Chapter 6

RELATIONSHIPS BETWEEN THE CIVILIAN AND NATIONAL SECURITY SPACE PROGRAMS

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FIGURE

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INTRODUCTION

Over the years, the National Aeronautics and Space Administration (NASA), the Department of Defense (DOD), and other Federal agencies have evolved a set of interlocking responsibilities for U.S. space activities. NASA is designated as the lead agency for most U.S. civilian space efforts. DOD, in accordance with the National Aeronautics and Space (NAS) Act of 1958, undertakes "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 (R&D) necessary to make effective provision for the defense of the United States). " Responsibility for coordinating the efforts of the civilian and the military programs was initially vested in the National Aeronautics and Space Council (see ch. 10) and a Civilian-Military Liaison Committee, although both were later abolished under Presidential reorganization plans. It was explicitly recognized that the President was ultimately responsible for dividing specific responsibilities between DOD and NASA.

The premise that there is a need for separate civilian and national security space programs has been examined and reaffirmed by several high-level policy reviews in the intervening years–each concluding that **the characteristics of the primary missions of each program justified the distinct institutional structures that had been developed.** These reviews also affirmed that relations between the two programs should be continually scrutinized and that opportunities for cooperation or better coordination should be sought.

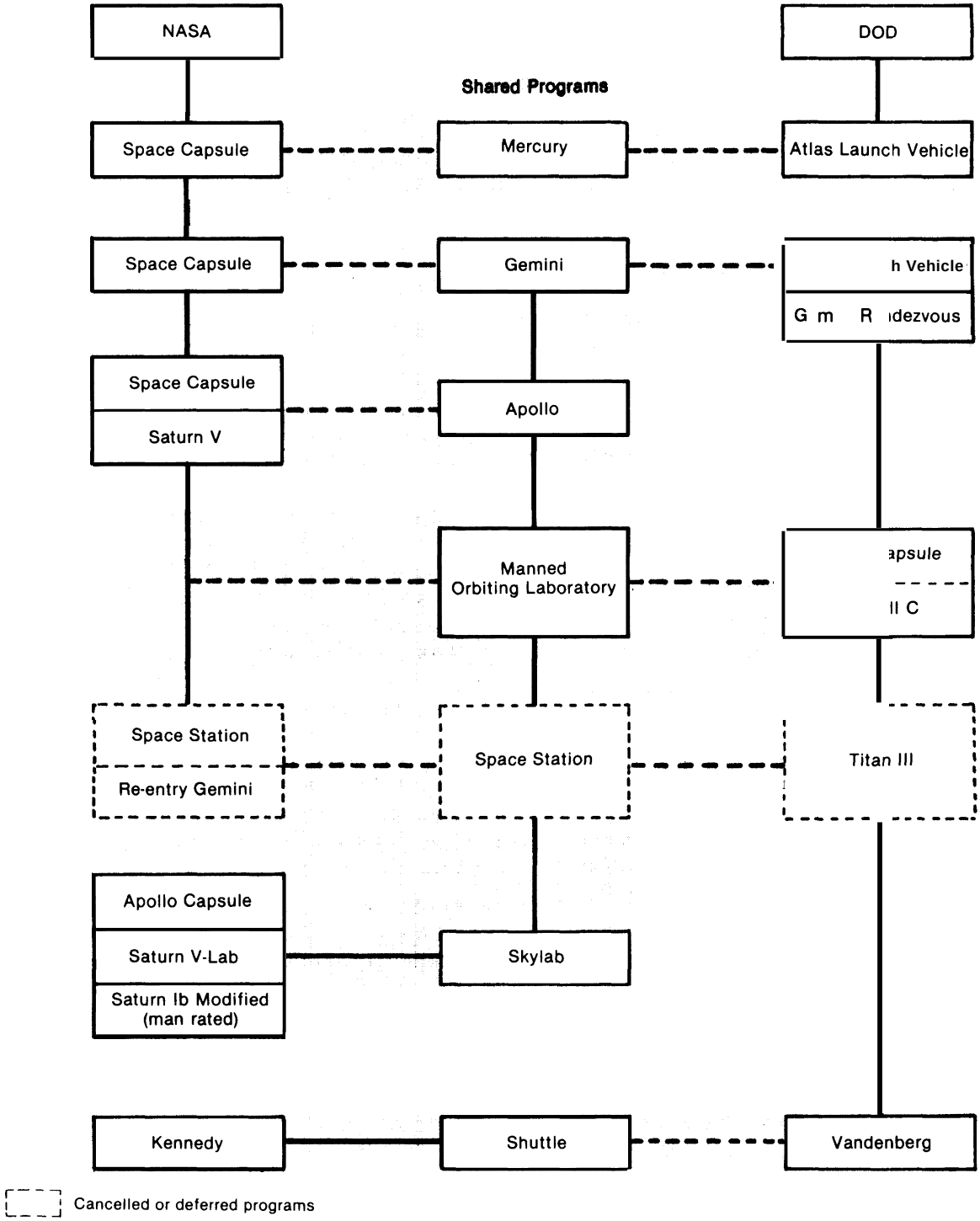
Now that NASA and DOD have been conducting space programs for nearly 25 years, under separate charters but with overlapping interests, it is appropriate to consider the current status and probable future of their relationships in light of overall U.S. civilian space policy. The recent rapid growth and projections of even more rapid future increases in military space programs and budgets make such a reconsideration essential.

Access to Classified Information

Any analysis of the relationships between the civilian and the national security programs that is intended for public dissemination has to confront the problem of access to classified information. Information is classified and placed under restrictive security controls if its unrestricted publication is deemed to harm the national security. Classified data were not used in the preparation of this report. Though discussion of the implications of classified-unclassified program relationships at an unclassified level is necessarily incomplete and sometimes unconvincing, it is nevertheless the only available approach to presentation of such matters to the general public. The material that follows has been written in such a way as to provide sufficient insight into the types of issues the classified programs generate and to ensure that the analyses and discussion of options are reasonable. Inevitably, there will be conclusions or observations that could be evaluated more completely in a classified document.

It must also be recognized that there are different degrees of classification within the military/intelligence programs. The most highly classified are the so-called "National Technical Means" and related systems; information about these systems is very closely kept, even within the national security community. These systems are mostly involved in strategic reconnaissance. Many military systems, on the other hand, such as communications and navigation satellites, are not themselves classified, though certain details of the technologies involved are kept secret.

Cooperation Between DOD and NASA in U.S. Manned Space Programs



SOURCE: Office of Technology Assessment.

Summary Assessment

Separate Programs

Space systems provide an increasing number of vital services to support a variety of military and intelligence missions. Continued technological advances, along with the need to counter an increasing level of military space activities by the Soviet Union, will expand the range of desirable national security programs. Similarly, on the civilian side advancing technology will make possible space activities that could contribute significantly to a number of high-priority national objectives. These include: 1) to enhance the image and prestige of the United States through continuing man-in-space activities; 2) to provide a base for commercial space services, most notably for communications; 3) to conduct research; 4) to extend the technology base for space and launching systems; and 5) to perform valuable public services such as meteorological observations, storm warning, and other **Earth observation or communication tasks.**

In today's environment of growth in expenditures for national security combined with reductions in civilian activities, it is necessary to consider the continued appropriateness of separate programs and separate institutions. This is especially important with the advent of the space transportation system, which represents a large new area of common interest and new opportunities for technology sharing. Three basic options seem possible: 1) separate civilian and military programs; 2) independent space R&D agency for all Federal space programs, civilian and military; and 3) absorption of NASA by DOD and other Federal agencies. These options are discussed under the heading "Institutional Change. "

Technology Transfer

Classification barriers necessarily protect sensitive national security information, but their existence disposes many in the civilian community to attribute unknown but vastly superior capabilities to classified systems. This leads to the claim that if military technology could be transferred more rapidly and more thoroughly to the civilian sector, civilian programs would benefit greatly from these superior capabilities. This view is, for the most part, oversimplified and fails to recognize important differences in agency missions and the resulting needs for space systems. Different mission objectives entail different emphases on performance characteristics and other design considerations in the development and adaptation of advanced technology. For example, a military system may have to be able to operate in a hostile environment, so that military specifications are frequently more stringent than those for civilian purposes.

Nevertheless, the adequacy of technology transfer between civilian and national security programs remains an important issue that will be examined in some detail in this chapter, The following observations summarize this analysis:

- Technology flows in both directions, and both sectors have benefited from such transfers. General-use space technology is transferred with relativ ease; mission-specific technology only with great difficulty.
- There are few incentives and, frequently, practical penalties for either a national security or a civilian program manager to enter cooperative technology sharing arrangements with other programs.
- The need to protect certain information and technology for national security purposes limits its accessibility to civilian users.
- Procedures exist to enable selected individuals from civilian agencies to gain access to classified systems and information, but this access is imperfect for a variety of reasons; continued management attention is needed to keep these procedures functioning effectively.

Asymmetrical Relationships

The need to protect national security space activities and products results in a continuing asymmetry in the relationships between the two programs. In general, systems operated by DOD are of high national priority; they are established in response to needs that are not easily questioned by those outside of the national security decision-making structure. Similarly, the determination of the boundary between classified and unclassified technology is made within the national security community. As a result, limitations have been set

on the allowable performance of civilian systems. These limitations tend to persist and act as continuing constraints on civilian users; in some cases, the civilian user community does not know the details of the restrictions that exist. There are few opportunities for the civilian community to question these restrictions, except within forums such as the National security Council (NW, where civilian agency interests are inevitably of secondary importance. These asymmetries suggest the need for a forum in which the civilian and national security space relationships can be equitably reviewed from a disinterested perspective, as discussed in chapters **3** and **10.**

National security concerns affect most, if not all, civilian space applications programs; therefore, a discussion of the relationships between the two sectors is especially pertinent to this assessment. An outline of the DOD-operated programs is given in the following section, but the limitations that result from describing them on the basis of unclassified data must be kept in mind.

