

Y4
C 73/7

1041

96Y4
C 73/7
96-39
Pt. 1

96-39/ OPERATIONAL REMOTE SENSING LEGISLATION

PT. 1
GOVERNMENT
Storage

HEARINGS
BEFORE THE
SUBCOMMITTEE ON
SCIENCE, TECHNOLOGY, AND SPACE
OF THE
COMMITTEE ON COMMERCE,
SCIENCE, AND TRANSPORTATION
UNITED STATES SENATE
NINETY-SIXTH CONGRESS

FIRST SESSION

ON

S. 663

TO ESTABLISH AN EARTH DATA AND INFORMATION SERVICE,
IN THE NATIONAL AERONAUTICS AND SPACE ADMINISTRA-
TION; AND FOR OTHER PURPOSES

AND

S. 875

TO PROVIDE FOR THE ESTABLISHMENT, OWNERSHIP, OPERA-
TION, AND REGULATION OF A COMMERCIAL EARTH RE-
SOURCE INFORMATION SERVICE, UTILIZING SATELLITES
AND OTHER TECHNOLOGIES, AND FOR OTHER PURPOSES

APRIL 9 AND 11, 1979

Part 1

Serial No. 96-39

Printed for the use of the
Committee on Commerce, Science, and Transportation

DOCUMENTS



004 1 6 1979

U.S. GOVERNMENT PRINTING OFFICE
FARRELL LIBRARY
WASHINGTON, D.C. 20540
KANSAS STATE UNIVERSITY

45-048 O

AUTHENTICATED
U.S. GOVERNMENT
INFORMATION
GPO

KSU LIBRARIES

11100 556283

COMMITTEE ON COMMERCE, SCIENCE, AND TRANSPORTATION

HOWARD W. CANNON, Nevada, *Chairman*

WARREN G. MAGNUSON, Washington
RUSSELL B. LONG, Louisiana
ERNEST F. HOLLINGS, South Carolina
DANIEL K. INOUE, Hawaii
ADLAI E. STEVENSON, Illinois
WENDELL H. FORD, Kentucky
DONALD W. RIEGLE, Jr., Michigan
J. JAMES EXON, Nebraska
HOWELL HEFLIN, Alabama

BOB PACKWOOD, Oregon
BARRY GOLDWATER, Arizona
HARRISON H. SCHMITT, New Mexico
JOHN C. DANFORTH, Missouri
NANCY LANDON KASSEBAUM, Kansas
LARRY PRESSLER, South Dakota
JOHN W. WARNER, Virginia

AUBREY L. SARVIS, *Staff Director and Chief Counsel*

EDWIN K. HALL, *General Counsel*

JOHN STEWART, *Professional Staff Member*

MALCOLM M. B. STERRETT, *Minority Staff Director*

GERALD J. KOVACH, *Minority Staff Counsel*

WILLIAM C. GIBB, *Minority Staff Counsel*

SUBCOMMITTEE ON SCIENCE, TECHNOLOGY, AND SPACE

ADLAI E. STEVENSON, Illinois, *Chairman*

WENDELL H. FORD, Kentucky
RUSSELL B. LONG, Louisiana
ERNEST F. HOLLINGS, South Carolina
DONALD W. RIEGLE, Jr., Michigan
HOWELL HEFLIN, Alabama

HARRISON H. SCHMITT, New Mexico
BARRY GOLDWATER, Arizona
NANCY LANDON KASSEBAUM, Kansas

CONTENTS

Opening statement by Senator Stevenson	Page 1
Opening statement by Senator Schmitt	2
Text of bills:	
S. 663	5
S. 875	25

CHRONOLOGICAL LIST OF WITNESSES

APRIL 9, 1979

Flinn, Monroe, Majority whip, House of Representatives, State of Illinois	106
Frosch, Dr. Robert A., Administrator, NASA	60
Monaghan, Jim, assistant to the Governor of Colorado	114
Prepared statement	118
Mork, Erling O., city manager, Tacoma, Wash.....	122
Prepared statement	123
Press, Dr. Frank, Director, Office of Science and Technology, Office of the President.....	45
Prepared statement	55
Questions of Senator Schmitt and answers thereto	58
Rado, Bruce, Department of Natural Resources, State of Georgia	117
Walsh, James P., Deputy Administrator NOAA, Department of Commerce.....	63
Prepared statement	66
Questions of the committee and the answers thereto	78
Wise, Robert, staff director, Council of State Planning Agencies	109

APRIL 11, 1979

Opening statement by Senator Stevenson	149
Davenport, Joan, Assistant Secretary for Energy and Minerals, Department of the Interior; accompanied by Dr. Fred Doyle, Acting Director, EROS Program, U.S. Geological Survey	150
Prepared statement	161
Fink, Daniel J., vice president and group executive, General Electric Corp., Valley Forge Space Center.....	186
Henderson, Dr. Fred, president, Geosat Committee, Inc.....	194
Prepared statement	199
McLucas, Dr. John, executive vice president, Comsat Corp	179
Prepared statement	182
Pickering, Thomas R., Assistant Secretary of State, Bureau of Oceans and International Environmental and Scientific Affairs; accompanied by Dr. Irwin Pikus.....	162
Prepared statement	178
Stevenson, W. A., president, Lockheed Electronics Co., Inc	190
Vincent, Dr. Robert K., president, Geospectra Corp	205
Prepared statement	206

ADDITIONAL ARTICLES, LETTERS, AND STATEMENTS

Atiyeh, Victor, Governor of Oregon, letter of April 17, 1979	240
Bennet, Douglas J., Jr., Department of State, letter of March 20, 1979	225
Cornwall, Sally Bay, chairperson, Earth Resources Data Council, statement.....	111
Eye in the Sky, article	43
Friedman, Dr. Bruce, chairman, District Five Energy Committee of B'nai B'rith, statement	215
Heiss, Klaus P., Econ Inc., letter of December 11, 1978	232

IV

Johnson, George B., vice president, government relations, Battelle Memorial Institute, letter of April 30, 1979	Page 240
Patton, H. Milton, associate director for environmental resources, Council of State Governments, letter of April 3, 1979	239
Slosky, Leonard, executive chambers, State of Colorado, letter of December 28, 1978	238
Tokerud, R. E., Lockheed Electronics Co., Inc., letter of December 8, 1978	227
United Nations General Assembly, Committee on the Peaceful Uses of Outer Space, report	165
Zimmer, Thomas M., Comsat General Corp., letter of March 6, 1979	223

OPERATIONAL REMOTE SENSING LEGISLATION

MONDAY, APRIL 9, 1979

U.S. SENATE,
COMMITTEE ON COMMERCE, SCIENCE, AND TRANSPORTATION,
SUBCOMMITTEE ON SCIENCE, TECHNOLOGY, AND SPACE,
Washington, D.C.

The subcommittee met at 9:35 a.m., in room 457 of the Russell Senate Office Building, Hon. Adlai E. Stevenson (chairman of the subcommittee) presiding.

OPENING STATEMENT BY SENATOR STEVENSON

Senator STEVENSON. The subcommittee will come to order. Today we begin hearings on legislation to establish an institutional framework for an operational remote-sensing system to gather data by satellite on the Earth's resources and environment. We are considering two legislative approaches: One embodied in S. 663, the Earth Data and Information Service Act of 1979, introduced on March 14 by Senators Cannon, Ford, Riegle, and myself. The second approach is contained in S. 875, the Earth Resources Information Corporation Act, introduced by Senators Schmitt, Pressler, and Young.

Two years ago the subcommittee held hearings on S. 657, a bill with the same objective of establishing a remote-sensing system. At that time administration witnesses opposed passage because, in their view, the legislation was premature. Dr. Press testified that a Cabinet-level group was assembled to consider the issue and make recommendations. Since then a number of groups inside and outside the Federal Government have studied the issue. To my knowledge, not one has proposed further delay. Reasonable persons may disagree over the structure of the operational system, but I am aware of no one, except possibly for a few in the Office of Management and Budget, who still contend that the United States should not make a commitment to an operational remote-sensing system. I hope that commitment will be forthcoming today from the administration.

The European Space Agency is moving forward with the development of an operational system. France is developing a remote-sensing satellite and will begin marketing products of that system in 1984. Japan and India are planning satellites. Meanwhile, the United States continues to study the problem.

Since the early 1970's experimental research and development efforts using the Landsat and other satellites have demonstrated the usefulness of remote-sensing in crop monitoring, mineral and fuels exploration, forest management, geodesy, flood control, and other activities. We should postpone no longer the next step in

developing an operational system that meets the needs of the private sector and governmental users.

Many operational problems have to be solved. In particular, better delivery systems for remote-sensing data have to be designed and implemented. Improving the handling of data on the ground is critical. However, the way to solve these problems is to get on with the job of developing an operational system. Keeping the technology locked in the artificial world of research and development only insulates it from the market environments that will determine the characteristics of a more efficient and useful system.

I won't describe the provisions of S. 663. They will be spelled out in the course of our hearing. I only want to emphasize that the time has passed for debating the issue of whether to support an operational system. As I have indicated on many occasions, I want to work cooperatively with the administration in developing this system. I know that Senator Schmitt and the other members of the Senate Commerce Committee feel likewise.

We hope this morning Dr. Press and Dr. Frosch in their forthcoming testimony will indicate that such cooperation is possible. If not, I will do all I can to convince my colleagues in Congress that we should resolve the impasse legislatively and quickly.

Senator Schmitt.

OPENING STATEMENT BY SENATOR SCHMITT

Senator SCHMITT. I would just like to add, Mr. Chairman, that these hearings begin yet another inquiry by this subcommittee into the future potential of space, in particular, the potential of modern Earth-resources monitoring systems, and the broadscale utilization of the unique view of the Earth provided by space began in the 1960's with the development of communications and weather satellite systems. The success of these efforts, culminating in such organizational structures as Comsat, Intelsat, and the world weather watch, was due in large measure to the unique nature of the data and services provided by the space segment of these systems and the long-established demand for global communications in weather information. The existence of an established institutional infrastructure for the process of disseminating and supplying such data to users and development of the need for Earth resources information has been slow, in spite of the obvious potential.

Unlike communications and weather data, Earth resources information was not in general use prior to the space age since it was not then available, with the exception, of course, of remote-sensing information, particularly in the form of photographs collected from airplanes.

With the existence and ever-broader use of information from Landsat, Seasat, and other systems, and the increased understanding of the techniques and value of the data from such systems, the time has come to develop an operational Earth resources information satellite service of some nature. Promotional governmental applications for the information from an operational system have been well demonstrated in the hearings of May and June 1977, of the Science, Technology, and Space Subcommittee, and many other recent reports support the viability of an operational Earth resources satellite system.

In particular, the following areas of utilization of satellite capabilities can be cited:

Improved agricultural information and production based on the identification and repetitive monitoring of crop yields, damage, and infestations.

Improved rangeland management and production based on the identification and repetitive evaluations of vegetation, soil, water, and livestock characteristics.

Improved forest products production based on identification of types and suitability of trees and on repetitive monitoring of changes due to natural and human effects.

Improved water resource management through direct and repetitive measurement and evaluation of surface water and by geologic evaluation of soil and subsurface features.

Improved targeting of favorable localities for mineral and energy exploration and expanded production based on more rapid and higher quality geologic maps and on the sensing of various elements due to their signatures in vegetation, mineral, soil, textural, or thermal characteristics.

Improved general and specific purpose maps for development planning and evaluation.

Improved repetitive monitoring of changes in urban and rural situations due to human habitation.

Improved monitoring of natural or artificial environmental changes based on repetitive coverage using a wide variety of techniques.

Improved identification, evaluation, and monitoring of marine and coastal resources through repetitive coverage.

Remote-sensing technology and the perceived uses of Earth resources information collected from space and aircraft have advanced to a point where an operational organization is warranted, in this Senator's opinion, and, I believe, in the opinion of the majority of the committee, including the chairman.

Commercial, institutional, State and local government and Federal Government users of such information all have testified to this fact on numerous occasions before the committees of the Congress for many years. Data from the developmental NASA Landsat system now in operation has shown ever-increasing demand for both commercial and public purposes. Other nations are beginning their own developments clearly with an eye toward marketing Earth resources information on a worldwide scale.

Thus, the United States must come to grips with how it can take advantage of the technology it introduced to the world. The potential advantages in the use of Earth resources information lie in both the commercial and public sectors. This would suggest that the operational management of an Earth resources information system should be organized as an investor-owned regulated corporation, modeled after the successful experience of Comsat in the telecommunications field. By such an organizational structure, I believe that we take advantage of the efficiencies of investor-owned corporations; while at the same time, through appropriate legislative bounds, require that that information be available to all users, including those in the public sector.

Mr. Chairman, I am hopeful that the end result of these hearings will be the passage of legislation leading to the establishment of an Earth resources information service of some kind. As you know, at this point I prefer the use of an investor-owned corporation for that purpose. Such a corporation, I believe, will foster the widespread utilization of Earth resources data for the benefit of not only this Nation but of all mankind.

Senator STEVENSON. Without objection, the bills, S. 663 and S. 875, will be printed in the record.

And without objection, the article that appeared in the Wall Street Journal, Thursday, April 5, entitled "Eyes in the Sky: NASA Finds Many Buyers for Satellite Pictures and Plans New, More Revealing Landsats in 1980's," will be added into the record.

[The bills and article referred to follow:]

To establish an Earth Data and Information Service, in the National Aeronautics and Space Administration; and for other purposes.

IN THE SENATE OF THE UNITED STATES

MARCH 14 (legislative day, FEBRUARY 22), 1979

Mr. STEVENSON (for himself, Mr. CANNON, Mr. FORD, and Mr. RIEGLE), introduced the following bill; which was read twice and referred to the Committee on Commerce, Science, and Transportation

A BILL

To establish an Earth Data and Information Service, in the National Aeronautics and Space Administration; and for other purposes.

1 *Be it enacted by the Senate and House of Representa-*
2 *tives of the United States of America in Congress assembled,*
3 That this Act may be cited as the "Earth Data and Informa-
4 tion Service Act of 1979".

PURPOSE

SEC. 2. It is the purpose of this Act to establish the institutional framework that will acquire and make available to users, on a timely and continuing basis, reliable data and

1 basic information products on the Earth's resources and envi-
2 ronment.

3 DEFINITIONS

4 SEC. 3. For the purposes of this Act—

5 (1) "Administration" means the National Aero-
6 nautics and Space Administration;

7 (2) "Administrator" means the Administrator of
8 the National Aeronautics and Space Administration;

9 (3) "data" means a set of signals acquired by a
10 spacecraft, other vehicle, or other means by remote
11 sensing or otherwise from objects on the Earth's sur-
12 face, within the Earth's atmosphere, or in space, and
13 transmitted from such spacecraft, other vehicle or other
14 means to an Earth ground station, including such cor-
15 rections to the acquired signals by preliminary process-
16 ing as needed to make the acquired signals complete
17 and useful for further processing into information
18 products;

19 (4) "basic information products" means a number
20 of information products meeting the needs of a broad
21 spectrum of users and specifically described in advance
22 by the Service;

23 (5) "interim period" means that period immediate-
24 ly following the date of enactment of this Act during
25 which the Service develops the institutional, financial,

1 technical, and marketing capabilities of the Service, but
2 such period may not exceed seven years;

3 (6) "Service" means the Earth Data and Informa-
4 tion Service, established under section 6;

5 (7) "System" means Earth Data and Information
6 System which includes—

7 (A) the Earth remote sensing satellites and
8 other observation or acquisition devices,

9 (B) the associated equipment for command
10 and control,

11 (C) data reception, aggregation, preprocess-
12 ing, and processing,

13 (D) the development of basic information
14 products from the data, and

15 (E) the archiving and dissemination of the
16 data and basic information products by the
17 Service;

18 designed to contribute to the understanding of the qual-
19 ity and quantity of the Earth's resources and environ-
20 ment; except the term does not include systems estab-
21 lished primarily for (i) purposes of national security, (ii)
22 the National Weather Service, or (iii) commercial tele-
23 communications, either domestic or international; and

24 (8) "user" means any person or organization, gov-
25 ernmental or private, domestic or foreign, which ob-

FINDINGS

(3) an institutional framework should be established in order to provide timely and continuing availability of reliable data and basic information products, and thereby contribute to the attainment of national objectives, serve the needs of Federal, State, and local governments and the private sector, and provide for

1 the betterment of all mankind through cooperative pro-
2 grams with other countries or groups of countries;

3 (4) the successful development of such an institu-
4 tional framework is dependent on the establishment of
5 systems requiring innovative institutional arrangements
6 that encourage initiative by, and participation of, the
7 private sector;

8 (5) an interim period is required to develop the in-
9 stitutional, financial, technical, and market structure to
10 achieve the purpose of the Act;

11 (6) continuing research and development of
12 remote sensing systems is essential; and

13 (7) technology and data transfer between military
14 and civilian space activities, to the maximum extent
15 practicable, will enhance the benefits to be realized
16 from remote sensing technology.

