Thomas M. Lillesand
Environmental Remote Sensing Center
Institute for Environmental Studies
University of Wisconsin-Madison
Madison, WI 53706

Issues Surrounding the Commercialization of Civil Land Remote Sensing from Space

The Land Remote Sensing Satellite Advisory Committee has formulated recommendations on the feasibility and appropriate form for prospective commercialization.

Abstract: *In November 1979, President Jimmy Carter issued Presidential Directive 54, which formalized a scheme for transferring the operational activities of the Landsat program from NASA to NOAA, which in turn would develop a mechanism for eventual transfer of the operational responsibility for civil land remote sensing from space to the private sector. Attendant to this entire process was a federal commitment to the continuity of land remote sensing data through the 1980s. Shortly after entering office, President Reagan announced termination of this commitment, and Landsat D" and D"' were deleted from the federal budget. Almost simultaneously, Comsat Corporation proposed that the Administration adopt a policy that would assign to Comsat the ownership and operation of both the Government's civil land and meteorological satellite systems. During the same period, other commercialization concepts were proposed.*

To provide advice on the management of the civil satellite program from a non-federal perspective, the Land Remote Sensing Satellite Advisory Committee was established by Secretary of Commerce Malcolm Baldrige. In parallel with federal interagency program review, this committee solicited expressions of private sector interest in assuming operation of all or part of the civil land and meteorological satellite programs. On the basis of the expressed interest and perceived capability of private industry to pursue these programs at a level commensurate with public as well as private interest, the committee formulated recommendations to Secretary Baldrige on the feasibility and appropriate form for prospective commercialization. This paper outlines these recommendations and summarizes the basic issues surrounding the commercialization of civil space remote sensing systems.

Background

The issue of potential commercialization of all or parts of the U.S. civil remote sensing systems has spanned two Presidents' Administrations. It is a complex issue and one that has taken on new scope and urgency. This urgency stems not only from the fact that there is currently no federal commitment to continue the land remote sensing program beyond Landsat D′, but also from the fact that the commercialization options currently under consideration could change the entire *modus operandi* by which the United States collects and distributes both land and weather satellite data.

Examination of the issue was initiated under the Carter Administration. The concept of com-

* Also with the Departments of Forestry and Civil and Environmental Engineering at University of Wisconsin-Madison.

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mercialization was then limited to the land satellite system (Landsat); a staged NASA-to-NOAA-to-industry plan was envisioned; and, a commitment to data continuity through the 1980's was made through provision of funds to support Landsat D'' and D'''. These funds were eliminated from the federal budget shortly after President Reagan took office.

It is the current Administration's judgment that the investment in Landsat to date has been sufficient to permit evaluation of operational uses of the data and, if these uses are cost effective, to attract a private sector owner/operator.

Very shortly after the Office of Management and Budget (OMB) recommended termination of the land satellite program beyond Landsat D (mid 1980's), Comsat Corporation proposed assuming ownership and management of both the land and meteorological satellite systems—with certain Government guarantees to purchase data. In response to this inquiry, OMB asked the Cabinet Council on Commerce and Trade (CCCT), a senior Cabinet-level policy-making body chaired by the Secretary of Commerce, to consider two issues:

- What is the best mechanism to implement the current policy of transfer of civil land remote sensing systems (Landsat) to the private sector as soon as possible?; and
- Should the Administration consider simultaneously private sector transfer of both civil weather and land remote sensing systems?

The CCCT has met on these issues on numerous occasions and has sought information from a range of sources prior to forwarding a recommendation to the President. The Program Board on Civil Operational Land Remote Sensing from Space was formed to facilitate the expression of federal agency views to the Secretary. Represented on the Board are the Departments of Agriculture, Commerce, Defense, Energy, Interior, and State, as well as the Agency for International Development, the U.S. Army Corps of Engineers-Civil Works, the Central Intelligence Agency, the Environmental Protection Agency, and NASA.

