

## Part II: Workshop Summary

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### WORKSHOP SUMMARY

Participant's comments revolved around five major topics affecting data pricing and distribution:

- (1) Federal government needs and low, cost-of-service pricing;
- (2) The relationship between Landsat commercialization and two-tier, or multiple-tier, pricing;
- (3) The chances for developing an internationally competitive U.S.-based industry in space-based earth imaging; and
- (4) Foreign policy, and price and distribution policies to support "open-skies" policy.
- (5) Academic research and instructional needs.

#### 1. Federal Government Needs and Low, Cost-of-Service Pricing

The Federal Government considers the provision of earth imagery an important public service. Since NASA launched the first Landsat satellite in 1972, users have applied its data to a wide variety of problems, including natural and cultural resource management, agriculture, land use planning, mapping, and resource exploitation (table 1). In the 1970s and early 1980s, U.S. users received data either directly from the satellite at no cost or at very low cost from NASA or the USGS EROS Data Center.<sup>46</sup> NASA charged foreign ground stations an access fee of \$200,000 per year to collect data directly from the satellite as it passed over.<sup>47</sup>

In 1982, because of the commercialization process, NOAA began to raise prices of Landsat data in anticipation of a transfer to the private sector. By 1985, it was charging users \$4,400 (in 1985 dollars) per digital Thematic Mapper (TM) scene (up from \$2,000 in 1982); this was NOAA's estimate of the market price of the data. When EOSAT assumed control of data sales in 1985, it initially lowered the price for a TM scene to \$3,300, but over time has raised the price again to \$4,400 (in 1992 dollars) to keep up with its costs of operations.

A wide variety of users have complained since data prices were raised arguing that higher prices inhibit use of the data for research and other activities supporting the public good.<sup>48</sup> The government's case for low prices for data from Landsats 6 and 7 is strengthened by increasing evidence of global change. Scientists will need a large number of Landsat scenes to track the various elements of global change; the existing price structure would make assembling those data sets extremely expensive, over and above paying for the satellite system in orbit. Use of data from both Landsat 6 and 7 would be a key element of any U.S. government plan to assert international leadership on global environmental issues. Currently "we have no institution taking its global change responsibilities seriously" said one participant. However, if the "federal establishment steps up to its responsibilities," Landsat data--distributed to international organizations and Cooperating foreign government--would be a major part of the effort.

DoD shares an interest with NASA and other federal agencies in the lowest-possible data prices. Its experience in using Landsat (and SPOT) data in the Persian Gulf War convinced DoD that Landsat was an important unclassified military resource.<sup>49</sup> As Defense Intelligence Agency official Brian Gordon noted in a 1991 Congressional Hearing:

Certainly DoD would be using Landsat and Spot [imagery]. We recognize that it's very important to get a wide area of coverage over our areas of interest, and we'll use everything we can get our hands on--any and all imagery data--because of the very, very strong technical tradeoffs between resolution and a broad area of Coverage.<sup>50</sup>

Landsat's usefulness for national security purposes seems to argue for distribution of Landsat data to the military at a low price as a public good.

Entities other than federal agencies also argue for low data prices. Since the discovery of the Antarctic ozone hole in 1987, there has been a marked growth in demand for remotely sensed data that bear on aspects of global

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<sup>46</sup> Prior to 1982, when Landsat 4 became operational, the data available were multispectral sensor (MSS) images, which have a resolution of 80 meters.

<sup>47</sup> EOSAT now charges a fee of \$600,000 per terminal.

<sup>48</sup> See U.S. Congress, House of Representatives, *The Landsat Program: Management, Funding, and Policy Decisions*, Hearing before the Committee on Science, Space, and Technology, Nov. 26, 1991, Sect. IV: "Solicited Comments on H.R. 3614; U.S. Congress, Senate, Hearing before the Senate Committee on Commerce, Science, and Transportation May 6, 1992.

<sup>49</sup> DoD spent \$5.6 million on Landsat and SPOT imagery for the Persian Gulf War.