17 POLICY

18 SEC. 5. (a) The Congress declares that it is the policy of
19 the United States that—

20 (1) the United States acknowledges the fundamen-
21 tal right of all countries to acquire data from space;

22 (2) the United States shall provide for the devel-
23 opment and operation of active and passive remote
24 sensing systems on a global basis in support of national
25 needs, and to meet the needs of other users;

1 (3) the capabilities of the private sector shall be
2 used, to the maximum extent practicable, to achieve
3 the purpose of this Act and especially in the design
4 and operation of the system;

5 (4) all United States Earth-oriented remote sens-
6 ing satellites shall be regulated by the Federal Govern-
7 ment;

8 (5) technological advances in the remote sensing
9 of the Earth from space shall be permitted pursuant to
10 appropriate governmental controls which shall be based
11 upon an assessment of civil benefits, national security,
12 and foreign policy;

13 (6) the Administrator, under supervision of the
14 President, and with the guidance of the Secretary of
15 State, shall cooperate with other countries and groups
16 of countries in carrying out the provisions of this Act;
17 and

18 (7) remote sensing data shall be used for the
19 benefit of all mankind.

20 Nothing in this Act shall be construed to preclude the owner-
21 ship and operation of the Service, or of a subsequent organi-
22 zational arrangement that achieves the functions of the Serv-
23 ice, by private business at the end of the interim period.

24 (b) The Congress of the United States directs that—

1 (1) the Service shall provide rapid processing of,
2 and ready access to, the data and basic information
3 products produced by the System at a reasonable cost
4 to the users;

5 (2) the Service shall be developed so as to encour-
6 age and promote competition among suppliers of equip-
7 ment and services for the System and to promote
8 maximum use of remote sensing data and basic infor-
9 mation products; and

10 (3) the products provided by the Service shall be
11 made available to all users, both domestic and foreign,
12 on the basis of charges to be established by the Admin-
13 istrator.

14 EARTH DATA AND INFORMATION SERVICE

15 SEC. 6. (a)(1) There is established in the Administration
16 the Earth Data and Information Service.

17 (2) The functions of the Administrator under this Act
18 shall be administered through the Service.

19 (3) The Service shall consist of the integrated institu-
20 tional, managerial, financial, technical, marketing, and other
21 operations necessary to make available the timely and con-
22 tinuing flow of reliable and useful data and basic information
23 products to the users.

24 (b)(1) The Service shall be headed by a General Man-
25 ager, who shall be appointed from civilian life by the Presi-

1 dent, by and with the advice and consent of the Senate.
2 Under the general supervision and direction of the Adminis-
3 trator, the General Manager shall be responsible for the exer-
4 cise of all powers and the discharge of all duties of the Serv-
5 ice.

6 (2) There shall be in the Service a Deputy General
7 Manager, who shall be appointed from civilian life by the
8 President, by and with the advice and consent of the Senate,
9 and shall perform such duties and exercise such power as the
10 General Manager may prescribe. The Deputy General Man-
11 ager shall act for, and exercise the powers of, the General
12 Manager during his absence or disability.

13 (c) The General Manager and the Deputy General Man-
14 ager shall not engage in any other business, vocation, or em-
15 ployment while serving as such.

16 (d) Whenever the President determines that it is feasible
17 to do so, during the interim period but not later than one
18 hundred and eighty days prior to the end of the interim
19 period, the President shall prepare and transmit to the Con-
20 gress recommendations, together with supporting justifica-
21 tion, on the appropriate organizational arrangement best de-
22 signed to continue the functions of the Service as a function
23 of a Federal agency (either as an independent agency or as a
24 unit of an existing agency), a Government corporation or a
25 private corporation.

1

1 (4) to enter into contracts or other arrangements
2 with users on such terms as the Administrator may
3 deem appropriate;

4 (5) to develop plans for the technical specifications
5 of all elements of the System after conferring with user
6 representatives; and

7 (6) to appoint and fix the compensation of such of-
8 ficers and employees as may be necessary.

9 (e)(1) The Administrator is authorized to establish such
10 communication networks as may be necessary to transmit
11 data and basic information products on a timely basis consist-
12 ent with the needs of the users as determined by the Service
13 in consultation with the users. Insofar as practicable, the
14 communications services needed to establish such communi-
15 cation networks shall be procured from the private sector.

16 (2) Before establishing any communications network au-
17 thorized by this subsection the Administrator shall consult
18 with the National Telecommunications Information Agency
19 of the Department of Commerce, and the Federal Communi-
20 cations Commission.

21 (f) The Administrator shall—

22 (1) provide recommendations for continued re-
23 search and development by the Administration on
24 remote sensing components, subsystems, and systems
25 for both space and ground operations of the System;

1 (2) arrange for the participation of the scientific,
2 technical, and user communities in planning the
3 System, and in acquiring, processing, analyzing, and
4 distributing data and basic information products to the
5 users; and

6 (3) provide for the widest practical and appropri-
7 ate dissemination of the data and basic information
8 products to the users.

9 (g) The Administrator, under the supervision of the
10 President, may participate in a program of international ac-
11 tivities related to the functions of the Service, pursuant to
12 agreements made by the President or by the President, by
13 and with the advice and consent of the Senate, as may be
14 appropriate. Under the supervision of the President and with
15 the advice of the Secretary of State, the Administrator may
16 initiate and conduct negotiations with other countries or
17 groups of countries relating specifically to the functions of the
18 Administrator under this Act. The Administrator shall keep
19 the Secretary of State informed of discussions or negotiations
20 with other countries or groups of countries. The Secretary of
21 State shall keep the Administrator advised on significant for-
22 eign policy considerations and developments related to such
23 discussions and negotiations. The Administrator shall request
24 the Secretary of State to assist in such discussions and nego-

1 tiations and the Secretary shall render such assistance as
2 may be appropriate.

3

REGULATIONS

4 SEC. 8. The President and the Administrator are au-
5 thorized to establish such regulations as may be necessary to
6 carry out the provisions of this Act.

7

USER CHARGES

8 SEC. 9. (a) The Administrator shall establish a schedule
9 of charges for products and services provided to users as re-
10 quired to carry out the provisions of this Act. The Adminis-
11 trator shall design such charges to assure, insofar as practi-
12 cal, that by the end of the interim period, the income from
13 such charges, combined with any other income to the Serv-
14 ice, will cover the costs of the Service exclusive of costs in-
15 curred by the Administration for research, development, and
16 testing on remote sensing systems, subsystems, and compo-
17 nents carried out under the National Aeronautics and Space
18 Act of 1958.

19 (b) Each department or agency of the Federal Govern-
20 ment needing data and basic information products of the kind
21 that are provided by the Service, shall procure such data and
22 basic information products from the Service. The Administra-
23 tor with the agreement of the President shall establish the
24 fees charged to such departments and agencies for such data
25 and basic information products.

1 (c) The head of each department or agency of the Feder-
2 al Government shall investigate the technical and economic
3 applicability of using the data or basic information products,
4 or both, of the Service in carrying out the functions of that
5 department or agency.

6 (d) Nothing in this Act shall be construed to prevent a
7 department or agency of the Federal Government from pro-
8 viding financial or other assistance to State and local govern-
9 ments in the procurement of data and basic information prod-
10 ucts from the Service or in the use of such data and basic
11 information products.

12 (e) In establishing charges and collecting such charges
13 from users, the Administrator is exempt from the provisions
14 of section 552 of title 5, United States Code and is not re-
15 stricted or limited to charges for reproduction and handling
16 set forth in that section.

17 (f) Nothing in this section shall be construed to limit or
18 otherwise affect the information, analysis, and distribution
19 functions of any department or agency of the Federal Gov-
20 ernment.

21 PROHIBITION OF REPRODUCTION FOR SALE OR DISTRIBUTION OF DATA AND BASIC INFORMATION PRODUCTS

22 SEC. 10. (a) It shall be unlawful for any person to re-
23 produce for sale or distribution, or to sell or distribute, any
24 data or basic information product produced by the Service,
25

1 except in accordance with conditions specified by the Admin-
2 istrator.

3 (b) Notwithstanding the provisions of subsection (a), the
4 fair use of any data or basic information product, including
5 such use by reproduction in copies or by any other means
6 specified by the Administrator, for purposes such as criticism,
7 comment, news reporting, teaching (including multiple copies
8 for classroom use), or scholarship, is not a violation of sub-
9 section (a) of this section. In determining whether the use
10 made of any data or basic information product in any particu-
11 lar case is a fair use the factors to be considered shall in-
12 clude—

13 (1) the purpose and character of the use, including
14 whether such use is of a commercial nature or is for
15 nonprofit educational purposes;

16 (2) the nature of the data or basic information
17 product;

18 (3) the amount and substantiality of the portion
19 used in relation to the data or basic information prod-
20 uct as a whole; and

21 (4) the effect of the use upon the potential market
22 for or value of the data or basic information product.

23 (c)(1) Whoever violates any provision of subsection (a)
24 or, any regulation issued under subsection (a), shall be sub-

1 ject to a civil penalty of not to exceed \$5,000 for each such
2 violation.

3 (2) Any such civil penalty may be compromised by the
4 Administrator. In determining the amount of the penalty, or
5 the amount agreed in the compromise, the appropriateness of
6 such penalty to the size of the business of the person charged
7 and the gravity of the violation shall be considered. The
8 amount of such penalty, when finally determined, or the
9 amount agreed upon in the compromise, may be deducted
10 from any sums owing by the United States to the person
11 charged.

12 (d)(1) The United States district court shall have juris-
13 diction, for cause shown, to restrain or enjoin violations of
14 subsection (a) of this section upon petition by the appropriate
15 United States attorney, or the Attorney General on behalf of
16 the United States.

17 (2) Actions under paragraph (1) of this subsection may
18 be brought in the district where any act or transaction consti-
19 tuting the violation occurred or in the district court where the
20 defendant is found or is an inhabitant or transacts business,
21 and process in such cases may be served in any other district
22 or where the defendant is an inhabitant or wherever the de-
23 fendant may be found.

1 (3) In any action brought under this subsection, sub-
2 penas for witnesses who are required to attend a United
3 States district court, may run into any other district.

4 APPLICABILITY OF THE NATIONAL AERONAUTICS AND
5 SPACE ACT OF 1958

6 SEC. 11. (a) Except as otherwise provided in this Act,
7 the Administrator shall, in carrying out his functions under
8 this Act, have the same powers and authority the Adminis-
9 tration has under the National Aeronautics and Space Act of
10 1958 to carry out its functions under that Act.

11 (b) Nothing in this Act shall be construed to reduce or
12 otherwise affect the authority of the Administration under the
13 National Aeronautics and Space Act of 1958 to continue the
14 research, development, and testing of remote sensing compo-
15 nents, subsystems, and systems for experimental purposes.
16 Such research, development, and testing activities shall be
17 coordinated with the activities of the Service.

18 TRANSFER OF RELATED FUNCTIONS

19 SEC. 12. (a) Subject to the provisions of this section, the
20 President during the interim period, may transfer to the
21 Service any functions and parts of functions of any other de-
22 partment or agency of the United States, or of any officer or
23 organizational entity thereof, which relate primarily to the
24 functions of the Service as prescribed by this Act. In connec-
25 tion with any such transfer, the President may, under this

1 section or other applicable authority, provide for appropriate
2 transfers of records, property, civilian personnel, and funds.

3 (b) Whenever any such transfer is made prior to Janu-
4 ary 1, 1982, the President shall transmit to the Speaker of
5 the House of Representatives and the President pro tempore
6 of the Senate a full and complete report concerning the
7 nature and effect of such transfer.

8 (c) After December 31, 1981, no transfer shall be made
9 under this section until—

10 (1) a full and complete report concerning the
11 nature and effect of such proposed transfer has been
12 transmitted by the President to the Congress, and

13 (2) the first period of sixty calendar days of regu-
14 lar session of the Congress following the date of re-
15 ceipt of such report by the Congress has expired with-
16 out the adoption by the Congress of a concurrent reso-
17 lution stating that the Congress does not favor such
18 transfer.

19 REPORTS TO THE CONGRESS

20 SEC. 13. (a) The Administrator shall transmit to the
21 President, who in turn shall transmit to the Congress in Jan-
22 uary of each year, a report which shall include a comprehen-
23 sive description of the activities and accomplishments of the
24 Service during the preceding calendar year together with an
25 evaluation of such activities and accomplishments in terms of

1 the attainment of the objectives of this Act and such recom-
2 mendations including recommendations for additional legisla-
3 tion as the Administrator deems necessary or desirable. The
4 President may transmit each such report to the Congress as
5 part of his report to the Congress as required under section
6 206 of the National Aeronautics and Space Administration
7 Act of 1958.

8 (b) No information which has been classified for reasons
9 of national security shall be included in any report made
10 under this section, unless such information has been declassi-
11 fied by or pursuant to authority given by the President.

12 COMPENSATION OF OFFICERS

13 SEC. 14. (a) Section 5314 of title 5, United States
14 Code, is amended by inserting at the end thereof the follow-
15 ing new paragraph:

16 "(70) General Manager, Earth Data and Informa-
17 tion Service, National Aeronautics and Space Adminis-
18 tration."

19 (b) Section 5315 of title 5, United States Code, is
20 amended by adding at the end thereof the following new
21 paragraph:

22 "(125) Deputy General Manager, Earth Data and
23 Information Service, National Aeronautics and Space
24 Administration."

1 AUTHORIZATION OF APPROPRIATIONS

2 SEC. 15. (a) There are authorized to be appropriated to
3 the Service such sums as may be necessary for the fiscal year
4 1980, for the purposes of carrying out the provisions of this
5 Act, including research and development, operations of the
6 Service, construction of facilities, and payment of personnel.
7 None of the funds appropriated pursuant to this Act may be
8 used for the acquisition or condemnation of any real property,
9 or the construction of any facility in excess of \$500,000
10 unless (1) a period of thirty days has passed after the receipt
11 by the Speaker of the House of Representatives and the
12 President of the Senate and the Committee on Science and
13 Technology of the House of Representatives and the Com-
14 mittee on Commerce, Science, and Transportation of the
15 Senate, of notice given by the Administrator containing a full
16 and complete statement of the acquisition or construction
17 proposed to be taken, or (2) each such committee before the
18 expiration of such period has transmitted to the Administra-
19 tor written notice to the effect that such committee has no
20 objection to the proposed acquisition or construction. Sums
21 appropriated pursuant to this subsection for the construction
22 of facilities, or for research and development activities, shall
23 remain available until expended.

24 (b) Any funds appropriated for the construction of facili-
25 ties may be used for emergency repairs of existing facilities

1 when such existing facilities are made inoperable by major
2 breakdown, accident, or other circumstances and such repairs
3 are deemed by the Administrator to be of greater urgency
4 than the construction of new facilities.

5 (c) Notwithstanding the provisions of this or any other
6 law, no appropriation may be made to the Service for any
7 fiscal year or portion thereof beginning after September 30,
8 1981, unless previously authorized by legislation hereafter
9 enacted by the Congress.

○

96TH CONGRESS
1ST SESSION

S. 875

To provide for the establishment, ownership, operation, and regulation of a commercial Earth resources information service, utilizing satellites and other technologies, and for other purposes.

IN THE SENATE OF THE UNITED STATES

APRIL 4 (legislative day, FEBRUARY 22), 1979

Mr. SCHMITT (for himself, Mr. PRESSLER, and Mr. YOUNG) introduced the following bill; which was read twice and referred to the Committee on Commerce, Science, and Transportation

A BILL

To provide for the establishment, ownership, operation, and regulation of a commercial Earth resources information service, utilizing satellites and other technologies, and for other purposes.

1 *Be it enacted by the Senate and House of Representa-*
2 *tives of the United States of America in Congress assembled,*

3 TITLE I—SHORT TITLE, DECLARATION OF
4 POLICY, AND DEFINITIONS

5 SHORT TITLE

6 SEC. 101. This Act may be cited as the "Earth Re-
7 sources Information Corporation Act of 1979".

1 DECLARATION OF POLICY AND PURPOSE

2 SEC. 102. (a) The Congress declares that it is the policy
3 of the United States to establish as expeditiously as practica-
4 ble a commercial Earth resources information service, which
5 will be responsive to public needs and national objectives,
6 and which will serve the Earth resources information needs
7 of the United States and other countries.

8 (b) The new Earth resources information service is to be
9 made operational as promptly as possible and is to dissemi-
10 nate timely, continuous and reliable Earth resources informa-
11 tion at the earliest practicable date.

12 (c) In order to facilitate this development and to provide
13 for the widest possible participation by private enterprise, the
14 Earth resources information service shall be in the form of a
15 private corporation, subject to appropriate governmental reg-
16 ulation. It is the intent of Congress that all persons and orga-
17 nizations, domestic and foreign, shall have nondiscriminatory
18 opportunity to purchase Earth resources information; and
19 that the activities of the corporation created by this Act and
20 of the persons or companies participating in the ownership of
21 the Earth Resources Information Corporation shall be con-
22 sistent with Federal antitrust laws.