Land Remote Sensing Satellite Advisory Committee

In parallel with the above, the Department of Commerce formed the Land Remote Sensing Satellite Advisory Committee (LRSSAC) to solicit the advice of a broad cross section of the non-federal community on the management of the civil land satellite program. The membership of this committee is shown in Table 1. Committee members represent end users, the value-added industry, academia, state government, aerospace industry, and the business and investment community. The committee's charter calls for the committee to provide advice and make recommendations on such matters as (a) identifying data requirements of the non-federal user community; (b) establishing policies for the conduct of the program, including pricing policies for data and standard data products; and (c) evaluating proposals for eventual private sector ownership of the land remote sensing satellite system.

LRSSAC first met in June 1982. Given the lack of federal commitment to any program beyond Landsat D', and with even this commitment in some jeopardy, the committee's first action was to pass two substantive resolutions. The first pointed out the importance of these programs. The second called for the Department of Commerce to test formally the feasibility and appropriateness of transferring all or part of the civil land and meteorological satellite programs to private industry. Inclusion of the meteorological satellites in the committee's deliberations was outside of the committee's original charter, but consideration of these systems was requested by the Secretary, given their examination by the CCCT in light of the original Comsat inquiry.

Original LRSSAC Resolutions and Commerce Request for Information

The resolutions passed by LRSSAC at its first meeting read as follows:

Resolution A

WHEREAS: The remote sensing of the Earth, its oceans, and its atmosphere holds great promise as a technology vital to the future welfare of mankind, and

WHEREAS: This technology is yet in its infancy on the time scale of complex scientific applications, and

WHEREAS: These facts are well accepted by the scientific community,

BE IT RESOLVED THAT: No action be taken by the U.S Government that will jeopardize the ongoing U.S. programs in these areas or the potential future fruits of the hard won progress to date.

Resolution B

WHEREAS: Administration policy is that all or part of the civil land remote sensing satellite program, its development and applications should be transferred to private industry as soon as possible, and

WHEREAS: The expense and risk of such a venture by private industry may as yet be excessive and require the continued leadership of Government on behalf of the public,

BE IT RESOLVED THAT: The Department of Commerce shall formally test the feasibility of transferring all or part of its civil land remote sensing satellite and weather satellite programs to private industry, and

TABLE 1. LAND REMOTE SENSING SATELLITE ADVISORY COMMITTEE

Mr. Michel T. Halbouty
Chairman, Land Remote Sensing Satellite Advisory Committee
The Halbouty Center
5100 Westheimer Road
Houston, Texas 77056

Mr. John Alsop
Chairman of the Board of Directors
The Covenant Group
95 Woodland Street
Hartford, Connecticut 06101

Mr. G. R. Barker, Manager
Forest Resource Information Systems
St. Regis Paper Company
435 Clarke Road, Suite 411
Jacksonville, Florida 32218

Mr. John Carter
Carter Exploration
P.O. Box 1694
Abilene, Texas 79604

Mr. Vern Cartwright, Chairman
Cartwright Aerial Surveys, Inc.
Executive Airport
Sacramento, California 95822

Dr. E. M. Cortright, President
Lockheed California Company
P.O. Box 551
Burbank, California 92520

Dr. Fred Harrison
515 Cedar Avenue
Grand Junction, Colorado 81501

Dr. Fredrick B. Henderson III
President
The Geosat Committee, Inc.
153 Kearny Street, Suite 209
San Francisco, California 94108

Dr. Hugo John, Director
School of Natural Resources
University of Vermont
Aiken Center for Natural Resources
Burlington, Vermont 05405

Dr. Thomas M. Lillesand, Director
Environmental Remote Sensing Center
Institute for Environmental Studies
University of Wisconsin-Madison
1225 W. Dayton Street
Madison, Wisconsin 53706

Mr. Warren Nichols
Vice President and Director of Engineering
Santa Barbara Research Center
75 Coromar Drive
Goleta, California 93117

Mr. Raymond O'Conner
Executive Vice President
Bache Halsey Stuart Shields, Inc.
100 Gold Street
New York, New York 10038

Mr. J. Robert Porter, Jr., President
Earth Satellite Corporation
7222 47th Street
Chevy Chase, Maryland 20015

Dr. Floyd F. Sabins, Jr.
Senior Research Associate
Chevron Oil Field Research Co.
3282 Beach Blvd., P.O. Box 446
La Habra, California 90631

