will continue its role as the agency in charge of space science and exploration.

Another policy principle which has remained unchanged in general form, but rather different in operational meaning, is that the *government will actively encourage private sector involvement in the uses of space technology, while also sponsoring research in areas of potential commercial application*. The development of relationships between public sector and private sector interests in space applications has proved a particularly difficult task. The transfer of the results of government-funded research on communications satellite technology to application in privately-owned, operational, communications satellite systems was straightforward in comparison to arranging for private sector involvement in areas such as navigation* and, particularly, remote sensing. With civilian space activities within the government now divided between NASA, NOAA, and a number of other federal agencies, relationships between the private sector and government space programs are even more complex. Private sector involvement with NASA in the design of research efforts in space applications is likely to continue to be necessary, as will be relationships between NOAA and private sector entities interested in the commercial potential of Earth observation systems.

Finally, the international dimensions of space activity are receiving considerably more attention at the present time than had been the case earlier. Congress has been particularly interested in international cooperation in space activities. Because other industrial countries are developing

* Most of the work leading to space-based navigation systems has been carried out by DoD, and making that capability available for civilian applications is proving problematical. NASA has undertaken only limited work related to space-based navigation or position-location systems.

substantial civilian space programs emphasizing applications of space technology, the United States finds itself in a situation in which *opportunities for meaningful cooperation in space are mixed with the potential for significant competition in areas of high economic and social payoff.* Also, other nations, perhaps more than the United States, still undertake space programs as means of enhancing national prestige, and this motivation constrains cooperative efforts. No clear policy principle relating to the international aspects of U.S. space activities has yet emerged from space policy debate of the last decade; this is an area of policy development which is "ripe" for increased attention.

Concluding Comments

As a new stage in the evolution of U.S. space activity is entered with the imminent launch of the Space Shuttle, a meeting such as this—aimed at focusing the attention of historical professionals on opportunities for study presented by space programs—seems to me to be quite appropriate. The space program deserves the attention of academic historians and their students, because academia provides the unconstrained and broad-gauged context within which it can be best understood. Future generations are almost certain to view mankind's first tentative expeditions away from its home planet as major historical events. From that perspective, it is a privilege to be in at the beginning.

Source Notes

1. The following account of the origins and early evolution of U.S. space policy and institutions is drawn from a number of sources, including: John Logsdon, *The Decision to go to the Moon*, (Cambridge, Mass.: MIT Press, 1970); Arthur L. Levine, *The Future of the U.S. Space Program*, (New York: Praeger Publishers, 1975); Robert L. Rosholt, *An Administrative History of NASA, 1958-1963*, (Washington, D.C.: NASA, 1966); and Enid Bok Schoettle, "The Establishment of NASA", in *Knowledge of Power: Essays on Science and Government*, ed. by Sanford A. Lakoff (New York: The Free Press, 1966).
2. See Logsdon, *op. cit.*, for a full account of how the Apollo decision was made and how it represented a fundamental reversal of previous space policy.
3. Mose L. Harvey in "Preeminence in Space: Still a Critical National Issue," *Orbis*, Vol. XII, No. 4 (Winter 1969), defines preeminence as "achieving broadly based capabilities with regard to all aspects of the space environment and then constantly building upon and adding to those capabilities." (p. 959). See also Vernon Van Dyke, *Pride and Power* (Urbana: University of Illinois Press, 1964) for an analysis of the motivations underpinning early U.S. space policy.
4. For an account of the development of U.S. policy on satellite communications, see Jonathan F. Galloway, *The Politics and Technology of Satellite Communications* (Lexington, Mass.: D.C. Heath and Co., 1972).
5. The works by Levine, Rosholt, Schoettle, and Logsdon cited earlier do contain such an account.
6. The only public announcement of the results of this review was in the form of a June 20, 1978 press release from the White House.
7. Quoted in Levine, p. 66.
8. For a detailed account of the NASA/Weather Bureau dispute, see Richard Chapman, *TIROS-NIMBUS: Administrative, Political, and Technological Problems of Developing U.S. Weather Satellites* (Syracuse, N.Y.: Interuniversity Case Program, Inc., 1972).
9. See Galloway, *op. cit.*, for a full discussion of this debate.
10. The foundations of U.S. policy toward international cooperation are described by Arnold Frutkin, *International Space Cooperation* (Englewood Cliffs, N.J.: Prentice Hall, 1965) and criticized by Don Kash, *The Politics of Space Cooperation* (West Lafayette, Ind: Purdue University Studies, 1967); there is no later analytic treatment of international space cooperation.
11. It is impossible to summarize the positions held by all parties in this debate, both in terms of overall space objectives and in terms of the priority to be given to specific programs or program areas. In Congress, Senators Adlai Stevenson and Harrison Schmitt and Representative George Brown have each proposed bills establishing national space policy, and organizations as diverse as the American Institute of Aeronautics and Astronautics, the L-5 Society, the Planetary Society, Gerald O'Neill's Space Studies Institute, and the National Space Institute, among others, have proposed different approaches to the national space effort. In addition, NASA through various advisory councils, summer studies, and in-house planning is seeking to define both technological possibilities and appropriate goals for the future.
12. "White House Fact Sheet on U.S. Civil Space Policy," October 11, 1978.
13. Statement by the President, March 7, 1970.
14. For an account of the Space Shuttle decision, see John M. Logsdon, "The Space Shuttle Decision: Technology and Political Choice," *Journal of Contemporary Business*, Vol. 7, No. 3 (Winter 1979), pp. 13-30.
15. "White House Fact Sheet on U.S. Civil Space Policy," October 11, 1978.
16. Statement by the President, March 7, 1970.