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INSTITUTE FOR DEFENSE ANALYSES

Leadership, Management, and Organization for National Security Space

Report to Congress of the Independent Assessment Panel on the Organization and Management of National Security Space

Mr. A. Thomas Young, Chairman
Lieutenant General Edward Anderson, USA (Ret.)
Vice Admiral Lyle Bien, USN (Ret.)
General Ronald R. Fogleman, USAF (Ret.)
Mr. Keith Hall
General Lester Lyles, USAF (Ret.)
Dr. Hans Mark

July 2008

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INDEPENDENT ASSESSMENT PANEL
ON THE ORGANIZATION AND MANAGEMENT OF
NATIONAL SECURITY SPACE

July 15, 2008

The Honorable Carl Levin
Chairman, Senate Committee on Armed Services
228 Russell Senate Office Building
Washington DC 20510

Dear Senator Levin:

Enclosed is the final report of the Independent Assessment Panel on the Organization and Management of National Security Space (NSS), in accordance with Section 914 of the FY 2007 Defense Authorization Act. (HR 5122).

Today, U.S. leadership in space provides a vital national advantage across the scientific, commercial, and national security realms. In particular, space is of critical importance to our national intelligence and warfighting capabilities. The panel members nevertheless are unanimous in our conviction that, without significant improvements in the leadership and management of NSS programs, U.S. space preeminence will erode to the extent that space ceases to provide a competitive national security advantage. Space technology is rapidly proliferating across the globe, and many of our most important capabilities and successes were developed and fielded with a government technical workforce and a management structure that no longer exist.

Our report details recommended actions in four areas.

First, establish and execute a *national* space strategy. The President should lead this effort and reestablish the National Space Council chaired by the National Security Advisor to implement the strategy and coordinate activities for NSS across the DoD, Intelligence Community, NOAA, NASA, and other responsible agencies. This provides a standing forum for assigning responsibilities, setting priorities, and breaking the roadblocks to cooperation that have stymied progress on key space programs.

Second, create a senior National Security Space Authority in support of the Secretary of Defense and Director of National Intelligence. Today, no one's in charge. The authority and responsibilities for military space and intelligence space programs are scattered across the staffs of the DoD and the Intelligence Community. The proposed arrangement, while unusual, is critically needed to rectify crippling shortfalls in the current system, including the inability to reconcile budget priorities and the inability to ensure that new acquisition program requirements are integrated and affordable across military and intelligence space.

Third, establish a National Security Space Organization that would consolidate the functions of the Air Force Space and Missile Systems Center, other parts of Air Force Space Command, and the National Reconnaissance Office. Under unified leadership, this organization could focus on employing the very limited available talent most effectively and on installing proven, successful engineering and acquisition practices, including early systems engineering and cost estimating. The persistent pattern of space acquisition program delays, cost overruns, and cancellations has drained

resources and caused the nation to rely on satellite constellations that have aged well beyond their original design lives. This is unacceptable, and small modifications to the *status quo* will not suffice.

Finally, each of the Military Departments and the Intelligence Community must adopt and implement strategies for identifying, selecting, educating, training, and managing a core group of government professionals in sufficient numbers to support the nation's space acquisition responsibilities. The careers of these space acquisition professionals must be managed such that they can provide continuity for program execution, while remaining eligible and competitive for career advancement. It is simply unrealistic to expect that we can succeed in developing and acquiring complex space systems without sufficient numbers of smart buyers -- technically competent, experienced government scientists, engineers and acquisition managers who are "steeped in space" and assigned to see programs through to completion.

It has been a distinct honor to serve on this panel. We stand ready to assist in any way in helping to restore the vitality of National Security Space and to sustain US primacy in space.

Very Respectfully,

A. Thomas Young, Chairman

Lieutenant General Edward Anderson, USA (ret.)

Vice Admiral Lyle Bien, USN (ret.)

General Ronald R. Fogleman, USAF (ret.)

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PREFACE

The Independent Assessment Panel (IAP) was chartered to review and assess the DoD management and organization of National Security in Space and make appropriate recommendations to strengthen the U.S. position. The IAP was supported in its efforts by a study team from the Institute for Defense Analyses (IDA). The IAP is grateful for the participation of liaison officers from the Department of Defense, the Office of the Director of National Intelligence, the National Reconnaissance Office, and the National Aeronautics and Space Administration (see Appendix C for the study team and liaison participants). This task was performed by IDA for the Director, Space Policy Office of Deputy Assistant Secretary of Defense for Strategic Capabilities under task entitled "Department of Defense Organization and Management for National Security in Space."

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EXECUTIVE SUMMARY

The Independent Assessment Panel (IAP) was chartered to review and assess the DoD management and organization of National Security in Space and make appropriate recommendations to strengthen the U.S. position. The panel members are unanimous in our conviction that significant improvements in National Security Space (NSS) leadership, management, and organization are imperative to maintain U.S. space preeminence and avert the loss of the U.S. competitive national security advantage. NSS inadequacies are unacceptable today and are likely to grow, but leadership can reverse this trend.

Scope of National Security Space

The National Security Space enterprise comprises a wide range of government and non-government organizations responsible for providing and operating space-based capabilities serving both military and Intelligence Community needs.

- *Military space* responsibilities are shared among many DoD components including the Office of the Secretary of Defense, Joint Staff, Defense Agencies, Combatant Commands, the Military Services and Defense Advanced Research Projects Agency **(**DARPA) activities involving space-based capabilities for communications, early warning, weather, surveillance, space control, and precision navigation and timing as well as launch, space ranges, and research and development (R&D).
- *Intelligence space* responsibilities include reconnaissance and related satellite systems and operations.
- The National Oceanic and Atmospheric Administration (NOAA) responsibilities include weather and remote sensing.
- *Commercial space* forms the industrial base supporting government space programs as well as providing commercial services in the form of satellite communications and remote sensing systems.
- The National Aeronautics and Space Administration (NASA) is primarily responsible for civil space activities; however, NASA's overall technology efforts and project management support contribute significantly to NSS activities.
- *Other* organizations with space responsibilities include the Department of Energy and the National Labs, the Department of Agriculture (U.S.

Geological Survey and LANDSAT), the Department of Homeland Security (National Applications Office), the National Science Foundation (Space Weather), Department of State, Department of Transportation, National Security Council, Office of Science and Technology Policy, Federal Communications Commission, and the satellite systems and activities of our allies.

The panel met with the heads of the major organizations responsible for National Security Space, along with numerous government, industry, and independent experts. The findings and recommendations reflect a widespread sense among informed experts that urgent and fundamental change is needed.

U.S. Leadership in Space is a Vital National Advantage

Space capabilities underpin U.S. economic, scientific, and military leadership. The space enterprise is embedded in the fabric of our nation's economy, providing technological leadership and sustainment of the industrial base. To cite but one example, the Global Positioning System (GPS) is the world standard for precision navigation and timing.

Global awareness provided from space provides the ability to effectively plan for and respond to such critical national security requirements as intelligence on the military capabilities of potential adversaries, intelligence on Weapons of Mass Destruction (WMD) program proliferation, homeland security, and missile warning and defense. Military strategy, operations, and tactics are predicated upon the availability of space capabilities. The military use of space-based capabilities is becoming increasingly sophisticated, and their use in Operation Enduring Freedom and Operation Iraqi Freedom is pervasive.

Significant Developments since the 2001 Space Commission

The Commission to Assess United States National Security Space Management and Organization (referred to in this report as the 2001 Space Commission) alerted us to growing threats to our NSS assets. Since then, U.S. dependency on those assets has grown while comparatively little has been achieved to make them more secure. Further, a host of world and national events have "changed the landscape" in which NSS must operate. Several threat-related developments have occurred: the September 11, 2001 (9/11), attacks on the U.S. homeland and the resultant Global War on Terror; Operations Enduring Freedom and Iraqi Freedom; the rapid emergence of China as a space power, to include substantial development in the areas of anti-satellite weapons (ASAT) and anti-cyber technologies; as well as the growing potential for conflict in space.

Several organizational developments have also occurred since 2001: (1) U.S. Space Command was decommissioned and space responsibilities were assigned to U.S. Strategic Command (USSTRATCOM), (2) Northern Command, Director of National

Intelligence, and the Department of Homeland Security were established, and (3) the DoD Executive Agent for Space was relieved of authority as Director, National Reconnaissance Office (NRO).

There have also been a number of acquisition-related developments: (1) acquisition delays, cost overruns, and performance shortfalls have become routine; (2) growth in international space design and operation—due in large part to International Traffic in Arms Regulation (ITAR) regulations—has leveled the playing field, now allowing many nations to compete favorably with the United States in space; and (3) the need for the United States to sustain legacy space systems and acquisition organizations has sacrificed agility common to potential adversaries who can buy and operate that which is most modern and tailored to rapidly changing user needs.

Many of these actions are favorable to the management and organization of NSS. But many others represent a family of challenges that require firm and prompt action if the United States is to sustain a technological lead that enhances national security.

Findings, Observations, and Recommendations

The Panel observed many pockets of excellence and positive trends in the course of its study. Among these, we note the long series of successful space launches, the growing employment and capability of space-based commercial communications and imagery, a clearer and stronger focus of USSTRATCOM on space, support being provided everyday to our national leadership and warfighters, and tireless efforts by those implementing our NSS programs to achieve mission success. There are many dedicated leaders, managers, and personnel who must be credited for their dedication and good work across the NSS enterprise.

Nevertheless, much of our success was realized with an NSS management and organization that was significantly different from what we observe today.

NSS performance shortfalls, vulnerabilities, and potential gaps in capabilities are emerging, and the future is of grave concern. Many of our capabilities are thin and fragile. Important space-based capabilities are provided today by on-orbit assets that are well beyond their design lives, while many new generation satellites designed to replace them have experienced unacceptable cost and schedule growth, technical performance problems, and cancellations.

Many of the necessary actions to address these adverse trends, such as those identified by the 2001 Space Commission and the 2003 Defense Science Board Study on Space Acquisition, have not been taken. Indeed, recent DoD and Intelligence Community reorganizations have further diffused responsibilities for space. Leadership for strategy, budgets, requirements, and acquisition across NSS is fragmented, resulting in an absence of clear accountability and authority –"*no one's in charge*." Additionally, career-management practices are often counterproductive, and the limited technical talent pool is insufficient.