Mr. James Souby, Director
Division of Policy, Development and Planning
Office of the Governor, Pouch AD
Juneau, Alaska 99811

Honorable A. J. Spano
6525 W. 52nd Avenue
Arvada, Colorado 80002

Dr. James V. Taranik
Dean and Professor of Geology
Mackay School of Mines
University of Nevada—Reno
Reno, Nevada 89557

Mr. Donn Walklet, President
Terra-Mar, Inc.
2113 Landings Drive
Mountain View, California 94043

THAT: The following procedure be followed:

1. The Department of Commerce shall identify its ongoing civil remote sensing programs and future plans, the cost of existing and contracted hardware, the cost of existing and contracted supporting facilities, and the direct and indirect operating cost.
2. Private industry shall be invited to study these programs and program assets and the present and future opportunities to develop a profitable business by acquisition of all or part of them.
3. Interested participants will report to the Department of Commerce and this committee, within ninety days of the invitation, the results of these studies, the recommended options, and the terms and conditions under which they would be interested in competing for them.
4. Based on the extent of the interest shown and the capability of private industry to pursue these programs at a level commensurate with public as well as private interest, the Committee will advise the Secretary of Commerce on the feasibility and the appropriateness of the transfer to private ownership of civil satellite remote sensing programs, and the manner in which this could be accomplished.

The latter resolution resulted in NOAA publishing a formal Request for Information (RFI) on 10 September 1982 with industry views due 45 days later, on 22 October. (Changes in the RFI delayed its release and caused the response time to be shortened to 45 days although LRSSAC had originally recommended 90 days.) Actually, the RFI

was published in two parts, the 10 September announcement in Commerce Business Daily and a "preamble" released as an adjunct to the original announcement. The substantive portions of the original RFI and the preamble are included below.

Excerpt from Original RFI

The Secretary of Commerce is examining two issues with regard to the nation's civil remote sensing satellites:

1. What is the best machanism to implement the current policy of transfer of civil land remote sensing systems (LANDSAT) to the private sector as soon as possible?
2. Should the Administration consider simultaneously private sector transfer of both civil weather and land remote sensing systems? (At this time, Administration policy is that civil weather satellite systems should remain in the Government.)

To assist in the process, the Secretary is requesting that the views of private industry be obtained. These views will be analyzed by the administration and its advisory committee. This committee includes private sector representatives. Based in part on the results of this process, it is planned that a formal Request for Proposals will be prepared.

Private sector representatives are invited to present their views and expressions of interest on ownership and/or operation of the land and weather satellites and the likelihood of Government savings in either mode and the mechanisms for transfer of these systems to the private sector. All or part of the information provided will be treated as confidential to the extent permitted by law. Offerors should clearly mark those pages of their response that contain proprietary information. The response may include both, either, or any part of either system. The desired information includes:

1. A statement of the recommendations and rationale for transfer of all or any part of these satellite systems.
2. A discussion of the technical and business aspects of any proposed transfer, with particular emphasis on continuity of service and the cost savings to the Government.
3. A description of the terms and conditions that are necessary for a successful transfer. This should include, but not necessarily be limited to:
   a. Any desirable or undesirable Government regulation.
   b. Any need for legislation.
   c. Use of Government facilities, ground stations, and equipment.
   d. Services to be provided to the Government and public.
   e. Time frame in which transfer is considered feasible.
4. A description of the proposed remote sensing system and its capabilities (area of coverage, spatial resolution, sensor frequency bands, interval between repeat coverages of a ground site, etc.), including plans regarding direct transmission of data to foreign ground stations and distribution of data to international and domestic customers.
5. Anticipated evolution of new or improved sensing capabilities under the proposed transfer, and recommendations for a means to assure the evolution in any contractural or regulatory vehicle.
6. Response to foreign competition and its effects.
7. Potential for commercial international joint ventures in remote sensing and their implications in the areas of export control and national security.
8. If transfer is recommended for all or part of the civil weather satellite systems, information should be supplied on:
   a. Assumption of command and control by the Department of Defense in emergencies.
   b. Effect of providing selected priority service to defense needs when required.
   c. Feasibility and savings associated with combining weather and land satellite functions (space and/or ground segment), and recommendation.
   d. Use of existing Government facilities, ground stations, and equipment inventory.
   e. Use of existing industry facilities, ground stations, and equipment inventory.
   f. Proposed criteria for launching replacement satellites and selection of orbital parameters.
   g. Weather satellite service costs under the proposed transfer to permit comparisons with current costs.
   h. A statement of the pricing and data distribution practice (domestically and internationally) that would be employed for weather data.
   i. Intended approach to the evolution of sensor systems still in R&D stage, such as the VAS on the geostationary weather satellites.
   j. Approach to be used with foreign-supplied instruments, such as the ARGOS and SSU on the polar-orbiting weather satellites.
   k. Approach to respond to the National Weather Service priorities for severe storm data (National Severe Storms Forecast Center in Kansas City and National Hurricane Center in Miami) and for major forecast operations (National Meteorological Center in Camp Springs, Maryland).

