A Post Cold War Assessment of U.S. Space Policy

A Task Group Report

VICE PRESIDENT'S
SPACE POLICY ADVISORY BOARD

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DECEMBER 1992

Vice President's
Space Policy Advisory Board

December 17, 1992

The Honorable Dan Quayle
Vice President
The White House
Washington, D.C. 20500

Dear Mr. Vice President:

On August 31, 1992 you charged a special task group of the Space Policy Advisory Board to review the nation's space policies in the context of the end of the Cold War and other developments. We were directed to report to you by December 20, 1992. We are pleased to present you with our report, *A Post Cold War Assessment of U.S. Space Policy*.

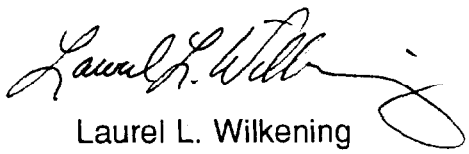
Our Task Group was comprised of individuals with considerable space policy experience including a former Congressman, a former Secretary of the Air Force, the current Chairman of the Defense Science Board, former leaders of the national security space program, a former director of NASA's Jet Propulsion Laboratory, current and former industry executives, and other space policy experts. Because of the limited time available for our task and the nature of your charge, our Task Group relied heavily on its own expertise augmented by two recent reports of the Space Policy Advisory Board, *The Future of the U.S. Space Industrial Base* and *The Future of the U.S. Space Launch Capability*; the *1990 Report of the Advisory Committee on the Future of the U.S. Space Program*; and a series of briefings by senior Administration officials from departments dealing directly and indirectly with the U.S. space program. Every effort, including the composition of the Task Group, was taken to ensure that its results were non-partisan.

Our report focuses on four recommendations. While we have identified implementing actions for each recommendation, we recognize that the incoming administration may wish to re-validate these suggested actions and measure them against their own policy goals before acting. However, we note that the world's political and economic situation as it affects space programs is evolving rapidly and that our own domestic and military agendas are also changing. So action is needed sooner rather than later. Failure to act will result in continued inefficiencies, higher costs than necessary, slower progress in using and understanding space, less competitiveness, and further uncertainty in our space industry.

Our four principal recommendations are that: (1) major changes be made in the way government space activities are organized and managed, eliminating duplication and fostering synergism among civil, military, intelligence, and commercial space programs; (2) the government seek to reduce, and where possible eliminate, security constraints associated with national security space programs; (3) the government take a series of

actions on an urgent basis to create a more cooperative and productive relationship with the U.S. space industry; and (4) the United States take the initiative in shaping a common international agenda in selected areas of civilian and national security space activity to address global problems and to maintain U.S. influence.

Finally, we unanimously urge that discussions begin immediately between the current and incoming Administration and with the Congress on these recommendations in order to enable timely actions by affected agencies.



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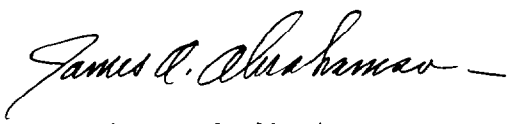

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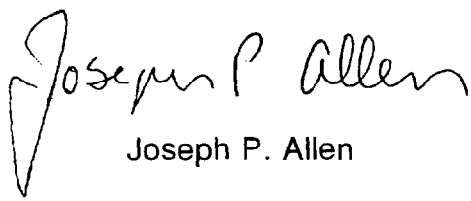

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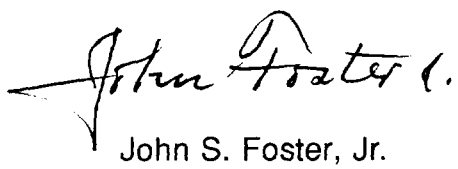

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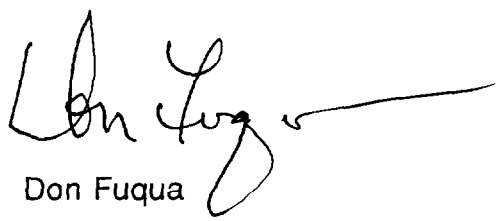

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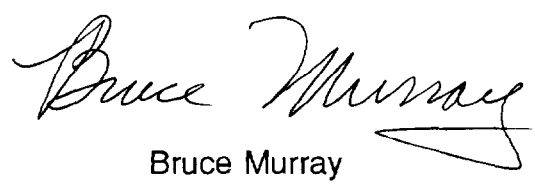

Bruce Murray

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Summary

The fundamental principles which have guided U.S. space activities were established nearly 35 years ago in the aftermath of the 1957 launch of Sputnik 1 by the Soviet Union. These principles provided for two separate space programs: one aimed at civil, peaceful purposes; the other aimed at using space systems and capabilities to enhance national security. Each program was to be carried out by a separate organization with its own research and development, acquisition, launch, and operations capabilities. Coordination between the civil and military space programs was to occur at several levels, including a presidential-led policy organization, the National Aeronautics and Space Council.

Since that time, the U.S. civil and national security space programs have evolved within a policy framework that reflected the international tensions, as well as the economic and technological constraints and alliance relationships of the Cold War period. A separate, highly classified, organization to develop and operate the U.S. space reconnaissance program was created in the early 1960's. More recently, a distinct non-governmental commercial space sector achieved policy recognition.

The U.S. space program now functions in a profoundly changed context. Space offers opportunities to address global problems on a global scale and its frontier challenges the scientific, technological, and problem-solving genius of humans. The end of the Cold War, advances in technology, and other developments present new opportunities for cooperation and progress in space. The continuing budget deficit and

changes in the aerospace industrial base associated with lessened defense spending impose new constraints on such progress.

Recognizing these changes and knowing that, more than ever before, the United States must ensure that it gets maximum return from its investments in space Vice President Dan Quayle, on August 31, 1992, asked his Space Policy Advisory Board to conduct a broad review of current national space policy. He charged the Board with making policy recommendations that would: (1) increase the efficiency of federal government space activities to enable the best space program possible for the funds available; (2) maintain U.S. leadership and competitiveness for the 21st century; and (3) sustain an industrial base capable of supporting future national security, civil, and commercial space requirements.

