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# **THE FUTURE MANAGEMENT AND USE OF THE U.S. SPACE LAUNCH BASES AND RANGES**

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**REPORT OF THE INTERAGENCY WORKING GROUP  
February 8, 2000**

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**Report of the Interagency Working Group on the  
Future Management and Use of the U.S. Space Launch Bases and Ranges**

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## **EXECUTIVE SUMMARY**

Space launch is important to U.S. national security and economic well-being. As such, it has been a policy goal of the U.S. government to foster a strong, internationally competitive, U.S. commercial space launch industry and to enhance cooperation between the federal government and the commercial space sector. Good progress has been made toward these policy goals, most notably through the public-private partnership conceived and supported by the Air Force in the Evolved Expendable Launch Vehicle (EELV) program. U.S. commercial space launches enhance national security by lowering costs and improving reliability, and this connection will be even more important with the advent of EELV.

The majority of U.S. expendable space launches are conducted from two major launch bases operated by the Air Force at Cape Canaveral Air Station (CCAS), Florida, and Vandenberg Air Force Base (VAFB), California. Human space flight missions are launched from NASA's Kennedy Space Center (KSC), adjacent to CCAS. The space launch facilities and range complexes associated with these bases are national assets employed by a wide variety of national security, civil, and commercial users. These multiple users have diverse technical and support needs.

Until recently, the bulk of the expendable launch missions (and, therefore, the bulk of the activities at the major bases and ranges) have been related to national security. However, since the mid-1990s, commercial space launch activities have grown as U.S. commercial companies responded to the increase in global demand for commercial satellite launch services.

In the spring of 1999, the Assistant to the President for National Security Affairs and the Assistant to the President for Science and Technology formed an Interagency Working Group (IWG) to review the future management and use of the primary U.S. space launch bases and ranges at CCAS and VAFB. This review was undertaken in response to issues raised as a result of the successful growth of U.S. commercial space launch activity since 1994 and the increasing reliance of government agencies on commercially provided launch services. This review was to include an assessment of the roles and responsibilities of the government and U.S. commercial space sector with respect to the operation and modernization of the two major launch bases and ranges.

*The Report of the Interagency Working Group on Future Management and Use of the U.S. Space Launch Bases and Ranges* examines the current roles and responsibilities of federal government agencies and the U.S. commercial space sector and the major policy and management issues resulting from the shift in launch base use from its historic government-dominated basis toward more commercial, market-driven activities. Following discussion of the issues, the report presents alternatives that outline several possible paths along which U.S. space launch capability could develop over the next one to two decades. Finally, the report offers recommendations, which represent the appropriate next steps in the nation's evolving management of the U.S. space launch bases and ranges.

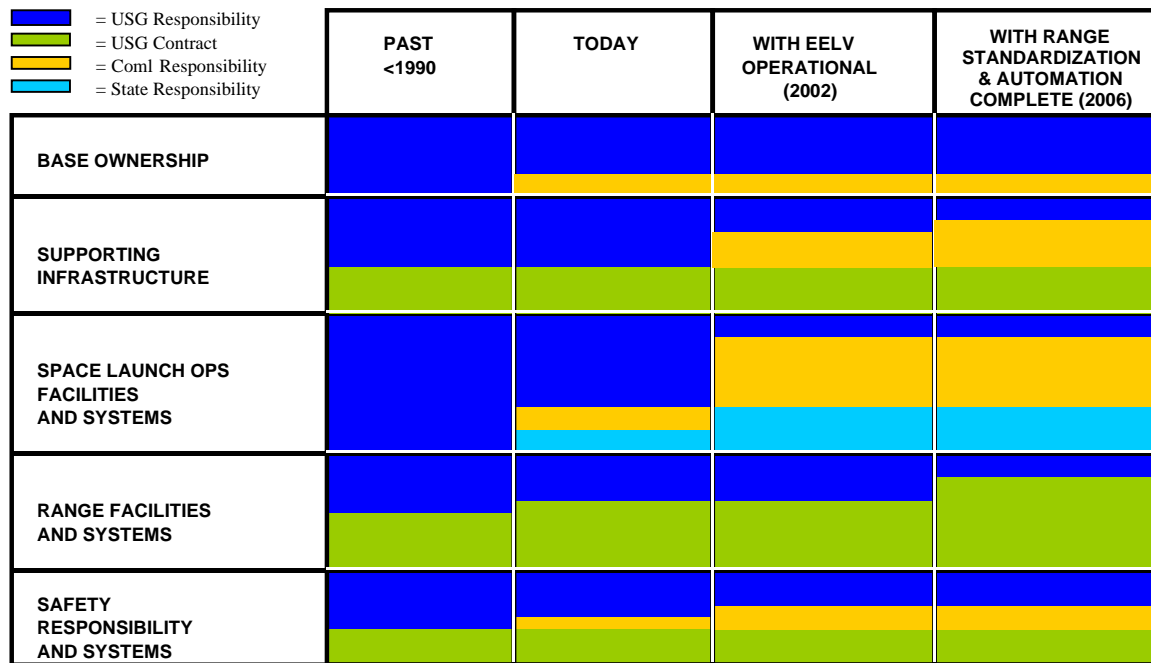
## Roles and Responsibilities

Figure 1 illustrates the current and planned division of management and funding responsibilities among federal government agencies, government contractors, the U.S. commercial space sector, and state-sponsored spaceports operating at CCAS and VAFB. Each of the five major elements that make up the U.S. space launch bases and ranges is highlighted.

As shown, prior to 1990, most responsibilities for the major U.S. space launch bases and ranges belonged to the federal government (particularly the U.S. Air Force), though much of the operation and maintenance for base infrastructure and range support was performed by government contractors and safety analysis and system maintenance were supported by government contractors.

Today, commercial launch operators and spaceports have environmental responsibilities for their own activities at the launch sites. Similarly, commercial operators and spaceports are responsible for operating and maintaining the satellite and launch vehicle processing facilities and launch complexes that they lease or license from the Air Force or construct on property leased from the Air Force. Commercial operators are also responsible for some aspects of ground safety for their own employees and operations at these locations.

A number of changes will take place over the next few years. DoD plans to transition the operation and maintenance (O&M) of the utility systems on the launch bases to commercial companies. Additionally, when the EELV family of vehicles becomes operational in 2002, the basic concept behind launch operations will change. Most notably, the EELV operators will be responsible for building and maintaining the EELV facilities and launch pads (using real estate



**Figure 1. Current and Planned Division of Responsibilities**

and some facilities leased from the government) and the government will purchase launch services. As a result, the government will maintain only a few unique satellite processing facilities and those launch facilities unique to national security and national test and evaluation needs.

Spaceports in Florida and California are also more directly involved under the EELV concept. Not only have the spaceports arranged hundreds of millions of dollars in financing to assist the EELV operators, but also they will manage some of the facility construction. As a result, while the heritage launch systems are retired over the coming years, a larger fraction of the launch operations conducted on the launch bases will be performed by commercial EELV operators. Much like today's commercial operators, the EELV operators will also be responsible for the ground safety of their own employees.

As shown, the U.S. government is already sharing responsibilities with the commercial sector and spaceports and is pursuing a path to share significantly more responsibilities with state governments and commercial operators. The Air Force plans to continue the Range Standardization and Automation (RSA) program to improve operability, reliability, and supportability of both the Eastern and Western Ranges while reducing operations and maintenance costs. Simultaneously, the government will continue to restructure and competitively source range O&M, improvement and modernization (I&M), and range sustainment workload in ways that improve efficiency and allow government agencies to share more of the direct costs with commercial range users.

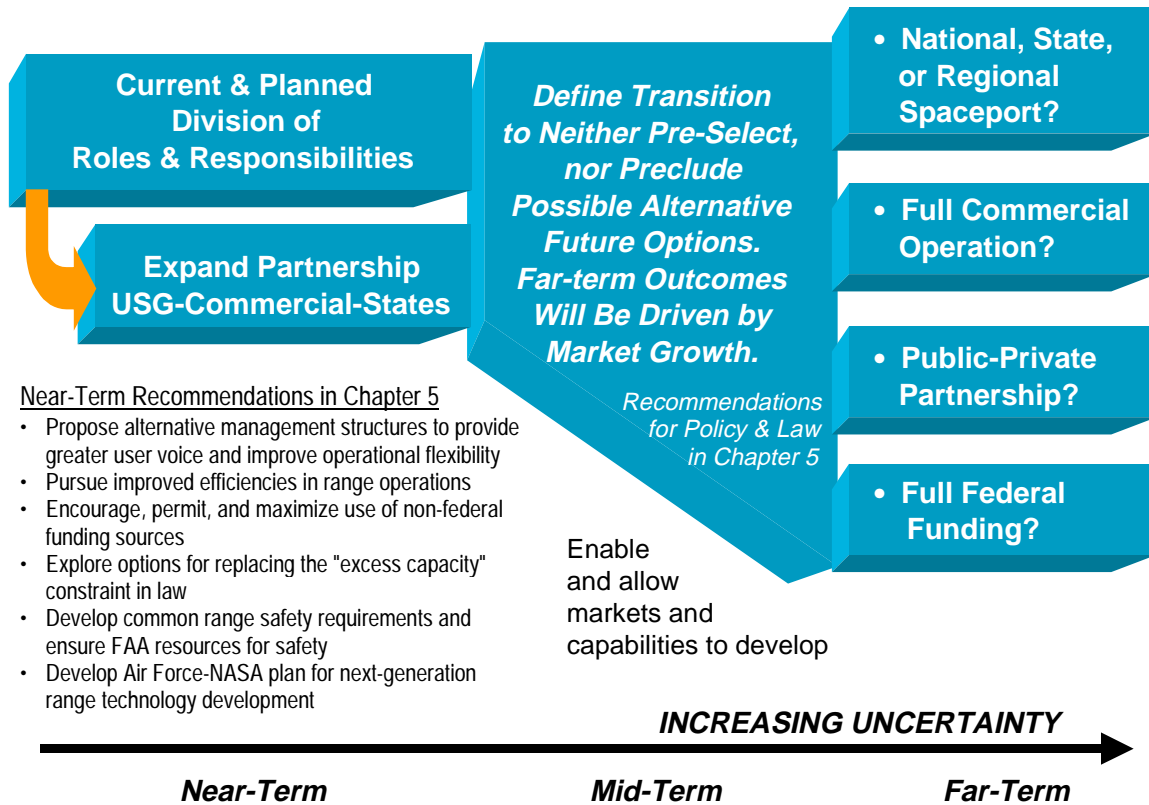
## **Challenges**

Although the basic legal and policy framework appears to be adequate to support the current level of government and commercial space launch activity, this framework may require revision in the future if the commercial satellite and launch market continues to grow. In particular, the IWG is concerned that the "excess capacity" constraints in the law may inhibit the future growth of the commercial space launch industry and limit the potential synergy between government and private sector interests. Regardless, other present symptoms indicate the current workload is straining management, operations, maintenance, improvement, and modernization processes at both major launch bases and ranges.

## **Recommended National Strategy**

In response to these issues and other concerns raised by commercial industry during the course of the review, the IWG developed a recommended national strategy. This strategy (summarized in Figure 2) proposes building on the already planned changes in roles and responsibilities with a series of additional near-term steps that will enhance and expand the government-private partnership. The working group also defined a range of alternative paths that could be considered in the future if federal, state, local, and commercial markets or national needs require.

Finally, the working group developed a series of near-term recommendations regarding the management and use of these bases and ranges. Some of these near-term recommendations are achievable within current policies and statutes, and all of them focus on expanding the federal-state-industry partnership to enable more direct involvement of civil and commercial space sector users, including spaceports. These recommendations include the following:



- Near-Term Recommendations in Chapter 5
- Propose alternative management structures to provide greater user voice and improve operational flexibility
  - Pursue improved efficiencies in range operations
  - Encourage, permit, and maximize use of non-federal funding sources
  - Explore options for replacing the "excess capacity" constraint in law
  - Develop common range safety requirements and ensure FAA resources for safety
  - Develop Air Force-NASA plan for next-generation range technology development

**Figure 2. Recommended National Strategy**

- Propose alternative management structures to allow commercial and government users of the U.S. space launch bases and ranges adequate opportunity to communicate their requirements so they can be actively considered and factored into decisions on improvements and operations with the goals of providing greater user voice and improving operational flexibility.
- Pursue means of achieving improved efficiencies in range operations.
- Encourage, permit, and maximize use of nonfederal funding sources (especially from states and spaceports) for the continued maintenance and modernization of the space launch bases and ranges to meet national needs for space transportation.
- Explore options for replacing the “excess capacity” constraint in the current policy and legal framework, while retaining priority access for national security and critical civil sector missions, to allow a more complete partnership to develop between the federal government and the U.S. commercial space sector, including States and spaceports.
- Develop common range safety requirements for government, civil, and commercial launches at federal and nonfederal launch sites and ensure that Federal Aviation Administration (FAA) resources are commensurate with its statutory requirements and safety responsibilities.
- The Air Force and NASA should develop a plan to examine, explore, and proceed with next-generation range technology development and demonstration, with a focused charter to

improve safety, increase flexibility and capacity, and lower costs for reusable and expendable launch vehicles. NASA should designate KSC as a National Center for next-generation Reusable Launch Vehicle (RLV) range technology development and demonstration.

The midterm step in the recommended strategy is to pursue changes to law to eliminate constraints and enable a transition path to let market forces and the pace of new developments help determine which future scenario makes the most sense to pursue for the far term, while retaining priority access for national security and critical civil sector missions.

The uncertainties associated with potential demand for commercial satellite and launch services, coupled with the need for flexibility and agility as we move to an uncertain future, leads the working group to recommend that the federal government should take no actions now that would either select or preclude any of the possible alternative futures in Figure 2. The working group believes the U.S. government should let market forces and the pace of new developments help determine which future scenario makes the most sense to pursue for the far term.

## **CHAPTER 1: INTRODUCTION**

Space launch is important to U.S. national security and economic well-being. As such it has been a policy goal of the U.S. government to foster a strong, internationally competitive, U.S. commercial space launch industry and to seek to enhance cooperation between the federal government and the commercial space sector. Good progress has been made toward these policy goals, most notably through the public-private partnership conceived and supported by the Air Force in the Evolved Expendable Launch Vehicle (EELV) program. Commercial industry has also made considerable strides toward becoming internationally competitive and state-sponsored and private spaceports are becoming a major force in the space launch business.

The majority of United States expendable space launches are conducted from two major launch bases operated by the Air Force at Cape Canaveral Air Station (CCAS), Florida, and Vandenberg Air Force Base (VAFB), California. Manned missions are launched from NASA's Kennedy Space Center (KSC), adjacent to CCAS. The space launch facilities and range complexes associated with these bases are national assets used by a wide variety of national security, civil, and commercial users. These multiple users have diverse technical and support needs.

The two space launch range complexes consist of technical support equipment (telemetry receivers, optical recording and tracking equipment, and radars), flight safety systems, and command, control, communications, and computer systems necessary to provide countdown services and supervisory functions. The Eastern Range (based at CCAS and its support base at Patrick AFB, Florida) and Western Range (based at VAFB) are dispersed over large areas of the globe and provide support for launch and reentry of expendable and manned launch vehicles, national test and evaluation activities (such as Intercontinental Ballistic Missile and Sea Launched Ballistic Missile testing), and space surveillance. In addition, supporting organizations provide security, disaster control response, communications, and many other logistical and support functions.

Until recently, the bulk of the expendable launch missions (and, therefore, the bulk of the activities at the major bases and ranges) have been related to U.S. government civil and national security activities. However, since the mid-1990s commercial space launch activities have grown as U.S. commercial companies responded to the increase in global demand for commercial satellite launch services.

In the spring of 1999, the Assistant to the President for National Security Affairs and the Assistant to the President for Science and Technology initiated a review of the future management and use of the primary U.S. space launch bases and ranges at CCAS and VAFB. The review was necessitated by the growth of commercial space launch activities, which has resulted in new challenges and opportunities at both locations.

The Air Force estimates that commercial launch activities now constitute about forty percent of the launch manifest at Cape Canaveral and Vandenberg. (Note: The launch manifest does not include other range support activities like aeronautical testing, space surveillance support, range upgrades and modernization, or general maintenance.) Although recent projections for future commercial growth have been revised downward, it appears that commercial activity will continue to form a major part of the workload (and may eventually become the dominant activity) at these two primary space launch centers now and into the future. In Fiscal Year 2002,



the government will begin a new era in expendable launch activities with the advent of the EELV family of vehicles. With EELV, the government will purchase commercial-like launch services instead of launch vehicles, further increasing the involvement and importance of a strong commercial launch industry. These factors, combined with government and industry concerns about the stresses caused by current and projected commercial activity, led to questions about whether the federal government should revise the operation, management, or ownership of CCAS and VAFB.

This report presents the results of the Interagency Working Group (IWG) review. The current operating regime for the launch sites is described in Chapter Two; in many respects these practices reflect the evolution of the national space programs (a survey of which is provided in Annex C). The challenges associated with dealing with larger numbers of commercial launches are detailed in Chapter Three. Chapter Four presents a number of possible alternatives to continued government dominance of the launch sites and presents the review's findings that major changes are not at present warranted or feasible. Chapter Five therefore presents recommendations for changes that can be implemented promptly, will be effective in resolving current difficulties, and that could encourage the development of conditions propitious to an even larger role for private enterprise, along with a proposed national strategy

It is clear that U.S. commercial space launches enhance national security by lowering costs and improving reliability, and this connection will be even more important with the advent of EELV. The IWG is confident that the actions recommended in this report will set the stage for further commercial growth, will benefit both government and the private sector, and will continue the success story begun more than a decade ago.

## CHAPTER 2: ROLES AND RESPONSIBILITIES

The current roles and responsibilities for the management, operation, maintenance, improvement, modernization, and sustainment of the U.S. space launch bases and ranges are divided among DoD, NASA, and the U.S. commercial space sector. The FAA licenses and regulates U.S. commercial launch, site, and reentry activities. There are five major elements that make up the U.S. space launch bases and ranges: (1) base ownership, (2) supporting infrastructure, (3) space launch operations facilities and systems, (4) range facilities and systems, and (5) safety responsibilities and operations. These are shown in Table 1 along with current responsibilities.

**Table 1. Current Division of Responsibilities**

Element	Current Division of Responsibilities
<b>Base Ownership</b>	USG owns real estate and manages real property processes, but commercial launch operators are responsible for environmental documentation and compliance on sites they use
<b>Supporting Infrastructure</b>	USG owns, operates, and maintains roads and utility systems for entire base; NASA Wallops Flight Facility shares responsibilities with users
<b>Space Launch Operations Facilities and Systems</b>	USG owns, operates, and maintains payload processing facilities and the active launch complexes used to support USG missions; commercial launch operators operate and maintain facilities they use exclusively
<b>Range Facilities and Systems</b>	USG owns, operates, and maintains; commercial launch operators pay "direct costs" for use in support of commercial missions
<b>Safety Responsibilities and Operations</b>	USG has safety responsibilities and conducts safety operations

### Base Ownership

Base ownership refers to ownership of the launch base and range real estate. Federal government agencies currently hold the responsibilities associated with base ownership at the primary U.S. space launch bases. The Air Force has these responsibilities at CCAS, including the headquarters base at Patrick AFB, Florida, and VAFB. NASA has these responsibilities at the Kennedy Space Center (KSC), Florida and Wallops Flight Facility (WFF), Virginia

As landlords and stewards for these bases, the Air Force and NASA are responsible for the following:

- Land-use planning, including land and facility assignments and development plans for government and commercial users.
- Lease and license processes and approvals for use of real property, including negotiating, maintaining, and managing leases for exclusive, long-term use of land and facilities by

commercial operators and real property licenses for shared use of land and facilities with government programs.

- Stewardship of natural resources, including compliance with environmental regulations, oversight of leaseholder compliance with environmental regulations, and obtaining environmental approval for new uses. As landowner, the federal government is responsible for managing environmental baseline surveys and approval and permit processes for government programs and commercial users by interfacing with regulatory agencies and the public. Commercial users are responsible for paying the direct costs associated with this management and for producing their own documentation required to complete these processes. Additional environmental responsibilities are assigned to commercial launch and launch site operators through the Commercial Space Operations Support Agreement, real property leases and licenses, and the EELV contract.

### **Supporting Infrastructure**

Supporting infrastructure at the U.S. space launch bases and ranges includes utilities (such as water, gas, and electricity), roads, security and fire protection, disaster management, medical care, office space, airfield operations, and other common facilities and services. The Air Force and NASA are responsible for operations and maintenance (O&M) and improvement and modernization (I&M) of the supporting infrastructure at the launch bases and ranges they own.