Excerpt from Preamble for Original RFI

The notice published September 10, 1982, is amended to include the following Preamble:

It is the policy of this Administration to seek commercialization of Governmental activities which are not uniquely Government in nature since private enterprise is the primary source of our national economic strength.

The United States Government currently operates civil satellite systems to collect and disseminate remotely sensed weather and land satellite data. This data is used by numerous departments and agencies to perform Government services and is used by the private sector to extract information valuable in that sector. Civil satellite remote sensing is an activity which has a potential for substantially greater commercialization. Private entities have expressed interest in providing the remotely sensed satellite data that is needed by the Government and non-Government users on a commercial basis. The Land Remote Sensing Advisory Committee is currently soliciting other expressions of interest from the private sector for ownership and/or operation.

While it is the current policy of the Administration to seek prompt commercialization of land satellite remote sensing and to retain the civil weather satellites in the Government, that policy will be reexamined if commercialization of both systems is shown to produce cost savings to Federal agencies.

Responses to the Request for Information (RFI)

Fourteen responses to the RFI were obtained, ranging from a postcard to a two volume proposal. In order to facilitate the review of these documents, a subcommittee of the LRSSAC was established. Called the Working Group on Commercialization, this subcommittee was chaired by Taranik and included Alsop, Henderson, O'Conner, and Sabins. The purpose of the Working Group was to review and organize the proposals received and to identify issues and actions for the main committee to consider.

The Working Group aggregated the 14 responses into four general categories:

(1) Responses which did not specifically propose a framework for prompt commercialization (Autometric, Inc., Computer Services Corp., Terra-Mar, University of Massachusetts).

(2) Responses which did not recommend commercialization (General Electric company, Dr. Robert Georgevic, Hughes Aircraft Company, Ocean Routes, Inc.).

(3) Responses which dealt with commercialization of only land satellites (American Science and Technology Corp., Control Data Corp., Space Services, Inc.) or only weather satellites (Environmental Satellite Data Inc., RCA).

(4) Responses which recommended immediate commercialization of both weather and land satellites (Comsat Corp.).

After categorizing the responses, the Working Group evaluated the technical feasibility and the degree to which each response addressed federal needs. The criteria used in this evaluation are contained in Table 2. The group's findings were considered by the entire LRSSAC and summarized in a report made public on 19 November 1982. The following discussion represents a synopsis of the fundamental findings, concepts, and issues contained in that report. (Much of the material below is extracted from the report verbatim.)

The intention of this discussion is not to highlight the detailed form of the various responses received. Rather, the objective is to synthesize the principles by which the LRSSAC recommends commercialization take place *if* a decision to implement commercialization is made. Again, the context for the crystallization of these principles is an Administration desire to transfer its responsibility for land remote sensing to the private sector by the mid-1980's, or sooner if possible.

