Future of the Landsat Program

Remarks by
Chairman George E. Brown, Jr

"Earth Observations & Global Change Decision Making:
A National Partnership"

National Press Club
October 23, 1991

Good afternoon, and thank you for this opportunity to participate in your program. I regret that I have not been able to participate more fully in what I hope have been productive sessions thus far.

The topic of this conference, "Earth Observations & Global Change Decision Making: A National Partnership," was well chosen, for it captures the essence of today's debate over global change. That debate centers on the process by which scientific information about the rate of environmental change on our planet will translate into policy decisions.

I explored this issue to some extent in a speech I delivered Monday during the annual meeting of the Geological Society of America, held in San Diego. In that forum, I explained my general view that the debate over global change has little to do with whether global temperatures will increase two, three, or zero degrees over the next fifty years. Rather, the real debate is whether or not we--as a society--will continue in the same pattern of population growth, resource consumption, and environmental degradation that has characterized human culture from its very beginnings.

It seems patently obvious to me, and I would assume to most of the people in this audience, that the scientific basis already exists--in the absence of any further data gathering--for the implementation of far-reaching changes in the pattern of relations between society and the global environment. Additional data, in the form of earth observations from space and ground-based monitoring devices, will refine our knowledge about global environmental change, but won't fundamentally alter what we already know: human activity has caused dramatic and perhaps irreversible changes in the chemistry of the atmosphere, the condition of whole ecosystems, and the general long-term habitability of our planet.

In this context, I believe that the true value of the Earth Observation System (EOS), and of the U.S. Global Change Research Program in general, lie in their potential to assess the results of ongoing policy "experiments" aimed at ameliorating some of these environmental disruptions, policy "experiments" such as major

changes in U.S. energy policy or in the further use of specific chemical substances. In this sense, EOS can be viewed as being analogous to the instrumentation used for conducting an annual physical of a patient who is trying to quit smoking, quit drinking, and get some exercise. Planet earth is an ailing patient which is in desperate need of a preventative health regime.

My fear is that the Earth Observation System, and the general issue of scientific uncertainty concerning global change, will serve as pretexts for avoiding decisions on global environmental issues. It is in that vein that I hope this conference keeps its focus on the decision-making aspect of its charter.

As for my contribution, I will not be focussing on any of the broad energy, economic, or life-style decisions that need to be addressed in order to confront the problem of global change. I'll leave those subjects for the rest of you to sort out. I trust that by tomorrow afternoon at the end of this conference you will have resolved all such matters. Rather than delving any further into the global change debate, I will instead use my time to address a single earth observation satellite program which has suffered badly in the absence of sound national decision-making. Specifically, I am referring here to the Landsat program.

Depending on one's perspective, Landsat can be viewed as the mother of EOS, a sibling of the EOS family, or simply its bastard child. In terms of national policy, Landsat clearly has been treated as the later of the three.

Although the United States pioneered the technology for land remote-sensing from space, its leadership in this technology has eroded substantially in recent years.

For more than a decade, in fact, Landsat has been surrounded by a cloud of uncertainty that has harmed market growth and stigmatized the program. Part of these uncertainties resulted from the past administration's premature effort to commercialize the program, which simply wasn't ready to be transferred to the private sector "as soon as possible," as was the goal in the early 1980's. Additional uncertainties stemmed from the failure to implement the "Land Remote-Sensing Commercialization Act," which envisioned a gradual commercialization effort involving federal support for at least two spacecraft after Landsat 5. What we experienced instead was an annual struggle to get any Landsat funding out of the previous administration's in order to complete but a single satellite.

Combined, these two factors--premature commercialization and poor implementation of the Landsat Act--have been nearly disastrous for the program.

In fact, the only reason why the nation has retained a

position in civil land remote-sensing at all over the past four years is because Landsats 4 and 5 have outlived their expected design lives by such a considerable margin. Landsat 4 (launched in June 1982) was built with a design life of only three years. The multi-spectral scanner aboard Landsat 5 (launched in early 1984) also had only a three-year design life, while its Thematic Mapper (TM) sensor had a design life of only one year. The nation is thus extremely fortunate that these two spacecraft remain operational today, nine and seven years, respectively, after they were launched.

