SPACE INDUSTRY STUDY REPORT 1996

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ABSTRACT

This study examines the potential for the United States to privatize and commercialize selected aspects of the space industry to ensure continued U.S. global dominance of space in an increasingly competitive international marketplace. With well-defined and culturally appropriate visions and plans, other nations have successfully leveraged government and industry partnerships to forge world-class firms and satisfy their national interests. The United States should do the same.

This report examines four sectors of the U.S. space industry--launch, satellites, satellite operations, and applications--and selectively compares them with the space industries in India and Japan. We conclude that the United States could greatly improve its international competitiveness, as well as reduce government space expenditures, by transferring selected segments of the government space industry to the commercial sector.

> *I believe that there are moments in history when challenges occur of such a compelling nature that to miss them is to miss the whole meaning of an epoch. Space is such a challenge.*
> --James A. Michener

> *There are some who question the relevance of space activities in a developing nation. To us, there is no ambiguity of purpose. We must be second to none in the applications of advanced technologies to the real problems of man and society.*
> --Vikram A. Sarabhai, India Space Program, 1962

INTRODUCTION

Contrary to popular thinking, the space industry did not start with the 1957 Sputnik launch. Although that event galvanized the United States to mobilize for the space race, the roots of the space industry go much further back and are truly international in nature. The first recorded use of rockets occurred in 1232 AD, when the Chinese used a rocket during a siege of the South China city of Kai-Fung-Fu by the Mongol hordes led by Ogdai, son of Genghis Khan. The fledgling rocketry industry grew slowly, culminating in the modern space age, which began on March 16, 1926, when Robert Goddard launched a small liquid-fueled rocket for a short but tremendously significant flight.

The space industry has evolved in interrelated yet distinct interactions among four major sectors--launch vehicles, satellites, satellite operations, and applications--for which sales approach $70 billion a year. Although initially supported completely by the government, commercial space today is rapidly growing and will soon command a sales majority. Of this growing enterprise, foreign entities have already cornered over 60 percent of the market.

Our study's purpose was to examine the U.S. potential to privatize and commercialize selected aspects of U.S. government space systems to ensure the continued U.S. global dominance of space in an increasingly competitive international marketplace. We examined the four sectors of the U.S. space industry and selectively compared them with corresponding space industry sectors in India and Japan.

The methodology of this study included individual student research, visiting lecturers and expert panelists, international travel for group research, and visits to domestic firms and government agencies representing the four space industry sectors. Facility tours, briefings, and discussion sessions focused on profitability and productivity trends, capital investment and return on investment, business expansion potential, research and development (R&D), industry downsizing and consolidation, production capacity (surge and mobilization), core competencies, political and social factors (management, work force, culture), and the role of the government.

THE SPACE INDUSTRY DEFINED

The space industry is a set of diverse companies and government agencies, interconnected as suppliers and market, that produce a wide range of space-related products and services for government, civil, and commercial entities. The "industry" comprises a number of interrelated activities: launch system development and manufacturing, satellite development and manufacturing, the supporting infrastructure, applications data processing, and the development and manufacturing of user equipment.

The U.S. space industry has traditionally been a virtual *oligopoly*--the government was the only significant buyer, the number of suppliers was limited, and the entry costs were and still remain very high. Today, however, commercial corporations are exerting increasing influence as they become buyers as well.

The space industry is *interdisciplinary*--it synthesizes fields as diverse as aeronautical engineering, materials science, high-energy chemistry, antenna engineering, radiation physics, and computer science. Within this vast assemblage of high-technology systems, the space industry is divided into four interconnected yet diverse sectors: *space launch, satellites, satellite operations, and applications*.

Space Launch

U.S. launch systems are based on 1950s and 1960s intercontinental ballistic missile designs. Each U.S. launch is a unique *technology demonstration* since launch vehicles are specially tailored for each satellite. More recently, U.S. productivity has increased as a result of quality improvements, the push for standardization, and improved management practices. However, some foreign space programs now have an advantage over the U.S. program because they use a more disciplined and standardized approach and have incorporated more current technology in their systems.

