

# Chapter 5:

## Commercial Space and Spacepower

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It is increasingly apparent that commercial opportunities for using space to make money by selling goods and services to governments and private customers are growing. Over the past 50 years, the United States has been the technological and commercial world leader in space. U.S. space policies, as reflected particularly in Presidential Directives but also in legislation and in regulations, reflect this leadership role. From the very first space policies in the Dwight D. Eisenhower administration to the present, policy documents assume that the United States is the world leader, attempt to ensure that role continues, and reserve the right to use the necessary means to protect space assets.

Until the 1980s, private companies in the United States were contractors and suppliers to the government space program and projects. They did not offer space services to the public. The one exception to this was in the important area of telecommunications. From the very beginning of the space age, U.S. private companies (in particular, AT&T) designed, built, and operated communications satellites and sold services to the public under strict government regulations and supervision.

Today, the landscape has changed. Companies in the United States are in direct competition with many foreign entities in space in almost all areas: launch vehicles, remote sensing satellites, telecommunications satellites of all kinds (voice, direct TV, fixed and mobile services), and navigation services. The technological capability to build and operate sophisticated space equipment has spread worldwide.

All evidence points to a continuation of this trend. Space has become a global enterprise with the number of nations and firms with space goods and services growing rapidly. And not only are more people involved in space but also the unique advantages of the space environment have contributed greatly to the growing trend toward globalization through its almost universal coverage of populated areas with communications and observation products and services.

In turn, an increase in globalization can stimulate the further growth of commercial space by making even larger markets with corresponding sales potentially available to companies. Globalization must be viewed as a summation of various components (political, business, and cultural). Space capabilities and technologies contribute differently to each component, and the extent of meaningful globalization must be analyzed by its components, not in the aggregate. This chapter will discuss the long-run trend toward globalization and how the growth of multinational companies and the global marketplace has influenced commercial space and spacepower.

Although no other nation spends as much on space as the United States, the ability of the U.S. Government to influence the rest of the world in space policy and in the use of space has greatly diminished over time. In some ways, space has become just another commodity. But government policy and security aspects of space do not treat commercial space as they treat automobiles, soap, or furniture. Because of the strategic value of space as well as the huge dependence of almost every industry on the space infrastructure, space commands special importance and has become a critical national resource.

This chapter will also review the process by which the U.S. Government has developed official policies toward space that have fueled the technological lead and put the United States at the forefront of space activity, while at the same time transferring some of the responsibility of this lead from purely government programs to the domestic commercial sector. However, other policies of the U.S. Government have had the opposite effect, encouraging foreign nations to develop similar and competitive space capabilities.

Questions without clear answers are the degree to which U.S. policy has sped up foreign space capabilities and what the effect has been on spacepower. Of course, not all foreign space programs can be attributed to U.S. policy actions. Because of the obvious advantage of using space for global monitoring, communications, and other activities, other nations naturally have had the desire and have developed independent space assets and capabilities.

## **Spacepower**

Spacepower can be viewed from a commercial perspective in two ways. The first is economic: encouragement of commercial U.S. space ventures to be dominant in the world marketplace, either through creation of a monopoly or by sheer market dominance. The latter often makes competitors follow the leader's standards and practices, which in turn practically assures that others will adopt systems compatible with those of the market leader.<sup>1</sup> The second is by a show of strength: aggressively denying others access or interfering with the operations of foreign space assets.

This chapter will focus on policies of commercial market dominance. Therefore, spacepower will be discussed without the notion of military control or aggressive action to protect space assets or deny others the ability to operate in space. A truly competitive commercial world assumes that companies can operate on a level playing field and that the deciding factor is the ability to make a profit rather than the ability to take out a potential competitor by military action.<sup>2</sup>

Looking to the future growth of commercial space companies and the multinational aspects of commercial space raises an interesting question regarding spacepower. Specifically, will it be possible for commercial interests to supersede other national interests in space? The short answer is *no*. Besides the clear dual use of all space products, space law, as defined by current United Nations treaties on outer space, makes nations responsible for the actions of their citizens in outer space. To get to space and to do anything there, a company will need the formal approval of a parent nation. Since

each nation may be both jointly and separately liable for certain types of damage from space objects, it will be difficult, if not impossible, for a company to operate in space without supervision. Therefore, unless the major legal tenets of space activity change, commercial interests will be subservient to national interests in space and will face major regulatory controls.<sup>3</sup>

### **Globalization and the Changing International Economic Environment**

Globalization is the process of human interaction characterized by the ease of transcending national borders for variously defined ends.<sup>4</sup> There are many different aspects of globalization occurring at any given point in time. It is important to distinguish between geopolitical globalization, multinational economic globalization, and cultural/information networks that have become global.

**Figure 5–1. Degrees of Globalization**

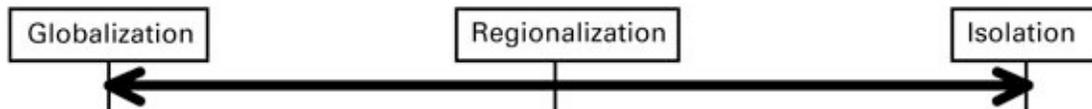


Figure 5–1 illustrates the range of possible degrees of globalization. As one moves to the left of the diagram, the degree of interaction among nations increases. At the other extreme, nations may choose to isolate themselves and raise barriers to global interactions. The concept of regionalization is intended to meet a middle ground where select groups of nations agree to form alliances. Since the overall concept of globalization is the combination of the different elements suggested above, it is instructive to look at the relative position on the continuum for each major element. In general, economic and cultural globalization today has moved toward the left of center, while geopolitical globalization is somewhere to the right of that.

Some of the most visible trends in today's world are the growth of multinational firms, the ease of financial transactions internationally, and the spread of ideas, culture, and entertainment through the advances in communication technologies. The availability and advantages of satellite communications have greatly contributed to these trends through both global coverage and the opening of the global communications services and markets to all nations.