STATUS OF NATIONAL SECURITY SPACE PROGRAMS

The national security uses of space technology are quite varied; however, they are all "applications" in that space technology is one means to achieve various national security objectives. The United States depends heavily on space-based systems: 1) to conduct continuing surveillance of activities in many areas of the world, particularly those controlled by its potential adversaries, and to monitor compliance with international agreements; 2) to provide timely warning of attacks on the United States and allied territory; and 3) to communicate with U.S. military forces around the world and at sea. The U.S. national security community is also actively exploring other space activities, including: 1) the need to protect both civilian and security assets already in orbit from Soviet antisatellite systems; 2) the ability to assure "freedom of the roads" for U.S. spacecraft and launch vehicles by developing a deterrent in the form of an antisatellite interceptor; 3) and the long-range potential of space-based weapons for defending the United States and its allies against hostile actions. The sum total of these activities comprises a fast growing national security space program; many military analysts see space technology as having a revolutionary impact on national strategy and national power in coming years. '

[1] **A recent study of the potentials of armed conflict in space is G. Harry Stine,** *Confrontation in Space* **(Prentice-Hall, 1981); see also the recently published report** *High Frontier,* **from the Heritage Foundation.**

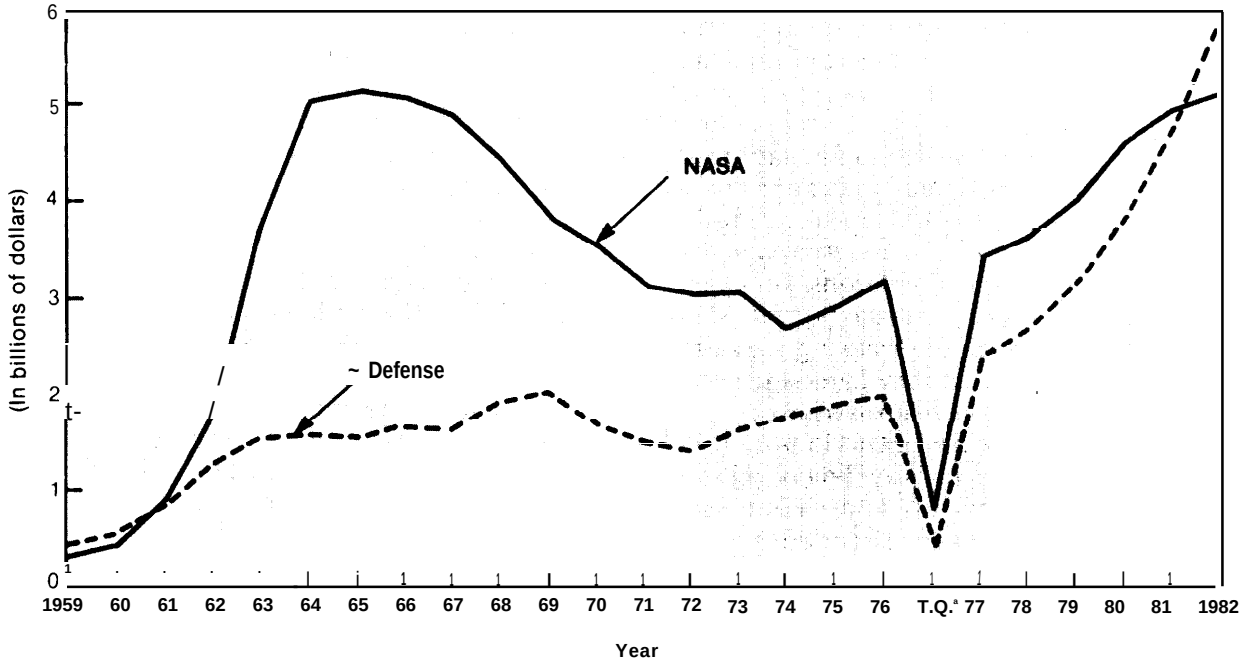
Current Systems

Precise figures regarding expenditures for DOD-supported space efforts are unavailable because many of them are classified. Figure 10 compared published data on spending for civilian (NASA) and military (DOD) space activities. Over the past several years, the national security budget has been growing at a much faster rate than the civilian one, and is now larger in absolute terms than the civilian budget. When one recognizes that the single major item in the NASA budget, the shuttle, will have DOD as its single largest user, the emphasis on national security applications of space becomes even more marked.

Current national security space systems perform (although in a very different context) functions similar to those performed by civilian space systems. Classification of these systems prohibits a full description of them in this analysis;[2] the following brief descriptions are thus intended only to emphasize the support role played by currently operational national security space systems:

[2] **Further information on intelligence and defense activities in space is contained in, for example, Trudy E. Bell, "America's Other Space Program,"** *The Sciences,* **December "1979; Eberhard Rechtin, "Future Military Applications in Space," Speech to International Aerospace Symposium, Paris, June** 1981; Thomas H. Karas, *Implications of Space Technology for* Strategic Nuclear *Competition, Occasional Paper 25, The Stanley Foundation;* **J. Preston Layton, "Military Space in Transition, "** *Aeronautics and Astronautics,* **October 1981; the annual** *Aeronautics and Space Report* **of the President contains an approved description of national security space efforts.**

Figure 10.—Historical Budget Summary-Budget Authority



[a]T, Q. - Transitional Quarter.

SOURCE Of fice of Management and Budgel

- ***Earth observation.*** –It was only in October 1978 that the existence of strategic surveillance satellites was officially acknowledged by an American President,[3] although the media and general public had assumed their existence for many years. Earth observation satellites are used to perform several different national security-related functions, including:
  1. early warning of missile attack;
  2. verification of compliance in related international arms-control agreements such as nuclear testing and strategic missile deployment; and
  3. surveillance of various areas of the world to gather data required for U.S. strategic and tactical planning.

  Miiitary systems require degrees and kinds of performance not required for civilian purposes. Many different kinds of satellites and sensors are used to satisfy specific requirements. To the degree that military systems are more specialized and provide advanced performance, transfer of this technology to the civilian sector will continue to be an issue, especially as civilian needs become more specialized in turn.[4]
- ***Communications.*** –Although the bulk of routine military messages are carried over civilian-operated communication circuits, both terrestrial and satellite, there is also a variety of satellite communications systems available for the exclusive use of the military services and national command authorities. These military satellites are crucial links in the Nation's command, control, and communications systems; approximately one-third of U.S. long-distance military traffic goes by dedicated DOD satellites.

  A continuing problem in national security communications via satellite is how to

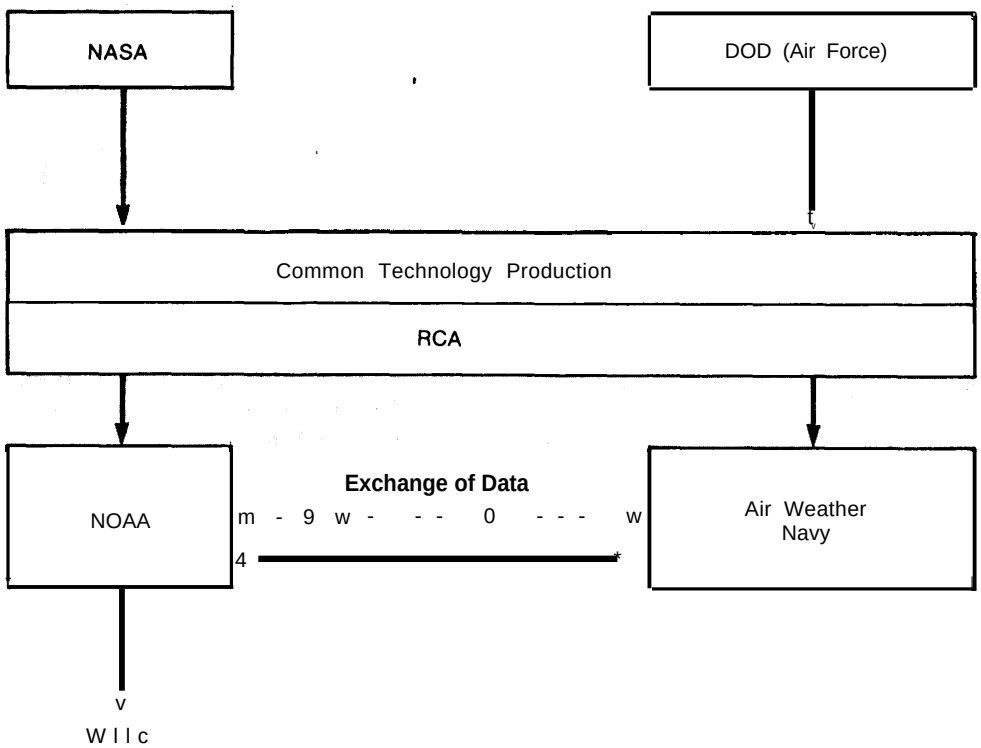
[3]President **Carter gave public recognition to the existence of intelligence satellites during an Oct. 1, 1978 speech at the Kennedy Space Center.**

[4]A pioneering analysis **of the use of space systems for surveillance and warning is Philip** Klass, *Secret Sentries* **in** *Space* **(Random House, 1971); see also, "Study on the Implications of Establishing an** International **Satellite Monitoring Agency," prepared for the 2d** U.N. **Assembly Devoted to Disarmament, Aug. 6, 1981, pp. 15-18.**

combine various existing and future systems into a coherent "architecture" which would allow the integrated use of communications capability by both civilian and military authorities under various crisis and conflict situations. At issue here is how dependent the military should be on nonmilitary communications channels and how much investment the military should make to ensure that civilian channels are survivable and secure under various conditions. For example, there has been substantial attention given to protecting the tracking and data relay satellites so that they can be used for defense as well as civilian purposes.

- ***Navigation.*** –There has been a long tradition in the United States of providing navigation services for both military and civilian uses; that tradition has been extended into the joint use of operational Navy navigation satellites. DOD's global positioning satellite (GPS) system, now in an advanced stage of development, will provide navigation assistance and position location for all military services, and will also be available for civilian use, albeit with somewhat degraded capabilities. Six Navstar satellites are now in orbit, with a total of 18 envisaged for the complete system.
- ***Meteorology.*** —The military operates its own weather satellites using technology rather similar to the National Oceanic and Atmospheric Administration (NOAA) satellites that serve civilian needs. There have been several analyses of the potential for combining civiiian and military meteorological satellite operations into a single system, but no such merger has been approved.
- Transportation. -The national security community has used the same launch vehicles,

Cooperation Between DOD and NASA in Meteorological Satellites



SOURCE: Office of Technology Assessment.

with certain variations, (except for the Saturn-class boosters used exclusively for manned Apollo launches) to boost its satellites into orbit as has the civilian space program (e.g., Atlas-Agena, Titan 11, Atlas-Centaur, Titan III). This pattern will continue with the shuttle. However, the military has separate checkout and launch facilities, both at Cape Canaveral and Vandenberg Air Force Base, for expendable launch vehicles, and is building a shuttle launch complex at Vandenberg. joint use of the shuttle implies joint use of mission control facilities at Johnson Space Center, though the Air Force is hoping to construct its own Consolidated Space Operations Center in Colorado Springs. There has been some suggestion of two separate shuttle fleets, one for civilian and one for national security use.