The Task Group has completed this review and found that space systems and missions remain important, and in some instances vital, elements of government activity. The Task Group also found that the dramatic changes in the geopolitical environment, the heightened sensitivity to issues affecting U.S. economic and technological competitiveness, increasing concerns about the global environment, the world-wide proliferation of space technologies, systems, and capabilities, and, not least, increased budgetary constraints have seriously changed the context for the U.S. space program.

Among the specific findings of the Task Group are that:

— The current U.S. government organization of space activities is not appropriate for the post Cold War era. A strong, cross-agency coordinating function is needed at the White House level. Additionally, significant institutional and structural changes are required.

— The economic competitiveness of the U.S. space-related industrial sector promotes the civil and national security interests of the nation and government actions are needed to foster its continued well being.

— Enhanced international cooperation in both the civil and military space sectors presents a strategic opportunity for the United States which should be pursued; but, the U.S. approach toward cooperation should be modified to better suit post Cold War interests.

Based upon these findings, the Task Group's four principal policy recommendations are that the U.S. government:

— Change the way space activities are organized and managed. The need to maintain distinct civil and national security space sectors remains valid but planning should be centralized across sectors and its execution streamlined within the respective sectors, thereby eliminating duplication and fostering synergism among civil, military, intelligence, and commercial programs.

— Reduce, and where possible eliminate, security constraints associated with national security space programs.

— Revitalize, on an urgent basis, a more productive cooperative relationship between the U.S. government and the space industry to meet the increased challenge of international competition and cope with reductions in defense spending.

— Take the initiative in shaping a common international agenda in selected areas of civil and national security space activity to address global problems and to maintain U.S. influence.

These recommendations provide a strategic direction and should guide policy makers as they transform the U.S. space program to meet the challenges of the new post Cold War era. The Task Group has also identified a number of specific implementing actions which are described in the recommendation section of this report.

While the recommendations and accompanying implementing actions might benefit from additional fact-finding and review, the Task Group urges that at least the initial steps toward broad, sweeping change be taken soon. The magnitude of these changes will almost certainly make them institutionally unpopular and difficult to implement. However, business as usual will not serve the country well. Failure to take prompt action along the lines identified in this report will undermine the U.S. space program and deny its potential benefits to future generations of Americans.

1

The Evolution of U.S. Space Policy and Programs

Leadership as the Overriding Goal of U.S. Space Policy

The goals set for the U.S. space program were initially a product of the Cold War. Early Soviet successes, culminating in April 1961 with the first orbiting of a human, galvanized the U.S. political leadership to confront the appropriate response to this powerful Soviet challenge to U.S. global leadership. In May 1961, President Kennedy accepted the recommendation of Vice President Lyndon B. Johnson, NASA Administrator James Webb, and Secretary of Defense McNamara that the United States not only be "a leader in space," as was mandated by the 1958 Space Act, but that it become the leader in all areas of space exploration. A centerpiece of this recommendation was that the United States enter and win the race for spectacular space achievement. Webb and McNamara argued that:

> *"Dramatic achievements in space, therefore, symbolize the technological power and organizing capacity of a nation...*
>
> *It is for reasons such as these that major achievements in space contribute to national prestige. Major successes, such as orbiting a man as the Soviets have just done, lend national prestige even though the scientific, commercial, or military value of the undertaking may by ordinary standards be marginal or economically unjustified.*

> *This nation needs to make a positive decision to pursue space projects aimed at enhancing national prestige. Our attainments are a major element in the international competition between the Soviet system and our own. The non-military, non-commercial, non-scientific but "civilian" projects such as lunar and planetary exploration are, in this sense, part of the battle along the fluid front of the cold war. Such undertakings may affect our military strength only indirectly if at all, but they have an increasing effect upon our national posture."*[1]

Two weeks later, President Kennedy initiated the Apollo program which culminated in the first lunar landing on July 20, 1969. In parallel, the United States successfully flew the first robotic expeditions to Mars and Venus and began robotic efforts that reached Mercury and Jupiter in the 1970's and Saturn, Uranus, and Neptune in the 1980's.

In the 1960's, and for most of the next two decades, space leadership clearly meant besting the USSR in visible, challenging space exploration endeavors. Each statement of national space policy issued since 1961 has identified leadership as a major goal of U.S. space policy; for example, the November 1989 space policy approved by President George Bush noted that "a fundamental objective guiding United States space activities has been, and continues to be, space leadership."

The Origins of Separate Civil and Military Programs

Heated debate followed the launch of Sputnik 1 regarding the best way to organize the U.S. space program. In those years, all U.S. space capability resided within the various military services and their laboratories and contractors. As a temporary measure to minimize interservice rivalry for the new space mission, the Secretary of Defense in February 1958 established an Advanced Research Projects Agency (ARPA) as the central organization for space projects.

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[1] Memorandum from Robert McNamara and James E. Webb to Vice President Lyndon Johnson, *Recommendations for Our National Space Program*, May 8, 1961.

President Eisenhower initially favored centralizing space efforts within the Department of Defense (DoD) on the grounds that he wanted to avoid needless duplication of activities and capabilities and that the most pressing space requirements were military in character. His advisors subsequently persuaded him of the benefits of a U.S. posture of openness — conducting as much of its program as possible openly under the auspices of a civilian agency, while also continuing a strong, yet less public, military space program within the Department of Defense. A bill proposing that a civilian space agency be created was sent to Congress in April. Following extensive debate in both houses of Congress, the President signed the National Aeronautics and Space Act of 1958 into law on July 29, 1958. Even in this founding legislation, Congress was particularly concerned about the need for policy and program coordination between separate civil and military space programs and included in the bill a White House National Aeronautics and Space Council, chaired by the President, to oversee such coordination.[2]

Between 1958 and early 1961, existing and planned space projects, facilities, and personnel were allocated to the new agency, the National Aeronautics and Space Administration (NASA), if they were predominantly civil in character, and retained within the Department of Defense if their primary application was national security. Most military programs were assigned to the individual services and ARPA quickly lost its role as a central DoD space organization. In the early 1960's a National Reconnaissance Office (NRO) was established within DoD to manage the country's highly classified reconnaissance satellite programs. In 1961 the Air Force was designated the executive agent for most DoD space efforts.