It is important to note here that had Landsats 4 and 5 ceased operations in accordance with their design lives, the U.S. would have experienced a five-year data gap before the launch of Landsat 6. This would have meant that all remote-sensing users (domestic, commercial, foreign, and military) between 1987 and 1992--and specifically, the U.S. military during Operation Desert Shield--would have relied upon the French SPOT system as their sole source of current multi-spectral remote-sensing imagery. Such a lengthy data gap as this almost surely would have resulted in the complete forfeiture of the U.S. position in remote-sensing to other nations.

As a Member of Congress who has followed this program since its inception, I have seen it in a state of crisis for an awfully long time. That crisis reached a peak, of course, in early 1989, when a minor shortfall in funding for the continued operation of Landsats 4 and 5 almost resulted in the premature termination of those spacecraft, despite their continuing technical success.

As so often is the case, crisis gives rise to opportunities. So it was with Landsat. The newly-formed National Space Council, led by the Vice President, took on Landsat as its first major issue and made a name for itself by helping secure the necessary funding for continued operations of Landsats 4 and 5. The Space Council also recommended that the President approve a policy statement committing the United States to the continuity of Landsat-type data, which he did, as announced by the White House on June 1, 1989.

However, well over two years have passed since that announcement, and no decisions have been made on implementation of a Landsat-type capability beyond Landsat 6. The opportunity to put this program back on a steady track has not been seized.

Throughout the past two years, I have received assurances from the Administration that the decision-making process for Landsat 7 is on a "fast track." In response to letters of concern about the program, I was told in 1989 that Landsat 7 funding would be provided in time to be included in the Fiscal Year 1991 budget. It didn't happen. I was then told in 1990 that a decision would be made in time for the Fiscal Year 1992 budget. It wasn't.

I am now told, and have been repeatedly all year, that a decision will be made in time for the Fiscal Year 1993 budget. And although I want to believe that the Administration will honor its commitment this time around, I have decided not to wait any longer. The U.S. has been squandering its position in remote sensing and is jeopardizing a program of tremendous value for global change research, national security purposes, and a broad array of other applications.

As a means of helping move the nation toward a new consensus on the Landsat program, today I will be introducing a major new piece of legislation titled the "National Land Remote Sensing Policy Act of 1991." This legislation is the result of several months of activity by our committee, with the goal of developing a compromise solution to a policy problem which involves many different competing interests. In the course of this process, our committee has worked closely with many of you in the audience today.

The legislation that we have come up with attempts to tackle all of the major outstanding issues associated with the Landsat program. Specifically, management and funding, spacecraft options, and data policy. Let me quickly walk through each of these three areas as they are covered by the legislation.

First, management and funding. It goes almost without saying that the Landsat program is in desperate need of a new institutional home within the United States Government. The program's current residence, within the National Oceanic and Atmospheric Administration (NOAA) of the Department of Commerce, simply has not worked. Because NOAA's budget has been extremely tight in recent years as a result of cost overruns in the GOES-NEXT and other NOAA satellite programs, it has been very difficult to carve out of NOAA's budget the funds necessary to complete Landsat 6. This problem was particularly acute during those fiscal years when the Reagan Administration requested no additional Landsat funding. More importantly, however, may be the fact that NOAA simply has not been a major user of land remote-sensing data.

In the search to find a new home for Landsat, some have pointed to the Department of Defense (DoD). However, it seems clear that giving the program to DoD would compromise the broad utility of Landsat for the nation as a whole. It should be fully assumed that if DoD is asked to pay for the follow-on land remote-sensing spacecraft, then that spacecraft would be optimized for specialized military missions. This could result in a program that yields data which is no longer compatible with public access.

Operating Landsat out of the Department of Defense also would greatly alter international perceptions of the program, which was specifically initiated as a demonstration of the nation's commitment to the peaceful uses of space. Moreover, DoD control of

Landsat could permanently preclude the eventual commercialization of the system, since it could drive up costs for the system and greatly complicate the effort to service commercial users.

While DoD control of Landsat should be avoided, the nation clearly cannot afford paying for two new broad-area coverage, multispectral imagery systems: one classified, and one unclassified. As such, every effort should be made to consolidate military and civilian requirements, funding, and management responsibilities into a single program. My legislation would accomplish this goal by creating a Joint Program Office (JPO) involving NASA and the Department of Defense, to be housed at NASA and managed by a civilian program manager. The two parties to the JPO would have equal funding and management responsibilities, which would be spelled out in a negotiated Memorandum of Agreement between the two.