23 (d) In recognition that Earth resources information is
24 gathered and disseminated by electronic means which utilize
25 similar technology and resources that now are utilized by

1 systems which are regulated by the Federal Communications
2 Commission, the area of regulatory responsibility granted to
3 said Commission shall be expanded to encompass regulation
4 of Earth resources information services.

5 DEFINITIONS

6 SEC. 103. As used in this Act, and unless the context
7 otherwise requires—

8 (a) The term "Earth resources information serv-
9 ice" refers to a system of satellites and other appropri-
10 ate data collecting systems, capable of monitoring
11 Earth and near-Earth resources, transmitting this raw
12 data to Earth receiving stations, the processing of this
13 data for use by the user organizations and the distribu-
14 tion of the processed data to those requesting it. This
15 is also to include such associated equipment and facili-
16 ties for tracking guidance, control and command func-
17 tions as are not part of the generalized launching,
18 tracking, control, and command facilities for all space
19 purposes.

20 (b) The term "corporation" means the Earth Re-
21 sources Information Corporation.

22 (c) The term "Administration" means the Nation-
23 al Aeronautics and Space Administration.

24 (d) The term "Commission" means the Federal
25 Communications Commission.

1 TITLE II—IMPLEMENTATION OF POLICY

2 SEC. 201. (a) In order to achieve the objectives and to
3 carry out the purposes of this Act, the President shall—

4 (1) aid in the planning and development and foster
5 the execution of a national program for the establish-
6 ment and operation, as expeditiously as possible, of an
7 Earth resources information service;

8 (2) provide for continuous review of all phases of
9 the development and operation of such a service, in-
10 cluding the activities of an Earth resources corporation
11 authorized under section 301 of this Act;

12 (3) coordinate the activities of governmental agen-
13 cies with responsibilities in the field of Earth resources
14 information so as to insure that there is full and effec-
15 tive compliance at all times with the policies set forth
16 in this Act;

17 (4) transfer to the corporation authorized under
18 section 301 of this Act, where consistent with national
19 security and the objectives of this Act, any functions
20 and parts of functions of any other Federal entity or
21 officer which relates primarily to the functions of the
22 corporation as provided by this Act; and in connection
23 with any such transfer, the President may provide for
24 appropriate transfers of records and property;

1 (5) exercise such supervision over relationships of
2 the corporation with foreign governments or entities or
3 with international bodies as may be appropriate to
4 assure that such relationships shall be consistent with
5 the national interest and foreign policy of the United
6 States;

7 (6) insure that timely arrangements are made
8 under which there can be foreign participation in the
9 establishment and use of an Earth resource information
10 service;

11 (7) take all necessary steps to insure the availabil-
12 ity of the Earth resources information service for gen-
13 eral governmental purposes and to insure that each
14 Federal entity which utilizes data and information of
15 the kind that are provided by the corporation shall pro-
16 cure such data and information from the corporation at
17 a just and reasonable price except where a separate
18 Earth resources information service is required to meet
19 unique governmental needs, or is otherwise required in
20 the national interest; and

21 (8) exercise such supervision over the corporation
22 to insure that advances in Earth imaging from space
23 will be permitted under controls and when such needs
24 are justified and assessed in relation to civil benefits,
25 national security, and foreign policy; and to establish

1 controls, as appropriate, on other forms of remote
2 Earth sensing.

3 (b) In order to achieve the objectives and to carry out
4 the purposes of this Act, the Administration shall—

5 (1) advise the Commission on technical character-
6 istics of the Earth resources information service;

7 (2) with the approval of the Commission approve
8 technical characteristics of the operational Earth re-
9 sources information service communication and non-
10 communication satellite systems, ground receiving sta-
11 tions and associated systems;

12 (3) cooperate with the corporation in research and
13 development to the extent deemed appropriate by the
14 Administration in the public interest;

15 (4) insure that the corporation takes an active
16 marketing role so that all Government agencies and
17 other users which might benefit from Earth resources
18 information are made aware of its availability and ap-
19 plications;

20 (5) consult with the corporation with respect to
21 the technical characteristics of the Earth resources in-
22 formation service;

23 (6) furnish to the corporation, on request and on a
24 reimbursable basis, satellite launching and associated
25 services required for the establishment, operation, and

1 maintenance of the Earth resources information service
2 satellite system; and

3 (7) to the extent feasible, furnish other services,
4 on a reimbursable basis, to the corporation in connec-
5 tion with the establishment and operation of the
6 system.

7 (c) In order to achieve the objectives and to carry out
8 the purposes of this Act, the Commission shall—

9 (1) insure effective competition, including the use
10 of competitive bidding where appropriate, in the pro-
11 curement by the corporation of apparatus, equipment,
12 and services required for the establishment and oper-
13 ation of the Earth resources information service; and
14 the Commission shall consult with the Small Business
15 Administration and solicit its recommendations on
16 measures and procedures which will insure that small
17 business concerns are given an equitable opportunity to
18 share in the procurement program of the corporation
19 for property and services, including but not limited to
20 research, development, construction, maintenance, and
21 repair;

22 (2) insure that all persons and organizations, do-
23 mestic and foreign, shall have nondiscriminatory oppor-
24 tunity to purchase Earth resources information under
25 just and reasonable prices, charges, classifications,

1 practices, regulations, and other terms and conditions;
2 provided that provision of such information shall be
3 subject to controls established under section 201(a)(8),
4 and further provided that such prices and charges will
5 cover the cost of the service exclusive of costs incurred
6 by the Administration for research, development and
7 testing on remote sensing systems, subsystems and
8 components carried out under the authority of the Na-
9 tional Aeronautics and Space Act of 1958;

10 (3) insure that subject to the controls established
11 under section 201(a)(8) all civilian information distrib-
12 uted by the corporation to any person or organization,
13 whether domestic or foreign, shall be complete and un-
14 abridged, and that no information shall be withheld
15 from one person or organization which is given to an-
16 other person or organization;

17 (4) prescribe such accounting regulations and sys-
18 tems and engage in such ratemaking procedures as will
19 insure that any economies made possible by an Earth
20 resources information service are appropriately reflect-
21 ed in charges for resources information;

22 (5) prescribe standards of quality, approved by the
23 Administration, for Earth resources information pro-
24 duced by the corporation, and set schedules for the
25 corporation's fulfillment of data requests;

1 (6) insure that the corporation allocates certain of
2 its time and resources to the development of improve-
3 ments in its services and in its products; and that ac-
4 tivities of the Commission, the Administration, and the
5 corporation are coordinated in this regard;

6 (7) require that additions be made by the corpora-
7 tion with respect to facilities of the Earth resources in-
8 formation service where such additions would serve the
9 public interest, convenience, and necessity;

10 (8) authorize the corporation to issue any share of
11 capital stock, except the initial issue of capital stock
12 referred to in section 304(a), or to borrow any moneys,
13 or to assume any obligation in respect of the securities
14 of any other person, upon finding that such issuance,
15 borrowing, or assumption is compatible with the public
16 interest, convenience, and necessity and is necessary or
17 appropriate for or consistent with carrying out the pur-
18 poses and objectives of this chapter by the corporation;

19 (9) insure that no substantial additions are made
20 by the corporation with respect to facilities of the
21 Earth resources information service unless such addi-
22 tions are required by the public interest, convenience,
23 and necessity;

24 (10) insure that the corporation maintains all
25 levels of operation and service now performed by the

1 Earth Resources Observation System Data Center;
2 and

3 (11) make rules and regulations to carry out the
4 provisions of this subsection.

5 TITLE III—CREATION OF AN EARTH RESOURCES
6 INFORMATION CORPORATION

7 CREATION OF CORPORATION

8 SEC. 301. There is authorized to be created an Earth
9 Resources Information Corporation for profit which will not
10 be an agency or establishment of the United States Govern-
11 ment. The corporation shall be subject to the provisions of
12 this Act and, to the extent consistent with this Act, to the
13 business corporation laws of the State in which it is incorpo-
14 rated. The right to repeal, alter, or amend this Act at any
15 time is expressly reserved.

16 PROCESS OF ORGANIZATION

17 SEC. 302. The President, no later than 2 years after the
18 enactment of this Act, shall appoint incorporators, by and
19 with the advice and consent of the Senate, who shall serve as
20 the initial board of directors until the first annual meeting of
21 stockholders or until their successors are elected and quali-
22 fied. Such incorporators shall arrange for an initial stock of-
23 fering and take whatever other actions are necessary to es-
24 tablish the corporation, including the filing of articles of in-
25 corporation, as approved by the President.

SEC. 303. (a) The corporation shall have a board of directors consisting of individuals who are citizens of the United States, of whom one shall be elected annually by the board to serve as chairman. Three members of the board shall be appointed by the President, by and with the advice and consent of the Senate, effective the date on which the other members are elected, and for terms of 3 years or until their successors have been appointed and qualified, except that the first three members of the board so appointed shall continue in office for terms of 1, 2, and 3 years, respectively, and any member so appointed to fill a vacancy shall be appointed only for the unexpired term of the director whom he succeeds. The three members appointed by the President shall be selected from the Earth resources data user community with the intent that they would provide representation of said user community on the board. One member each shall be appointed by the Department of Agriculture, the Department of Commerce, and the Department of the Interior, to be chosen and to serve as described above with regard to members appointed by the President. One member shall be appointed by the National Association of State Governors. Ten members shall be elected by all stockholders, and other such officers as may be named and appointed by the board, at rates of compensation fixed by the board, and serving at the

1 pleasure of the board. No individual other than a citizen of
2 the United States may be an officer of the corporation. No
3 officer of the corporation shall receive any salary from any
4 source other than the corporation during the period of his
5 employment by the corporation.

6 FINANCING OF THE CORPORATION

7 SEC. 304. (a) The corporation is authorized to issue and
8 have outstanding, in such amounts as it shall determine,
9 shares of capital stock, without par value, which shall carry
10 voting rights and be eligible for dividends. The shares of such
11 stock initially offered shall be sold at a price not in excess of
12 \$100 for each share and in a manner to encourage the widest
13 distribution to the public. Subject to the provisions of subsec-
14 tion (d) of this section, shares of stock offered under this sub-
15 section may be issued to and held by any persons.

16 (b)(1) Twenty percent of the shares of stock authorized
17 for issuance at any time by the corporation shall be reserved
18 for purchase by the Federal and State Governments. At no
19 time after the initial issue is completed shall the aggregate of
20 the shares of voting stock of the corporation owned by the
21 Federal and State Government exceed 20 percent of such
22 shares issued and outstanding, unless the corporation is
23 under-capitalized.

1 (2) At no time shall any stockholder other than the Fed-
2 eral Government own more than 10 percent of the share of
3 voting stock of the corporation issued and outstanding.

4 (c) The corporation is authorized to issue, in addition to
5 the stock authorized by subsection (a) of this section, nonvot-
6 ing securities, bonds, debentures, and other certificates of in-
7 debtedness as it may determine. Such non-voting securities,
8 bonds, debentures, or other certificates of indebtedness of the
9 corporation as a data distributor may own shall be eligible for
10 inclusion in the rate base of the distribution to the extent
11 allowed by the Commission. The voting stock of the corpora-
12 tion shall not be eligible for inclusion in the rate base of the
13 distributor.

14 (d) At no time shall more than an aggregate of 20 per-
15 cent of the voting stock of the corporation be owned by non-
16 United States citizens.

17 POWERS AND DUTIES OF THE CORPORATION

18 SEC. 305. (a) In order to achieve the objectives and to
19 carry out the purposes of this chapter, the corporation is au-
20 thorized to—

21 (1) plan, initiate, construct, own, manage, and op-
22 erate itself or in conjunction with foreign governments
23 or their designated entities a commercial Earth re-
24 sources information service;

1 (2) receive by transfer all functions of production
2 and operation which relate primarily to the functions of
3 the corporation as prescribed by this Act, which are
4 now carried out by other Government agencies includ-
5 ing those carried out by the Administration and the
6 Earth Resources Observation System Data Center;
7 such transfer of functions to also include appropriate
8 transfers of records and property;

9 (3) market Earth resources raw and preprocessed
10 data;

11 (4) own and operate Earth resources satellites,
12 aircraft and other appropriate data collection systems;

13 (5) own and operate ground receiving stations;
14 and

15 (6) own and operate information distribution cen-
16 ters for the provision of raw and preprocessed data.

17 (b) Included in the activities authorized to the corpora-
18 tion for accomplishment of the purposes indicated in subsec-
19 tion (a) of this section, are, among others not specifically
20 named—

21 (1) to conduct or contract for research and devel-
22 opment related to its mission;

23 (2) to acquire the physical facilities, equipment,
24 and devices necessary to its operations, including satel-

1 lites, aircraft, and associated equipment and facilities,
2 whether by construction, purchase, or gift;

3 (3) to purchase satellite launching and related
4 services from the United States Government;

5 (4) to contract with authorized users, including
6 the United States Government, for the services of the
7 Earth resources information service;

8 (5) to develop plans for the technical specifications
9 of all elements of the satellite system; and

10 (6) to procure from the private sector, insofar as
11 possible, the communications services needed to estab-
12 lish communication networks as may be necessary to
13 transmit Earth resources information to users.

14 (c) To market "value-added" Earth resources informa-
15 tion only through a subsidiary corporation which shall receive
16 no preference in any way whatsoever in comparison to other
17 entities which acquire raw and preprocessed data from the
18 corporation.

19 (d) To carry out the foregoing purposes, the corporation
20 shall have the usual powers conferred upon a stock corpora-
21 tion by the laws of the State in which it is incorporated.

22 TITLE IV—MISCELLANEOUS

23 FOREIGN BUSINESS NEGOTIATIONS OF THE CORPORATION

24 SEC. 401. Whenever the corporation shall enter into
25 business negotiations with respect to facilities, operations, or

1 services authorized by this chapter with any international or
2 foreign entity, it shall notify the Department of State of the
3 negotiations, and the Department of State shall advise the
4 corporation of relevant foreign policy considerations.
5 Throughout such negotiations the corporation shall keep the
6 Department of State informed with respect to such consider-
7 ations. The corporation may request the Department of State
8 to assist in the negotiations, and that Department shall
9 render such assistance as may be appropriate.

10

SANCTIONS

11 SEC. 402. (a) If the corporation created pursuant to this
12 Act shall engage in or adhere to any action, practices, or
13 policies inconsistent with the policy and purposes declared in
14 section 201, or if the corporation or any other person shall
15 violate any provision of this Act, or shall obstruct or interfere
16 with any activities authorized by this Act, or shall refuse,
17 fail, or neglect to discharge his duties and responsibilities
18 under this Act, or shall threaten any such violation, obstruc-
19 tion, interference, refusal, failure, or neglect, the district
20 court of the United States for any district in which the corpo-
21 ration or other person resides or may be found shall have
22 jurisdiction, except as otherwise prohibited by law, upon peti-
23 tion of the Attorney General, to grant such equitable relief as
24 may be necessary or appropriate to prevent or terminate such
25 conduct or threat.

1 (b) It shall be unlawful for any person, directly or indi-
2 rectly, in any manner other than through the channels of data
3 dissemination established by the Commission and the corpo-
4 ration, to sell or disclose to any other person any Earth re-
5 sources information which is compiled by the corporation.

6 (c) Nothing contained in this section shall be construed
7 as relieving any person of any punishment, liability, or sanc-
8 tion which may be imposed otherwise than under this chap-
9 ter.

10 (d) It shall be the duty of the corporation to comply,
11 insofar as applicable, with all provisions of this Act and all
12 rules and regulations promulgated thereunder.

13 REPORTS TO THE CONGRESS

14 SEC. 403. (a) The President shall transmit to the Con-
15 gress in January of each year a report which shall include a
16 comprehensive description of the activities and accomplish-
17 ments during the preceding calendar year under the national
18 program referred to in section 301, together with an evalua-
19 tion of such activities and accomplishments in terms of the
20 attainment of the objectives of this Act and any recommenda-
21 tions for additional legislative or other action which the
22 President may consider necessary or desirable for the attain-
23 ment of such objectives.

24 (b) The corporation shall transmit to the President and
25 the Congress, annually and at such other times it deems de-

1 sirable, a comprehensive and detailed report of its operations,
2 activities, and accomplishments under this Act.

3 (c) The Commission shall transmit to the Congress, an-
4 nually and at such other times as it deems desirable, (i) a
5 report of its activities and actions on anticompetitive prac-
6 tices as they apply to the Earth resources information serv-
7 ice; (ii) an evaluation of such activities and actions taken by it
8 within the scope of its authority with a view to recommend-
9 ing such additional legislation which the Commission may
10 consider necessary in the public interest; and (iii) an evalua-
11 tion of the capital structure of the corporation so as to assure
12 the Congress that such structure is consistent with the most
13 efficient and economical operation of the corporation.

14 AUTHORIZATION FOR APPROPRIATIONS

15 SEC. 404. There are authorized to be appropriated to
16 the President, for purposes of carrying out the provisions of
17 section 304(b)(1), sums not to exceed \$20,000,000 for the
18 fiscal year ending September 30, 1981.