Globalization is not a new phenomenon, nor is it inevitable.<sup>5</sup> Decreases in barriers to trade—most recently through the North American Free Trade Agreement and the World Trade Organization, but through other bilateral agreements in the past as well—and better coordination among nations characterized the decade of the 1990s. Similar eras of increased interaction among people have existed before the most recent times but have then been followed by wars, economic depressions, or other occurrences, which slowed or stopped the trend toward globalization. Even in the first few years of the 21<sup>st</sup> century,

the changed policies and attitudes toward international travel and security because of the events of September 11 have, at least temporarily, slowed the rapid globalization pace established in the 1990s.<sup>6</sup>

Other influences may also slow economic globalization. As described by Rawi Abdelal and Adam Segal, the speed of globalization may become less rapid in the upcoming years for the following reasons: politicians are more nervous about letting capital goods and people move more freely across borders, energy is the object of intense resource nationalism, and bilateral agreements appear to be replacing multilateral agreements (particularly with the United States skeptical of "global rulemaking").<sup>7</sup>

As impressive as the economic and cultural spread of ideas and interactions has been during the past several decades, it has been balanced by the decided lack of geopolitical globalization. With the important exception of the European Union (a limited form of primarily economic globalization on a regional basis), nations have not changed their approach to territorial rights.<sup>8</sup> These rights are jealously guarded and are strong limits to true international geopolitical globalization.

Although there has been a trend toward multinational firms and a global economic regime, history has shown that there is no assurance that this trend will continue on a smooth path. Current economic globalization is dependent on nations moving toward a free market-based economy that also implies some form of democratic government. Economic globalization also depends on the establishment of a relatively uniform regulatory system that is predictable, fair, and enforceable.

Space is a global industry. Within limits established by the political system, companies compete for launch services internationally. Satellite manufacturing, once heavily dependent on U.S. companies, is now an industry with companies located around the world. Space services are also available internationally. However, because of the dual-use nature of many space activities, there are regulatory and legal limits on the degree of international trade that can occur in this industry.

There are many good economic reasons that explain why commercial space needs to be global in nature to survive in a competitive world. Primarily, it is the satellite capability to connect to ground stations anywhere in the world and to transmit data and information globally (or, if not to all nations, to a vast majority of the world's populated areas). To make a profit on an investment that has high technological risk and very high up-front demands, a large market is essential. The additional cost of adding a new ground station is small in comparison to the cost of the space system. Since satellites can have global coverage, having a global market becomes an attractive profit potential. It can be easily argued that many space services are "natural monopolies." That is, one large provider can have the ability to serve all customers much more inexpensively than can multiple providers.<sup>9</sup>

However, in economic government regulatory policy, a monopoly of any sort is counter to a free market competitive philosophy. It should be noted, though, that early U.S. policy

encouraged a U.S. monopoly in international telecommunications, not for reasons of economic efficiency, but for U.S. control and security (see the discussion below on U.S. telecommunications policy).

Globalization can have both positive and negative effects on the growth of the space sector and on the development of specific space applications. On the positive side, privatization of space assets would be possible if markets were large enough to be profitable for some space activities. If this were to occur, governments would have to be willing to relinquish some control of space activities. Applications that involve very large international markets—such as launch services, remote sensing, distance learning, and telemedicine—would benefit.

Globalization also would mean rising per capita income among most nations (although at different rates of growth), which would create the potential for more markets for space (and other) goods and services. New and larger markets might open opportunities for the expansion of currently profitable consumer space-related services such as global positioning system (GPS) navigation equipment and telecommunications (information-based) services, and perhaps the use of space for entertainment services (such as real-time distribution of movies and new music delivery services).

On the negative side, globalization and economic growth are likely to stimulate a backlash among some in society who will push for a "simpler" life and are against using new technology. A cultural backlash can also be expected that, coupled with the spread of highly advanced communications and space technology, is likely to encourage countermeasures by advocates wanting to block or reduce the influence of alien cultures.

Security and defense issues will be of major governmental concern. Space applications will be used to monitor and control these activities, and this should be a growth sector for government programs using new satellites. However, this can easily lead to a decline in market-based commercial space applications as government demands and regulations supplant the development of private market opportunities.

In the financial community, commercial space activities would have to be shown to have a greater opportunity cost and return on investment (ROI) than other high-technology and high-risk investments. As with other "negative" aspects of globalization, the availability of sufficient private capital for space investments will depend more on opportunity costs and the expected ROI of specific projects than it will on globalization. When dual-use technologies are involved, a lack of private capital will necessitate government subsidies.

## **Regionalization**

The effects of regionalization are likely to be similar to those of globalization on space, although at somewhat lower levels of activity due to:

- less harmonization among nations in areas of regulation
- possibility of more regional conflicts

- lower per capita income growth
- less convergence of growth rates in general.

Nevertheless, satellite capabilities will be used for additional security concerns and for global monitoring. There is likely to be less private sector investment in space under this scenario than under the globalization scenario. However, regional markets may be large enough to support sizable space investments by the private sector. Other than the European Union, regional cooperation in space has not been a market or security issue to date.

### **Crisis/Independence**

If nations increasingly choose to develop independent space systems, defense and other government uses of space will become more important with governments discouraging private investment in space because of the potential dangers of dual-use technologies in the hands of companies and other nations. Since each nation will attempt to develop its own space systems, the duplication and oversupply of both hardware and space products will act to discourage commercial space investments. Technological progress in areas such as space science and exploration would be hurt greatly by the divergence of funds to more immediate problems.

Finally, private investment in space will be even more challenged, but governments may opt to purchase space services directly from domestic commercial private firms. These firms may be precluded by regulation or contract from offering services to customers in the general marketplace.

### **Globalization and Spacepower**

Globalization is not an inevitable outcome of current and past trends, but some very important aspects of globalization are on a steadily expanding path that is unlikely to be deterred. They include multinational business and financial connections and networks as well as cross-border information, cultural, and entertainment products and services. Space assets provide a key enabling infrastructure component of both of these developments.

The commercial space activities that are profitable today are those that serve these sectors by providing rapid worldwide communications. Whether it is navigation and timing services of the GPS satellites, or direct TV broadcasts, or very small aperture terminal links of the credit card companies, or electronic financial trading, the global economic system is now linked via satellites and space capabilities. If it were not for the existence of a large and well-funded global market for these services, the satellite systems serving them would likely not be profitable. What has developed over time is a circular dependence: technologies create new economic opportunities, and large markets create profitable infrastructure investments with subsequent multiplicative terrestrial businesses.

However, this evolution of satellite services (from the early space years when governments provided and controlled the telecommunications satellites) has created dilemmas. No longer can a nation such as the United States even rationally plan for control of the systems or capabilities. In time of conflict, it would be almost impossible to interrupt services because businesses and governments as customers depend on them. In fact, the government is one of the major users of commercial communications networks.