<sup>50</sup> Brian Gordon, statement in "Science, Military, and Commercial Applications of the Landsat Program," a Joint Hearing before the Committee on Science, Space, and Technology, and the Permanent Select Committee on Intelligence of the U.S. House of Representatives, June 26, 1991 (Washington, DC: U.S. Government Printing Office, 1991), p. 28.

change. These include requests from foreign government agencies and public interest nonprofit groups, both of which contend they should have the data at a low, cost-of-service price. Representatives of conservation and international groups at the workshop pointed at that Landsat data are an important tool for managing and monitoring development. They endorsed a single-tier pricing policy in which data are priced at the marginal cost of fulfilling a user request. Alternatively, they favored a two-tier policy in which groups such as theirs can obtain data at the lower (i.e., first-tier) price.

The issue of data pricing is at the intersection of **several competing and unresolved national goals (box B)**. If the Congress were to resolve that a single price, set as low as possible, be charged to all users, it would uphold a longstanding commitment to a principle of broad access to data it acquires at public expense for the public good. Examples include weather, census, and economic data. Proponents of low data prices argue that such prices would assist governments, **private groups, and individuals** in the study of global change.

The Administration's present management plan for Landsat 7, and both House and Senate bills, recognize commercialization of unenhanced data as a policy goal. However, some workshop participants, especially those from private industry, contended that the NASA management plan for Landsat 7 goes beyond the appropriate role of the public sector and is "a gigantic step in the wrong direction in terms of the future of this technology." They argued that leaving the distribution of unenhanced data in government hands would in effect stifle the evolution of a viable commercial industry. Several of them suggested that commercialization could work if the system were designed as a commercial system from the start. Pricing would then be an integral part of the system design. Orbital Sciences Corporation's Seastar satellite, which carries the Seawifs sensor, provides one example of how this could work (box. C).

Other participants disagreed with the entire thrust toward commercialization, contending that a single-tier, low price would most effectively stimulate the value-added industry. One participant noted that the government had successfully developed new products that are finding new markets, citing as an example the U.S. "Census Bureau's TIGER files.

OMB Circular A-130 (appendix B) governs the pricing of publicly owned data, such as that acquired from Landsat 7. The general debate over A-130 has revealed conflicts between users of inexpensive government data and those who would supply competing data products. Thus, the debate over the pricing of Landsat data exists

### **Box B-A Selection of Goals Identified by the Workshop**

- 1 **Maximizing** access to data by *all* users, as a pure public good;
- 1 Ensuring maximum data access by government users;
- 1 Spurring research:
  - 1 Partial or full cost recovery for Landsat system investment;
  - 1 Meeting foreign policy goals, including 'open skies'; "
  - 1 Maintaining data control for national security purposes;
  - 1 Fostering U.S. industrial competitiveness;
  - 1 Fostering development of the value-added industrial and
  - 1 Fostering development of greater private investment in supply of unenhanced data.

SOURCE: Office of Technology Assessment, 1992.

within a larger context, in which government-created data and information can affect the marketplace.

## **2. The Relationship Between Commercialization and Two-Tier, or Multiple-Tier, Pricing**

The United States is in a period of transition, participants agreed between the second phase—attempted commercialization --of the Landsat program and an undefined future. In the first stage of Landsat's history in the 1970s and early 1980s, the system and its data were a U.S. government monopoly. In those early days, NASA viewed development and testing of the sensors and operation of the system more as an exploratory research and development. (R&D) activity than as a routine operational service. Data were used primarily by federal agencies and a small group of researchers. A value-added industry gradually developed to support government applications and to assist extractive industries such as oil, gas, and minerals. Under these circumstances, most policymakers agreed that a federal agency (first NASA and then NOAA) should operate the system archive and distribute data, and encourage research and federal agency use through uniform, cost-of-service pricing.