The majority of the O&M and I&M for the supporting infrastructure are carried out under contract to the Air Force and NASA. The Air Force and NASA share these responsibilities at CCAS and KSC under the Joint Base Operations Support Contract (JBOSC), which recently consolidated separate contract vehicles maintained by CCAS and KSC. Managed by a joint program management office, the JBOSC is intended to save money through more streamlined management and to increase efficiency and responsiveness of contract support services.

At VAFB and CCAS, there are DoD-sponsored initiatives under way to privatize many of the base utility systems. Under privatization, utility customers—including the government—will buy utility services at rates established by the utility system operator and determined by a metering arrangement. The private utility operator will be responsible for the O&M and I&M of the utility system to meet the needs of the entire user population of the bases. At NASA WFF, a board of directors, made up of the local NASA management and major tenants, such as the Navy and the Virginia Space Flight Center, determines how to equitably share responsibility for the O&M and I&M of the supporting infrastructure that is required to support the entire user community on a shared-use basis.

The initiatives undertaken by the Air Force and NASA are redefining the government's approach to providing the supporting infrastructure for users of the space launch bases. Instead of requiring that nearly all base support services be purchased through the host organization, the Air Force and NASA now encourage commercial customers to enter direct contractual arrangements with the base support service providers. The government is evolving to a system in which only certain types of support services—such as mandatory safety analyses—are provided to customers directly through the host organization.

## **Space Launch Operations Facilities and Systems**

Space launch operations facilities and systems include those facilities and dedicated-use systems required for assembly, test, checkout, and launch for satellites and launch vehicles. More specifically, this includes payload and launch vehicle processing and assembly facilities, launch complexes, launch control centers, checkout control centers, associated propellant servicing systems, and other vehicle- or payload-specific facilities and systems.

Responsibility for the space launch operations facilities and systems is currently shared between government agencies and commercial operators, depending on whether the facility is dedicated to government use, shared by government and commercial users, or dedicated to commercial use. For those facilities and systems dedicated to government programs, the government is wholly responsible for funding and maintaining the facilities. Examples would include the Space Shuttle and Space Station facilities at KSC and the Titan IV launch facilities and the Global Positioning System (GPS) satellite processing facility at CCAS, among others.

For shared-use facilities and systems that support both government and commercial operations, the government typically pays O&M costs. Under the Commercial Space Launch Act (as codified in 49 U.S.C., Subtitle IX, Chapter 701), commercial operators reimburse the government only for those direct costs that “can be associated unambiguously with a commercial launch or reentry effort; and the government would not incur if there were no commercial launch or reentry effort.” Where modifications to government facilities are required to accommodate commercial activities, commercial operators are responsible for funding the improvements. Each of the three major U.S. commercial launch service providers have funded modifications to government launch facilities to meet their commercial requirements: At CCAS Lockheed Martin funded modifications to Space Launch Complex (SLC)-36A to accommodate the Atlas IIAS, and Boeing funded modifications to SLC-17B to accommodate the Delta III; Orbital Sciences funded modifications to Building 1555 at VAFB to accommodate Pegasus processing activities.

In some cases, commercial operators are the sole users of facilities and systems that they built or modified on the federal launch bases. Typically, the commercial company operates the facility under a lease and pays rent based on the fair market rental value of the land and any government-owned facilities. For such dedicated commercial facilities, the commercial operator is responsible for funding all O&M and I&M associated with these facilities. One example is the construction and operation of the Astrotech payload processing facility on leased land at VAFB.

Under the EELV program, responsibility for the space launch operations facilities and systems being constructed for the new Delta IV and Atlas V launch vehicles will belong to the commercial operators. As part of the EELV philosophy, the government will not operate or maintain any EELV-related facilities or systems; rather, the government will purchase launch services from the two companies. As such, the government will use the EELV leases and contractual vehicles to shift the burden for the upkeep of the EELV-related launch operations facilities onto the commercial operator. The commercial operators (Boeing and Lockheed Martin) will be responsible for funding all O&M and I&M “within the fence” (i.e., in areas where they are the sole users).

## **Range Facilities and Systems**

Range facilities and systems include sensor and command and control capabilities necessary to safely conduct national security, civil, and commercial space launch operations, as well as test and evaluation of land- and sea-based ballistic missiles and other systems. Range facilities and systems also include buildings, instrumentation, support equipment, associated utility systems, and command and control networks, such as:

- Range operations control centers providing command and control, and communications.
- Radar systems and other metric tracking assets.
- Optical tracking, video and photographic assets.
- Telemetry receivers and processing systems.
- Command transmitters and other safety system assets.
- Weather measurement and prediction capabilities.
- Communications systems and switching nodes to distribute voice and video and data.
- Airspace, sea, and land area surveillance assets .

### Eastern and Western Ranges

The Air Force operates the two primary ranges used for space launch operations and ballistic missile and other national tests. Two space wings assigned to Air Force Space Command are responsible for the ranges. The Eastern Range, operated by the 45th Space Wing at CCAS and Patrick AFB, Florida, covers an area off the East Coast of the United States extending north to Canada and southeast to Africa. The Western Range, operated by the 30th Space Wing at Vandenberg Air Force Base, California covers an area off the West Coast extending north to Canada, south to Central America, and southwest to Kwajalein in the Pacific Ocean. With limited exceptions, such as a command transmitter and range support aircraft operated by the U.S. Navy at Point Mugu, California, the Air Force operates each of the component assets that make up the ranges along with the supporting base infrastructure.

As operator of the Eastern and Western Ranges, the Air Force is responsible for funding all O&M and I&M necessary to support national security missions conducted on the ranges, except for those assets provided by other government agencies. Government users of the ranges (including Air Force users) reimburse Air Force Space Command for range use. Commercial space launch missions use many of the same range assets as government missions, with direct costs reimbursed to the Air Force as determined by current policy and law.

For more than 30 years the Air Force has purchased contract services for the major operational and maintenance activities of the ranges, to include most of the range operations and maintenance personnel. The Air Force currently maintains separate O&M contracts at both the Eastern and Western Ranges managed by the 30<sup>th</sup> and 45<sup>th</sup> Space Wings, respectively. The total Air Force funding to operate, maintain, sustain and modernize the ranges in FY 1998 (including appropriate base operating support) was \$452 million, including \$290 million for the Eastern Range and \$162 million for the Western Range. In 1998, the total cost for both Cape Canaveral Air Station and Vandenberg Air Force Base was closer to \$570 million which includes approximately \$25 million in operational reimbursements from commercial users and \$91 million from other government users and pads.

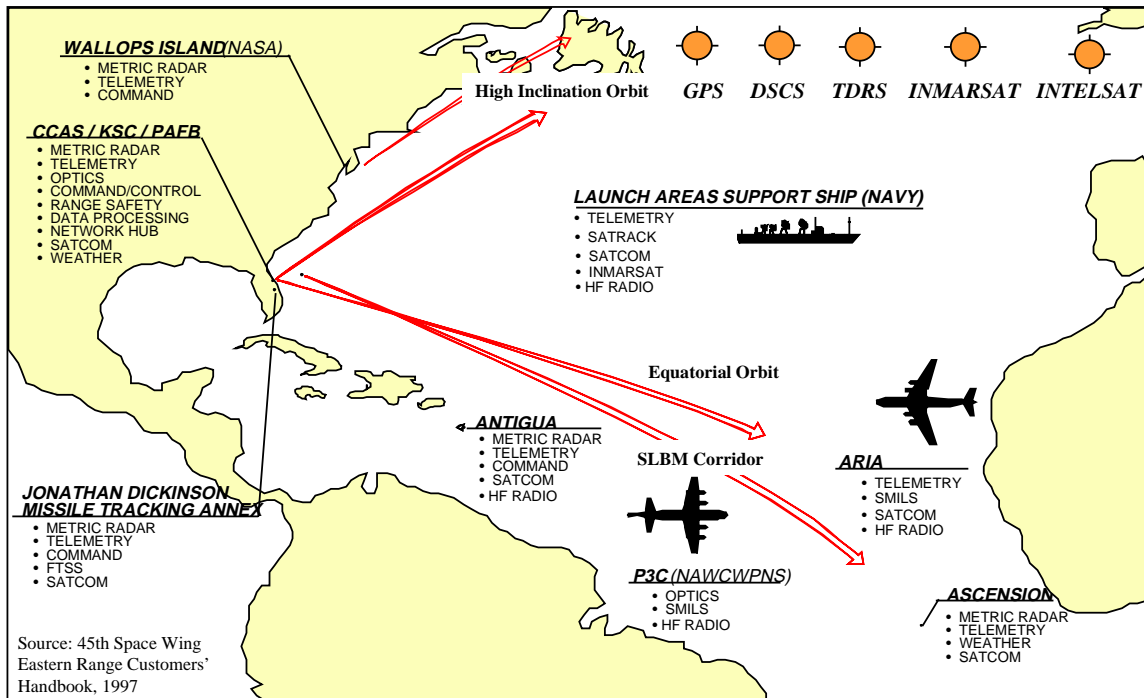


Figure 3. Eastern Range and Wallops Range Assets

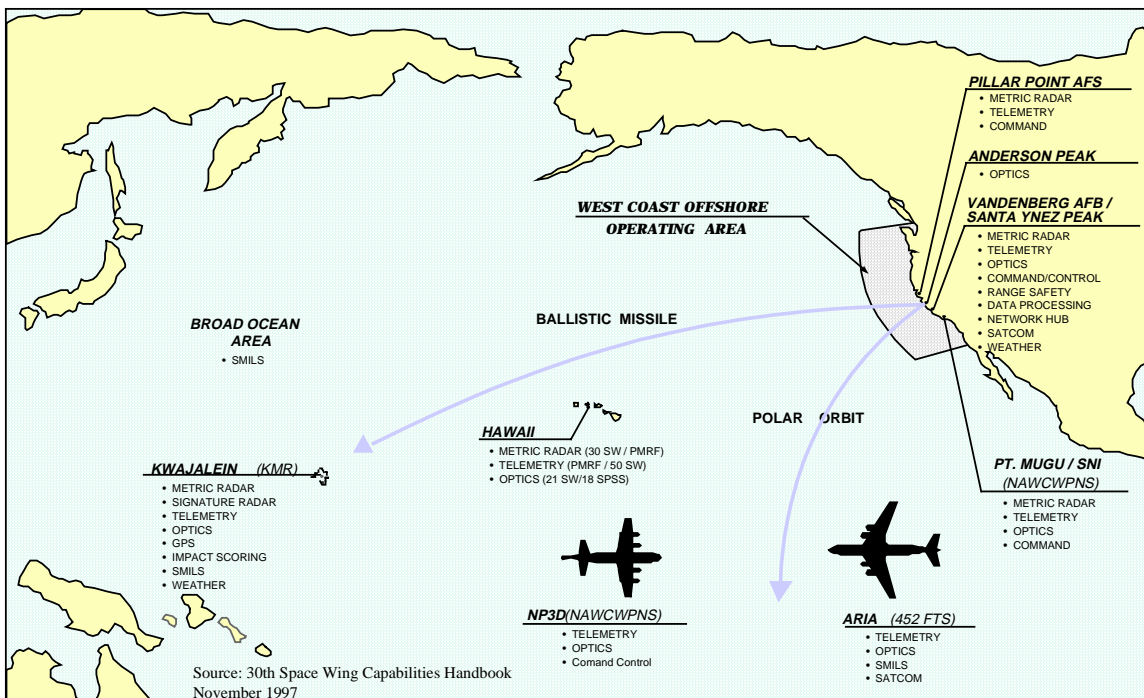


Figure 4. Western Range Assets

For the last several years the Air Force has been upgrading the Eastern and Western Ranges through two closely related efforts: the Range Standardization and Automation (RSA) program and the follow-on Spacelift Range System Contract (SLRSC). The goals of the RSA program are to improve operability, reliability, and supportability of both the Eastern and Western Ranges while reducing operations and maintenance costs. RSA will modernize the ranges by replacing several thousand obsolete and unsupportable components and systems and create a standardized Spacelift Range System (SLRS). Another component of RSA is the planned replacement of 14 space launch tracking radar assets (eight on the Western Range and six on the Eastern Range) in favor of GPS as a metric tracking source, which is expected to significantly reduce the Air Force's range O&M costs. The second upgrade effort is the SLRSC, which will develop and procure automated fixed instrumentation, engineer and execute recapitalization projects to replace hardware that is no longer economically sustainable, and provide integrated systems engineering and sustainment functions to standardize the spacelift ranges. The RSA program makes up the majority of the modernization activity and funding at both ranges and is managed by the Air Force Space and Missile Systems Center (SMC) at Los Angeles AFB. Each range under a variety of individual contracts manages specific incremental improvement and modernization activities.

### Wallops Flight Facility Test Range

NASA operates the WFF Test Range at the WFF, Virginia, on the East Coast of the United States. The Wallops Test Range is used for aeronautical and suborbital and orbital space launch operations originating from Wallops and provides orbital tracking and launch support for missions originating from CCAS and the KSC, including those of the Space Shuttle. Wallops also operates a deployable range, complete with mobile range control centers, radars, telemetry receivers, and command transmitters, that has have been used in support of NASA, DoD, and commercial missions. A full set of these mobile range assets will be deployed in 2000 to support a NASA mission to be launched from the state-sponsored Kodiak Launch Complex in Alaska.

NASA is responsible for funding all O&M and I&M for the Wallops Test Range, which costs around \$17.3 million per year. NASA is typically reimbursed approximately \$3 million per year by other government agencies and commercial users of the range. The contracts for Wallops O&M and I&M have been recently integrated into NASA's Consolidated Space Operations Contract (CSOC), which encompasses practically all NASA launch and satellite tracking, command, control, and communications facilities and systems worldwide.

### **Safety Responsibilities and Operations**

Safety responsibilities and operations include those activities related to ensuring public safety and protecting property and other resources during space launch ground and flight operations. Specific safety responsibilities and operations include, but are not limited to establishing safety requirements, standards, and procedures; oversight of ground operations (e.g., hazardous materials operations, compliance with safety requirements and national consensus standards for government personnel and equipment, and compliance with Environmental Protection Agency (EPA) regulations); flight operations (e.g., analysis; design requirements and standards for flight systems; and blast, toxic materials, and debris containment); system safety (e.g., design requirements and standards for spacecraft and launch vehicle safety); and establishing safety training and certification requirements for personnel.

Federal safety responsibilities are divided among the Air Force, NASA, and the FAA. The Air Force and NASA are responsible for the safety of people and property on their respective launch bases and for protecting the public from hazards associated with ground and flight operations on the bases and ranges. These responsibilities are derived from public law, federal regulations, and from various Department of Defense, Air Force, and NASA directives, instructions and standards. In particular, DoD Directive 3200.11 “Major Range and Test Facility Base” places safety responsibilities on the Range Commander (i.e., the 30th and 45th Space Wing Commanders at VAFB and CCAS). Under the Occupational Safety and Health Administration (OSHA) regulations, each employer (contractor or commercial operator on a federal range) is responsible for the safety of its employees and equipment.

The FAA is the regulatory agency with responsibility for the safety of U.S. commercial launches and for the safe operation of nonfederal launch sites. In fulfilling its responsibilities, the FAA issues licenses for launch and reentry of commercial orbital and suborbital rockets, and launch site operator licenses for the operation of sites from which commercial launch activities are conducted, excluding federal launch sites.

Under the licensing regime, licensees bear responsibility for the safety of their own operations within the framework of federal safety regulations. For launch operators, this includes responsibility for both flight and ground safety, regardless of whether launches occur from a federal launch range or a licensed launch site. For launches from the federal launch ranges, however, the FAA has not sought to duplicate the safety reviews of the federal launch ranges and has, to date, relied on the Air Force to perform safety oversight of commercial licensees.

### **Evolving Responsibilities**

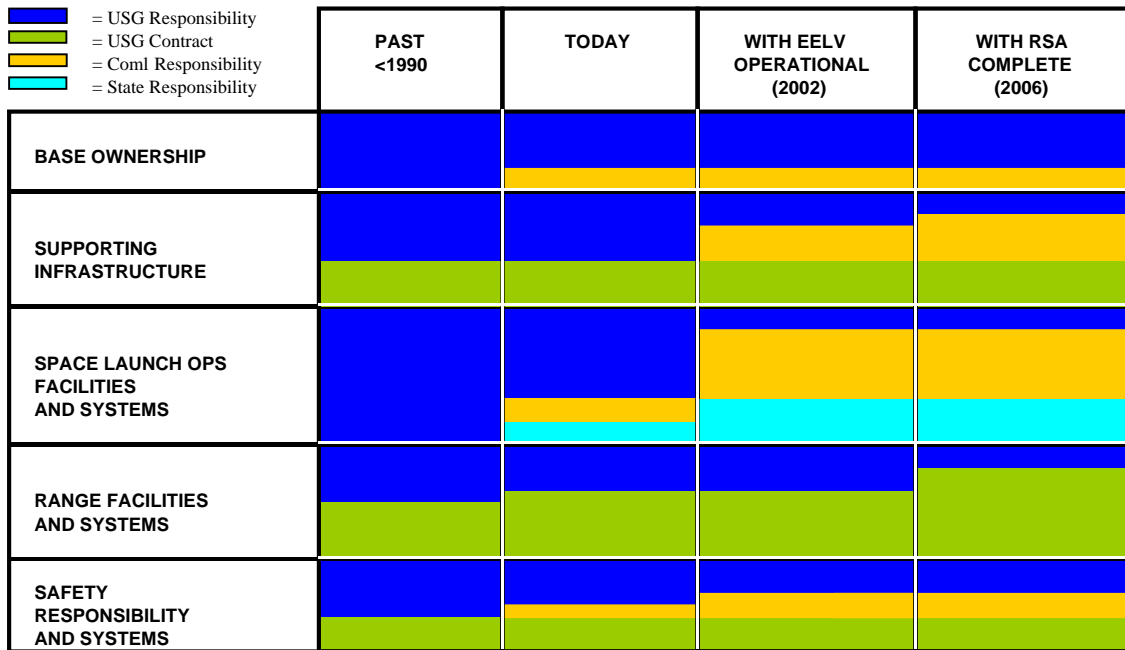
Figure 5 depicts how management and funding responsibilities for each of the five major elements that make up the space launch bases and ranges at CCAS and VAFB are divided among federal government agencies, government contractors, the U.S. commercial space sector, and state-sponsored spaceports operating on the federal installations and how those responsibilities are projected to change in the future.

Prior to 1990, responsibility for the major space launch bases and ranges at CCAS and VAFB belonged to the federal government, specifically the Air Force. Throughout that time, companies under contract to the Air Force performed much of the O&M for base infrastructure, range support, safety analysis, and safety system maintenance. In addition, many other support services at CCAS (including security and some disaster control services) were performed by government contractors.

The federal government (i.e., the Air Force) still “owns” the bases today. The Air Force leases and licenses real property and facilities to commercial companies and state spaceports but retains ownership. However, unlike in years past, today commercial launch operators and spaceports have environmental responsibilities for their own activities at the launch sites. This is depicted in the figure as the yellow bar on the “Base Ownership” line. Similarly, the yellow and vertical striped bars on the “Space Launch Ops Facilities and Systems” line indicate that commercial operators and spaceports are responsible for operating and maintaining their own satellite and launch vehicle processing facilities and launch complexes. Finally, commercial operators are



responsible for some aspects of the ground safety of their own employees and operations at these locations, as indicated by the yellow bar on the “Safety Responsibility and Systems” line.



**Figure 5. Current and Planned Division of Responsibilities**

More changes are about to occur. During the next few years, DoD plans to transition the ownership and O&M of the utility systems on the launch bases to private companies, as indicated by the growing yellow bar on the “Supporting Infrastructure” line. When EELV is operational in 2002, the government will maintain only a few satellite-processing facilities (indicated by the remaining blue bar on the “Space Launch Ops Facilities and Systems” line). The EELV operators will build and maintain their own facilities and launch pads (indicated by the large yellow bar), and spaceports in Florida and California are arranging hundreds of millions of dollars in financing for them will manage some of the facility construction (indicated by the vertically striped bar). The relative size of the yellow bar on the “Safety” line increases in the EELV column because, as the heritage launch systems retire, the EELV operators will conduct a larger fraction of the launch vehicle operations on the launch bases. Like today’s commercial operators, EELV operators will be responsible for the ground safety of their own employees.

The Air Force currently plans to continue competitively sourcing more of the range operations, maintenance, and sustainment work, as indicated by the growing crosshatched bar on the “Range Facilities and Systems” line.