Another dilemma is that satellite signals do not cleanly begin and end at national borders. Some nations are increasingly incensed at their inability to censor or control economic and political messages received by their populations. Similarly, some cultures are attempting to resist the intrusions of Western values that are predominant in the business and entertainment sectors. This is creating political and regional isolationist sentiments that may someday result in attempts to interrupt certain satellite transmissions. Such attempts make the issue of spacepower integral to both the growth of globalization and the continued development of large world markets for satellite services that can create profits and new commercial space endeavors. The nation that leads in commercial space will have a larger share of economic growth and be able to dictate industry standards, an important tool for future economic dominance as well as for space security.

Thus, if globalization continues its rapid advance, then a nation's commercial spacepower is of greater importance; if globalization stalls, dedicated national security and military uses of space will increase, and a nation's ability to garner larger market shares for commercial services will be more limited.<sup>10</sup> Spacepower may then be determined more by military power than market power.

### **U.S. Government Approach to Commercial Space over Time**

This brief review of U.S. Government space policy documents as they relate to commercial space activities clearly shows a changing attitude and increasing dependence on private space activities. U.S. Government space policy, however, is very complex and is not adequately or comprehensively reflected in any one document or even any one series of documents (such as Presidential Decision Directives [PDDs] on Space Policies). When viewed from a commercial space perspective, even analyzing only unclassified policies yields a set of guidelines that is sometimes inconsistent. At any given time, one can point to both documents in which the government provides incentives for commercial space to develop and mature and ones in which significant barriers to commercial space exist. Sometimes these incentives and barriers are erected purposefully and sometimes they are inadvertent, being unintended byproducts of other government priorities and initiatives. Several categories of government policies will be described below. First, trends in PDDs that have direct implications for commercial space are analyzed. Second, PDDs and documents concerning the satellite communications sector are described. Third, major legislative changes that have had an impact on the development of commercial space and regulations imposed on commercial space endeavors over time are reviewed. Fourth, other government policies such as the deregulation of many industries and the decision of the Department of Defense (DOD) to encourage the consolidation of aerospace companies are discussed.

A summary of government policy toward commercial space produces a confused set of signals to the industry and to foreign governments and potential competitors. The reasons for the contradictions include:

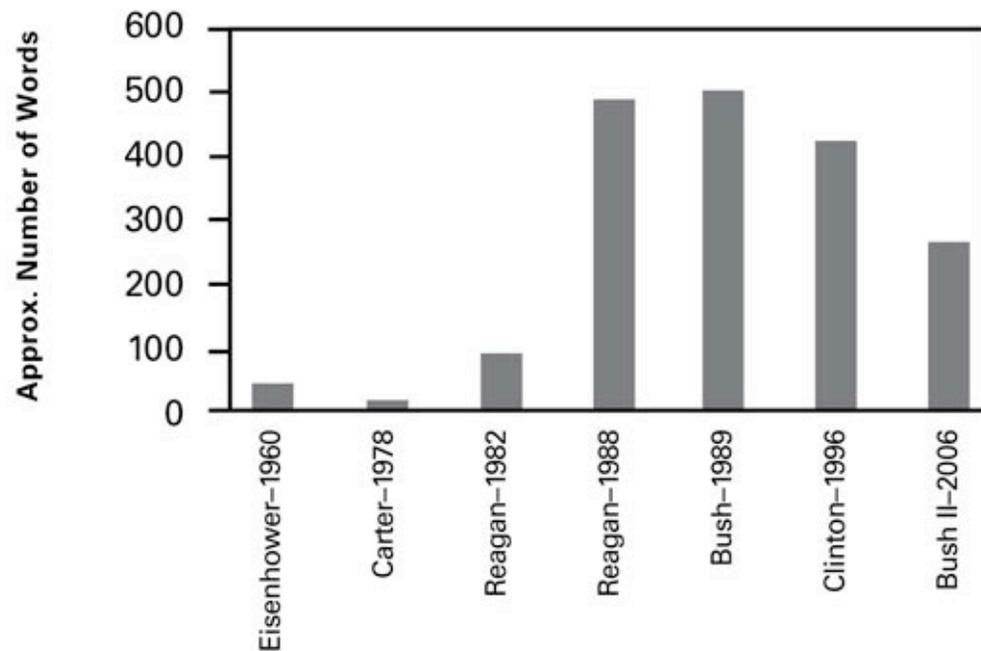
- the important role of space in national security and a goal of reserving some space capabilities, whether commercially or government owned, for national purposes
- a rapidly changing industry that has not yet reached commercial maturity
- the use of space assets for international political purposes
- changes in government policy over time concerning competition and deregulation.

Finally, it should be noted that most other nations have developed space capabilities and space programs to encourage and subsidize economic growth through cutting-edge technological developments (as well as to create jobs).<sup>11</sup> The charters of most foreign space agencies specifically state this as one goal.<sup>12</sup> That provides a basis for an overt and active "industry policy" toward space. The United States has a government philosophy of not having an industry policy for any economic sector, therefore making it more difficult for the government to find a unified way of providing incentives to any industry, aerospace included.<sup>13</sup>

### **Presidential Space Documents and Decisions**

Since 1960, there have been seven major Presidential documents on space policy. Changes over time to the policies have never been radical but have reflected changing technological, political, and economic conditions. The following discussion will broadly summarize the approach over time of the various administrations to commercial space and will analyze the significance of those changes to the U.S. economy and to how commercial space plays a role in spacepower.<sup>14</sup> It is clear from the very rudimentary count of words in these documents that the economic and commercial aspects of space only became important policy considerations in the 1980s (see figure 5–2).