As use of these data by private industry grew, some analysts suggested that the Landsat system could eventually **become self-supporting by marketing unenhanced data to a wider range of users. As a result, beginning with** passage of the LandSat Commercialization Act of 1984<sup>51</sup> the United States began an experiment designed to encourage the growth of a private earth-sensing industry

<sup>51</sup>The Reagan Administration had initiated the process of transfer by issuing an Executive Order in late 1983.

in the United States that would eventually enable the marketplace to pay for the satellite system, including launch, and the marketing of Landsat data. The implicit goal of commercialization was to create a new industry that would offset the costs of Landsat launch and operation to the Federal Government, and pay for future satellites in the Landsat series.

Some workshop participants commended the progress EOSAT has made towards the goal of commercialization. Several noted that EOSAT had created "a worldwide marketing system" for Landsat imagery, which, although underutilized is a prerequisite for market growth. However, EOSAT had not been aggressive enough in marketing, some said. Opinions differed on whether EOSAT's distribution and pricing policy had hindered EOSAT's growth. One participant pointed out that the prerequisite for market growth is identifying existing products or services that can be improved by using Landsat imagery, which leads to lower data prices and an increase in demand for imagery. An aggressive marketing system would then help in identifying new products.<sup>52</sup>

Most participants agreed that the circumstances of 1992 are very different from those of 1986, when EOSAT assumed control of data distribution. Today a growing value-added industry is developing new products and markets and cheaper, user-friendly technology. In addition, other countries (table 2) are providing remotely sensed data

The idea of moving to a two-tier or multiple-tier pricing structure arose in order to preserve part of the commercialization process begun in 1984 and to avoid outright termination of the existing contract with EOSAT, which would likely be required in order to implement other proposed pricing structures.<sup>53</sup> In theory it could allow a private operator to earn a profit by selling higher-priced data while also supplying data to government users at cost-of-service prices. Alternatively, it would allow a government-operated system to offset some of the costs of building, launching, and operating a satellite system.

Some workshop participants expressed concern about the workability of a two-tier arrangement, others insisted that a multi-tier pricing system would be practical. There appeared to be differences in perspective between those participants for whom charging prices according to market demand is the key to profitability and a viable business, and participants who are managers in the federal sector. One federal manager at the workshop contended that dual-tier pricing would be "an administrative nightmare." In rebuttal, a participant from the private sector

### Box C—The SeaStar Satellite System

*The commercial* market for remotely sensed data has not grown as fast as early predictions once heralded. The data remain too expensive for many of the smaller users such as farmers and the fishing industry. In the future, the Federal Government may purchase quantities of data from private systems, allowing these firms to earn a profit marketing data to other users. The Federal Government and the Orbital Sciences Corporation (OSC) have recently entered into an experimental data purchase agreement that may provide valuable lessons for possible future agreements of a similar character.

The Sea Wide Field of view Sensor (SeaWiFS) is a multi-band (8) imager that operates in the very near infrared portion of the spectrum. SeaWiFS will be used to observe chlorophyll, dissolved organic matter, and pigment concentrations in the ocean. The sensor will contribute to monitoring and understanding the health of the ocean and concentration of life forms in the ocean. Data will have significant commercial potential for fishing, ship routing, and aquaculture, and will be important for understanding the effects of changing ocean content and temperatures on the health of aquatic plants and animals.

Under the arrangement with NASA, the company's SeaStar satellite will collect ocean color data for primary users (including NASA), who then have the option to sell both unenhanced and enhanced data to other users. NASA has agreed to purchase \$43.5 million of data from Orbital Sciences. This arrangement allowed OSC to seek private financing for design and construction of the satellite. OSC has developed a virtually identical sensor for the EOS-Color satellite, one of the Earth Probes included under the vast umbrella of EOS. EOS-Color, to be launched in 1998, will measure oceanic biomass and productivity.

said that offering different prices is "not a problem. It is in the noise" of running a business. He noted that many businesses charge different prices for different types of service. However, *another* participant noted that discriminating according to product or service is very different from discriminating according to type of client, adding, "Only a monopoly can afford to discriminate according

<sup>52</sup> The market for telecommunication services from satellites provides an instructive example of this process. When satellite communication services were introduced in the 1960s, they entered a telecommunications market that was already well-established. Communications by satellite soon became much cheaper than by copper undersea cable. Hence, satellite communications quickly gained market share and forced the cost of international communications services down. See Office of Technology Assessment, op. cit., footnote 22, ch. 6.