Future Developments

For the most part the systems discussed above support ground-, sea-, and air-based military operations and extend or enhance existing logistical capabilities. Under consideration now, however, are weapons systems that could operate in space. There is a vigorous science and technology development program oriented toward a wide range of future applications, including antisatellite systems and directed energy weapons. If the United States should decide to develop and deploy some sort of space-based, antisatellite or ballistic missile defense system, such an effort would require a major expansion of our space infrastructure, including the development of space platforms, space power systems, and space construction facilities. Pursuing such a course would imply major changes in strategic thinking, and thus a decision to develop space weapons systems is as much an issue of national policy as it is of technological potentials

Another area of future development is manned military space operations. Some see a need for manned observation, inspection, command and control, servicing, or other operations in Earth orbit. Military use of the shuttle will provide experience on which to base future decisions on the military role of man in space.

Large-scale development and deployment of manned and unmanned military systems in space, beyond those currently required for support purposes, will be based on decisions, not yet made, concerning military doctrine and national policy. The notion that space is a fourth theater of war which can supplement or supplant air, sea, and ground operations is not fully accepted by either the civilian or the military leadership of the national security community. Extensive manned military operations and/or weapons in space are still very much in the exploratory stage. In addition, current international treaties, such as the **1972** Anti-Ballistic Missile Treaty with the Soviet Union, as well as hopes for future arms-control agreements, may prevent or delay the deployment of space weaponry. There is a substantial degree of international concern, expressed at the United Nations (U. N.) and elsewhere, about any expansion of the arms race into outer space.

Civilian-National Security Relationships in Space: 1957-81

The decision to house defense-related space operations and the R&D leading to them within DOD and to create a new civilian agency for nondefense space research were made in the immediate wake of Sputnik, as the Eisenhower administration began to organize the U.S. space effort. These decisions were controversial; individuals both in and outside Government, particularly in Congress, the defense industry, and the military services, believed that the Nation should undertake a single integrated space program under military management.[6] However, President Eisenhower and the majority of Congress believed that there were significant advantages for the country in separating the national space effort into separate elements and in creating a separate man-

[5] **Rechtin, op. cit., pp. 7-8.**

[6] **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 Future of the U.S. Space Program* (Praeger Publishers, 1975); Robert L. Roshlt, *An Administrative History of NASA, 1953-1963*, NASA, 1966, and Enid Bok Schoettle, "The Establishment of NASA, " in *Knowledge of Power: Essays on Science and Government*, The Free Press, 1966.**

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agement and institutional structure for each element.

Similarly, President Kennedy rejected the notion, raised early in his administration, of combining NASA and Air Force space programs under military auspices. Like Eisenhower, Kennedy viewed the national space effort as having distinct civilian and military components, and decided to use the civilian space program as one of the major arenas for competition with the Soviet Union.

Early Policy Choices

Several factors influenced the decision by the Eisenhower administration and by Congress to establish a separate civilian space agency. One reason was the view of the scientific community that the major objectives of the civilian space program should be scientific in character, and that these objectives could best be met by a separate agency not linked to DOD programs. A more telling concern was Eisenhower's view that there were specific and positive benefits for the United States, in terms of both foreign policy and domestic politics, in creating an open space program under civilian control. These benefits were particularly evident, given that the Soviet space program was closed. The United States could claim that its civilian space program was an accurate reflection of the open, achievement-oriented character of American society, while at the same time developing whatever national security space systems were deemed necessary through a second, much less open program. Cooperation with other countries, desirable both to meet specific needs for access to sites for tracking stations, and to further general foreign policy goals, would be greatly facilitated by such a separation.

At the policy level, Eisenhower and his top advisors did not deal with military and civilian space efforts in isolation, but rather viewed them as parts of a single national space program. Eisenhower authorized DOD to undertake whatever military space efforts could be justified by existing and future military requirements, but he did not approve the futuristic plans generated within the Air Force (such as a manned Moon-base) and the Army. Nor did he approve ambitious NASA plans for the 1960's. There were attempts to develop a comprehensive national space policy under NSC auspices. The objective of such a policy was the development and exploitation of U.S. outer space capabilities to achieve scientific, military, and political goals, and to establish the United States as a recognized leader in this field. However, Eisenhower and his advisors did not believe that the political returns from space achievement were large enough to merit a major investment of resources, and thus were unwilling to approve an aggressive civilian space program aimed at political objectives.

President Kennedy was willing to approve such a program, however, and, in Apollo, the United States undertook an enterprise justified primarily by national prestige and political payoff.[7] The policy that led to the Apollo commitment was formulated in the context of developing an integrated national space policy. Apollo was the centerpiece of an across-the-board acceleration of both civilian and military space programs, aimed at achieving U.S. preeminence in all areas of space technology. Kennedy was told that "the nonmilitary, noncommercial, nonscientific but civilian projects such as lunar and planetary exploration are . . . part of the battle along the fluid front of the Cold War."[8]

While Presidents Eisenhower and Kennedy both desired a national space program in consonance with overall national policy objectives, one which maximized returns on both the civilian and military investments of national resources, coordination of the two programs was not a straightforward matter. During the 1960's the civilian space program, and particularly its central activity, Apollo, developed in ways that made close interactions with major defense space applications difficult. Although NASA did maintain Earth-oriented science and applications programs, its major manned and unmanned efforts such as Apollo and planetary exploration were oriented outward, away from Earth. Though there were attempts to undertake joint planning for tracking stations, meteorological satellites, and

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[7] A full account of the Apollo decision is contained in Logsdon, op. cit.

[8] Ibid., p. 126.

geodetic satellites, none of these resulted in closely integrated civilian-military activities. The exception was in the area of launch vehicles. NASA used the Atlas, developed by the Air Force, for its Mercury program and the Air Force developed Titan for the Gemini program. In fact, with the exception of Saturn, which was used only for NASA's Apollo program, launch vehicles for all these manned satellites were shared; DOD had no use for such a large and expensive launch vehicle as Saturn. As DOD requirements for some launch vechicles, such as the Thor and Atlas, decreased, these were transferred to NASA.

In particular, the decision to accomplish Apollo by means of lunar-orbit rendezvous (LOR) was a watershed in separating civilian and military manned space flight programs for almost a decade.[9] There was extensive controversy preceding the decision for LOR. Many argued that if Earth-orbit rendezvous were used to accomplish Apollo, the knowledge gained from rendezvous of spacecraft and assembly of structurs in low-Earth orbit would be valuable not only for the lunar program, but also for national security activities. However, NASA, driven by a desire to meet the lunar landing goal before 1970, chose LOR as the method most likely to make this achievement possible. This choice, in addition to NASA's emphasis on planetary exploration in its unmanned scientific programs, to a large degree separated the central element of the NASA program from national security space efforts during the 1960's and early 1970's.

Program Relationships in the Early Years

The NAS Act, which provided for separate civilian and national security space programs, also called for "close cooperation among all interested agencies of the United States in order to avoid unnecessary duplication of effort, facilities, and equipment. " As this directive was carried out, there were substantial interactions between civilian and national security space efforts during the first decade of the national space program, even though NASA had set its sights on the Moon. At the project and program levels, these interactions were on balance cooperative and productive. However, at the policy and institutional level there were, perhaps inevitably, stresses between separate programs in the same technological arena. It is beyond the scope of this assessment to detail these interactions, but the following brief summary may provide some sense of their character. 1°

MANNED SPACE FLIGHT

It was the armed services that during the 1950's did the first detailed planning for manned space flight, but NASA was assigned the U.S. manned mission in 1958. Project Mercury was based on Air Force plans, and the Air Force was left with only a modest, and never fully funded, space glider program (Dyna-Soar), which was eventually canceled. At one point the Air Force contemplated a "Blue Gemini" program using NASA's Gemini vehicles; when NASA balked, DOD settled for a modest series of experiments on Gemini flights. Late in 1963, Defense Secretary McNamara approved the Manned Orbital Laboratory program for the Air Force. This program was terminated in 1969 because foreseeable military requirements were inadequate to justify it, despite the $1.3 billion already spent. Since that time NASA has had complete responsibility for the manned flight portion of the national space program, although this situation will change when the shuttle begins to fly missions dedicated to national security.

LAUNCH VEHICLE DEVELOPMENT

Immediately after the acceleration of the U.S. space program in 1961, there was an intensive attempt to integrate future launch vehicle developments. This attempt was not successful, and NASA went on to develop Saturn boosters for Apollo missions while DOD added the Titan III as the heavy-duty launcher for military and intelligence programs. When it came time to consider whether to continue to use Saturn as the workhorse for the post-Apollo civilian space pro-

[9] John M. Logsdon, "Selecting the Way to the Moon: the Choice of the Lunar Orbital Rendezvous Mode, " Aerospace Historian, June 1971, contains an account of this decision.

[10] An account of early NASA-DOD relationships is contained in W. Fred Boone, *NASA Office of Defense Affairs: The First Five Years,* NASA Historical Note HHR-32, 1970.

gram or to develop a new type of reusable launch vehicle, the policy was made in an explicit context of joint civilian-national security requirements, although the development task was assigned to NASA. That the shuttle would be a multiuse launch vehicle with its design suited to meet defense and intelligence requirements as well as civilian needs was essential to the program's approval. ' [1],

COMMUNICATIONS SATELLITES

Originally, NASA was assigned responsibility for developing passive communications satellite technology (e.g., Echo), whereas DOD developed active communications satellites. There was an early shift in this division of labor, and NASA by 1960 had begun to develop active communications satellites for civilian use. With the cancellation of the Army's ADVENT geosynchronous satellite program due to technical and management problems, it was left to NASA to develop geosynchronous communications satellites, which have proved to be the key to both civilian and military satellite communications efforts. During the 1960's and 1970's both NASA and DOD had active R&D programs investigating communications satellite technology appropriate to differing civilian and military requirements.

[11] Jerry Grey, *Enterprise* (Morrow, 1979), pp. 66-68.

