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As a public policy analyst, Dr. Pace works for the RAND Corporation's Critical Technologies Institute (CTI) in Washington, D.C. CTI is a federally funded research and development center for the White House Office of Science and Technology Policy (OSTP). His research interests include space policy, technology policy, and international competitiveness and he is responsible for space-related studies by CTI that support OSTP. He recently led a major study on national policy for the Global Positioning System (GPS). In addition, Dr. Pace has conducted research for the Joint Chiefs of Staff on military space issues.

From 1990 to 1993, Dr. Pace served as the Deputy Director and Acting Director of the Office of Space Commerce, in the Office of the Deputy Secretary of the Department of Commerce. He represented the Department in interagency working groups of the National Space Council, administration reviews of space-related legislation, and advisory committees on a wide variety of space issues. Dr. Pace coordinated space policy issues across the Department and participated in efforts affecting export controls for space technologies, space trade negotiations with Japan, Russia, China, and Europe, the licensing process for private remote sensing systems, missile proliferation, and the U.S. space industrial base.

Scott Pace received a Bachelor of Science degree in Physics from Harvey Mudd College in 1980; Masters degrees in Aeronautics & Astronautics and Technology & Policy from the Massachusetts Institute of Technology in 1982; and a doctorate in Policy Analysis from the RAND Graduate School in 1989.

He previously worked at Rockwell International as a project engineer in the Space Transportation Systems Division and at the Jet Propulsion Laboratory on liquid behavior in microgravity. While at JPL, he served as a flight crew member during zero-g operations of KC-135 aircraft.

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## Promoting Commercial Space Activity

Statement of Scott Pace, Ph.D.  
The RAND Corporation

before the Subcommittee on Space and Aeronautics  
U.S. House of Representatives

July 24, 1996

Mr. Chairman and Members of the Committee:

Thank you for the opportunity to appear before you today. This committee has played and continues to play an important role in creating effective incentives for the establishment of robust commercial space industries that benefit all Americans. Before I begin, I should make it clear that the views and conclusions expressed are my own and should not be interpreted as representing those of RAND or any of the agencies or others sponsoring its research.

The commercial space industry is a very diverse one which encompasses activities such as satellite communications, remote sensing, satellite-based navigation, and space transportation. The U.S. Department of Commerce estimates that commercial space activities generated almost \$7.5 billion in revenues last year and is experiencing steady growth. This growth is particularly important in light of the continuing fiscal pressure on government space activities, both military and civilian. Over time, the character of U.S. space activities is changing, and commercial forces are increasingly important. Thus it is appropriate and timely for this committee to look to the future and how it can best promote the commercial activities that will constitute a greater proportion of U.S. space capabilities.

The most rapidly growing areas of commercial space, like so many other areas of the U.S. economy, are those driven by information industries. We are familiar with the exciting potential of mobile satellite systems to provide ubiquitous global services. Global Positioning System (GPS) equipment is appearing in luxury cars and in farm equipment. Commercial remote sensing satellites are now under construction and the first launch, other than Landsat, will occur later this year. The importance of information-driven industries to commercial space is easy to understand since the costs of computing and telecommunications continue to drop and the demand for more and better information of all sorts is growing.

In addition, since information doesn't weigh anything, industries providing communications and data have been willing to bear the high costs of access to space. Costs of several thousands of dollars per pound are clearly prohibitive for other types of economic activities such as space manufacturing, power generation, and even space tourism -- a subject dear

to many space visionaries. These costs are also an increasing burden on the U.S. government, which leads the world in the use of space for civil, scientific, and military purposes. Thus, the recent announcement by Vice President Gore of the selection of a contractor for the X-33 experimental, reusable space launcher is especially important. This experimental effort could lead to a new era of lower cost access to space, creating new opportunities for both the public and private sectors.

### **Global Positioning System Policy**

The signals transmitted by GPS enable precise navigation, position location, and timing applications. GPS was developed by the U.S. Department of Defense to improve long-range navigation for military forces. While public awareness of GPS increased dramatically as a result of the Persian Gulf War, commercial applications of GPS in areas such as land survey and telecommunications network management have been growing in prior years. GPS today is a dual-use technology which is having a profound impact on military, commercial, scientific and civil activities around the world.