Summary of Findings of the Working Group on Commercialization

Members of the Working Group were in unanimous agreement that commercialization of ac-

Table 2. Criteria Used for Evaluation of Responses to RFI

Feasibility of Commercialization
METSATS only
LANDSATS only
Both METSATS and LANDSATS
Addressed CBD-RFI 8a-8k for METSATS
LANDSAT
Continuity of MSS Data Provided
Continuity of TM Data Provided
Introduced New Technology
Provided Satellites
Collects Data
Distributes Data
Processes and Interprets Data
Proposed Additional Systems
Business Plan
Sole Operator Proposed
Lease From Government Proposed
Government Funding Needed
Guarantee of Government Data Purchase
Used Government Facilities
Government Launch Services Needed
Special Tax Incentives Required
Recommends Government Regulation
Recommends Legislation
Time Frame for Commercialization
Addressed Market
Cost Projections Provided
Savings to Government Indicated
Addressed Foreign Sector
U.S. Treaties and Policies
Addressed National Security Concerns

tivities within the Government which were not inherently governmental should enhance the development of the economic base of the country. Such commercialization should also lead to expanded tax revenues and introduction of better operational systems because the needs of the marketplace should drive the requirements for current technology. It was generally felt that commercialization should be accomplished in the environment of an open marketplace which encourages free enterprise and healthy competition on both a domestic and international scale.

The majority of the responses to the RFI indicated that commercialization should occur gradually, beginning with the ground data handling segment of the land remote sensing system. All responses indicated that the market for land remote sensing data was not developed to a point where commercial viability could be demonstrated within the next ten years. Generally, most respondents felt that designation of a sole operator, which would have exclusive and proprietary rights to the data from acquisition to delivery to users under conditions of guaranteed subsidy and guaranteed tax incentives, would severely limit the degree of natural market development.

The Working Group also felt it was absolutely essential to minimize or eliminate Governmental involvement in those elements of land remote sensing that affect the market directly. Specifically, those elements involve services to (1) convert raw data into images in computer compatible tape and film product form; (2) enhance, process, and analyze image data; and (3) distribute image data to non-government users.

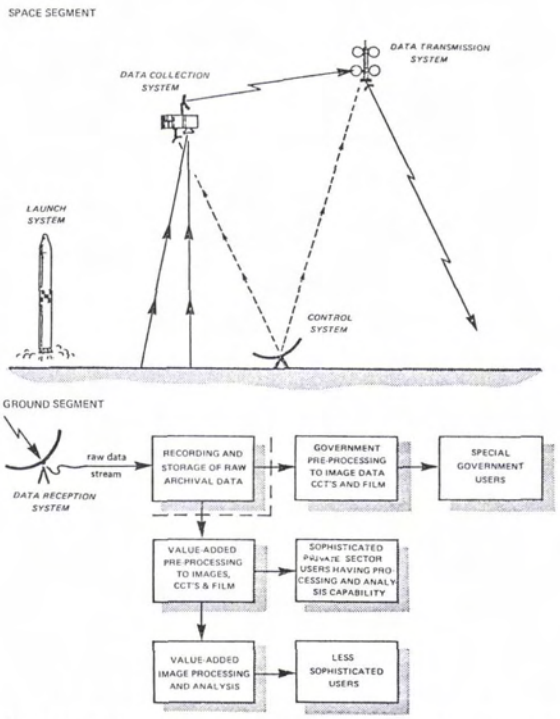

FIG. 1. Elements of the Civil Space Remote Sensing System. (a) Space Segment, (b) Ground Segment (After Attachment 6 in Report of the Working Group of Commercialization.

INTERNATIONAL COMPETITION IN LAND SATELLITE SYSTEMS

International competition in civil remote sensing was regarded as healthy. However, the Working Group felt that it was important to recognize that the most serious foreign competitors in the data market (France and Japan) write off the costs for operation of the space segment of their remote sensing systems (Figure 1) in the hope that the activities of their ground segments will lead to new information technologies that will rapidly enhance growth and development of their economies. For this reason it is doubtful that a United States commercial venture which recovers the costs for operation of the space segment will be able to compete on an international basis without Government support.

In addition to supporting the space segment of their programs, competitors also "write off" aggressive research and development efforts within their government as investments in their economic future. Serious concern was expressed by members of the Working Group that the responses to the RFI only proposed very conservative, proven technologies for new systems to be utilized in the next decade. Accordingly, any plan for commercialization must be paralleled with an accelerated program for remote sensing research of a fundamental, high-risk, and long-term nature. The responses to the RFI underscore the fact that such research in development of advance technology will not be done by industry. Industry will focus on applied, low-risk, and short-term research to improve profitability using current, proven technology. A program board was suggested as a means to evaluate requirements for research within the Government with respect to the needs for advanced technologies.