**Summary**

In summary, the IWG found that the U.S. government is already sharing substantial responsibilities with the commercial sector and is pursuing a path to share significantly more responsibilities with state spaceports, state governments, and commercial operators. Simultaneously, the Air Force is seeking ways to enhance its use of contract providers for range O&M, I&M, and sustainment to improve efficiency and allow the federal government to share more of the total costs with commercial industry.

## **CHAPTER 3: CHALLENGES**

### **Key Elements of National Space Policy and Federal Law**

Since the mid-1980s, national policy and federal law have established the goal of fostering the growth of the U.S. commercial space launch industry.

- The Commercial Space Launch Act (CSLA) (originally signed into law in 1984 and later amended and codified at 49 U.S.C., Subtitle IX, Chapter 701) is intended “to facilitate the strengthening and expansion of the United States space transportation infrastructure, including the enhancement of United States launch sites and launch-site support facilities, and development of reentry sites, with Government, State, and private sector involvement, to support the full range of United States space-related activities.”
- The President’s 1994 National Space Transportation Policy declares that the government will “foster the international competitiveness of the U.S. commercial space transportation industry, actively considering commercial needs and factoring them into decisions on improvements in launch facilities and launch vehicles.”
- The President’s 1996 National Space Policy establishes “a fundamental goal . . . to support and enhance U.S. economic competitiveness in space activities while protecting U.S. national security and foreign policy interests.” It encourages “private sector ownership, investment, and operation of space assets” and directs U.S. government agencies to “facilitate stable and predictable U.S. commercial sector access to appropriate U.S. government space-related hardware, facilities, and data on a reimbursable basis. However, the U.S. government reserves the right to use such hardware, facilities, and data on a priority basis for national security and critical civil sector requirements.”

A more complete and detailed discussion of the current policy and legal framework is included as Annex B of this report.

### **U.S. Government Support Enabled by the National Policy and Legal Framework**

Under the current national policy and legal framework, the U.S. government has provided the U.S. commercial space sector and state government users with stable and predictable access to U.S. government-owned space launch operations facilities and systems, as well as supporting infrastructure, and range support. In addition, the significant Air Force, private sector, and state government investment in the EELV program will further strengthen and expand the U.S. space transportation infrastructure. Private sector ownership and operation of space launch assets will increase, while in some cases federal ownership will decrease, as both DoD and NASA shift toward the use of more commercial launch services. The U.S. government has also involved the U.S. commercial space sector in management processes—most notably the launch scheduling process—as another means of facilitating stable and predictable access to U.S. government property and services.

## **Recent Developments and Trends**

The stable national policy and legal framework that has been in place for more than a decade—establishing that U.S. commercial space launch activities should be fostered using the federally funded and managed launch bases and ranges on a reimbursable basis—has played a critical role in the emergence and development of a viable, internationally competitive U.S. commercial space launch industry. The U.S. commercial space launch industry has recently started showing signs of maturity, earning revenues of more than \$1 billion in 1998 and investing more than twice that amount in improved launch vehicles and related facilities at CCAS and VAFB. In addition, the average U.S. commercial launch rate more than doubled between the first and second half of this decade, with the U.S. commercial space launch industry capturing a larger portion of the global market (47 percent) than any other nation in 1998. These positive trends are expected to continue, though the pace of continued growth is the subject of some debate. This very success—enabled and fostered by the stable national policy and legal framework—has altered the balance between government and commercial activity at U.S. space launch bases and ranges and raised questions about the viability of the government-commercial arrangements.

Historically, the limiting factor in U.S. launch capacity was the time required to prepare the launch vehicle and satellite on the launch pads. Over the past five years, however, government and industry have worked hard to reduce launch processing time lines as launch rates have increased. Further decreases in satellite and launch vehicle processing time are expected with the advent of EELV, making complementary improvements in range availability crucial for overall operational success. Range modernization efforts are under way; however, the IWG is concerned that range availability will remain a limiting factor on the number of launches that can be conducted annually from the U.S. launch bases and ranges. Particular concern exists in the near term while the operations tempo remains high and the ranges are periodically taken off line to conduct the modernization upgrades necessary to complement vehicle and satellite processing improvements.

Some strains already show. For example, the Eastern and Western Ranges were each unavailable to support operations for nearly 60 days in 1998 because of scheduled down times for modernization activities.

## **Limitations in the National Policy and Legal Framework**

The effectiveness of the national policy and legal framework formulated in the 1980s has in many ways exceeded expectations, raising concerns about whether or not the current framework can continue to meet the needs of both U.S. government and commercial users of the bases and ranges. Most significantly, symptoms have recently been observed that point to the need to reconsider whether the “excess capacity, direct cost” legal framework is sufficient now and for the future.

Despite strong policy and legislative intent for government to foster the growth of commercial space launch activities, and recognizing that existing policy and law provide a great deal of flexibility, some policy and legal provisions intentionally constrain the type and scope of support federal agencies can provide. For example, the CSLA states that U.S. government agencies should facilitate and encourage private sector and state government access to U.S. government

“launch property that is excess or otherwise is not needed for public use; and launch services, including utilities, otherwise not needed for public use.” Another provision limits the costs for which commercial providers can reimburse the government to “direct costs,” which are defined as “the actual costs that—(a) can be associated unambiguously with a commercial launch or reentry effort; and (b) the Government would not incur if there were no commercial launch or reentry effort.” Further, national space policy prohibits the use of direct federal subsidy to support commercial industry needs.

Although this legal and policy framework is adequate to meet the current level of government and commercial launch activity, the IWG is concerned that the “excess capacity” constraint in the law may inhibit the future growth of the U.S. commercial space launch industry and limit the potential synergy between government and private sector interests. Both law and policy demand that federal agencies encourage commercial industry growth because of the benefits such growth brings to national security, scientific and technical advances, and economic growth and well-being. However, the “excess capacity” provision, when combined with the “direct cost” definition in law could limit the federal government’s ability to accommodate growing commercial requirements.

The federal government can foster commercial growth with excess property and services, but cannot budget for additional resources to create this excess capacity. Meanwhile, the “direct cost” provision bars the federal government from effectively obtaining the resources from the private sector to create additional capacity to meet commercial sector needs. The government can be reimbursed only for those activities directly and unambiguously associated with the commercial operations. It cannot recoup indirect costs because they cannot be tied to a specific commercial user or operation. As a result, if commercial space launch activities continue to grow, the current policy and legal regime could eventually constrain commercial market growth.

There is some debate with regard to whether and when the effects of these constraints will emerge. However, commercial users are concerned because a high overall workload has limited the operational flexibility of the U.S. ranges, while international competition remains intense. These concerns must be addressed to continue to meet the objectives of national policy. The commercial sector concerns become especially relevant to national security as the national security space sector transitions to EELV because the price the U.S. government will pay for launch services, as well as the effectiveness of these services, will be strongly influenced by the success of the U.S. commercial launch service providers.

Basically, the IWG looked at four areas of concern from the commercial users and government agencies: customer needs, resources and accounting, safety regulation, and technology development.

### **Accommodating Commercial Customers and Their Needs**

U.S. Government Investments and Unique Commercial Needs. Currently, DoD provides enough funding to maintain the infrastructure and personnel to support U.S. government launch activities. Because government activity is not steady, “excess capacity” exists. Earlier this decade, U.S. commercial space launch rates were much lower than U.S. government launch

rates, and DoD was able to accommodate commercial needs within this excess capacity while recouping only direct costs from commercial users.

Now, however, the commercial workload represents around 40 percent of the launch manifest and civil and commercial users of the ranges have expressed a need for additional staff and range improvements that will increase operational flexibility for all users. At the same time, commercial users have not established a business case to justify increased individual investments that would benefit all commercial users.

The Air Force has embarked on a major range modernization effort (the RSA) that will dramatically improve flexibility for all users but is pursuing this effort on a pace that meets the needs of DoD and intelligence users. Commercial and civil users have stated that the pace of RSA does not improve operational flexibility in the near term to accommodate their launch schedule requirements more efficiently. Commercial and civil users have also expressed concern that the availability of the range is limited by activities required to continue the implementation of the planned modernization program. Since satellite companies choose among competing launch providers primarily on the basis of availability, flexibility, cost, and risk, U.S. commercial launch providers say they are hampered by tension between the need to modernize and the need to conduct parallel operations.

Although national policy tells federal agencies to actively consider commercial needs and factor them into decisions on improvements in launch facilities and launch vehicles, the federal government cannot expend resources to meet unique commercial needs. Where government and commercial needs coincide, or where the government can make minor changes to account for commercial needs, the government can satisfy those needs. Unique commercial needs are not considered in the government's requirements process, are not validated by any government agency, are not coordinated among the often numerous (and sometimes conflicting) commercial companies and interests, and, ultimately, must be accommodated outside the government process. Today, the federal government agencies do not have a formal process for evaluating commercial needs and determining whether they overlap or complement government requirements.

Commercial User Participation in Strategic Planning and Management Processes. The emergence and development of an active U.S. commercial space launch industry, including nonfederal launch site operators, has broadened considerably the number of customers who rely on launch base and range support. Over the past several years, the Air Force has established a formal process to involve civil and commercial sector users in the launch scheduling process. However, as “excess capacity/direct cost” users of DoD facilities and support services, civil and commercial sector users of the primary launch bases and ranges typically have no official voice in processes or decisions regarding strategic planning or implementation of operation, maintenance, improvement, modernization, and sustainment of range equipment, facilities, and capabilities. It is fundamentally the “excess capacity” framework that limits the ability of the U.S. government to partner fully with state governments and industry.

## **Operational Flexibility**

During several discussions with the IWG, commercial users placed “operational flexibility” at the top of their list of needs. Although the Air Force estimates that it will have sufficient overall range capacity to meet the demands of the launch schedule over the next five years, commercial and civil users pointed out that additional flexibility (e.g., more operations personnel, increased technical capability, reduced range recycle times) would help them commit to launch schedules with high confidence and would allow the ranges to efficiently overcome normal schedule disruptions. This need is particularly acute when commercial business is frequently awarded based on a company’s ability to commit in advance to specific satellite on-orbit delivery dates. In the view of commercial users, sufficient overall theoretical range capacity does not get to the heart of their concern—responding with agility to a fluid commercial market. The government’s mission needs are met within the planned range modernization program.

## **Financial Issues and Opportunities**

Opportunities for Nonfederal Investments. Based on current legal restrictions, federal government investment in the ranges can be based only on requirements for national security and civil space launch missions. At the same time, U.S. government agencies have very limited authority to accept private funding (i.e., “gifts”) to supplement the appropriation accounts for range improvement and modernization. This, and the lack of a business case, prevents the commercial space sector from investing its own funds to accelerate or supplement the currently planned range improvement and modernization programs or to hire additional range personnel to meet commercial needs.

The “excess capacity/direct cost” framework for commercial use of the launch bases and ranges places the burden for funding the operation, maintenance, improvement, modernization, and sustainment of the range facilities and systems on the U.S. government—in practice, the Air Force—and prevents government agencies from recouping expenses related to amortization or re-capitalization of range infrastructure. Nor does the “direct cost” construct in the law allow government agencies to recoup costs associated with most civil service or military personnel operating and managing the ranges because each is necessary to support government requirements. While commercial activities already account for as much as 40 percent of launch activities scheduled on the ranges, reimbursements to the government account for less than 10 percent of the costs associated with the U.S. space launch ranges.

Clear Cost Accounting. To better understand current or proposed changes to the financial arrangements between the government and commercial users of the U.S. space launch bases and ranges, the U.S. government must also address the transparency of its billing practices. For example, the cost accounting system in use by the Air Force to track costs and bill commercial space launch and site operators was constructed for and meets the mission needs of DoD but is not based on commercial business practices. This limits the ability of commercial sector users to perform cost-benefit analyses on the individual range support services that they request. In addition, the Air Force and NASA implement the direct cost provision of current policy and law differently in charging commercial space launch operators for launch base and range support. Finally, because industry must make business decisions well in advance of conducting launch activities, the stability and predictability of government pricing for range services is of great

concern. For instance, under the EELV contracts for firm fixed-price launch services, any future increases in launch base and range support costs will have to be absorbed by the commercial operators even when these increases were unanticipated at the time the contracts were negotiated.

As government agencies continue to consolidate and restructure launch base and range support contracts so more of the total expenses are billable as “direct costs,” clear and consistent cost accounting capabilities would help both government and industry to understand whether and how these cost increases to commercial operators could effect their international competitiveness.

### **Roles, Resources, and Requirements for Public Safety**

Roles and Resources. Air Force safety personnel at the ranges are increasingly burdened by oversight responsibilities for commercial launches at the federal ranges. Under current law, the FAA is responsible for oversight of FAA-licensed commercial launches from federal and nonfederal launch sites. In carrying out this responsibility, the FAA has accepted the Air Force safety regime through its baseline assessment of safety at the CCAS and VAFB ranges. As a result, the Air Force performs the bulk of the work—and bears the burden—for safety oversight of commercial launches at the federal ranges.

The FAA will need to provide sufficient trained safety personnel for oversight of licensed commercial activities at the federal ranges to relieve the growing burden on Air Force safety personnel and to build the required safety workforce to oversee the increasing commercial activities at nonfederal launch sites.

Common Requirements. With the growing number of commercial launch sites, and with the FAA’s codification of its safety requirements, launch operators must meet two sets of safety requirements—Air Force requirements for launches from Air Force installations and FAA requirements for launches from nonfederal launch sites. Differing safety requirements not only cause inefficiencies for the launch operators; they cause uncertainty and confusion.

Prior to 1995, both the Eastern and Western Ranges imposed a separate set of safety requirements, prompting launch operators to ask that a common set of standards be created. Although some differences remain, the Air Force has since instituted a common set of safety requirements applicable at both launch bases and ranges and is taking steps to further standardize its requirements and procedures. To avoid the potential for two incompatible safety standards evolving as more nonfederal launch sites become active, the FAA and the Air Force have begun to develop common national range safety requirements applicable to both licensed commercial and government launches, at federal and nonfederal launch sites, to be implemented under their independent authorities.

### **Next-Generation Technology Development and Demonstration for Launch Ranges**

While the Air Force is pursuing substantial range upgrades through the RSA program, currently no focused, funded effort exists within the federal government to develop and demonstrate long-term, next-generation technologies for range capabilities. Next-generation range technologies will be essential to improve safety and reduce costs by orders of magnitude to enable high launch rate operations using next-generation highly reusable space transportation systems.

## CHAPTER 4: ALTERNATIVE FUTURES AND MANAGEMENT MODELS

At this point in the evolution of the U.S. space launch bases and ranges, pursuing a radical change in management—such as transferring ownership and responsibilities for operations to a private or state-sponsored entity—does not appear to be in the interest of either the U.S. government or commercial space sector. As has been the case since the beginning of the Space Age, for the foreseeable future, the U.S. space launch bases and ranges must continue to satisfy critical national security, intelligence-gathering, and human space launches and testing of land- and sea-based ballistic missiles, which together account for more than half of the total range workload. Furthermore, no commercial sector entity has expressed interest, willingness, or a business case that would make it possible to seriously consider such alternatives in the near to midterm.

Development of the commercial space launch market, although quite dramatic over the past five years, is not sufficient to make it possible for state or commercial entities to operate, maintain, and sustain the launch bases—or even just the ranges—as a viable, sustainable business. Commercial space launch market projections are neither robust nor predictable enough to support a sustainable business case for private sector operation and maintenance of the launch bases or ranges.

However, because it is in the interest of the U.S. government to encourage the continued growth of commercial space launch activities, the IWG believes it is prudent to examine alternatives to the current regime. Such alternatives could serve as a model for the future or could illuminate steps that should be taken to enhance the government-private space launch partnership.

A variety of possible alternative end states for the management and use of the U.S. space launch bases and ranges exist. The desirability and constraints associated with each management model will depend strongly on several factors with futures that are neither clear nor easy to predict. Some of these factors include the extent and pace at which new space transportation technologies and systems are developed, whether and how fast the commercial space launch market continues to grow, and whether and how fast commercial activities migrate to nonfederal launch sites. Another influencing factor is the extent to which federal government agencies continue to require unique capabilities, for example, to meet human spaceflight requirements.

In addition to the national security imperatives to ensure access to space, market forces and commercial developments are important in determining the course of the future management and use of the U.S. space launch bases and ranges. For example, level or slow but steady growth in demand for expendable launches of increasingly heavy commercial communications satellites to geosynchronous orbit would result in one management scenario emerging as the most attractive. Development and operation of a variety of low-cost, next-generation reusable launch vehicles could suggest another. While explosive growth in demand for access to low-altitude, high-inclination orbits could suggest a third.

The working group defined a range of alternatives that could serve as future paths if commercial markets or national needs require. However, the uncertainties associated with potential demand for commercial satellite and launch services, coupled with the need for flexibility and agility as we move to an uncertain future, leads the working group to recommend that the federal government take no actions now that would either select or preclude any of these possible



alternative futures. The working group believes the U.S. government should let market forces and the pace of new developments help determine which future scenario makes the most sense to pursue for the far term.

### **Public-Private Partnership**

One possible future end state for management and use of the U.S. space launch bases and ranges is management by a public-private partnership that involves sharing launch base and range management responsibilities between federal government agencies and private sector entities. A public-private partnership would include the transfer of some government functions and responsibilities to the private sector, while the government would retain some of its current management roles and responsibilities. A partnership could also include the formation of an overall management organization consisting of both government and private sector participants.

The nature of the public-private partnership could be modeled after a variety of arrangements already in existence in other areas of endeavor. The IWG looked at several that might serve as examples. One possibility is the Electric Power Research Institute where both government and private entities participate in a common board of directors and a for-profit subcontractor conducts operations on behalf of the users of the research institute. Another example is the National Renewable Energy Laboratory—a federally funded research and development center (FFRDC) managed by a nonprofit consortium and housed in a government-owned, contractor-operated (GOCO) facility.

Shared use airports, such as the one at Colorado Springs, where both civil and military aviation facilities and activities use common supporting infrastructure, could provide yet another model for shared management responsibilities in a public-private partnership. Finally, a GOCO arrangement, such as those previously used at the Delta, Atlas, and Titan launch vehicle production facilities, could serve as another management model. In the past, this type of GOCO arrangement allowed the companies to make and execute operating decisions with minimal direct government involvement. Additional examples exist that should be studied more fully if this alternative proves desirable in the future.

Some potential considerations for this approach include the following:

- Management by a public-private partnership could provide a central means through which all the launch base and range users' voices could be heard by launch base and range decision-makers, because the commercial sector interests would be represented within the management structure overseeing the operation, maintenance, sustainment, improvement, and modernization of the U.S. space launch bases and ranges.
- Given statutory changes, a public-private partnership could provide an investment vehicle to accommodate both federal government budget needs and private sector investment desires.
- Management by a public-private partnership could represent an incremental step between the current division of management responsibilities between the federal government and the private sector and establishing a national or regional spaceport authority.

Some policy questions and potential issues regarding this approach include the following:

- How could multiple, competing commercial space launch operators participate fairly in and benefit from a management structure that includes their competitors as well as other companies and a variety of government entities with different and competing interests?
- How could U.S. government agencies be appropriately authorized to use a mix of government and private sector funding to conduct operations, maintenance, sustainment, improvement, and modernization of launch base and range facilities, systems, and equipment?
- What sort of organizational structure would enable a smooth transition from today's all-government management structure to a public-private partnership without precluding other possible options if conditions continue to change and develop?
- How would the U.S. government protect national security interests in a public-private partnership when the private sector element is not wholly U.S.-owned (e.g., international mergers, agreements, consortiums)?

### **Commercial Operation**

Another possible future end state for management and use of the U.S. space launch bases and ranges includes leasing the U.S. space launch bases and ranges to a commercial entity to fund and operate. Commercial operation of the launch bases and ranges would involve full commercialization of all launch base and range functions currently provided by government entities and government contractors, with a single private entity in charge of making management decisions with regard to operations, maintenance, sustainment, improvement, and modernization. Under this scenario, the private entity would have sole responsibility for base ownership, supporting infrastructure, range facilities and systems, and safety systems and operations. Many of these functions could be subcontracted, but federal government agencies would retain responsibilities for those space launch operations, facilities and systems, that would be required to conduct its own unique missions (e.g., ballistic missile and other national test launches and operations, Space Shuttle operations, national security space activities). Furthermore, the FAA would retain its regulatory responsibilities and authorities.

This alternative depends on commercial markets continuing to grow and sustain steady demand for commercial space launches at rates substantially higher than those required to conduct government national security and civil missions. That is, commercial demand has to become sufficiently robust and predictable to make it feasible to close a business case to sustain commercial operation of the U.S. space launch bases and ranges. In that case, it may be appropriate for the federal government to seriously consider this alternative, consistent with the national security need for ensured access to space.