[From the Wall Street Journal, Apr. 5, 1979]

EYES IN THE SKY

NASA FINDS MANY BUYERS FOR SATELLITE PICTURES AND PLANS NEW, MORE-REVEALING
LANDSATS IN 1980'S

(By Arlen J. Large)

WASHINGTON—The space age has already spawned one entire industry made up of companies that traffic in beeps from communications satellites. Now a second industry is springing up around camera-carrying satellites that take pictures of the surface of the earth.

Orbiting 570 miles overhead are two Landsat satellites owned and operated by the National Aeronautics and Space Administration. They take pictures of nearly every spot on the globe, and the government sells the images, in various forms, to anyone who wants to pay the nominal price.

In its present phase, the "remote sensing" industry consists of companies that interpret the Landsat pictures as an aid to oil and mineral exploration, crop forecasting, forest inventories and decisions on where to put new factories.

"There's already an industry that's functioning, and others are coming in," says Martin Matthews, a geologist at Gulf Oil Corp.'s science and technology laboratory near Pittsburgh. Like several big oil companies, Gulf buys Landsat data from the government's sales outlet at Sioux Falls, S.D., for computer analysis of broad-scale geologic features that hold promise of oil.

FAULT-FINDING

When Baltimore Gas & Electric Co. decided to build a nuclear generating plant at Perryman, Md., near Chesapeake Bay, it hired the consulting engineering firm of Dames & Moore to check out the site. Any hint of a geologic fault in the neighborhood would assure a veto by federal regulators. Dames & Moore bought winter and early-spring Landsat images of the Perryman area, to see if the low sun angle would reveal any suspicious fault traces warranting further investigation on the ground.

"We use Landsat as a reconnaissance tool," says Donald Beccasio, of the consulting firm's Washington office, which did the work. "We didn't find any lineaments at Perryman that were of major concern."

Increasingly sophisticated picture-satellites are planned for the 1980s. Because of them, the remote-sensing industry is expected to evolve into new phases, probably with a reduced role for government.

NASA and a group of oil- and mineral-exploration companies are already talking about a plan for joint financing of a \$100 million satellite having extremely sharp stereoscopic vision. Beyond that, the government is considering turning ownership and operation of the picture-satellites themselves over to a new, quasi-private, for-profit company. It would be patterned after Communications Satellite Corp., chartered by Congress in the 1960s to exploit the government's research in that field.

A Comsat-type picture-satellite company is "a very strong possible contender," NASA boss Robert Frosch has told Congress. Space-agency officials are having informal talks with experts of Citibank and other New York financial institutions on the likely shape of such a company.

Even so, critics say the Carter administration is taking too long to make up its mind about the future direction of the remote-sensing industry. By law, NASA is supposed to be a research agency, not in the business of running a permanent "operational" system of taking earth pictures. To many, this legal limitation gives the current flow of Landsat pictures a disquietingly tenuous status.

"Many potential users refrain from making necessary investments for the use of remotely sensed data because they fear the experimental system will be abandoned by the government," says Democratic Sen. Adlai Stevenson of Illinois, chairman of the Senate subcommittee that oversees NASA. He's sponsoring a bill instructing the space agency to run an "operational" Landsat program for seven years before deciding whether to turn it over to some other organization.

Playing for time, administration officials put down the "operational" Landsat question as a semantic quibble. NASA's Mr. Frosch insists the program will look just the same in the years just ahead whether it wears an "experimental" or an "operational" label. Presidential science adviser Frank Press assures customers that the data gathered by Landsat satellites will continue to be available "through the 1980s."

POLAR ORBITS

Earth images from Landsats have been available since the first one was put into orbit in 1972. It finally wore out early last year, but two replacement satellites currently are operating, circling the earth in a pole-to-pole orbit 14 times a day. The pictures, covering a square patch 115 miles on each side, are taken at 9:30 a.m. local time to provide consistent illumination for a given season.

Private industry buys 30 percent of the images (or digital-tape data for computer processing), with 24 percent ordered by the federal government, 18 percent by state and local governments and private individuals, 16 percent by schools and colleges and 12 percent by foreign nations. For its customers the Sioux Falls sales center can draw on an inventory of 1.3 million Landsat frames. A nine-inch color print costs \$12.

"There's no question that the mineral and petroleum companies are already making money off Landsat," say Pitt Thome, a NASA specialist on earth sensing. Exploration geologists use the images to spot promising broad-scale features that otherwise would be overlooked on aerial photographs or ground mapping. The images, for example, are being used by U.S. companies looking for oil in China. "Landsat data are the only data they have on China," Mr. Thome says.

CROP FORECASTING, TOO

"In oil exploration there's no better tool for covering the earth than satellite observation," says Earl Merritt, vice president at Earth Satellite Corp., a Washington-based company that interprets Landsat data for private clients. The company is predictably closed-mouthed about places these clients are interested in, but, says Mr. Merritt, "We can point to locations that wouldn't have otherwise been explored for oil."

Earth Satellite Corp. also uses Landsat data as one element in an elaborate, computerized crop-forecasting service for commodities traders, grain exporters and food processors. Crop forecasting for private clients also is one of the services offered by Lockheed Electronics Co., a subsidiary of Lockheed Corp., which last summer opened a new laboratory in Houston for processing Landsat data.

"What is important is the continuity of data and the timeliness of data," says Robert Tokerud, manager of the Lockheed lab. But "timeliness" has been a sore point between the government and its Landsat data customers, especially those seeking up-to-date pictures of crop conditions.

Depending on orbital position, signals from the two Landsats are sent to earth receiving stations in Alaska, California or Maryland. Tapes then go by air freight to NASA's Goddard Space Flight Center just outside Washington, where they're put through a computer for processing. Images and digital tapes are then flown to the U.S. Geological Survey's Sioux Falls sales center. In all, it is between 30 and 60 days from the time Landsat snaps an image until the arrival by mail of a customer's picture.

QUICKER DELIVERY

To speed things up, NASA is just now putting into operation a new data link using and RCA-owned communications satellite. Instead of flying tapes around, NASA will transmit the Landsat data from its ground stations to Goddard, then to Sioux Falls by way of circuits on the RCA satellite. Officials hope this will allow delivery of the pictures in a third of the current time.

The Geological Survey's sales of Landsat pictures rose steadily from 81,000 frames in 1973 to a peak of 249,000 in 1976, but since then business has fallen off. Officials attribute this partly to a 50 percent price increase for the prints since 1976 and partly to former customers' satisfaction with what they already have. The survey expects sales to pick up again when more precise, more revealing data become available from new picture satellites planned for the 1980s.

The first of these is called Landsat D and is scheduled to be launched in 1981. Like the previous three, it's being built by General Electric Co. The \$77 million spacecraft will have considerably improved vision, being able to detect objects as small as 30 meters across, compared with the 80-meter resolution of the existing Landsats.

PICTURES IN 3-D

Planned for the mid-1980s is Stereosat, the most elaborate picture-satellite yet. As the name implies, it will provide three-dimensional images of geologic structures. The first four Landsats have been designed to take their pictures in an array of colors that are of primary interest to crop forecasters, but Stereosat is being designed especially for the geologists. It will have the sharpest resolution yet for a civilian picture-satellite, 10 to 20 meters, which may be approaching the undisclosed

limit set by the National Security Council to protect the turf of the government's supersharper military spy satellites.

NASA is being coaxed on Stereosat's technical requirements by a unique organization called the Geosat Committee, made up of 100 companies that specialize in oil and mineral exploration. The space agency, looking for new financial arrangements for the remote-sensing industry, has suggested that these beneficiaries pony up the entire \$100 million cost of Stereosat.

"That's just not in the cards," says Frederick Henderson, the Geosat Committee president. "You can't get front-end money out of our companies and then turn around and make the data available to their competitors." He proposes instead that NASA pay the entire cost of putting up Stereosat, and then charge prices high enough to recoup at least half of it from the customers.

NASA, or some sort of private company that takes its place in the picture-satellite business, will in a few years feel the pressure of foreign competition. Both France and Japan are planning to send up remote-sensing satellites in the mid-1980s to provide pictures to world-wide customers, just as NASA does. "The competition," says NASA's Mr. Thome, "will be a good thing for people looking for a wide variety of data."

Senator STEVENSON. It is a pleasure to welcome two good friends and familiar witnesses before this subcommittee, Dr. Frank Press, Director of the Office of Science and Technology Policy of the Executive Office of the President; and Dr. Robert Frosch, the Administrator of NASA.

May we proceed with you, Dr. Press. If you would like to summarize, I would be happy to enter your full statement.

Senator SCHMITT. Mr. Chairman, if I may just interrupt Dr. Press for a moment and say, in an unrelated context, I want to thank Dr. Press for what I presume was a significant involvement in the President's recent energy decisions. I think that on balance they go a long way toward the beginning of the solution of some of our major problems. I think he and his staff and others who work with him should be complimented for their efforts.

STATEMENT OF FRANK PRESS, DIRECTOR, OFFICE OF SCIENCE AND TECHNOLOGY, OFFICE OF THE PRESIDENT

Dr. PRESS. Mr. Chairman, Senator Schmitt, as usual, I appreciate the opportunity to appear before this committee.

As you know, the executive branch has completed two major reviews on space policy, and important components of these reviews were the remote-sensing issues, the problems associated with them, and the associated institutional arrangements.

These reviews provided the administration with significant insight and understanding about the direction of remote sensing, the topic of today's hearings. During my presentation I will describe the initiatives we are taking, and I will also respond to proposed legislation to establish an institutional framework for acquiring and distributing remote-sensing data.

The United States has derived and will continue to derive many benefits from space applications. These benefits will serve to meet needs and objectives in the areas of national defense, foreign policy, social policy, and the economy. Remote sensing from space contributes to national needs in a number of ways, and I won't go over each of them, since you know them well.

With regard to land programs, the United States operates two land-imaging satellite activities for different purposes: A national security effort; and the open civilian program, or Landsat. The classified effort is designed to support national security needs. The administration, however, has encouraged wider application of

space-related data and products at lower or no classification where possible, to permit broader use of our national space capability. Multispectral Landsat data are now the only satellite imagery routinely available for general use.

In 1972 NASA launched the first experimental remote-sensing R. & D. satellite, designed to study the Earth's surface features. The Landsat program has experimented with the value of multispectral observations from space. Landsat D, approved for launch in late 1981, has a program life through the end of 1984. Landsat D-1 is planned as a backup for Landsat D and could be used to extend data to the end of 1985. There are a number of domestic applications of Landsat in agriculture, mapping, energy, land-use management, private oil and mineral exploration, forest management, land-use classification, and so on.

Cooperative international activities undertaken by the United States using Landsat have involved many countries. Under the present U.S. policy of data dissemination, Landsat data has been provided to any requester at nominal charge, reflecting the cost of reproduction. That's not the entire cost, but simply the reproduction cost of the data.

In addition to applying Landsat-derived natural resource information in the traditional development projects, the U.S. Government has bilateral programs to build up national remote-sensing laboratory centers in less developed countries. This is called "Project AIDSAT," which helped establish three regional remote-sensing training and user-assistance centers, funded primarily by AID. Foreign receiving stations have been built by Canada, Sweden, Brazil, Italy, Iran, and Japan. Three countries have ground stations under construction, and eight other countries have indicated their intention to establish such stations. To date, no direct U.S. funding has been used to support the development of a foreign Landsat receiving station.

Landsat has many purposes, and no single one has emerged more dominant than any other. One problem is the lack of a clear focal point in the Government which can aggregate user requirements for remote sensing and other resources data. On the other hand, as demonstrated by the increasing number of foreign ground stations, Landsat has generated considerable overseas interest, especially in developing countries.

Private sector involvement in remote sensing, especially in the oil and mineral industries, is evidenced by their interest in Landsat and other follow-on satellite capabilities such as the stereoscopic large format camera.

The President is committed to the continuity of remote-sensing data for several applications through the 1980's. He has so stated in his fiscal year 1980 budget submittal and his recent message to Congress on science and technology. This should assure those seeking a commitment to an operational remote-sensing system of the administration's intent to give remote-sensing technology every reasonable chance to develop its full potential.

Specific details and configurations of this system and its management will evolve over the next several years. There are various options for providing a continuing flow of space imagery to civil users. These range from a system based on sensors derived from

Landsat technology to a yet unspecified technology mix of civilian and other imaging capabilities. To investigate further the value of satellite data for monitoring agricultural crop conditions, the President has approved the requests for funding for the Departments of Agriculture and Commerce, NASA, and AID, to initiate a 6-year research program in worldwide agricultural production forecasting. This is a positive indication that civilian user agencies are willing to expend their own funds to explore remote-sensing applications. The program is outlined in the fiscal year 1980 budget requests of these agencies, which you have now had the opportunity to examine.

I will skip over the atmospheric programs part of my remarks because they will be covered by NOAA.

The oceans programs: As you know, Seasat 1 was launched in mid-1978, the first civil remote-sensing R. & D. satellite exclusively dedicated to studying the oceans dynamic features. Such data would contribute to improved ship routing and coastal disaster warning. In addition, maps of ocean current patterns and temperatures will be used in fishing, pollution dispersion, iceberg hazard avoidance, and local climate studies.

Several Federal agencies have funded selected scientific experiments using Seasat data. While Seasat 1 data was available for only a short period of time, user benefits were verified. Wide-scale ocean observations, which are needs of the Navy, NOAA, and others, might be met from a program called the "National Oceanic Satellite System," or NOSS, the administration supports an integrated approach in principle, and we are looking into the matter in order to implement that.

Integrated remote-sensing systems: Until now, civil space programs for the observation of the atmosphere, the land, and the sea, have been conducted more or less separately. However, there are new developments and considerations that make the establishment of an integrated national system for observing the Earth worthy of consideration.

The global and political nature of remote sensing from space requires proper focus and Government organization and regulation. There have been a number of R. & D. organizations, two operating organizations, and AID, making international arrangements.

The President, as a consequence of these developments and a desire to maintain American leadership in space technology, has directed NASA to chair an interagency task force to examine options for integrating current and future potential systems into an integrated system. The review is to cover technical, programmatic, and institutional arrangements. This review will be completed by the fiscal year 1981 budget cycle. The issue of organizational arrangements for designation of a single lead agency with operating responsibilities for future civil remote sensing activities will be considered as part of this review.

Private sector involvement: To date, remote sensing activities have been primarily a Federal function. Several private sector companies and groups have recently expressed interest in the commercial exploitation of Earth resources satellites. Some would like to be able to sell proprietary imagery to any prospective purchaser. Others would like to see remote-sensing spacecraft specifically de-

signed to carry out certain missions of interest to private companies.

Private sector roles include broad range possibilities: management of space segments and provision of commercial services; delegated operational responsibility for major components of remote sensing ground systems—for example, data reception and processing center marketing and pricing; normal contractor roles in providing contractual services on products and in building hardware and software, and the provision of services derived from remote sensing data.

Previously more active participation in the private sector and remote-sensing activity was discouraged because of national security problems. The President's decisions announced in June 1978 provided the basis for more active but Government supervised private sector roles.

Higher resolution imagery that would be attractive to selective industrial, commercial, and public agency and individual users is now possible.

In October 1978, the President directed NASA and Commerce to actively explore private sector emerging interests, roles, and conditions of Government control. This effort is being pursued in parallel with the integrated systems study mentioned earlier.

In summary, although much experience has been gained, the configuration of future remote-sensing systems, in our view, still needs further comparative study before institutional framework and desired technological mix experience suggests that integrated systems are practical.

Therefore, as I mentioned before, the President has directed that a comprehensive plan covering expected technical programmatic private sector and institutional arrangements be developed.

These interagency task forces, with emphasis on user and agency requirements, will examine options for integrating current and future potential systems into a plausible integrated national system.

We believe this cautious approach is necessary. The potential to involve the private sector, for example, has not been adequately explored or emphasized to date. The private sector interest is a rather new one and is developing rather fast.

The President's decision to commit to continuity of remote imagery data for civil applications through the 1980's will allow task forces outlined earlier to develop serious alternatives for consideration in the next session of the Congress.

This permits, we believe, the necessary flexibility to best meet remote sensing data requirements. Importantly, it will allow adequate time to benefit from the congressional deliberations.

Mr. Chairman, as evidenced by the extensive administration activity in land, atmospheric, and ocean remote sensing that I have discussed today, I believe the executive and legislative branches are on a convergence path with respect to the future of remote sensing.

S. 663 defines an interim period of 7 years to develop institutional, financial, technical, and marketing capabilities of the service.

This is precisely what the interagency task force, as I mentioned earlier, is trying to define. S. 663 also recognizes this will be an

evolutionary process, and the Government could play a variety of roles.

The bill appropriately leaves these decisions open for the future. We plan to carry out many of the bill's provisions and will pursue critical investigations with or without specific legislation.

The President's commitments—public commitments—in this area demonstrate his strong support. The administration is committed to an operational remote sensing system, although yet undefined.