### **Figure 5–2. Commercial Space in Presidential Space Policy**



Space policy emerged from the Cold War as a security, political, and technological endeavor for the United States. Early space policies focused on ensuring the security of the United States through winning the technological race with the former Soviet Union. In addition, there were concerns and issues of nuclear proliferation and deterrence in those early space policies, reflecting the capabilities of launch vehicles to deliver weapons. The economic capabilities of the United States were mentioned in the Eisenhower Policy but more as a general recognition that the design and development of space equipment would stimulate the economy. That is, jobs would be created and possible spin-off products would enter the economy. The Eisenhower Policy also recognized the future potential economic aspects of two civilian applications of space technologies, communications and meteorology, but these technologies were not discussed in detail in this overall policy document.<sup>15</sup>

It is also interesting to note that the Eisenhower Policy called for international cooperation in civilian space exploration, but at the same time space was to "demonstrate an over-all U.S. superiority in outer space without necessarily requiring the United States supremacy in every phase of space activities."<sup>16</sup>

The beginnings of change were apparent in the 1978 National Space Policy of the Jimmy Carter administration that focused on remote sensing; it called for a study and report on private sector involvement and investment in civil remote sensing systems.<sup>17</sup>

The official encouragement of commercial space did not occur until the 1980s.<sup>18</sup> Several different domestic factors, as well as several international developments, were responsible. First was the beginning of the maturation of the Earth observation satellites and the growth of a private value-added industry selling specialized products based on

Landsat imagery. Second was the successful partial commercialization of the upper stages of launch vehicles (the Payload Assist Modules). Third was the *Challenger* accident in 1986 that suddenly changed the launch scenario for commercial satellites (mostly telecommunications).<sup>19</sup>

On the international scene, the 1980s were marked by the success of the French Ariane launch vehicle and Spot remote sensing satellites. Both were designed to directly compete with U.S. systems and were marketed by private companies but were essentially vehicles funded through government sources. Other nations were also beginning to design and build competitive commercial space systems and satellites.

Therefore, on both the domestic and foreign fronts, commercial companies that had been solely government contractors for space equipment were branching into independent offerings of space components and systems. The industry was beginning to mature and, at the same time, the United States was entering an era of overall policy shifts toward economic deregulation of all industry. Although space would never be "deregulated," the philosophical shift meant more attention to commercial capabilities and opportunities along with the recognition that the government could be a customer for rather than a producer of some space goods and services.

The Ronald Reagan administration policies of 1982 and 1984 further extended the mandate for the government to both "obtain economic and scientific benefits through the exploitation of space, and expand United States private-sector investment and involvement in the civil space and space-related activities."<sup>20</sup> Collectively, these policies emphasized that the space systems were to be for national economic benefit and that the U.S. Government would provide a climate conducive to expanded private sector investment and involvement in civil space activities with due regard to public safety and national security. It also called for a regulatory and supervisory system.

It should be noted that all policies that encouraged private sector space activity and commercialization of space also contained caveats that required the consideration of national security. Thus, any commercial space venture had, and still has, investment risk that is subject to deliberately vague government rules and possible decisions on what might constitute a breach of national security.<sup>21</sup>

The George H.W. Bush administration expanded these commercial policies.<sup>22</sup> Collectively, they called for the active encouragement of commercial investments in space as well as for the promotion of commercial space activities. There were even directions in the policy of 1991 to study the possible disposition of missiles by converting them into commercial launchers. (This was subject to a number of security and economic caveats.) Also of significance was the mandate for the government not only to promote commercial remote sensing, but also to "not preclude" private sector remote sensing activities.

The Bill Clinton administration took further steps to encourage commercial space. In particular, remote sensing again was the focus of attention, with not only the previous

security limits on the resolution of imagery that could be made public greatly relaxed, but also with specific policies on remote sensing that were to support and enhance U.S. global competitiveness in the international remote sensing market. Success in this type of commercial activity was viewed as contributing to our critical industrial base.<sup>23</sup>

Another Clinton policy directive called for the private sector to have a significant role in managing the development and operation of a new reusable space transportation system. The National Aeronautics and Space Administration (NASA) was directed to "actively involve the private sector."<sup>24</sup> Although this system (the X-33/VentureStar Project) was begun but never completed, it was one of the first major initiatives in space for a public/private partnership in the research and development (R&D) of a new launch system.

By the mid-1990s, the GPS military navigation satellites, which had a free and open signal, had stimulated a rapidly growing private sector market for ground receivers. A policy directive issued in 1996 clearly recognized that the private sector investment in U.S. GPS technologies and services was important for economic competitiveness, and the policy encouraged continued private activity in this area, subject to issues of national security.<sup>25</sup>

The George W. Bush administration issued a set of space policies dealing with specific issues (Earth observations, transportation, navigation, and the vision for exploration) as well as the final policy document that covers overall space policy.<sup>26</sup> The commitment to promoting and encouraging commercial activity is continued in all of these policies. However, in the overall policy document issued in August 2006, there is a noticeable decrease in references to commercial objectives and a noticeable increase in references to national security issues.

This should not be interpreted as a retreat from supporting commercial space endeavors. In fact, there are more companies involved in entrepreneurial space activities than ever before in the United States and the rest of the world. And the U.S. Government is actively promoting commercial ventures, both independently of and with government support, in programs such as NASA's commercial-off-the-shelf initiative. In addition, NASA is actively seeking foreign national and commercial partnerships and initiatives for future activities on the Moon.

But this new policy should also serve as a sobering warning that national security will supersede commercial issues, if necessary, adding a significant risk to commercial investments on one hand, and insuring that U.S. commercial interests in space will be backed by some form of government protective action if they are threatened.

In summary, overall space policy directives have slowly been transformed from a Cold War emphasis that marginalized the economic and commercial implications of space activities into a truly integrated policy that recognizes the maturity of many space applications, sophisticated industrial capabilities, the globalization of space technologies, and the importance of the space infrastructure to both civilian uses and security concerns.

It is important to recognize that events in the past 6 years in the United States have led to a new space policy that continues to recognize and encourage commercial space, but with a greater emphasis on security and on the protection of both public and private U.S. space assets.

In the early years of space, the dominance of the United States in its technology permitted spacepower to be practically a given, rivaled only by the competition with the Soviet Union. Today, the reality is that the Nation is still the leader in space expenditures but no longer dominates or controls developments in many space applications. Spacepower, as it might be measured by dominance in economic or commercial space activity, is broadly spread around the globe. There are only limited ways the United States can use commercial space for maintaining elements of control over the industry. One is to have the largest market share in any sector, which encourages others who may want to compete to adopt compatible standards for interoperability. The other is to be the leader in developing new technology and establish dominant control over particular markets by protecting that technology. Both methods are risky, expensive, and do not necessarily guarantee success.

The only other way the United States can assert spacepower in the commercial sector is by using nonmarket (political, diplomatic, or military) actions to discourage or deny others access to commercial space. It is highly unlikely in today's world that such measures would be successful. Other nations have independent access to space and space assets. Many companies using space for commercial purposes are multinational enterprises, often with significant U.S. corporate investments and components. And the U.S. Government itself depends not only on U.S. commercial space goods and services but also on foreign systems.<sup>27</sup> Therefore, at this time, disrupting the fragile market and price system that is developing for space commercial assets would not be in the best interests of the United States.