Second: spacecraft options. The fundamental considerations here are data continuity, technological enhancements, and cost. All, of course, are tightly linked.

The most important of these three variables is data continuity. Data users of all kinds--current and potential, civilian and military, commercial and foreign--need to know that the system will be there three, five, and ten years from now. In the absence of knowing whether Landsat will be an enduring system, the U.S. remote sensing program may never reach its full potential.

Data continuity has fundamental importance for the U.S. global change program, for national security purposes, and for the broad range of operational users who need this data to carry out their missions. For global change, the existing 19-year continuous Landsat archive represents a baseline data set of fundamental importance. The National Academy of Sciences, the Committee on Earth and Environmental Sciences, and global change scientists throughout the country have expressed concerns about the potential of a data gap--if not an outright termination--in the Landsat program.

Similarly, military users are alarmed about the prospects of a data gap. During a hearing before my committee earlier this year, we were told that "DoD users of multispectral data are highly concerned over the prospect of a data gap." Specifically, we were told that "if a data gap continued beyond 12 months, DoD users would experience significantly downgraded multispectral imagery to support" a variety of military missions.

With data continuity thus firmly established as the primary goal, the question, then, is how to accomplish it. Specifically, what should Landsat 7 look like? On this topic, there is no shortage of proposals on how to build a more advanced spacecraft than the current Landsat design, but there is a shortage of money.

Many of these proposals would double, if not triple, the cost of the follow-on system. There is also a shortage of time.

Landsat 6, scheduled for a mid-1992 launch, has a five-year design life. Under normal contracting procedures, Landsat 7 could take anywhere from five and one half years to as long as eight years to procure. As a result, late 1997 might be the earliest that Landsat 7 could be made available for launch. While one might hope that Landsat 6 has a longer operational life than five years, that should not be the basis for our program plans since the spacecraft also could experience technical problems or a catastrophic launch failure. This could result in a data gap of five years or longer.

Over the past several years, many proposals have been made on paper to implement a generational change in spacecraft and sensor design for the nation's land remote-sensing system. Specifically, DARPA and the Department of Energy have proposed so-called "smallsats" as a means of demonstrating technological advances that could revolutionize the nation's land remote-sensing program. Such proposals appear to hold promise, yet have not been proven and thus would represent a substantial risk if pursued as the sole means of providing data continuity. The nation's experience with the GOES-NEXT fiasco demonstrated that some risks are not worth taking--especially within an operational program. This said, however, I do believe that a technology demonstration of advanced remote sensing technologies should be aggressively pursued as a means of helping define the follow-on to Landsat 7.

Taken together, the fragile nature of our existing remote sensing system, the length of time it will take to procure a follow-on to Landsat 6, the importance of precluding a data gap, and the value of pursuing advanced remote sensing technologies have led us to propose a two-part implementation plan.

First, the United States Government should exercise all available options to expedite the procurement of Landsat 7. Specifically, our legislation directs the Administrator of NASA to begin immediate negotiations for the procurement of Landsat 7 with EOSAT--the commercial entity awarded a contract for Landsat 6. The bill sets out a special 120-day expedited procurement process to reduce the risk of a data gap. It directs that Landsat 7 should be essentially a clone of Landsat 6. However, it encourages the Administrator to consider adding an advanced sensor (such as a 5-meter stereo sensor) if the additional development would not significantly jeopardize data continuity. If no final agreements are entered into during this special 120-day procurement process, then the procurement would be opened for competitive bidding.

Second, the bill establishes a new five-year technology demonstration program to promote the development and demonstration of advanced land remote-sensing components, sensors, and system

designs. The bill directs the President to designate which agency would be responsible for carrying out this program. The Landsat Joint Program Office would have a coordinating role in this technology demonstration, yet would not necessarily have any direct funding responsibility. The goal of the technology demonstration is to achieve a launch within five years of a system which would help the nation determine whether Landsat 7 should be funded and managed by the United States Government, by the private sector, or by an international consortium.

If a technology demonstration program such as this is not pursued, then the U.S. may find itself in the late-1990's in precisely the same position in which it finds itself today--in need of a follow-on spacecraft to provide data continuity, yet uncertain about the risks of implementing a major technological change in the program.

Finally, let me address the issue of data policy. In many ways, this issue is the most important.