Satellites

Satellite development and production, which uses mostly U.S.-sourced, high-technology components, involves high unit costs, low production volumes, and long production flow times. Government quality and reliability standards are highly demanding parameters, but commercial standards are increasingly meeting or exceeding them. Recently, government satellite development has been plagued by discontinuous production, outdated processes and manufacturing technologies, critical foreign dependence, and reliance on parts and components that are either obsolete or have limited availability. Commercial satellite production is moving to efficient, production-line manufacturing that is extremely responsive to market forces.

Satellite Operations

Satellite operations ensure successful satellite deployment by means of launch and early-orbit operations, monitor and maintain the day-to-day health and status of spacecraft on orbit, and manage specific mission payload operations on each satellite. The operations vary widely depending on whether the satellite is a one-of-a-kind defense mission or a one-of-many commercial satellite.

Applications

Space applications, whether commercial or military, can be defined as the products and services provided by space assets. While these products and services are either collected (e.g., imagery) or transmitted (e.g., telecommunications) by satellites in orbit, the vast potential commercial opportunities for space applications lie in the exploitation of these data for defense or for the general well-being of the nation.

Commercial space systems are currently producing military-quality products and services, and the Department of Defense (DoD) is buying them. Examples of civil space applications are global broadcast, mapping, search and rescue, disaster warning, and comprehensive resource management and planning. The DOD' s requirements are generally summarized as the areas of communications, surveillance and reconnaissance, navigation, meteorology, and space R&D.

CURRENT CONDITIONS

Space Launch

Orders and sales of U.S. military space-launch systems declined from $5.9 billion in 1990 to $4.4 billion in 1994; during the same period, the total *nearly doubled* for the U.S. nonmilitary sector, increasing from $2.8 billion to over $4 billion. French, Russian, and Chinese launch systems have captured 60 percent of the global commercial market for medium-launch vehicles.

The major U.S. space-launch firms, Lockheed Martin and McDonnell Douglas, were exceptionally successful and profitable in 1995. Launch sales accounted for approximately 29 percent of Lockheed Martin's and 14 percent of McDonnell Douglas's profits in 1995. Overall, sales and profits increased during the last quarter of 1995 for larger, upper-tier firms while those for smaller, lower-tier supplier firms declined slightly. The average profit margin industrywide was 10.5 percent for the year.

The world launch forecast is for at least 30 launches annually (1995-2010), the majority in the medium-launch vehicle range. No single supplier has the capacity to produce that many satellites of that size. In contrast, the immature market for small-launch vehicles has an overcapacity of potential suppliers. Many companies attempting to enter small launch found 1995 profitable but have yet to prove a mature capability in the global marketplace.

The launch sector is primarily dual use, and technologies are the same or similar for both commercial and defense systems. The U.S. subsidizes such industry activities as the operation and maintenance of government-owned launch facilities, range instrumentation, and infrastructure at the two U.S. launch sites: Cape Canaveral, Florida, and Vandenburg, California. When the government opens its facilities for launches, it requires only that commercial customers pay specific charges associated with a particular launch.

No quotas are directly imposed on the industry, but some restrictions exist on the export of launch vehicle technology. Calls for protectionism come from commercial Spaceport authorities at each launch site, who maintain that U.S. commercial launches should be conducted at their facilities, and from commercial industries, who propose limiting foreign launches of U.S. satellite systems. For example, the space industry objects to U.S. government approval for Ukrainian and Russian vehicle launches of commercial U.S. spacecraft.

Satellites

The global commercial spacecraft market has an overcapacity of suppliers and six primary U.S. competitors: Japan, France, Russia, India, China, and Israel. Leading domestic satellite developers include Lockheed Martin, TRW, GM-Hughes, and Loral Space Systems. Spacecraft integration is a U.S. core competency. The world market wants U.S. technology, as characterized by "international cooperation," the term commonly used to describe a foreign country's desire for U.S. technology. Business flows two ways: the United States buys satellite components and sensors from foreign sources, and other nations buy heavily from U.S. sources. As beneficial as this may be for the balance of trade, the downside for national security is that U.S. production depends on foreign sources for some critical items, such as space-qualified batteries. Foreign dependence may be controlled but not eliminated.