<sup>53</sup> Terminating the contract with EOSAT could cost the government millions of dollars and jeopardize data distribution from Landsat 6.

to client type.” H.R. 3614 proposes to distinguish prices on the basis of client type, rather than service delivered

The heart of the issue is whether any entity—a private group like EOSAT or NASA for Landsat 7—can help bring **a new industry (for unenhanced data) into being with a single-tier pricing policy.** Several participants argued that a larger market for Landsat data would materialize only with a two- or multi-tier pricing system and an organization devoted to building a market for Unenhanced data. According to this argument, low, single-tier pricing will inhibit the ability of the system operator (whether the government or the private sector) to offset investment and operating costs. In addition, when data are provided only at prices that reflect only the costs of reproduction and distribution, no feedback is possible between users of the data and suppliers regarding the intrinsic value of the data compared to the system costs. Such feedback is needed to guide future investment, such as choice of spacecraft operating parameters, or the choice of new sensors. In other words, users of data provided on a single-tier, low-cost basis may undervalue the data. In addition, there is the danger of encouraging the development of a larger bureaucracy for data distribution purposes.

In sum, during this period of transition, when a major U.S. market for Landsat imagery is still forming, proponents of two-tier or multi-tier pricing argued that this policy may be the only way providers of unenhanced earth imagery can earn sufficient revenues to grow. In addition, it was argued the perception of an unreliable federal or private monopoly would discourage the growth of the industry. Shifts in federal Landsat policy may have already inhibited the growth of a U.S.-based industry.

Government-gathered meteorological data are in some sense analogous to Landsat data.<sup>54</sup> Weather data are essential to two federal government functions: civil aviation safety and the armed forces. But satellite weather data is now also down-linked at “spigots” around the country, from which commercial users, such as television news stations, can draw. These commercial users then “enhance” the weather data—for example, to display it on news broadcasts. Given the large number of commercial users who can enhance and resell such public goods—i.e., weather or Landsat data—for profit, should not the Federal Government charge a royalty for such commercial use, asked one workshop participant. He suggested that some of the value of unenhanced data could be captured charging royalties and licenses on the use of data. Under this approach, a value-added firm would pay a royalty on its profit when it buys unenhanced data, adds value to them, and resells them.

One participant offered an alternative to a single-tier pricing policy, in the form of a hypothetical private firm that would contract to distribute Landsat data using two-tier pricing. Users entitled to data at the lowest, “Tier One,” prices would be “all Federal Government users, plus “authorized” academic, nonprofit research users.” “Tier Two” users would be “everyone who is not a member of Tier One. The firm would be free to establish internal use and commercial resale fees, in the form of up front payments or those made “downstream” for later or repeated use. This was one of several suggestions for meeting the needs for low-cost pricing for public service uses of Landsat data and giving the managing entity enough freedom with all other prices to develop the industry.

Most participants agreed that the role of the Federal Government during this period of transition is not well defined and that different pricing policies can lead to different outcomes in shaping the future of U.S. remote sensing in the early 21st century.

The workshop discussed another suggestion for resolving the question of data pricing and retaining a private sector supplier of unenhanced data. If EOSAT or any other commercial seller of unenhanced data were free to improve its unenhanced data—i.e., allowed into the “value added” business—the seller would have an additional market **from which to recoup** investment and operating expenses. Several participants countered that although existing law does not prohibit EOSAT from entering the value-added business, such a step would give it an unfair competitive advantage because of EOSAT’s inside knowledge of demand based on requests for raw data<sup>55</sup> (this information is not available to value-added firms). Yet if other firms were also given the right to collect and distribute unenhanced data from the satellite, EOSAT would lose this competitive advantage. To date, EOSAT has chosen not to enter the value-added business.