These organizational developments created a powerful, but expensive, national space program with overlapping programs and duplicate facilities. Such duplication was tolerated because:

— The foreign policy value was recognized of having an open, unclassified civil program that other countries could cooperate with, in contrast to the closed, secretive Soviet program.

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[2] The 1958 Space Act was revised in April 1961 to make the Vice President the Chairman of the National Aeronautics and Space Council.

— Protecting against Soviet knowledge of the character of U.S. military and intelligence space efforts through a high level of security classification was a key consideration.

— For the first decade or so, America's accomplishments in space were limited more by the availability of technology than by funding constraints. Overlapping programs (at least at the technology level) were thought to further desirable technical progress.

The policy decisions made in the early years of the space age resulted in the establishment of separate and distinct space sectors within the U.S. government:

— A civil space program managed by NASA and focused on demonstrating America's technological leadership through human space exploration and new scientific knowledge.

— A military space program focused on supporting strategic deterrence and an evolving role in supporting tactical forces.

— An intelligence space program focused on providing comprehensive surveillance of areas of the world closed to normal observation and on providing strategic indications and warning to National Command Authorities.

— In addition, a commercial sector emerged as private industry became involved in space programs.

Each of these sectors evolved under separate organizational structures for management, budgetary control, and policy oversight. Each of these separate "stovepipe" organizations contained within itself most or all capabilities required to perform its mission. Not surprisingly, the lack of strong coordination among these organizations encouraged both different solutions to similar problems and overlap in capabilities, particularly in areas such as technology development, launch, and support services.

Though successful, this "stovepipe" organizational structure has grown large and has spawned excess bureaucracy and as new applications of space have been developed, new "stovepipes" have been created (Figure 1).

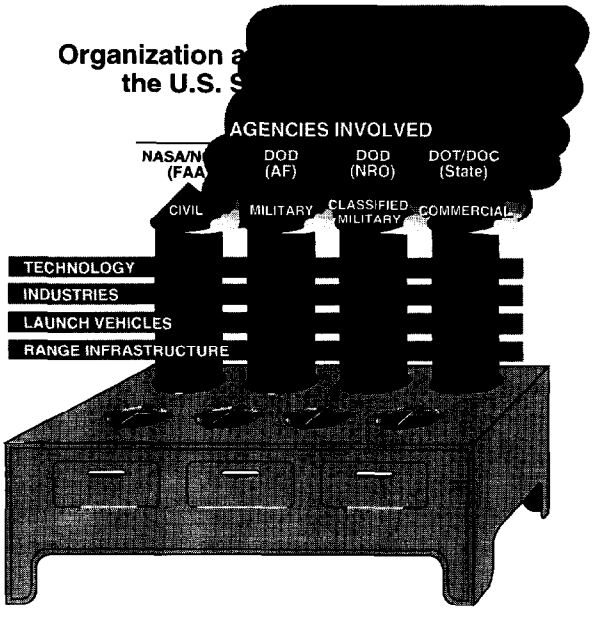

Figure 1. "Stovepipe" Organizational Structure

Increasing layers of policy oversight and review have been added. Congressional review has increased; as many as ten congressional committees now have jurisdiction over some portion of the three government space sectors, with each committee enforcing its own priorities. Each space organization has carried out its acquisition, operations, technology development, command and control, and other functions in a manner optimized for the missions it was charged with conducting. In short, each space organization now has its own institutional culture.

The scope and character of government space activities have changed significantly during the past 35 years. These changes have been reflected in annual spending levels for space (Figure 2). Three major factors have had an overarching effect on funding levels.

The first was the Apollo program, which entailed a very large effort over a relatively short time and clearly dominated space spending through the 1960's. Apollo, together with an aggressive planetary science program, led to an early surge of funding for NASA that at its peak constituted approximately 1 percent of the nation's gross national product. This was

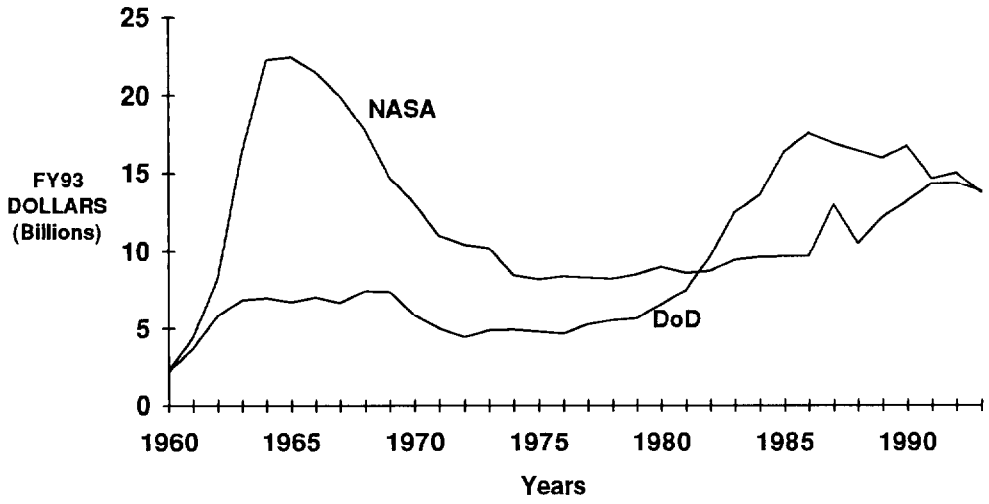

Figure 2. National Space Spending

an extraordinary investment which established the NASA institutional structure still in existence today.