METEOROLOGICAL SATELLITES

DOD sponsored the initial research on meteorological satellites; this work led to the TIROS program, which was transferred to NASA and then became the basis for the first operational civilian weather satellite. DOD used the same contractor to develop weather satellites dedicated to military uses. The result has been the existence of two systems which, while using the same "bus" contain different sensors and fly in different orbits, and a continuing controversy over the need for separate weather satellite systems.

EARTH OBSERVATION PROGRAMS

The advantages of the view from outer space for strategic surveillance were obvious from the beginning, and DOD and various intelligence agencies began highly classified Earth observation programs. As the sensors developed for these early national security programs (e.g., the Return Beam Vidicon) were supplanted by more advanced models, some of them were declassified and became part of NASA's civilian remote sensing experiments in the late 1960's. There has been a continuing tension between the desire to maintain maximum secrecy about the capabilities of U.S. surveillance systems and the desire to use both the products of those systems and the components developed for them for operational civilian applications systems.

CURRENT POLICY AND POLICY REVIEW PROCESS

Policy Formulation and Program Stresses in the Post-Apollo Period

Carrying out the Apollo commitment kept NASA fully occupied during the 1960's, and for the most part relations between the civilian and national security space programs were conducted on a case-by-case basis, mainly at the project and technology level. Only occasionally, as in the controversy over control of Gemini and post-Apollo manned programs, did the tensions rise to the policy and institutional level. The major channel for interaction was the Aeronautics and Astronautics Coordinating Board (AACB), a joint NASA-DOD body. NASA also established an Office of Defense Affairs, which was active in maintaining liaison with defense and intelligence space efforts. Tensions rarely escalated to a level at which White House policy offices such as the National Aeronautics and Space Council and the Office of Science and Technology got involved in their resolution.

During the past decade, however, there have been several Presidential-level policy reviews of the national space effort that have dealt with civilian and national security programs in a common framework. Perhaps the basic point to be made about these reviews is that each examined and revalidated the policy that civilian, military,

and intelligence programs should be carried out in separate institutional frameworks, although each review also recognized opportunities for closer cooperation and coordination among these separate programs.

The first such comprehensive review was carried out during the summer of 1969 under the auspices of a Space Task Group (STG), created ad hoc and chaired by the Vice President. (The deliberations of the STG are described in some detail inch. 5.) President Nixon charged STG with providing him a "definitive recommendation on the direction the national space program should take in the post-Apollo period. "[12] The review considered future directions of both the civilian and military space programs, but its focus was on the future for the civilian manned program. A major and lasting result of STG'S review was the concept of a reusable space shuttle to serve almost all national launch vehicle requirements, from commercial uses to intelligence missions. To realize this concept, technical characteristics, as well as managerial and funding patterns, were negotiated by NASA and DOD (represented primarily by the Air Force). As has become evident since the 1969-72 period, the interagency planning did not resolve all of the program issues that have subsequently caused continuing NASA-DOD tension over the shuttle program.[13]

By 1977, enough stresses had built up among the civilian, military, and intelligence space programs that president Carter authorized a Presidential-level space policy review. **The stated purpose of the review** was "to resolve potential conflicts among the various space program sectors and to recommend coherent space principles and national space policy."[14]

Recent Policy Reviews

The Carter administration adopted the NSC policy review process as the primary mechanism for considering and developing space policy, both civilian and military. The initial review was carried out under the guidance of Presidential Review Memorandum 23, which considered questions about civilian-military relationships and resulted in Presidential Directive 37 (PD/NSC-37). This review was followed by further interagency review requested by the president in June 1978, which led to a second Presidential Directive (PD/NSC-42) and a public announcement on U.S. civilian space policy in October 1978. In this statement, President Carter identified decisions that were designed to set the direction of U.S. efforts in space over the next decade. Among other things, the announced civilian space policy was to promote a balance of applications, science, and technology development that would "increase benefits for resources expended through better integration and technology transfer among the national space programs and by using more joint projects when appropriate. "

As part of the Presidential review several decisions were made in specific applications areas, either as program guidance or for the conduct of further studies.

- NASA was to chair an interagency task force to examine options for incorporating current and future remote-sensing systems into an integrated national system, with emphasis on defining and meeting user requirements.
- The Defense community, NASA, and NOAA were to conduct a review of meteorological programs to determine the degree to which these programs might be consolidated in the 1980's and the extent to which separate programs supporting specialized defense needs should be maintained. The possibility for integrated systems for ocean observations from space was also to be examined.
- With respect to technology sharing, steps were to "be taken to facilitate technology transfer between the space sectors. The objective was to maximize efficient utilization of the technologies while maintaining necessary security and management relationships.

In November 1979, president Carter approved further civilian space policy that amplified the policies established in PDs 37 and 42. The new

[12] The space Task Group was established by a Feb. 13,1969, memorandum from the President.

[13] Edgar U lsamer, "Space Shuttle Mired in Bureaucratic Feud," Air *Force,* September 1980.

[14] Th, unclassified version of the results of the review of space policy was issued in the form of a White House press release on June 20, 1978.

policies were contained in Presidential Directive/NSC-54.

The policy decisions in PD-54 were the result of extended interagency debate, and were based, in part, on the results of the various studies and reviews mandated by PD-42.

PD-54 directed that DOD and the Department of Commerce (DOC) maintain and coordinate dual polar-orbiting meteorological programs, with each continuing to procure systems and operate separate satellites to meet the differing needs of the military and civilian sectors. When new polar-orbiting satellites became justifiable they were to be jointly developed and procured by DOD, DOC, and NASA in order to maximize technology sharing and minimize cost. An "appropriate" coordination mechanism was to be established to assure effective cooperation and to prevent duplication.

For oceanic programs, PD-54 further stated that if oceanographic satellites were to be developed, DOD, DOC, and NASA were to pursue joint development, acquisition, and management. A committee was to be established with expanded representation to forward recommendations on policy issues to the policy review committees in NSC for consideration and actions.

The classified character of the basic documents, accentuated by the use of NSC as the forum for discussion, has made congressional and public discussion difficult. This has been a continuing problem in raising and resolving many issues of civilian-military relationships.

Current Administration Policy Review

The various policy reviews of the 1977-79 period continue to provide the formal underpinning and guidance that govern today's programs in both civilian and military applications. However, the Reagan administration has initiated a broad examination of the extant policy. Although strongly driven by the administration's perceived need to constrain the Federal budget, the review is intended to be comprehensive, and will include an examination of the provisions of the NAS Act. The review will focus on the use of the space transportation system for civilian and national security purposes and on commercialization of civilian Earth observation systems.

The President's science adviser has undertaken the review, which will be coordinated via a "Cabinet Council" mechanism. The Policy Review Committee (Space) of the Carter administration has now been disbanded. There are new pressures on several fronts. The administration's budget cuts have necessitated a wholesale reevaluation of many planned civilian space program initiatives in applications and also in space sciences. In addition, the success of the shuttle has introduced the need to focus on civilian-military relationships at a new level of detail.

CURRENT INSTITUTIONAL AND PROGRAMMATIC CHARACTERISTICS OF CIVILIAN AND NATIONAL SECURITY SPACE EFFORTS

The possibility and desirability of closer civilian-national security relationships in space depend on the strengths and weaknesses of the current structure and the differences and similarities between the two areas of space activity. Although the two programs have certain common interests and a history of cooperating to solve common problems, their different goals and consequent divergence in evolution have resulted in different institutional and program characteristics. These are reviewed below.

Mission Differences

NASA is an R&D agency with its primary mission the development and demonstration of space and aeronautics systems and associated technology, the provision of launch services, and the operation of research and scientific satellites. NASA has a tradition of evaluating the potential of space technology in a broad societal context with a long time horizon. NASA's R&D efforts are linked to the requirements of various users, but

its **strongest tendency is towards development of new technologies rather than meeting short-term needs** of users. Civilian missions require the collaboration of the widest possible body of users to help share and justify the very large front-end costs of space systems. For example, the design of civilian remote sensing systems has been affected by the need to resolve the data requirements of a multitude of civilian missions and to determine a fair allocation of costs. Conflicts among agencies over instrument selection, system characteristics, and technical tradeoffs will continue to plague the Government-sponsored growth of operational systems.

DOD's space activities, by contrast, have some characteristics of technology push, but they are primarily responsive to the requirements of military operations. DOD has a clear and vital mission, national defense, and space technology is seen as one means, among others, for accomplishing it. The military users of space technology are within DOD, and the problems of transfer from developer to user are fewer than if the two were in separate organizations. DOD has been considering possible changes in management that would reflect the military's increased dependence on space systems and allow for efficient use of the space shuttle. These include establishing a separate Space Command, either in the Air Force, or as a fourth service.

In congressional testimony early in **1981, the Secretary of the Air Force identified an order of priority for the various program activities that the Air Force conducts in space.**

- **First priority** was given to the maintenance and development of a reliable and satisfactory launch vehicle capability. Employing the shuttle to maximum advantage for missions related to national security and protecting against possible delays and failures in the shuttle program were considered vital.
- Second priority was given to surveillance and warning satellites. These functions generally cannot be performed by alternate ground-based facilities.
- Third priority was assigned to satellites related to communications. Though communications satellites are important, alternate ground-based means of communications (undersea cables, short-wave) are usually available.
- Fourth priority went to weather observation and navigation. Because other means exist to carry out their tasks, they are lower in priority than other satellite systems.

Openness v. Need for Secrecy

The NAS Act mandates, among other things, that NASA provide for the " . . . widest practicable and appropriate dissemination of information concerning its activities and the results thereof. " The specific provision to make information available to the public contrasts sharply with the information policies governing classified military and intelligence programs, which operate under stringent requirements to protect information, including even the fact that some of the programs exist.

The differences in orientation between the civilian and military programs have been maintained from the beginning of the programs to the present and are fundamental to consideration of policies on technology sharing and other interjector relationships.