The DoD satellites now on orbit exceed their projected design lifetimes; the large backlogs of space assets have resulted in fewer new system starts. The corresponding erosion of engineering capability in the industry is a serious concern. Government labs and development organizations perform more of the R&D previously done by industry; National Aeronautics and Space Administration (NASA) centers and DoD labs do some spacecraft integration tasks in competition with industry. In the past, government centers and labs worked *with* industry to fulfill critical technology requirements. Recently, industrial funding of the government lab infrastructure has forced labs into more direct competition with their support industry. This raises questions about the roles of government labs in spacecraft-building functions other than fundamental science--which might be better done commercially.

Although U.S. satellite firms operate with little foreign competition for DoD, NASA, or commercial payloads, reductions in the DoD satellite budget suggest leaner times ahead. Budget projections for DoD satellite production show a significant reduction from 1996 to 1999 (mostly resulting from backlogged assets awaiting flyout)--16 percent from 1994 to 1999 and from a $2.1 billion high in 1995 to an estimated $600 million in 1998. The industrywide trend is toward medium-sized spacecraft, although some large and small satellites will be retained. Advances in space components miniaturization mean *more capability* vice smaller size.

Most traditional DoD spacecraft and payload prime contractors are in financially viable positions. Lower-tier firms are merging with primes, going out of business, or exiting defense for commercial markets.

Capital investments peaked in 1991 and have declined since--a trend of major concern. Failure to invest in R&D and new equipment, coupled with the loss of skilled designers, will weaken the industry's ability to introduce new technology unless specific action is taken to reverse this trend.

Defense cutbacks directly affect the critical skills of the satellite industry's work force. Because many displaced workers are disinclined to return to the unstable aerospace workplace, their many critical skills will be lost to the industrial base. It takes two to five years to reconstitute the critical engineering and technical skills lost. The booming commercial satellite market provides stability for skills used in both the commercial and defense industries, but defense-specific technologies may have very cold production base if the United States attempts mobilization or reconstitution in the future.

The current condition of the satellite market reflects of the absence of a coherent national space policy. In lieu of such a policy, market forces are the only stimulus for the industry's current condition. A plan that balances free-market support and government responsibility is essential. The government cannot be in the business of picking winners and losers in the space industry but can ensure that all U.S. firms get a fair chance to compete internationally and domestically.

Satellite Operations

Command and control (C^2) of spacecraft on orbit was pioneered by the U.S. government as an engineering-dominated activity. Technical experts manned consoles 24 hours a day to ensure a rapid response to satellite problems. The government still uses this approach, resulting in high personnel overhead. This slow evolution in satellite operations results in cumbersome, expensive, and outdated hardware and software systems support. In contrast, commercial satellite ventures employ more automated and modern data systems and minimal staff.

Industry leaders in satellite operations include Lockheed Martin, TRW, and Loral Space Systems. The sector is a niche market at best. Lockheed Martin has had measured success marketing operations support services, but this support is often bundled with spacecraft development in the commercial market and sold to foreign governments and commercial customers as a package.

Applications

Some of the most profound space applications are the direct result of recent government deregulation that allowed commercial 1 meter (m) resolution remote sensing, or imagery, satellites and thereby immediately caused an explosion of activity in the U.S. commercial sector. Five firms already hold licenses to operate 1-3 m systems before 2000, and the first will launch a 3 m satellite in 1996. The expected market is over $10 billion in annual sales of imagery and geographic information systems. Another application resulting from deregulation is the global positioning system (GPS). The decision by the government to allow commercial access to previously classified parameters has driven the value of the GPS market from $80 million in 1990, to $1.2 billion in 1996, to a forecast of over $8 billion by 2000.

U.S. civil and commercial remote-sensing capabilities currently consist of Landsat, first launched in 1973. Landsat multispectral (30 m) data, the best U.S. nonmilitary imagery available, is used worldwide. France operates the superior SPOT remote-sensing system (10 m resolution imagery). The DoD annually buys commercial imagery from both Landsat and SPOT and leases deployable SPOT ground stations.

India has taken the world lead in the civil/commercial "resolution race" with its IRS-C satellite, which collects 6 m resolution imagery. India has also established an effective, extensive system to distribute applications to all government agencies and the private sector with the goal of improving national well-being through the direct application of satellite-derived products and services. Japan has also entered the remote-sensing market in ground stations and satellites. These international developments clearly demonstrate the need for the United States to develop a vision, strategy, and policy for space.