Fundamental change is needed to correct these problems. The panel advocates top-to-bottom reform to bring stronger leadership and improved management for National Security Space. This entails actions in four areas: (1) National Space Strategy, (2) Leadership, (3) Organization and Management, and (4) government expertise for developing and acquiring space systems.

National Space Strategy

Presidential leadership is needed to establish a common focus on space priorities across the organizations responsible for National Security Space. Important new programs such as National Polar-orbiting Operational Environmental Satellite System (NPOESS) and the recently cancelled Space Radar program have been hamstrung by the inability to resolve interagency differences in setting achievable requirements and resource priorities. Capabilities for Space Situational Awareness and Space Control will require collaboration among several federal agencies. A national strategy with an oversight mechanism is needed to unify efforts, set priorities, establish roles and responsibilities, and adjudicate issues.

***Recommendation 1*. The President should establish and lead the execution of a National Space Strategy** *that assures U.S. space preeminence, integrates the various participants, establishes lines of authority and accountability, and delineates priorities. To implement the strategy, the President should reestablish the National Space Council, chaired by the National Security Advisor, with the authority to assign roles and responsibilities, and to adjudicate disputes over requirements and resources.*

Leadership

Within the DoD and Intelligence communities, the leadership for National Security Space is currently fragmented and unfocused. Authorities and responsibilities are spread across numerous organizations, including many within the Office of the Secretary of Defense (OSD) [Under Secretary of Defense (USD)/Intelligence; USD/Acquisition, Technology, and Logistics; USD/Policy; and the Assistant Secretary of Defense (ASD)/Networks & Information Integration], USAF, USN, USA, USMC, DARPA, MDA, and NRO. Although the Secretary of the Air Force is the DoD Executive Agent for Space, its authorities have been diminished from those envisioned by the 2001 Space Commission. Moreover, as perceived by many, its stewardship of space does not enjoy the same priority as other traditional Air Force missions. The customers who use space capabilities observe that there is no responsible official who looks across all the available resources and capabilities to seek the best solution, whether from the military, intelligence, civilian, or commercial sector. This represents a critical need.

A strong executive is needed to integrate customer capability needs, set resource priorities, evaluate alternatives, develop and advocate investment plans and programs, and formulate and execute budgets for National Security Space. This executive must be responsive to DoD, the Intelligence Community, and other customers for space

capabilities, and must serve as a focal point for coordinating efforts across the federal government.

Recommendation 2. Establish a National Security Space Authority (NSSA). *The Director of NSSA should be assigned the rank of Under Secretary of Defense for Space and also serve as Deputy DNI for Space, reporting to the Secretary of Defense and the Director of National Intelligence. The Director, NSSA will be the Executive Agent for Space with sole authority, responsibility, and accountability for the planning and execution of the NSS program, including acquisition. Key functions will be defining and formulating the Major Force Program-12 Budget*[1] *and serving as the focal point for interagency coordination on NSS matters. Analytical and technical support from a National Security Space Office-like organization augmented with Intelligence Community expertise will be required to effectively execute this responsibility.*

Organization and Management for Providing NSS Capabilities

There are insufficient numbers of experienced space acquisition personnel to execute the responsibilities of the Space and Missile Systems Center (SMC) and the National Reconnaissance Office (NRO). Both organizations suffer from the long-term ill effects of the reductions in government technical personnel made during the 1990s, and neither has instituted necessary career development and management practices. Strengthened management focus is needed to identify, develop, assign, and promote acquisition personnel who are "steeped in space."

Lack of requirements rigor, technical performance problems, cost growth, and schedule delays have plagued U.S. space programs. Programs such as the Future Imagery Architecture, Transformational Communications Satellite System (TSAT), and Space Radar exemplify the failures in existing leadership and management practices to define, fund, and execute new satellite programs. Strong management is needed to implement proven acquisition practices. This will require reinvigorating government capabilities for systems analysis, costing, and budgeting in order to define more realistic programs. Throughout the NSS enterprise, improved processes are needed to ensure that requirements are consistent with available resources. Continuity of key personnel is essential for program success.

At the same time, the traditional focus of the NRO on innovation has been diverted by the need to keep aging on-orbit assets operating. The needed focus on innovation can be restored by rebalancing sustainment, operations, and routine production tasks within a unified organization.

Recommendation 3. Create a National Security Space Organization (NSSO). *Assign to it the functions of the National Reconnaissance Office, the Air Force Space and Missile Systems Center, the Air Force Research Laboratories Space Vehicles*

[1] The FY 2008 Authorization Act (Sect 8111) directs DoD to establish a Major Force program (MFP-12) for Space, and designate an OSD official to provide overall supervision of the preparation and justification of Program recommendations and budget proposals to be included in MFP-12.

Directorate, the operational functions of the of Air Force Space Command (AFSPC), and Army and Navy organizations now providing space capability . The merged organization will report to NSSA for policy, requirements, and acquisition and AFSPC for organization, training, and equipping responsibilities. Spacecraft command, control, and data acquisition operations as well as launch operations will be NSSO responsibilities.

Recommendation 4. Change AF and IC human resource management policies for space acquisition professionals in order to emphasize technical competence, experience, and continuity. *Establish a career education, training, and experience path for the development of engineers and managers who are steeped in space. Establish as the norm that space project management personnel be in a given position for sufficient time to maximize project success—four years or more—without adverse effect upon an individual's career. Support should be given to the current Space Cadre management and training program being implemented by the Services, as exemplified by the USAF through AF Space Command and Air Education and Training Command.*

Concluding Remarks

The panel believes that a major top-to-bottom overhaul is needed to restore the vitality of National Security Space, and regain and sustain the competitive advantages afforded the United States by our space programs. The resulting organization would foster greater unity of effort by establishing a strategy framework at the national level, consolidating authority in the National Security Space Authority, and integrating the organization and management of space capability providers in the National Security Space Organization. If structured as envisioned, this unified leadership and management structure for National Security Space would better serve the needs of DoD, the Intelligence Community, and other customers than does the system in place today. This call to action has the highest level of urgency.

LEADERSHIP, MANAGEMENT, AND ORGANIZATION FOR NATIONAL SECURITY SPACE

I. INTRODUCTION

A. Panel Tasking

This report, commissioned by the Department of Defense at the direction of the Congress, provides an independent review and assessment of DoD organization and management of National Security in Space. The Independent Assessment Panel (IAP) was formed by the Institute for Defense Analyses in October 2007, and its fact-finding activities were completed in May 2008.[1] In response to the congressional direction, the panel assessed the current NSS stewardship across the federal government and identified the actions that can and should be taken to:

1. strengthen the organization and management of the NSS Program;
2. improve and enhance the relationship of intelligence space and military space; and
3. enhance the quality of the work force for conceiving, designing, building, and operating space-based capabilities.

The panel met with the heads of the major organizations responsible for National Security Space, along with numerous government, industry, and independent experts.[2] The panel also considered the findings and recommendations of relevant studies, including the Commission to Assess United States National Security Space Management and Organization (referred to in this report as the 2001 Space Commission) and the 2003 Defense Science Board Task Force on Acquisition of National Security Space Programs.

The panel members are unanimous in our conviction that the leadership and management of NSS programs must improve significantly, or the United States will lose space preeminence and the attendant national advantage.

After decades of success and clear leadership in space, our ability to develop and field new capabilities is plagued by a persistent pattern of overruns, delays, and cancellations, while global space technology spreads and other nations are vigorously pursuing competitive space-based capabilities. From a military, intelligence,

[1] The congressional charter is provided in Appendix A. The biographies of the Independent Assessment Panel members are provided in Appendix B. Appendix C identifies the government liaison officials and the IDA study team members who supported the panel.

[2] Appendix D lists the organizations and individuals who met with the panel.

commercial, and scientific perspective, there can be no doubt that continued leadership in space is a vital national interest. However, the continuation of U.S. space leadership now requires a renewed national commitment to strong stewardship.

We advocate top-to-bottom initiatives to strengthen leadership, management, and organizations for National Security Space. Over the last two decades, numerous space commissions/panels have reviewed the management and leadership of national security space, and we have tried a multitude of solutions. But the current state of National Security Space clearly indicates that a bold step is now required. The attempts to make refinements have failed because they have not attacked the fundamental need for an organizational structure that fosters rational decisions and a technically competent and experienced workforce that can execute space acquisition programs. The fragile state of today's on-orbit NSS architecture, the scale of the resources associated with NSS, and the ever-increasing importance of NSS to U.S. leadership—not just our military and intelligence communities—mandate aggressive action. As a nation, we must continue to have a strong, integrated space program.

B. Leadership in Space is a Vital U.S. Advantage

The IAP's assessment, our findings, and our recommendations for aggressive action are based on the understanding that space-based capabilities are essential elements of the nation's economic infrastructure and provide critical underpinnings for national security. Space-based capabilities should not be managed as derivative to other missions, or as a diffuse set of loosely related capabilities. Rather, they must be viewed as essential for restoring and preserving the health of our NSS enterprise. NSS requires top leadership focus and sustained attention.

The U.S. space sector, in supporting commercial, scientific, and military applications of space, is embedded in our nation's economy, providing technological leadership and sustainment of the industrial base. To cite one leading example, the Global Positioning System (GPS) is the world standard for precision navigation and timing, directly and indirectly affecting numerous aspects of everyday life. But other capabilities such as weather services; space-based data, telephone and video communications; and television broadcasts have also become common, routine services. The Space Foundation's 2008 Space Report indicates that the U.S. commercial satellite services and space infrastructure sector is today approximately a $170 billion annual business.

Manned space flight and the unmanned exploration of space continue to represent both symbolic and substantive scientific "high ground" for the nation. The nation's investments in the International Space Station, the Hubble Telescope, and scientific probes such as Pioneer, Voyager, and Spirit maintain and demonstrate our determination and competence to operate in space. They also spark the interest of the technical, engineering, and scientific communities and capture the imaginations of our youth.

The national security contributions of space-based capabilities have become increasingly pervasive, sophisticated, and important. Global awareness provided from space—including intelligence on the military capabilities of potential adversaries, intelligence on the proliferation of weapons of mass destruction, and missile warning and defense—enables effective planning for and response to critical national security requirements.

The communications bandwidth employed for Operation Iraqi Freedom today is over 100 times the bandwidth employed at the peak of the first Gulf war. Approximately 80 percent of this bandwidth is being provided by commercial satellite capacity.