The second was the Space Shuttle program which has had a pervasive effect on space spending over the past two decades. Beginning in the mid-1970's acquisition of national security satellites to perform new missions and necessary improvements to satellites performing existing missions were deferred until such time as they could be designed to take advantage of the Shuttle's unique capabilities. This deferment created a "bow wave" of unfunded requirements, suppressing DoD space spending in the 1970's and driving up spending in the early 1980's. The Challenger failure in 1986 and the actions necessary to recover from that failure added more than $12 billion in new funding requirements to the country's space budget, including, a new Shuttle (Endeavour), restoring expendable launch vehicle (ELV) production lines, developing and procuring the Titan IV, Delta II, and Atlas II launch vehicles, and redesigning satellites from configurations optimized for the Shuttle to configurations that could be launched on ELVs. The economic effect of the Shuttle is still being felt in

terms of the continuing high cost of Shuttle operations, currently consuming approximately one third of the total NASA budget.

The third major factor affecting space spending is DoD's increasing reliance on space to perform essential national security missions formerly accomplished using terrestrial or aircraft systems. This reliance, demonstrated during Desert Storm, is discussed in other sections of this report. As space has become the preferred means to accomplish essential military functions, the cost of additional space systems has been largely offset by phasing non-space alternatives such as terrestrial communications systems and reconnaissance aircraft out of the military inventory.

It is important to note that to date civil and national security space programs have not competed directly against one another for funds. Instead, each competes within its own sphere against other, non-space, alternatives for furthering U.S. national security, scientific, technological, economic, and political goals.

The Evolution of Commercial Space Activities

During the earliest years of the U.S. space program, the government played a catalytic role in bringing into being the first commercial application of space, using satellites to relay voice and video signals around the globe. The government agreed to launch any communications satellite developed by the private sector, thereby enabling the initial commercializing of space activity without requiring the private sector to bear the burden of developing its own launch capability. The government also funded research, development, and demonstrations of possible uses of communications satellites. Finally, the government took the initiative in developing the policy and institutional framework, both domestic and international, for operating communications satellites. The result of these farsighted government actions was the creation of a major new area of economic activity in which the United States has had, from the start, the dominant market share.

Indeed, satellite technology has revolutionized communications not just in the U.S. but throughout the world. The capacity and speed of domestic and international telecommunications have increased by orders of

magnitude, and the cost of an individual call has decreased substantially. Governments, the military, industry, and the individual consumer have all benefited. The communications satellite industry — satellites, launches, ground stations, and services — in the United States is nearly five billion dollars per year and is growing at a rate of about 20 percent per year.

The government also took the lead in facilitating a commercial industry built around the capability to sense the Earth from space for a variety of both public and private applications. The first Landsat satellite was launched in 1972, and Landsat 6 is scheduled for launch in 1993. There have been continuing policy challenges to finding the appropriate framework for bringing the benefits of remote sensing into widespread commercial use and a notable lack of success to date in demonstrating the economic viability of such an application. Nevertheless, the government devotes resources to technologies that, in the long run, could have substantial economic payoffs.

It was not until the 1980's that the overall commercial potential of space received specific policy attention. A series of policy and organizational initiatives over the past decade have made the government crucial to U.S. industry in developing new profit-making applications of space capabilities and services. The existence of a separate commercial space sector was first acknowledged in a 1988 statement of national space policy. The need to plan government space activities so that they enhance U.S. industrial competitiveness and to oversee commercial space activity in order to protect the public interest has added new complexities and new participants to the space policy process.

Other countries, recognizing the economic potential of space, are competing, often successfully, with the United States for a share of this growing market. U.S. taxpayers, through funding government's civil and national security space programs, and U.S. industry have spent large amounts of money to develop the knowledge, technology, manufacturing skills, and systems that underpin U.S. space competitiveness. U.S. policies and practices need to safeguard these investments and to facilitate continued U.S. competitiveness. In particular, as the United States contemplates enhanced international space cooperation, attention should be devoted to making sure that such cooperation does not compromise U.S. competitive advantage in the commercial space arena.

The Evolution of International Space Cooperation

From the earliest days of the space program, international cooperation has been a prominent feature of the U.S. approach to space, particularly in the civil sector. The United States invited its allies to participate in space science and applications programs and, after 1970, in its human space flight program. While there have, on occasion, been problems between the United States and its partners, on balance the benefits of cooperation clearly outweighed its costs and risks.

In both the civil and national security sectors, the United States has always approached international cooperation from a position of strength, at its own initiative, largely on its own terms, and usually as a discretionary, "value-added" activity that complemented core U.S. elements of a particular mission or capability. The size of the U.S. space program and the preeminence of U.S. space capabilities made such an approach possible. International partners were willing to accept American dominance in cooperative undertakings as the price of associating themselves with the recognized leader in space. This approach may not always be achievable in today's changed environment.

2

The Changing Environment

Several factors are having a profound impact on U.S. space activities including the dramatically changed geopolitical environment, the heightened sensitivity to issues affecting U.S. economic and technological competitiveness, increasing concerns about the global environment, the world-wide proliferation of space technologies, systems, and capabilities, and, not least, increased budgetary constraints.

More and more space programs such as the Space Shuttle and Space Station Freedom have faced tough competition for resources from other discretionary civil needs. Now, with the Cold War over and the Soviet Union itself gone, President Bush's goal of returning humans to the Moon to stay and human exploration of Mars has not yet received Congressional support. These are indications of the United States' changed view of the role of space programs as political tools.

While one powerful enemy may have disappeared, and with it much of the original motivating force for our past space efforts, competition in space has by no means disappeared as a legitimate and important factor driving our present and future efforts. Political concerns are being replaced by economic concerns.

Foreign nations, particularly in Europe and Japan, have targeted space, and indeed the entire aerospace industrial sector, as an area of strategic importance to their economic future. A similar emphasis on space industries is evident in many countries, notably the People's Republic of

China, Russia, and other former Soviet republics, where space systems are one of the very few areas in which these countries can field technologies capable of competing on the world market.

The commercial competitiveness of the U.S. private sector is increasingly challenged in terms of helping the nation's trade balance. The challenge is aggravated by the negative effects of reduced government spending for defense in the aerospace sector.