As background, let me review the current situation. Under the "Land Remote-Sensing Commercialization Act of 1984," a single private sector entity, EOSAT, was awarded exclusive marketing rights for the sale of Landsat data. The theory behind that legislation was that the revenues generated from Landsat would grow at a sufficient pace that they would result in a self-sustaining commercial enterprise which no longer needed federal support. In practice, however, it hasn't happened. Whether it was the policy experiment's design or its execution, or a combination of the two, that failed isn't all that important in this context. What is important is the fact that full commercialization of the Landsat program, which would entail complete private funding of the space segment, cannot be achieved within the foreseeable future, and thus should not serve as the near-term goal of national policy on land remote sensing.

Market studies conducted in 1988 for the Department of Commerce concluded that even under the most optimistic market growth scenarios, the space segment of a U.S. land remote-sensing system could not be commercialized during the present century. This view is now broadly shared within the remote-sensing industry. Although certain segments of the remote-sensing market are experiencing considerable growth, total revenues remain dwarfed by the cost of procuring, launching, and operating the spacecraft. As such, it is simply unrealistic for the government to assume that the revenue from data sales will enable the private sector to takeover the full funding responsibilities of this program anytime soon.

The objective of the commercialization effort was to capture within the price of Landsat data some of the expenses associated with the program. Up until now, the only expenses that have been

covered have been those associated with EOSAT's marketing and profit-taking needs. With the launch of Landsat 6 next summer, however, EOSAT will also be responsible for paying the cost of satellite operations. This is an important step, yet remains a long distance from the goal of having the revenue stream from Landsat data sales cover all expenses associated with the program.

From another perspective, however, the cost-recovery goal reflected in current data prices has had costs of its own. Specifically, it has impeded the use of Landsat data by scientists and other public sector users.

Over the past 15 years, the number of Landsat scenes purchased annually by the academic research community dropped has precipitously, from a high of 34,000 in 1976 to a low of 450 in 1990. This phenomenon was partly due to declining federal support for remote-sensing applications programs that utilized a large volume of Landsat data. Primarily, however, it has been the result of price increases that began in the late 1970's and continued with commercialization.

At the current rate of $4,000 for a single Thematic Mapper scene, Landsat data are beyond the reach of all but the most well-funded remote-sensing researchers. For global change research, which often involves change detection studies over very large areas of land, the use of Landsat data at current market rates is cost-prohibitive. As a result, researchers are relying upon less expensive and less appropriate data, such as gathered by the AVHRR instrument aboard a NOAA weather satellite. Although one cannot quantify the loss to society stemming from this situation, it is clear that a considerable amount of potentially valuable research involving patterns of change on the planet is not being done because the data is too expensive under the current pricing structure.

This is a particular concern given the enormous importance of Landsat to global change research. A 1990 study by the Committee on Earth and Environmental Sciences concluded that Landsat data are "mission essential" to five of the seven science priorities of the U.S. Global Change Research Program. As Bob Correll, who headed the CEES report on Landsat, told the Science, Space, and Technology Committee earlier this year:

> No EOS sensors will return data similar in characteristics to Landsat, i.e. high spatial resolution, broad spectral bands, and wide area coverage. The existing Landsat data provide a unique baseline of data to document land conditions and changes over the last 20 years. These data will not be available from any other source. In addition, Landsat data will be needed to develop, test, and validate EOS data processing algorithms prior to and after the launch of EOS. Thus, the Global Change Research Program will rely on data

from both Landsat and EOS.

With such considerations in mind, some have argued that global change researchers should receive Landsat data at the marginal cost of reproduction and transmission, which would be consistent with EOS data policy. This, however, raises a fundamental question about the value of Landsat data to the U.S. taxpayers as a whole. Specifically, why should a global change researcher be any more deserving of privileged access to Landsat data than a Department of Defense analyst generating improved military maps, a Department of Interior official seeking to improve the management of federal lands, or an Environmental Protection Agency scientist assessing coastal wetlands?

Although I do beliee that global change researchers are doing God's work, so, too, are these other public sector data users. As such, our legislation directs that data generated from civil remote-sensing satellites funded by the United States Government should be made available to all non-profit users--defined as Federal, State, and local government agencies, domestic universities, and to other domestic nonprofit institutions--at the marginal cost of acquisition, reproduction and transmission.