### 3. Chances for Developing an Internationally Competitive, U.S.-Based Industry

Most workshop Participants agreed that the goal of commercialization is not presently being met through the existing arrangement with EOSAT. While participants noted that the value-added market is moving toward a wider variety of products, and growing fast because of smaller, cheaper, user-friendly technology, they differed over which pricing policy would stimulate the market and improve the chances of fully commercializing the provision of unenhanced data.

As mentioned some participants felt that continuing a single-tier pricing policy at existing prices and service

<sup>54</sup> See Office of Technology Assessment, *op. cit.*, footnote 1, ch. 4, for a discussion of weather data as they relate to data collected by Landsat.

<sup>55</sup> I.e., knowledge of the data purchasing habits and customer base of competing value-added firms, and the ability to delay or deny data delivery.

would fail to encourage commercialization of the sale of unenhanced data. 'There is a bigger market so long as we get better performance' from suppliers, said one participant, apparently referring to more timely service and better quality of data.

However, the private sector representatives at the workshop did not agree regarding two-tier pricing. At least one representative of a private firm argued that the revenues would increase if prices were lowered more, or kept at a relatively low rate. This participant noted that when EOSAT offered special "sales" of data, the firm had gone out and bought more data. For value-added firms, data costs can be a key business expense; being able to buy popular scenes (at lower cost) that can be utilized in many projects gives them a price advantage over value-added firms that cannot afford to maintain a library of scenes. But this has a greater impact on which value-added firms receive a contract and not whether a client will undertake a project in the first place. Ultimately, it is the number of projects purchased that influence data sales.

Private sector representatives differed in their outlook for the future of the industry. Some were gloomy that the Federal Government would not understand how to nurture a viable new segment of the U.S. economy. Participants agreed however, that taken together, the Landsat system, research community, and innovative private firms represent a potentially large national economic resource. One participant offered the following view:

Remote sensing is part of the country's strategy for recovering world economic leadership, to make the country more important and successful. How well industry and government work together will determine whether a major U.S. industry comes into being, and how successful it is internationally while helping U.S. public and foreign-policy goals.

The health of the value-added industry is key both to enhancing a new and potentially large element of the economy and to building up a market for unenhanced data. Spokesmen for the maturing-and growing—industry of firms who "add value" to unenhanced Landsat data from EOSAT argue that the data and techniques to enhance it amount to a "strategic technology" akin to the Nation's former leadership in TVs and VCRs. The vast majority of potential buyers of remotely sensed data cannot use the unenhanced data that EOSAT (and after 1997, NASA) offer. In this they are like the average citizen who cannot use the raw data from a weather satellite, but regularly watches the television weather reports that display and interpret these raw data. Even if a self-sustaining market for unenhanced data were to develop, the value-added industry will still provide the

greatest return to the Nation's tax base, because the value added to the data will generally far exceed the original cost of the data. A strong value-added industry would also indirectly assist governmental uses for the data by continuing its development of innovative ways of manipulating, displaying, and analyzing them and creating low-cost computer hardware and software.

#### 4. Foreign Policy and Data Price and Distribution Policies

For the balance of the century, several participants argued, Landsat could be an increasingly important component of U.S. foreign policy. The United States, as a good global citizen and leader, could exploit its past investment in Landsat by offering imagery to foreign governments and international entities, such as the World Bank, that need information about desertification, water supply, patterns of settlement, wildlife habitat, forest cover, and coastal issues. In the 1970s, through U.S. AID and NASA, the United States mounted a major effort to make Landsat imagery available to developing nations. Those efforts often resulted in a beneficial transfer of know-how and technology to these countries. However, because they were not continued in the 1980s, the growth in use of Landsat imagery has slowed considerably. Many developing countries still lack supportive institutions and appropriate training to make effective use of land remote sensing data. Others are highly capable but often lack funding to support extensive use of Landsat data.