Commercial revenues for Global Positioning System equipment currently amount to several billion dollars and industry analysts estimate that this market will grow to \$8.5-11.0 billion over the next four years. Commercial applications in transportation and mobile computing are among the fastest growing areas, and military sales, while growing, are continuing to be a smaller and smaller proportion of the overall market. In recognition of the importance of GPS to U.S. national security, industry, and international users (e.g., in aviation and shipping), the Office of Science and Technology Policy asked RAND in 1994 to conduct a study of the major policy issues raised by growing use of GPS.<sup>1</sup> The major recommendations made in the final RAND report included the following:

- The United States should initiate discussions with Japan and Europe on regional security and economic issues associated with GPS; potentially leading to international agreements. These agreements should be mutually beneficial to all parties but not involve the exchange of funds. The United States should be prepared to commit itself to providing the levels of GPS service defined in the Federal Radionavigation Plan.
- The United States Government should ensure that the GPS is funded and maintained in a stable manner, free of direct user charges, to promote the adoption of GPS as a global standard for position location, navigation, and timing. The GPS space and control segments should remain under U.S. jurisdiction for the foreseeable future.

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<sup>1</sup> *The Global Positioning System: Assessing National Policies*, Scott Pace, et al. The RAND Corporation, Washington, D.C., MR-614-OSTP, December 1995.

- The United States should work to minimize international barriers to commercial GPS-related goods and services such as proprietary standards and inadequate spectrum allocations.

On March 29, 1996, the Vice President announced the results of a broad Administration review of GPS policy in a Presidential Decision Directive. This directive defined overall U.S. policy toward GPS and defined roles for U.S. government agencies, such as the Department of Defense, State, and Transportation. The directive reiterated U.S. commitment to the maintenance of GPS and that civil signals would continue to be available free of direct user charges.

With the creation of a specific national policy for GPS, the next challenge is the shaping of a supportive international framework for the use of GPS. The State Department is currently preparing to lead an interagency team in GPS discussions with Japan, to be followed by later discussions with Europe and Russia. It is my understanding that these discussions will seek to encourage commercial uses of GPS, remove potential trade barriers, and address mutual security issues such as potential misuse or denial of GPS signals. As these discussions move forward, I believe that it is important that the United States speak with a single voice that integrates both security and economic interests in advancing wider international acceptance of GPS.

### **Commercial Remote Sensing System Licenses**

It has been four years since the passage of the 1992 Land Remote Sensing Policy Act (P.L. 102-555) which streamlined the licensing process for commercial remote sensing systems. Changes in technology and markets helped create new opportunities for commercial remote sensing, but the importance of the regulatory changes should not be underestimated. Prior to the 1992, only two commercial licenses had been granted by the Department of Commerce, one of which was Landsat. Since 1992, there have been over a half-dozen, including EarthWatch (formed by the combination of Ball Aerospace and WorldView Imaging), Space Imaging, OrbView, Seastar, AstroVision, and Motorola.

With the experience of the past four years, it is instructive to look at how the licensing process is working. From discussions with industry and my own observations, the license process managed by the National Oceanic and Atmospheric Administration within the Department of Commerce is generally a good one. NOAA has been diligent in working with industry and seeking to resolve licensing questions. Improvements could be made, however, in the process of submitting license applications. In particular, it may be helpful for NOAA to publish a complete list of required information upfront rather than engaging in multiple rounds of questions and answers.

The primary cause of unexpected delays in processing operating licenses seems to stem from interagency reviews of potential foreign policy

concerns. There have been protracted debates over the ability of current U.S. license holders to work with foreign firms without starting the entire license process over from scratch. In contrast, the 1992 Land Remote Sensing Act and the President's March 10, 1994 directive on remote sensing intends that there be a stable, predictable license process, not a new interagency debate with every international business arrangement. Prohibitions on dealings with certain countries, such as Cuba, Libya, Iran, and Iraq are already in place and new, redundant restrictions are not necessary to meet the policy goals set by the Administration and Congress.