### **Government Policy toward Telecommunications Satellites**

Until the 1990s, most space policy topics were covered in overall policy statements.<sup>28</sup> Telecommunications was handled separately from the very beginning of the space era, mainly because in the 1950s and 1960s, its relevance to security and its obvious commercial potential were much further developed than other space applications. In addition, telecommunications was truly a public/private endeavor, mainly developed in the private sector by AT&T. As early as the mid-1950s, comparisons were made that showed the tremendous capacity increases that could be available through satellite telephone calls when compared to the capacity of the transatlantic cable at that time.<sup>29</sup>

The change in 1961 from the Republican Eisenhower administration to the Democratic John F. Kennedy administration also signaled a change in attitude toward the telecommunications satellite system. In the Eisenhower era, it was accepted that AT&T was the monopoly provider of long-distance telephone service, and having the company expand into satellite service was not disputed. In fact, there was a clear recognition that a U.S. monopoly in satellite communications would be advantageous from many

perspectives, ranging from control over the world system (and also, therefore, increasing the military and economic power of the United States) to cost efficiencies from scale economies of operation.

The Kennedy administration altered this perspective and encouraged competition in the United States for privately funded satellite systems by awarding contracts for the development of new communications satellites by several firms. AT&T launched the Telstar system of two satellites in 1962, NASA awarded a competitive contract to RCA for the Relay satellites, also first launched in 1962, and Hughes received a sole-source NASA contract for the Syncom satellites, launched first in 1963.

As the need for a world satellite communications system developed, COMSAT was formed in 1962 as a U.S. public corporation with shares held by both the communications companies as well as the general public. It was not only the manager for the International Telecommunications Satellite Corporation (Intelsat), but also was its U.S. official representative. Intelsat was formed in 1964, and its first satellite, Early Bird, was launched the next year. As early as 1969, there was global coverage, with agreements in place for ground stations across the world.

In 1965, the Lyndon Johnson administration approved National Security Action Memorandum 338, which clearly stated the U.S. policy toward foreign communications capabilities.<sup>30</sup> The essence of this policy was to encourage a single global commercial communications satellite system. It stated that the United States should refrain from providing assistance to other countries that would significantly promote, stimulate, or encourage proliferation of communications satellite systems. It went on to say that the United States should not consider foreign requests for launch services in connections with communications satellites (except for those satellites that would be part of the international system).

The European (French-German) Symphonie satellite program begun in 1967 presents an interesting case study. This was the first European-built telecommunications satellite, and the Europeans requested a launch to geosynchronous orbit from NASA. The United States, as a matter of policy, would not guarantee them a launch opportunity for Symphonie as an *operational* satellite. (Eventually, the United States did launch the satellite in 1974 under the policy exception that the satellite was an *experimental* one.) This U.S. refusal to launch a foreign, and possibly competing, satellite was one of the main factors prompting the development in Europe of the Ariane launch vehicle so that Europe would have an independent capability to launch its own operational satellites.<sup>31</sup>

What this example illustrates is that a policy of spacepower (denying others access to space while attempting to create a U.S.-led monopoly) can backfire by providing incentives for others to be able to ignore U.S. policies by building and operating their own systems. As is well known, the Ariane launch system was optimized to capture the launch market for commercial telecommunications satellite launches to geosynchronous orbit. It became a huge tactical and market success, capturing over 60 percent of the

commercial launch market by the 1990s and effectively eliminating any hope of U.S. "control" of the launch vehicle market, particularly for telecommunications satellites.<sup>32</sup>

Over time, with the trend in the United States toward deregulation, the telecommunications industry monopolies have disappeared. At the same time, many nations have built and launched domestic telecommunications satellites. COMSAT became a private company and has now disappeared after being sold to Lockheed-Martin. Intelsat (and Inmarsat) are now privately operated. Many firms around the world are able to build new telecommunications satellites, and the U.S. position in this industry has changed from a virtual monopoly to a large, but by no means dominant, competitor.

### **Other Government Regulatory Actions**

Besides the official administration PDDs on space activities, there are numerous other social, technological, budget, political, and economic actions that are decided by all branches of the government—executive, legislative, and judicial. Some are related to space issues but are handled through other venues. Antitrust reviews, for example, done by the Department of Justice and the Federal Trade Commission, often have far-reaching space and spacepower implications when dealing with firms engaged in space activities. The list of direct and tangential actions with an impact on spacepower would span almost the entire spectrum of government activities, from securities regulations to decisions from the courts.

### **Examples**

Below, some examples are listed.<sup>33</sup> The major issue for consideration in the context of spacepower, however, is that many actions taken by the government for very valid purposes that are unrelated to space may create conditions that negate the ability to carry out space policies as proscribed in PDDs and/or create incentives for other nations or the companies in other nations to more aggressively develop systems in direct competition with U.S. capabilities. Taken collectively, many of these actions may make any attempt at a U.S. policy that emphasizes economic spacepower very difficult, if not impossible, to carry out. And looking historically, many of these nonspace policies and actions may have created and sped up the development of robust space capabilities in other nations, which, in turn, has weakened U.S. economic leadership in space and diluted the Nation's power in space systems development as well as in the technology and use of space applications.<sup>34</sup>

***Overall U.S. Government philosophy toward economic deregulation of industry.*** Deregulation, along with policies to avoid developing government enterprises, is oriented toward letting the market and price system allocate resources more efficiently than government fiat can do. This works well in a truly competitive industry with many producers and many consumers. Unfortunately, space is an industry characterized by only a few producers and with governments as the major purchasers. What has occurred is a shift in power and human resource capability from governments to large corporations. Whether this is advantageous to either the development of space commerce or to U.S.

spacepower is a matter of empirical analysis and further research, neither of which has been done as yet.<sup>35</sup>

***Overall government attempts to privatize and outsource functions.*** Examples such as the attempted privatization of remote sensing satellites, first in the late 1970s and again in the mid-1980s, were premature and not very successful. In fact, the suggestion that the satellite weather service be privatized resulted in Congress declaring that meteorology and weather systems were a "public good" and would not be privatized. Essentially, the private market for space goods and services has never developed as rapidly as was expected, and most of these proposals have not happened due mainly to a lack of a sizable nongovernment market as well as to the large up-front investments.