Some considerations are the following:

- Under this scenario, the burden for funding, operating, maintaining, sustaining, improving and modernizing the U.S. space launch bases and ranges would be borne by both the commercial users and U.S. government agencies.

- The dominant user—in this case, the U.S. commercial space sector—would have the dominant voice in managing the U.S. space launch bases and ranges.
- Managing the U.S. space launch bases and ranges as a commercial business could provide adequate incentives and mechanisms to meet user requirements efficiently in response to market forces, demand, and new developments.

Some policy questions and potential issues regarding this approach include the following:

- How would U.S. government agencies ensure their ability to meet national security and critical civil sector mission requirements for access to space if the U.S. space launch bases and ranges were under the control of a commercial entity whose decisions are driven by commercial market forces, business considerations, and returns to shareholders?
- How would the Air Force sustain a core of career specialists with expertise in space launch-related matters as a means of ensuring its ability to conduct national security missions if all of the launch base and range functions were privatized?
- What conditions would have to be met before a credible, sustainable business case could be made for commercial operation of the U.S. space launch bases and ranges? Factors for consideration include the uncertainties associated with projected commercial demand, environmental cleanup costs that would have to be paid before transferring base ownership from the federal government to a private entity, and the political realities associated with any proposed base realignment and closure actions, including the disposition of tenant units currently active at the launch bases?

### **National, State, or Regional Spaceport Authorities**

This alternative suggests transferring management responsibilities from the federal government agencies that currently own and manage the U.S. space launch bases and ranges to a national, state, or regional spaceport authority. Under this scenario, all of the launch base and range functions currently provided by government entities and government contractors would be turned over to a spaceport authority that would be responsible for launch base and range funding, operations, maintenance, sustainment, improvement, and modernization. The spaceport authority would have sole responsibility for base ownership, supporting infrastructure, range facilities and systems, and safety systems and operations. Many of these functions could be subcontracted, but, as with the commercial alternative, federal government agencies would retain responsibility for those space launch operations, facilities, and systems that would be required to conduct government missions. In this alternative, national security agencies (in this case the Air Force) would relinquish control of the bases and ranges and become tenants.

This alternative is somewhat analogous to civil, commercial, and military aircraft using runways, facilities, and services at state or regional airports or civil, commercial, and military ships using state or regional seaports. However, in the case of airports and air traffic, the federal government retains responsibility for regulatory oversight (mostly to ensure public safety) and some infrastructure (e.g., the air traffic control system). In many cases airport authorities manage the overall development, sustainment, and use of the airports by civil, commercial, and military aircraft. The Airport Trust Fund, which is funded through fees on airline passenger tickets and

aircraft fuel taxes, is used by airports to support improvement, modernization, and safety-related projects. Although there are also some similarities between this alternative and the U.S. highway system (supported in part by the Highway Trust Fund), in general there is no direct analogy to a national spaceport authority for other U.S. transportation modes (i.e., land, sea, and air).

A reliable alternative source of funding outside the defense budget would have to be identified. Possibilities include funds from another federal government department or agency; establishment of a new trust fund analogous to the Airport Improvement Program with licensing fees, fuel taxes, and possibly even a few cents-per-month fee on end-user services (e.g., direct-to-home television broadcasts, very small aperture terminals, satellite telecommunications): state or municipal government funding; and spaceport bonds, tax incentives, etc. That is, national, state, or regional spaceport authorities would have to come up with credible alternatives for raising and sustaining the substantial annual funding required to operate, maintain, sustain, improve, and modernize the U.S. space launch bases and ranges for all users (i.e., civil, national security, and commercial).

Some considerations are as follows:

- Under this scenario, the burden for funding, operating, maintaining, sustaining, improving, and modernizing the U.S. space launch bases and ranges is shared by another entity—the spaceport authority—in addition to the national security, civil, and commercial users.
- A national spaceport authority could serve as an honest broker in managing the U.S. space launch bases and ranges in a manner that balances the best interests of the national security, civil, and commercial users. The spaceport’s interest is in satisfying its customers, sustaining jobs, and stimulating economic growth.
- Assuming spaceport authorities would have the authority to raise adequate funds through bonds, there could be some advantages in terms of cost and flexibility in financing and conducting improvement and modernization projects.

Some policy questions and potential issues regarding this approach could include the following:

- How could the U.S. government preserve its ability to meet critical national security and civil sector mission requirements if the U.S. space launch bases and ranges were under the control of a spaceport authority (especially regional or state authorities) whose interests are driven primarily by commercial factors?
- What federal government roles and responsibilities would change and how?
- How could the Air Force sustain a core of career specialists with expertise in space launch–related matters as a means of ensuring its ability to conduct national security missions if all of the launch base and range functions were placed under the control of a spaceport authority?
- What conditions would have to be met before a credible case could be made for a spaceport authority to be able to raise and sustain annual funding sufficient to operate, maintain, sustain, improve, and modernize the U.S. space launch bases and ranges?

- How would the federal government address issues and costs, such as environmental cleanup that would have to be performed before transferring base ownership from one federal government agency to another agency or spaceport entity, the political concerns associated with any proposed base realignment actions, and the disposition of tenant units currently active at the launch bases?

### **Full Federal Funding**

This alternative involves an increase in federal government funding for the operation, maintenance, sustainment, improvement, and modernization of the U.S. space launch bases and ranges. Under this scenario, agencies would include commercial needs as requirements to be funded by the federal government. Management responsibilities would remain as currently structured.

This option is somewhat analogous to the federal government's funding of the eighteenth century canals or the twentieth century interstate highway system and air traffic control system because a strong transportation infrastructure is essential to our national security and economic advancement.

This alternative could become attractive if foreign governments continue to aggressively support their commercial space industry's programs and capabilities to the point at which U.S. international competitiveness suffers.

Some considerations include the following:

- Fully funding all commercial needs at the U.S. space launch bases and ranges using federal government funding would encourage, support, and facilitate the further development of the U.S. commercial space launch industry, and improve its international competitiveness, particularly for the small launch providers, by reducing operating costs.
- Government responsibility for all funding offers the ability to provide sufficient capital to ensure commercial needs are met with some predictability.
- This alternative recognizes the importance of commercial space launch as a transportation mode to the national security and economic well-being of the nation.
- This scenario may require a change to the policy prohibiting direct federal subsidies in pursuit of U.S. commercial space goals.

Some policy questions and potential issues regarding this approach are as follows:

- Most of the other modes of transportation in the United States are supported by user fees or user taxes.
- How would commercial sector needs be verified, validated, advocated, and be made accountable within the federal budget?
- How would the government ensure that it does not give unfair advantages to particular companies or create barriers to entry for new technologies?

- Is there still some appropriate mix of federal, state, and commercial involvement and investment that would result in more efficient operation and timely modernization of the U.S. space launch bases and ranges to meet all user needs?
- How would launch base and range users be encouraged to request only the support they actually need if they would no longer have to pay even the direct costs associated with the support they request?
- How could stability be generated for federal funding for private sector needs?

## **CHAPTER 5: NATIONAL STRATEGY, RECOMMENDATIONS, AND CONCLUSION**

Because of the increased number of commercial launches and the substantial investment by industry in future launch capabilities, the IWG was assigned to assess the implications of this increase and develop appropriate policy recommendations on the future management and use of the U.S. space launch bases and ranges, particularly at CCAS and VAFB. Therefore, the working group developed both a national strategy and a series of recommendations.

The national strategy and recommendations are based on inputs provided by the Department of Defense, the Air Force, the Federal Aviation Administration, the National Aeronautics and Space Administration, commercial enterprises, state-sponsored spaceports, local governments, and academia. The national strategy builds on actions already under way, proposes near-term recommendations to expand the public-private partnership, and posits a number of alternative futures. The recommendations address the most immediate issues and concerns regarding the U.S. space transportation capability and propose a number of actions to eliminate constraints and enable market forces and technology to determine which, if any, of the alternative futures and management models best meet the needs of the government and commercial space sectors.

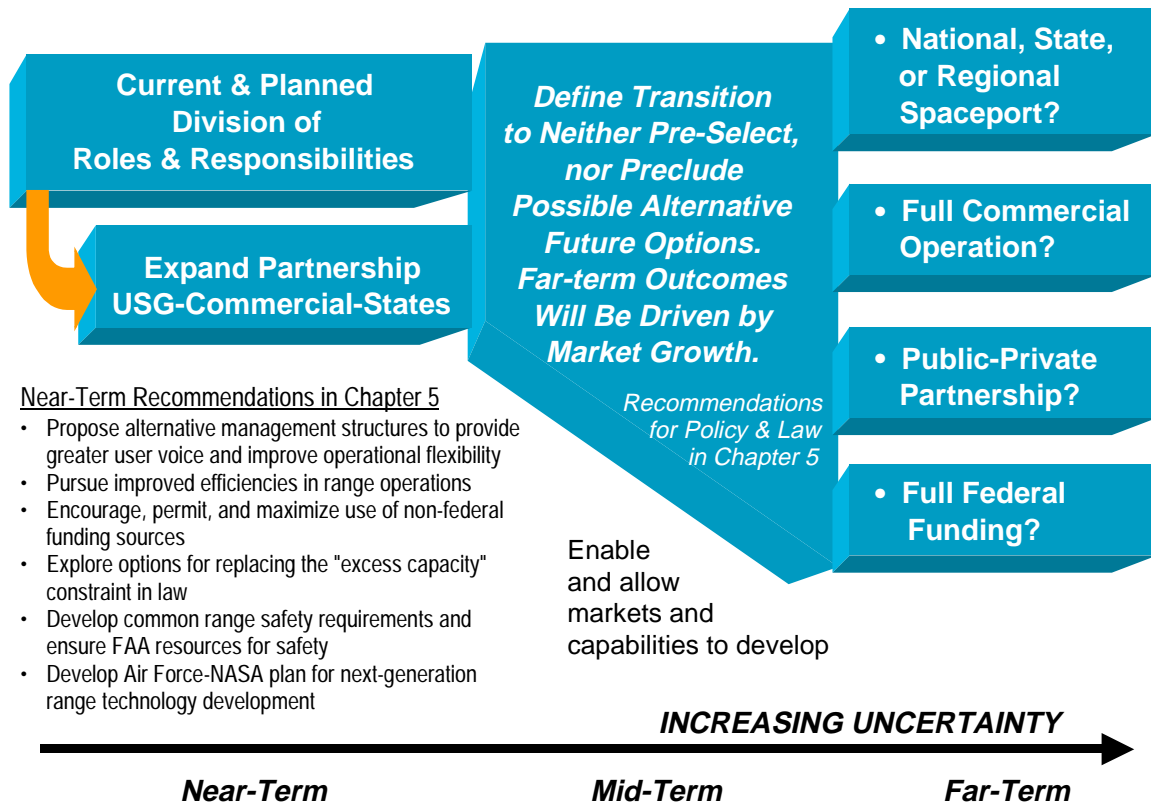
The recommendations are based on the premise that, for the foreseeable future, there continues to be significant national interest in U.S. government ownership and operation of the U.S. space launch bases and ranges in order to preserve access to space for national security, civil, and ballistic missile-related test and evaluation missions and to ensure public safety. However, the recommendations also take into account the significant shift from government-dominated use of the bases and ranges toward increasing commercial activity, as well as the growing interdependence of the U.S. government and commercial sectors. Some of these near-term recommendations are achievable within current policies and statutes, and all of them focus on expanding the federal-state-industry partnership to enable more direct involvement of civil and commercial space sector users, including spaceports.

The working group does not recommend increasing federal funding to meet requirements that are unique to the commercial space launch sector; therefore, these recommendations are not intended to create any unfunded mandates for any departments or agencies of the federal government. Also, the IWG believes government and industry should continue to work together to more fully understand all the potential implications of any recommendations for changes to policy and law.

### **Recommended National Strategy**

The IWG developed a recommended national strategy to respond to the challenges of increased commercial activity and other concerns raised by commercial industry during the course of the review. This strategy takes into account the reality of today's launch tempo and the uncertain projections for future commercial launch growth. It also builds on actions already under way with regard to changes in roles and responsibilities and the advent of the EELV.

This strategy first recommends a series of near-term steps that can be taken within existing policy and law, and that will enhance and expand the government-private partnership. These near-term recommendations are explained in detail below.



**Figure 6. Recommended National Strategy**

The next step in the proposed strategy is to eliminate constraints and enable a transition path that allows the commercial space industry to develop in response to market forces, not direction from the federal government. The working group defined a range of alternatives that could serve as future paths if commercial markets or national needs require. However, the uncertainties associated with potential demand for commercial satellite and launch services, coupled with the need for flexibility and agility as we move to an uncertain future, leads the working group to recommend that the federal government take no actions now that would either select or preclude any of these possible alternative futures. The working group believes the U.S. government should let market forces and the pace of new developments help determine which future scenario makes the most sense to pursue for the far term.

### Recommendations for the Near Term

The near-term recommendations are based on the working group’s assessment that the U.S. government must ensure access to space for defense, intelligence, and critical civil sector missions and must retain ranges for test and evaluation activities of strategic importance to U.S. national security. In addition, the group was advised on all sides that no likelihood now exists that commercial developments would support an operating regime that depended on equity markets (as do private companies as well as state and local revenue authorities). Hence, CCAS and VAFB should continue to be owned and controlled by DoD.

The near-term recommendations also recognize the recent and significant shift from government-dominated use of the launch bases and ranges toward increasing commercial activity. After five years of growth, it is clear that commercial activity will remain a major (if not the dominant)



factor in launch base and range activities through the next five years. In addition, U.S. industry is investing more than \$2 billion of its own money in future space launch capabilities, including the construction, operation, and maintenance of new launch facilities at both CCAS and VAFB, which will provide access to space for future national security missions. Recommendations must take into account the important interactions between the U.S. government and commercial space sectors, including balancing continuing national security interests with commercial industry's reliance on the federal launch bases and ranges to conduct their business.

Therefore, the overarching theme of these near-term recommendations is expanding the partnership among the federal government agencies and the commercial space sector, including states and spaceports. Should commercial markets and capabilities develop in a way that makes it feasible for states or commercial entities to generate a viable and sustainable business case for operating, maintaining, and sustaining the launch bases or ranges, the U.S. government should seriously consider the merits of such a transition, if it is in the best interest of the nation.

**Recommendation #1: Propose alternative management structures to allow commercial and government users of the U.S. space launch bases and ranges adequate opportunity to communicate their requirements so they can be actively considered and factored into decisions on improvements and operations with the goals of providing greater user voice and improving operational flexibility.**

#### Rationale

With the emergence of a sustained commercial launch market, it is clear that the U.S. government is no longer the only major user of the major U.S. space launch bases and ranges. Commercial activities constitute about 40 percent of the launch manifest on the Eastern and Western Ranges, and may increase that percentage at some point in the future. Currently, civil and commercial sector users have a limited voice and role in determining the requirements, plans, investments, and timing associated with operating, maintaining, improving, and modernizing the ranges. The federal government has no formal process for gathering, validating, or advocating commercial sector requirements, neither are there established processes for seeking or using nonfederal investment sources for range operations, maintenance, improvement, modernization, or sustainment.

Establishing management organizations and processes that include civil and commercial users up front would enable the federal government, commercial industry, and state governments, including spaceports in California and Florida, to plan and operate together more efficiently, thereby forming a more active and balanced partnership. As partners, civil and commercial sector operators and state spaceports should be allowed and encouraged to participate in processes to define range requirements, seek and plan investments—especially from nonfederal sources—shape range modernization programs, and continue to participate in the scheduling and operation of the launch bases and ranges. The goal of this enhanced partnership should be to improve the overall operational flexibility of the ranges so they are better able to accommodate the needs of all U.S. government and commercial sector users—now and in the future—in a more efficient, cost-effective manner. This will be especially important while planned range upgrades are being implemented over the next several years.

### Desired Outcomes

- **Establish an ongoing process for communicating and considering commercial requirements.**
  - Requirements Development. The Departments of Commerce (DOC) and Transportation (DOT) should take the lead in working with the U.S. commercial space sector users of the launch bases and ranges, DoD, and NASA to initiate a formal process to gather and communicate civil and commercial sector requirements for launch base and range support and modernization—especially those common to multiple users—and translate them into specific investment alternatives that could be considered in the DoD requirements process. Agencies should develop a mechanism for evaluating these requirements and determining which will be satisfied by planned federal modernization activities. Agencies and industry should also apply metrics to all requirements (particularly operational flexibility), set goals, and determine the benefits of additional public or private funding. DoD and NASA should work with DOC and FAA to ensure that commercial sector needs for launch base and range support are considered in the DoD requirements process. However, this process should not create any unfunded mandates. DoD should not be responsible for providing funding to meet requirements that are unique to the commercial space sector.
  - Operational Management. DoD should work with civil and commercial users and the state spaceports to reengineer and streamline base and range operations and support processes so lead times and interfaces more closely align with the needs and desires of civil and commercial sector users.
- **Improve range operational flexibility.**
  - Core Crew. DoD should explore options for improving the operational flexibility of the Eastern Range and work with civil and commercial users to determine the requirement for additional operations personnel while implementing planned improvements under the RSA program. Over the next seven years, upgrades to the Eastern Range under the RSA program are expected to cause significant disruption in launch operations due to prolonged periods when the range is taken off line to replace and validate components.

### **RECOMMENDATION #2: Pursue means of improving efficiencies in range operations.**

#### Rationale

Range operations at CCAS and VAFB are highly complex, having evolved over more than 40 years of space and ballistic launch activities. Improved efficiency of the range has the potential to reduce costs and increase operational flexibility benefiting all users. In 1998, NASA conducted a comprehensive review of all Space Shuttle support requirements levied on the Eastern Range and was able to drastically reduce the demands on the range. Similar reviews for other launch systems have the potential to reduce both the cost and range time associated with launch and improve range operational flexibility and efficiency. In addition, privatization and competitive sourcing through performance-based contracts can reduce overall range costs.

## Desired Outcome

- **Improve the overall efficiency of range operations.**
  - Privatization and Competitive Sourcing. DoD should continue current and planned privatization of the launch base utility systems and commercial services supporting the launch bases. Where possible, these actions should be done competitively. This may result in more of the total costs associated with operating, maintaining, and sustaining the U.S. space launch bases and ranges being directly accountable to commercial operators as “direct costs” under the current definition in the law. This will provide an incentive for all users to review their support requirements and improve overall efficiency of operations.
  - Reevaluate Range Support Requirement. DoD should work with all government and commercial users of the Eastern and Western Ranges to carefully reevaluate range support and operations requirements. The goal of this review is to reduce any unnecessary or outdated workload burden and improve operational flexibility and efficiency.

**RECOMMENDATION #3: Encourage, permit, and maximize use of nonfederal funding sources (especially from states and spaceports) for the continued maintenance and modernization of the space launch bases and ranges to meet national needs for space transportation.**

## Rationale

Over the next decade, the Department of Defense projects it will spend on the order of \$650 million per year to operate, maintain, sustain, and modernize the common-use portions of CCAS and the Eastern Range, plus VAFB and the Western Range. Government users of the bases and ranges, including NASA, the NRO, and the Navy, reimburse the Air Force for about 13 to 15 percent of this total amount each year. While commercial sector activities are projected to account for roughly 40 percent of the launch manifest at the Eastern and Western Ranges, commercial sector reimbursements typically amount to about 4 to 5 percent of the annual budget. At the same time, however, commercial industry is investing more than \$2 billion in the EELV program, which includes launch vehicle development and the construction, operation, and maintenance of all EELV facilities and pads.

The “excess capacity” basis for the government-commercial relationship in current law prohibits the federal government from planning, programming, and budgeting for the commercial sector workload. The “direct cost” definition in the law limits federal agencies’ ability to share either amortization or recapitalization costs with commercial users. As a result, the Air Force funds only the highest-priority improvements to meet national security needs.

Current federal law also limits the augmentation of federal appropriations with nonfederal funding from private or state sources (i.e., “gifts”)—funding sources that might otherwise be used to expand the scope of range modernization efforts or to accelerate the pace toward completion, as has been advocated by civil and commercial users. To establish a more equitable and sustainable basis for funding the operation, maintenance, improvement, modernization, and

sustainment of the Eastern and Western Ranges, commercial users and states, including spaceports, should be allowed and encouraged to seek and provide funding for the range improvements and modifications that are uniquely required to support commercial activity at the ranges.

### Desired Outcomes

- **Identify and eliminate policy and legal impediments that restrict, prevent, or impede the use of nonfederal investment sources to supplement federal government appropriations used to operate, maintain, improve, modernize, and sustain the U.S. space launch bases and ranges.**
  - Legislative Proposal. In light of the commercial sector’s growing role as a user of the federal launch bases and ranges, the U.S. government should develop and propose specific policy and law modifications to eliminate impediments to nonfederal investment.
  
