The Commercial Space Act of 1997:
Commercial Remote Sensing

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The purpose of the hearing in which these remarks were delivered was to seek input on the commercial remote sensing provisions of the Commercial Space Act of 1997. The hearing explored: (1) ongoing and anticipated commercial space activities and their benefits to the U.S.; (2) applications of commercial remote sensing imagery that help to improve life on earth; (3) policy issues that surround the creation and future growth of the emerging remote sensing industry; and (4) identifying improvements that can be made in the legal and regulatory environment to support the continued growth of the U.S. commercial remote sensing industry.

Mr. Chairman and distinguished members of the subcommittee, thank you for inviting me to testify before you today. My name is Molly K. Macauley and I am a senior fellow at Resources for the Future, an independent, nonpartisan research and educational organization established in 1952 to conduct independent analyses of issues concerned with natural resources and the environment. I would like to take this opportunity to emphasize that the views I will present today are mine alone. Resources for the Future takes no institutional position on legislative, regulatory, judicial, or other public policy matters.

I am an economist and have been a member of the Resources for the Future staff since 1983. During that time, I have specialized in the analysis of space policy issues with a particular focus on economics, government regulation, and industry organization. For the past nine years I have conducted research pertaining to public policy concerning the remote sensing industry. This research has taken the form of published articles and speeches. In addition, through research grants from the National Aeronautics and Space Administration, I have had the opportunity to work with both customers of remote sensing information and suppliers of remote sensing data.

I am here today to speak on issues bearing on the role of government in the remote sensing industry. In my prepared remarks I wish to focus on three specific questions. First, what might be the role of public policy in fostering a successful remote sensing industry during the next five to ten years? Second, do the legislative and regulatory provisions already in place appear to be working effectively for customers and suppliers of remote sensing data? Third, are there changes or improvements that might be made in these provisions?
THE MARKET AND EXTERNAL FACTORS

Good public policy for remote sensing cannot (and should not seek to) ensure commercial success.

As I'm sure the committee is aware, many observers expect space remote sensing to be the next major commercial success in space, following telecommunications satellites. These observers predict that the market for spatial information will be at least several billion dollars annually. Three aspects of this market determine its profitability. *These factors largely, and appropriately, fall outside the scope of public policy for remote sensing:*

- Continued technological innovation in tools associated with use of remote sensing data. These tools include computing power and software; the Global Positioning System (GPS); the availability of Internet and other means of electronic communication; methods for payment and protection of intellectual property when data are transmitted electronically; and human capital (e.g., ability to interpret and analyze data to render them useful information).

- Demand and willingness to pay for information derived from remote sensing data. Demand emanates largely from the desire for understanding spatial and intertemporal relationships among people, resources, and economic activity. Customers include domestic and foreign, public and private managers of natural resources; environmental regulators and regulators; investors in and managers of infrastructure such as transportation and pipeline corridors; the media; defense departments and mapping agencies; and researchers in natural, atmospheric, and geographic sciences. Willingness to pay is key to the size of demand, however, and depends on many factors. These include the value of the resources or activities about which the data provide information; substitute or "next best" sources of information other than space-derived data; the costs of tools needed to use the data (item above); the sizes of private and public sector budgets for information products; the occurrence of random events such as extreme weather, forest fires, or oil spills; and the scope of domestic and international environmental and natural resource policy.

- The costs of inputs into the supply of space remote sensing data (for example, launch, spacecraft, instrumentation, downlinks, spectrum allocation).

To be sure, a host of public policies influence all of these determinants of the remote sensing industry's future financial prosperity (for example, space launch regulation, policy on GPS, environmental regulation that drives part of the demand for data). In general, however, legislative and regulatory policy specifically targeting remote sensing exerts little direct influence (with exceptions that I will note below). Moreover, even if such policy sought to help the market through, say, specific tax breaks for investing in remote sensing activities, it is far from clear whether such intervention would guarantee or even improve financial prospects. Government fiscal incentives have a mixed if not poor track record in fostering commercialization in many technologies (examples are tax breaks for technologies such as solar power, use of ethanol, windfarms, the supersonic transport).

PASSING A BENEFIT-COST TEST

Poor public policy towards remote sensing can undermine commercial success.

While even the best public policy for remote sensing cannot (and should not) ensure industry profitability, poor policy can unduly burden industry. In the past several
years, studies of the cost to the economy and to various industries of government regulation have figured prominently in the news and in policy debate. The studies show that these costs take many forms—higher prices, job losses, reduced shareholder earnings. By way of example, the Environmental Protection Agency estimates that private firms, individuals, and agencies at the federal, state, and local levels currently spend about $130 billion annually to comply with environmental regulation, or about 2.2% percent of GDP. The estimated amount of annual compliance expenditures for all federal regulation, environmental and otherwise, is around $400 billion. Estimates also suggest that 10% to 65% of the prices of consumer and household products, pharmaceuticals, transportation services, and telecommunications services are attributable to government regulation. For some regulations, studies find that the benefits in terms of safety, health, and environmental protection well justify the costs; in many other cases, however, research suggests that they do not.

