

**The Landsat Program:
Management, Funding and Policy Decisions**

Testimony presented to:

U. S. House of Representatives
Committee on Science, Space and Technology
George E. Brown, Jr., Chairman

By: Lawrie E. Jordan, III
ERDAS, Inc.

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*31 - capture Landsat
data - house will look
at it*

*Set aside of funds to
Landsat? should be included
in '96 (not '93)*

*What data on a time by basis
OK for field reports + universities
to get data at cost
However others should
pay full price*

*State pricing cost
Fed cost - \$100 to 100 per
scene
- when \$4000 per scene*

Introduction

Thank you, Mr. Chairman, for the opportunity to attend this hearing and to present our views on the new proposed legislation for the "National Land Remote-Sensing Policy Act," H.R.3614, and the importance of Landsat's future in general. In order to respect the Committee's schedule this morning and in consideration of the research staff's workload, I would like to limit my remarks to a non-technical nature and focus on the key business and management issues that need to be addressed in connection with H.R.3614. In supporting this important piece of legislation, I believe our firm brings to this forum the unique perspective of a very successful high technology small business which was a spin-off of the original Landsat program over 13 years ago. The founders of ERDAS have been involved with Landsat since 1972, and we have had the opportunity to present testimony to Congress in support of the Landsat program's evolution on numerous occasions since 1977.

The three primary issues of H.R.3614, data continuity, technical enhancements, and cost, have deep historical roots and are as important to us today as they were in our 1977 testimony. I would like to preface our remarks this morning by providing a brief historical backdrop of our involvement in building the commercial market for Landsat data and related technology. Hopefully, this will provide some insight to the Committee as part of the validation process for going forward with a new Landsat policy at the national level.

Background

ERDAS, Inc. is an Atlanta, Georgia-based high technology small business founded in 1978. We were originally a spin-off of the successful NASA Landsat Technology Transfer Program with the State of Georgia in the mid-70's, which combined prototype Geographic Information System (GIS) research and concepts developed at Harvard University. ERDAS pioneered the world's first commercial, low cost Landsat and GIS processing system on a micro-computer in 1978 for about \$50K, at a time when the industry

standard was a million-dollar mainframe system.

The ERDAS system's capabilities and low cost revolutionized access to Landsat data by groups such as universities and other non-profit institutions that were previously excluded due to the high cost of computer hardware and software. The ease of use, combined with the attractive price and continued enhancements over the last decade, have resulted in ERDAS becoming the world's leading supplier of turn-key Landsat processing systems, with thousands of systems installed today in over 70 countries around the globe. These systems have been used successfully in both research and operational projects that have leveraged the sale of thousands of Landsat scenes over the years. In addition, ERDAS technology has been extensively used in hundreds of studies of the environment, most recently including deforestation of tropical rain forests, the spotted owl/old growth timber controversy, a Lake Michigan ozone study, and numerous wetland mapping projects. The latest independent national surveys published by Dataquest and Daratech indicate that ERDAS is now the market leader in this technology within educational institutions.

With recent DoD budget cutbacks placing a new emphasis on using commercial off the shelf (COTS) technology, ERDAS has emerged as the de-facto standard system within DoD for Landsat Multispectral Imagery (MSI) processing with several hundred systems deployed throughout the U.S. military and Intelligence Community. We are very proud to have had the opportunity to successfully support U.S. armed forces with our technology during Operation Desert Shield and Operation Desert Storm. Dedicated military and civilian men and women used Landsat data with our systems in-theatre to produce some unique products under very adverse conditions. The special advantages of Landsat MSI imagery compared to other sensors were clearly demonstrated in several applications during the conflict. The leadership and creativity shown by the DoD in using MSI during Desert Storm has created a renewed interest in Landsat in other military applications such as Mission Planning and Special Operations/low intensity conflict.

Although environmental research and defense applications of Landsat are good current markets and will continue to get stronger, by far the largest application and market for Landsat is its use as the foundation layer for global, national, and local GIS systems. GIS systems need accurate maps, and we believe that the "map of the future" will actually be an intelligent image derived from satellite data, particularly Landsat multispectral imagery. Once again, ERDAS has played a pioneering role by creating a unique product called the ERDAS/ARC-INFO "Live-Link". The "Live-Link" is the first product to merge Landsat or other imagery with the popular ARC-INFO vector-based GIS system for rapid updating of maps and change detection using imagery. This technique uses imagery as a backdrop to provide new meaning to the existing line maps, allowing users to visualize information much more clearly.