Military capabilities at all levels—strategic, operational, and tactical—increasingly rely upon the availability of space-based capabilities. Over the recent decades, navigation and precision munitions were being developed and refined based on space-based technologies. Space systems, including precision navigation, satellite communications, weather data, signals intelligence, and imagery, have increasingly provided essential support for military operations, including most recently from the very first days of Operation Enduring Freedom in Afghanistan. Similarly, the operational dominance of coalition forces in the initial phase of Operation Iraqi Freedom provided a textbook application of the power of enhancing situational awareness through the use of space-based services such as precision navigation, weather data management, and communications on the battlefield. These capabilities are continuing to provide major force-multipliers for the soldiers, airmen, sailors, and marines performing stabilization, counter-improvised explosive device (IED), counterterrorism, and other irregular warfare missions in Iraq, Afghanistan, and around the world.

As the role and importance of space-based capabilities for military operations grows, the users are demanding that they be more highly integrated with land-, sea-, and air-based capabilities. During the first decades of the Cold War, the premier applications of space could be exemplified by the highly specialized systems that enabled exposed photographic film to be parachuted from space, developed and analyzed by intelligence experts, and rushed to the situation room in the White House for strategic purposes. Space-based capabilities were uniquely capable of providing visibility into areas of denied access. Today and in the future, the employment of space-based capabilities will increasingly support military operations. And for all users, the employment of space-based capabilities will be more accurately exemplified by sophisticated database searches of a range of relevant commercially available and specialized national security digital information, using tools that integrate such information across all sources.

For all the reasons cited here—military, intelligence, commercial, scientific—there can be no doubt that continued leadership in space is a vital national interest that merits strong national leadership and careful stewardship.

II. ISSUES IN NATIONAL SECURITY SPACE

The IAP's review of the stewardship of National Security Space and recent performance trends finds that, in spite of the many advances and successes the nation has achieved in space, there is great cause for concern. This section details major NSS issues, which fall into four areas: (1) acquisition problems, (2) the continued separation of military space and intelligence space, (3) growing threat capabilities and space technology proliferation, and (4) NSS organizational inefficiencies.

A. NSS Acquisition Continues to Generate Failures, Delays, and Overruns

A major concern in the Congress that triggered the request for this review is the pervasive pattern of delays, overruns, and satellite system failures over the past decade. These acquisition problems have forced the United States to continue to rely on the previous generation of on-orbit satellites, many of which are operating beyond their original design lives. This has increased the fragility of our on-orbit constellations, not only posing a serious risk of compromising some capabilities, but causing unacceptable delays in the deployment of needed new technologies and capabilities. Billions of dollars have been lost and timely capability denied to our warfighter and the Intelligence Community in the past decade because of acquisition failures.

The persistent space acquisition problems have been well documented by the Government Accountability Office and other independent studies.[3] Taken together, the Future Imagery Architecture, Space-Based Infrared Satellite Network (SIBRS) High, Space Radar, and NPOESS programs exemplify the problems with cost overruns, delays, quantity reductions, and cancellations. As a rough generalization, several of the more troubled NSS acquisition programs are providing substantially reduced capability, at about *twice* the cost, about *six years late*.

Based on the IAP's visits to NRO and the Space and Missile Systems Center, and on the testimony of senior experts, the IAP finds that there is no lack of individual efforts to execute NSS acquisition programs effectively. But these good efforts are offset by fundamental problems that have hamstrung the acquisition of NSS systems.

- ***There are insufficient numbers of technically competent and experienced space acquisition personnel to execute the responsibilities of the Space and Missile Systems Center (SMC) and the National Reconnaissance Office (NRO).*** Both organizations suffer from the long-term ill effects of the reductions in government technical personnel made during the 1990s. At the Space and Missile Systems Center, the number of educated and trained scientists and engineers was reduced by 40 percent. Both military and intelligence space programs have had

[3] See as recent examples: Christina T. Chaplain, "Major Space Programs Still at Risk of Cost and Schedule Increases," General Accountability Office GAO 08 552T, March 2008. Natalie W. Crawford, "Developing Space-Based Capabilities: Has DoD Lost the Recipe?" RAND Corporation, January 2008.

remarkably poor track records in executing acquisition programs since that time. Neither has instituted the necessary career development and management practices to fully recover. The reduced availability of government personnel with the necessary technical competence has sharply reduced the government's capability to acquire space systems and is believed by many experts to be a major cause of acquisition program failures.

In addition, continuity of key personnel is essential for program success. It is critical that the available competent people be assigned with tour lengths sufficient to provide needed continuity.

- ***Lax requirements discipline, technical performance problems, cost growth, and schedule delays have plagued U.S. space programs.*** As noted above, persistent program delays, overruns, and cancellations exemplify how existing leadership and management practices have failed to define, fund, and execute new satellite programs. Strong management is needed to implement proven acquisition practices.[4] This will require reinvigorating government capabilities for engineering systems analysis, costing, and budgeting in order to define more realistic programs. Throughout the NSS enterprise, improved requirements processes are needed to ensure that acquisition requirements are consistent with available resources.

In spite of the concerns expressed, the panel observed many pockets of excellence and positive trends in the course of its study. Among these, we note the long series of successful space launches, the growing employment and capability of space-based commercial communications and imagery, USSTRATCOM's clearer and stronger focus on space, valuable support being provided everyday to our national leadership and warfighters, and tireless efforts by those implementing our NSS programs to achieve mission success. There are many dedicated leaders, managers, and personnel who must be credited for their dedication and good work across the NSS enterprise.

Nevertheless, our current success was realized with an NSS management and organization that was significantly different from what we observe today.

B. The Separation of Military Space and Intelligence Space Has Outlived Its Historical Purpose

Two major organizations—the NRO and SMC—have been responsible for the bulk of spacecraft systems of the National Security Space Program. Other federal agencies, including NASA and NOAA, also contribute substantially to NSS capabilities.

[4] Needed improvements are detailed in the Defense Science Board/Air Force Scientific Advisory Board Joint Task Force on "Acquisition of National Security Space Programs," May 2003.

There was good reason to establish and manage the NRO and military space programs as distinct activities at their inception. However, with the end of the Cold War and the reduced veil of secrecy surrounding the NRO space programs—the initial rationale for the separation of the NRO—has diminished. At the same time, the current shortage of available skilled and experienced government space expertise, the lack of a common focus on priorities, the lack of unity of effort in instituting needed acquisition process improvements, and the persistent "cultural divide" between the military and intelligence space communities have increased the penalty of maintaining separate NRO and military space organizations to unacceptable levels. In combination with these issues, there is an ever-growing commonality of the customer-base served by the NRO and the Air Force that demands substantial unity of effort in devising new space systems and associated dissemination capabilities.

At its outset, the NRO was established in 1960 to conceive, research, develop, build, and operate advanced space-based intelligence gathering systems. Its very existence was classified, and it was to develop and operate the new "Corona" satellites, among other still-classified satellite systems. The NRO was to be a joint operation between the Central Intelligence Agency (CIA) and the military, primarily the Air Force. The intelligence function of the NRO made the CIA the inevitable principal participant at the beginning, and the agency developed a first-rate capability to conceive, develop, and build reconnaissance spacecraft. The NRO was created as a defense department agency, with a budget jointly determined by the Secretary of Defense and the Director of Central Intelligence (DCI) and advocated by the director of the NRO. An Executive Committee (EXCOM) was created to adjudicate any disputes between the CIA and the Department of Defense.

There is no question that the NRO played an absolutely critical part in securing victory for the United States during the Cold War. Information obtained from satellites was crucial in resolving several major crises during this time that might have led to a shooting war. None of the major arms control agreements reached during the Cold War would have been possible without information provided by the "national technical means of verification." The fact that the NRO itself was classified was an extremely important factor in the technical success achieved by the organization. The classification of the NRO enabled it to employ streamlined procurement procedures that were not available to mainline DoD acquisition organizations. The fact that the NRO was a secret organization gave it an elitist aura that made it professionally attractive to some exceedingly competent people.

All of this changed after the end of the Cold War in 1991. In September 1992, the existence of the NRO was declassified. It is sometimes more difficult to use some of the streamlined procurement methods that were in place in the early days of the NRO. Furthermore, as the NRO became just another federal agency, it became more difficult to persuade highly competent scientists and engineers to join the agency. Some believe that a case can be made to attribute the technical failures that the agency has experienced in recent years to this circumstance.

At the same time that the NRO achieved success with the "Corona" program, the military services were each beginning to use orbiting satellites for various purposes. The fact is that the very first American spacecraft successfully launched on January 31, 1958, was built by agencies of the U.S. Army in response to the Soviet Sputniks. The launch vehicle, a modified Redstone rocket, was developed at the Army's Redstone Arsenal and the spacecraft was developed by Cal Tech's Jet Propulsion Laboratory, which was an Army contract laboratory at the time.

The Air Force was given responsibility for developing Intercontinental Ballistic Missiles in 1952. An organization called the Western Development Division in El Segundo, California, was assigned responsibility for the creation of the Atlas, Thor, and Titan missiles. All of these also were employed as launch vehicles for military and NRO satellites. During the 1950s, the Western Development Division was also responsible for initial development of the WS-117L satellite system that was the precursor to the Corona program. Since that time, the organization has gone through several name changes and is currently the Air Force Space and Missile Systems Center, or SMC.

The Air Force launched its first satellite in the early 1960s (the "Tiros" weather satellites in 1960). During that period, the Navy also launched a satellite (the "TRANSIT" Navigation Satellite). These initial steps were rapidly followed by others, the Navy concentrating on navigation and the Air Force on communications and weather satellites.

Starting in the late 1960s and then in the 1970s and 1980s, three important new technologies were developed and then fielded aboard Earth orbiting satellites:

- The Global Positioning System (GPS)
- Infrared sensors aboard satellites to detect missile launches and to provide initial trajectories (DSP)
- Space-based imagery

These technologies began to blur the line between the Intelligence Community and military users of space, because they had significant military value as well as the ability to facilitate and gather national-level intelligence.

The GPS system proved to be extremely useful in making very accurate navigation for aircraft possible during the 1980s. Eventually, the GPS system became accurate enough to be useful for the targeting of weapons as well. In the spring of 1999, for example, there was a massive 11-week air campaign with the objective of ejecting Serbian military forces from the province of Kosovo. After 23,000 weapons were dropped on Serbia and Kosovo, Serbian President Slobodan Milosevic resigned. Fewer than 1,000 casualties were due to collateral damage. It was a near-perfect operation with a military victory and minimal casualties. Without GPS this could not have happened.