***DOD incentives for mergers and combinations of firms since the 1990s.*** As discussed below, this has encouraged a more oligopolistic space industry in the United States. It also encouraged similar combinations abroad as the only way other nations could compete with U.S. companies. Lower-tier suppliers have been subsumed under larger companies, and the result has been a different type of competition than existed before these developments in the space sector. It has also created more powerful and capable foreign competition.

### **Examples from Space-related Decisions**

***Imposition of strict export controls on space systems and high-technology products.*** Both U.S. and foreign industries as well as foreign governments have complained bitterly about the strict enforcement of export control laws since the late 1990s. It is increasingly more difficult to share R&D information, to sell U.S. space goods and services abroad, and to cooperate with foreign nations, even on government projects. The hardest hit space industry has been satellite manufacturing in the United States, where foreign competitors have built and are selling equipment worldwide at the expense of a market that formerly was controlled and dominated by U.S. firms.

***Sunset provisions on indemnification of space third-party liability.*** Although perhaps of a lesser economic disadvantage to the United States in providing competition in launch services, most foreign launch companies fully indemnify their domestic industry from the unlikely, but possibly very expensive, liability claims that could accrue if there were a major disaster from a space object destroying property or taking lives upon reentering the Earth's atmosphere. The United States requires private insurance and indemnifies firms (with a cap) on claims above what insurance would pay. That is a reasonable policy, but it has never been made permanent. Congress has consistently put a sunset provision into that authorizing legislation and therefore has increased the risk of investment for U.S. launch firms compared to our foreign competitors.

***Decision in the 1970s to put all commercial payloads on the space shuttle and not fund R&D for expendable vehicles.*** The economic results of the *Challenger* disaster in 1986 clearly highlighted the potential problems with this policy. In particular, Arianespace, the French/European launch vehicle company, was developing a series of vehicles mainly

designed for the commercial market in geosynchronous telecommunications satellites. As a result of the United States falling behind in R&D and manufacturing of expendable rockets and the change in policy toward commercial space shuttle launches after *Challenger*, Arianespace was able to capture up to 60 percent of the launch market. The United States needed over a decade and a major policy shift toward stimulating commercial launch developments before being able to regain some of the lost market share.

***Decision not to authorize launches of foreign operational telecommunications satellites on U.S. launch vehicles.*** As with other restrictive policies, nations were given the incentive to develop independent capabilities. With the ensuing maturation of launch and satellite technologies, they were able to build very competitive and capable equipment without U.S. components or assistance.<sup>36</sup>

***DOD decision to retain governance of GPS.*** Even though GPS was funded, designed, built, and operated by DOD, it had provided an unencrypted free signal for worldwide use as part of the program. Use of this signal has grown into a multibillion-dollar industry very quickly. Receivers are manufactured in many nations, and the system has become one of the important infrastructure services offered from space. It is important now to both the military and to civilian communications and timing systems. From the mid-1990s to today, it has been the only fully operating space navigation system. That is about to change as Europe, Russia, and possibly China develop their own systems. Nobody questions the integrity or value of the U.S. global positioning system, but partially because it is controlled by DOD without any inputs from other nations, there are incentives to invest billions of dollars abroad to duplicate the capability. From a military viewpoint, not giving up control of a critical technology is understandable, but from a practical and economic perspective, the United States likely could have maintained a monopoly position, or at least greatly stalled foreign developments, if the government had been able to compromise on this policy.

***Delayed decision to allow release of higher resolution images from Earth observation satellites for civil and commercial purposes.*** By the early 1990s, when the restriction was lifted on releasing or permitting private U.S. companies to collect or sell imagery with a resolution of less than 10 meters, France had been selling such imagery on the open market, as had Russia. Again, nations with aggressive economic and industry space policies were able to capture market shares from U.S. companies hindered by policies designed for security, not commercial purposes.

## **The United States and the Changing International Space Environment**

In the early days of space activity, the United States and the Soviet Union were alone in having a full range of space capabilities. National security, particularly with respect to fear of the use and/or spread of nuclear weapons, and Cold War-era jockeying for both economic and technological supremacy were the driving forces behind the space race. Private sector initiatives and the commercialization of space were concepts and ideas far from being realized. Even telecommunications through satellites was in its infancy and, at

least in the United States, involved private companies but only under careful economic regulatory supervision. Essentially, there was no commercial or economic issue of any great magnitude for the government to be concerned about. And where it might be possible, the United States had a virtual lock on competition.

Today, just about everything has turned around. There is no technological race with another superpower. Nuclear technology has spread across the world despite remaining under strict controls. Likewise, space capabilities ranging from launch vehicles to satellites are available to almost any nation with the money and inclination to purchase them. Space technical and manufacturing capability exists in just about every developed region of the world, and nations are not dependent on the United States. The world economy has become far more interconnected, and U.S. dependence on international trade in goods and services has grown from approximately 5 percent of the gross domestic product in the 1960s to about 20 percent.

The issue that confronts U.S. space policy in regard to economic and commercial spacepower is whether *any* policy that attempts to put the United States in a dominant economic role in space will be effective. The above discussion has amply illustrated that most such policies have backfired. They have encouraged other nations to invest in competitive systems so as to develop and maintain their own independent capabilities in space. Although worldwide competition in space infrastructure as well as space-related products and services may have many benefits, it does severely limit the amount of control any one nation might have on important dual-use technologies in space.

Economic competition does encourage the development and deployment of new products and services, but not all of them may be of domestic origin. However, some U.S. policies, such as those that have encouraged the merger of many companies involved in space and defense work into an oligopolistic framework, have led to an interesting new economic structure where competition is among a few giant firms rather than among many providers. It also has led to similar conglomerations of firms abroad. This type of competition may not yield the same advantages (particularly to consumers—including the government as a purchaser of services) that usually are attributed to true competitive industries.

In summary, for a variety of reasons, the United States cannot return to the space era and space policies of the 1960s. It can be and is a leader in space technology, but it is not the leader in all aspects of space. Spacepower through commercial prowess is likely to be shared among spacefaring nations. Policies aimed at isolation and at protection of commercial industries only encourage others to develop similar (and sometimes better) products. The only policy that can now be effective in developing a larger and more powerful economic competitive engine for space products is one that encourages R&D investments by space firms. The introduction of new and more advanced products will create a larger global market for the United States. A policy emphasizing offense rather than defense would be advantageous for stimulating spacepower through space commerce.