The technology mix and institutional arrangements will evolve over time. Because of this convergence of views, the administration believes that legislation is not needed to continue the program activities that have been described today.

More appropriately, we would extend the offer to work closely with Congress, as we have in the past, on completion of the task force review so as to develop mutually acceptable legislation in the next session of Congress.

Senator Schmitt's bill was just introduced this past Thursday, and we felt it was not desirable to comment on it until after its submission.

My own view, having looked at the bill, is that it asks for a commitment to a very specific form of management and operational status which we believe is premature in the light of all the ferment that's going on—the ferment in the form of new private sector interest for commercialization of remote sensing; the renewed and expanded interest by domestic agencies putting up their own budgetary funds for remote-sensing applications; the expanded foreign interest in remote sensing; the review by NASA and the Department of Commerce, which is now in a mature stage, for finding means to encourage private sector involvement—for all of these reasons, especially because the technology is still evolving, we feel that to make a commitment at this time to a very specific form of management would be premature.

Senator STEVENSON. Thank you, Dr. Press. Your full statement will be entered into the record.

I understand you must leave shortly, so I think it would be better to go ahead with questions to you and then hear from Dr. Frosch.

Dr. PRESS. Thank you, Mr. Chairman.

Senator STEVENSON. I commend you and the administration for that statement. I quote: "The administration is committed to an operational remote sensing system."

It is the most forthcoming, definitive statement of commitment and purpose on this subject by the administration to date. With that statement, we should be able to stop debating whether there should be a remote sensing system and get on with the business of developing the institutional framework for such a system.

I trust that, in that work, you will be prepared to cooperate with the Congress. As you know, these bills are pending. I would be prepared to hold back, at least temporarily with mine, if I can assume full cooperation between ourselves and the Congress in developing that framework.

Dr. PRESS. That's our intention. As you know, your bill particularly influenced the movement in this direction. I think you will find that our intent is very close to your own.

Senator STEVENSON. I think, Dr. Press, what concerns me most is the suggestion, at least by implication, that the development of the institutional framework and what you call the "technological mix" have to go hand in hand, or simultaneously.

Now that's not the way the Europeans are operating. That's not the way ESA is doing it. It certainly isn't the way the United States went to the Moon. The Government decided it was going to the Moon, and the technology followed.

Did I misunderstand you or are we going to make a commitment now and get on with the institutional framework, and then let the institution in charge dot all the "i's" and cross the "t's" and get the technology together?

It's the institutional framework that comes first, isn't it?

Dr. PRESS. As your own legislation will offer an interim period of some 7 years to determine specifically the market, the institutional and technological requirements, we believe that should be done.

So far as the Europeans are concerned, they're starting in a position so far behind us that all of their activity right now is an effort just to get going. The resources that we commit to remote sensing and other applications of space far exceeds all that they do together. It far exceeds the European and Japanese budgets in this area, and I have no doubt that based upon the great demand for Landsat data, the growing demand from all over the world, that we'll maintain that leadership position both technologically and in the services that we offer.

So I for one am not overly worried about the growing interest of other countries—the Soviet Union, the European nations, Japan—in remote sensing. We should never have thought we could keep them out of this; it's too important. But by maintaining technological leadership and offering services, making a commitment to continuity of data throughout the next decade, and recognizing that an operational decision including institutional arrangements will have to be made in the next few years, doing all of these things I think will maintain our leadership position.

Senator STEVENSON. Well, Dr. Press, they don't stay behind for very long. The Japanese are now developing very successfully, according to the projected economic models that we have, more technology and transferring it to industrial application.

The French are going to be selling stereoscopic graphic images in a very few years. It's this complacency that does it to us. We could stay ahead, but others are catching up. And let me just add, in connection with my bill, that it first establishes the service in NASA and then we can get on with it, with the technology, the decisions in the Federal and private sector and the rest.

I don't know what the timeframe may be, but do you expect under the administration approach to make a decision on the institution by the end of this year?

Dr. PRESS. I wouldn't like to guess on the timeframe. I think we want to understand all the issues. And I mentioned before, they need to be fully comprehended before we make that commitment.

I can't conceive that this administration or succeeding ones would allow remote-sensing technology of other countries to supersede our own and become technologically more advanced.

As you know, the President's commitment to maintaining leadership includes and subsumes remote sensing as one of the many areas in space where we want to maintain leadership.

So I'm not as concerned that we will lose our leadership position. I think when I see all of the possibilities that we're looking at in terms of integrated systems and all sorts of new technology for remote sensing to do things that we're not now doing, like soil moisture content, forest management, and so on, that these needs, these applications will push us and will push technology to the limit.

And so maintaining technological leadership and therefore possibly commercial leadership in this area is, I think, on everybody's mind. And I'm just not worried that we will lose that position.

Senator STEVENSON. If you'd make a commitment and put somebody in charge, I wouldn't be, either. But I have my doubts that somebody is in charge.

I know there are feelings widespread within the administration that are sympathetic to my own. I just can't for the life of me understand all the reasons for delay, when everybody I've talked to in the administration agrees that we've already waited 2 years; we've already lost 2 years and wasted 2 years.

There are many within this administration that would like to go to the U.N. Conference for Science and Technology for Development in August with a proposal for an operational system that would involve other countries, peacefully. We're already being attacked because of our other uses of space by the suspicions and resentments which they create. Couldn't we get a decision from the administration and a program in time for the U.N. Conference?

Dr. PRESS. Mr. Chairman, it doesn't buy you anything to go to that meeting in Vienna next August, because those countries that want the data, they want the training, they want the systems, and they can get them right now. They can make their own investments in this technology, because we have agreed to a continuity of these data through the years ahead.

I think it's a question of R. & D. management whether one wants to freeze the institutional arrangements when the technology is changing almost every year, and when the kinds of interest groups who are now becoming involved with Landsat, when that mix is changing every year.

A year ago, or a year and a half ago, I couldn't find a commercial company that was willing to consider commercial involvement in remote-sensing systems. Their views are now changing.

A year ago, many of the mineral and oil companies would come to my office and say, "You owe us a certain kind of technology for remote sensing because we're taxpayers and we don't want to pay anything for what we want to come out of public funds."

But today they're saying, "We would consider other kinds of arrangements, and possibly paying for some of the realistic costs of some of the data, with guaranteed buys," and all sorts of other things like that.

When things are changing so rapidly, on those occasions one shouldn't freeze the institutional arrangements. That's our management position.

Senator STEVENSON. Dr. Press, I'm not suggesting we freeze anything. I'm just suggesting we get a lead agency and get going, and defer the decisions on the major role of the private sector until later.

Well, I am encouraged on the one hand, but discouraged on the other. I don't know how much patience there is up here. I tentatively would be willing to just wait out the balance of this year for a firm start with a lead agency, but no longer than that, before pressing for legislation.

Legislation, in time, will probably be necessary, but I hope this could be a cooperative decision, and by the end of the year at the latest, let's identify the agency that's going to be in charge. Above all, let's get going with the institutional decisions.

Senator Schmitt?

Senator SCHMITT. Thank you, Mr. Chairman. I hope you won't let up on the pressure.

We've been "studying" Earth resources issues for a very large number of years. We've heard very much the same testimony this year as we heard 2 years ago. And I just don't see, along with you, why it is such a difficult birth to undertake.

Dr. Press, I'm a little bit disappointed that you did not comment more specifically on S. 875. We made a draft available to you, to your office, several weeks ago—a couple of weeks ago, anyway—and it's not that much different than the bill I introduced last year.

There are some basic questions of policy that it addresses. I would just add, as an aside, I don't think the issue of freezing technology is a real issue. I didn't think so 2 years ago and I still don't.

You're always going to freeze some technology, but that doesn't mean that you can't develop new technology. If that's going to be the argument against an operational system, whether publicly or privately owned, then we'll never have an operational system; we'll never freeze technology.

The arguments that you gave at the end of your testimony against a private investor-owned corporation to me sound like arguments for such a corporation. And if we had followed such lines of logic, I'm sure we would not have created Comsat.

There are major differences, as I hope I have always recognized, between communications and Earth resources information, in terms of the market and the maturity of the market, but with the number of years now under our belt with the interest from both the public and the private sector in operational data and a guarantee of operational data, it seems to me that we can move along those lines.

Now, could you be specific on why you have a reluctance to endorse or really apparently even strongly consider an investor-owned corporation along the lines of Comsat for the operation of Earth Resources Information Service?

Dr. PRESS. The Comsat decision is a good analog, because Comsat was created to fill an important need. Comsat became a commer-

cial success in the sense that it doesn't require Government subsidies. It charges commercial prices, has aggregated a market, and makes sufficient money to keep the technology viable and all the services—improve services over time.

We're not sure that an analog of Comsat operating in the area of remote sensing would be that successful at this time.

We don't know that if you were to charge realistic prices for remote sensing data, what it costs, including the R. & D. and the launch and construction and everything, we don't know whether that market would disappear or not, or whether very large subsidies would be required. We want to understand all of these things, including the others that I mentioned in terms of the impact of the Shuttle on remote sensing, in terms of the impact of the transfer of knowhow from previously unavailable sectors to remote sensing.

All of these things have to be understood well before we launch such an operation, if this is the way we choose to go of a semi-public company to operate remote sensing. To do it prematurely could invite a disaster that could set remote sensing back for many years.

So why make that decision now at a time when everybody is receiving the kind of data they want when they can write to Sioux Falls, Goddard, or elsewhere and get precisely what they need? Before I came to Government, I was a user of remote-sensing data. I had no problem getting what I wanted. It was very well set up. It was very smooth, and that's the case for any State government, any private company, any foreign country that wants access to use data.

So the data for remote sensing are being supplied; the technology is being improved, but we don't know enough about whether a specific mechanism, as you suggest, will be successful to launch it at this time. We want to understand it better.

Senator SCHMITT. Dr. Press, I think we will hear some disagreement in these hearings as to whether the public and private entities are getting what they need from the remote-sensing services now in existence. I frankly don't see why you think we might have a disaster if we began a commercial operation now.

The best way to find out what to do in the marketplace is to begin to work in the marketplace. I don't see what's going to happen over the next year, 7 years, or 10 years of Government activity in this area that's going to change the situation. You're eventually going to have to fish or cut bait.

You're either going to have to go commercial or you're going to have to keep the management entirely within the public sector. With the growing market here and abroad, private and public, with the sophistication of technology and the great potential of remote sensing—and I think it's an obviously rapidly accelerating demand—it sounds like there is a marketplace. It's a place where an investor-owned enterprise could do very well and sort some of these things out far faster than we're ever going to sort them out in the Government because we don't understand the marketplace.

That's one thing that this Government doesn't understand: the marketplace; otherwise, we wouldn't have some of the problems we have in energy and elsewhere. I think it's going to take awhile for us to reach an accommodation with this.

What I would like to request is that you or your staff provide us with detailed comments on S. 875. There are some major questions on the functional transfer. What do you transfer if we went commercial? Or even what do you transfer if you go operational within the Government? What are the functions? Does Sioux Falls become part of that operation? Should the Government and private enterprise be required to purchase from that organization?

You have to guarantee that market in order to create a viable system. I don't have an answer to that. I would like very much if we could get your detailed comments on this, at least from the perspective of your office. We'll be asking those kind of questions later.

I know you have to go, Dr. Press, but I will be submitting some questions to you for the record.

Thank you.

Senator STEVENSON. Let me just emphasize again, Dr. Press, we're not looking for a final decision on anything. I think Senator Schmitt and I both agree that we do need at least an interim institutional decision to get this process started. And over time—I suggested no more than 7 years—I believe some final decisions, including some final institutional decisions, should be made. But if we don't get that interim decision made soon on our lead agency, I don't see anything else that will follow.

There has to be a lead agency. The establishment of Comsat was made at a time when technology in that case wasn't nearly as far advanced as the technology is in this case. A.T. & T. at that time was saying that telephonic reception from geosynchronous orbits was impossible. But the commitment was made, and it became possible. I don't know about Senator Schmitt or anybody else, but my present intention is to hold off pushing my bill until the end of the year. But if there isn't that decision on the interim institutional question by then, I'll suggest to my colleagues up here that we make the effort in Congress and get a bill passed early next year.

Senator SCHMITT. Mr. Chairman, I hope that certainly there would be no more than a delay until the end of the year or whenever the subcommittee reports to the full committee. I would prefer us taking all the necessary legislative steps, at least up to the final report, and a full committee markup, so at least we have gone through that process and we've done the thinking, so that if no action is forthcoming on the part of the administration we can take that action promptly. If nothing else, we may keep the pressure on the administration.

Senator STEVENSON. As I said earlier—I'm sure Senator Schmitt would agree—we'd like to cooperate and we'll try to. If you reciprocate, we'll work on this together; and as we go along, decide what, if any, action is necessary. I hope that such legislation that is required will also be the product of cooperation. But if cooperation hasn't produced that interim decision by the end of the year or if it looks as if it's not going to before the end of the year, well, we should get started.

Senator SCHMITT. I think you and I could come to some kind of accommodation on the two bills, at least for that certain time-frame, and I would like to see us continue to try and do that.

Now, if necessary, early next year you could introduce a bill. Hopefully, it won't be necessary. I agree with you. But I'm afraid it may be.

Senator STEVENSON. Dr. Press, thank you again for your promises of cooperation, and for that commitment. It's very encouraging.

Dr. PRESS. Thank you, Mr. Chairman.

Senator STEVENSON. I don't like to denigrate it by suggesting that it isn't quite encouraging enough or as much as we'd hoped for. Thank you, sir.

[The statement follows:]

STATEMENT OF DR. FRANK PRESS, DIRECTOR, OFFICE OF SCIENCE AND TECHNOLOGY
POLICY, EXECUTIVE OFFICE OF THE PRESIDENT

Mr. Chairman, Senator Schmitt, members of the committee, I appreciate this opportunity to appear before the subcommittee on Science, Technology, and Space. As you know, the Executive Branch has completed two major reviews of space policy. Central to these reviews were serious considerations of remote sensing issues, problems, and associated institutional arrangements. These space policy reviews provided the Administration with significant insight and understanding about the direction of remote sensing—the topic of today's hearings. During my presentation I will describe the initiatives this Administration is taking in remote sensing. I will also respond to proposed legislation to establish an institutional framework for acquiring and distributing remote sensing data.

BACKGROUND

The United States has derived and will continue to derive many benefits from space applications. These benefits will serve to meet needs and objectives in the areas of national defense, foreign policy, social policy, and the economy. Remote sensing from space contributes to national needs and goals, including:

Contributing to national security in support of a wide variety of military and arms control verification activities.

Assessing and managing domestic and foreign resources for economic development, energy sources, conservation, world's food supply, etc.

Improving weather and other environmental forecasts and enhancing our scientific understanding of earth on a global basis.

Promoting international cooperation and stability.

Maintaining U.S. leadership in space technology and its application, to the benefit of our security, economy, and the balance of trade.

LAND PROGRAMS

The U.S. operates two land imaging satellite activities for different purposes—a national security effort and the open civilian program, Landsat. The classified effort is designed to support national security needs. This administration, however, has encouraged wider application of space related data and products at lower or no classification where possible to permit broader use of our national space capability. Multispectral Landsat data are the only satellite imagery now routinely available for general use.

In 1972 NASA launched the first experimental remote sensing R. & D. satellite specifically designed to observe surface features of the earth. The Landsat program has experimented with the value of multispectral observation from space. Landsat D—approved for launch in late 1981—has a prograded life through the end of 1984. Landsat D' is planned as a backup to Landsat D and could be used to extend data through the end of 1985.

Domestic applications of Landsat include the following:

Agriculture, NASA, Commerce, and AID are engaged in a joint initiative to research the use of Landsat and other remote sensing data to monitor crop conditions and provide production forecasts.

Interior is using data for small-scale mapping, exploration for minerals and fuels, pollution detection, and inventories of irrigated land.

Energy is exploring the potential contributions of Landsat data for energy policy and planning; e.g., exploration, exploitation, powerplant siting, and environmental assessment and monitoring.

Many States are using data for planning and management of their natural resources and demonstration projects in land cover inventory, surface water inventory, and flood control mapping.

Private oil and mineral companies are known to be using Landsat data in their search activities.

Experimentation is now underway to refine operational remote sensing applications of satellite data in forest management, land use classification, and conservation practices assessment.

Cooperative international activities undertaken by the United States using Landsat have involved many countries. Under the present U.S. policy of data dissemination, Landsat data have been provided to any requester at nominal charge reflecting the cost of reproduction. In addition to applying Landsat derived natural resource information in traditional development projects, the U.S. Government has bilateral programs to build up national remote sensing laboratory centers in less-developed countries. Project AIDSAT helped establish three regional remote sensing training and user assistance centers, partially funded by AID. Foreign receiving stations have been built by Canada, Brazil, Sweden, Italy, Iran, and Japan. Three countries have ground stations under construction; eight countries have indicated their intention to establish such stations. To date, no direct U.S. funding has been used to support the development of a foreign Landsat receiving station.