In 1991, during the conflict in the Persian Gulf, the Iraqis used modified Soviet SCUD missiles to attack both Riyadh and Tel Aviv. The satellites of the Defense

Support Program (DSP) were mobilized to detect the Iraqi SCUD missile launches, determine the initial trajectories, cue available defensive systems, and provide early warning to the people in the target cities. The DSP satellites, in this instance, clearly performed a vital combat support mission.

In the 1991 Desert Storm land campaign, GPS enabled US forces to maneuver over 300 km across featureless desert at unprecedented speeds in order to cut off and destroy Iraqi forces attempting to retreat from Kuwait. It was this movement, the famous "left hook," which led to the decisive defeat of the Iraqi Republican Guard. Without the capability provided by GPS, a coordinated maneuver of such magnitude and speed could not have been possible.

Today a very large number of NRO products are being provided in support of current military operations. As the military uses of NRO capabilities expand in volume and importance, the organization for National Security Space must evolve to ensure that both NRO and military space activities are sufficiently integrated to effectively acquire needed capabilities and to provide excellent operational support for military operations, while continuing to meet the needs of Intelligence Community customers.

Both the NRO and the military space communities have strong cultures and can be justifiably proud of their accomplishments. Nevertheless, the IAP finds that continuing the historical separation of these cultures will greatly inhibit their ability to provide integrated support for military and Intelligence Community customers, and it will effectively guarantee failure in achieving the necessary improvements in acquisition program performance described above in Section A.

C. Space Technology Is Proliferating Globally, Posing Growing Threats to U.S. Assets

The progress in addressing the vulnerability of U.S. space assets has not kept pace with growing threat capabilities; consequently, the vulnerability of our space assets continues to grow. A critical factor in the developing threat to U.S. space supremacy is the accelerating proliferation of space technology. The growth in international space design, production, and operations spurred in part by U.S. restrictions on the export of space technology [under the International Traffic in Arms Regulation (ITAR)] is leveling the playing field so that many nations now compete with the United States in space.

1. Technology Proliferation and Declining U.S. Space Industry Leadership

A recent study by the Center for Strategic and International Studies (CSIS) on the health of the space industrial base concluded: "There is rapid growth in foreign space capabilities and the U.S. does not control their proliferation." Indicators of the global access to space technologies cited in the report include:[5]

[5] CSIS, "Health of the U.S. Space Industrial Base," February 2008, p. 46.

- 12 nations now launch their own satellites.
- six nations own positioning/navigation systems (up from two in 1999)
- 27 nations have launched their own reconnaissance and earth observation satellites (up from 14 in 1999)
- 38 nations control their own communications satellites

The U.S. space industrial base is heavily dependent on national security budgets. In 2006, about 60 percent of revenues came from domestic national security programs. Domestic non-defense accounted for about 30–35 percent, and the rest was foreign. Government NSS funding, which has historically driven innovation, is not providing the same impetus for innovation as in the past. Increasingly, NSS investment programs and personnel have been forced to focus on sustaining legacy space systems and acquisition organizations. This undermines our agility, while potential adversaries can buy and operate modern systems tailored to their needs.

In parallel, the space industrial base has shrunk dramatically through aggressive consolidation since the end of the Cold War. Today the "big four" space contractors (Lockheed-Martin, Boeing, Raytheon, and Northrop-Grumman) comprise the combined engineering and production personnel and facilities of over 50 firms that were operating independently in the mid-1990s.[6]

The CSIS review of the U.S. space industrial base cited above found that the ITAR restrictions have had a counterproductive effect on U.S. space competitiveness. These restrictions have limited the ability of U.S. firms to engage in overseas markets, including limitations on technology and reduced responsiveness due to government approval cycles. But these restrictions have not effectively limited the proliferation of space technologies and the access of foreign firms to competitive space technologies. As a consequence, highly competitive foreign suppliers have emerged who have greater flexibility to compete aggressively than do U.S. firms, and the U.S. share of global space markets is in decline. The IAP supports the recommendations of the CSIS panel to revisit the ITAR and relax those aspects that are counterproductive to U.S. competitiveness.

2. Threats and Vulnerabilities

Potential adversaries inevitably will employ available advanced capabilities to challenge current U.S. preeminence in space operations. The Russians are still the most capable space-faring people aside from us. They are not our enemy, and indeed we are working together with the Russians on the International Space Station. Still, available Russian technologies pose the most important potential threat to American space operations. Over the years, they have developed an extensive stable of capable launch

[6] LTC John L. Thurman, "National Security Space Industrial Base Study," OSD Cost Analysis Improvement Group, September 19, 2006. See also Final Report of Commission on the Future of the United States Aerospace Industry (Walker Report, 2002) on aerospace industry consolidation.

vehicles, and in 1977 they demonstrated their capability to shoot down Earth orbiting satellites.

China is clearly on the path to developing the capability to conduct sophisticated space operations. In 1964, they detonated their first nuclear weapon. This was followed by the "Long March" series of missiles, built first to carry nuclear weapons and then to achieve the capability to reach Earth orbit. Since 1999, China has initiated a national navigation system, launched a 3-meter-resolution imagery satellite, conducted its first manned space flight, exported a satellite to Nigeria, and launched its first lunar probe.[7] China also demonstrated the capability of an anti-satellite weapon when it destroyed one of its aging weather (Fengyun 1-C) satellites on January 11, 2007.

In assessing the potential vulnerability of U.S. space systems, it is also essential to factor in potential adversaries' growing cyber-attack capabilities, as well as the potential employment of land-based directed energy weapons that could attack satellites in low-earth-orbit.

At this time, we do not believe either Russia or China poses a major threat, but the United States must be prepared to face adversaries who have obtained the available advanced capabilities. Both the Chinese and the Russians have an interest in common—to eventually remove the United States from its current dominant military and economic position in the world. They will continue to develop capabilities to deter or deny the employment of U.S. space assets, and they may also use surrogates to accomplish this objective. Continued investments in technical capabilities to attack space systems, and the proliferation of associated technologies, signal the capability and intent to intimidate, deter, and perhaps attack space-based systems. Ultimately, the United States must be prepared to face challenges to our freedom of action in space, and perhaps actual conflict in space.

3. U.S. Military Actions to Address Space Vulnerabilities

DoD has made a number of major realignments in the military command structure since the 2001 Space Commission, including the assignment of space responsibilities to U.S. Strategic Command upon the decommissioning of the U.S. Space Command and the creation of Northern Command. Commander U.S. Strategic Command is assigned space responsibility in the Unified Command Plan. In support of USSTRATCOM, the Joint Force Component Command for Space (JFCC-SP) was established in July 2006 with the 14th Air Force (AFSTRAT) Commander dual-hatted as the Commander JFCC Space. The JFCC is taking the lead in establishing concepts of operations and plans for space operations, strengthening space situational awareness, and identifying other capabilities needed to reduce the vulnerabilities of U.S. space-based capabilities. To better coordinate military and intelligence space operations, the operations centers of the JFCC and the NRO are exchanging senior personnel and beginning to collaborate closely on space operations.

[7] CSIS, "Health of the U.S. Space Industrial Base," February, 2008, pg. 22.

These are important steps, but there nevertheless remain major challenges in establishing and executing the strategies, concepts of operations, plans, and programs needed to address the vulnerability of U.S. space systems. Because the programmatic responsibilities for space protection capabilities are spread across many agencies, it will be extremely difficult in the current organizational structure to coordinate the needed contributions and to discipline adherence to overarching policies and practices necessary to address vulnerabilities across the NSS enterprise. The improvements in military planning need to be complemented by cohesive resource and acquisition programs across the responsible agencies.

The panel concludes that the risk of a space "Pearl Harbor," as described by the 2001 Space Commission, has increased markedly, without an adequate response across National Security Space. There is a critical need for better space situational awareness as well as credible deterrence and response options. USSTRATCOM and AFSPC are providing needed military leadership. Commensurate leadership is needed for the investment programs that must be coordinated across the agencies responsible for providing space-based capabilities.

D. Organizational Changes Have Weakened NSS Leadership and Management

The 2001 Space Commission recommended several organizational changes to strengthen the leadership and organization for National Security Space. These included a framework for integrating activities across the government agencies with responsibilities for NSS; closer coordination between the Secretary of Defense and the Director of Central Intelligence on space matters; the creation of an Under Secretary of Defense for Space, Intelligence, and Information; and the establishment of a strong Executive Agent for Space in the USAF with management responsibilities for both military space and the National Reconnaissance Office.[8] The Commission saw these actions as steps toward a much more unified NSS enterprise in support of both the military and the Intelligence Community.

Several of the Commission's recommendations were acted on. The most significant was the designation of the Secretary of the Air Force as the DoD Executive Agent (EA) for Space. The Secretary of the Air Force further delegated the EA for Space to the Under Secretary of the Air Force. The EA for Space was assigned acquisition authority for military space programs and was "triple hatted" as the Under Secretary of the Air Force (USecAF), the DoD EA for Space, and the Director of the NRO. The purpose was to provide leadership for integrating their programs and provide strong, unified leadership for needed acquisition process improvements. But other key actions were not taken. These included establishing a White House leadership framework, creating a DoD Under Secretary with space responsibilities, and establishing a firm budget category for space administered by the EA for Space.

[8] Marc J. Berkowitz, "Implementation Assessment of the 2001 Space Commission's Recommendations," (Briefing and memorandum for the IAP on NSS Organization and Management), January 2008.

Following the attacks on September 11, 2001 (9/11), as the government focused on the global terrorist threat, Operation Enduring Freedom, and Operation Iraqi Freedom, the impetus for the recommended changes in space organization and management waned as priority shifted toward initiatives to strengthen the organizations for intelligence. The Director of National Intelligence (DNI) was established to bring greater unity across the intelligence agencies. Within DoD, an Under Secretary for Intelligence (USD(I)) was created and in that process DoD also created an Assistant Secretary for Networks and Information Integration (ASD(NII)).

While there are some good reasons for the organization changes that have occurred since 9/11, the effect of these changes has been to diffuse responsibilities for National Security Space. DoD officials indicate that any decisions on space require extensive consultations and coordination across a range of organizations within the Office of the Secretary of Defense (OSD), Services, and the Interagency. Space is being managed as a decentralized supporting capability, and the result is a diffuse structure that is not serving the nation well. The current situation is described in the following sub-sections.