## **Conclusion**

Economic and commercial spacepower is about market dominance and control. When the United States has a monopoly or near-monopoly in space goods or services, control is not a problem, and it can dictate (and has done so) to the rest of the world what it was willing to sell and provide. History has amply illustrated that this is a short-term phenomenon and that, given the value of space technologies to many sectors and to domestic security, nations with the ability and resources will develop their own independent capabilities.

When other nations have similar capabilities, control becomes a problem assuming, as is the case with space, that control is also a critical issue in security. Options for control through spacepower change and become more limited. Once lost, it is almost impossible to regain economic control; therefore, spacepower may revert to issues of bargaining and negotiating power and/or military might.

Exerting spacepower may be inconsistent with expanded commercial developments in space, raising investment risks and creating incentives for foreign competitors. At the same time, spacepower is highly correlated with increased dual-use government purchases of space services as well as with other security issues in space activities.

Economic investments are made on the basis of expected rates of return. Expanding potential market opportunities is one of the prime motivators for private investment. The government may be a large customer for commercial goods and services. The economic question is whether it is better for a firm to invest in space because there are expanding private markets resulting from growth in global opportunities or because of expected domestic government sales, primarily for dual-use and security services.

To the extent that the global market opportunity is denied by restrictive commercial policies, spacepower from a purely international economic competitive perspective is diminished. As encouraging as the U.S. commercial space policies are in Presidential documents over the past 20 years, they have been unintentionally undermined to a large extent by other policies. In the United States, security almost always trumps commerce.

The United States is still the largest investor in space in the world and the technological and commercial space leader in many areas. This leadership is being challenged. From an economic standpoint alone, it will become increasingly important for the United States to stimulate its industry to develop better and less expensive space products in order to maintain its competitive position. A strong commercial space industry can and will contribute to spacepower. It must be recognized that space is no longer the province of one or two strong nations and that other nations will continue to enter the market and continuously challenge this leadership.

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## **Notes**

1. The advantage is twofold: it encourages purchases of technical components from the market leader, and it gives the market leader a military advantage in understanding the technological workings of others' systems.
2. The police power to ensure a status quo (or improvement) is recognized as an important component of a level playing field. For this chapter, the purpose is to isolate economic and business arguments from military and security issues.
3. Even international nongovernmental organizations, such as the European Space Agency, that have independently agreed to the principles of the United Nations (UN) Treaties on Outer Space cannot make claims for liability directly to a nonmember offending nation or to the UN. They are required to make such claims through one of their member nations that has ratified the treaties.
4. This section is based on a working paper by Henry Hertzfeld and Michel Fouquin, "Socioeconomic Conditions and the Space Sector," Organisation for Economic Co-operation and Development, Working Paper SG/AU/SPA (2004) 3, May 12, 2004.
5. See Stanley Fischer, "Globalization and Its Challenges," *American Economic Review Papers and Proceedings* 3, no. 2 (May 2003), 3.
6. Some actions such as the tightening of visa requirements for entrance to the United States have had a definite effect on the number of foreign students in U.S. universities. These actions have also made it more difficult for professionals to attend conferences and workshops in the United States, both evidence of a slowing of at least some global communications links. Globalization is also closely tied to overall economic growth trends. The early 2000s were marked by a slowdown in growth that may have temporarily slowed globalization trends. The 9/11 events had a particularly strong influence on U.S. policies. It is unclear how much those policies affected other nations.
7. Rawi Abdelal and Adam Segal, "Has Globalization Passed its Peak?" *Foreign Affairs* 86, no. 1 (January–February 2007), 103–114.
8. Even in the European Union, nations have retained jurisdiction over many areas, including telecommunications policy. It is important to note the failure of a popular vote on establishing a European constitution.
9. That does not guarantee that the prices charged to customers will necessarily be lower than if the industry were competitive (that is, if multiple providers had been offering services to the same customers). Economic theory tells us otherwise. Monopoly means higher prices and less quantity offered on the market. Regulatory licensing, oversight, and enforcement can compensate for this. The trade-off in the case of space is one of avoiding duplication of expensive assets coupled with the space-power inherent with a monopoly that is owned by a company within the United States and under the supervision of U.S. laws. Arguments that the space sector should be "competitive" and respond fully to market prices sound persuasive but fail to recognize the reality that space economic activity is, at best, the province of a handful of companies and is beholden to large purchases from governments—both factors clearly denying space enterprise from fitting any textbook definition of a price-competitive sector. Competition in the space sector has to be viewed as a goal, not a reality.
10. This is because there will be a combination of more satellites serving only one nation or region, and there will also be restrictions on sales of services within particular nations and market areas.
11. The former Soviet Union is the obvious exception to this. Its goals were very similar to those of the United States in the space and technological race of the 1960s through the 1980s, but because of the socialist nature of the government it did not seek commercial involvement during those years.
12. See, for example, article VII of the European Space Agency Charter, SP–1271(E), March 2003.
13. Not having an industry policy is, in itself, an industry policy. And in spite of that overall philosophy, the United States has provided many specific incentives and subsidies to the aerospace industry. For example, the Independent Research and Development funds that are part of many Department of Defense research and development contracts to commercial funds provide incentive for new commercial technological development. The Export-Import Bank provides loans to industry to encourage trade. Import restrictions on some products protect domestic industry. And the largest incentive is the sales to the U.S. Government of equipment and services.
14. National Security Space Project, "Presidential Decisions: NSC Documents," ed. Stephanie Feyock and R. Cargill Hall (Washington, DC: George C. Marshall Institute, 2006). This volume (along