To date, and compared with other industries, commercial remote sensing is relatively unfettered by government regulation. A sensible framework for the essentials is in place—spectrum allocation, licensing of new systems, and provisions for "shutter control" (regulation of space remote sensing in the event of threats to national security). Over the past five years, the collective efforts of individuals in government, Congress, and industry have paid off in structuring this framework, and because it covers just the essentials, it appears to be a good basis for cost-effective regulation.

While remote sensing does not appear to be "overly" regulated, many in industry express concern that parts of the policy framework or its implementation are problematic. For example, they note that government may take longer than necessary in responding to companies' requests for licenses or license amendments, and that an effective "appeals process" for discussing amendments is not yet available. There is also concern that implementation of shutter control provisions may be subject to lengthy interagency dispute or other delays, or that new policies may result in further restrictions on remote sensing resulting, as one expert puts it, "in a Swiss cheese approach to imaging the globe." Another concern is that preemption of real-time spacecraft operations in the interest of national security, if not conducted according to consistent rules, can hurt suppliers and customers alike. A related concern is whether policy will be made on the heels of emotionally charged situations (for example, a radical enlargement of the scope of shutter control in the immediate aftermath of a threat to national security).

Studies of the effects of regulatory delay and uncertainty in other industries—the pharmaceutical industry is a good example—indicate that these problems can indeed impose costs that are incommensurate with benefits for both producers and consumers. Accordingly, the Food and Drug Administration has implemented a "fast track" approach for some categories of new drug approvals. Similarly, requiring and enforcing expeditious review and developing a track record of consistent application of policy can minimize the regulatory burden on the new remote sensing companies.

Legislative or regulation beyond these essentials, however, should be subject to benefit-cost tests to make sure that any additional policies achieve a reasonable
relationship between the incremental costs and benefits—a test that many other government activities must now undergo. Benefit-cost analysis usually requires assumptions about qualitative dimensions of policy effects, but this alone should not prevent its use. One of the most helpful aspects of such analyses is that when they are well done, they force analysts and decisionmakers to clarify assumptions and identify costs as well as benefits. Such studies also sometimes reveal the effects of even small changes in policy design.

OPPORTUNITIES FOR IMPROVING POLICY

The relationship between commercial remote sensing and government remote sensing continues to be unsettled.

The supply of remote sensing data, and in many cases, the demand for these data, have traditionally been vested in government. With the advent of privately owned and operated high-resolution spacecraft, reorganizing this government-industry relationship is as challenging as the restructuring of heavily regulated industries into private or decentralized entities, such as rail transportation, civil aviation, or most recently, electric utilities. Some elements of the necessary restructuring in the case of remote sensing are:

- Develop a "one-stop-shop" for routine licensing, but for responding to innovative proposals from industry. Fourteen government agencies regulate the production of bakery products. At my count, seven agencies regulate space-remote sensing. Although primary licensing and coordination responsibility has been assigned to one agency, a roadmap of steps to take for interagency approvals has yet to be charted, especially for new companies or for innovative proposals. One example, which resulted in an all-too-rare yet encouraging new partnership between government and industry, involved a small company in Maryland seeking to market regional wind forecasts. The company, User Systems, succeeded—eventually—in coordinating arrangements for installing its own hardware at a National Oceanic and Atmospheric Administration facility in order to tap into the data stream provided by NASA's scatterometer (NSCAT) flying on Japan's Advanced Earth Observing Satellite (ADEOS). The company's patience and perseverance, as well as various agencies' efforts, did pay off, but only after significant delay and expense. A lesson learned is that consideration be given to establishing a "one-stop-shop" point of contact for new, unprecedented ideas involving industry and the host of government agencies involved in remote sensing, to streamline if not eliminate the cost of delay in obtaining approvals and clearances.

- Provide incentives for government and industry to work together. It is imperative to reduce the gap among scientists, engineers, and business in commercial remote sensing. Each of these communities admits that it doesn't talk with the others very much, for a variety of reasons. The soon-to-be issued Request for Offer to buy data or data products from the private sector for scientists involved in Mission to Planet Earth is an experiment in reducing this gap. Another approach, in the 1992 Land Remote Sensing Commercialization Act, would provide for the issuance of data vouchers to scientists to allow them to purchase directly whatever data best meet their requirements. An even better approach is routinely to include some additional funding for data in research grants, thus allowing researchers themselves to make trade-offs among all inputs in the research project—hardware, software, the salaries of all investigators, travel, data, and so forth.