1. National Space Strategy

At the national level, the National Security Council's Space Policy Coordinating Committee was established to coordinate national space policy matters that affect federal government agencies. Within DoD, the Information Operations and Space Executive Committee is the principal forum for addressing space activities and issues. There are other committees and councils, such as the Space Partnership Council (an informal group with representation at senior levels), that review interagency concerns. However, none of these organizations has provided the decision-framing forum necessary to support the Presidential leadership needed to establish a common focus on space priorities across the organizations responsible for National Security Space. This has greatly hindered progress in some areas. Essential NSS capabilities commonly rely on the coordinated efforts of a wide range of government and non-government organizations.

- *Military space* responsibilities are shared among DoD components including the Office of the Secretary of Defense, Joint Staff, Defense Agencies, Combatant Commands, the Military Services, MDA, and DARPA activities involving space-based capabilities for communications, early warning, weather, surveillance, space control, and precision navigation and timing as well as launch, space ranges, and R&D.
- *Intelligence space* responsibilities include reconnaissance and related satellite system development, acquisition, and operations as well as R&D.
- *NOAA* responsibilities include weather and remote sensing.
- *Commercial space* forms the industrial base supporting government space programs as well as providing commercial services in the form of satellite communications and remote sensing systems.

- *NASA* is primarily responsible for civil space activities; however, its overall technology efforts and project management support contribute significantly to NSS activities.
- *Other* organizations with space responsibilities include the Department Of Energy and the National Labs; the Department of Agriculture (U.S. Geological Survey and LANDSAT); the Department of Homeland Security (National Applications Office); the National Science Foundation (Space Weather), and the satellite systems and activities of our allies.

Lacking an effective national-level leadership mechanism, important new programs such as NPOESS and Space Radar have been hamstrung by an inability to resolve interagency differences in setting achievable requirements and resource priorities. Emerging requirements for new capabilities for Space Situational Awareness and Space Control will also require collaboration among several federal agencies. The current administration has established a U.S. National Space Policy, signed by the President on August 31, 2006. But an overarching space strategy is sorely needed to support the National Space Policy. This strategy needs to be accompanied by an oversight mechanism to assure implementation and funding, unify efforts, set priorities, establish roles and responsibilities, and adjudicate issues.

2. EA for Space

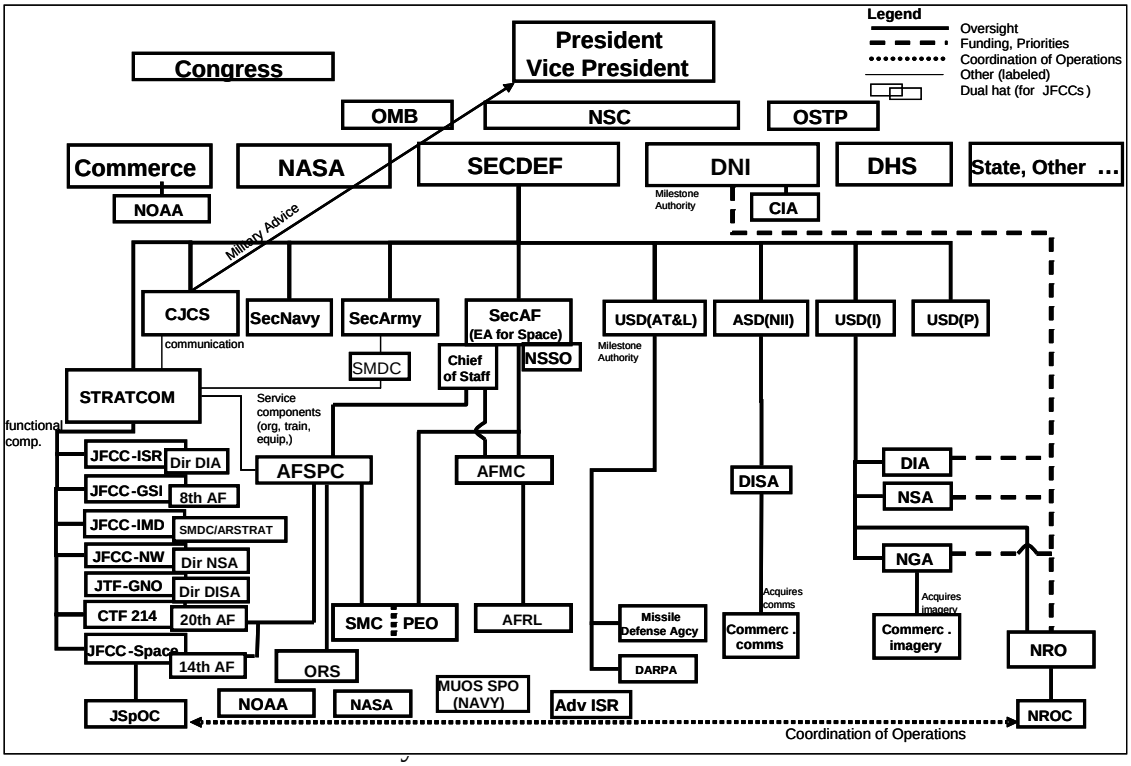
The EA for Space was never given the full authority envisioned by the 2001 Space Commission. The EA lacked budget authority. Budget reforms within the Pentagon created "capability portfolios" designed to bring focus on the "capability outputs" produced by defense programs; consequently, budget advocacy for space programs was distributed across multiple investment portfolios. In addition, the recommended Under Secretary of Defense for Space, Information, and Intelligence was never established to provide space oversight within OSD. Instead, the ensuing reorganizations created new power centers with responsibilities for space, and often competing interests. (DoD had created a virtual space major force program to track expenditures on space programs, but this has not provided an effective framework for understanding, advocating, or managing space programs.)

The consolidated authorities of the EA for Space lasted four years. After the first EA for Space left the government, the Under Secretary of Defense (AT&L) rescinded the acquisition milestone decision authority to the EA for Space in March 2005. In July 2005, a separate NRO Director was named from the Intelligence Community. Many of the experts who met with the IAP described a wide "cultural divide" between the very different and strong cultures of military space and intelligence-community space. Many believed the EA for Space was afforded neither the authority nor the time necessary to bridge this divide.

3. The Current Organization for NSS

Figure 1, below, shows the organizations involved in National Security Space today. Clearly, the intent of the 2001 Space Commission to unify the NSS enterprise has not been achieved.

Figure 1. The Current Organization for National Security Space



- There is no standing forum or mechanism below the level of the President to coordinate efforts among the agencies responsible for NSS or to adjudicate differences over requirements and resources:
    - The predominant capability providers are NRO and SMC, which today have parallel requirements and funding paths within the IC and the DoD.
    - Space capability providers in NOAA, NASA, and other federal agencies have their own requirements, funding, and reporting chains.
- Within DoD, there is no common authority below the Secretary of Defense to integrate space acquisition programs and resources, or to adjudicate differences
    - There are separate requirements and funding chains within the Pentagon for the Air Force, NRO, DARPA, MDA, Navy, and Army, commercial satellite communications, and commercial imagery.
- A structure for coordinating space operations between the DoD and Intelligence Community is emerging and is thought to be on target.

III. IMPROVING NSS LEADERSHIP, MANAGEMENT, AND ORGANIZATION

In view of the major trends and issues identified in the IAP's review, we see major reasons why a new, strengthened organization for the NSS Program is needed:

- The credible threat by available Russian and Chinese technologies to deny the U.S. employment of space assets.
- System failures resulting from the declining technical and management capability of the NRO and the SMC and from the organization of the military space program.
- The longer-term trend toward an ever-heavier dependence on space systems for the support of our military operations, which will make it increasingly attractive for our opponents to disrupt their capabilities or destroy them.

A. Principles for Reform

Several principles should guide the development of the new NSS organization:

- The President must set policy objectives and establish a strategy and mechanisms to attain the objectives.
- The Secretary of Defense and the Director of National Intelligence both have equally important interests in a successful National Security Space enterprise.
- The NSS Program should have a single identifiable leader.
- Combat support is now a much more important function of space operations than it has been in the past.
- The Air Force is the military Service that should have the principal role in organizing, training, and equipping the people in the NSS Program.
- CIA should remain involved in the National Security Space enterprise.
- The technical and management competence of the people in the NSS Program must be significantly improved.
- Tested and proven management practices must be adopted across the board in the NSS Program.

B. Recommendations

The IAP offers the following recommendations in accordance with these principles. Our review of the recommendations and intent of the 2001 Space Commission, and the ensuing actions, leads us to conclude that fundamental structural

changes are needed to effect lasting improvement. We therefore advocate more fundamental changes in structure than were proposed by the 2001 Space Commission.

Recommendation 1. ***The President should establish and lead the execution of a National Space Strategy*** *that assures U.S. space preeminence, integrates the various participants, establishes lines of authority and accountability, and delineates priorities. To implement the strategy, the President should reestablish the National Space Council, chaired by the National Security Advisor, with the authority to assign roles and responsibilities and to adjudicate disputes over requirements and resources.*

Presidential leadership is needed to establish a common focus on space priorities across the organizations responsible for National Security Space. A national strategy with an oversight mechanism is needed to unify efforts, set priorities, establish roles and responsibilities, and adjudicate issues. Expert witnesses who met with the IAP observed that in the current executive branch structure, space lacks a coherent voice and leadership at the national level. They identified several reasons why efforts need to be better integrated at the national level. These may be addressed by assigning responsibilities such as the following to the National Space Council:

- Foster needed interagency collaboration for space control and space situational awareness: Capabilities for space control and space situational awareness will require collaboration among several federal agencies.
- Adjudicate differences on requirements and resources: Because of the lack of a standing forum for addressing issues, the IAP was told, key resource issues are often resolved by the Office of Management and Budget, which is not the appropriate place to resolve such complex issues associated with roles and missions, technology, architecture, mission priorities, etc..
- Maintain the health of the U.S. space infrastructure and industry: There are many common sources of the underlying capabilities supporting NSS, commercial space, and scientific space, and it is in the nation's best interest to collaborate across federal agencies in assessing capabilities and addressing shortfalls. National initiatives should be devised and coordinated through the National Space Council. In particular, the IAP advocates that this framework be engaged to address the recommendations on export controls related to satellite technology of the CSIS Group on the Health of the U.S. Space Industrial Base and Impact of the Export Controls, February 2008.[9]
- Ensure the effective execution of joint, interagency space programs: Important new programs such as NPOESS and Space Radar have been hamstrung in part by the inability to resolve interagency differences in setting achievable requirements

[9] CSIS, "Health of the U.S. Space Industrial Base," February 2008.

and resource priorities. In the case of Space Radar, technical misjudgments contributed to delay and cancellation of the program of record.