CHALLENGES

Space Launch

The key challenges in space launch are to improve responsiveness and reduce costs while maintaining high reliability. The heritage of the U.S. space-launch infrastructure is that of a R&D environment. Although the U.S. capability is relatively reliable, each launch is slightly different, and economies of scale are not and cannot be achieved. Lack of standardization and interoperability significantly increase the time lines and costs of launch preparation.

We estimate that *the United States must decrease its costs for launch and launch operations by one-third to one-half* to be competitive in the evolving international commercial launch market. The U.S. government has attempted to reduce launch costs by embarking on several new launch programs since the 1980s, but in each of the first three attempts programs were canceled because of excessive cost growth. The most recent program, the Evolved Expendable Launch Vehicle (EELV), whose design was primarily driven by cost, appears to be on track. We expect that developers will use EELV technology for commercial sales. In addition, the Reusable Launch Vehicle (RLV) technologies also show promise for the next-generation launch vehicle.

Satellites

There are currently four major prime contractors for domestic satellites: Lockheed Martin, TRW, GM-Hughes, and Loral Space Systems. Despite layoffs (and loss of critical skills), the primes' financial positions are stronger than during any recent period. According to the U.S. Air Force Industrial Base Assessment, satellite primes and major subcontractors are considered to be in a better position than lower-tier contractors because of their flexibility and capability for vertical integration--pulling lower-tier work in-house to counteract temporary drops in sales or losses (Manufacturing Technology Directorate, 1993). The satellite industry will most likely continue downsizing and consolidating, but the nation must protect its technology and not treat it as a commodity to be sold.

Mounting debt incurred by U.S. firms as the space industry consolidates--with resultant high debt-to-equity ratios--may limit their ability to compete internationally. Analysts speculate that Lockheed Martin will pay for its purchase of most of Loral Corp. by increasing the firm's debt, raising Lockheed Martin to 179 percent equity, up from 64 percent in 1990; ideal levels for the industry are 70-100 percent. Analysts maintain that as business shifts increasingly to global markets, firms must invest in modifications to suit new customer requirements. Firms with high debt levels lack the flexibility to take action, and high debt ratios pressure firms to cut costs and prevent spending on expensive projects with high-risk payoffs. Because return on investment is time dependent, this also translates to cuts in R&D funding.

Critical Technologies and the Industrial Base

The space industrial base requires numerous critical skills, processes, facilities, equipment, and technologies. Satellite development requires high-technology engineering, materials, and processes, and satisfactory production requires the development of proprietary processes and highly trained engineers and specialists with distinctive skills. Defense budget cuts could significantly affect U.S. satellite production capabilities. Trends are toward loss of multiple sources for space-qualified parts and materials and sole sources for high-technology parts and materials.

Government Procurement Practices

Advocates of dual-use technologies assert they provide opportunities for large and small firms to offset business losses caused by a declining defense budget. However, most individuals interviewed said that there is evidence neither of government policy or money spent on incentives nor of contracts awarded as a result of any dual-use technology program. Many firms have decided to forgo government contracting rather than continue to absorb the cost of compliance with government contracting standards.

The DoD policy requiring firms to separate government and commercial production lines exacerbates the problem. Integrated military and civil production could give firms the incentive to maintain DoD capabilities or develop expensive, risky new ones.

Satellite Operations

The primary challenges in this area are to streamline the government infrastructure for satellite operations and incorporate more modern hardware and software systems for satellite C^2. Obstacles to achieving these goals are change-resistant, bureaucratic organizational equity, protectionism within the government, and limited funds for major C^2 system upgrades in an austere federal budget environment. Teaming with commercial firms, outsourcing to them, or both could yield substantial benefits to the government.

Applications

The government's deregulation of telecommunications, GPS, and imagery has opened the door to the interdisciplinary commercial market, which contains an array of products and services that will yield a profitable return on investment. Global and domestic firms seek control of all market sectors--space, data processing, and product distribution--through "international cooperation" and partnerships. The commercial sector's challenge is to be the first on the market with a total system package. The firm that first combines a constellation of high-resolution (up to 1 m) imaging satellites with ground control, data control, and services will gain a predominant market share.