- There are inherent conflicts between the need for secrecy in national security programs, and the free exchange of data characteristic of the civilian space program. These conflicts extend into the project office, where secrecy requirements imposed on sensitive national security projects are a continuing fact-of-life, though they are essentially nonexistent on the civilian side.
- For technology sharing, these differences generate a basically asymmetrical relationship. Activities or technology in the civilian sector are examined in detail for potential national security uses. The reverse does not hold except through specific interagency mechanisms that have been formed to promote information exchange. Even with information exchange, the civilian community rarely has an opportunity to affect national security planning. The reverse is less true. **National security planning may often affect civilian programs.**

- Military and intelligence missions normally enjoy a high relative priority within the Government. This is reinforced by the secrecy surrounding such programs, making it dificult for most members of the Executive, of Congress, and the public to criticize them effectively or to bargain for increased attention to and funding for civilian activities. The result is that the military or national security program can seek out or develop new technology to aid in accomplishing their missions, using the full range of classified and unclassified experience, whereas civilian programs have definite limits set on use of sensitive or classified technology.
- in some cases, not only technical details of military or intelligence space systems, but even the fact that such a system exists may be classified. This creates a special burden upon the program managers and the contractor teams, and makes it very difficult to carry out technology-sharing activities with other programs. The precautions that may be necessary to protect the "fact of" a certain system would act as a significant deterrent to the ability of the classified program team to volunteer its assistance.

Differences in the Institutional Support Base

At NASA's founding, it incorporated the National Advisory Committee on Aeronautics, its technical centers, and a number of DOD activities such as the Army Ballistic Missile Group in Huntsville, Ala., and the Jet Propulsion Laboratory in pasadena, Calif. Thus, NASA inherited an infrastructure of Government-owned facilities and supporting technical staffs that were already familiar with all phases of the agency's projects, from early definition to the production and test of flight hardware. When NASA expanded to meet the demands of Apollo and other new program activities in the early 1960's, it elaborated the pattern of relatively autonomous technical centers (see ch. 9). NASA's technical personnel and specialized facilities represent a unique national resource, developed at great cost and representing over 20 years of experience in designing and operating successful space systems.

DOD's role in operating the military and national security programs, on the other hand, evolved very differently. Although encompassing an extensively laboratory structure, DOD moved away from the "arsenal approach" of in-house technical laboratories in the years following World War II. The process of developing ballistic missiles, the prototype for DOD's space effort, followed a pattern in which a Government project team of civilian and military personnel acted as overall managers for a private contractor team; one major contractor acted as system integrator. This pattern persists today. Technical assistance for specific parts of the system is often obtained from government laboratories, but the laboratories typically do not undertake management. Practically the entire DOD space program management is vested in the Air Force Space Division, a part of the Air Force Systems Command. This Space Division is supported by the Aerospace Corp. as system engineers. Thus, whereas NASA development management activities are done largely at separate centers, DOD activities are centralized. The Space Division has responsibilities equivalent to those of NASA in that it is responsible for all procurement, launch, and on-orbit control and recovery. Generally, when a satellite system becomes operational, the mission aspects of the satellite system come under the control of a user command, say Strategic Air Command or Defense Communications Agency, while the Space DiviSion maintains control of other aspects of the satellite system including replacements. The Space Division can and does call on other DOD agencies and laboratories. The Space Division has direct control of the launch facilities at the Eastern Test Range at Cape Canaveral and the Western Test Range at Vandenberg AFB.

Thus, in both the civilian and military space programs, a great deal of the national capability resides in the contractors, and to the extent that a single contractor may support both programs, significant technology transfer occurs, without documentation and without the need for specific efforts. Within NASA, programs are largely developed and managed by the centers, and any consideration of technology sharing or closer institutional relations between NASA and DOD needs to take into account these differences in the two programs.

International Aspects

International cooperation was one of the objectives set for NASA in 1958, and the United States has pursued an extensive cooperative program with technical, economic, and political benefits. Although certain foreign countries participate in some DOD space activities, their participation is based on joint defense objectives; its character is quite different, from NASA's international activities.

There would likely be tension between security requirements and any extensive interaction between other countries and the United States in civilian space efforts if there were a much closer civilian-military relationship. Some of these tensions are already evident as the military and non-U.S. users both plan to use the shuttle. Scientists in foreign countries might also be less willing to deal with a U.S. space program closely linked to national security activities.

The relationship between the civilian and military space programs is affected by the presence or absence of treaties, laws, and rules of conduct governing activities in the "international commons" of outer space—i.e., by the entire international legal framework. During the 1960's precedents were set that strengthened the U.S. position that governments could carry on nonthreatening activities constrained only by the prohibition in the 1967 "Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space" on weapons of mass destruction. The SALT I agreements in 1972 further recognized that there were "national technical means of verification" (presumably overhead reconnaissance by spacecraft) and that such collection devices should not be interfered with. Civilian remote sensing systems such as Landsat and meteorological satellites have also operated on a global basis without restriction; partly to forestall criticism, the United States has made data from these systems available to all countries. The emergence of significant programs by France, Japan, and others during the 1980's may complicate the existing ground rules and put additional pressure on the United States to maintain open programs conducted in cooperation with other nations, particularly with less developed countries. Current discussion in the U.N. and elsewhere about restricting the gathering and dissemination of civilian data should not be expected to affect U.S. military satellites.

An additional factor that may drive the U.S. space program to emphasize international visibility and accessibility would be the need to respond, for practical political considerations, to a newly emerging Soviet presence in peaceful space applications. The Soviets are known to have carried out an ambitious program of launching and recovering film camera satellites with high-resolution data. The lag by the U.S.S.R. in critical areas of technology, particularly computers, has until recently caused the Soviets to say little about their space applications programs while playing up manned space flight activities. However, the Soviets recently issued an important paper to the U. N.* that describes their applications programs in greater detail than previously available (described in detail in ch. 7). In particular, the Soviets claimed to be planning a "quick-look" sensing system with several types of multispectral sensors. Mindful of the tremendous impact of Sputnik, 25 years ago, forums such as the upcoming U.N. conference, UN ISPACE '82, to be held in Vienna in August 1982, may well provide the occasion for the Soviets to announce plans to make their data available to other countries.

Common Civilian-National Security Needs and Cooperative Activities

Many of the problems faced by both civilian and national security space programs have common roots in the inescapable realities of the harsh space environment and the stringent requirements associated with launching payloads into space. In the early stages both the civilian and military space programs depended on using the most suitable military systems. Improving their reliability was an early and important common task for both civilian and military authorities. As a result, a wide range of basic system details were shared. They included rocket engine design,

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structures, electronics, guidance, control systems, and a variety of subsystems.

Both programs have common needs for ground launch complexes with adequate instrumentation for prelaunch, launch, and postlaunch monitoring and control of satellites and vehicles, and launch safety and tracking. These common needs have resulted in highly integrated operations at both Vandenberg AFB (polar orbit and high inclination launches) and at Kennedy Space Center (low inclination, deep space, and synchronous orbit launches).

There is also a continuing common need for better understanding of outer space. This includes scientific observations of electromagnetic radiation at all wavelengths, the characteristics of solar radiation, studies of the Earth's atmosphere and its attenuation, propagation and reflection characteristics, and variations in gravitational effects. Beyond these basic common needs, some civilian and national security programs, such as those for meteorology and communications, have very similar technical characteristics.

Combining programs that provide specific types of information, such as the weather data, has been an attractive but difficult goal. Meteorological data is valuable principally if it is put in the hands of users as rapidly as possible, and conflicting demands for data between customers may mean that one set of users will be slighted if the system is less than sufficient for total coverage. Military needs for aircraft operations, for example, may constrain the satellite's orbital timing and type of data gathered in ways incompatible with civilian weather forecasting.

In collecting observational data of the Earth, the civilian community has information needs that are both identical to and quite separate from those of the military. Both communities have quite similar requirements for medium-scale maps. However, the military need for intelligence requires high resolutions not needed for most civilian programs. As civilian programs have matured, additional resolution and spectrum needs have caused some convergence of technical requirements, which further complicates the task of preserving the security of the DOD-operated systems while improving the capability of systems used for civilian operations. An example of the difficulties encountered in implementing joint systems is the National Oceanographic Satellite System (NOSS) (for description see pp. 50-51).

ISSUES AND POLICY OPTIONS

Technology Transfer

Inherent in the establishment of separate national space programs has been concern for effective "technology transfer" among different activities and agencies. In many cases costly technologies developed to meet the objectives of one space program may have direct utility for other programs. Sharing hardware and expertise can avoid unnecessary duplication of effort, save scarce financial, technical, and human resources, and enhance program capabilities.

In considering technology transfer, one must distinguish ***space-related*** technology (launch vehicles and facilities for guidance, command, and control of launchers and satellites) from ***applications-related*** technology (sensor systems, communication equipment, data collection, and processing technologies). A special result of applications technology is the data themselves (e.g., remote-sensing images), which can be shared without transferring the technology used to gather or process them. in general, space-related technology has been more easily transferred, because it is less sensitive and less specialized than applications technologies.

Technology can be transferred either from civilian to military/national-security (MNS) programs, or vice versa. Substantially different issues arise depending on the direction and type of technology involved. In general there are few if any restrictions placed on the transfer of civilian or NASA-developed technology to MNS programs. Problems arise when classified technology or data appears to be of use to the civilian sector.

- Transfers to the civilian sector of space-***related*** technology developed for the military are relatively direct and open for unclassified programs and technology, but involve additional controls and supervision when there are classification considerations that affect the MNS programs. In practice, there is considerable sharing of military space-related technology between the sectors.
- By far the most complex and difficult relationships to manage are those involving the transfer of ***applications-related*** technology from the military/national security sector to the civilian sector. Since the national security applications are highly sensitive, there are necessarily strict limitations on access to technical information, even to evaluate its potential usefulness for civilian purposes.

The key to effective transfer is to combine awareness of different programs at the policy and administrative level, to exchange information at the technical level, and to agree on joint responsibilities:

- The easiest transfers to implement are those that involve the direct use by a private contractor of technology developed in a classified program to meet similar needs in another. This situation allows a lower bid to be made, and enables the contractor to assure adherence to costs and schedules. Since contractors cannot themselves approve the transfer of classified technology, the Government must take the lead in facilitating such actions, even though the same personnel and facilities may be used by the firm involved,
- Procedures for transfer are most complex when a classified technology is suitable for a civilian program but no channels have been established for the two programs to interact. Frequently, no direct interface between classified and unclassified programs, or even between separate classified activities, is allowed at many technical and managerial levels.

The objective of technology sharing or transfer arrangements is to ensure that the broadest use is made of available technology and that national resources are not wasted through unnecessary duplication of effort. The condition governing such transfers is that disclosure of the technology not reduce the effectiveness of a program or project, or harm national security.

There are several factors that impede the technology transfer process at the program-management level. There are few internal incentives to transfer technology to other programs; from the point of view of national security program managers, transfer to civilians may compromise security and tie up valuable time, money, and manpower in conducting and supervising the transfer. Unless there is a clear quid pro quo in the form of additional resources or the prospect of future aid from the civilian program, technology transfer will have low internal priority.