METEOROLOGICAL SATELLITES

The matter of commercialization of weather satellites was analyzed in the light of the responses. While lacking expertise in the weather satellite area (relative to the land program), the Working Group concluded that there was only a small commercial opportunity associated with weather satellites. This situation exists because the Government is almost the sole user of data produced by them. Therefore, the weather satellite systems were judged to be inherently governmental. A large market for weather satellite data might be

developed, but the National Weather Service would have to be commercialized before it can be tapped (a subject far from the purview of the committee).

Members of the Working Group concluded that there might be greater efficiency by managing both the land and weather satellite systems as an entity. Common satellite command and control, common data reception, and common raw data recording and archiving facilities could be utilized. Weather data could be used to target land data acquisition and to correct land data for atmospheric effects. However, the issue of the degree of savings to the Government for combined operation of land and weather systems could not be quantified by the Working Group. It was felt that the issue should be more appropriately that of improved products and services and therefore a more competitive system for the international marketplace.

ROLE OF VALUE-ADDED INDUSTRY

On the basis of the responses, it was concluded that major commercial opportunities exist in the value-added portion of civil land remote sensing. One of the reasons that market development has been inhibited is that the Government has extended its activities into non-governmental areas of data management and that the Government has managed the ground segment in an experimental mode, rather than an operational one. Specifically, the Government has developed the system to support the needs of scientific investigators rather than general users.

The responses indicate an industrial interest in receiving land satellite data directly and distributing such data in near real time to users. Although there is a perceived need to have data archived in raw form and also to provide the Government with near real-time data, the Working Group felt the commercial sector should also be permitted to have direct access to the downlinked government data stream. Access to this Government data stream should be permitted on a cost reimbursable basis.

The Working Group concluded that value-added industries should be allowed to develop preprocessing services that would format raw data to images in film and computer compatible tape (CCT) form. Users having a need for raw, unprocessed data should be allowed to obtain copies of such data directly from a master archival facility. Users having a processing and analysis capability could order film and CCT data directly from such value-added industries. Those lacking a level of sophistication in image processing could also request additional services. This concept is illustrated in Figure 1, wherein Government data are provided directly from the raw data archive. These data would flow through a Government processing facility (e.g., the EROS Data Center) for internal use. Private sector data access is provided through one or more of the value-added industries.

SYSTEMS AND FACILITIES MANAGEMENT

The Working Group recognized that there would be an efficiency in management that would derive from operation of the space segment by a sole entity. Certainly a transfer of operation to the Department of Defense in times of emergency would be facilitated. However, the Working Group felt that it was not clear that a transfer of the ownership and management of the space segment to an industrial entity would necessarily lead to increased profit opportunities for the aerospace industry, given industry's role in current operations.

On the basis of the majority of the responses, the Working Group concluded that, if a sole entity is selected to operate the space segment, its span of control over the data should extend only to the raw, unprocessed data. Secondly, the Working Group concluded that, if Government facilities are utilized in any manner, or a Government subsidy is provided, such raw data should be placed into a National archive in the public domain. The system must be designed such that any sole entity operating the space segment should not be allowed to compete unfairly with the value-added industry in furnishing processed and analyzed data to users. At the same time, it is recognized that the market portion of the system must drive data acquisition technology, data acquisition plans, etc., if commercialization is to succeed. It was concluded that a review board should be formed to reconcile the potential differences between market requirements generated by users, the needs of the value-added industry, and the needs for new efficient data collection technology.

LAUNCH SERVICES/PROPRIETARY DATA RIGHTS

Several respondents indicated a desire to fly their own specialized sensors and have proprietary rights to the data provided by such sensors. Because the market to support such a possibility in the near term (probably the next ten years) is insufficient, the Working Group felt that the government could stimulate commercial opportunities of this kind by providing launch services and/or access to satellite platforms until such a market develops. If public monies are used for this purpose, then data so acquired could be placed into the public domain, but the Government should not be allowed to distribute such data, except for its own internal use.