Other nations recognize the potential to gain national power and prestige from successful, world-class space programs. Many countries--some that may someday be U.S. adversaries--could operate satellite systems on a par with the that of United States. As a result, the U.S. government must reexamine the full spectrum of doctrine, policy, and strategy. Future military and diplomatic operations must be conducted under the assumption that all potential adversaries possess 1 m visibility into U.S.

activities as well as an array of broadcast and communication satellites (comsats). National security implications are also clear--the United States would have to request precrisis imagery of an area, and that request could easily be denied.

OUTLOOK

The next few years should mark a turning point for the space industry. The market is fast changing from one of reliance on national space programs and international consortia to one driven by private industry. Traditional space companies, like Lockheed Martin and Orbital Sciences, are also moving to provide satellite-based services.

Another trend in the space industry is that the competitive desirability of offering customers one-stop, turnkey operations is encouraging corporate mergers, acquisitions, and joint ventures. The overall effect will be to reduce even further the number of space prime contractors.

Space prime manufacturers are consolidating as the market expands. Normally, this trend would reflect overcapacity within an industry, but in this case it means that firms are anticipating a large and diverse space market and positioning themselves to take advantage of as many market segments as possible.

Space Launch

In general, the space-launch sector can support national security requirements in the short term with excess capacity and high costs. The major shortfall remains in procedural turnaround time. Over the long term, the nation will be unable to meet its national security needs without EELV.

The launch infrastructure is adequate for national security needs, but its technology needs modernization. Modernizing the infrastructure would improve the on-pad processing of boosters and payload integration for some spacecraft, which would in turn improve surge and mobilization capabilities. An important point to remember, though, is that launches must be reliable. While space launch is expensive, its percentage cost is much less than that of satellites or the product delivered from those satellites.

The production of launch vehicles now follows a pseudo "just-in-time" schedule: they are produced slightly in advance of specific launch manifests. The schedule is considered "pseudo" because the DoD has in reserve at least one type of every booster needed to launch one of its satellites. Space-launch mobilization takes the form of "outprioritizing" launch customers already on the manifest and "using" their boosters until production is increased to meet the demand.

Payload availability is another key ingredient in space-launch surge and mobilization. Satellite industry moves toward a standard interface with boosters will enable flexibility in establishing launch manifests.

The industry is also moving toward space-launch standards. As a result, the DoD will have to use standard commercial launch specifications in the future. A recent Air Force Scientific Advisory Board study recommended that the government use commercial launch services for *most* military satellites (U.S. Air Force Scientific Advisory Board, 1995). This policy shift would boost the commercial sector and allow government funds to focus on R&D instead of on launch and operations infrastructure. It is this support, however, that the United States provides on a subsidized basis to commercial customers. The U.S. ELV market is facing fierce competition from the European Space Agency, Russia, Ukraine, and China. The success of U.S. commercial launch will depend on continuing a general U.S. policy preference for using U.S. launchers for U.S. payloads. Obviously, NASA's use of commercial launch services and DoD-funded launches would greatly offset an imbalance in U.S.-negotiated launch allocations with other countries.

The trend toward small satellites using lightweight launchers may not be as pronounced as originally anticipated. The use of multiple-manifested satellites on large boosters may prove to be the most cost-effective means of launching the planned large constellations of small, commercial satellites.

Finally, future surge and mobilization capabilities will be improved by the ELV and RLV programs. If booster life-cycle costs are reduced by 50 percent as predicted, the industry may be able to afford to stockpile key common components, making mobilization much easier. Sharing production lines will also make surge much more realistic.

Spacecraft

The expansion of the space industry will continue to be driven largely by growth in demand for a wide variety of telecommunications. Spacecraft technology has evolved to the point where it is commercially feasible to offer satellite-based communications services. Satellites, though smaller, are now technically more advanced and powerful than before, allowing a wider range of applications.

About half of the 1,000 satellites scheduled for launch worldwide through 2000 will be small (less than 500 pounds), low-earth-orbiting (LEO) mobile comsats. Most will belong to multisatellite systems such as Motorola's Iridium or Orbital Sciences' Orbcomm. Also planned are medium Earth-orbiting mobile systems using slightly larger satellites, such as ICO Global Communications' Inmarsat-P. About 10 percent of the comsats will be larger, geosynchronous orbiters offering advanced, fixed services such as direct-broadcast TV. The most common geosynchronous satellites should continue to be traditional telecommunications and TV broadcast satellites for national systems, such as Japan Satellite Systems' JCSat.