The competitiveness of the aerospace industry in part offsets the reluctance to share information and expertise. Competitiveness works in two major ways. In the first place, it causes new proprietary technology to be developed to improve products and sales potential across the space sectors. ***In*** the second place, the competitive bidding for Government work promotes technology sharing because using an existing technology is less costly in time and resources than developing a new one. These factors provide an incentive for both Government and industry to consider existing technology and hardware in the development of system requirements, specifications, and design approaches. Additionally, even if a complete system such as a space vehicle may be classified, technology sharing of many unclassified subsystems or component technologies may be possible.

In practice, there is a continuing exchange of data and viewpoints between programs in the several sectors at both formal and informal levels. in many instances informal exchanges and discussions are preferred over formal, because of lower visibility and the greater flexibility afforded by the absence of formal arrangements and their related institutional/bureaucratic implications. Without access to classified information it is impossible to evaluate the overall efficiency of these relationships.

Technology transfer is further enhanced in those situations when a common contractor base

is involved across sectors, or when personnel from one sector and technology are able to move to similar or related functions in other sectors. A good example of the latter has been active or retired military personnel working with NASA.

In addition to various informal and intra-industry mechanisms for technology transfer or sharing, there is a formal body to coordinate between NASA, DOD, and AACB. AACB is the highest level formal coordinating mechanism between DOD and NASA. By a 1960 interagency agreement, the responsibilities of AACB included:

- planning of NASA and DOD activities to avoid undesirable duplication and to achieve efficient utilization of resources;
- coordination of activities of common interest;
- identification of problems requiring solution by either NASA or DOD; and
- exchange of information between NASA and DOD.

AACB is cochaired by the Deputy Administrator of NASA and the Director of Defense Research and Engineering (DDR&E) of DOD. Both of these are policy-level officials. AACB has panels to deal with issues that arise in several main areas. AACB is concerned primarily with defining broad policies rather than working out detailed arrangements for cooperative activities. Technical details have generally been coordinated by special interagency committees or working groups organized for those purposes. Many joint NASA/DOD subpanels and committees, which report to AACB panels, have been established to assist interaction. There are also many individually negotiated agreements and understandings.

Security Classification Barriers

Civilian access to classified technology is inevitably limited. As defined in executive orders that establish the rules for security classification, there are specified levels of potential damage to the national security that must exist before security classification and controls can be imposed. When such conditions exist, the relevant information is classified at its appropriate level and restricted to those individuals possessing the requisite clearances and "need-to-know."

Because the effectiveness of a national security program may depend on the security protection of key attributes, there are many legitimate incentives for managers of classified programs severely to limit knowledge or access by personnel who have secondary, as opposed to primary, reasons for program involvement. Technology sharing inevitably falls in the "secondary" category. On the civilian side there are incentives to remain free from the restrictions and encumbrances that classification and security controls require. Sharing classified sector technology with programs in the civilian sector, therefore, has disincentives on both sides. It is warranted only when it can be established that there are sufficient benefits and savings to civilian programs to justify the transfer, given additional program costs and potential security risk.

Interagency Government mechanisms have been established that provide for selected civilian personnel to be cleared in order to have access to sensitive programs and related technology. Because of the security considerations and "need to know" criteria, the number of such personnel is kept as low as is judged feasible, to discharge technology transfer or other coordination objectives. The few cleared civilian agency personnel are responsible for knowing the entire range of civilian interests in their field and for identifying the potential match between civilian program needs and the classified system technology. When the civilian need occurs, an evaluation is made of the potential benefit in relation to the security risk of release. Though in practice there is wide variation, the relationship between classified and unclassified programs cannot fail to be unbalanced. Personnel working in classified programs can readily learn about technologies under development in unclassified programs, but the reverse does not hold. A security concern at the margin will almost always outweigh an otherwise equivalent civilian benefit.

There are long-standing controversies concerning the security classification programs of the Government. The issues have not been ***whether*** there should be classification, but how to provide appropriate levels of security protection for necessary programs without abuses and without undue shielding of Government activities from public scrutiny. Because determinations of

whether given entities are to be classified and if so, to what degree, are necessarily made by members of the national security community (under guidelines established by the President as Commander-in-Chief), whose primary responsibility is to protect national security, not to foster civilian applications, there is an inevitable tendency to "play it safe" by stringently classifying all sensitive materials.

Persons who have had experience in both civilian and national security programs acknowledge that there are instances of failure, but also note successes in technology transfer; given the inherent difficulties, they generally argue that the processes are as good as it is reasonable to expect within current policy guidelines.

The uneven relationship between national security and civilian interests is frustrating, primarily to personnel in the civilian sector. They distrust the capabilities and incentives of classified program managers to evaluate the potential for civilian uses of technology developed in classified programs. Civilian sector personnel are not in a position to "browse" through classified technology, or to pursue ideas or insights generated in the normal course of engineering or scientific endeavors. Civilian frustration is particularly acute when independent civilian investigation leads to, or stumbles onto, technology that has already been classified or is then placed under security restrictions.

Within the executive branch, interagency boards and mechanisms charged with exchanging information and coordinating implementation of policy guidelines provide oversight of transfer processes. Congressional oversight is provided through the Select Committees on Intelligence and the various committees that oversee the civilian and other military space programs. An entirely new dimension will be brought into being if significant operational space systems are developed and operated by private commercial firms.

Additional problems arise from the existence of various levels of security controls within the classification scheme, whereby those privy to certain kinds of information may not have access to other parts or to the whole. Internal Government reviews have been carried out periodically to re-examine: 1) the need to provide continuing protection for specific classified systems, technology, and data, and 2) the degree of protection that may be required. Oversight is provided by properly cleared congressional committees and staff. Because the congressional oversight function extends to many other aspects of the DOD-operated space program, there is need **for continuing review of security classifications** in order to ease barriers to technology transfer and to the broader use of data from DOD-operated systems.

Interagency Review Mechanisms

The current practice of permitting access to a limited number of key individual from NASA and other civilian agencies with a need to know about the nature and capabilities of classified systems provides an initial indication of what is available and what is possible. The subsequent steps, leading to detailed understanding of the classified system and its components, and relating this understanding to the possible civilian setting in which the technology might be used, are all dependent on this initial, survey-type exposure to the classified systems. Therefore, it is incumbent on DOD (and other national security entities) to **continue the practice of clearing individuals at various levels in the civilian user agencies and to provide them with periodic briefings on classified systems and technologies.** it is equally necessary for agencies with a need for such information **to select individuals for access to highly classified information who are capable of making broad judgments about the desirability of technology transfer.** Individuals at the policy level as well as at the technical and managerial levels are needed in order to cover the various aspects of the agencies' needs.

The next steps in the transfer process call for more detailed knowledge of the technology and a degree of individual specialization that will vary greatly depending on the nature of the technology. At this level, quite often an expanded set of cleared people is required from the civilian agency, with a very narrow focus on the specifics of the system or subsystem involved. This degree of access will depend on a determination that the technology in question can be transferred

without compromise. This determination inevitably is made by DOD or another national security agency. If a decision is made that a technology (or piece of hardware) may not be transferred, an appeal may be made up to the management level at AACB. Further appeal would require referral to an interagency forum at the White House level, usually via the NSC mechanism. Because of the special clearances required for the discussions in such a'forum, the NSC mechanism is well suited for this purpose. Alternatively, the "mechanisms for consensus" discussed in this report could also serve as the interagency forum, with properly cleared representatives from the agencies involved.

It should be emphasized that there is no indication that there has been arbitrary or capricious application of the security barriers to preclude civilian use of military technology. The central fact is that national security authorities have little incentive to press for greater access or use of their technology, systems, or data. Such broadened access is potentially threatening because of the loss of control it implies—the prospect that more information is being released than is desirable. These legitimate concerns are not readily dismissed, nor can they be easily tested by the civilian agencies. Thus, the interagency mechanism needs a "third party" such as the NSC staff, the Science Adviser, or perhaps the Vice President, to ensure that such questions receive balanced consideration. Congress can play an important role through hearings, oversight, and explicit incentives, both in uncovering the scope of the problems and in resolving them.

Future of the Space Shuttle System

The shuttle program represents the largest current area of interaction between the civilian and military space sectors, and it will be the continuing focus for many of the civilian-military policy issues in the period immediately ahead. The shuttle will be central to both the civilian and military space programs.

From the beginning of consideration of the shuttle, the Air Force worked closely with NASA to incorporate defense requirements into the vehicle. Formal coordinating mechanisms were established, with AACB serving continuously as the mechanism for coordinating formal policy at the highest level. The Presidential decision on the shuitle in 1972 directed it to serve all users, civilian and military. This decision entailed development of a vehicle that would integrate civilian and military requirements, and military requirements had a significant bearing on many of its design specifications.

NASA has borne most of the development funding for the shuttle, rather than sharing this responsibility with DOD. The initial plan was to limit the Air Force to building and operating the Vandenberg shuttle launch and landing facility, and to paying for operating costs for DOD missions. The Air Force later assumed development responsibility for the inertial upper stage.

The rationale for NASA's lead role in funding and management has been that sharing between the two organizations would complicate the management of an already difficult and challenging program and drive up the program's total costs, and that NASA was better equipped to design and oversee manned systems than DOD. A formal NASA/DOD memorandum of understanding (MOU) on management of the space transportation system was signed in early 1977, and revised in early 1980. The basic MOU establishes the broad policies; there are additional agreements and MOUS on specific aspects of the program.

A major problem with this arrangement is that NASA has had to cut other programs to pay for shuttle overruns. Given DOD's much larger budget, it has been argued that the Air Force should shoulder some of the shuttle costs; the Air Foce has resisted in order to avoid being put in a budget situation similar to NASA'S. An arrangement to "fence off" the shuttle budget so that it competes with other national programs, and not with either agency's continuing projects, would help to alleviate many tensions between NASA and DOD.

At the present time, interaction between NASA and DOD elements proceeds at all management levels, with active coordination on a daily basis. Inevitably, there has been a continuing series of strains and issues that stem from differences in basic mission and outlook between the two organizations. Many decisions must be made by

NASA without the opportunity for total coordination with all parties of interest, including DOD.