- **Identify alternative funding mechanisms to increase nonfederal investment in the launch ranges.**
  - Identify and Encourage Nonfederal Investment. DOC and DOT should work with DoD and NASA, states and industry, to identify and encourage nonfederal investment in the space launch bases and ranges at CCAS and VAFB. Nonfederal investment could include both public and private funds.
  
  - Form Investment Partnerships with States and Spaceport Authorities. DoD should take the lead to work with state and regional enterprises, such as the California and Florida Spaceport Authorities, to form appropriate investment partnerships and plan investment strategies capitalizing on the unique advantages inherent in the spaceport makeup. These partnerships should be designed to facilitate planning and investments by states and regional spaceport authorities and to highlight areas where mutual interests and complementary capabilities can be exploited for the benefit of both government and commercial users of the major U.S. space launch bases and ranges.
  
  - Management Mechanisms. As the steward of the space launch ranges, DoD should take the lead in working with DOC, FAA, and NASA to examine and propose appropriate mechanisms and processes to manage and use a mix of both federal and nonfederal funds.
  
- **Retain the “direct cost” definition in public law, continue range contracting restructuring, and conduct an audit of range costs.**
  - Retain the “Direct Cost” Construct. The IWG does not recommend modifying or removing the “direct cost” definition from public law.
  
  - Process to Redefine Burden Sharing. DoD, in consultation with DOC, FAA, NASA, and commercial industry, should evaluate the need to redefine burden-sharing arrangements. This process should evaluate and quantify the potential effects on industry’s international competitiveness before proposing that changes should be implemented.

- **Contract Restructuring.** DoD should consider the effect any contract restructuring could have on the prices U.S. commercial sector users would have to pay for launch base and range support services before implementing the restructuring.
- **DoD Audit.** DoD, in consultation with OMB, should conduct an audit to establish firm baseline data for launch base and range support costs and prices for all elements of reimbursable support.
- **Stable Pricing.** Prices for government launch base and range support to commercial sector activities should be stable, predictable, and well defined. DoD should evaluate expanding its current fixed-pricing practices to include a fixed-price catalog for support services. DoD and NASA should work to ensure they consistently define direct costs.

**Recommendation #4: Explore options for replacing the “excess capacity” constraint in the current policy and legal framework, while retaining priority access for national security and critical civil sector missions, to allow a more complete partnership to develop between the federal government and the U.S. commercial space sector, including states and spaceports.**

#### Rationale

The “excess capacity” constraint in the law has been very effective in enabling the emergence and development of the successful and growing U.S. commercial space sector during the past decade. However, now that the commercial sector’s activities drive nearly half the total workload at the Eastern and Western Ranges, the working group is concerned that the “excess capacity” constraint in the law may inhibit the future growth of the U.S. commercial space launch industry. It also limits the potential synergy between government and private sector interests because it represents a built-in constraint on the ability of the federal government to address the needs of commercial sector users of the U.S. space launch bases and ranges. With this constraint in place, commercial users, including spaceports, cannot be viewed or treated as full participants or partners in planning for or providing resources to improve the ability of the launch bases and ranges to meet the needs of U.S. government and commercial users. To reduce these limitations, the “excess capacity” constraint in the law should be eliminated and replaced by a new legal and policy construct that enables a more complete partnership to develop between the federal government and the U.S. commercial space sector, including states and spaceports.

#### Desired Outcomes

- **The Executive Branch should explore options for replacing the “excess capacity” constraint in the law with a goal of achieving a more complete partnership with the U.S. commercial space sector, including states and spaceports.**
  - **Legislative Proposal.** The Executive Branch should develop a recommendation for a new legal construct to replace this constraint in the law with a new construct.
  - **Accommodate All Users.** Space transportation is a form of transportation that is in the *national* interest. The activities of each sector contribute to U.S. national and economic security. While national security and civil launches have long been recognized as benefiting the nation’s security, commercial launch activities also contribute to national

security through increased reliability, lower costs, and increased responsiveness. Commercial launches also contribute to the general welfare and economic development of the nation enabling space-based services. Because space transportation is in the national interest, the new legal construct should permit the U.S. government to develop the necessary infrastructure and policies to accommodate the needs of all users—national security, civil, and commercial—using a mix of federal and nonfederal resources, as appropriate.

- Enable More Complete Partnership. Enable a more complete partnership to develop between the federal government and the U.S. commercial space sector, including states and spaceports.
- Include Specific Bounds. The Executive Branch’s recommended new legal construct should ensure the U.S. government retains appropriate priority for national security and critical civil sector mission requirements, include specific bounding language to preclude unintended consequences and ensure no unfunded mandates are created for federal government agencies.

**Recommendation #5: Develop common range safety requirements for government, civil, and commercial launches at federal and nonfederal launch sites and ensure that FAA resources are commensurate with its statutory requirements and safety responsibilities.**

#### Rationale

The Air Force is responsible for establishing launch safety requirements and executing ground and flight safety programs for government and commercial activities at CCAS and VAFB. Launch safety requirements and procedures have been developed and refined over many years and are documented by the two launch wings in one centralized manual. Under current law, the FAA is responsible for overseeing the safety of FAA-licensed U.S. commercial space launch, reentry, and site activities on and outside the federal launch bases and ranges. However, under current policy, the FAA accepts the Air Force safety requirements and oversight through the FAA’s baseline assessment of safety at the federal launch bases and ranges. To support the growing commercial launch activities not located on federal ranges and the emerging U.S. reusable launch vehicle industry, the FAA is currently in the process of developing safety requirements to be applied to commercial activities at nonfederal launch sites. Standardization of requirements and procedures among launch locations, vehicles, and federal agencies is important to improve efficiency and reduce cost.

#### Desired Outcomes

- **Institute common safety requirements.**
  - Common Requirements. The FAA and the Air Force should continue their cooperative development of common safety requirements to be applied to government and commercial launches at federal and nonfederal launch sites.
- **Continue to modernize the National Airspace System to account for space launch and reentry through the airspace.**

- Include Space Launch and Reentry in National Airspace System Modernization. The FAA should seek to safely and efficiently accommodate the atmospheric flight of space launch and reentry vehicles as they pass through the National Airspace System as it undergoes modernization.
- **FAA should ensure appropriate resources commensurate with its statutory requirements and safety responsibilities.**
  - Ensure Appropriate FAA Resources. The FAA should continue to consider additional personnel and funding commensurate with its statutory responsibilities to oversee the safety of commercial launch, reentry, and nonfederal launch site activities.
- **Enhance the Air Force–FAA partnership on safety for commercial launches.**
  - Air Force–FAA Memorandum of Agreement. The Air Force and the FAA should work together to develop a Memorandum of Agreement to formalize their respective responsibilities for the safety of space launch activities. The Air Force should retain all current responsibilities for safety of government activities and retain safety of flight operations for commercial activities on the Eastern and Western Ranges.

**Recommendation #6: The Air Force and NASA should develop a plan to examine, explore, and proceed with next-generation range technology development and demonstration, with a focused charter to improve safety, increase flexibility and capacity, and lower costs for reusable and expendable launch vehicles. NASA should designate KSC as a National Center for next-generation RLV range technology development and demonstration, while the U.S. Air Force remains the overarching authority for Eastern and Western Range architecture.**

#### Rationale

Today, no Air Force–NASA program focuses on next-generation range technology in support of the missions of both the Air Force and NASA. Such a program would address capabilities beyond modernization activities the agencies are currently executing, such as the Air Force RSA program. Space-based or other advanced alternatives need to be examined to create revolutionary improvements in such areas as range safety, flexibility, capacity, and cost. Next-generation technologies could benefit future operational expendable and reusable launch systems, as well as test and evaluation activities.

Potential benefits from a coordinated Air Force–NASA advanced range technology program could include low support costs per launch, short lead times to schedule or reschedule launch-related range activities, high overall throughput and capacity, high schedule flexibility, fewer weather-related launch delays and scrubs, high range reliability, and lower costs for capital improvements, as well as operating, maintenance, and sustainment costs.

#### Desired Outcomes

In support of their existing mission responsibilities, NASA and the Air Force should agree on plans for coordinating, developing, and demonstrating next-generation range technologies.

The Air Force and NASA should jointly set and pursue goals to improve safety and reduce costs by orders of magnitude, to support expendable launch and test and evaluation activities more efficiently at lower cost, and to enable high launch rate operations using next-generation highly reusable space transportation systems.

## **Conclusion**

In pursuit of long-standing goals in national policy and law, the U.S. government has fostered the growth of commercial space launch activity by providing access to government launch property and services. Commercial space launches now comprise about 40% of the launch manifest at Cape Canaveral Air Station and Vandenberg Air Force Base, and commercial companies are investing substantial sums of money into their commercial launch businesses. At the same time, a new public-private partnership is emerging with the advent of the EELV program. While this increased commercial activity is a success story, growth has raised near- and long-term questions and challenges regarding the adequacy of the traditional government-dominated space launch arrangements and the viability of the national policy and legal foundation on which government support is based.

In that context, the Interagency Working Group on Future Management and Use of the U.S. Space Launch Bases and Ranges examined the current roles and responsibilities of federal government agencies and the U.S. commercial space sector and any major policy and management issues that could result from the shift in launch base use from its historic government-dominated basis toward more commercial, market-driven activities. The IWG reached the following broad conclusions:

- Although the basic legal and policy framework appears to be adequate to support the current level of government and commercial space launch activity, this framework may require revision in the future if the commercial satellite and launch market continues to grow.
- The U.S. government is already sharing substantial responsibilities with the commercial sector and is pursuing a path to share significantly more responsibilities with state spaceports, state governments, and commercial operators in the future. Simultaneously, the Air Force is seeking ways to enhance its use of contract providers for operations, maintenance, improvement, modernization, and sustainment.
- Symptoms indicate the significant growth in the current workload could impact management, operations, maintenance, improvement, and modernization processes at both major U.S. space launch bases and ranges. Emerging concerns were identified to the IWG in the following areas:
  - Limitations in the national policy and legal framework
  - Accommodating commercial customers and their needs
  - Operational flexibility
  - Financial issues and opportunities



- Roles, resources, and requirements for public safety
- Next-generation technology development and demonstration for launch ranges
- At this point in the evolution of the U.S. space launch bases and ranges, pursuing a radical change in management--such as transferring ownership and responsibilities for operations to a private or state-sponsored entity--does not appear to be in the interest of either the U.S. government or commercial space sector.
- The IWG defined a range of alternatives that could serve as future paths if commercial markets or national needs require. However, the uncertainties associated with potential demand for commercial satellite and launch services, coupled with the need for flexibility and agility as we move to an uncertain future, leads the IWG to recommend that the federal government take no actions now that would either select or preclude any possible alternative future management models or arrangements.

In response to these concerns, the IWG developed a strategy that proposes building on the already planned changes in roles and responsibilities with a series of additional near-term steps that will enhance and expand the government-private partnership (including federal government agencies, the U.S. commercial space sector, states, and spaceports). These near-term recommendations are based on the IWG's assessment that the U.S. government must ensure access to space for defense, intelligence, and critical civil sector missions and must retain ranges for test and evaluation activities of strategic importance to the United States. In addition, the IWG was advised that no likelihood now exists that commercial developments would support an operating regime that depended on equity markets. Hence, CCAS and VAFB should continue to be owned and operated by DoD.

Should commercial markets and capabilities develop in a way that makes it feasible for states or commercial entities to generate a viable and sustainable business case for operating, maintaining, and sustaining the launch bases or ranges, the U.S. government should seriously consider the merits of such a transition, if it is in the interest of the nation.

Space launch is important to U.S. national security and economic well-being. Enhancing and evolving the government-private partnerships will help continue the progress made over the last decade by the commercial space launch industry and help establish the pathway to the future.

**ANNEXES**

## **Annex A – TERMS OF REFERENCE**

The Terms of Reference serves as the charter for the Interagency Working Group (IWG). It was written and agreed upon by the IWG in April and May 1999 and distributed to the Senior Executive Steering Group in June 1999.

### **Introduction**

The President’s 1994 National Space Transportation Policy states that “Assuring reliable and affordable access to space through U.S. space transportation capabilities is a fundamental goal of the U.S. space program.” Clear and appropriate roles and responsibilities of the government and the private sector, including management and operation of the U.S. space launch bases are critical to the ability of all four U.S. space sectors—military, intelligence, civil, and commercial—to access space. Over the past few years, commercial sector launch activities have begun to outpace government activities at the U.S. space launch bases and their supporting ranges. Based on industry and government projections, this trend will continue, with the majority of launches per year being commercial.

This review will assess the implications of the continuing increase in commercial launches and develop appropriate policy recommendations on the future management and use of the launch bases and ranges. The review will assess civil, commercial, and national security roles and responsibilities for operations, maintenance, improvement, and modernization at U.S. space launch bases and ranges, particularly at Vandenberg Air Force Base, California, and Cape Canaveral Air Station, Florida. The review will be structured to accommodate inputs from each affected U.S. space sector, including state and local governments and operators of non-federal launch sites, commonly referred to as spaceports. Implementation of the recommendations will be accomplished within the overall resource and policy guidance provided by the President.

### **Goals and Objectives**

This review will develop a recommended national strategy for management and use of the U.S. space launch bases and ranges. This national strategy will:

- Describe the current division of roles and responsibilities for management of the U.S. space launch bases and ranges;
- Describe a desired future end state, or vision for the future management of the launch bases and ranges, and identify intermediate steps leading to that desired end state; and
- Recommend how management roles and funding responsibilities for operations and maintenance (O&M) and improvement and modernization (I&M) of the launch bases and ranges, including infrastructure, facilities, and systems should be divided between the U.S. government and commercial space sectors and among U.S. government departments and agencies.

A primary objective of the review will be to recommend any changes to policy, law, or budgets to enable implementation of the national strategy for management and use of the U.S. space launch bases and ranges.

## Scope of Review

This review will address major aspects of applicable policy and law, as well as the division of management roles, funding responsibilities, and allocation of risk between the U.S. government and the U.S. commercial space sector, and among U.S. government agencies, for all aspects of launch base and range management at Cape Canaveral Air Station, Florida and Vandenberg Air Force Base, California, including ownership, operations, maintenance, and sustainment, including technology development, improvement, and modernization as they relate to the following elements:

- Base Ownership (e.g., environmental approval processes and responsibilities, land use planning and assignment, lease and license processes and approvals for use of real property, compliance monitoring for lease and environmental requirements, etc);
- Supporting Infrastructure (e.g., utility systems; roads; security; airfield operations; ordnance, propellant and commodity storage, handling, and delivery; fire protection; medical care; office space; lab analysis; calibration services; etc);
- Space Launch Operations Facilities and Systems (e.g., payload and launch vehicle processing and assembly, space launch complexes, launch control centers, checkout control centers, etc);
- Range Facilities and Systems (e.g., radar and/or other metric tracking assets, optical tracking assets, telemetry receivers and processing systems including software development, command transmitters and/or other safety systems and assets, communications systems, range operations control center, test and evaluation support, scheduling functions, airspace management and coordination, planning for modernization, etc);
- Safety Responsibilities and Operations (e.g., OSHA compliance; safety training and certification requirements and implementation; ground safety—including requirements, standards, procedures, and review and approval functions; flight safety—including analysis, design requirements and standards for flight systems, and operational roles; system safety—including design requirements and standards for spacecraft and launch vehicle safety, and review and approval functions).

## Participants

The Interagency Working Group (IWG) will be co-chaired by the Director for Defense Space Policy on the National Security Council staff and the Assistant Director for Space and Aeronautics within the Office of Science and Technology Policy. At a minimum, participants in the IWG will include representatives from the Office of Management and Budget, the Office of the Vice President, the Department of Defense (including the U.S. Air Force and the Joint Staff), the Director of Central Intelligence, the Federal Aviation Administration, the Department of Commerce, and the National Aeronautics and Space Administration. Other agencies may assign representatives to the IWG as determined by the co-chairs.

The IWG may also seek inputs from nonfederal stakeholders, including the U.S. commercial space sector (e.g., launch vehicle and satellite manufacturers, launch and satellite service providers, base and range operations contractors, launch site operators, operators of commercial

payload processing facilities, etc.); academia; representatives of the nonprofit sector; and state and local governments. The IWG may also request specific input related to the nonfederal launch sites, commonly referred to as spaceports, which are currently licensed by the Federal Aviation Administration to operate in Florida, California, Virginia, and Alaska.

To provide top-level guidance and advice to the IWG, the Assistant to the President for Science and Technology shall chair a Senior Executive Steering Group (SESG) to consist of senior management representatives from the National Security Council, the Office of Management and Budget, the Office of the Vice President, the Department of Defense, (including the U.S. Air Force and the Joint Staff), the Director of Central Intelligence, the Federal Aviation Administration, the Department of Commerce, and the National Aeronautics and Space Administration. This SESG shall meet as appropriate upon the recommendations of the interagency working group co-chairs, and as necessary to approve recommendations or reach decisions.

### **Ground Rules and Assumptions**

In conducting the review, the IWG will assume the following ground rules and assumptions as a point of departure for analysis. These ground rules focus on projected workload at the U.S. space launch bases and ranges, the makeup of the customer base, the future of certain programs, and the policy environment.

- The Launch Forecast, COMSTAC GEO, and FAA LEO Forecasts will be used to project future U.S. space launch missions.
- ICBM, SLBM, and aeronautical test requirements are included in the current 30th and 45th Space Wing workload forecasts.
- EELV is planned to be operational from 2001/2002 to at least 2020. Current ELVs will continue operating on a commercial basis to address market demand. U.S. Air Force responsibilities for the supporting infrastructure and space launch operations facilities and systems associated with Atlas and Delta will be phased out as EELV becomes operational.
- The Space Shuttle will continue operating at least until a suitable replacement is available and has demonstrated desired reliability. The shuttle commercialization effort will proceed as permitted by current policy and law.
- Reusable launch vehicle (RLV) technology demonstrations will begin as early as 1999 with the X-34 and continue at least through 2010.
- Commercial RLV development and test will continue, and operations will begin in 1999 if development and test are successful.
- The Range Standardization and Automation (RSA) program will remain on track and be complete by 2006.
- The U.S. Air Force will continue to own launch base real estate for the foreseeable future.

- To stimulate private sector investment, ownership, and operation of space assets, the U.S. government will facilitate stable and predictable U.S. commercial sector access to appropriate U.S. government space-related hardware, facilities, and data.
- The U.S. government will continue to facilitate commercial space activities without direct federal subsidies to commercial industry, per current policy.
- The U.S. government will continue to reserve the right to use U.S. space launch and range-related capabilities on a priority basis to meet national security and critical civil sector requirements.
- For the foreseeable future, U.S. government payloads will be launched on U.S.-manufactured launch vehicles unless exempted by the President or his designee, per current policy.
- U.S. government agencies, in acquiring space-launch related capabilities, will, to the extent feasible and consistent with mission requirements involve the private sector in the design and development of space transportation capabilities and encourage private sector financing as appropriate, and encourage private sector and state and local government investment and participation in the development and improvement of U.S. launch systems and infrastructure.

## **Products**

The IWG will develop two products—a report and a briefing. The report will be used to document the results of the review; the briefing will summarize and communicate these results. Both products will describe the current and future division of roles and responsibilities among federal government departments and agencies and the U.S. commercial space sector. Both will also include any recommended changes to policy and/or law, as well as any recommendations regarding funding implications for future budgets.

The description of roles and responsibilities will include management roles, funding responsibilities, and allocation of risk for O&M and I&M of each element of the launch bases and ranges. The elements of the launch bases and ranges to be addressed include those listed above under Scope: (1) Base Ownership, (2) Supporting Infrastructure, (3) Space Launch Operations Facilities and Systems, (4) Range Facilities and Systems, and (5) Safety Responsibilities and Operations.

The report will describe the current division of roles and responsibilities and recommendations on how and when various aspects of these roles and responsibilities should change as the nation moves toward the desired future end state or vision. The report will recommend intermediate changes for the initial step in FY 2001, when EELV is operational in 2002, and when RSA is projected to be completed in 2006.

## **Annex B – CURRENT POLICY, LAW, AND IMPLEMENTATION DIRECTIVES**

For more than a decade, U.S. National Space Policy has included consistent direction for U.S. government agencies to foster the international competitiveness of the U.S. commercial space transportation industry by encouraging access to the U.S. space launch bases and ranges on a reimbursable basis and by encouraging private sector, state, and local government investment and participation in the development and improvement of U.S. launch systems and infrastructure.