The GIS industry, according to the experts, is growing at a rate of 20-30% per year, and it is expected to exceed \$2 billion by 1993. Image processing is now widely recognized as being an integral part of the GIS market, rather than a separate business. ERDAS has focused its technology development and marketing efforts toward integrating Landsat data into a GIS since 1978. The success of this strategy can be seen in part by the growth of our company - an average annual growth of 36% for the last 6 years, with an 80% increase last year.

The explosive growth in GIS presents the single largest market opportunity in the future for Landsat applications. GIS will be to the 1990's what office automation and electronics were to the 1980's. It is our view that GIS will be the enabling technology or "centerpiece" that allows the maximum benefits from Landsat, EOS, and other technologies to be applied towards solving global as well as local problems. The need for an operational Landsat system that is well managed and delivers reliable, affordable data is greater now than it has ever been in the history of the program. A \$2 billion market should be reason enough for the U.S. to retain its leadership in this arena and not hand it over to foreign competition. However, of greater importance than any economic market, regardless of size, is the protection of our global environment - it is priceless.

It is with this experience and perspective accumulated over more than a decade and through involvement with the Landsat program at many levels, that we offer the following views on H.R.3614, the "National Land Remote-Sensing Policy Act." For simplicity and ease of reference, our responses are enumerated

Response to Key Issues:

1. Data Continuity and Technical Enhancements

Data continuity is essential for studying global change, especially those phenomena that occur over 10-20 year time frames. To ERDAS, continuity means that Landsat data must not only continue to flow, but also that the new data is consistent with earlier data in the spectral domain, even though spatial resolution is scheduled for improvement. It is my understanding based on discussions recently with senior EOSAT management, that Landsat 6's enhanced thematic mapper formats allow either of the spacecraft's multiplexers to be commanded to operate in any of the three Landsat 6 modes:

- (1.) Bands 1-7, just like Landsat 4-5
- (2.) Bands 4, 5, and 6, with a 15 meter pan band
- (3.) Bands 4, 5, and 7, with a 15 meter pan band

Therefore, customers can order 7 TM bands, pan only, pan with 4, 5 and 6, pan with 4, 5 and 7, or a "maxi-scene" which is pan with all 7 bands.

This seems to us to be a flexible and well designed approach which should be carried forward to Landsat 7 for continuity of spectral data. Then there would be a baseline of 15 years of consistent TM data when Landsat 7 is launched, and access to the full range of data will become critical.

We agree with the position that the addition of a 5 meter Panchromatic band and stereo coverage is very attractive and desirable, provided it does not jeopardize the current schedule or budget. Stereo is attractive because it allows topographic data to be generated, and this is currently a major GIS component which is missing in many parts of the world. Five

meter resolution is important for Landsat to be globally competitive with other systems. With regard to the thermal data, Band 6, it has been our experience that most users do not use this due to its poor spatial resolution of approximately 60 meters. I found it interesting to read published articles recently about certain events which would have seemed natural opportunities to use Band 6, including the mapping of oil fires in Kuwait. However, the prevailing judgement was that the Landsat's infrared bands provided better information. Therefore, for better delineation of pollution sources and other toxic wastes an improved thermal band should be considered.

The final point on this issue is a continuing concern about the 1998 launch of Landsat 7. This is two years too late in our view and should be accelerated to 1996 if possible. Even if we are fortunate enough for Landsat 6 to stay healthy, the increased demand from the GIS industry in mid-decade may overburden Landsat 6. My understanding is that Landsat 6 has approximately 53 minutes of real-time acquisition and approximately 75 minutes of recorded data acquisition, resulting in a theoretical maximum (at 2 scenes per minute) of 106 real-time scenes and 150 play-back scenes, or a maximum total of 256 scenes per day. Landsat 7 is needed earlier to lighten the load on Landsat 6 and to insure that a data gap does not happen.

2. Program Management and Control - J.P.O.

We believe that NASA and DoD could be very effective together as a team in operating the program through a joint program office (J.P.O.), especially if some internal "ground rules" are laid down early in the process. In general, a civilian program seems appropriate and it should be one that conforms to The United States' tradition of an "open skies" policy whenever possible. However, we strongly believe that the national security of the United States should always be an overriding priority, and the DoD should have operational control during a crisis or other urgent contingencies. We have seen that other countries which lack the capable assets and technical means of the U.S. have attempted to use systems such as the SPOT satellite for intelligence gathering. An enhanced

Landsat system that is funded by the people of the United States should be adequately safeguarded during times of crisis to protect our national interests.