Another significantly changed circumstance is the economic and financial condition of the United States. The United States is burdened with a large debt, a large trade deficit, and increasing foreign ownership of business assets. Previous reports such as those of the National Commission on Space (Paine report) and the Augustine Committee assumed that increased federal support of the U.S. space programs was likely. However, U.S. fiscal problems cast considerable doubt on the assumptions that more funding will be available. Current budget projections for civil and military programs show little or no growth.

This new context for the U.S. space program is so dramatically different, that a comprehensive reexamination of the fundamental premises and principles upon which U.S. space policy and organization have been based is warranted. This report is a first step toward such a reexamination and focuses on four major policy questions:

— Whether leadership should remain "the fundamental objective guiding United States space activities," as specified in current national space policy;

— Whether the government is appropriately organized for the space programs of the next decade and beyond;

— Whether the way that the federal government interacts with the U.S. private sector is the most productive approach to ensuring the growth of the commercial space sector and future U.S. competitiveness in the global marketplace, and;

— Whether the U.S. approach to international cooperation in civil and national security space activities requires revision.

3

The New Meaning of Space Leadership

As noted previously, the quest for leadership has been a fundamental objective of the U.S. space program. For at least the past half century, U.S. ability to influence the shape and flow of events around the world has been a core national interest, and Presidents since Dwight Eisenhower have recognized the contributions that the U.S. space program made to the perception of the United States as a leading nation; one whose influence is exercised for the common good.

The measure of space leadership was straightforward when the United States and the Soviet Union were engaged in a bilateral contest for primacy in areas of highly visible space accomplishment. But with the end of the Cold War and the increased significance of economic competition among the industrial nations, the term "space leadership" takes on new meaning. To remain a leading nation in space continues to be in the U.S. interest as leadership creates a shared pride among Americans regarding their country's place on the cutting edge of accomplishment and also adds to this country's ability to influence the actions and opinions of others around the world. In addition, future economic benefits from being the leader in private sector space efforts could be substantial.

However, to desire leadership does not assure it. Space leadership must be earned. By maintaining unsurpassed technological capacities in key areas and using those capacities effectively and efficiently, the United States will have the capability to act independently, visibly, and impressively when and where it chooses.

In the future, the United States must be perceived as using its space capabilities effectively in addressing global environmental problems, managing renewable resources, supporting regional military operations, and verifying compliance with international agreements — both civil and military. As part of the United States' continuing post Cold War leadership, space achievements must be widely viewed as a key to an improved world future.

Another facet of future U.S. leadership is the ability of the U.S. space industry, working in a productive partnership with the federal government, to compete successfully in the global space marketplace. Fostering and supporting this industry through minimizing regulation, acquiring government systems using commercial-like practices, and protecting proprietary and government-provided technology and know-how are examples of the sort of actions the government can and should take to stimulate the competitiveness of U.S. industry in this area of growing economic importance.

The United States cannot maintain an appropriate level of technological leadership in space without the continuing influx of well educated scientists and engineers. Historically, many of the best young people have been drawn to the space program and have found in its challenges the inspiration to undertake the long and difficult years of education needed to make significant contributions to the field. The United States must signal to today's aspiring youth that it intends to continue to conduct a preeminent space program.

If the United States is to maintain its leading position in space, it must invest in diverse mission-oriented space research and development (R&D). The country cannot be a leader by slowing down the pace of its R&D or by broadly seeking to restrict the dissemination of R&D results. The most effective means of both ensuring that the best students are attracted to the space arena and of guaranteeing continuing scientific and technological advance is through undertaking a series of technologically demanding space missions on a timescale consistent with the pace of university training. This implies programs that are both small enough and inexpensive enough so that they can be developed and launched on a time scale of fewer than five years.

Future space leadership, then, requires combining challenge, openness, quality of execution, and productive application of results. Proceeding ahead with a well-conceived, successfully executed national space program aimed at concrete objectives that are scientifically, economically, and socially beneficial, and that serve important U.S. interests, is the best way to ensure leadership in space. Leadership, in this sense, becomes both a goal in itself and the result of excellence in formulating goals for space and achieving them as planned.

It is this concept of leadership that should guide future U.S. activities in space.

4

Federal Government Space Activities

The changed circumstances brought on by the end of the Cold War present new opportunities to achieve efficiencies in the way government space activities are organized and conducted. Realizing these efficiencies could increase the purchasing power of the funds available, thus substantially offsetting the effects of no-growth budgets. In assessing possible efficiencies, the Task Group has considered the structural relationships among different government space activities, regulations and procedures including those related to security classification of national security space activities, and opportunities to streamline the acquisition of space systems.

New Opportunities and Constraints

Federal government spending on space and space-related activities has increased significantly during the past decade. Many factors contributed to this increase, among them the technical advances enabling space systems to compete successfully with non-space approaches for addressing important needs in areas ranging from military support to environmental monitoring. There has also been some recognition of the fact that investments in space contribute to important national objectives, such as furthering educational goals by inspiring our youth and enhancing U.S. economic competitiveness in the international marketplace.

The federal government will invest approximately $30 billion in all space-related activities this year and funding is projected to remain relatively constant at this level for the foreseeable future. While $30 billion per year is relatively high when compared with past spending levels, these funds are increasingly committed to the continued development and operation of currently approved programs. No-growth budgets will increasingly preclude new initiatives and curtail investments needed to maintain space leadership and the nation's competitive, technological edge in the future unless efficiencies can be achieved.

For NASA, the effect of a no-growth budget is severe. In 1990, a comprehensive review of NASA's civil space activities was undertaken by the Augustine Committee. That Committee's recommendation, which was broadly endorsed by the Administration and the Congress, was that the United States should conduct a balanced space program composed of a strong space science component, two mission oriented undertakings — Mission To Planet Earth aimed at understanding the Earth's climate and related physical and biological systems and Mission From Planet Earth focused on human and robotic exploration of space — an enhanced technology program to support future endeavors, and development of a new launch system to off-load tasks from the Space Shuttle. In the judgement of our Task Group, these goals remain valid.