A second essential step is to create a position whose occupant is in charge of the entire National Security Space enterprise. The Director of the National Security Space Authority will report directly to the Secretary of Defense and to the Director of National Intelligence. The individual will also hold the rank of Under Secretary of Defense for Space and Deputy Director of National Intelligence for Space. The dual reporting structure proposed here continues the practice that has been in place since 1960.

Recommendation 2. Establish a National Security Space Authority. *The Director of NSSA should be assigned the rank of Under Secretary of Defense for Space in addition to being designated the Deputy DNI for Space, reporting to the SecDef and the DNI. The Director, NSSA will be the Executive Agent for Space and the NSS acquisition authority. The director will also be responsible for defining and formulating the Major Force Program-12 Budget,[10] be the focal point for interagency coordination on NSS matters, and be the single authority with responsibility and accountability for the planning and execution of the NSS program. Analytical and technical support from a National Security Space Office-like organization augmented with Intelligence Community expertise will be required to execute this responsibility effectively.*

A strong executive is needed to integrate user capability needs, set resource priorities, evaluate alternatives, develop and advocate investment plans and programs, and formulate and execute budgets for National Security Space. This executive must be responsive to DoD, the Intelligence Community, and other users for Space capabilities and must serve as a focal point for coordinating efforts across the federal government.

Many of the experts who met with the IAP observed that within the DoD and Intelligence Community, the responsibilities for National Security Space are currently fragmented and unfocused because authorities and responsibilities are spread across numerous organizations. Although the Secretary of the Air Force is the DoD Executive Agent for Space, his authorities have been diminished from those envisioned by the 2001 Space Commission. Moreover, as perceived by many, USAF stewardship of space does not enjoy the same priority as other traditional Air Force missions. Customers of space-based capabilities observe that there is no responsible official who looks across all the available resources and capabilities to seek the best solution, whether from the military, intelligence, civilian, or commercial sector.

To address this critical need, we advocate a National Security Space Authority with the authority and resources necessary to perform the following functions:

[10] The FY 2008 DoD Appropriations Act (P.L. 110-116, Sect. 8111) directs the Secretary of Defense to establish a Major Force Program (MFP-12) for Space and to designate an official in OSD to provide overall supervision of the preparation and justification of program recommendations and budget proposals within MFP-12.

Requirements: A rigorous requirements development and approval process supported by systems engineering and independent cost estimating is needed. As an input to established requirements-approval processes, NSSA would be responsible for assuring the conduct of the necessary studies to ensure program requirements are consistent with available resources. It is envisioned that three interrelated capabilities and processes would be established in support of this function:

-- The DNI, employing its Mission Requirements Process (MRP), would identify and advocate Intelligence Community capability needs to NSSA.

-- U.S. Strategic Command would continue to serve as the advocate for joint military requirements in DoD's Joint Capabilities Integration and Development System (JCIDS) and would convey prioritized requirements to NSSA through the Joint Requirements Oversight Council (JROC).

-- NSSA would conduct or oversee the necessary trade and affordability studies to develop resource-informed program plans.

Executable programs must be budgeted to the most probable cost including appropriate margin. Independent government capabilities are needed to identify overly optimistic cost and risk assessments to ensure that program budgets are adequate to support proven design, engineering, and acquisition practices. To this end, NSSA should implement the recommendations of the National Research Council Study, "Pre-Milestone A and Early Phase Systems Engineering."[11]

Budgets: The NSSA would be responsible to formulate and execute budgets for Major Force Program 12. MFP-12 offers the mechanism to pull the many National Security Space funding sources together, provide funding visibility in the decision process, ensure that NSS requirements are supported within the available NSS resources, and integrate the various sources of Title 10 and Title 50 funds. MFP-12 should include all NSS funding from conception; through research and development, procurement, launch, on-orbit and down-link operations; to transmission to principal users, including synchronizing ground stations and dedicated receiving equipment. It should not include embedded user equipment.

Investment Strategy and Planning: In conjunction with its budgetary responsibilities and requirements definition responsibilities, the NSSA should be responsible for developing and executing an overall investment strategy. The IAP has noted three important cross-cutting investment planning areas that will require special attention from NSSA:

[11] National Research Council, "Pre-Milestone A and Early Phase Systems Engineering," 2008.

- Integration of space-based capabilities with air-, land-, and sea-based capabilities. NSSA is in a position to ensure that investment plans for space are well coordinated with related capability investment plans.
- Space Control capabilities: As noted earlier, we need to support the emerging military command structure for space operations with corresponding leadership for developing the needed capabilities. The NSSA must ensure that space protection concerns are incorporated in NSS programs. In addition, particular attention should be paid to developing and fielding space situational awareness and command and control capability.
- Commercial space-based capabilities. Commercial providers of communications and imagery provide relatively low-cost, responsive space-based capabilities. As noted earlier, 80 percent of the satellite communications bandwidth provided for Operation Iraqi Freedom is being provided by commercial satellites. At the same time, there are concerns among NSS customers about the security, exclusivity, stability, and priorities of commercial providers. Given that the military and Intelligence Community rely heavily on these commercial capabilities, and the evident advantages of continuing to do so, there is a need to take a more strategic approach in planning for and employing commercial satellite capabilities. NSSA should be assigned responsibility to investigate options and develop a strategic approach for procuring and integrating commercial capabilities into NSS planning.

Milestone Decision Authority: NSSA should have oversight and Milestone Decision Authority responsibilities for NSS major acquisition programs to ensure these programs are consistent and aligned with budgets and meet the requirements of NSS users.

Technical Architectures: NSSA should be assigned oversight authority for the development of technical architectures for space operations. This includes the spacecraft as well as the architectures for the space systems. A technically competent official should be assigned this responsibility. The day-to-day responsibilities for developing and maintaining NSS program capabilities should be assigned to the National Security Space Organization proposed in recommendation 3, below.

Interagency Coordination: The IAP also believes that the NSSA should be responsible for coordinating all aspects of NSS in the interagency arena to include policy as well as the development of common capabilities across federal agencies for space control and NSS space operations.

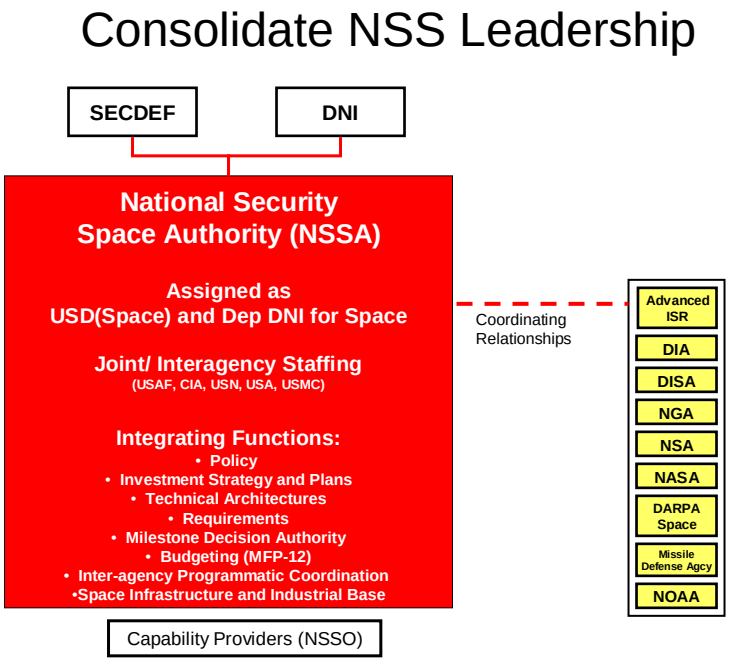
Space Infrastructure and Industrial Base: The IAP recommends that the NSSA lead a space industry summit with participation of NASA and NOAA to discuss

management and engineering issues. NSSA should charge industry to develop a collective plan for corrective action.

The relevant relationships are shown in Figure 2. The NSSA answers to the Secretary of Defense and the Director of National Intelligence. The IAP debated this dual-reporting relationship and concluded that it provides an essential guarantee that the NSS enterprise will continue to give appropriate priority to customers in DoD and the Intelligence Community. (One function of the national structure outlined earlier will be to assist in managing this relationship.)

Within the NSSA, the capability must exist to understand, represent, and balance the requirements and capabilities of military space, Intelligence Community space, civil space, and commercial space. The NSSA needs to work closely with these four stakeholders in National Security Space and ensure that they are represented in NSSA deliberations. We also advocate the assignment of needed analytic capabilities to the NSSA, along the lines of those provided by the National Security Space Office.

Figure 2. National Security Space Authority



The IAP does not recommend a specific internal structure for the NSSA. However, one practical approach would be to assign four deputy directors, one responsible for space technology development, one for information technology, one for intelligence matters, and one for military matters. The staff for the directors' office should be drawn from organizations that work in various sectors of the NSS enterprise. One key responsibility relates to our fourth recommendation on human capital

management: The deputy director for space technology should have the specific responsibility to see that the senior managers in the National Security Space Authority have the necessary technical education and experience to do their jobs.

In arriving at the recommendation to establish a National Security Space Authority, the IAP considered a range of alternatives, including the establishment of a separate Space Corps within the Department of the Air Force and the creation of a new Space Department within the DoD. Both of these alternatives have advantages, which could be of growing importance as capabilities in space continue to advance and become increasingly available to potential adversaries who may choose to confront the U.S. in space. We believe, nevertheless, that the establishment of NSSA is the logical next step, as it provides the needed focus for unifying efforts to provide space capabilities, without the costs of establishing an entirely new Corps or Department and without severing needed relationships with military and Intelligence Community users.

In the congressional direction, we were asked to look at "the organization and management of the Department (of Defense) over the near term, medium term, and long term in order to strengthen the United States' national security in space and the ability of the Department to implement its requirements and carry out future missions." We believe our current recommendations are responsive to current needs and provide a logical path to an even more focused organization in the future (such as a "Space Corps") if deemed necessary.