Due in part to the multipurpose nature of remote sensing, no dramatic single beneficial application has emerged. Another complicating factor is the lack of a clear focal point in the government which can aggregate user requirements for remote sensing and other earth resources data. On the other hand, as demonstrated by the increasing number of foreign ground stations, Landsat has generated considerable overseas interest, especially in developing countries. Private sector involvement in remote sensing—especially in the oil and mineral industries—is evidenced by their interest in Landsat and other follow-on satellite capabilities such as the stereoscopic Large Format Camera.

The President is committed to the continuity of remote sensing data for civil applications through the 1980's. He has so stated in his fiscal year 1980 budget submittal and in his recent message to Congress on science and technology. This should assure those seeking a commitment to an operational remote sensing system of the Administration's intent to give remote sensing technology every reasonable chance to develop to its full potential. Specific details and configurations of the system and its management will evolve over the next several years. There are various options for providing a continuing flow of space imagery to civil users. These range from a system based on sensors derived from Landsat technology to a yet unspecified technology mix of civilian and other imaging capabilities.

To investigate further the value of satellite data for monitoring agricultural crop conditions, the President has approved the requests for funding for the Departments of Agriculture and Commerce, NASA, and AID to initiate a 6-year research program in worldwide agricultural production forecasting. This is a positive indication that civilian user agencies are willing to expend their own funds to explore remote sensing applications. The program is outlined in the fiscal year 1980 budget requests of these agencies which you now have had the opportunity to examine.

ATMOSPHERIC PROGRAMS.

The United States is the leader in developing worldwide meteorological satellite systems, although other countries either have launched their own meteorological satellites or are planning them. The first meteorological satellite was launched by NASA in 1960. NASA developed the prototype spacecraft in conformance with specifications provided by NOAA. The entire procurement and launch of the space equipment as well as all the data are provided unrestricted throughout the United States and to over 70 foreign countries that have direct readout facilities.

In a parallel activity, Defense operates the Defense Meteorological Satellite Program (DMSP). Direct readout is now provided to operational military commands on land and at sea. The military weather service uses DMSP and NOAA satellite data along with other military and civil data to supply military operational customers worldwide such as SAC penetration route flight planning. The DMSP data are routinely made available to NOAA for use by the weather service.

The current operational capability is scheduled to continue with improvements introduced as feasible and necessary. NOAA and NASA selected Defense's versions of the DMSP satellite in 1976 as the spacecraft for their follow-on Tiros-N satellite. During the administration's space policy reviews the question was raised whether additional civil and defense program convergence was warranted. As you know, we are now examining organization and convergence alternatives to determine whether cost savings as well as efficiencies are possible in the mid-1980's.

OCEAN PROGRAMS

In mid-1978 NASA launched Seasat 1, the first civil remote sensing R. & D. satellite exclusively dedicated to observing the dynamic characteristics of the ocean surface. Wave characteristics, ocean surface temperature, and sea ice dynamics could be derived from Seasat observations. Such data could contribute to improved ship routing and coastal disaster warning. In addition, maps of ocean current patterns and temperatures will be used in fishing, pollution dispersion, iceberg hazard avoidance, and global climate studies.

Several Federal agencies have funded selected scientific experiments using Seasat data. Such efforts contribute to a better understanding of the natural processes affecting the earth. While Seasat 1 data was available for only a short period of time, user benefits were verified. Large-scale ocean observations—which are needs of the Navy, NOAA, and others—might be met from a program called the National Oceanic Satellite System (NOSS). The administration supports an integrated approach in principle; however, whether to proceed still needs to be determined.

INTEGRATED REMOTE SENSING SYSTEM

Until now, civil space programs for the observation of the atmosphere, the land, and the sea have been conducted more or less separately. However, there are new developments and considerations that make the establishment of an integrated national system for observing the earth worthy of consideration.

The array of sensors now emerging for the observation of the atmosphere, land, and oceans, and examination of data needs, indicate that a select group of several sensors on a limited number of common platforms can meet a large number of requirements.

The Shuttle and new satellite data relay technology will make possible combining sensors on the same platform on an economical basis without compromising reliability.

The global and political nature of remote sensing from space requires proper focus and government authorization and regulation. There have been a number of R&D organizations, two operating organizations, and AID making international arrangements.

The President—as a consequence of these developments and the desire to maintain American leadership in space technology—has directed NASA to chair an inter-agency task force to examine options for integrating current and future potential systems into an integrated system. The review is covering technical, programmatic, and institutional arrangements. This review will be completed by the fiscal year 1981 budget cycle. The issue of organizational arrangements for designation of a single lead agency with operating responsibilities for future civil remote sensing activities will be considered in this review.

PRIVATE SECTOR INVOLVEMENT

To date remote sensing activities have been primarily a Federal function. Several private sector companies and groups have expressed interest in the commercial exploitation of earth resources satellites. Some would like to be able to sell proprietary imagery to any prospective purchaser. Others would like to see remote sensing spacecraft specifically designed to carry out certain missions of interest to private companies.

Private sector roles could include a broad range of possibilities: (1) management of space segments and provision of commercial services; (2) delegated operational responsibility for major components of remote sensing ground systems (e.g., a U.S. centralized data reception and processing center, marketing and pricing functions); (3) normal contractor roles in providing contractual services on products and in building hardware and software; and (4) the provision of services derived from remote sensing data.

Previously, more active participation of the private sector in civil remote sensing activity was discouraged because of national security problems. The President's decisions announced in June 1978 provided the basis for a more active but government-supervised private sector role. Higher resolution imagery that would be attractive to selective industrial, commercial, public agency, and individual users is now possible. In October 1978 the President directed NASA and Commerce to actively explore private sector emerging interests, roles, and conditions of government control. This effort is being pursued in parallel with the integrated system study mentioned above.

In summary, although much experience has been gained, the configuration of future remote sensing systems, in our view, still needs further comparative study before an institutional framework and desired technology mix are selected. Experience suggests that integrated systems are practical. Therefore, as I mentioned

before, the President has directed that a comprehensive plan covering expected technical, programmatic, private sector, and institutional arrangements be developed. These interagency task forces—with emphasis on user agency requirements—will examine options for integrating current and future potential systems into a plausible integrated national system. We believe this cautious approach is necessary. The potential to involve the private sector, for example, has not been adequately explored or emphasized to date.

The President's decision to commit to continuity of remote imagery data for civil applications through the 1980's will allow task forces outlined earlier to develop serious alternatives for consideration in the next session of Congress. This permits, we believe, the necessary flexibility to best meet remote sensing data requirements. Importantly, it will allow adequate time to benefit from congressional deliberations.

Mr. Chairman, as evidenced by the extensive administration activities in land, atmospheric, and ocean remote sensing that I have discussed today, I believe the executive and legislative branches are on a convergence path with respect to the future of remote sensing. S. 663 defines an interim period of 7 years to develop institutional, financial, technical, and marketing capabilities of the service. This is precisely what the interagency task forces I mentioned earlier are trying to define. S. 663 also recognizes this will be an evolutionary process and the government could play a variety of roles. The bill, appropriately, leaves these decisions open for the future.

We plan to carry out many of the bill's provisions and will pursue critical investigations with or without specific legislation. The President's public commitments in this area demonstrate this strong support. The administration is committed to an operational remote-sensing system—yet undefined; the technology mix and institutional arrangements will evolve over time. Therefore, the administration believes that legislation is not needed to continue the program activities which have been described today, and the administration is opposed to enactment of legislation at this time. More appropriately, we would extend the offer to work closely with Congress—as we have in the past—on completion of the task force reviews so as to develop mutually acceptable legislation in the next session of Congress, if needed.

QUESTIONS OF SENATOR SCHMITT AND THE ANSWERS THERETO

Question 1a. What functions and parts of functions of any federal entity or officer would be appropriate to transfer to the Corporation? What records and property would be appropriate to transfer to the Corporation? What price, if any, should be attached to the transfer of records and property?

Answer. Presently the Executive Branch is undertaking a comprehensive study to examine these kinds of questions. As you know, we have initiated an integrated remote sensing system study which will address the technology mix appropriate for the future national remote sensing system and the institutional arrangements to provide this service. The second phase of the study, the institutional arrangements, will be completed by late Summer. The private sector involvement option will be part of that review. Therefore, to comment now on what records, property and price should be charged for the transfer to any private sector entity would be premature. If there is a decision to have an operation run by a corporation we will need to designate a government entity to carry out the task associated with effecting a transition from government to the private sector if the present review of institutional arrangements results with the private sector approach as the preferred direction.

Question 1b. The President shall insure that each federal entity shall purchase remote sensing data from the Corporation at a just and reasonable price except where a separate earth resources service is required to meet unique government needs or is otherwise required in the national interest. What are your views regarding this requirement? What would be in your view unique government or national interest needs sufficient to not require purchase of earth resources data and information by a federal entity from the Corporation?

Answer. This question is difficult to answer in light of the ongoing review of integrated remote sensing systems. It would be our intention to encourage private sector growth rather than place a ceiling on its potential. With respect to unique government needs, I don't think we have adequate experience to determine which civil application might require a separate service.

Question 1c. Is the Federal Communications Commission the appropriate federal agency to regulate activities of the Corporation or would another federal agency be more appropriate.

Answer. This is the kind of issue that the integrated remote sensing system study needs to address. We will be in a better position to answer this question after completion of our review in late Summer.

Question 2. Should the terms "raw data and information," "preprocessed data and information," and "process data and information" be defined? If so, how should they be defined?

Answer. We need to make a distinction between data and information. However, a series of technical definitions of several categories is inappropriate for legislation because categories may have to be redefined as the technology changes.

Question 3. What benefits and difficulties would the federal government experience in working with the Corporation established in S. 875? How could such a Corporation be structured that would minimize difficulties while maximizing benefits? What problems have been encountered by the existing Landsat system and how could the creation of the private operational Corporation contribute to alleviate such problems?

Answer. As you know, the Executive Branch has undertaken a rather extensive examination of the benefits risk and difficulties with private sector involvement. Accordingly, it would seem more appropriate if we responded to this question in discussions after the integrated system study and the private sector involvement study have been melded later this Summer. How could any system better serve user needs is an underline tenant of our overall examination—whether government or private sector operated.

Question 4. S. 875 provides for a continued NASA role in the activities of a private sector operational earth remote sensing system including appropriate research and development activities. Are the functions and responsibilities assigned to NASA pursuant to the provisions of S. 875 appropriate?

Answer. The Executive Branch is reviewing the appropriate role for NASA in an operational remote sensing system. To preclude or add to NASA's responsibilities at this juncture would be premature. On the completion of the integrated remote sensing systems study we will be in a better position to define precisely NASA's activities in this area. NASA's role, regardless of whether any national system is private sector or government managed, in research and development activities will continue.

Question 5. What principle should govern the integrated development by the civilian, defense and intelligence sectors of space systems, including satellites, ground facilities and data utilization. What affect has the inter play between the interest and legitimate concerns of those sectors had upon the development and the implementation of an operational private sector earth resources monitoring system.

Answer. In the President's decision memorandum of June 1978 he set forth the guiding principles for national space policy and established the inter-relationships between the various space sectors. Specifically, the U.S. will maintain current responsibilities and management relationships from the various space programs and as such coordination and information exchange will be maintained among the space sectors. This will avoid unnecessary duplication and allow maximum cross utilization of all capabilities. The President again directed in October 1978 that the Policy Review Committee (Space) will take steps to enhance technology transfer between the space sectors. Furthermore, when the President asked for comprehensive studies covering the expected technical, programmatic, private sector and institutional arrangements for a remote sensing system, he directed NASA to chair an interagency task force which includes representation from all three sectors. The inter play among sectors has been a positive one. The legitimate concerns of the three sectors are now reflected within the Policy Review Committee (Space).

Question 6. Does S. 875 make adequate provisions for safeguarding of national security interest?

Answer. The President in June 1978 encouraged the domestic commercial exploitation of space capabilities and systems for economic benefit and to promote the technological position of the U.S. However, all U.S. earth oriented remote sensing satellites will require U.S. Government authorization, and supervision or regulation. The Executive Branch will have to take the major responsibility and guaranteeing the safeguarding of national security interests. For those reasons we have involved all sectors—both defense and civilian agencies—in the integrated remote sensing systems study.

Question 7. What are the major constraints that presently exist that discourage the private sector from developing an earth resources information operational system? What do you envision to be the development cost associated with the development by the private sector of an operational earth resources information system.

Answer. There is the uncertainty of future data demand. Moreover, few firms have sufficient knowledge in the remote sensing field to consider seriously the investment of substantial amounts of capital to broaden their market in this area. The field of satellite remote sensing is an evolving area. It seems like some contin-

ued government/industry partnership over a number of years will be necessary to bring this field to its full maturity. With respect to the development cost associated with an operational earth remote sensing system; this question would be more appropriately answered by the private sector in your upcoming hearings.

Question 8. How do you envision the development of market for earth resources information data? Is there an adequate market to support the private sector? How long do you envision that an expanded market for such data would take to develop? How much of that market demand would be from the government sector?

Answer. It is the uncertainty of the future demand for data that is an underlined reservation in moving rapidly to a private sector operation in the remote sensing. There is a general belief that the federal government is now and will continue to make up the largest share of the market for earth resources data and services and that government support will be necessary for several years. The current market demand at present prices will not support the system costs. While the market development is best done by the private sector, some assurances against government competition must be guaranteed. The Administration is committed to an operational sensing system, yet undefined, and the technology mix and the institutional arrangements will evolve over time. A continuing government/industry partnership over a number of years will likely be necessary to bring this field into its full potential.

Question 9. S. 875 provides that no stock holder may own more than 10 percent of the share of the voting stock of the corporation. Will you please comment on this provision?

Answer. We do not fully understand the intent of this provision since the operation proposed in S. 875 would be fully regulated.

Question 10. The time period during which the operational system would be transferred from the federal government to the private sector is an issue that deserves further discussion. Will you please comment on this issue and give your views concerning an operable time period and framework for the transfer of this function to the private sector.

Answer. The integrated remote sensing system study is examining various alternatives. As stated in previous questions, there will likely be a requirement for a government/industry arrangement to continue over a period of years. Specifically, S. 663 defines this transition period to be seven years. It would not be useful at this time to set a specific time frame and framework for such a transfer but any transition will take several years. Even if our recommendation at the end of the current review is a government remote sensing system, you can be assured that private sector options will be kept open for the future.

Question 11. How long would it take the private sector to develop and make operational an earth resources information system?

Answer. This is a difficult question for the Executive Branch. It would seem more appropriate if you raise this question with the private sector. They would be in a better position to address and give specifics along these lines.

Senator STEVENSON. Let me invite Mr. James Walsh, the Deputy Administrator of NOAA, to come up and join Dr. Frosch. Please proceed, Dr. Frosch. Thank you again for joining us this morning.

STATEMENT OF ROBERT A. FROSCHE, ADMINISTRATOR, NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

Dr. FROSCH. Thank you, Mr. Chairman. It's a pleasure to appear before you today to add my views to those you heard from Dr. Press on the subject of operational remote-sensing systems.

Operational space systems are very important as direct ways for the Nation's space effort to provide continuing benefits to mankind. In the past, two experimental systems have become operational: Weather satellites, which are operated by the Government, and communications satellites, which are operated by the private sector under Government regulation and control. Today, I am here to discuss the operational status of a third category: remote-sensing satellites. I'd like to start with a brief appraisal of where I believe we stand in the development of this new capability.

Since July 1972, almost 7 years ago, we have had civil remote-sensing satellites in orbit for a series of experiments designed to

develop methods of observing the surface of land areas and lately the surface of the ocean. The experiments have had several purposes, including the development of sensors to measure various wavelengths of radiation from the Earth, the development of techniques for the extraction and display of useful information from the sensor signals, and the discovery and development of an array of practical uses for the product.

As is often the case with such systems, R. & D. results have been used for practical purposes, and sizable investments in civil ground systems have been made both here and abroad.

Examples of potential and some actual uses in a variety of fields include: Agriculture, forestry, land management, census surveys, mineral resource surveys, and oceanography. The Departments of Agriculture and the Interior, NOAA, and several other agencies are regular users; and Interior's EROS Data Center has been in operation for half a decade.

Based on the U.S. investment in this space capability, there are many foreign ground stations relying on the data, thus providing a significant foreign policy benefit. The Agency for International Development feels that this capability is important for its objectives, and training facilities have been established in several underdeveloped areas with AID assistance. Europe and Japan feel the promise of valuable returns is attractive enough to warrant their own investments in remote-sensing satellites, and have announced plans to launch such satellites in the next few years. Most of our States and many local governments are using or developing uses for data from the system. Commercial interest is strong, as evidenced by the formation of the Geosat Committee, and a vigorous support industry has sprung up.

Our experience with Earth remote sensing makes it clear that improvements in several areas are necessary for satisfactory operation in certain types of applications. These are basically the frequency of coverage, particularly of agricultural areas during the prime growing season; timeliness in providing information acquired by the system when that information has largely transient value, as in agriculture; and assurance of continuity of data. Investments in facilities, personnel, and commitments to operating procedure must be based on more than the novelty value of seeing Earth from the vantage point of space. Consequently, an operating system must be configured to guard against failures.