Operations of the space shuttle bring civilian and DOD-operated payloads into the same stream of activities, from prelaunch preparations through recovery and postlaunch processing, with the result that special provisions must be made to ensure that adequate protection is provided to sensitive information and systems. When examined in detail, the transportation system cannot be divorced from its payloads. Every payload entails specific operating characteristics that then become subject to some of the same controls that exist for the compartmented classified systems. Given this added complexity, many have suggested that separate shuttle orbiters uniquely configured for DOD launches would be preferable to joint facilities, and that DOD ought to operate a separate shuttle fleet altogether. In the future, maintaining payload-shuttle compatibility for civilian and DOD payloads will be difficult unless this common-use principle is strongly supported at the highest levels in the Government, because each agency desires to maintain direct control over all aspects of their programs.

There have been suggestions that it might be appropriate to have DOD assume funding and management responsibility for the entire shuttle system after it becomes operational, for it appears that among the users DOD would have the largest number of missions. This role for DOD **would have several advantages:**

- as the major user, DOD could ensure compatible scheduling for its high-priority launches;
- under current budget constraints, operations costs and engineering refinements for the shuttle could more easily be funded by DOD; NASA could concentrate on science, applications and man-in-space programs; and
- security requirements for DOD payloads could more easily be accommodated ‘under DOD shuttle management.

The disadvantages of such approaches are considerable, however:

- NASA, as the development authority, has a detailed understanding of the shuttle and its complexities; this knowledge base is shared between the NASA centers and their con tractors and cannot be easily shifted to DOD (or to any other organization);
- there are several non-U.S. payloads currently scheduled for launch by U.S. vehicles; these and future launches will be more difficult to accommodate under DOD management. There is likely to be some foreign resistance to cooperative programs dependent on DOD launches;
- the major technical support base for the shuttle—the NASA centers—would be in a different agency and would be less easily accessible to the operational manager (unless centers were transferred to DOD); this situation would create difficulties in implementing changes and improvements to the shuttle system; and
- the image of the U.S. space program would be altered; although still conducted for “peaceful purposes,“ it would be controlled by the military.

Man-in-Space

One of the features of the shuttle is that man is an integral part of the system, required for its successful operation and available to operate experiments, to deploy payloads, and to recover them in order to return them to Earth or to repair and refurbish them in orbit, as appropriate. For launch of DOD-operated systems, the astronaut crew will need to be aware of the system’s operating characteristics and may be able to contribute to improved operation by using man’s unique attributes. These may be DOD personnel or selected non-DOD astronauts. Clearly, foreign astronauts or experimenters could not be employed on such missions. Beyond this limitation, there is a great deal of commonality between civilian and DOD-operated missions, and significant advantage can be taken of this fact, with consequent net economies.

The next major step in advancing the capability of man-in-space is expected to be an extended

lifetime manned space station in LEO. Experiments in such a station are likely to address civilian and DOD objectives, and the lessons learned will have significance for both civilian and national security purposes. Certain DOD missions, such as the possible launch of large space platforms with directed energy weapons, could require a significant role for men in orbit. A space station is likely to be of broad value for both civilian and national security purposes, and require continued DOD-NASA coordination for manned space flight. The current policy calls for such coordination, but the mechanisms are largely informal.

If a decision is made to proceed with space station development, it will likely be designed to satisfy broad national needs including those of the national security community. In order to satisfy this objective, the national security community will need to be brought into the space station program at an early phase, and should have a formal and significant presence **in the planning process** leading to program approval, when and if this occurs. The history of the shuttle demonstrates that such large-scale, long-term, and highly complex developments can be successfully pursued and be responsive to the needs of several agencies. The shuttle has also demonstrated that such programs are not easy to execute. Many of the problems with the shuttle concerning international perceptions, separating classified and unclassified systems and personnel, and devising a joint management structure, would recur with a space station. Given our experience with the shuttle, special attention should be given to providing adequate long-term funding from both the civilian and the military agencies.

Common-Use Systems (Unmanned)

The U.S. space effort has derived considerable benefit from its ability to use civilian and DOD technology almost interchangeably wherever such technology was most appropriate to mission needs (with the highly classified and sensitive DOD-operated systems a partial exception). Perhaps the earliest example was the use of DOD missile propulsion and guidance systems as space launchers. This joint use has continued, as the basic Thor, Atlas, and Titan missiles form the core of a modified and improved family of expendable space launch vehicles. Even the shuttle uses solid-fuel strap-on rocket technology with its roots in DOD missile experience and DOD space launches.

in spacecraft design, detailed characteristics of DOD-operated payloads are not generally revealed, but as described in earlier sections, there have been significant common uses in this area. Beyond detailed design features such as solar cell arrays, radioisotope power supplies, pointing and stabilization instruments, thermal coatings, temperature control devices (such as the heat pipe), fuel cells, small thrusters, and a host of other subsystems, there are several major systems that can meet both civilian and DOD needs.

One of the potential common-use areas is in navigation. The Department of Transportation is the lead agency for the civilian national navigation plan and is responsible for coordination of navigation system planning, with the Coast Guard and the Federal Aviation Administration as major participants. In space, however, DOD has taken the lead in the development of global navigation systems. In the earlier transit system and more recently in the new GPS system, DOD's needs are being addressed; civilian users are also being accommodated, though not with the same positioning accuracy as is available to DOD users. In general, civilian use has been considered in making GPS decisions, but non-DOD agencies have responded inadequately, leaving the entire burden of justification to the military rather than viewing GPS as a joint national system like the shuttle.

In telecommunications, the military makes use of civilian systems by leasing transponders from INTELSAT and from U.S. suppliers. The Navy, for example, uses maritime communications links provided by COMSAT'S MARISAT satellites. Present-generation communications satellites dedicated to DOD are not, however, normally shared with civilian users. As the technology continues to mature, and advance concepts such as the Large Communications Platform (LCP) become realistic possibilities, joint DOD-civilian LCPS may evolve. There are numerous issues surrounding the concept of LCPS that need to be resolved

(discussed inch. 3), and the questions that result fro DOD involvement would add a further degree of complexity to ownership, management, funding, and use of such systems. There appear to be no insurmountable barriers to DOD involvement in an LCP, and there may be significant benefits from use of such a system. These factors suggest a general guideline that should be followed for DOD programs as well as for those **in the civilian sector: proposed DOD research, development, and demonstration programs in areas where there is significant civilian interest and technology base should be reviewed to determine if there is technology available from the civilian or commercial sector that can be applied to the DOD requirement.**

In other applications areas, such as meteorology and Earth (and ocean) observations, there is a degree of common use: DOD uses data collected from platforms primarily supplying civilian users. The executive branch has initiated periodic reviews of meteorological satellites (metsats) to ensure: 1) that maximum use is made of common systems, and 2) that if there are separate civilian and DOD platforms (as in the case of the medium-altitude metsats), there is a clear and persuasive justification for separate programs. For ocean observations, the concept of a NOSS was proposed as a common-use system to satisfy the needs of three agencies—NASA, NOAA, and DOD. Contributions to the program were to come from the three agencies, and the sensor systems and platform characteristics were to be determined by common agreement. Data were to flow into the two user agencies, NOAA and DOD; NASA was to be the principal space R&D agency. The planned multiagency sponsorship broke down, however, when DOD funding support did not materialize because of concern that the attempt to meet multiple needs would raise the cost beyond what the Navy was willing to pay.

The experience with NOSS indicates that **shared or common use of space** systems—although desirable from the standpoint of efficient use of national resources—does not occur, and cannot be sustained, without careful attention to management and funding channels and to approaches that reduce interagency stresses. It should be possible for the United States to carry out such multiagency programs, but the record to date has not been particularly promising. A similar situation exists in the land remote-sensing arena. There are multiple agency interests, both for civilian and national security purposes, in data from Landsat-type systems, but no single agency can justify the investment in a satellite platform. A cooperative agreement among agencies would appear to be one approach that could move the U.S. program from experimental to operational status. But long-term Cooperative funding of a common project such as this appears to be beyond our current capabilities.

Civilian Use of Data From DOD-Operated Systems

One of the delicate subjects in the relationships between civilian and DOD-operated space program activities is the use of remote-sensing data derived from classified systems for civilian purposes. There are presumably two security concerns related to the dissemination of data products from classified programs: sensitive technology and sensitive information content.

- The question of whether classified sensor or applications characteristics (e.g., sensor acuteness) are reflected in the data products of a classified system generally can be determined in advance for an entire class of products. Such products, in theory, could then become eligible or not, on the basis of technology, for direct utilization outside of classified controls and established need to know. Data might be modified so as to conceal the characteristics of the instruments used. In general, too, the sensitivity of technology declines steadily with the passage of time.
- The question of whether sensitive information content is contained in the products of a classified system, generally can be determined only on a case-by-case basis and even then may be very difficult to evaluate. For example, the possibilities of disclosing potentially embarrassing information about a foreign country are almost impossible to disprove, particularly in “worst-case” analyses, if the original sources of data were classified.

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Information content, therefore, may have longer-lasting sensitivity than the technology involved.

The unyielding complexities and uncertainties of attempting to identify and weigh these two types of sensitivities have effectively limited civilian uses of the data products from systems that have primary national security-related missions. It is infeasible in an unclassified report to present a rounded evaluation of the mechanisms that are employed to declassify and disseminate information initially obtained from classified space systems. There are, however, some aspects that are appropriate for open discussion, and illuminate the types of issues that are involved:

Executive orders that have defined the criteria for classification also provide for the orderly downgrading and ultimate declassification of data as their original sensitivity declines with age. Sensitive intelligence information is eligible for exemption from automatic downgrading at specified intervals, but not from the requirement for periodic review. As a result of these overall provisions, there are mechanisms and procedures within all national security related departments and agencies that regularly effect the release of data that were once classified. However, the delay often amounts to a decade or more.

. Information itself, even when derived from currently classified sources, is released occasionally to sharpen public understanding of issues or programs. DOD and the Department of State, for example, regularly report on the strategic-military capabilities and programs of the U.S.S.R. or other foreign countries. In such cases there is no reference or attribution to the specific source of the information. Such decisions inevitably turn on the judgment of the responsible officials, who weigh the potential benefits and risks. One problem is that many civilian agencies often do not have highly placed officials with the proper security clearances to deal directly with their opposite numbers in the military and intelligence agencies. This leaves key decisions entirely in the hands of national security authorities.