To support this agenda, the Augustine Committee recommended a number of management reforms. It also recommended increases in NASA's budget of approximately 10 percent per year throughout the decade of the 1990's, leveling off at about 0.4 percent of GNP. The management recommendations appear to have been taken seriously and the Task Group supports the actions that are being taken by NASA's current leadership to implement them. However, it is now probable that the recommended increases in funding for NASA will not be available in the near future.

At the same time, NASA is becoming increasingly committed to conducting routine, repetitive activities associated with operating and maintaining existing systems. This includes operation of Space Shuttle flights, which consumes nearly one third of the NASA budget, as well as operation of the Tracking and Data Relay Satellite System (TDRSS), the Deep Space Network, the Hubble Space Telescope and other observatory

programs, and the institutional cost of maintaining a large government infrastructure. Future operational commitments include the Earth Observing System, Landsat, and Space Station Freedom. These commitments are the result of NASA's pursuing large, complex systems that require years to develop and entail sustained high operating costs.

The situation in the DoD is similar in terms of operational commitments. While overall defense spending is being very substantially reduced, expenditures for space are actually projected to increase slightly. But this level of funding will probably be inadequate to meet current needs and to support required improvements in infrastructure.

The end of the Cold War has brought a change in the focus of national security space activities. For the past 35 years national security space requirements were focused on the strategic threat posed by the USSR. The technologically sophisticated, closed society which was the Soviet Union had the capacity to threaten directly the existence of the United States. To counter this threat U.S. space systems focused on strategic warning and on understanding the threat posed by the nuclear forces of the Soviet Union. Tactical forces, during the Viet Nam conflict and later, relied little on space systems, depending instead on conventional capabilities such as remotely piloted vehicles for weather information, reconnaissance aircraft, troposcatter communications systems, and TACAN navigation systems which were under the direct control of the combat commands. Today, while strategic needs remain important, the demise of the Soviet Union has made reconnaissance aimed at it less critical. But, the changing environment has created important new needs. Systems designed in response to the threat formally posed by the Soviet Union are now contributing to decisions regarding Yugoslavia, Somalia, and other areas. At the same time, tactical support has grown to be a significant mission. As demonstrated during Operation Desert Storm, space support to tactical forces is now an essential element of the nation's ability to wage war. The conventional systems on which tactical forces previously relied have, by and large, been phased out.

In addition to supporting national security needs, space systems have application for an increasing variety of non-defense uses. For example, the Air Force Global Positioning System (GPS) constellation of navigation satellites was designed from the start to accommodate civil users. Today,

this system assists surveyors, geologists, large and small boat owners, hunters, and campers. The system is used for automobile and truck fleet management and is already in use for air navigation.

The demonstrated capability of the U.S. GPS system and its Russian counterpart system, GLONASS, has caused the international air traffic control community to undertake numerous studies of ways to utilize Global Navigation Satellite Systems (GNSS) to improve efficiency and safety. The International Civil Aeronautical Organization has estimated that GNSS will provide billions of dollars of savings. At the request of the FAA Administrator, an industry task force has just completed its study on how to move to GNSS-based air traffic control with initial steps starting this year and next. The United States has committed to free international use of our GPS system for air traffic control for the foreseeable future.

There are additional examples of the potential civil benefits of military space systems. For example, geodetic as well as surface feature data gathered for security purposes could revolutionize both terrain and feature mapping as appropriate data is released. Other space derived security data can add significantly to civil scientific earth observation efforts, such as NASA's EOS program. The U.S. Space Command also routinely provides space debris data to U.S. and international space activities.

Conversely, civil programs will increasingly benefit our security efforts. During Operation Desert Storm, commercial communications satellites were used extensively by the military forces of many nations allied with the United States. Some scientific and commercial earth observing satellites also provided useful low resolution data for military mapping and broad area surveillance. Finally, exchanges of space derived weather data has long been a practice between the DoD and the National Oceanic and Atmospheric Administration (NOAA) and could become even more important in the future.

Investments in new capabilities are needed to support both military and civil requirements, particularly to improve space transportation. A Space Policy Advisory Board Task Group recently completed a comprehensive assessment of the nation's space launch capabilities and shortfalls. The conclusion of that assessment was that investments are needed both to upgrade current facilities and to develop a new generation space launch

vehicle. The new vehicle would serve civil and military needs, provide a basis for replacing the Space Shuttle for human spaceflight in the future, and enhance U.S. commercial competitiveness in the international market. A new management arrangement was also recommended to coordinate activities in this important cross-cutting area. The recommendations of the Advisory Board report on *The Future of the U.S. Space Launch Capability* should be implemented.

Achieving the existing civil and military space agendas without increases in funding will be very difficult. Risks will have to be carefully weighed against savings as such changes are considerable. For example, it might be possible to free some funds through merging of now separate but similar civil and military programs such as meteorological satellites. It might also be possible to reduce space budgets somewhat by slipping acquisition schedules for replacement satellites. But, the risks and consequences of gaps in coverage that could result from such cutbacks are substantial. And, historically, the inefficiencies induced by such schedule adjustments increase the total cost of programs.

Organization and Management

Development and operation of space missions and systems have historically been the responsibility of the government organization utilizing the space system or mission. Thus, civil weather satellites are acquired and operated as an element of the weather service (now NOAA), naval communications satellites are the responsibility of the Navy, and so forth. Each organization employing space systems has evolved the management, budgetary control, and many of the technical support capabilities required to conduct space activities in support of its mission. This situation was depicted earlier as a series of "stovepipes." As opportunities to use space assets to accomplish diverse missions have increased, so have the number of government organizations involved in the conduct of space activities. Figure 3 displays the current dispersion of space-related functions across the government.