- Reconsider the applicability of OMB Circular A-130. The practice of providing subsidized data from government remote sensing systems to science researchers has at least three serious flaws. One is that free data naturally discourage researchers from availing themselves of new data from private suppliers. Another problem is that classification of government data as a public good (and
therefore, continuing to freely supply them) is not an absolute; that paradigm depends on market conditions and the state of technology. The new technologies and markets giving rise to commercial remote sensing position the industry as an able supplier of data to government—a reversal of the traditional conviction that as a public good, such data must be supplied by government. For this reason, the prevailing policy requiring that government data be supplied at the cost of reproduction (the 1995 Paperwork Reduction Act and OMB Circular A-130) is an anachronism in the case of remote sensing and fully at odds with development of private industry. (It also is inconsistent with the sentiments expressed in reinventing government initiatives, and in the congressionally proposed "Freedom from Government Competition Act of 1997.") The third problem is that when data are "free" (or supplied at the cost of reproduction), the value of the data is not clear. How much should taxpayers invest in remote sensing data? As an example, one estimate is that 1-meter digital ortho quarter quad aerial photography costs taxpayers $1,100 per scene, yet the government sells it for $18. What has been the economic return to use of the data, and is it commensurate with costs? Ironically, sometimes subsidies lead to poor-quality data. Have the best data been available to researchers, or has the gap between value and cost led to poor-quality data?

- **Develop general guidelines, compatible with commercial business, for the allocation of property rights to data.** In the case of NASA's Small Spacecraft Technology Initiative (SSTI), a group of government and industry representatives painstakingly developed a policy specifically for allocating property rights and access to SSTI data. The policy seeks to maximize the low-cost use of data by scientists, but to limit access to and, in some cases, initial collection per se of some data, to reduce the potential for competing with the supply of data from private remote sensing systems. Similarly, under the proposed purchase of data for Mission to Planet Earth, the allocation of rights between the commercial supplier and NASA for distribution of data to scientists and international collaborators is being determined. Beyond these projects, a host of new opportunities for government and industry collaboration is evolving—for example, flying a commercial instrument on the EO spacecraft and commercial development of a LightSAR in conjunction with government. These and other opportunities all require policy for the specification and allocation of intellectual property rights, data pricing, and data access. As noted above, traditional widespread no- or low-cost data distribution is likely to conflict with industry, since commercial returns will rely heavily on repeat sales. Some general guidelines rather than piecemeal, reactive, and case-by-case decisionmaking would provide a better point of reference for industry as it formulates its business plans for data supply. In addition, these guidelines should be compatible with commercial practices in licensing and copyrights. At present, however, it is not clear where within government the leadership and expertise in developing effective policy on intellectual property resides in the case of commercial remote sensing data.

- **Confine government's role to basic R&D.** In addition to providing data vouchers or augmenting research grants with funding for data purchases, government might:

  *Offer "wind-tunnels."* As commercial remote sensing matures, there is the potential for a heightened role for government in the funding or conduct of research and development in spacecraft and instrumentation and in verifying and calibrating data. A "wind-tunnel" analog in the case of remote sensing is the provision of some government facilities for testing hardware, testing and evaluating data quality, and supporting basic science research of new analytical practices. The case for government's role here is not without limits, however, as industry may well fund some or even much of this research, establishing its own Bell Laboratories for technological research, or setting up a third-party approval facility, like the Underwriters' Laboratory, for testing and sanctioning data quality.
**Auction research spacecraft.** When government spacecraft are launched for research purposes, consideration can be given to auctioning the spacecraft (for example, SSTI, the Earth Observing "EO-" series spacecraft) after the data required for government have been acquired or instruments have been proven. Such steps focus government on research, and restrict government from "routine operations."

**SUMMARY**

The contrast between U.S. commercial remote sensing technology today and the state of the art in technology and institutions at the time of the first remote sensing spacecraft in the 1960s is truly revolutionary. The thirty-year-old paradigm of government ownership of remote sensing spacecraft, supply of remote sensing data, and "free" exchanges of data is no longer appropriate. To the credit of leaders in industry, the Congress, and the executive branch, much of the new policy designed thus far seems carefully crafted. Its implementation and application in the case of future unknowns (for example, shutter control) are less certain. Data purchases or vouchers, coflight of government and private spacecraft and instruments, spacecraft auctions, and new roles for government and industry in basic research—all are opportunities for top managers in industry and government to seize as sponsors of innovation. Most important, for the research community, "having to pay for data" would be far from unfortunate (and, of course, "free" government data really are not, in fact, free). A future market is likely to generate greater variety in types of data, delivery of data, and qualities of data; ultimately, a market may even result in a lower real price of data. The opportunities for industry and government in moving towards such a future should be seen as a portfolio of experiments. In oil exploration, a large number of holes are drilled with the knowledge that many will be dry; but the more holes drilled, the greater the likelihood of major success (and even in the case of dry holes, there are useful lessons). Analogously, spurring innovation in remote sensing policy—the MTPE data purchases are an example—involves seeding many diverse projects with the expectation that although some will fail, others will pay off.