Recommendation 3. Create a National Security Space Organization. *Assign the NSSO the functions currently assigned to the National Reconnaissance Office, the Air Force Space and Missile Systems Center, the Air Force Research Laboratories Space Vehicles Directorate, the operational functions of the of Air Force Space Command (AFSPC), and other Service organizations now providing space capability. The merged organization will report to NSSA for policy, requirements, and acquisition and AFSPC for organization, training, and equipping responsibilities. Spacecraft command, control, and data acquisition operations as well as launch will be the responsibility of National Security Space Organization (NSSO).*

The Director will be a Uniformed 3 Star or a Civilian 3 Star Equivalent reporting to AFSPC/CC for military Service organize, train, and equip functions and to the NSSA for policy, requirements, and acquisition matters. The NSSO would be a Joint interagency-staffed organization composed of the current Acquisition and Launch Resources assigned to the SMC, NRO, ORS, NRO S&T, AFRL/SD, USN, USA. To facilitate Life Cycle Program Management, Military Space operations currently assigned to the Services and NRO Ops will be assigned to this organization.

Under the NSSO the staffs and capabilities of the NRO, SMC, and several other organizations now providing space capability would be the purview of a single director. In time, these entities would be integrated into an effective, unified organization designed

to address the root causes of problems in space acquisition. Under unified leadership, this organization could focus on the most effective use of limited resources and on installing proven, successful engineering and acquisition practices, including early systems engineering and cost estimating. The organization's primary responsibility would be the development and operation of space-based capabilities.

Space Research, Development, and Acquisition: The NSSO would be assigned the acquisition and science and technology activities currently within the Air Force Space and Missile Systems Center, the National Reconnaissance Office, the Operationally Responsive Space Office, the Air Force Research Lab Space Vehicles Directorate, and other Service organizations now providing space capability. This consolidation would enable the assignment of available engineering and acquisition talent to the most important tasks. The organizations must be integrated, duplications eliminated, and best management practices instituted.

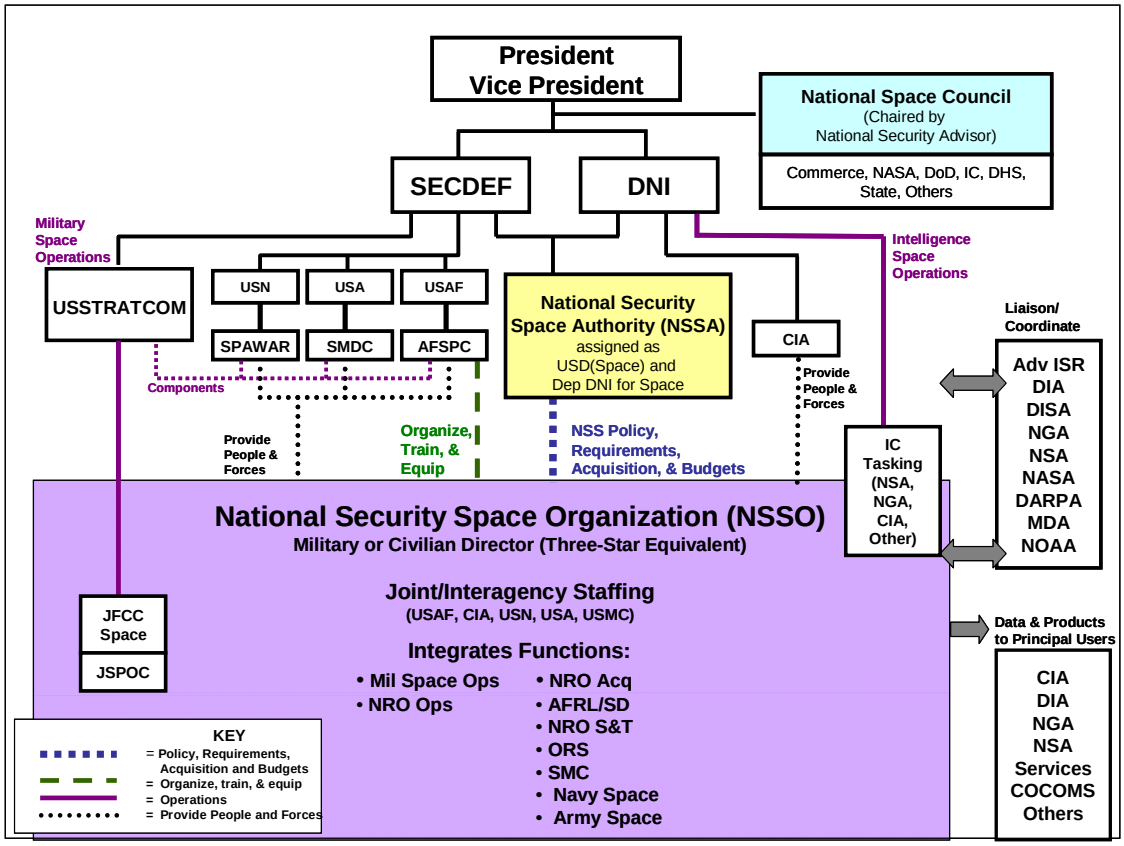
Operation of Space Systems: The NSSO would be assigned the operating elements of NRO and military space, including SMC, NRO, AFSPC space operations, Air Force Research Laboratory Space Vehicles Directorate (AFRL/SD), Operationally Responsive Space (ORS) and other Service organizations now providing space operations capability. Integrating these operating elements would help to unify space operations, contributing to the development of space situational awareness and space control capabilities.

The IAP strongly believes that essential operating relationships will not be undermined through the consolidation of the military space and intelligence space operational centers. To ensure this, the IAP advocates that existing operational tasking relationships be retained, and that any subsequent realignments in operational relationships be made only after careful study involving the customer communities and NSSO. Tasking for imaging would remain the responsibility of the National Geospatial-Intelligence Agency (NGA). Tasking for signals intelligence would remain with the National Security Agency. Tasking for military space would remain with U.S. Strategic Command by way of the Joint Force Component Command for Space.

The structure of the NSSO and its key relationships are shown in Figure 3. The director would report to Air Force Space Command for organizing, training, and equipping and to the National Security Space Authority for policy, requirements, and acquisition.

The NSSO would receive resources from Major Force Program 12, and associated space requirements would flow down from the National Security Space Authority. The organization would maintain relationships with the remaining NSS capability providers (e.g., NOAA, NASA, DARPA, and MDA).

Figure 3. National Security Space Organization



The organization would respond to operational tasking from the Intelligence Community and from U.S. Strategic Command. Operational tasking and priorities would be set collaboratively, and the responsibility for adjudicating disputes and establishing operational priorities would reside in the National Space Council, with staffing support from the National Security Space Authority. The NSSO would establish liaison relationships with key user organizations, including the President, the National Security Council, the NGA, CIA, DIA, NSA, the combatant commands, the military departments, and other federal agencies.

The staffing of the new organization will be the critical determinant of its eventual success. The IAP believes that the organization must have a strong Joint and interagency character consistent with its national mission. This will enable the organization to better understand and work with the broad range of customers who rely on space-based capabilities. At the same time, solid linkages and identification with the Air Force are essential to maintain strong connections with warfighters and to maintain the institutional support that only a military Service can provide. This structure also provides a foundation for growth and evolution of the organization into a Corps or independent Service as necessary to adapt to future events.

The IAP's recommendation to consolidate NRO, SMC, and other space capability providers goes substantially beyond the actions proposed by the 2001 Space Commission. We believe this fundamental restructuring is necessary and appropriate. We offer this recommendation fully understanding that it is likely to be highly controversial and challenging to execute. We are impelled, however, by the lesson of the failed experiment with the EA for Space to guide us. Confident in our conviction that it is essential to fix the problems with space acquisition and bridge the "cultural divide" between military space and intelligence space, we cannot in good conscience recommend half measures that would be circumvented or undermined.

Recommendation 4. ***Change AF and IC human resource management policies for space acquisition professionals in order to emphasize technical competence, experience, and continuity.*** *Establish a career education, training, and experience path for the development of engineers and managers who are space acquisition professionals. Establish as the norm that space project management personnel be in a given position for sufficient time to maximize project success—four years or more—without adverse effect upon an individual's career. Support should be given to the current Space Cadre management and training program being implemented by the Services, as exemplified by the USAF through AF Space Command and Air Education and Training Command.*

The IAP was briefed on the career management approach of the Jet Propulsion Lab (JPL), through which talented individuals are identified and developed into senior program managers by selective assignments and grooming over many years. Senior program managers there have 10 to 20 years of proven performance in space acquisition or engineering. The standard practice is for senior program and technical managers to remain on a program for its entire development and acquisition cycle. The Director of JPL maintains that success requires competent, experienced personnel who remain engaged continually over the life of a program.

The IAP concludes that the NSS acquisition communities must similarly develop experienced government space scientists, engineers, and acquisition program management personnel who can be assigned clear responsibility for the success of their programs. This will require new military career management policies, particularly in the Air Force. Today's Air Force personnel policies emphasize the need to broaden experience and offer leadership opportunities rather than to develop in-depth technical knowledge. The IAP was told that it is exceptional for an Air Force Officer to remain in an NSS assignment for more than two years without an adverse impact on his or her career. The Navy's Limited Duty Officer and Engineering Duty Officer career paths offer a potential model for how a military service can educate, develop, and retain experts in highly technical areas. Another model would be the Air Force non-line officer corps, such as the USAF JAG and medical corps. The Air Force offers special incentives and promotion opportunities to ensure the availability of needed talent in these specialty

areas, and it might be useful to implement this practice for space. The IAP strongly urges each Service to reexamine its personnel management practices to meet space requirements to ensure it is building the needed capabilities.

As noted under recommendation 2, one Deputy Director within the NSSA should be assigned responsibility for ensuring effective human capital management programs are in place.

IV. CONCLUDING REMARKS

Throughout its investigation, the IAP has interacted with many current and former NSS officials who share the concern that the current organizational structure and management system is not serving the Nation well. Today, the U.S. continues its leadership in space, but our advances have slowed at a time when other nations are investing heavily in advancing their space capabilities, and space technology is rapidly proliferating across the globe. Significant improvements are needed in the leadership and management of NSS programs, and lacking this the erosion of our leadership will continue.

The IAP advocates a top-to-bottom overhaul to restore the vitality of National Security Space and regain and sustain the competitive advantages afforded the United States by our space programs. The proposed actions would foster a cohesive NSS effort by:

- establishing a strategy at the national level,
- consolidating leadership in the National Security Space Authority, and
- integrating the organization, management, and operations of space capability providers in the National Security Space Organization.
- increasing the numbers of technically competent, experienced government scientists, engineers, and acquisition managers who are “steeped in space” and assigned to see programs through to completion.