For civil and commercial space, in addition to NASA, the Department of Transportation, the Department of Commerce (including NOAA), the Department of the Interior, and most recently the Department of Energy

	NASA	DOE	DOC	DOT	AF	Army	Navy	NRO	SDIO	DARPA
R & D	✓	✓	✓		✓	✓	✓	✓	✓	✓
Acquisition	✓		✓		✓		✓	✓	✓	✓
Launch[1]	✓			✓	✓		✓		✓	✓
Operations	✓		✓		✓	✓	✓	✓	✓	✓

[1] Launch includes regulation or procurement of commercial launch services

Figure 3. Agency Functions and Responsibilities

have evolved space-related functions. Within the national security community, the Air Force (with separate development and operational elements), the NRO, the Strategic Defense Initiative Office (SDIO), and the Army, Navy, and the Defense Advanced Research Projects Agency (DARPA) are all actively involved in the development and operation of space systems. Each organization has a distinctly different culture. Technical requirements, acquisition procedures, and technical operations differ. Institutional arrangements encourage overlap and discourage cooperation and synergism.

A number of actions have been taken over the years to coordinate some of these diverse activities. For example, one approach has been the establishment of joint programs, managed and funded partially by DoD and partially by NASA, as a mechanism for gaining synergism when needs were similar or overlapped. The Space Shuttle was intended to support all government launch needs. While the core program was managed and funded by NASA, the Department of Defense added its performance requirements and was responsible for developing and operating a West Coast launch facility and a new upper stage (the Inertial Upper Stage or IUS) to support all users of the Space Shuttle. More recent examples of

joint programs have included the National Aero-Space Plane Program, the New Launch System, and the Landsat remote sensing satellite system.

These joint programs have proven difficult to implement and have often become a source of conflict among agencies. Differing agency priorities have often resulted in budget mismatches. Another factor complicating joint programs is the need for support from several different congressional committees, each of which with its own priorities. The process through which Congress allocates funds also complicates the execution of joint programs because subcommittees have tended to cut "their" agency's requests for a joint program in the hope that the subcommittee with jurisdiction over other participating agencies will make up the difference.

Within the DoD, a Unified Space Command has been created with responsibility for the use of military space assets. However, its responsibilities encompass only a segment of the national security space systems and even within that segment it is limited to operational matters.

To date, joint programs and umbrella organizations have not been effective in coordinating the broad range of national security space activities.

Security and Classification

The security classification requirements created to protect U.S. space and intelligence capabilities during the Cold War contribute to inefficiencies in the conduct of the nation's space program and limit the broader utility of certain systems. The objectives of national security systems have evolved over time, and the number of people allowed access to classified information relating to them has increased substantially. With the end of the Cold War, the original rationale for many of the current security safeguards is less compelling and the potential benefits from removing many security constraints are substantial.

In addition, many of the technical capabilities subject to security protection have proliferated despite their being subject to classification. For example, Russia is marketing imagery with a spatial resolution of approximately two meters. In the coming decade, the cutting edge in

technologies and systems designed to sense the Earth may increasingly be found in NASA's unclassified Earth Observing System (EOS).

Security constraints drive up the cost of U.S. government space programs in many ways. Physical and personnel requirements and their administration necessitate special building construction, extensive background checks, and systems for producing, processing, and storing material. They restrict the transfer of technical knowledge within the government and to and within industry. For industry, security requirements encourage the creation of separate facilities and a dedicated workforce, thus contributing to costly duplication and overlap.

U.S. industrial competitiveness in the world marketplace is also affected because, for the most part, foreign sales and commercial spin-offs of highly classified space capabilities are not allowed. This contrasts with other sophisticated military equipment such as fighter aircraft where foreign purchases offset a portion of U.S. investment costs thus helping to maintain a production base in this country and contributing positively to the U.S. balance of trade.

There have been some benefits of classification. Because of the sensitive aspects of high security systems, a more streamlined management structure was employed for overseeing their acquisition and operation. This streamlining reduced overhead costs, eliminated unnecessary paperwork, reduced decision time, and yielded high quality, high performance systems. These practices should be preserved and could be applied more broadly across the U.S. space program to reduce the cost and shorten the development time for other civil and military space programs.

While many potential benefits could be gained by reducing security requirements, it remains important to protect certain sensitive national security space capabilities. Because of increased threats posed by proliferation of the technologies associated with weapons of mass destruction, stemming the proliferation of ballistic missile technology remains a major concern.

The Task Group endorses recent actions by the Administration to reduce security requirements including the declassification of some information concerning the NRO and the launch of national security satellites. Relaxing additional security constraints could:

— enable industry to more easily move employees between civil and national security development programs

— ensure that technology and experience developed for one government application are easily transferable to other government or private sector applications

— reduce the overhead costs associated with maintaining strict physical and personnel security

— increase the data available to support public benefit applications

— provide an opportunity for U.S. industry to market systems or capabilities, either through some form of foreign military sales or through sale of information. The export of some advanced satellite technologies and systems would strengthen the competitiveness of the U.S. private sector in the international marketplace.

Federal Acquisition Regulations

A third area of possible savings relates to the processes and procedures associated with the acquisition of space systems by the government. Current acquisition rules create a burden on space programs — adding cost and time to everything. Many previous advisory group reports have contained specific recommendations for improvements in this area. Implementing the recommendations put forward by the Packard Commission, the Augustine Committee, and recently by the Vice President's Space Policy Advisory Board Task Group report on *The Future of the U.S. Space Industrial Base* could yield substantial savings in the cost of conducting the space programs of the nation.

Findings

1. The U.S. government's organization of space activities is not appropriate for the post Cold War era.

— Government resources committed to space are not being efficiently used. Government space-related organizations have proliferated and they have too many facilities and too many employees focused on redundant oversight and operational activities.

— No process exists to ensure: that agency space efforts utilize other agency-developed capabilities and technologies; that programmatic and facility redundancies are removed; or, that other synergism is gained among diverse space efforts when possible.

— Space launch capabilities are required by all users of space. Current launch capabilities cost too much, lack responsiveness and flexibility, and are not sufficiently safe or reliable. A coherent national effort to improve launch capabilities is desperately needed.

— No coordinated national effort currently exists to encourage the sharing of government-sponsored space technology among U.S. government agencies or between the government and the private sector.