One proposed comsat system, Teledesic, could radically alter all current projections for the future space market. Its ambitious network plan--800 active LEO satellites--would dwarf currently planned systems such as Iridium (66 satellites) in size and cost.

To a lesser extent than that for telecommunications, the nascent market for commercial Earth imaging also drives industry expansion. The loss of Landsat 6 in 1993 and subsequent concern over the U.S. capacity for Earth imaging highlighted a need--and the potential for large profits--within the market. A recent U.S. policy allowing the commercialization of high-resolution imagery fueled the interest of firms such as Lockheed-

Martin, Orbital Sciences, and Ball Aerospace/WorldView Imaging. Along with government-sponsored programs such as NASA's Earth Observing System, Japan's ADEOS, and India's IRS, about 50 Earth-imaging satellites are planned for launch through 2000. These larger satellites mean an ongoing need for at least medium-lift launch capacity.

The range of promising opportunities for growth in satellite-based businesses worldwide will enable top- and middle-tier firms to focus on the satellite business and its excellent growth potential. There is room for several successful, high-quality organizations with different technologies serving different sectors of the market.

Satellite Operations

In the satellite operations sector, industry has correctly reacted to and outpaced the government in efficiency improvements. The government has begun taking steps to streamline and update its satellite operations, but the organizational infrastructure has so much inertia and the costs of reengineering entire hardware and software systems are so massive that any significant changes are unlikely for several years.

Commercial operations continue to refine their systems and procedures to improve efficiency. One threshold technology that will improve satellite operations is communications cross-linking from satellite to satellite. This technology has been proved on some DoD spacecraft, and it has the potential to eliminate the need for overseas ground stations during normal telemetry, tracking, and commanding. Cross-linking would result in tremendous savings for the government as well as simplify operations for future commercial low-Earth orbit satellites.

Applications

Space applications will be the backbone of the information age and show exponential growth in the coming decades. Revolutions in space-based information technology--weather, cellular telecommunications, paging, broadcast--affect not only government and industry but individuals' livelihoods internationally.

Space applications will enable countries to leapfrog from the industrial age directly into the information age. A lack of ground communications infrastructure will no longer hold a society hostage to the technological dark ages. This phenomenon is not evolutionary progress but rather a revolution that catapults the world into the information age.

GOVERNMENT GOALS AND ROLE

> *We're going to spend $125-150 billion--a lot of money--over the next 10 years on space programs, and currently I have nothing to take to the Defense Secretary that qualifies as a strategic plan . . . . There's no single master plan for spending $13 billion per year. That's personally unacceptable. It just doesn't pass the common sense test.*
>
> --Robert V. Davis, Deputy Under Secretary of Defense, Space

Define Policy

In 1995 a bipartisan, blue-ribbon panel convened by the congressional Office of Technology Assessment concluded that there is a "lack of consensus on U.S. space policy goals." With the dissolution of the National Space Council in 1993 and the subsequent move of space policy responsibilities into the Office of Science and Technology Policy (OSTP), this finding is hardly surprising.

To add to the confusion about space policy, during his Senate confirmation hearing on January 26, 1993, the president's science advisor, Dr. John H. Gibbons, testified that his priorities lay more with inner space than with outer space. This testimony, coupled with the fact that the highest White House official now responsible for overseeing space policy is only at the assistant director level in the OSTP, only validates the fact that the administration has placed a relatively low priority on space.

The executive branch must take vigorous steps to define a national space policy, vision, and strategic plan if the United States is to maintain its preeminence in the space arena. Other nations, such as Japan, France, and Germany, are building the technology to compete in along with the vision to penetrate the global market. The degree to which the United States can maintain its leadership is directly proportional to the energy the nation devotes to developing and executing a national space strategy.

Key areas that the national space policy must address and in which the government must *take action* include the following.