Our proposal is intended to establish focused, unified leadership for NSS at the national level as well as at the level of the National Security Space Authority. Under this unified structure for National Security Space the necessary leadership authority can be exercised and unity of action achieved. Strong leadership can reverse the current adverse trends in executing NSS programs and avert the loss of the U.S. competitive national security advantage. The resulting structure would better serve the needs of DoD, the Intelligence Community, and other users than does the system in place today. This call to action has the highest level of urgency.

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APPENDIX A

Congressional Direction

HR 5122 National Defense Authorization Act for FY 2007

SEC. 914. INDEPENDENT REVIEW AND ASSESSMENT OF DEPARTMENT OF DEFENSE ORGANIZATION AND MANAGEMENT FOR NATIONAL SECURITY IN SPACE.

(a) Independent Review and Assessment Required- The Secretary of Defense shall select an appropriate entity outside the Department of Defense to conduct an independent review and assessment of the organization and management of the Department of Defense for national security in space. In selecting the entity to conduct the review and assessment, the Secretary shall consult with the chairman and ranking minority member of the Committee on Armed Services of the Senate and the chairman and ranking minority member of the Committee on Armed Services of the House of Representatives.

(b) Elements- The review and assessment required by this section shall address the following:

(1) The requirements of the Department of Defense for national security space capabilities, as identified by the Department, and the efforts of the Department to fulfill such requirements.

(2) The actions that could be taken by the Department to modify the organization and management of the Department over the near-term, medium-term, and long-term in order to strengthen United States national security in space, and the ability of the Department to implement its requirements and carry out the future space missions, including the following:

(A) Actions to improve or enhance current interagency coordination processes regarding the operation of national security space assets, including improvements or enhancements in interoperability and communications.

(B) Actions to improve or enhance the relationship between the intelligence aspects of national security space (so-called "black space") and the non-intelligence aspects of national security space (so-called "white space").

(C) Actions to improve or enhance the manner in which military space issues are addressed by professional military education institutions.

(D) Actions to create a specialized career field for military space acquisition personnel, to include an emphasis on long-term assignments, that could help develop and maintain a professional space acquisition cadre with technical expertise and institutional knowledge.

(c) Liaison- The Secretary of Defense shall designate at least one senior civilian employee of the Department of Defense, and at least one general or flag officer,

to serve as liaison between the Department, the Armed Forces, and the entity conducting the review and assessment under this section.
(d) Report- Not later than one year after the date of the enactment of this Act, the entity conducting the review and assessment under this section shall submit to the Secretary of Defense and the congressional defense committees a report containing--

(1) the results of the review and assessment; and

(2) recommendations on the best means by which the Department may improve its organization and management for national security in space.

APPENDIX B

IAP Member Biographies

Mr. A. Thomas Young, Chairman

A. Thomas Young is the former Director of NASA's Goddard Space Flight Center and President and Chief Operating Officer of Martin Marietta. He retired from Lockheed Martin in July 1995. He is currently a Director of the Goodrich Corporation and Science Applications International Corporation. Mr. Young is involved in various advisory and review activities associated with the U. S. Space Program.

Mr. Young has chaired numerous review panels and study groups including; the Mars Program Independent Assessment Team, the International Space Station Management and Cost task Force, and the Joint Task Force on Acquisition of National Security Space Programs.

Mr. Young graduated from the University of Virginia with bachelor degrees in aeronautical and mechanical engineering. He holds a master of management degree from the Massachusetts Institute of Technology, which he attended as a Sloan Fellow. Mr. Young is a member of the National Academy of Engineering.

General Ronald R. Fogleman, United States Air Force - Retired

General Ron Fogleman is the Chairman of the Board of The Durango Group, LLC, an international consulting firm with a client list that includes The Boeing Company, FMC, Raytheon, and RSL Electronics. Additionally, he serves on the board of directors for AAR Corp, Alpha Security, Alliant Techsystems, First National Bank of Durango, Integrated Data Corporation, Liberator Holdings, MITRE Corporation, and Thales-Raytheon Systems.

On his final tour of duty, General Fogleman served as Chief of Staff of the U.S. Air Force and a member of the Joint Chiefs of Staff. From 1992 until 1994 he was Commander in Chief of the U.S. Transportation Command (CINCTRANS). Since retiring from the Air Force he has served on and sometimes chaired numerous boards, committees, commissions, and task forces, including the following:

- Defense Policy Board
- National Aeronautics and Space Administration Advisory Council
- Jet Propulsion Laboratory Advisory Board
- Air Force Laboratory study on directed energy weapons
- National Research Council Committee on Aeronautics Research and Technology for Vision 2050: An Integrated Transportation System

- NASA Mars Program Independent Assessment Team
- Congressionally directed Commission to Assess United States National Security Space Management and Organization
- NASA Shuttle Return to Flight Task Group.

.
He holds a BS from the USAF Academy and an MA from Duke University.

Dr. Hans Mark

Dr. Hans Mark is a leading expert in the fields of both aerospace design and national defense policy. Dr. Mark served as director of NASA's Ames Research Center from 1969 to 1977. He was named Under Secretary of the Air Force and Director of the National Reconnaissance Office in 1977 and served until 1979. While Director of the National Reconnaissance Office, he initiated the development of a new reconnaissance system and the upgrade of two others. As Secretary of the Air Force (1979 to 1981), Dr. Mark initiated the establishment of the U.S. Air Force Space Command. During his tenure as Deputy Administrator of NASA from 1981 to 1984, Dr. Mark oversaw the first fourteen Space Shuttle flights and was a leading contributor to the establishment of the U.S. Space Station Program. Over the past 20 years, Dr. Mark has served as Chancellor of the University of Texas System (1984 to 1992) and is still actively involved in research and teaching at the University of Texas Cockrell School of Engineering in Austin. From 1998 to 2001, Dr. Mark was on leave from the University to serve in the Pentagon as Director of Defense Research and Engineering. Dr. Mark received an AB Degree in physics from the University of California, Berkeley and a PhD in physics from the Massachusetts Institute of Technology.

General Lester Lyles, United States Air Force - Retired

General Lester Lyles retired from the U.S. Air Force following a distinguished career at the rank of four-star general. In his 36 years of service, General Lyles gained tremendous experience in space and logistics. He served as Commander of Ogden Air Logistics Center, Commander of the Space and Missile Systems Center, Director of the Ballistic Missile Defense Organization, Vice Chief of Staff and Commander, Air Force Material Command at Wright-Patterson Air Force Base.

In addition to serving on the NASA Advisory Council, General Lyles was appointed by President George W. Bush to the Presidential Commission on the implementation of the New U.S. Space Policy in 2004.

General Lyles has a B.S. in mechanical engineering from Howard University, an MS in mechanical engineering and later an Honorary Doctorate from New Mexico State University.

Mr. Keith Hall

Keith Hall is a Vice President of Booz Allen Hamilton and director of the company's work with the National Reconnaissance Office (NRO) and related space and intelligence activities.

Prior to joining Booz Allen Hamilton, Mr. Hall's 32 years of public service included significant leadership roles as Director of the NRO, Assistant Secretary of the Air Force, Deputy Assistant Secretary of Defense, and Deputy Staff Director of the Senate Select Committee on Intelligence. At the NRO, Mr. Hall was responsible for the acquisition and operation of all U.S. space-based reconnaissance and intelligence systems.

Mr. Hall received a master of public administration degree from Clark University as well as a bachelor's degree and honorary doctorate from Alfred University.

Lieutenant General Edward Anderson, United States Army – Retired

Lieutenant General Edward Anderson is a Business Leader for the consulting firm of Booz Allen Hamilton headquartered in McLean, Virginia. He is based in Colorado Springs.

Specializing in strategic planning and the management of complex organizations, General Anderson headed the Army staff organization responsible for developing the Army's modernization strategy and funding priorities. He commanded the Army Space and Missile Defense Command, served as Director for Strategic Plans and Policy of the Joint Staff, and was the Deputy Commander-in-Chief of the U.S. Space Command and Northern Command.

General Anderson is a graduate of the U.S. Military Academy and holds a Master of Science degree in Aeronautical Engineering from the Georgia Institute of Technology. He was awarded a Master of Arts degree in National Security and Strategic Studies from the U.S. Naval War College.

Vice Admiral Lyle Bien – United States Navy, Retired

Vice Admiral Lyle Bien is a defense industry consultant to a number of commercial satellite manufacturers and satellite service providers. He is also a senior mentor to the Missile Defense Agency and several Combatant Commanders in major exercises and Title X Wargames. He has served on the Air Force Scientific Advisory Board, is a member of the U.S. Strategic Command's Strategic Advisory Group, several defense-related panels and corporate and university boards.

In his thirty-one years of active duty service, Vice Admiral Bien commanded an F-14 fighter squadron, two Carrier Airwings, a Carrier Battle Group, and the Naval Space

Command. Vice Admiral Bien also served as Deputy Commander-in-Chief and Chief of Staff at the United States Space Command in Colorado Springs, Colorado.

Vice Admiral Bien graduated from the National War College and holds a degree in biology from Augustana College. He lives on the family cattle ranch in Hillhead, SD.

APPENDIX C

Liaison Officials and the IDA Study Team

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- Larry Burgess & Cynthia McKinley, USD(I)
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- Chuck Alsup & Shishu Gupta, DNI
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IDA Study Team

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APPENDIX D

IAP Fact-Finding Interviews and Briefings

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Deputy J-8: BGen Ray Fox

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Chief of Staff: Gen T. Michael Mosley

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A1: Joe McDade, Harry Disbrow

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Peer Review Group, May 19, 2008

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14. ABSTRACT

An Independent Assessment Panel (IAP) of former senior civilian executives and military officers was formed by IDA to examine congressional concerns regarding the stewardship for National Security Space and identify the "actions that can and should be taken to strengthen organization and management, improve and enhance the relationship of the National Reconnaissance Office and the U.S. Air Force, and enhance the quality of the work force." The panel identified major challenges and expressed the unanimous conviction that without significant improvements in National Security Space (NSS) leadership, management, and organization, U.S. space preeminence will erode to the extent that space ceases to provide a competitive national security advantage. The panel advocates a top-to-bottom overhaul to restore the vitality of National Security Space programs. This includes (a) establishing a strategy framework at the national level, (b) consolidating leadership in a National Security Space Authority, (c) integrating space capability providers in a National Security Space Organization, and (d) revamping career management to re-establish a strong government workforce for space acquisition.

15. SUBJECT TERMS

National Security Space, Space, Defense Organization and Management, Defense Acquisition, National Reconnaissance Office, Air Force Space Command, US Strategic Command

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