### **National Space Policy (1996)**

The President’s 1996 National Space Policy recognizes that “access to and use of space is central for preserving peace and protecting U.S. national security as well as civil and commercial interests.” One of the goals of the policy is to “encourage state, local, and private sector investment in, and use of, space technologies.” The policy assigns DoD the responsibility to maintain the capability to support the space launch systems, infrastructure, and support activities necessary to meet national security requirements.

The President’s policy also establishes “a fundamental goal . . . to support and enhance U.S. economic competitiveness in space activities while protecting U.S. national security and foreign policy interests.” Expanding U.S. commercial space activities will generate economic benefits for the nation and provide the U.S. government with an increasing range of space goods and services. The policy precludes the use of direct federal subsidies. It encourages “private sector ownership, investment, and operation of space assets” and directs U.S. government agencies to “facilitate stable and predictable U.S. commercial sector access to appropriate U.S. Government space-related hardware, facilities, and data on a reimbursable basis. The U.S. Government reserves the right to use such hardware, facilities, and data on a priority basis for national security and critical civil sector requirements.”

### **National Space Transportation Policy (1994)**

The President’s 1994 National Space Transportation Policy establishes a U.S. government role to maintain a strong space transportation capability, including launch systems, infrastructure, and support facilities, to meet the national needs for space transport of personnel and payloads. It also says “the U.S. Government will . . . foster the international competitiveness of the U.S. commercial space transportation industry, actively considering commercial needs and factoring them into decisions on improvements in launch facilities and launch vehicles.” It says “the U.S. Government is committed to encouraging a viable commercial U.S. space transportation industry,” and it directs U.S. government agencies to “make all reasonable efforts to provide stable and predictable access to appropriate space transportation–related hardware, facilities, and services; these will be on a reimbursable basis. The U.S. Government reserves the right to use such facilities and services on a priority basis to meet national security and critical civil sector mission requirements.” U.S. government agencies, “in acquiring space launch–related capabilities, will, to the extent feasible and consistent with mission requirements, involve the private sector in the design and development of space transportation capabilities and encourage private sector financing, as appropriate” and “encourage private sector, state, and local government investment and participation in the development and improvement of U.S. launch systems and infrastructure.”

## **Commercial Space Launch Act, 49 U.S.C., Subtitle IX, Chapter 701**

Consistency through time has also characterized the legal framework regarding U.S. government support for commercial space launch activities. The same basic legal framework for commercial space launch support has been in place since the Commercial Space Launch Act was signed into law in 1984, though the law was amended in 1988 and 1998 and codified at 49 U.S. Code, Subtitle IX, Chapter 701.

The findings and stated purposes of Congress in crafting the CSLA are consistent with the goals and direction that have been elements of the National Space Policy framework through the Reagan, Bush, and Clinton Administrations. For instance, the CSLA begins with the findings of Congress, some of which are listed below:

- “the development of commercial launch vehicles, reentry vehicles and associated services would enable the United States to retain its competitive position internationally, contributing to the national interest and economic well-being of the United States;
- “the United States should encourage private sector launches, reentries and associated services;
- “space transportation, including the establishment and operation of launch sites, reentry sites, and complementary facilities, the providing of launch services, reentry services, the establishment of support facilities, and the providing of support services, is an important element of the transportation system of the United States, and in connection with the commerce of the United States there is a need to develop a strong space transportation infrastructure with significant private sector involvement; and
- “the participation of State governments in encouraging and facilitating private sector involvement in space-related activity, particularly through the establishment of a space transportation-related infrastructure, including launch sites, reentry sites, complementary facilities, and launch site and reentry site support facilities, is in the national interest and is of significant public benefit.”

Two of the purposes stated for the law are “to promote economic growth and entrepreneurial activity through use of the space environment for peaceful purposes; and . . . to facilitate the strengthening and expansion of the United States space transportation infrastructure, including the enhancement of United States launch sites and launch-site support facilities, and development of reentry sites, with Government, State, and private sector involvement, to support the full range of United States space-related activities.”

The CSLA also says that U.S. government agencies should facilitate and encourage private sector and State government access to U.S. government “launch property that is excess or otherwise is not needed for public use; and launch services, including utilities, otherwise not needed for public use.” This law also defined the “direct cost” basis for commercial sector reimbursement to the federal agencies providing this support. Current law defines “direct costs” as “the actual costs that—(A) can be associated unambiguously with a commercial launch or reentry effort; and (B) the Government would not incur if there were no commercial launch or reentry effort.”



This same law also established that the Department of Transportation has the following basic responsibilities:

- “only to the extent necessary, regulate those launches and services to ensure compliance with international obligations of the United States and to protect the public health and safety, safety of property, and national security and foreign policy interests of the United States;
- “encourage, facilitate, and promote commercial space launches by the private sector; [and]
- “facilitate the strengthening and expansion of the United States space transportation infrastructure.”

In fulfilling its responsibility to ensure public health and safety, the FAA issues licenses for commercial launch and reentry of orbital and suborbital rockets, and launch site operator licenses for the operation of sites from which launch activities are conducted.

The CSLA of 1984, as codified at 49 U.S.C., Subtitle IX—Commercial Space Transportation, Chapter 701, Commercial Space Launch Activities, established within the Department of Transportation a licensing and regulatory regime for nongovernment launch activities. The CSLA authorizes the Secretary of Transportation to oversee, license, and regulate commercial launch and reentry and the operation of launch and reentry sites as carried out by U.S. citizens or within the United States. The Act directs the Secretary of Transportation to exercise this responsibility consistent with public health and safety, safety of property, and the national security and foreign policy interests of the United States and to encourage, facilitate, and promote commercial space launches by the private sector.

The Act was amended in 1988 to enhance the competitiveness of the nascent U.S. commercial launch industry. The 1988 amendments established new rules for insurance requirements whose effect was to limit liability for damages to government property and third parties. The revised CSLA also established protections against government preemption of commercial launches on government ranges. The Commercial Space Act of 1998 revised the statute regarding commercial space launches to grant the Department of Transportation licensing authority for reentry vehicles, including launch and reentry of reusable launch vehicles, and for operation of reentry sites and provided the FAA authority to issue safety approvals of vehicles, safety systems, processes, services, and personnel. It also states that the Secretary shall ensure the establishment of uniform guidelines for, and consistent implementation of acquisition of U.S. government property and services, by all federal agencies. (49 U.S.C. §70111(b)(3))

The statute also provides a mechanism for the use of excess government property and services by the private sector as part of the effort to “facilitate the strengthening and expansion of the United States space transportation infrastructure.” Under the law, “the Secretary of Transportation shall facilitate and encourage the acquisition by the private sector and State Governments of a) launch property of the United States Government that is excess or otherwise is not needed for public use; and b) launch services, including utilities, of the Government otherwise not needed for public use.” In facilitating the use of excess government capacity, prices for such property and services shall be established in accordance with direct cost principles in consultation with the Department of Transportation where “‘direct costs’ means the actual costs that a) can be

associated unambiguously with a commercial launch effort; and b) the Government would not incur if there were no commercial launch effort.”

### **DoD and USAF Implementation Direction**

#### DoDD 3100.10, “Space Policy”

Department of Defense Directive 3100.10, Space Policy, was signed by the Secretary of Defense on 9 July 1999. It supercedes the 1987 DoD Space Policy Memo and serves to codify direction already implemented by DoD and the Air Force. As the first DoD Space Policy promulgated since the end of the Cold War, DoDD 3100.10 recognizes the growing importance of space for national security, civil, and commercial purposes. It takes into account the major changes that have occurred since 1987 in order “to maintain the nation’s leadership role in space into the next century and achieve U.S. national security objectives.”

DoDD 3100.10 addresses several areas that were of interest to the interagency working group, including the observation that “the ability to access and utilize space is a vital national interest.” The Directive touches on issues such as the enhancement of partnerships between the DoD, civil, and commercial space sectors, the facilitation of stable and predictable private sector access to space-related hardware, facilities, and data, and the aggressive outsourcing or privatization of space-related functions, consistent with mission requirements. Overall, DoDD 3100.10 represents an evolution in policy to bring DoD guidance into alignment with National Space Policy and existing DoD practices.

#### DoDD 3200.11, “Major Range and Test Facility Base”

Department of Defense Directive 3200.11, Major Range and Test Facility Base (MRTFB), recognizes that the MRTFB is a national asset operated and maintained primarily for DoD Test and Evaluation (T&E) support missions. The Directive notes that the MRTFB should “also be available to all users having a valid requirement for its capabilities.” This availability, however, must not increase the cost to the DoD and should not be factored into the decision-making process for sizing and maintaining the MRTFB. In other words, support to commercial enterprises wishing to use the MRTFB will be provided on an “excess capacity” basis.

While equitable consideration is to be given to all DoD Components, MRTFB commanders are to ensure that equitable access is also provided for commercial customers and non-DoD Government users. MRTFBs are permitted to provided this access insofar as it does not compete with U.S. private sector enterprises. Cost for the use of the MRTFB by non-DoD Component users (e.g., State and local governments, allied foreign governments, U.S. commercial companies, etc.) shall be charged in accordance with Volume 11A of DoD 7000.14-R, “Financial Management Regulation,” to be discussed subsequently.

MRTFB commanders are empowered by this Directive to safeguard the public health and safety and safety of property from all test and evaluation activities. In addition to decision-making authority over DoD and non-DoD Government activities, the Directive stipulates that the MRTFB commander may “terminate, prohibit, or suspend immediately any commercial test or evaluation activity” that endangers the public healthy and safety, the safety of property, or the

national security interests of the United States. Any such determination by the MRTFB commander must be made in writing.

DoDD 3230.3, “Commercial Space Launch Support”

DoDD 3230.3 outlines the guidelines for establishing policies, procedures, and pricing to be employed in providing DoD support for commercial space launch activities. It establishes DoD policy to encourage the U.S. private sector development of commercial launch operations, to endorse and facilitate the commercialization of ELVs consistent with economic, foreign policy, and national security interests, and to assist the Department of Transportation in implementing the Commercial Space Launch Act. The Directive states that commercial ELV operators will be provided DoD-owned equipment not needed for public use or on a non-interference basis. This forms the basis for the “excess capacity” framework in DoD policy.

Cost to non-DoD users of DoD equipment “will be direct costs (including any specific wear and tear and damage to the property) the Government incurs as a result of such use.” This is expanded upon in Enclosure 2 of the Directive, which covers the pricing and disposition of collections for commercial space launch programs. For the sale of launch property, fair market value shall be charged so long as the sale guarantees a reasonable return to the Government and does not constitute a direct subsidy. If launch property is made available through a lease agreement, direct costs based on the cost of providing the equipment and the direct cost of replacing or restoring the property or site shall be applied. Launch services shall be made available with reimbursement equal to the direct costs incurred by the DoD, unambiguously identified with the particular launch support.

In accordance with DoDD 3230.3, the proceeds from the sale of excess launch property are deposited into the Miscellaneous Receipts Accounts of the U.S. Treasury, while collection from services and nonexcess property are to be credited to the appropriation from which the cost of the services or property was paid.

DoDFMR 7000.14R, Volume 11A, Chapter 12, Major Range and Test Facilities.

Chapter 12 of DoD 7000.14-R, “Financial Management Regulation” provides reimbursable policy for the provision of specific DoD activities at MRTFBs to DoD Component users and non-DoD Component users including Federal, State or Local Government agencies.

DoD Component users must reimburse MRTFB activities for direct costs that are directly traceable to test and evaluation (T&E) activities. Reimbursement will also include a proportional share of maintenance costs related to the T&E activity. Such indirect costs are to be paid by the activity’s direct appropriations.

Non-DoD Component users (e.g., State and Local Governments) must reimburse the MRTFB for all direct costs associated with their activity in addition to an appropriate amount of indirect costs. Chargeable direct costs include “labor, material, facilities, minor construction specifically performed for the customer, utilities, equipment, supplies, and other resources damaged or consumed during testing or maintained for a particular user.” Charges for indirect costs that are not billed to a customer shall be billed to the activity’s institutional funds providing that

institutional funding levels do not need to be increased to finance the costs incurred due to non-DoD activities.

#### DoDFMR 7000.14R, Volume 11A, Chapter 13, “DoD Support to United States Commercial Space Activities”

Chapter 13 details the guidelines for the provision of excess launch property and services to commercial sector entities. Chapter 13 defines direct costs as “the actual costs that are associated with a commercial launch effort or other commercial space activity that would not be borne by the DoD in the absence of the commercial launch effort or other commercial activity.” The Chapter specifically includes as part of chargeable direct costs “labor, materials, utilities, equipment, supplies, transportation, mission-specific construction, and any other resources required, consumed, or damaged in providing government support or services.”

Commercial entities that lease or license space launch property are to be charged for the direct costs described above. The acquisition price for space launch services (including utilities) is also to be equal to the direct costs incurred as a result of the acquisition. However, if space launch property is sold or transferred by other transaction instead of sale, then the price for that property shall be commensurate with the fair market value.

Similar to DoDD 3230.3, Chapter 13 directs that the proceeds from the sale of excess launch property are to be deposited into the Miscellaneous Receipts Accounts of the U.S. Treasury if the property is not to be replaced. If the property is to be replaced, the proceeds shall be deposited to the DoD appropriation account or fund currently available for the procurement of the launch property. For licensed launch property and the sale of launch services, the proceeds shall be deposited to the DoD appropriation available for financing the provision of the property or service.

#### Air Force Real Property Policy

It is the policy of the United States to facilitate and encourage the use by the private sector and State Governments of launch property that is excess or otherwise not needed for public use. On 7 May 96 SAF/SN and SAF/MI published a policy letter for Air Force Space Command’s use in dealing with issues and making decisions regarding real property. This policy superseded existing real property policy and all other previous lower level guidance. The policy specifically addresses launch property, real property instruments (leases and licenses), commercial space operations support agreements, environmental requirements, criteria for allowing commercial users access to excess launch property, competition, exclusive/shared use, multiple user requests for same excess launch property, and consideration costs.

#### Commercial Space Operations Support Agreement (CSOSA)

CSOSA is a new master operational agreement between the Air Force and US launch companies performing commercial launch activities at Vandenberg AFB and Cape Canaveral Air Station. This new agreement implements national policies (e.g., CSLA and PDD/NSTC-4) to provide commercial access to Government space assets/services. CSOSA sets forth terms and conditions (including legal and financial) [these provisions do not apply to FAA licensed activities – only to unlicensed activities] under which the Air Force will furnish Government facilities, launch

property and/or launch services. The agreement covers FAA licensed US commercial launch company activities plus their supporting non-licensed commercial activities.

### Current Launch Schedule Review Board (CLSRB)

The scheduling of launches on the Spacelift Ranges occurs through the CLSRB, made up of government agencies and commercial launch service providers, and chaired by Air Force Space Command. The CLSRB produces the Space Launch Manifest (SLM), a three-year forecast of launch slots allocated for individual missions contained in the National Mission Model. The CLSRB assigns launch dates for all launch customers, ensuring that launch times do not overlap or otherwise conflict. As a three-year projection of programmed missions, the SLM is a more reliable forecast than the National Launch Forecast for US mission requirements due to its shorter timeframe.

### Range Scheduling

Air Force Space Command manages a scheduling process to support DoD, NRO, NASA, and commercial spacelift operations. Management of the space launch schedule occurs through a launch queue assignment process. The launch scheduling process is accomplished in three phases: planning, allocation, and execution. The process involves Air Force providing written schedule commitments to DoD, civil, and commercial users. It establishes the 8-year National Launch Forecast, 36-month Space Launch Manifest, and the 18-month Current Launch Schedule as the official Air Force documentation for projecting, scheduling, and executing space launch operations. Once the launches are manifested, users can then provide written requests to the ranges for an executable range launch date. Users receive one primary and one back-up launch date from the range. Air Force Space Command maintains Instruction 10-1213 which codifies specific organizational responsibilities and operational procedures.

### **NASA Implementation Direction**

NASA range support references the CSLA as their primary guideline for direct cost pricing policy. Commercial Launch Companies requesting NASA property and services are provided under the terms of Commercial Space Launch Agreements. The terms for pricing are identified in these documents consistent with the CSLA, as amended. This Act was further interpreted by NASA's comptroller for specific guidelines on direct costing for commercial space launch support. NASA's Financial Management 9090 includes specific language on NASA pricing policy unique to these agreements.

In general, the commercial support costs considered "core" to the organization's mission, such as depreciation or civil service, are not charged to the commercial customer. Direct costs that are charged to the commercial customer are direct Contractor labor, direct support civil service labor, and to a lesser extent, equipment and instrumentation costs that can be directly attributed to commercial use, such as consumables and or/calibration required based on use. The commercial customer submits its requirements to the government. An estimate is developed from those requirements and agreed to by the customer and paid by the customer before the support is required. Any changes or adjustments are reconciled at the end of the required support.

## **FAA Regulation of Commercial Space Transportation**

The Department of Transportation's responsibility to license and regulate commercial space transportation activities was established by the CSLA of 1984. As codified in Title 49, U.S. Code, Subtitle IX, Sections 70101-70121, the Secretary of Transportation has the responsibility to "only to the extent necessary, regulate those launches and services to ensure compliance with international obligations of the United States and to protect the public health and safety, safety of property, and national security and foreign policy interests of the United States,

- "encourage, facilitate, and promote commercial space launches by the private sector, [and]
- "facilitate the strengthening and expansion of the United States space transportation infrastructure."

The Office of the Associate Administrator for Commercial Space Transportation (AST) within the FAA acts on behalf of the Secretary of Transportation in carrying out its statutory responsibilities regarding commercial launch activities. Established in 1984 as the Office of Commercial Space Transportation (OCST) in the Department of Transportation (DOT), AST was transferred to the FAA in November 1995.

In fulfilling its responsibility to ensure public health and safety, the FAA issues licenses for commercial launch and reentry of orbital and suborbital rockets, and launch site operator licenses for the operation of sites from which launch activities are conducted.

### Licensing of Commercial Launch Operators

The FAA issues two general types of launch licenses, a launch-specific license and a launch operator license. A launch-specific license authorizes a licensee to conduct one or more launches, having the same launch parameters, of one type of launch vehicle from one launch site. The license identifies, by name or mission, each launch authorized under the license. A licensee's authorization to launch terminates on completion of all launches authorized by the license or the expiration date stated in the license, whichever occurs first. A launch operator license authorizes a licensee to conduct launches from one launch site, within a range of launch parameters, of launch vehicles from the same family of vehicles transporting specified classes of payloads. A launch operator license remains in effect for five years from the date of issuance. The first DOT-licensed launch was conducted in 1989, and 114 licensed launches have been conducted through June 30, 1999.

For launch, the components of the licensing process include pre-application consultation, policy review and approval, safety review and approval, payload review and determination, financial responsibility determination, and an environmental review, described below. Once the license is issued, the FAA monitors the licensee's compliance with the terms and conditions set forth in the license. In brief, the process includes the following:

- Pre-application Consultation—Prior to submitting a license application, the applicant and the FAA engage in a pre-application consultation process, familiarizing the FAA with the applicant's proposal and the applicant with the licensing process.

- **Policy Review and Approval**—Once an application has been received, the FAA conducts its own review and an interagency review of the application to determine whether it presents any issues affecting U.S. national security or foreign policy interests or international obligations.
- **Safety Review and Approval**—The purpose of the safety review is to determine whether an applicant can safely conduct the launch of the proposed launch vehicle(s) and any payload. Under FAA regulations, a licensee is responsible for public safety and must demonstrate that its commercial launch operations will pose no unacceptable threat to the public. To do this, applicants typically perform quantitative analyses of the reliability and functions of critical safety systems, the hazards associated with the hardware, and the risk those hazards pose to public property and individuals near the launch site and along the flight path, to satellites and other on-orbit spacecraft. Applicants also detail the organizational attributes of the applicant, such as launch safety policies and procedures, communications, qualifications of key individuals, and critical internal and external interfaces. For applicants proposing to launch from a federal launch range who have contracted with the federal range for the provision of safety-related launch services and property, the FAA issues a safety approval if the applicant satisfies the requirements of the federal launch range and if those launch services and the proposed use of launch property are within the federal launch range’s experience. A more extensive review is conducted by the FAA for applicants proposing to launch from a nonfederal launch site.
- **Payload Review and Determination**—The FAA reviews a payload proposed for launch to determine whether its launch can be conducted safely and whether the license applicant or payload owner or operator has obtained all required licenses, authorization, and permits, unless the payload is exempt from review. The FAA does not review payloads subject to regulation by the Federal Communications Commission (FCC) or the National Oceanic and Atmospheric Administration (NOAA) or owned or operated by the U.S. government.
- **Financial Responsibility Determination**—The CSLA requires that all commercial licensees demonstrate financial responsibility to compensate for the maximum probable loss from claims by a third party for death, bodily injury, or property damage or loss resulting from an activity carried out under the license and the U.S. government against a person for damage or loss to government property resulting from an activity carried out under the license. The FAA sets the amounts of financial responsibility required of the licensee, which then can elect to meet this requirement by proving it has financial reserves equal to or exceeding the amount specified, placing the required amount in escrow, or purchasing liability insurance equal to the amount specified. The most common and preferred method is through the purchase of liability insurance. The maximum probable loss determination is based on an analysis and assessment of the maximum monetary losses likely to be incurred by government and third-party personnel and property in the event of a mishap. It is calculated by assessing the dollar value of government and third-party properties at risk by launch accidents likely to occur as the result of the conduct of launch activities.
- **Environmental Review**—An environmental evaluation is conducted to assess the environmental impact of proposed launch activities.