It is our general view that if the United States Government has determined that it is in the public interest to fund and launch a remote-sensing satellite system, then the goal of U.S. policy for those systems should be to maximize the public's return on that investment. This means that for nonprofit applications, data should be provided at the lowest possible cost. Any other policy amounts to rationing the data, with the greatest impact falling upon those users who do not make a profit from the data.

To implement this new policy, the legislation directs the Administrator of NASA to enter into negotiations with EOSAT for modified terms and conditions for the pricing, acquisition, and access of data from Landsats 1 through 6. Specifically, the legislation directs NASA to seek agreement with EOSAT that Landsat data shall be provided at the marginal cost of acquisition, reproduction, and transmission for nonprofit users, on the condition that such data not be used for commercial purposes.

NASA is also instructed to seek agreement with EOSAT that data will be acquired to meet the needs of the U.S. Global Change Research Program. The problem here is that EOSAT currently collects images only in response to specific customer orders. As a result, the annual acquisition of data from the system has been declining by twenty percent or more per year over the past three years. Because of this situation, and since global change researchers are not currently placing orders, data of high-priority global ecosystems may not be in the archives five or ten years from now when needed.

Thirdly, NASA is instructed to seek agreement with EOSAT that it will make every effort to assist in getting data for U.S. nonprofit entities from foreign ground stations at the marginal cost of reproduction and transmission. A great deal of Landsat data of importance to global change researchers is contained within the two million scenes held by foreign ground stations. EOSAT is the contracting party with those ground stations, and thus can assist in getting better terms for access to that data.

Finally, NASA is instructed to seek agreement with EOSAT that copyright restrictions be waived for nonprofit applications. In so doing, this would enable DoD, NASA, Interior, and other federal agencies and domestic nonprofit users to share data without having to place multiple orders for specific scenes of interest. It makes no sense for users in the Army, Air Force, and intelligence agencies, for example, to have to purchase a scene multiple times.

The legislation specifies that this set of negotiations on data policy may be combined with the negotiations between NASA and EOSAT on the procurement of Landsat 7. Also, as with those negotiations, a 120-day period is established for the discussions. If no agreement is reached in this time frame, then NASA is directed to report back to Congress on options for achieving these policy goals.

Finally, in terms of the rights for Landsat 7 data, negotiation of these rights may be put on the table during the negotiations with EOSAT for the procurement of Landsat 7. However, if no agreement is reached on Landsat 7 data within these negotiations, then the Joint Program Office is directed to conduct a long-term study of options for creating a competitive system for the commercial marketing and distribution of this data.

The one aspect about data policy that we are sure about is that the government should be excluded of a role in the commercial marketing of such data. The government once had this role, and demonstrated its ineptness at it. Beyond that, however, there are many possible approaches to ensuring that the private sector perform the duty of aggressive market development and responsive data distribution. It may take several years of additional experience after the launch of Landsat 6 to know whether the existing formula, or some entirely different approach, is the best mechanism. For this reason, the report on options for Landsat 7 data distribution would not be due until 1995, which would still be at least a year before the anticipated launch of Landsat 7.

The legislation also requires provides for an enforcement procedure to ensure that data received by nonprofit entities is not used for commercial purposes. This enforcement role is assigned to the Department of Commerce.

The legislation, as drafted, takes the form of amendments to

the "Land Remote-Sensing Commercialization Act of 1984." As such, it preserves many of the provisions contained in that statute. The provisions on archiving of data and of the licensing of private sector remote sensing systems have been left intact. The non-discriminatory access provision also is retained, except for the single major major exception that domestic nonprofit users shall receive data from government-operated land remote-sensing systems at the marginal cost of acquisition, reproduction, and transmission. In other cases, data is to be provided on nondiscriminatory terms. I believe that this policy has served the nation well in the past, and will continue to provide leverage against foreign systems that may be operated solely for internal economic intelligence-gathering.

I am introducing this legislation today as a means of moving the process along toward a national decision on the future of the Landsat program. Within three weeks, I intend to hold a hearing at which Administration witnesses will be asked to provide their plan for meeting its commitment to data continuity after Landsat 6. We will also be soliciting the views of individuals such as yourselves. Clearly, our effort is aimed at reaching a national consensus and partnership, as suggested by the title of this conference. The Landsat issue, like the overall issue of global change, is complex and involves many competing interests and perspectives. Nonetheless, these competing views cannot be the basis for inaction. Decisions must be made, and the time to decide the future of Landsat is now.

Thank-you.