- with its supplement) is a collection of all of the unclassified and declassified Presidential Decisions on space. That document is the source of the information in this section.
15. Telecommunications, meteorology, and remote sensing have all been subjects of separate policy documents over time.
  16. National Security Council (NSC) 5918/1, "Draft Statement of U.S. Policy on Outer Space," December 17, 1959.
  17. Presidential Decision Directive (PDD)/NSC-37, "National Space Policy," May 22, 1978, available at <http://fas.org/spp/military/docops/national/nsc-37.htm>.
  18. The exception was telecommunications satellites, which are discussed in separate policy documents.
  19. With an operational shuttle, the U.S. Government had adapted two related policies: one was to put all commercial U.S. payloads on the shuttle, and the second was to stop performing advanced research and development on expendable launch vehicles. After the *Challenger* accident, it was clear that the United States needed both capable expendable vehicles and the shuttle. The commercial launch sector was at this point mature enough to manufacture and sell launches of expendable vehicles to both the government and private customers. The 1984 Commercial Space Launch Act was significantly amended in 1988 to encourage government purchases of launch vehicles and licensing of U.S. vehicles for commercial satellite launches rather than having the government be the intermediary between the commercial firms and the vehicle manufacturers.
  20. National Security Decision Directive (NSDD)-42, "National Space Policy," July 4, 1982, available at [www.hq.nasa.gov/office/pao/History/nsdd-42.html](http://www.hq.nasa.gov/office/pao/History/nsdd-42.html); NSDD-94, "Commercialization of Expendable Launch Vehicles," May 16, 1982, available at [www.fas.org/irp/offdocs/nsdd/nsdd-094.htm](http://www.fas.org/irp/offdocs/nsdd/nsdd-094.htm); "Fact Sheet: National Space Strategy," August 16, 1984; and NSDD-254, "United States Space Launch Strategy," December 27, 1986, available at [www.fas.org/irp/offdocs/nsdd/nsdd-254.htm](http://www.fas.org/irp/offdocs/nsdd/nsdd-254.htm).
  21. One could argue that any commercial venture in any industry might be subject to a similar constraint. However, given the dual-use nature of all space activities, along with the history of the space industry, this constraint is of a more direct and significant importance for most activities in space.
  22. NSDD-30 (National Security Presidential Directive [NSPD]-1), "National Space Policy," November 2, 1989, NSPD-4, "National Space Launch Strategy," July 10, 1991, available at <http://fas.org/spp/military/docops/national/nspd4.htm>; NSPD-5, "Landsat Remote Sensing Strategy," February 13, 1992, available at [www.au.af.mil/au/awc/awcgate/nspd5.htm](http://www.au.af.mil/au/awc/awcgate/nspd5.htm); NSPD-6, "Space Exploration Initiative," March 13, 1992, available at <http://fas.org/spp/military/docops/national/nspd6.htm>.
  23. PDD/NSC-23, "Statement on Export of Satellite Imagery and Imaging Systems," March 10, 1994.
  24. PDD/National Science and Technology Council (NSTC)-4, "National Space Transportation Policy," August 5, 1994, available at [www.fas.org/spp/military/docops/national/launchst.htm](http://www.fas.org/spp/military/docops/national/launchst.htm).
  25. PDD/NSTC-6, "U.S. Global Positioning System Policy," March 29, 1996, available at [www.fas.org/spp/military/docops/national/gps.htm](http://www.fas.org/spp/military/docops/national/gps.htm).
  26. George W. Bush, "U.S. Commercial Remote Sensing Policy," Section VI, "Foreign Access to U.S. Commercial Remote Sensing Space Capabilities," April 25, 2003, available at <http://ostp.gov/html/Fact%20Sheet%20-%20Commercial%20Remote%20Sensing%20Policy%20-%20April%2025%202003.pdf>; George W. Bush, "A Renewed Spirit of Discovery: The President's Vision for Space Exploration" (Washington, DC: The White House, January 2004), available at [http://ostp.gov/html/renewed\\_spirit.pdf](http://ostp.gov/html/renewed_spirit.pdf); "Fact Sheet: U.S. Space-Based Positioning, Navigation, and Timing Policy," December 15, 2004, Background, §II; "Fact Sheet: U.S. Space Transportation Policy," January 6, 2005, available at [http://ostp.gov/html/Space\\_Transportation\\_Policy05.pdf](http://ostp.gov/html/Space_Transportation_Policy05.pdf), U.S. National Space Policy, August 31, 2006.
  27. This is particularly important for the purchase of communications bandwidth as well as for Earth observation imagery. In addition, there are many scientific and meteorology satellites that provided data that are shared with many nations and are important for U.S. security as well.
  28. Today, remote sensing, navigation, transportation, and NASA's "vision" are all enumerated in separate policy documents. The administration's overall space policy addresses general issues and direction, as well as topics not dealt with in the separate policy documents.

29. The brief summary in this paper is based on information in David J. Whalen, "Communications Satellites: Making the Global Village Possible," available at [www.hq.nasa.gov/office/pao/History/satcomhistory.html](http://www.hq.nasa.gov/office/pao/History/satcomhistory.html), and in Joseph Pelton, "The History of Satellite Communications," in *Exploring the Unknown*, ed. John M. Logsdon (Washington, DC: National Aeronautics and Space Administration, SP-4407, 1998). It is also interesting to note that the most profitable private use of satellites has changed and is now in the broadcast of direct-to-home television. Technology has changed and copper-wire cables have been superseded by fiber optic cables, which now carry the majority of voice communications, although they cannot serve point-to-multipoint transmissions as effectively as satellites. The U.S. Department of Defense, in addition to having its own communications satellites, also purchases a large amount of bandwidth from private satellite providers.
30. Reproduced in Pelton, *Exploring the Unknown*, 91.
31. M. Bigner and J. Vanderkerckhove, "The Ariane Programme," *Philosophical Transactions of the Royal Society of London A* 312, no. 1519; "Technology in the 1990s: The Industrialization of Space" (July 26, 1984), 83-88, available at <http://links.jstor.org/sici?sici=00804614%2819840726%29312%3A1519%3C83%3ATAP%5BD%3E2.0.CO%3B2-A>.
32. See below for a brief discussion of the remote sensing industry and the navigation space sector. In both cases, subsequent to the telecommunications experience, Europe (led by France) developed, launched, and successfully operated a competitive remote sensing system (Spot) and is actively engaged in a competitive navigation system (Galileo).
33. A full analysis of this issue is far too lengthy and complex for this chapter but would be a useful topic for further research.
34. Given the overall maturity of parts of the space industry and the very obvious advantages of having space systems, foreign technological and economic development of competing systems is inevitable and advantageous in many cases. However, the argument given above relates to unilateral U.S. actions that have created unusually strong incentives for foreign development of competing systems and resulted in a competitive disadvantage for U.S. industry.
35. A hint of the effects might be found in the telecommunications sector where COMSAT as the U.S. monopoly representative to Intelsat was supposed to do advanced telecommunications research and development (R&D). After COMSAT was formed, the government did not fund much new basic research in that area. However, COMSAT, as a private company, had other research objectives, mainly developing new products rather than doing more fundamental R&D. NASA, with great political difficulty, finally did establish a new R&D program in telecommunications (the Advanced Communications Technology Satellite program) in the 1980s to attempt to catch up to other nations that had continued government funding in that area.
36. See discussion of the French-German Symphonie satellite above.