To the extent the United States has an interest in helping other nations learn more about their resources and processes of change, it may have a strong interest in providing data to some foreign governments at cost-of-service prices. On the other hand, two participants proposed that the U.S. foreign aid program be empowered to subsidize friendly countries' purchase of Landsat data at whatever price is charged. U.S. foreign aid could also be directed to help other nations build or maintain downlink stations on their territory and assist indigenous research using the data and value-added enhancement of imagery.<sup>56</sup> A fundamental problem with such "aid" to many developing countries, however, is the difficulty of making such resources available through the foreign aid budget, which has many other demands placed on it.

Foreign countries also use earth imagery to find out information about their neighbors and adversaries. Some participants noted that some governments would be willing to pay extremely high prices for scenes of adjoining areas for purposes of national security. Such uses of Landsat data may not qualify as a "public good" by the standards of the U.S. foreign aid program. This leads to the awkward conclusion that in a free market for earth imaging information, some governments-perhaps

ones at war with their neighbors--would be in the same price category as farmers or state governments, i.e., "commercial" users paying the market or tier two, prices.<sup>57</sup> Foreign companies would be expected to pay market prices; they could be very large customers for Landsat data in the future, as they already account for about 25 percent of EOSAT sales.

The workshop did not resolve how a two-tier pricing arrangement, if it were instituted would apply to foreign users. Participants contended that the application of mm-tier pricing to foreign users warranted careful study. A related issue, barely discussed was the extent to which the U.S. government should open its "black" systems in remote sensing for public access and international use. The Russian release of data from its synthetic aperture radar system Almaz, could be an important precedent--since the system offers an important new source of data about the oceans, ice pack and land surface.<sup>58</sup> Some asked whether--with the Cold War over and the Russians opening up formerly closed systems to public, international use--the United States should make some of its now-classified systems publicly available as well? One participant noted that the U.S. national security community is closely following the fate of EOSAT, the overall commercialization process, and NASA's Landsat 7 and EOS programs, with an eye to what role its own classified systems might play in the public market.<sup>59</sup>

Most legitimate foreign policy uses--such as helping friendly governments or monitoring global change--might deserve a low, cost-of-service price for data. However, the international market for Landsat imagery offers the same problems as the domestic one: the smaller value of unenhanced data versus a potentially large market for value-added information.<sup>60</sup> These problems underscore the vital role of private value-added firms in enhancing data and making it more useful. The workshop did not resolve these issues, except to note that the French, the European, Japanese, Russian, and Indian systems will no doubt be joined by other earth-imaging systems. In short, an international industry will grow, no matter what the United States does with Landsat.

The workshop also explored the U.S. nondiscriminatory data distribution policy, which is codified in the Landsat Act of 1984. When the Landsat Act was under

debate in Congress, several private entities, who wished to launch and operate their own satellites, contended that they should have the right to market data on whatever terms would result in a profitable business. In their view, the right to discriminate among services and, for example, to offer exclusive rights to data to those who would pay substantially more than the standard price for the privilege, was key to establishing a viable commercial business. Others argued on the contrary, that the nature of Landsat as a government-owned system required that data sales adhere to the "open skies" principle originally enunciated by President Eisenhower, and that data should be offered on a nondiscriminatory basis to all potential buyers.<sup>61</sup> These experts reasoned that a **nondiscriminatory policy would allay** fears among the poor nations that the United States or some other rich country would gain important economic information about a poorer country, itself without access to similar data. A nondiscriminatory data policy would also underscore U.S. adherence to the principle of the free flow of public information across national boundaries.

The Administration has proposed changing the law regarding nondiscriminatory data policy in order to encourage private entry.<sup>62</sup> H.R. 3614 as passed by the House of Representatives and S. 2297 also include a provision that would void the nondiscriminatory provision for privately funded satellite systems. However, even if changing this policy enhanced the chances of a private firm launching its own satellite, the firm would still have to compete with Landsat in marketing data. Therefore, the data a private system supplied would have to hold considerable additional or distinct value over Landsat data in order to earn a profit.<sup>63</sup>

Most workshop participants felt that, on the whole, the nondiscriminatory policy has served this country and users of remotely sensed data well, as it has not only made data readily available (for a price) to all U.S. users, but has helped stimulate the overseas market as well. U.S. policy has set the standard for the world community. It was a major factor in the French decision to establish the same policy for data from SPOT. However, with the entry of SPOT and other satellite systems offering remotely sensed data, some workshop participants felt that the supply of data was sufficiently diverse and the market sufficiently competitive that systems financed entirely

<sup>57</sup> On the other hand, the United States government intervenes in export markets for other commodities of strategic value during times of war or vastly heightened tensions. It could do so for remotely sensed data as well.