### Licensing of Launch Sites

For the operation of a launch site, the FAA evaluates an applicant's proposal on an individual basis to ensure it will not jeopardize public health and safety, safety of property, U.S. national security or foreign policy interests, or international obligations of the United States. Launch site applications are evaluated on an individual basis taking into account many of the same considerations discussed above for launch operator licenses. The FAA has issued licenses to the operators of four launch sites: Spaceport Florida Authority, at CCAS; Spaceport Systems International, at VAFB; Virginia Commercial Space Flight Authority, at Wallops Island, Virginia; and Alaska Aerospace Development Center, at Kodiak Island, Alaska.

### Licensing of Reentry and Reentry Sites

The Commercial Space Act of 1998 extends the licensing authority of the Secretary of Transportation to reentry vehicle operators and the operation of reentry sites by a commercial or nonfederal entity. Under this act, any vehicle, reusable or not, designed and operated such that it would intentionally return to Earth from Earth orbit or outer space, substantially intact, requires an FAA license. A U.S. citizen who offers use of a designated site for purposes of containing landing impacts is also subject to FAA licensing for purposes of public safety. In April 1999, the FAA published a notice of proposed rulemaking on reusable commercial space transportation launch vehicles and reentry licensing, opening to public comment its proposed regulations.



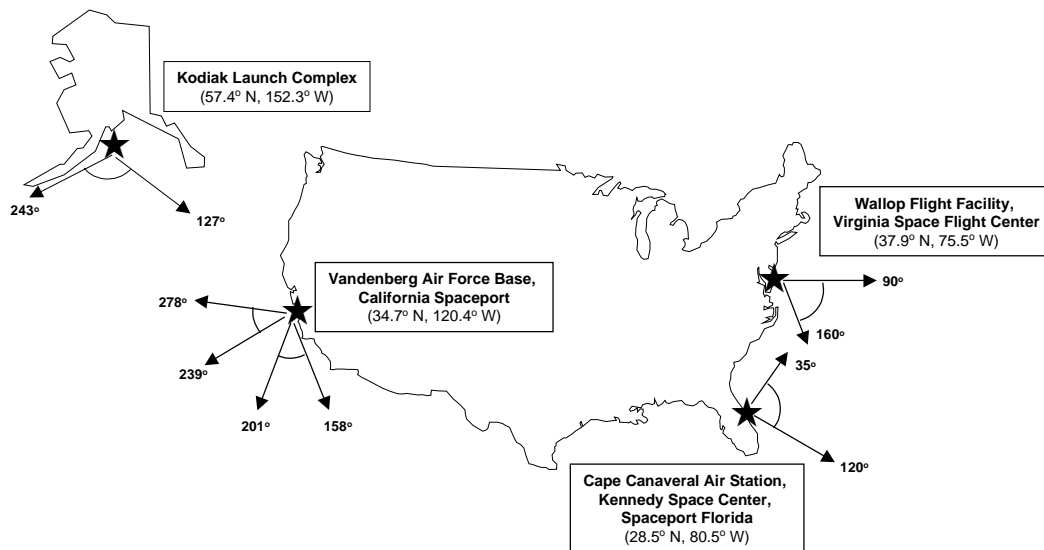
## Annex C – HISTORICAL PERSPECTIVE ON THE EVOLUTION OF U.S. SPACE LAUNCH BASES AND RANGES

The primary U.S. space launch bases and ranges at Cape Canaveral Air Station, Florida and Vandenberg Air Force Base, California were established in the 1949 and 1957 to meet vital national security and civil missions of the highest national priority, including access to space for intelligence-gathering and human spaceflight missions and testing of land- and sea-based ballistic missiles. Over the next four decades, the U.S. space launch bases and ranges evolved to meet changing national priorities, including support over the past decade for commercial space transportation, which has grown to make up nearly 40 percent of launch base and range activities.

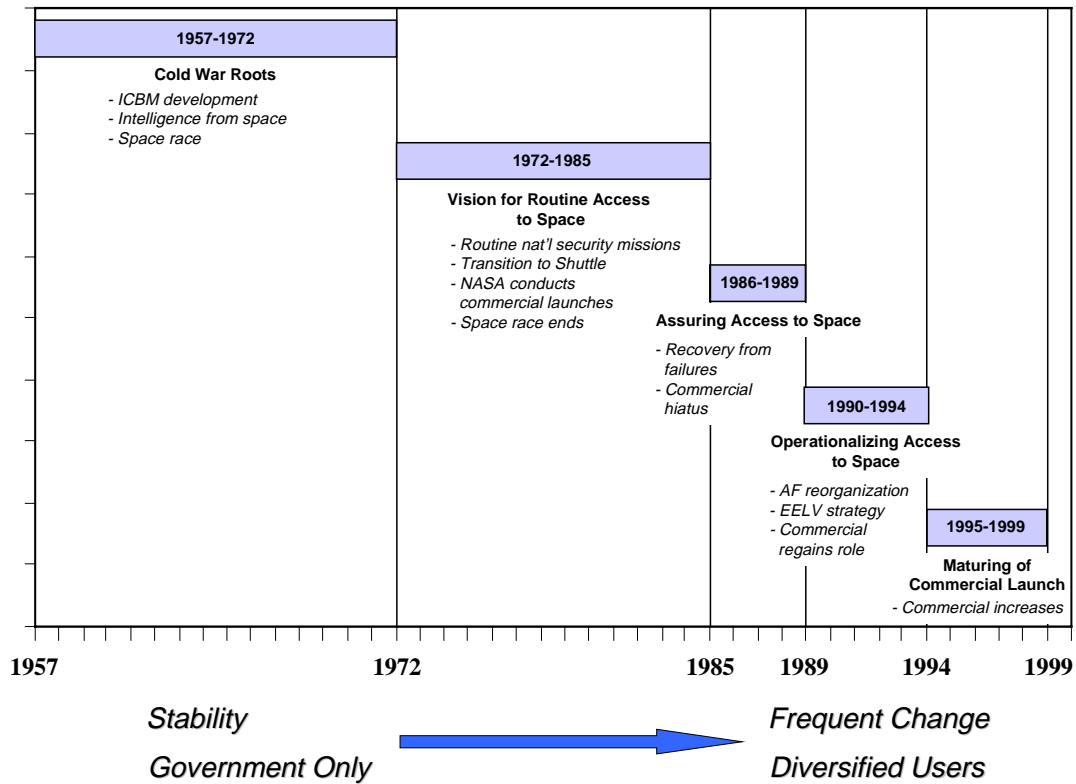
To understand the current issues associated with the space launch bases and ranges at CCAS and VAFB it is important to understand their origins and the evolution of their capabilities in response to changing national priorities. While commercial launch activities have increased significantly in recent years, the federal space launch bases and ranges continue to meet the U.S. government’s requirement for access to space for national security, civil, and ballistic missile-related test and evaluation missions. This history provides the context for assessing those issues currently surrounding the use and management of the U.S. space launch bases and ranges.

### Cold War Roots: 1957–1972

The primary U.S. space launch bases and ranges were built in the 1950s in direct response to Cold War national security interests, including development and testing of land- and submarine-based ballistic missiles; deployment of space-based intelligence-gathering capabilities, which required a launch base and supporting range on the U.S. West Coast; and the launching of humans into space as part of the space race with the Soviet Union, which required a launch base and range on the U.S. East Coast.



**Figure 7. U.S. Federal and Nonfederal Space Launch Sites**



**Figure 8. Evolution of the Management and Use of U.S. Space Launch Bases and Ranges**

For the first 15 years of their operation, the U.S. space launch bases and ranges operated and evolved in response to consistently focused policy and government programs with the highest national priority. Then, the focus was on test and evaluation of ICBMs and SLBMs and on developing these systems into space launch vehicles, primarily to support the intelligence mission on the West Coast and the human spaceflight mission on the East Coast.

The initial development, test, and evaluation of land- and submarine-based ballistic missiles drove requirements for extensive tracking, telemetry collection, and precise photographic capabilities at the major ranges on both the East and West Coasts. The requirement for range operators—in this case the Air Force—to protect public safety and property drove efforts to develop, install, and verify the operation of extremely reliable systems on the ground and on each test vehicle to prevent operations from endangering the public. Users of the U.S. space launch bases during this period were exclusively DoD and NASA, and the missions they conducted were ICBM and SLBM development testing and space launch missions using expendable launch vehicles, mostly derived from U.S. ICBMs.

The launching of commercial, or quasi-commercial, satellites began in 1962 with the launch of the Telstar-1 satellite for AT&T. During the next 10 years, 20 communications satellites were launched to geosynchronous orbit (GEO) for AT&T, Intelsat, and Telesat Canada, the Canadian post, telephone, and telegraph organization; however, all were conducted by NASA on a

reimbursable basis. The 20 launches represented barely three percent of the 666 space launches the United States conducted between 1957 and 1972. Although not purely commercial, these launches established the U.S. government as the provider of launch services for the Western world.

#### Vision for Routine Access to Space: 1972–1986

In 1972, with the completion of the Apollo program, President Richard Nixon initiated the Space Shuttle program as a means of achieving a vision for routine, reliable, low-cost U.S. access to space. This represented a major shift in the national priority for access to space: no longer would the United States be relying on ELVs based on the original ICBM designs. Instead, the new national priority between 1972 and 1985 was to develop and operate the partially reusable Space Shuttle as the primary U.S. means of placing national security, civil, and commercial satellites into space.

Under the national strategy of relying on the Shuttle, DoD and NASA were flying off the last of their ELVs and essentially stopped making investments in the facilities, infrastructure, and range systems not required to support the Space Shuttle or ballistic missile development. This represented a profound shift in the strategic direction being pursued in developing and sustaining the major U.S. space launch bases and ranges. The launching and processing facilities and related supporting infrastructure were not maintained as well as they would have been if the strategic direction had included continued use of ELVs for the long term. Instead, the focus was on developing facilities and infrastructure to support the Space Shuttle and ballistic missile development.

Throughout this period, the space launch bases and ranges continued to support operational test and evaluation of the active U.S. ICBM and SLBM forces. They also supported development programs for missile upgrades and developments, including the Minuteman I, II, and III and Peacekeeper programs based on solid rocket motors. During this period there were significant investment and numerous test launches involving Peacekeeper, Rail Garrison, and Small ICBM at VAFB and Trident D-5 at CCAS.

From 1972 to 1985, NASA continued to conduct launches of communications satellites on behalf of U.S. commercial and foreign customers, as well as those of foreign scientific satellites. As U.S. civil and military launch rates declined, launches of communications satellites steadily increased, rising to a high of nine launches in 1982. During this entire 13-year period, commercial launches accounted for 22 percent of all U.S. launches. Once the Shuttle became operational, production of Atlas and Delta ELVs was shut down and launches of all commercial satellites were to be conducted by the Shuttle once the existing stockpile of ELVs had been used up. The Shuttle first flew in 1981 and conducted its first commercial launch in 1982, and in 1985, NASA launched 11 commercial communications satellites on four Shuttle flights, and only three on Atlas Centaur flights.

While the U.S. government had decided to cease production of ELVs, some of the manufacturers of these vehicles as well as others proposed to continue production and to compete with the Shuttle and the European Ariane launch vehicle. However, NASA's support to keep the Shuttle price low and Europe's support to keep the Ariane price low remained major impediments to their commercial success. Despite their hesitation, in February 1984, President Ronald Reagan

signed Executive Order 12465 on “Commercial Expendable Launch Vehicle Activities,” and Congress passed the CSLA of 1984 establishing a licensing and regulatory regime for nongovernment launch activities within the Department of Transportation. This established the fundamental framework for the current law still in place today.

The CSLA of 1984 recognized that U.S. ELV production facilities and launch facilities would no longer be needed for government use in light of the national policy to rely on the Shuttle as the primary means of U.S. access space. This law established the foundation and mechanisms necessary for U.S. companies to obtain use of or even ownership of these ELV-related facilities that were to become “excess or otherwise not needed for public use,” as well as launch base and range support services from the Air Force and NASA, which would similarly no longer be “needed for public use.”

#### Assuring Access to Space: 1986–1989

Between mid-1985 and mid-1986, virtually all U.S. space launch systems experienced launch failures. The most significant was the tragic loss of the Space Shuttle *Challenger* and its crew of seven. The second most critical was the loss of Titan 34D-9 in May 1986, which also damaged both Titan launch pads at VAFB. This series of failures led to serious concerns regarding the reliability and resilience of the U.S. national access to space, which in turn led to another important shift in national policy and national strategy for the future of access to space.

The *Challenger* accident reinvigorated the debate over the use of the Space Shuttle to launch commercial satellites only six months after President Reagan had resolved it to allow NASA to price Shuttle launch services below cost to remain competitive with Ariane. In August 1986, President Reagan announced that the Shuttle would no longer be permitted to launch commercial satellites, a policy formalized in December 1986 in National Security Decision Directive 254, “United States Space Launch Strategy.” A total of 44 commercial and foreign payloads that had been manifested on the Shuttle were forced to find new launchers.

It took almost three years for the Air Force to make and execute plans for restarting the U.S. ELV production and launch capabilities and to redesign and modify satellites to be launched on ELVs instead of the Shuttle. During the years when the U.S. national strategy had been to rely exclusively on the Shuttle for access to space, significant deterioration had taken place in the launch base and range infrastructure and launch-related facilities required for ELVs. Consequently, the shift back to ELVs required additional funding to fix the problems that had resulted from years of planning to retire these systems. During this period, while the U.S. was recovering its ELV capabilities, many instances occurred where facilities and infrastructure at the launch bases and ranges that had not been maintained for long-term use and had to be repaired, modernized, modified, and returned to a condition suitable for routine, reliable use.

Following the *Challenger* accident and the Titan, Delta, and Atlas failures in the same time frame, U.S. government payloads were given priority on available U.S. ELVs to maintain access to space. As a result, the United States practically ceased commercial launch activities for several years, conducting just three commercial satellite launches (one just prior to the *Challenger* flight) for only six percent of U.S. space launches from 1986 to 1989.

During this period, however, two actions were initiated that, combined with the new Shuttle use policy, would enable the emergence of a U.S. commercial launch industry. First, the Department of Defense committed to purchasing a large number of ELVs as part of a strategy to maintain access to space using a mixed fleet of both the Shuttle and ELVs. This reopened the dormant U.S. ELV production lines at government expense and helped provide economies of scale necessary to enable U.S. companies to effectively compete against Ariane. Second, in 1988, Congress amended the CSLA to establish new insurance requirements whose effect was to limit liability for U.S. companies in case their launches caused damage to government property or third parties. The revised CSLA also established protections against government preemption of commercial launches on government ranges.

The combination of three conditions—President Reagan’s change to the Shuttle use policy, the Commercial Space Launch Act Amendments of 1988, and the Air Force decision to enter ELV launch services contracts for DoD satellites—enabled U.S. companies to make significant decisions to enter the commercial space launch market. As a result, the first DOT-licensed U.S. commercial space launch to orbit was conducted from CCAS in 1989—nearly five years after the CSLA was passed. Beginning in 1989, U.S. launches of commercial satellites were conducted by commercial launch companies (in most cases, the same companies providing launch services for DoD and NASA payloads as government contractors), not the U.S. government.

#### Operationalizing Access to Space: 1990–1994

An important policy shift occurred within the Air Force management structure for space transportation in the early 1990s. From the beginning, responsibilities for ELV acquisition, development, and operations, as well as the operation, maintenance, improvement, and modernization of the launch bases and ranges, resided in the acquisition and development arm of the Air Force, Air Force Systems Command. In 1990, to establish a new focus on “operationalizing” access to space, some of these responsibilities were transferred from the acquisition and development arm of the Air Force to the operational arm under Air Force Space Command. (The acquisition and development responsibilities, including range improvement and modernization, remained in the restructured Air Force Materiel Command, but the launch operations, launch base, and range operation and maintenance functions were transferred to Air Force Space Command.)

One of the most important reasons for shifting these responsibilities was to position the space launch bases and ranges to compete more effectively for funding within the Air Force to support the recently reestablished ELV capabilities. The Air Force needed to recover and repair the launch base and range capabilities required to support ELV operations after the years of deterioration they had experienced while they were being treated as if they were going to be retired under the national strategy of relying on the Shuttle. It had been difficult to sustain adequate funding for these facilities and systems in the Air Force budget process when they were being advocated by the development command, instead of relying on “operational” requirements to justify the need.

Just as the Air Force was shifting its space launch focus from “development” to “operations,” the U.S. commercial space launch industry began its own growth and expansion. Between 1990 to 1994, commercial launch activities climbed back to their pre-*Challenger* level of around 20 percent of U.S. space launches conducted. For the next few years, U.S. commercial launch

providers engaged in intense competition with Arianespace for leadership of the commercial launch industry. As the backlog of commercial payloads that had been delayed by the launch failures was flown out, an average of more than 12 launches per year were conducted from 1990 to 1994, matching the sustained launch rate of the early to mid-1980s.

Recognizing the critical importance of space transportation to the U.S. national security, civil, and commercial space sectors, the Clinton Administration issued a National Space Transportation Policy in 1994. A key feature of the policy was that it established a clear division of responsibilities: DoD would evolve the ELV fleet, and NASA was given primary responsibility for RLV technology development and demonstration. Both agencies were directed to involve the U.S. commercial space sector, including state governments, as partners, participants, and investors in these programs. This policy formed the genesis for DoD's EELV program and for NASA's X-33, X-34, and X-37 RLV technology demonstrators.

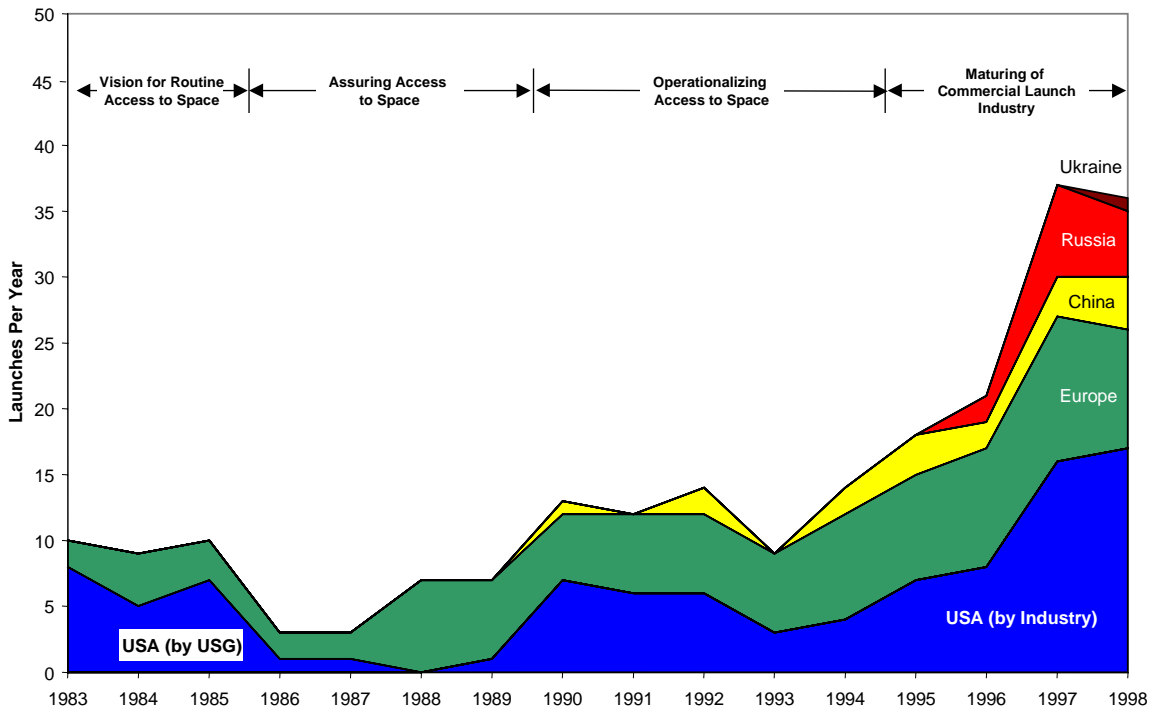
The EELV effort is especially noteworthy in the context of the launch bases and ranges. The program includes more than \$1 billion in launch infrastructure upgrades and the formal transition to the purchase of commercial launch services for all Air Force and NRO payloads. In addition, the EELV procurement includes a requirement to use standardized booster processing procedures to reduce launch costs and shorten on-pad cycle time. The EELV is expected to be on the pad for one to eight days versus 30 to 120 days for today's Delta, Atlas, and Titan systems.