Invest in Future Technologies

Reductions in capital investments and R&D funding (both government and private) will harm the satellite development sector more in the long term than will any current reductions in procurement. The government must work with industry to develop standardized payload configurations and satellite subsystems to reduce the payload-to-orbit cost, provide increased R&D funding for next-generation spacecraft to replace current systems, and provide incentives--through revised regulations and tax policy--for the industry to make significant R&D investments. The government, however, must fund the majority of fundamental science R&D. Finally, space policy must preclude the transfer of technology without a commensurate exchange, which would protect technology as an asset vice selling it as a commodity.

Teamwork with Industry

Foreign competition for launch services is and will be the greatest obstacle to growth in the U.S. space transportation market unless the government takes a more aggressive, protectionist stance --at least until U.S. commercial launch has an opportunity to benefit from lower-cost, modular EELV and its common launch infrastructure.

The government should also take further steps to provide low-cost or no-cost launch operations and range support for commercial launches. Currently, commercial launches are required to pay for the proportionate share of the range they use. If the government has the staff and facilities on hand, it should provide the services at no cost as a way to level the international playing field.

In another teamwork issue, the government should devise a strategy for taking advantage of the coming explosion of remote-sensing data from commercial systems. The tremendous savings made possible by using commercial imagery for certain applications could be reinvested in future technologies. This strategy for using commercial products could also serve to bolster the industrial base by guaranteeing a certain level of orders for a company, thus improving its ability to secure financing.

Finally, the government should commercialize all routine satellite health and welfare operations. Firms have been supporting satellite operations for over 35 years, and significant savings across the board would result from simply hiring the "best in class"--a qualified contractor--to perform routine satellite operations.

Maintain the Industrial Base

Market forces will likely cause further downsizing and consolidation, but the government should implement a coherent policy for maintaining the U.S. space industrial base. This policy should include incentives for small businesses and lower-tier suppliers and provisions for the government to act as an "anchor-tenant" for a commercial firms attempting to develop and process new technologies.

Reform the Acquisition Process.

The government must also continue the progress made in reforming DoD acquisition to facilitate dual-use initiatives. Contractors cannot be required to maintain fully redundant production lines for commercial and government work just to meet procurement regulations. There must be concrete financial incentives for dual-use production. Because of market competition, multiyear procurement contracts can also yield significant benefits--in both planning and costs. Specific acquisition reforms for the space industry include:

- Embrace commercial standards in acquisition practices.
- Provide stability through multiyear procurement.
- Acquire commercial products instead of having the government build a unique end item..

- Support advanced technology demonstrations.

- Collapse the time it takes for an idea to evolve into a product.

- Support cooperative R&D agreements.

- Support the increased use of computer-assisted design and manufacturing and concurrent engineering.

CONCLUSIONS

The space industry plays a strategic role in the nation's future. The application of space technologies in future military operations will facilitate a U.S. global presence, knowledge on demand, space control, and power projection. All of these developments are made possible by designing spacecraft with modern, low-cost techniques, adapting innovative architectures that incorporate distributed satellite systems, developing affordable access to space, and embracing commercial standards in acquisition practices. Although on August 5, 1994, the White House announced a National Space Transportation Policy that attempted to improve the nation's launch situation, no strong national space strategy with a far-reaching vision has emerged. *The first and foremost need is to establish a strong national vision and a strategic plan that integrates all activities in space: military, civil, and commercial.*

To that end, the United States urgently needs an overarching national space policy to improve its competitiveness in the world market. Government and industry must work as a team to compete globally. We therefore strongly urge that the U.S. government:

- Establish a *quid-pro-quo* national policy that views technology as a national strategic asset and precludes its transfer without a commensurate exchange.

- Promote the modular design of satellites, interfaces ,and boosters.

- Offer free launch operations and range services to U.S. firms.

- Commercialize and privatize standard satellite control operations.
- Establish a government-industry team approach to the use of commercial space products and services.
- Fund R&D for fundamental science.
- Provide tax incentives for commercial R&D investment.
- Create a commercial environment that allows U.S. firms to control a share of the market for space products and services applications.

Space is a key part of the nation' s economic and national security and the cornerstone of leadership in the information age. In the next century the space industry will require a clear, strong government policy and a willingness on the part of the government to work with industry to satisfy the right requirements--on time and at an affordable cost.

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