<sup>58</sup> The European Space Agency's ERS-1 satellite system and Japan's JERS-1 also carry synthetic aperture radar systems.

<sup>59</sup> The intelligence community has a - of this question underway, particularly with respect to the use of previously classified data for global change research.

<sup>60</sup> While it is true, for example, that photographs made from Landsat data are used directly for some applications, electronically processed digital data potentially carry much greater value.

<sup>61</sup> Office of Technology Assessment, op. & footnote 1, for a discussion of the nondiscriminatory policy and its relationship to the open skies policy.

<sup>62</sup> Space Business News, Apr. 13, 1992, p. 5.

<sup>63</sup> KPMG Peat Marwick, op. cit., footnote 34, p. 11.

with private investment capital could soon begin to offer data that discriminated according to price or timing without undercutting the foreign policy benefits of the nondiscriminatory policy for the Landsat system. Most participants agreed that *publicly funded systems* should retain the nondiscriminatory policy consistent with the open skies principle.<sup>64</sup>

## 5. Academic Research and Instructional Needs

Many participants agreed that the U.S. academic research community can contribute to the development of public and private applications of earth sensing technology. Published research broadens remote sensing technology and applications. Students trained in college and university programs form a cadre of experts needed by government, private industry, nongovernmental organizations, and international institutions.

Several participants suggested strongly that academic researchers should be able to purchase Landsat data on the same terms as government users.<sup>65</sup> Even participants who advocated multiple-tier pricing agreed that university researchers were performing a public service and therefore should be charged cheaper prices or proffered subsidies to support purchases at higher prices. Participants from nonprofit conservation groups stated that the costs of earth imagery for evaluating major environmental problems such as African desertification or depletion of Amazonian rain forests were a major part of their annual budgets. They argued in favor of low data prices

During the 1980s when EOSAT came into operation, federal support for applied research in the earth sciences

decreased as did support for new technology exploration and demonstration. The problem the academic community is encountering, according to this argument, is not that EOSAT'S prices are "too" high or unfair, but that support for university research and teaching has declined. Adherents of this view argue that a proper remedy, in this case, may not be to force data prices lower, but for the Federal Government to offset whatever price is charged--and any price increases by appropriate grant and contract research support.

Most academic researchers do not require data immediately after it is acquired so that charging of premiums for rapidly filling orders is not an issue for them.<sup>66</sup> A key issue for academics, however, is the need for government to maintain the quality of archived images,<sup>67</sup> so that historical data they need will remain useful in later years.

While university users were considered as legitimate candidates for low prices, some of the workshop participants did not place state and local governments in this category. They said state and local governments form a major market for specialized value-added services, which can be provided most efficiently by private firms. However, participants recognized that cases might arise in which state or local governments need Landsat or EOS data to serve national purposes. In such cases the Federal Government could award grants or offer other preferential treatment to provide these data at a lower price.

<sup>64</sup> H.R. 3614, while allowing a privately funded system to set its own price with a nondiscriminatory policy, would retain a nondiscriminatory policy with respect to publicly funded systems.

<sup>65</sup> Note that H.R. 3614 would allow such low & pricing for global change researchers and those funded by government grant or contract.

<sup>66</sup> As global change research grows in importance, many more academic users may require timely access to data in order to evaluate the utility of data for studying environmental changes and for coordinating field campaigns for collecting *in situ* data.

<sup>67</sup> Archived photographic and digital Landsat images are maintained at the EROS Data Center in Sioux Falls, which is operated by the U.S. Geological Survey.