The technology of remote sensing is not unique to the United States and the window of opportunity for U.S. industry in remote sensing will not last forever. U.S. firms have stepped up to the challenge of competing as a result of earlier government actions, but continuing attention is needed to ensure the regulatory process does not stall as a result of internal agency delays and debates. Seeking to hold back U.S. firms, or creating special rules and exceptions for how they can operate only creates niches for others and reduces the ability of the United States to exercise influence during true emergencies such as crises and war. Like GPS, remote sensing is a dual-use technology which carries both opportunities and challenges for U.S. interests.

### **Commercial Remote Sensing and Mission to Planet Earth**

The current fiscal environment makes it imperative for NASA to be able to leverage commercial resources as much as possible. This is no more true than in the case of NASA's Mission to Planet Earth. With the emergence of a more capable commercial remote sensing industry as well as advances in aerial photogrammetry, the government should have more options for meeting its needs at less cost. As in many other government activities, public-private partnerships can be mutually beneficial and the Mission to Planet Earth program should be encouraged to integrate commercial activities into the baseline program and not just add a "commercial program" as a veneer after major decisions are made.

NASA should consider how it might acquire space-based and airborne Earth remote sensing data and services from U.S. industry in support of Mission to Planet Earth science objectives. Such acquisitions should be cost-effective compared to the conduct of a government program and meeting scientific requirements should be the primary consideration. In some cases, commercial data will be usable as is. In other cases, science requirements will call for data that has no commercial counterpart. The most difficult questions will be those middle cases involving trade-offs where the most scientifically desirable data are very expensive.

NASA has relatively little experience with purchasing private sector data to meet scientific objectives. It may be reasonably anticipated that numerous procurement and legal issues will arise in the process, such as allocating intellectual property rights for data acquired with public and private



resources. As a beginning step, NASA could provide more information to the private sector on baseline scientific requirements so that industry can propose creative solutions.

### **Excess Intercontinental Ballistic Missiles as Space Launchers**

Some advocates of the use of converted ICBMs for space launch purposes see them as a low-cost alternative to commercial or government space launch systems. While this use can be tempting, it has been the policy position of past and current Administrations that the use of ICBMs for space launch should be subject to some exacting conditions. Commercial launch firms have stated that such vehicles should not be available for commercial use as they constitute unfair government competition with private industry. This is similar to the economic policy rationale for limitations on the use of space launchers from non-market economies (or economies in transition) such as Russia, China, and Ukraine.

Under certain conditions, the government may use converted ICBMs for space launches. First, the use of a converted ICBM must be consistent with the treaty obligations of the United States, especially in international arms control. Second, the converted ICBM must meet the mission requirements of the using agency. Third, the use of a converted ICBM must result in cost savings to the government. There are significant technical differences between an ICBM and a space launcher, although the technology can be indistinguishable. These differences result in conversion costs that can often make ICBM use economically unattractive.

Some educational institutions have asked that they be allowed to use excess ICBMs for student training and research, arguing that they cannot afford a commercial launch. Given the concern of commercial launch providers with unfair government competition, conditions could be imposed to ensure that using a converted ICBM truly enables an educational function and does not compete with industry. For example, a converted ICBM might be allowed for use by an institution of higher education if the payload itself will not compete with commercial firms, the cost of converting and using the missile is less than 50% of the price of a comparable commercial launch, and the educational institution pays for the cost of conversion and launch (rather than being subsidized).

### **Conclusions**

Space commerce consists of several different industry sectors with their own market dynamics. I have not addressed those sectors, such as reentry vehicles, where I have not done research. In areas where I have worked, such as remote sensing, GPS, and space launch, it is my view that:

- The United States can most effectively promote GPS as a global standard in discussions with Japan and Europe if security and economic interests are closely integrated into a single approach.

- The regulatory process for remote sensing licenses can be made more efficient and predictable by clarifying information requirements and streamlining the interagency review process.
- Clear conditions on the use of converted ICBMs for space launchers can prevent competition with commercial launch firms while still enabling appropriate government and educational uses.

Assuming the X-33 program is a success and truly low-cost access to space becomes possible, I hope there will be future hearings to address new challenges such as space manufacturing, tourism, and property rights beyond earth. Until then, there is much that can be done to promote the reality of space commerce today.

Thank you very much and I would be happy to respond to any questions you might have.