Although the improvements required for the present system are clearly understood, there are several problems yet to be resolved. The first of these is a pricing policy. During the R. & D. phase, the price of the product has been essentially the marginal cost of reproducing copies. This is not adequate for an operational system. Given the developing state of market demand, expectations of foreign users, and the subtleties of establishing an intrinsic value for the information provided, we have work to do on pricing. Such work includes determining real market demand under a more realistic price schedule.

The second unresolved area is establishing the conditions under which the private sector can play the largest practical role in remote sensing. The issues here have to do with the economics of the business, the proprieties of handling the valuable information

coming from the system and any liabilities that may arise from the dissemination of that information, the interaction of the private sector with foreign interests, and the responsibility of the Government for continuing R. & D. in remote sensing.

The third area is the creation of a permanent operating organization and an arrangement for governance and oversight of that organization. This is a matter quite different from designating an organization like NASA to insure that the initial system is properly developed technically and in condition to provide good service to the users. In addition to having adequate technical and managerial talent, the demand for breadth of interest in the operating organization is impressive.

The operator must be prepared to deal with data of importance to a large number of disciplines—an increasing number as we see what possibilities there are to combine observational tasks on a single space platform. At the same time, it must be able to interact constructively with a large number of user communities. There is no unique client; public, private, domestic, and foreign users already exist. More will appear.

The operator must be flexible and prepared to deal with products in various forms; the product is not maps, nor is it photographs; it is information in usable form to some, data products from which information will be extracted to others.

The central question, then, has been this: Is it time to commit to an operational remote-sensing system? In the sense that there are regular users of Landsat products, we already have an operating system. Indeed, the President's space policy recognizes that fact. The President has already committed to continuity of data through the 1980's. Dr. Press has testified that the Carter administration is committed to an operational remote-sensing system, and the NASA program is aimed not only at providing continuity, but also at improving both the timeliness and utility of the data products.

We are continuing to operate Landsat 3, and will operate Landsat 2 throughout the rest of its useful life. Landsat D and D prime are under development, and we are upgrading the ground processing equipment to improve the timeliness of delivery of data products. The thematic mapper, which is the next generation of mechanically scanned multispectral sensors, is still under development, and we are studying possible designs of entirely solid state scanners. We are a party to initiating the joint agriculture research program, and we are continuing to work with the Geosat Committee to explore ways to satisfy the needs of the petroleum and mining industries.

We are also developing Earth observation capabilities that are complementary to Landsat. The large format camera will provide high resolution stereoscopic photographs which will be of benefit to some parts of the user community. Its test flight on the Shuttle is expected in the 1981-82 timeframe. NASA is presently conducting definition studies for an oceanic satellite system which will increase our ability to conduct ocean observations. In addition to these program activities, we are actively working on the resolution of the problem areas I mentioned earlier, perhaps the most important of which is developing an advantageous role for the private sector.

Mr. Chairman, I think it is clear that our planned program comprises the essentials of progress toward an operational system of the sort your bill, S. 663, contemplates. We are working on the technical problem areas, and we are studying the technical options for the next generation of Earth sensing systems while we investigate the institutional issues that will govern the assignment of operating responsibilities to the public and private sectors.

I support the administration view that under these circumstances no legislation is desirable at this time. I have reviewed the progress of the interagency studies on integration of remote-sensing satellites and on private sector involvement and I believe that they will make a considerable contribution to illuminating the issues that need to be resolved before final plans are made.

I shall undertake to work closely with your committee and the other concerned committees of the Congress as we develop our plans. With your help, we will succeed in having the sort of operational remote-sensing system that both of us want for the Nation and the world.

Thank you, Mr. Chairman.

Senator STEVENSON. Do you have time to remain and hear Mr. Walsh's testimony?

Dr. FROSCH. Yes, Mr. Chairman.

Senator STEVENSON. Mr. Walsh, would you proceed next, please.

**STATEMENT OF JAMES P. WALSH, DEPUTY ADMINISTRATOR,
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION,
DEPARTMENT OF COMMERCE**

Mr. WALSH. Thank you very much, Mr. Chairman. On behalf of the National Oceanic and Atmospheric Administration and the Department of Commerce, I appreciate this opportunity to appear before you today and discuss legislation concerning the operation of Earth remote-sensing satellite systems. The subcommittee is to be commended for its leadership role in seeking to realize the significant potential offered by satellite technology.

This morning I would briefly like to provide you with some background on the operational satellite activities of NOAA, and to comment on the bills presently before the subcommittee. I will try to summarize my statement, as I can.

The National Oceanic and Atmospheric Administration is the Federal Government's principal agency for operating environmental remote-sensing satellites. Satellites are a fundamental part of our science and service activities, and are playing a growing role in our oceanic and atmospheric programs.

Our satellite program began in 1966 to take advantage of space technology in observing weather conditions and predicting severe weather events. Since that time we have successfully operated 16 polar orbiting and 7 geostationary satellites. In 1979 the National Environmental Satellite Service in NOAA is responsible for a program, involving 628 people and an annual budget of approximately \$97.6 million, that runs the spacecraft; extracts the data from the satellite's sensors; stores that data in computers; and then makes it available to users, often on a real-time basis.

The polar-orbiting system, which is referred to as the NOAA series, began operating in 1966. Initially, this system produced

global data for large-scale weather analysis and forecasting and, to a more limited degree, local data for short-range forecasting. However, with the advent of the geostationary satellite system in 1974, the polar-orbiting satellites are no longer used for local forecasting or severe weather warnings. Yet the polar system remains an integral part of our remote-sensing system and is used both for the collection of environmental data and for immediate data transmission to meteorologists, hydrologists, and oceanographers worldwide. This system is also important to the U.S. Armed Services, which uses the data routinely, and the system is available as an alternate military system if and when this might be needed.

Our geostationary operational environmental satellite system, or the "GOES" series, is the satellite that provides you the picture you see each morning in your daily newspaper and on television weather programs. We are presently operating two satellites, one located at 75 degrees west directly over southern Colombia and the second located at 135 degrees west over the eastern Pacific Ocean. Together, these satellites provide regular coverage of the entire United States and adjacent oceans areas. The GOES system has become a very effective tool in monitoring the development and movement of severe weather, such as hurricanes, thunderstorms, and winter storms. Its ability to view weather conditions frequently over a large geographic area has made it superior to the polar-orbiting satellites for this purpose. In addition, because of its location, the GOES system is an effective relay device for transmitting data from remote locations on Earth, such as river-level gages or weather buoys at sea, to data storage systems where it can be used in a timely fashion.

Mr. Chairman, two of the strengths of our satellite program are worth mentioning here. First, we have a close working relationship with NASA, and, second, we have close ties with the users of the data we acquire, users not only within NOAA, but also others within the Federal Government and in the private sector.

NASA develops our satellites, in cooperation with our scientists; conducts the prototype phase of a new system—for example, the TIROS-N polar orbiter—and provides launch services for the operational system. We consider this relationship to be extremely effective and an efficient allocation of our responsibilities.

The primary user of our satellite data is the National Weather Service, also in NOAA; but it is by no means the only user. In fact, each day we are searching for more ways to utilize the enormous amounts of data we acquire. In my testimony I briefly cite a couple of examples; one related to use of the satellites to pinpoint fish concentrations for the fishing industry, another to the use of satellite data to identify approaching frost edge for the citrus industry in Florida, and also we have used data in conjunction with Exxon so that they might make use of the momentum provided by the Gulf Stream currents. These are a couple of examples, Mr. Chairman.

I would like to submit for the record, if I might, a study showing in more depth some of these applications we have found.¹

¹ "The Economic Benefits of Environmental Satellites," published by NOAA, U.S. Department of Commerce, April 1978.

In addition, our data is used by the Coast Guard for the search-and-rescue operations and their ice patrol. It is used by the Department of Agriculture in developing yield models for sorghum and wheat; the U.S. Geological Survey and the Army Corps of Engineers use our satellite for data relay.

Finally, Mr. Chairman, our satellites are also providing data to agencies of the United Nations and to the majority of foreign countries. For example, one of our earlier GOES satellites is still operational and is being operated by the European Space Agency (ESA) in support of a major global weather experiment. We are also working with Japan, India, U.S.S.R., and the ESA to provide a global network of geostationary meteorological satellites located at the equator. We are strongly committed to sharing our data with other countries.

I might mention, Mr. Chairman, that much of NOAA's management team is presently in China, where we are seeking to develop an agreement with the People's Republic of China on meteorology and on satellite data.

In summary, NOAA has been operating remote-sensing environmental satellite systems for over 13 years. Of the 23 spacecraft we have operated, all but 2 exceeded their design lifetimes. This experience has taught us several lessons about running a successful operational system. In general, an operational system has significantly different requirements than a research and development system. First, it must be user oriented and must be tailored to the operational needs of those users. Second, it requires technical and management skills that keep the entire system working continuously and smoothly.

The system should include people knowledgeable in a wide range of skills to operate the system. These experts must continually strive to make the system more efficient in cost and manpower, more reliable in operation, and more useful in output to the users who represent the only reason for its existence. Third, an operational system should provide the initial, general processing of data to make it usable by all clients, but specialized information extraction should be the responsibility of individual user groups. Finally, the system must be designed to provide adequate redundancy and reliability without making the cost prohibitive to users.

Mr. Chairman, I will just briefly turn to legislation now because our position on the legislation is, of course, in accord with that already mentioned by Dr. Frank Press and by Dr. Frosch.

I would like to iterate again that the Administration is committed to an operational system to provide Earth resources remote-sensing data for the 1980's and it recognizes the need to clarify responsibilities for the service component of such a system.

However, as we mentioned, we are still considering the possible arrangements for management of that system. Mr. Chairman, I would also like to offer the assistance of NOAA to work with you and members of the committee staff in developing legislation on this or working, as necessary, to answer any questions you might have for your work here this morning.

That concludes my prepared statement, and I am prepared to answer any questions you might have.

[The statement follows:]

STATEMENT OF JAMES P. WALSH, DEPUTY ADMINISTRATOR, NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION

Mr. Chairman and members of the subcommittee, on behalf of the National Oceanic and Atmospheric Administration (NOAA) and the Department of Commerce, I appreciate this opportunity to appear before you today and discuss legislation concerning the operation of earth remote-sensing satellite systems. The subcommittee is to be commended for its leadership role in seeking to realize the significant potential offered by satellite technology. This morning I wish to provide you with some background on the operational satellite activities of NOAA, and to comment on the bills presently before the subcommittee.

The National Oceanic and Atmospheric Administration is the Federal Government's principal agency for operating environmental remote-sensing satellites. Satellites are a fundamental part of our science and service activities, and are playing a growing role in our oceanic and atmospheric programs. Our satellite program began in 1966 to take advantage of space technology in observing weather conditions and predicting severe weather events. Since that time we have successfully operated 16 polar-orbiting and 7 geostationary satellites. In 1979, the National Environmental Satellite Service in NOAA is responsible for a program, involving 628 people and an annual budget of approximately \$97.6 million, that runs the spacecraft; extracts the data from the satellite's sensors; stores that data in computers; and then makes it available to users, often on a real-time basis.

The polar-orbiting system, which is referred to as the NOAA series, began operating in 1966. Initially, this system produced global data for large-scale weather analysis and forecasting and, to a more limited degree, local data for short-range forecasting. However, with the advent of the geostationary satellite system in 1974, the polar-orbiting satellites are no longer used for local forecasting or severe weather warnings. Yet the polar system remains an integral part of our remote-sensing system and is used both for the collection of environmental data and for immediate data transmission to meteorologists, hydrologists, and oceanographers worldwide. This system is also important to the United States Armed Services, which uses the data routinely, and the system is available as an alternate military system if and when this might be needed.

Our Geostationary Operational Environmental Satellite System or the "GOES" series, is the satellite that provides the picture you see each morning in your daily newspaper and on television weather programs. We are presently operating two satellites, one located at 75° West directly over southern Colombia and the second located at 135° West over the eastern Pacific Ocean. Together these satellites provide regular coverage of the entire United States and adjacent oceans areas. The GOES system has become a very effective tool in monitoring the development and movement of severe weather, such as hurricanes, thunderstorms, and winter storms. Its ability to view weather conditions frequently over a large geographic area has made it superior to the polar-orbiting satellites for this purpose. In addition, because of its location, the GOES system is an effective relay device for transmitting data from remote locations on earth, such as river-level gauges or weather buoys at sea, to data storage systems where it can be used in a timely fashion.

Mr. Chairman, two of the strengths of our satellite program are worth mentioning here. First, we have a close working relationship with the National Aeronautics and Space Administration (NASA) and secondly, we have close ties with the users of the data we acquire, users not only within NOAA, but also others within the Federal government and in the private sector.

NASA develops our satellites, in cooperation with our scientists; conducts the prototype phase of a new system (e.g. the TIROS-N polar orbiter); and provides launch services for the operational system. We consider this relationship to be extremely effective and an efficient allocation of responsibilities.

The primary user of our satellite data is the National Weather Service, also in NOAA; however, it is by no means the only user. In fact, each day we are searching for more ways to utilize the enormous amounts of data we acquire. It has been our strong belief, throughout the history of our satellite program, that close cooperation between users and operators is critical to a successful system. Furthermore, research on expanding the uses of our satellite data has resulted in some interesting applications. Let me cite a few examples:

Since 1975, we have been using satellite data to help pinpoint fish concentrations on the West Coast. The satellite can spot thermal "fronts" on the ocean surface. Tuna are found on the warmer side of a front and salmon may be found on the cooler side, since both are temperature sensitive. We estimate that effective use of this data could save the West Coast fishing industry \$2.5 million annually by improving harvesting efficiency.

Satellite images showing surface temperatures in Florida, accurate to within 1° Celsius, are helping us warn the citrus industry of approaching frost danger. With adequate advance warning, the industry can make efficient use of fuel for citrus grove heaters. By reducing the use of heaters by one and one-half hour on a cold night, Florida citrus growers could save \$1 million. Savings over one year could amount to \$45 million.

Enhanced infra-red satellite images also play a role in improving ship movements. With such data, we have been working with Exxon Corporation to identify the Gulf Stream current so that its tankers could use the current's momentum and save fuel. On the basis of our joint study, Exxon has calculated possible fuel savings for its tanker fleet of \$360,000 annually (at 1975 fuel costs). Greater application of this information to our entire coastwise fleet could result in significant energy conservation.

These are but a few examples of the applications of the environmental data we now collect. I would like to submit for the record a recent analysis of several other areas of unique data application that have resulted in economic benefits, mostly relating to energy conservation.

Our environmental satellite services are also used by other Federal agencies in conducting their missions. Let me give you a few examples:

The Coast Guard uses our satellite images for its search and rescue efforts and in its ice patrol.

GOES satellite data on surface brightness, cloud brightness, and cloud cover are joined with surface measurements of precipitable water and surface pressure by the Department of Agriculture to be used in yield models for sorghum and wheat.

The U.S. Geological Survey and the U.S. Army Corps of Engineers use the GOES satellite data relay system for transmitting river flow data from 2,000 remote data points.

Finally, Mr. Chairman, our satellites are also providing data to agencies of the United Nations and to the majority of foreign countries. For example, one of our earlier GOES satellites is still operational and is being operated by the European Space Agency (ESA) in support of a major global weather experiment. We are also working with Japan, India, U.S.S.R., and the ESA to provide a global network of geostationary meteorological satellites located at the equator. We are strongly committed to sharing our data with other countries.

In summary, NOAA has been operating remote-sensing environmental satellite systems for over 13 years. Of the 23 spacecraft we have operated, all but two exceeded their design lifetimes. One was projected to last 6 months but was operational for 7 years. Neither of our systems has experienced a total loss of service. This experience has taught us several lessons about running a successful operational system. In general, an operational system has significantly different requirements than a research and development system. First, it must be user-oriented and must be tailored to the operational needs of those users. Secondly, it requires technical and management skills that keep the entire system (e.g. spacecraft, data processing, analysis, storage, and delivery) working continuously and smoothly. The system should include people who know spacecraft operations and navigation; data processing, including sensor calibration, earth location and basic analysis; system maintenance, both hardware and software; system design and integration; and specialized development and applications. These experts must continually strive to make the system more efficient in cost and manpower, more reliable in operation, and more useful in output to the users who represent the only reason for its existence. Thirdly, an operational system should provide the initial, general processing of data to make it usable by all clients, but specialized information extraction should be the responsibility of individual user groups. Finally, the system must be designed to provide adequate redundancy and reliability without making the cost prohibitive to users.

Let me now turn to the legislation under consideration by the Subcommittee. S. 663, introduced by Senator Stevenson and others, would establish a regime for developing an operational earth resources and environment satellite system.

It would create an Earth Data and Information Services in the National Aeronautics and Space Administration to be responsible for instituting such a system, within seven years from the enactment of the bill.