Any DOD/civilian program interaction in the use of classified data products, even through screening mechanisms controlled by national security interests, inevitably increases the exposure of the national security programs. At the same time, such joint activity imposes some national security controls or considerations on the civilian activities. While these relationships can be balanced within the context of Federal Government activities and operations, there are no mechanisms in place to handle such interaction with the private sector, State and local governments, or academia. **To make broad and routine civilian use of data products generated by classified systems it would be necessary to effect fundamental changes in policy at the national level.**

An important option, therefore, would be **to conduct an interagency review and/or a congressional inquiry of: 1) the degree to which national security systems can satisfy civilian user needs, and 2) the funds, personnel, and hardware required to satisfy appropriate needs. In the planning of next-generation DOD and intelligence systems, the possibility of accommodating well-defined civilian needs should be explicitly considered. It may also be appropriate to articulate a general policy in this area, in order to overcome the obvious reluctance of national security authorities to be burdened by considerations of civilian utility.** Such a policy directive might include the following points:

- DOD-operated systems will be designed to respond to national security needs and are consistent with the overall principles of "peaceful purposes," as stated in the NAS Act, and relevant treaty obligations such as the Outer Space Treaty;
- to the extent that such systems can satisfy civilian user needs, they will be planned and operated to do so, subject to the provision that acceptable performance of the primary missions be a priority;
- cost of incremental additional operations, hardware, personnel and supplies, to the extent these can be explicitly identified, will be borne by the civilian user or users; and
- there will bean interagency mechanism for coordinating the activities required to carry out the above tasks.

Institutional Change

Introduction

The world is a much different place in 1981 than it was in 1958, when the current policy and institutional framework for the national space program was developed. The United States and other leading countries have had almost 25 years to assess the ways in which space achievement might, as President Kennedy suggested in 1961, "hold the key to our future on Earth."

In carrying out the Apollo mission, NASA grew into a capable organization, one which became larger than anyone anticipated in 1958. On the basis of its over two decades of experience, NASA has also developed into a particular kind of institution in the eyes of the world, of the U.S. public, and of its own staff. Any consideration of changes in the overall structure of the U.S. space program cannot ignore the results of these past 23 years of activity. In particular, it must recognize that the political environment, especially the nature and scope of foreign competition and the degree of U.S. domestic support, has altered a great deal since 1958.

One major change is that the U.S. national security space program is larger and more vital to our defense posture than anyone except a few visionaries expected in 1958. As DOD and the intelligence community exploit existing space capabilities and explore the potential of future space systems, they have given an ever more important role to space technology in U.S. security planning. The national security space program has also evolved with particular institutional characteristics, and two decades have demonstrated that there are substantial differences in organizational style and methods between the civilian and military space programs.

As discussed previously, there have been repeated interactions between the separate space programs, and those interactions reflect a mixed record of cooperation and conflict. periodic assessments of this record and of the reasons for maintaining separate program structures have all concluded that the existing relationships are fundamentally sound, What the following discussion examines is whether this conclusion remains valid in the 1980's.

The Original Rationale Reconsidered

The reasons for establishing separate space program structures in 1958 were discussed previously. Briefly restated, they included: 1) that there were clear defense and intelligence applications of space technology, and that those applications, including the R&D supporting them, were best carried out under the management of national security agencies; 2) that there were also scientific, economic, and political justifications, not tied to national security applications, for space activities, and that these required a sizable nonmilitary space program; 3) that the national interest was best served by keeping these "other" space activities outside the national security framework, because:

- they were not relevant to DOD's mission and might even interfere with high-priority security-oriented space projects by, for example, competing for resources and technical talent or by making it harder to keep the security-related efforts classified; and
- the existence of a separate civilian space program meant that the United States could make use of that program as a tool of domestic and foreign policy by openly engaging in both cooperative and competitive international space efforts of a nonmilitary character, and could more easily transfer the results of the Government's space research efforts into the civilian economy.

This analysis will present the implications and alternatives that flow from differing assumptions about the civilian and military programs and their proper relationships. The issue is whether the advantages of maintaining the current separation outweigh the benefits of closer policy, institutional, and programmatic relationships among the various Government space programs. If it appears that there is no longer adequate justification for a large, institutionally distinct civilian space effort on the current scale of NASA, then the issue becomes how best to reduce or redeploy the existing capabilities (facilities and personnel) of the

civilian space effort to meet current priorities and needs.

Options for Future Civilian-National Security Relationships

At this time the United States has a civilian space program which, despite past accomplishments and a high degree of technical and managerial expertise, is having difficulty gathering political and budgetary support for new programs. On the other hand, the national security uses of space technology are receiving high priority. From the national perspective, what would be the implications of a closer NASA-DOD relationship including even the possibility of merging the civilian, defense, and/or intelligence programs into a common structure?

There are three distinct kinds of relationships the two programs can have, depending on the status of the two sectors:

- Option 1: Separate Civilian and National Security Programs:
  - A. Separate projects with provisions for technology transfer (status quo).
  - B. Single project, with designated lead agency (space shuttle, metsats).
  - C. Ad hoc joint management/funding for specific projects.
- Option 2: independent Space R&D Agency for both civilian and national security projects (with operations conducted separately).
- Option 3: Absorption of elements of NASA by DOD and other Federal agencies.

The following will present the advantages and disadvantages of the three options.

Option 1:

Separate civilian and military programs.

The general rationale for this approach was presented in the previous section. In addition, there are specific pluses and minuses depending on how relations are handled:

A. Separate projects with provisions for technology transfer.—This is the current practice for most projects:

1. Benefits:
   - Allows defense and intelligence space programs to be managed in the context of their particular goals, without slighting civilian programs.
   - Preserves high degree of security for DOD/intelligence programs.
   - Maintains well-established management patterns for all sectors.
   - Stimulates beneficial competition between projects.

2. costs:
   - May lead to overemphasis within NASA on developing new technology rather than meeting national needs and satisfying potential users.
   - Accepts some duplication and inefficiencies.
   - Increases difficulty of planning and funding national programs of interest to civilian and military/intelligence sectors.
   - May lead to premature commitment to a major civilian post-shuttle development program to maintain vitality of independent civilian sector.

B. Single project with designated lead agency.—This has been the procedure adopted for the space shuttle (and attempted for NOSS), where both sectors are able to agree on the need for a common capability. **One agency (in this case,** NASA) **is chosen as the lead agenc:y and designs and develops the technology according to its own management procedures, in consultation with other users. In the case of the shuttle, the current plan is that operations will also be managed by one agency:**

1. Benefits:
- **Avoids duplication of effort and associated costs.**
- **Increases political and financial sup**port for long-term projects.
- Facilitates coordination between developer and user.

2. costs:

Leads public and international community to confuse civilian and military programs.

. In the case of the shuttle, has absorbed a disproportionate amount of

NASA budget and personnel, without direct support from DOD; lead agency tends to be left "holding the bag."

C. Joint management/funding for selected projects.–This has not been the practice, but might be useful to avoid some of the problems associated with separate programs and lead agency responsibilities:
   1. Benefits:
      - As for the previous case; in addition, joint management and funding would ensure careful attention by both parties and ease the strains on the lead agency.
   2. costs:
      - As above; however, joint management might complicate decisionmaking.

Given the underlying separation of the civilian and national security programs, any of the above three approaches can be used for specific projects. This gives management considerable leeway in establishing patterns for cooperation and funding; in the case of joint civilian-military projects, congressional oversight would have to involve several subcommittees.

Option 2:

Independent space R&D agency for all Federal space projects, civilian and military.

In this case, an essentially new agency would be created to manage all U.S. **space-related** R&D. Based primarily on existing NASA and Air Force capabilities, the new agency would be oriented toward serving a variety of national needs, including those of DOD and the civilian agencies (Departments of the Interior and Agriculture, etc.). The operation and maintenance of systems, once developed, would be the responsibility of the mission agencies.

1. Benefits:
   - Links NASA's technical capabilities in areas such as manned space flight and space propulsion to high-priority national security objectives.
   - Provides political support and policy rationale required to preserve the major part of NASA's facilities and personnel.
   - Allows for budgetary and programmatic coordination of entire U.S. space R&D effort, civilian and military, including what are now distinct DOD programs; better balance between technology push and user pull in what are now NASA programs.
   - Permits total Federal space budget to be adjusted to policy priorities and allows the new agency to be reimbursed from other Government agencies and private sector for its R&D work in direct support of their requirements.
   - Routine links to users would facilitate transition from R&D to operations for programs now in NASA.
   - Facilitates joint programs in areas such as space transportation of interest to entire space community.
2. costs:
   - Inverse of most benefits of option 1; puts the space agency in a less public support role and makes it difficult to use for political and foreign policy purposes.
   - Likely, in current context, to result in unbalanced R&D program with national security requirements predominant (this might also be considered a benefit).
   - Disrupts established DOD-contractor relationships.
   - Does not answer question of what to do with space science programs such as planetary exploration, because agency emphasis would be on user-oriented applications; likely to lead to reemphasis of space science.
   - Potential loss of NASA's role as innovator and developer of new technologies relevant to the civilian economy.
   - Some highly classified national security programs will still remain off-limits.
3. Requirements:
   - Establishing extensive pattern of

mutual trust and cooperation between new agency and various users of its R&D services.
- Requires some means for resolving conflicts between different users over how to employ the new agency's technical capabilities and over priority to be given to different program activities.
- Change in congressional oversight of civilian space activities, with more emphasis on mission-agency oriented committees (Armed Services, Agriculture, Natural Resources, etc.).

Option 3:

Absorption of NASA by DOD and other Federal agencies.

In this case, NASA would be dissolved with key elements, such as the centers, being taken over by DOD, other Federal agencies, and private firms or universities:

1. Benefits:
   - May reduce costs.
   - Links technical and institutional capabilities relevant to national security objectives directly to users within DOD and intelligence agencies.
   - Minimizes problems of transition from R&D to operations.
   - Provides opportunity to trim or eliminate nonessential parts of NASA institutional base.
   - May facilitate transfer of space systems to the private sector.
2. costs:
   - Loses the benefits posited for option 1.
   - Gives up an established and successful institution for uncertain efficiencies and budget savings.
   - Not clear that NASA centers could easily be absorbed within DOD and other mission agencies.
   - No single locus for space R&D in support of civilian mission agencies and U.S. private sector.
   - Public and congressional reaction likely to be mixed, but predominantly negative; same for overseas reaction.
   - Makes ambitious civilian programs such as Apollo or permanent manned stations much more difficult to consider.