On the civil side, NASA charted a new course by placing greater responsibility for space flight operations with its private sector contractor, United Space Alliance (USA). Since 1992, NASA and United Space Alliance, have improved Space Shuttle system safety by more than 80 percent according to probabilistic models, increased performance by almost a third, cut ground processing time nearly in half, and reduced operating costs by more than a third, adjusting for inflation. NASA continues to invest about \$100 million per year in Shuttle improvements to address safety and obsolescence, while USA has invested substantially to improve Shuttle operations, and has plans to invest millions more. At the same time, NASA is investing more than \$1 billion in RLV technology with the X-33, X-34, and X-37 Future-X programs—again in partnership with industry.

#### Maturation of the U.S. Commercial Space Launch Industry: 1994–1999

In the past five years, the commercial space launch industry has matured at a rate that few could have predicted. In the second half of the 1990s, U.S. commercial launch rates have doubled from their levels in the early 1990s. Commercial launch activity now represents more than 40 percent of launches conducted worldwide annually. The increasing number and diversity of commercial space launches has placed increasing pressure on aging national launch bases and ranges.

Driven by expanding market demand in the 1990s, the private sector has begun to make substantial private investments toward the improvement and development of U.S. ELV capacity and capabilities. For example, over the past several years, the private sector has simultaneously improved the performance of commercial launch systems, decreased processing timelines, and decreased costs.



**Figure 9. Historical Commercial Launch Rates (1983-1998, by Country)**

Another trend that reflects the growing maturation of the commercial space launch industry is the formation of international joint ventures to provide commercial launch services and address segments of the global market that would not otherwise be available to U.S. launch providers.

Following the end of the Cold War, U.S. aerospace companies formed a number of joint ventures with Russian and Ukrainian launch companies to provide launch services on former Soviet launch vehicles. Prominent among these new relationships is International Launch Services (ILS), a joint venture between Lockheed Martin and Russia’s Khrunichev and Energia to market the Proton launch vehicle. Another is Sea Launch, a joint venture between Boeing, Ukraine’s Yuzhnoye, Russia’s Energia, and Norway’s Kvaerner to launch a Zenit rocket from a launch platform in the middle of the Pacific Ocean. For launches to GEO, Sea Launch operates from an equatorial location in the Pacific Ocean so far from any populated areas that the launch system meets the FAA safety requirements with an autonomous thrust termination system. This eliminates the need for tracking radars, redundant safety data and displays, receivers and ordnance for a destruct system, and command transmitters to activate it in case of errant flight.

### The Way Ahead

While all commercial launches are currently conducted using ELVs, a number of private companies are also designing and developing RLV to dramatically reduce the cost of a launch. The only RLV in operation today is the Space Shuttle, which is only partially reusable. Because RLVs can be reused many times, they are expected to be considerably more cost-effective than ELVs. While RLVs promise to be cost-effective to operate, they are proving expensive to develop. Because of the high investment costs required, a number of entrepreneurial and established companies are seeking government assistance and incentives toward development of commercial RLVs.

Another indicator of the maturation of the commercial launch industry is the emergence of State and local government-sponsored spaceports. At present, four U.S. nonfederal launch sites are licensed by the FAA: Spaceport Florida, at CCAS; California Spaceport, at VAFB; Virginia Space Flight Center, at Wallops Island, Virginia, and Kodiak Launch Complex, on Kodiak Island, Alaska.

Significantly, Spaceport Florida Authority, an arm of the state government, has arranged low-cost financing and provided management services for more than \$600 million worth of construction projects to benefit Air Force, NASA, Navy, and commercial space-related projects in Florida. These projects include major processing facilities on CCAS for the Boeing Delta IV and Lockheed Martin Atlas 5 EELVs, a storage facility located on a Florida Air National Guard base for Air Force Titan IV solid rocket motor segments, a visitors' center housing a Saturn V moon rocket at NASA's KSC, and a hangar-type facility near the Space Shuttle runway to support test flight activities with NASA's X-34 reusable launch vehicle technology demonstrator.



## Annex D – COMPARISON BETWEEN U.S. AND FOREIGN SPACE LAUNCH BASES AND RANGES

As the commercial use of space has rapidly grown over the past decade, so too has the number of launch service providers in the international market. U.S. launch companies now face intense competition from launch providers in Europe, Russia, and China, with other countries expected to begin offering commercial launches in the next few years. Foreign industrial competition is heavily subsidized by their respective governments, and Russia and China are additionally the beneficiaries of nonmarket economies, resulting in lower labor and materials costs.

### Europe

Historically, the strongest competition to U.S. launch service providers comes from Europe’s Ariespace, which conducts launches of the Ariane 4 and Ariane 5 launch vehicles from the Guyana Space Center in Kourou, French Guyana. Ariespace has dominated the open commercial market for launches to geosynchronous orbit since the mid-1980s when the U.S. commercial space launch fleet was grounded following the *Challenger*, *Atlas*, and *Delta* failures.



**Figure 10. U.S. and Foreign Medium to Heavy Commercial Launch Vehicles**

The Ariane series of launch vehicles were developed by the European Space Agency (ESA) and the French space agency, the Centre National d'Etudes Spatiales (CNES). Although developed by the French and European governments, the Ariane launch vehicles are operated by Ariespace, a private company. Ariespace is a consortium of 53 European shareholders including 41 manufacturers from 12 countries, 11 banks, and the French government through its space agency, CNES. French participation in Ariespace amounts to over 55 percent, with Germany’s participation second at 18.6 percent. The single largest shareholder is CNES, with 32.45 percent. CNES manages launch vehicle development on behalf of ESA; however, it also acts in a commercial capacity as a contractor to Ariespace and ESA on launch vehicle and satellite-related activities. Several of the French companies that are shareholders of Ariespace are partially owned by the French government as well. However, the majority of Ariespace stock is under the control of private companies, since besides CNES, SNECMA is the only Ariespace shareholder controlled by the French government. Perhaps the most important aspect of the relationship between Ariespace and the French and European governments is that they act as a team in a seamless manner to their commercial customers at the Kourou launch site.

Arianespace currently markets and conducts launches of the Ariane 4 and Ariane 5 launch vehicles, both of which were developed by CNES and ESA in partnership with European industry. Development of both vehicles was funded entirely by the French and European governments before being turned over to Arianespace for commercial operation. For Ariane 5, the total government investment reached over \$8.1 billion (7.9 billion Euros). In May 1999, ESA approved an upgrade program to improve Ariane 5's performance to compete with the U.S. Delta IV and Atlas 5 EELVs. The Ariane 5 Plus upgrade program is budgeted at \$585 million (568 million Euro) through 2001. Arianespace has agreed to fund an additional \$100 million of development cost, and paid for the third qualification flight vehicle, 503. In addition, Arianespace is fully funding the new S5 preparation building.

Construction of the launch facilities at Kourou has also been funded by the French and European governments. Construction of the launch vehicle processing facilities and launch complexes is managed by CNES on behalf of ESA, which provides funding. Once a vehicle completes its demonstration flight phase, the facilities are turned over to Arianespace for commercial operation. From that point on, Arianespace pays 100 percent of the operations and maintenance costs for the vehicle processing and launch facilities. Arianespace also pays 100 percent of the operations and maintenance costs for the payload processing facilities constructed by CNES, but in turn contracts with CNES to perform the payload processing operations. Arianespace pays roughly \$100 million a year for the operation and maintenance of the launch vehicle and payload processing facilities at Kourou.

The range facilities at Kourou for launch vehicle tracking and telemetry are owned and operated by CNES. Funding for range operations is provided by CNES, ESA, and Arianespace, which pays a fixed contribution plus an annual fee based on launch activity. Arianespace typically pays roughly \$30 million a year toward range costs, conducting 10-12 launches per year. Therefore the total Arianespace contribution to activities at Kourou amounts to about \$130 million per year, representing about 47 percent of the total Kourou budget.

### Former Soviet Union

In 1993, the United States and Russia signed a commercial space launch trade agreement allowing Russian launch providers to provide commercial launches on the worldwide market. In order to allow Russia to conduct commercial launches while protecting U.S. industry from a large number of cheap foreign vehicles, the agreement established a quota on the number of launches that could be conducted to GEO and pricing provisions that applied to all launches. The agreement was renegotiated in 1996, increasing the quotas, and expires at the end of 2000. An agreement was recently reached to increase the number of launches from 16 to 20. Since the agreement was signed, Russia has conducted commercial launches on several launch vehicles including Proton, Soyuz, Cosmos, and Start. A similar agreement was signed with Ukraine allowing the use of the Zenit and Cyclone former Soviet launch vehicles.

A number of international joint ventures have been formed to market the former Soviet launch vehicles. In 1993, Lockheed Martin (then Lockheed) formed a joint venture with Russia's Khrunichev and RSC Energia to conduct launches of the Proton launch vehicle. The joint venture is now known as International Launch Services (ILS). Proton has conducted 16 commercial launches since its first in 1996, representing a formidable presence in the commercial launch services market. In 1995, Boeing formed the Sea Launch joint venture with

Russia's Energia, Ukraine's Yuzhnoye, and Norway's Kvaerner to develop and launch Yuzhnoye's Zenit with Energia's Block-DM upper stage from a sea-based platform in the Pacific Ocean. Sea Launch's first launch, that of a satellite simulator, was successfully conducted in March 1999 and it successfully placed a commercial satellite into orbit in October 1999. In 1996, France's Arianespace and Aerospatiale formed the Starsem joint venture with the Russian Space Agency and Russia's Samara Space Center to market the Soyuz launch vehicle. Starsem conducted its first three commercial launches in early 1999.

Since the breakup of the Soviet Union in 1991, the Russian economy has struggled as it attempts to adapt to market principles. However, the cost of labor and materials used in the construction of launch vehicles remains far below Western market levels even today, although these costs have risen gradually over the past decade. As a result, prices for Russian launch vehicles remain more flexible than those for U.S.-manufactured vehicles and can be lowered to maintain significant market presence.

Both Proton and Soyuz are launched from Russia's Baikonur Cosmodrome in Kazakhstan. Baikonur is a vast launch site from which at least six different launch vehicle and ballistic missile types are launched, as well as Russia's entire human spaceflight program. Historically, Baikonur was operated by the Russian military but is now undergoing a transition, at least in part, to civilian control under the Russian Space Agency. Commercial launches at Baikonur are conducted largely by military personnel who process the vehicles and conduct the launch operations. Payload processing for commercial payloads is conducted by the commercial launch providers in facilities built specifically for commercial launch activities and paid for by the launch provider. Operation of the range remains entirely controlled by the military, with commercial customers obtaining no insight into the range control process. Commercial launch providers pay the military for each commercial launch conducted, although it is not known how much. In addition, the Russian Space Agency receives a portion of all commercial launch contracts as well.

Because of its very nature, the Sea Launch system operates outside of the Russian launch ranges. Sea Launch uses a modified oil rig as the launch platform and a command ship, where the launch vehicles are processed and from which the launch countdown is conducted. Sea Launch's home port is in Long Beach, California, and both the ship and platform sail to the middle of the Pacific Ocean on the equator to conduct the launch. As a result of its unique setup, the Sea Launch command ship contains all the tracking and range equipment onboard and uses NASA's Tracking and Data Relay Satellite System (TDRSS) to augment its telemetry capability.

Russia has also conducted commercial launches from its other three launch sites Plesetsk, Kapustin Yar, and Svobodny. The Cosmos launch vehicle has been used to launch piggyback payloads for the U.S. company Final Analysis from Plesetsk in 1995 and 1997 and for Germany from Kapustin Yar in early 1999. Kapustin Yar is a space and missile launch site in southeast Russia whose last orbital mission had been conducted in 1988. The EarlyBird 1 satellite for U.S.-based EarthWatch was launched on a Start-1 launch vehicle from Svobodny in 1997. Svobodny is a converted ICBM launch site in Russia's Far East.

## China

Commercial launches on Chinese launch vehicles are conducted by the Chinese government in their entirety. The Chinese government owns and operates all launch site infrastructure, including the facilities for launch vehicle processing, payload processing, launch operations, and range control. The launch vehicles are designed and built by the government through the China Academy of Launch Vehicle Technology and other government institutes. While China benefits from the same nonmarket economic factors as Russia does, the poor reliability of Chinese launch vehicles has thus far kept China from developing into a major commercial launch provider.

## **Annex E – CURRENT AND PROJECTED WORKLOADS AT U.S. SPACE LAUNCH BASES AND RANGES**

The current and projected workload forecast for U.S. space launch bases and ranges consists of the space and ballistic missile launches conducted for the military, intelligence, civil, and commercial space sectors. Based on the projections described below, an average of 43 launches per year are to be conducted from the Eastern Range through FY 2008 and 28 launches are to be conducted from the Western Range. This represents a substantial increase from the level of activity in CY 1998 in which 28 launches were conducted from the Eastern Range and 15 from the Western Range. The current and projected workload forecast for U.S. space launch bases and ranges is presented in Table 2 and Figures 11 and 12 below and described in detail in the following sections.

The defense and intelligence community portion of the projected space launch workload consists of those space launches conducted on behalf of the Air Force, NRO, Navy, Ballistic Missile Defense Organization, and other defense organizations. Projected workload for these launch activities is taken from the National Mission Model compiled by Air Force Space Command. Based on the most recent National Mission Model, dated March 10, 1999, an average of 12 DoD launches per year will be conducted from both ranges through FY 2008. More than two-thirds of the DoD launch activity is expected to be conducted at the Eastern Range, with the remaining one-third conducted at the Western Range, as shown in Table 2. This represents a steady level of activity relative to defense and intelligence community launch activity over the past several years.

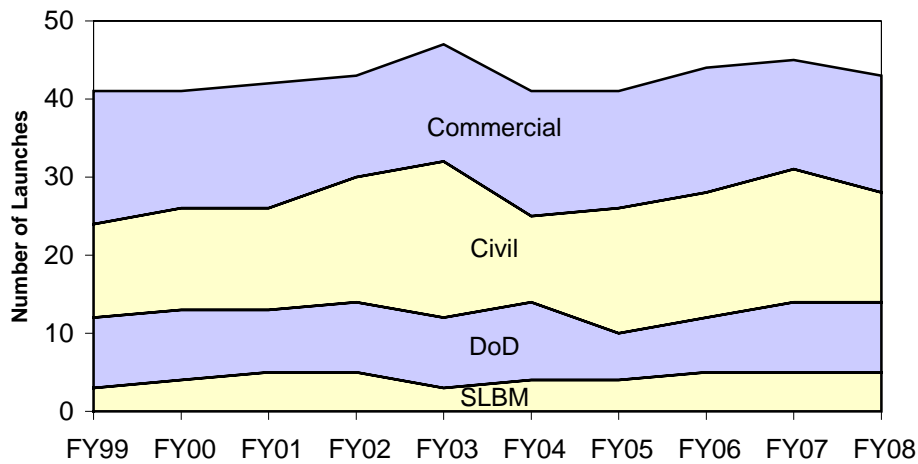
The civil portion of the projected space launch workload consists of those space launches conducted on behalf of NASA and NOAA and includes launches of the Space Shuttle as well as ELVs. Projected workload for these launch activities is taken from the NASA input to the March 1999 National Mission Model, which projects an average of 20 launches per year from both ranges through FY 2008. Of those launches, 15 will be conducted from the Eastern Range, including all Space Shuttle launches, and five will be conducted from the Western Range each year, as shown in Table 2. This represents a large increase in activity over the 11 civil launches conducted in 1998.

The commercial portion of the projected space launch workload represents those space launches conducted from U.S. launch sites for commercial or international customers. The forecast of U.S. commercial launch activity is derived from projections of worldwide commercial launch demand compiled by the FAA and the Commercial Space Transportation Advisory Committee (COMSTAC), an industry advisory committee to the FAA. In May 1999, the FAA and COMSTAC jointly published the *1999 Commercial Space Transportation Forecasts*, which updated the 1998 forecast used as the commercial baseline in the National Launch Capabilities Study and projects that on average, 51 commercial space launches a year are will occur worldwide through 2008, an increase of more than 40 percent from the 36 commercial launches conducted in 1998. Overall, 1,210 commercial payloads are projected to be deployed to geosynchronous and nongeosynchronous orbits on 514 launches through 2008. The projected payload demand is dominated by the high number of LEO payloads expected to be launched for low Earth orbiting communications constellations, which fluctuates considerably year to year. Deployment of LEO satellites is expected to reach a low of 64 payloads in 2001 and a high of

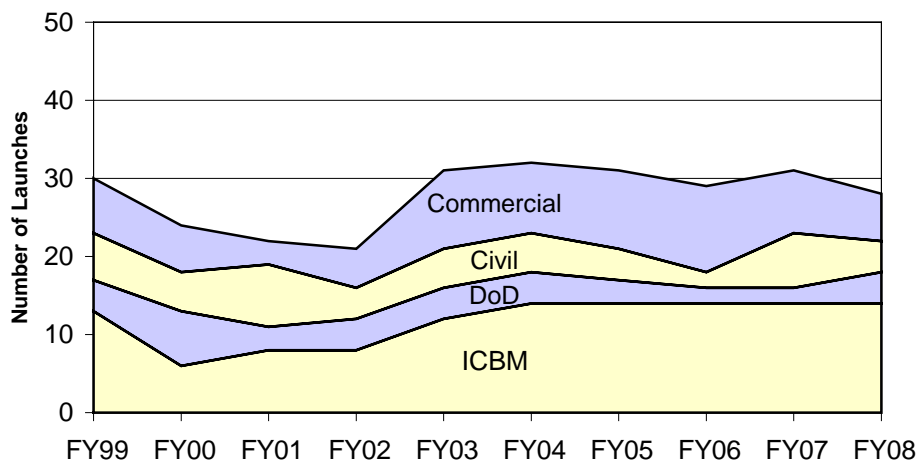
**Table 2. Workload Projection for Eastern and Western Ranges**

	FY99	FY00	FY01	FY02	FY03	FY04	FY05	FY06	FY07	FY08	TOTAL	Avg
<u>Eastern Range</u>												
DoD	9	9	8	9	9	10	6	7	9	9	85	8.5
Civil	12	13	13	16	20	11	16	16	17	14	148	14.8
Commercial	17	15	16	13	15	16	15	16	14	15	152	15.2
SLBM	3	4	5	5	3	4	4	5	5	5	43	4.3
<b>Total Launches</b>	<b>41</b>	<b>41</b>	<b>42</b>	<b>43</b>	<b>47</b>	<b>41</b>	<b>41</b>	<b>44</b>	<b>45</b>	<b>43</b>	<b>428</b>	<b>42.8</b>
<u>Western Range</u>												
DoD	4	7	3	4	4	4	3	2	2	4	37	3.7
Civil	6	5	8	4	5	5	4	2	7	4	50	5
Commercial	7	6	3	5	10	9	10	11	8	6	75	7.5
ICBM	13	6	8	8	12	14	14	14	14	14	117	11.7
<b>Total Launches</b>	<b>30</b>	<b>24</b>	<b>22</b>	<b>21</b>	<b>31</b>	<b>32</b>	<b>31</b>	<b>29</b>	<b>31</b>	<b>28</b>	<b>279</b>	<b>27.9</b>

**Figure 11. Eastern Range Projected Launch Activity**



**Figure 12. Western Range Projected Launch Activity**



192 payloads only two years later in 2003. By contrast, the number of GEO spacecraft projected does not fluctuate as much, with a high of 39 in 2001 and a low of 29 in 2003 and 2004.

Because these projections are for worldwide commercial launches, the number conducted by U.S. launch providers from U.S. launch sites will be only a subset of the overall activity. To forecast the number of commercial launches that will be conducted by U.S. launch providers, an assumption must be made about the relative market share that will be captured by U.S. launch companies. The commercial portion of the projected workload for U.S. launch sites was developed assuming a conservative estimate of between 40 to 50 percent U.S. market capture, which correlates with U.S. providers' market share over the past three years. For example, in 1998, U.S. launch providers conducted 17 of the world's 36 commercial launches for a 47 percent commercial market share. The resulting U.S. commercial launch forecast is an average of 23 launches per year through 2008, peaking at 27 launches per year.