Finally, with respect to the specific response proposing Government transfer of both the weather and land satellite systems, the Working Group concluded that natural (as opposed to subsidized) commercialization would be adversely affected if such a sole entity were given proprietary

rights to the data and had control over the data, including the provision of value-added services and the distribution of data to users. In short, the Working Group reiterated its belief that, if the operation of the weather and land satellites were transferred to a single industrial entity, that entity's control over the data should only extend to the archiving of raw, unprocessed data in a National facility.

LRSSAC Final Recommendations

The report of the Working Group was discussed by the entire LRSSAC and presented in outline form to the public on 18 November 1982. Based on this discussion and public comment (albeit limited), LRSSAC made minor modifications to the Working Group report and used it as the primary basis for formulating the committee's final recommendations to Secretary Baldrige as follows:

> The Committee believes, without reservation, that the U.S. Government must commit itself in the best interest of the nation to the continuity of Governmental and/or private sector civil land remote sensing system. This conviction stems not only from the role remote sensing technology will play in enhancing the economic base of the country but also from the pervasive influence such information will have on improving the future quality of life on Earth.
>
> Therefore, we recommend that:
>
> (1) The Government of the United States will attempt to negotiate an arrangement with private industry to own and/or operate under contract specified space and ground segments, up to and including only archiving of raw unprocessed data, of the land satellite system by itself, or both the meteorological and land satellite systems.
>
> (2) The Government of the United States will make a firm, long range commitment to continue to provide or cause to be provided viable R&D programs on both the land and meteorological satellite projects.
>
> (3) The requirement be made that the operator, whether it be the Government and/or the private sector, subscribe to the open sky policy—which primarily means that anyone, anywhere, in any country can purchase the data at equitable prices.
>
> (4) All necessary legislation and appropriations be enacted *at once* to implement these recommendations.
>
> The Land Remote Sensing Satellite Advisory Committee unanimously endorses this report and its recommendations and offers its continued assistance to Secretary Baldrige in the implementation of this report.

Commentary

To this point, the author has attempted to convey as objectively as possible the genesis and form of the LRSSAC activities and recommendations to date. The remainder of this discussion represents a brief personal interpretation of these actions.

The Need for Action

To say that this is a critical time for remote sensing is a severe understatement in that the current Administration has explicitly stated its intention to transfer its responsibility for land remote sensing to the private sector as soon as possible. In theory, Landsat D' is scheduled to operate until 1988. Nothing is planned thereafter. With the lead time needed for system development, a decision to pursue some form of program must be made now for data acquisition to continue without interruption. In the absence of such a decision, not only may opportunities for effective commercialization be lost, but also the U.S. leadership role relative to the foreign sector will be at stake. Most importantly, current trends in global population, food and fiber supply, energy demand, tropical deforestation, climatic change, and environmental degradation make it imperative that this country maintain and enhance its civil remote sensing programs. In this respect, perceived shortrange Government cost savings should not be the primary driving force for planning the future disposition of these programs.

The committee's recommendations urge NOAA to rapidly solicit and evaluate proposals from industry and seriously attempt to negotiate commercial agreements *only within the recommended constraints. Further, in the event these negotiations fail, the committee underscored the need for the Government to continue, and actually heighten, both its operational, and R&D activities in remote sensing.*

Fundamental Concerns

Commercialization, in this author's opinion, is an inherently desirable objective for portions of our existing program. However, a phased (rather than wholesale) approach appears to be in order at this juncture, and industry itself has indicated we cannot expect a land system to "pay for itself" in the next several years. In this light, Government must continue to create an environment in which it can work with industry (and universities) in a manner compatible with the national interest. In the spirit of the free enterprise system, creating such an environment should not involve effective subsidization of a single company to operate the program. Such schemes appear to not only violate the basic principles of free enterprise, they appear to encourage, rather than eliminate, wasteful government spending.

It is important to note the committee's concern about the span of operational control by any sole industrial partner in any future system. That is, the operational control of a single entity should not extend beyond the data archiving stage (Figure 1). This limitation is essential to the dynamism and competition potentially available in the value-added portion of the system.