3. Timeliness of Delivery and Other Improvements

Turn-around time for Landsat data has been an issue that goes back many years. ERDAS is pleased to see the current efforts underway at EOSAT to improve the delivery and quality of the product as part of the Landsat 6 ground segment, including:

- Introduction of 8mm tape in fast format
- Movable areas of coverage
- Subsampled TM to replace MSS
- Co-registered Pan data
- Reduced time for new scene order cut-off
- Order confirmation cycle reduced
- Increased quality monitoring using automation
- Improved cloud cover assessment
- Bar code system for error-reduction

These and other initiatives should be continued by the J.P.O. Experiments should be considered in the future using transportable ground stations for real-time reception.

4. Data Pricing Policy

Although "commercialization" policies have not worked with Landsat, there is nonetheless a significant commercial market for civilian remote sensing data such as Landsat and SPOT. We are pleased to see that the SPOT program is targeting commercial GIS applications with good success. The Landsat program should do the same. Also, the number of published studies that conclusively prove Landsat's cost effectiveness for resource inventory and mapping compared to any other source for equivalent coverage (10,000 square miles, every 1/5 acre) is too lengthy to reference. Although ERDAS continues to believe that Landsat data is one of the "greatest bargains" available anywhere when compared to the

true costs of other alternatives, we must acknowledge that the current pricing of the data has severely impacted universities and other research institutions who want to use the data for important research but cannot afford to purchase it. The policy contained within H.R.3614 attempts to provide relief in this area by offering "non-profit" institutions the data at some marginal level of cost. In general, we feel this is a good idea, and universities should be at the top of the list. Federal agencies should also be included. However, given the rapid increase in use of satellite data at the state and local levels in the past two years and the continuing trend of the nation's renewed commitment to urban and regional planning and natural resource monitoring, we don't think that we should "give away the farm." State and local governments are seen as a viable market to GIS software and hardware vendors, and they should be part of the balance in maintaining program viability. Giving away the data "for free" to a major market such as this could jeopardize future Landsat funding, and undermine the good efforts already undertaken by SPOT and others to build the commercial market. Also, there is a significant market in the commercial sector, such as timber companies, utilities, exploration firms, etc. that would respond positively to affordably priced data. In this regard, several points should be clarified as the proposed legislation goes forward, such as:

- Who is eligible under "non-profit"?
- Pricing for copies
- Are price increases capped?

The bill should go into more detail in these areas. We believe that a simple pricing structure is essential. Given the investments that the Federal Government will need to make in the Landsat program to insure continued operations as well as enhancements, it would seem equitable and straightforward to adopt a 2-tiered policy as follows:

1. Federal Agencies and Universities = No cost, except for shipping and handling (say \$50.00 per tape)
2. All Others = \$500-\$800 per scene, fixed price with other derivative products (ie: 1/4 scenes) priced proportionately. This would greatly increase sales and revenues as well as increase use of the data for

global studies. In order to maintain market viability and program integrity, it is absolutely mandatory that strict enforcement policies and penalties be applied towards any "non-profit" organization that uses the data for commercial purposes.

5. Leveraging Assets

Perhaps the greatest supporting mechanism behind the Landsat program is the value-added industry, including companies such as ours. As discussed earlier in the background section of this technology, we, along with many others, have served as an extended marketing infrastructure for the Landsat program world-wide since its beginning. The millions of dollars we invest and the jobs we create represent a commitment that does not involve taxpayer's money. The successful applications we have conducted with Landsat are helping to improve the earth's environment and to increase security in many parts of the world. The new J.P.O. management of the Landsat program should realize that there is an "extended family" in the value-added industry which represents the best opportunity for expanding Landsat into GIS and other future markets at a global scale. ERDAS believes that a very effective campaign for Landsat can be developed through J.P.O.'s coordination with industry. J.P.O. policy should be to support the value added industry, not become a part of it or compete with it. This is essential for Landsat survival.

These remarks conclude our testimony at this time, and I would once again like to express my sincere appreciation for the opportunity to represent ERDAS before this committee.