— With the overall decline in general defense spending, procurement practices and acquisition decisions related to any single program will effect the industrial capacity for other programs. No mechanism exists to ensure cooperation and consultation among the space sectors prior to individual agency actions affecting the space industrial base.

2. A focus specifically on space issues within the Executive Office of the President is required to develop policies and strategies for coordination of civil, commercial, and national security space activities.

3. The demands on space budgets associated with operating and maintaining successful ongoing programs will increasingly consume available resources. Without significant management adjustments, focussed on reducing the operational costs of missions, the nation will not

be able to develop the advanced technologies and capabilities which form the underpinnings of space leadership in the future.

4. Current government guidelines regarding the classification of national security space activities, including secrecy surrounding organizational and contractual relationships, the existence and capabilities of space programs, operating procedures, and technology increase costs, restrict coordination and cooperation, and limit opportunities for productive synergism.

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5

The Relationship Between Government and Industry

The U.S. government accomplishes its space goals in cooperation with industry. It is through industry that policies and plans are transformed into the hardware and software of actual space programs. In turn, the space industry in this country is almost totally dependent on the government. The civil space sector and the military space sector combined spend $30 billion per year of federal funds in pursuit of space goals. The U.S. commercial space sector represented $5 billion in 1992 sales and is growing at double digit rates. However, of these commercial sales, approximately 30 percent are made directly to the federal government. The remainder are heavily influenced by the government through regulatory processes, export controls, financial incentives, and licensing requirements.

U.S. government space programs benefit from commercial sales by the industry. For example, sale of commercial space launch services enables stable production rates thus reducing unit costs and increasing reliability. The same is true for production of satellite components which can be used for both commercial and government satellites. Other examples include value-added processing for meteorological and remote-sensing data and ground terminals for communications and navigation systems.

However, the United States no longer dominates the international marketplace for space hardware and services. 60 percent of all commercial space launches are performed by Europe's Ariane rocket. A decade ago,

the United States had more than an 80 percent share of the worldwide commercial communications satellite market. The U.S. share of that market for the 1990 to 1993 time period is estimated to be just over 50 percent. French firms have captured about 20 percent of this important and growing market. In addition, Japan has the worldwide lead in providing large satellite ground stations. These shifts in market share are largely the result of focused decisions by other industrial nations to pursue commercial space activities. Russia, Ukraine, and Kazakhstan take justifiable pride in considering their space industries to be the "Crown Jewels" of their industrial base.

Government and industry are indeed partners in space. But factors resulting from the changed domestic and international circumstances are straining this partnership and the relationship between industry and government is perceived by industry to be less cooperative than it was in the past. This relationship is governed by a myriad of complex laws and frequently changing policies, processes, regulations, restrictions, and requirements some of which were established to foster expanded competition. The need for simplification and reform to these laws and regulations is accentuated by the ongoing contraction in the aerospace industry. Without question, the efficiency of the contraction process is adversely affected by current government regulatory practices.

Additionally, the government's interest in protecting commercially valuable proprietary information is probably greater now than in the past because of the heightened economic implications of space industry competitiveness in the international marketplace.

The Vice President's Space Policy Advisory Board report, *The Future of the U.S. Space Industrial Base,* recently addressed these and other issues affecting the relationship between the U.S. government and its industrial partners. In preparing that report, the task group solicited the views of a broad spectrum of industrial firms, both large and small, that provide space systems and services in the civil, military, and commercial space sectors. One of the recurring themes in these presentations was that the government is not a particularly good partner and that friction between partners becomes more critical in an era of restructuring and contraction. Fifteen specific recommendations were presented in six generic categories. Many of these recommendations dealt directly with improving the efficacy

of the partnership between government and industry; including easing antitrust laws to permit efficient consolidation within industry, implementing many previously recommended improvements to the acquisition process, and actively promoting a robust commercial space industry. Other significant recommendations included maintaining a strong emphasis on research and technology by both DoD and NASA during this period of contraction; stressing the importance of DoD and NASA working more closely together; and emphasizing the need for a modern and cost-effective expendable launch system. The industrial base report, released in November 1992, should be considered a companion piece to this policy assessment.

Findings

1. The continued international competitiveness of the U.S. space industry strengthens the U.S. space program and promotes the civil and national security interests of the nation.

2. For over a decade, the government fostered expansion of the space industrial base resulting now in substantial overcapacity in many segments of the industry. A number of current government laws and regulations serve as disincentives for effective industry contraction.

3. Government acquisition laws and regulations continue to foster inefficiencies and to contribute unnecessarily to the cost and complexity of space programs.

4. Government procedures and security regulations deter use of government-funded space systems and technologies for commercial applications, adversely effecting the global economic competitiveness of U.S. industry.

5. The DoD budget strategy for general defense programs is to reduce production while maintaining a robust research and technology base. However, DoD acquisition policies do not encourage the industry to invest in or otherwise support research and development.

6. Security constraints inhibit U.S. industrial competitiveness resulting in lower foreign sales of security-related space hardware and services and, thus, increased costs to the U.S. government.

7. Restrictions surrounding industrial proprietary information should be respected by government as they are needed to safeguard U.S. industrial competitiveness.

6

International Cooperation

Current national space policy states that "the United States will conduct international cooperative space-related activities that are expected to achieve sufficient scientific, political, economic, or national security benefits to the nation." This policy makes clear that international cooperation is a means to achieve additional benefits from the U.S. space program, not an end in itself.

The United States cooperates with many countries in both civil and national security space efforts. Such cooperation takes a wide variety of forms, depending both on the character of the cooperative activity and on the identity of the international partner. Among the approaches to cooperation that have been employed are:

— Data exchange (e.g., U.S.-USSR in life sciences, SCUD warning to allies in Desert Storm);

— Providing technical assistance or services (e.g., foreign use of the Deep Space Network; reimbursable launches of non-U.S. spacecraft supporting civil and military needs);

— Joint projects with the United States in control of the critical path for mission success (e.g., Space Station Freedom; Cassini);

— Joint projects with shared control of the critical path (e.g., Apollo-Soyuz, satellite tracking, telemetry, and control systems);