Another important tenet contained in the committee's recommendations is reaffirmation of the open skies policy, which provides for public nondiscriminatory availability of remote sensing data. While the granting of total proprietary rights to data to a commercial operation may enhance opportunities for profits, such a scheme would compromise the principle of open data access and potentially limit the application of data in the best national interest. Therefore, the committee reiterated the importance of making remote sensing data available to users around the globe at an equitable price.

The committee's deliberations underscored the need for being creative as we reconsider the management of our land remote sensing program. A range of alternatives can and should be considered. An environment nurturing industrial creativity in launch, sensor, and data distribution systems should be provided. For example, unification of the management of the land and weather systems may reap a number of benefits. However, any proposal to transfer operation and/or ownership of the weather satellites to the private sector must be viewed with extreme caution, given their relationship to public health and safety and the existing research-operational relationships in this system worldwide.

THE NEED FOR POLICY DEVELOPMENT

Much is technologically possible, but little is practically feasible, until we move off the mark in the formulation of a substantive policy direction for our remote sensing programs. As pointed out in the Working Group's report, "One of the most significant problems in remote sensing has been the lack of direction for the program." To this end, the report suggests a Board of Directors for Civil Remote Sensing to evaluate Government programs of research, industry proposals for commercial activities, etc. The primary purpose of this group would be to maximize commercial opportunities while insuring the public interest is being best served. Such a board would be appointed by, and report to, the President. This would provide a mechanism for remote sensing policy development at the level where it is needed.

The question of what form our civil remote sensing program should take over the long-term has no clear-cut answers. However, what is clear is that it is time we make a substantive investment of thought and dollars in crystallizing such a program and recognizing its importance to the national and global interest. Aggressive R&D is needed; funds to provide for program continuity are essential; and an institutional structure for clear policy development is critical. For too long our programs have concentrated on developing a multiplicity of "things" without particular regard for how these "things" relate to one another or for what they may be useful. Let's hope that the federal agencies, universities, and industry are beyond the point of the right hand not knowing what the left is doing. Further, let us hope that in the future our programs place appropriate emphasis on how to provide remote sensing data in a timely, useful, and affordable fashion. Historically, our interest in data collection has far exceeded our consideration of data accessibility and usability.

Conclusion

While our civil remote sensing program has some shortcomings, much has been accomplished in the last decade. The exciting fact is that we've only begun to scratch the scientific surface of remote sensing's role in improving our understanding and management of the atmosphere, lithosphere, hydrosphere, and biosphere. This will become increasingly apparent as experience with Landsat-4 TM data is acquired. The real challenge before us is to formulate a policy for our remote sensing programs which will insure future scientific advances, provide creative commercial opportunities, and bring remote sensing to a much higher position on our national agenda.

With the age of information upon us, remote sensing will play an increasingly important role in providing for the improved peaceful and bountiful habitability of Earth. The long-term global implications of the choices made on the form and conduct of our civil remote sensing programs are profound. We must recognize this fact and bear it ever in mind as we consider the issue of commercialization of remote sensing from space.

Epilogue

The responses to the RFI have been evaluated in parallel by the federal interagency taskforce. The report of this group was not available at the time of this writing (late November, 1982).

With the passage of Public Law 97-324 (15 October 1982), further NOAA in-house analyses of the commercialization issue are to be completed and reported to Congress by 1 February 1983. These analyses are to consider

(1) federal needs for land remote sensing data;
(2) equipment, software, and data inventory that could be transferred to the private sector; and
(3) an evaluation of four alternative approaches that range from totally private operation to continuation of federal operation of U.S. land satellite programs.

The specific institutional alternatives to be considered are

(1) wholly private ownership and operation of the system by an entity competitively selected;

(2) phased-in Government/private ownership and operation;

(3) a legislatively chartered privately owned corporation; and

(4) continued membership and operation by the Federal Government.

Further, section 201(b) of Title II of PL 97-324 calls for two parallel studies to be conducted by non-government entities. Their reports of feasible financial and organization approaches to commercialization are to be reported to Congress by 1 April 1983.

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