The Administration is committed to an operational system to provide earth resources remote sensing data through the 1980's and recognizes the need to clarify responsibilities for the service component of the experimental Landsat program. However, the technical definitions of such a system and the institutional arrangements associated with it have not yet been determined. As you know, in October 1978 the President requested a series of national space policy studies, which are now underway. Two of these studies are particularly germane to the subject we are

discussing today. One study, the Integrated Remote Sensing Satellite System Study, will be examining sensor technology and possible space platforms to meet the Administration's commitment. The second study, that dealing with Private Sector Investment and Involvement in Satellite Remote Sensing, will examine options on how and when to provide a greater role for private industry in obtaining and using earth resources information from space. Both of these studies are scheduled for completion this summer.

Because we expect that these studies will offer possible institutional arrangements and discuss agency responsibilities for remote sensing satellites, we recommend that any legislation be delayed until that information is available.

At that time, we will, of course, be happy to work closely with the Committee to develop any new legislation which might be needed and could be considered in the next session.

Mr. Chairman, that concludes my prepared statement. I am prepared to answer any questions you might have.

Senator STEVENSON. Thank you, sir.

Dr. Frosch, you're familiar with the bill I introduced. You're aware that it creates a service within NASA to operate a remote-sensing system on an interim basis. Does NASA have the technical and managerial resources to perform such a function as is contemplated in that bill?

Dr. FROSCH. I think we have the basic competencies. There are areas which are required for running operational systems where I think we would have to build up the organization capability and possibly add some manpower.

Senator STEVENSON. Now, Mr. Walsh, NOAA, as opposed to NASA, is an operating agency. It operates client services. NASA is an agency for research and development. Does NOAA have the managerial resources, the history and the expertise with which to perform these functions conferred by my bill on NASA?

Mr. WALSH. I think, Senator, I would point out that the exact shape of the operational Landsat system would be somewhat different than the meteorological satellites which we operate. Our system is basically an operational system. As I mentioned, NASA engages in the research and development and then turns new systems over to us to operate. Our organization, the National Environmental Satellite Service, is essentially a management agency which is responsible for the things I mentioned in my testimony. But our system is, of course, a system which is primarily Government supported. We provide our data basically free to everyone on an instantaneous basis. However, we do have small charges for data that is stored and later delivered. We have in place a system that could be utilized, assuming that the Landsat system that eventually emerges is somewhat comparable to the kind of operation we have. I would suspect that more people would be required, though.

Senator STEVENSON. Could you refresh our recollection. When was the National Environmental Satellite Service established in NOAA—it was sometime in the 1960's; wasn't it?

Mr. WALSH. It was established in 1965. It was set up under the former Environmental Science Services Administration (ESSA). As you know, NOAA has gone through several reorganizations, and there is another proposed. But it was set up in ESSA when Bob White was the Administrator.

Senator STEVENSON. What happened? Was an agency established? There is NOAA. Was it established to perform this service?

Mr. WALSH. That's essentially what happened when NESS was established.

Senator STEVENSON. If we can do these things in the 1960's, why can't we do them in the 1970's? Do you have any reaction to this basic proposition, which seems to insist always on putting the cart before the horse?

Mr. WALSH. In terms of the satellites that we have operated, as you can tell from my testimony, the fundamental driving factor behind our system was that we discovered that satellite technology would aid us in the delivery of basic services that the Government has traditionally performed; that is, observations of weather, warnings of severe weather events. That is a fundamental Government activity, and no one has ever debated about whether that is necessary or not.

So, we essentially used this system and we have used it in lieu of other more personnel-intensive activities, and it is true primarily of the satellites and, particularly, of the more advanced computer systems that we've been able to keep pace with delivering weather to the public.

Senator STEVENSON. Senator Schmitt?

Senator SCHMITT. Thank you, Mr. Chairman.

Mr. Walsh, for our record, would you provide a detailed analysis of S. 875 based on NOAA's experience with the programs that you've managed?

Mr. WALSH. Yes, sir.

Senator SCHMITT. We will be asking you some specific questions of which we would like your analysis, also.

Senator SCHMITT. Also, would you provide us with a listing of the users, both governmental and nongovernmental, of data from NOAA?

Mr. WALSH. In detail or in general, Senator?

Senator SCHMITT. In detail. We would like to know who the user community is for the data you provide through the Environmental Monitoring Service.

Mr. WALSH. We have some direct users. We also provide information through our Environmental Data and Information Service, which has a special component for serving satellite users.

I don't know whether I could give you each and every one of the users, because they can be rather legion.

Senator SCHMITT. Can you categorize them, the various groups, both the public and private, that are using the data and those that you provide data to directly, and identify them specifically?

Mr. WALSH. Yes.

Senator SCHMITT. That's one of the things we need to understand completely: What is the user community out there that will be potentially utilizing this kind of information.

Senator SCHMITT. In those areas where your agency would be using Earth resources information from an operational entity to integrate with your present information-gathering system, would you comment now in general, and more specifically for the record, what your agency's views would be on purchasing that information from a private corporation?

Mr. WALSH. I'd like to supplement it for the record, but by and large we have used Landsat data. We've been involved in the use of

Landsat data in such things as the large area resources inventory for agricultural crops.

As has been mentioned earlier here, we've been engaged in something called the "LACIE" experiment for some time now, where we apply satellite data and come up with yield models that estimate production rates throughout the world. We have been involved in that, but by and large—unless some of the people with the company here today will correct me—we have not been large users of the Landsat data.

Senator SCHMITT. Would you expect to be a large user in the future?

Mr. WALSH. It depends on what kind of data is going to be forthcoming, and it depends on what the responsibilities of NOAA are going to be in the future.

At the present, our basic mission where we'll be using satellite data is in the weather area. Although we are doing more and more work with satellites in our research program, we are more generally heavily involved in Seasat, and also in discussions leading to the possible preparation of a system called "NOSS," with is an ocean observing system. Those are basically research activities.

In terms of the supplying of data to individual users and our specific responsibility, basically we would not see ourselves as a major user at this time.

Senator SCHMITT. Not even if you were responsible for a major climate program?

Mr. WALSH. The climate program, quite possibly; but we're using our existing polar orbiters for that purpose.

Senator SCHMITT. You don't think there's any value to multispectral data coming from the Earth resources systems in that kind of program?

Mr. WALSH. Our people believe very strongly that there will be.

Senator SCHMITT. OK, how would you feel about purchasing that information from a private corporation?

Mr. WALSH. Well, if it was needed, we'd get it however it was possible.

Senator SCHMITT. Do you see any disadvantages to that versus negotiating with NASA to supply it to you from a Government-run operation?

Mr. WALSH. No, I don't see any problem with dealing directly with NASA. We have a very good relationship. In fact, we would work very closely with them in how we develop the systems, and we always share the data.

Senator SCHMITT. Mr. Walsh, do you deal with Comsat at all in your operations?

Mr. WALSH. Yes, I believe we do. To what extent, I don't know.

Senator SCHMITT. Since S. 875 is modeled to a large extent after Comsat in terms of statutory authority, would you give us for the record a review of your experience with Comsat and how that might relate to a private corporation for Earth resources?

Mr. WALSH. Yes. As I understand, the Comsat system essentially replaced a land-line system that was already in place. So we were using that, and now we're using the satellite system.

Senator SCHMITT. I am interested in your operational interface with Comsat, because if we establish a corporation for Earth re-

sources information, then there will be an operational interface service with it on the part of certain Government agencies, NOAA being one of them.

I just wanted to see if there are any lessons you may have learned that you might like to provide for us as we try to improve this legislation.

Senator SCHMITT. Dr. Frosch, I would ask the same question of you. You may want to make a general comment, but you've had a great deal of experience dealing with Comsat. In trying to refine S. 875, would you give us the benefit of that experience and any lessons that you've learned and the mistakes we might avoid if we set up a pilot corporation.

Dr. FROSCH. We'll certainly provide such an analysis.

[The following information was subsequently received for the record:]

The NASA experience with the COMSAT Corporation provides lessons in a number of areas, some of which are applicable to remote sensing. It must be emphasized that remote sensing differs from communications in type of commodity, nature of clientele, and state of maturity. Salient points are discussed below.

Market.—COMSAT is a U.S. corporation and is a member of Intelsat, an international organization. Their business is largely selling communications services to existing communications carriers, private or governmental. In certain cases, the services are provided directly to users of communications services, like NASA or the DOD. However, basically, COMSAT is a carrier's carrier. Thus, when COMSAT was started the market was in existence; the customers, known or potential, could be identified easily. The expansion in services which COMSAT offered was being provided, in general, by other technical means.

Financing.—By the act of creating COMSAT, the full prestige and determination of the U.S. government stood behind the venture, which was an excursion into a market perceived by the industry, the government, and the public as profitable. Initial funding was provided equally by the carrier industry and the public. The initial stock offering was oversubscribed before it went on the market, and purchases were arbitrarily limited. Two other circumstances combined to help cushion the early financial situation. The prevailing technical opinion on which COMSAT was capitalized was that a low-altitude, randomly spaced system of approximately 40 satellites would be required to establish any service. The development and acceptance of the "Synchronous," or "stationary" orbit satellite permitted a service to be established with a small number of satellites, changing considerably the funding requirement. The Communications Satellite Act was passed in 1962 and the first successful "stationary" satellite, Syncom II, was flown in 1963. The second was the commitment of U.S. government agencies to the use of the service. Intelsat-I, the Early Bird, was entirely subscribed by AT&T, but the commitment of NASA to using Intelsat-II for support to the Apollo Program provided impetus to the expansion of service beyond the transatlantic route. The Defense Communications Agency (DCA) also used certain services. These government customers provided a core of business that was encouraging to the young corporation.

Pricing.—Since communications is a regulated industry, a base for rate determinations had to be developed, and the early price structure had to be treated as tentative. In fact, for a period the Federal Communications Commission (FCC) held certain funds in escrow against the possibility that the final rate determinations would require rebates to the customers. The situation was complicated for the FCC by the fact that the commercial carriers were operating competitive services, and the rulings on the rate structure could have an effect on the recovery of investment in the existing plant. One source of early cost uncertainty was that NASA had never before provided reimbursable commercial launch services, and it took some time to establish what was an equitable allocation of the government's cost for such services. Although the problem will be less severe, we can expect a similar period of adjustment as the Shuttle settles into a routine operational process.

Technology.—All of the technology needed for the early satellites in the system had been developed at government expense by contractors. The transfer of this technology to the private sector was accomplished initially by using the same contractors to build satellites very similar to those already developed in the government program. COMSAT promptly began to advance the state-of-the-art by demanding increases in capability in subsequent generations of satellites and in the devel-

opment of improved ground communications equipment. It started its own laboratory, which has grown into a first-class organization which solves recognized problems and develops new technology in selected areas to demonstrate the feasibility of meeting the capability requirements in COMSAT specifications for new equipment. In the early years NASA and COMSAT held a series of joint R&D program reviews to ensure continued awareness of advances in the state-of-the-art and to avoid duplication. With the passage of the ComSat Act of 1962, there was an assumption by many, both in Congress and in the Administration, that governmental funding of continued R&D on communications satellites could eventually be phased out. This contributed to a decision in the early 1970's to phase out the NASA R&D effort. It should be noted, however, that COMSAT and the industry at large now are advocating an increased NASA role in the development of high risk, more advanced technology.

NASA support.—In addition to providing reimbursable satellite launch services at the times required by COMSAT, NASA provided particular assistance during the first year of existence of COMSAT. Before the COMSAT Staff had developed in either size or experience, NASA provided reimbursable technical assistance and consultation, for example in the calculation of spacecraft orbits and in the methods of spacecraft control. NASA also provides technical assistance and consultation to the FCC, as required by the ComSat Act of 1962.

System concept.—The original system concept, already mentioned, of operating a constellation of satellites in nonsynchronous orbits was technically very conservative. This concept was soon abandoned in favor of the present system, but the system concept had a strong influence on the formation of the Intelsat organization. The original concept certainly dominated the initial requirement for financing. It is conceivable that the organizational structure of both COMSAT and Intelsat would have been different had the subsequent system concept been accepted from the very beginning.

Dr. FROSCH. I might make a comment or two at this point about S. 875. The situation when Comsat was set up I believe was a situation in which it was clear at the outset that the principal customers for the services to be provided were outside of the U.S. Government; there it was dominated in terms of customers by commercial private customers, except during the first few years of existence, when the Government was a significant customer.

The situation with regard to Landsat or remote sensing is not so clearly in that situation. In fact, one of the problems is that we would expect at the outset that the majority of the direct purchase of data would be U.S. Government purchase, although I would expect that to shift over time.

In fact, one of the key questions in establishing any private entity as the favored or chosen instrument, which I believe was the term that was used in the onset of Comsat, is the question of the establishment of the Government as, in effect, a single buyer from that single source, because I think that's likely to be the initial economic guarantee that makes such an enterprise a viable one as it gets started and as it faces the problem of aggregating and developing for the non-Government market.

I see no particular reason why the Government could not agree to buy all of its data from a particular outside corporation, whether it was chosen and set up in a Comsat sort of way, or whether it was chosen through normal commercial bidding, except that this is an area in which the marketplace is not completely established as a marketplace. We have a problem in deciding what an appropriate price for data would be so that we would face the problem of having an outside-of-Government entity establishing a price for data which the Government would then in advance agree to pay.

I do not mean to suggest that this is an insoluble problem; only that it is a problem that we would have to understand at the very

beginning in order to make the arrangements that are contemplated in S. 875.

Senator SCHMITT. I think you're entirely correct. That is one of the reasons why we have the Government through, in this case, the FCC acting as a rate regulator. That presumably would be early on in the three-part discussion of just what do we establish as a rate, subject to future negotiation, when we see how it works.

If we create a commercial enterprise, it is initially going to be an experiment. Certainly it's an experiment in terms of the rate, in terms of the market, and how that market develops. I'm afraid if we don't do that, we will never fully understand those questions, if we leave it entirely within the Government as an operational unit.

You've said the Government is the principal purchaser of any information from Landsat. It was my understanding that the private sector was the principal purchaser at Sioux Falls. Now does the Government not get any data through Sioux Falls?

Dr. FROSCH. Perhaps "purchaser" was too restrictive a term.

Senator SCHMITT. I mean, they may not have used that.

Dr. FROSCH. My point simply is that the Government itself is probably the largest user of Landsat at this point.

Senator SCHMITT. I'm not sure. Is that clear? There's an awful lot of information being bought. Dr. Calio is sitting here nodding his head.

Dr. FROSCH. I think if you just count films or pictures, they mostly go to the Government. It's confused, I think, by the fact that a good deal of what goes into the Government and appears to be a Government use, probably goes out through technology transfer arrangements of one sort or another, either to a level of government other than the Federal Government, or in some cases overseas or outside entirely.

I'm not sure we have an adequate understanding of exactly what the initial state of the commercial situation would be.

Senator SCHMITT. I think that's true, because most of what the private sector is doing is maintained on a proprietary basis. It is sometimes very difficult to decide just how broadly it's to be used. All you can do is look at the volume of purchase, and that's pretty high, as I understand now, at Sioux Falls.

Dr. Frosch, if a private corporation were selected as the operational entity for a remote sensing system, what role would you see for NASA in that system? We've defined some roles in the bill, and I would appreciate, certainly for the record, comments on those specific roles. But would you feel that we've learned our lesson with Comsat and there ought to be a continuing R. & D. role for NASA if that were the chosen course?

Dr. FROSCH. I think there would have to be a continuing governmental role in R. & D., partly because we need that continuing stimulus for progress which would not certainly in the initial provision of services be easily accommodated while an outside entity was building up a market; and partly because it's clear that this would, in any case, be a heavily regulated situation, and one would need to keep inside the Government a real technical competence to understand the regulatory environment.

I think that can best be done by keeping the research and development capability in the Government. But we would like to

encourage the stimulation of research and development capabilities in the private entity, as well. That has happened to some degree in the communications industry—but clearly, not to a sufficient degree to obviate the need for what I'll call a "national," which turns out to be a "governmental," capability in that area.

Senator SCHMITT. You provide technical consultation, in a way, to the FCC on satellite communications services. Is that correct?

Dr. FROSCH. Yes, we do.

Senator SCHMITT. Do you see any problem in providing comparable technical consulting service to the FCC if they had a regulatory role in remote sensing?

Dr. FROSCH. No. That would be straightforward.

Senator SCHMITT. I've got a thousand questions, but we've got a thousand witnesses, too.

Finally, for both you gentlemen: What principles do you think should govern joint-use satellites? That is, satellites that are going to be used both by the military and by the public sector that may be operating through a private distribution channel?

Dr. FROSCH. Well, I think that one ought to be able, in the first place, to have what I would describe as "separate spigots." That is, it should be clear that the data that are provided on the civil side come through a civil organization directly from the space segment; while that which goes through the military side goes for a military organization, so that the data streams are not confused.

I think that is probably the key requirement, so that a civil user is dealing with a civil organization. I think that's necessary for several reasons—for some real reasons, and for some perceived reasons.

I think it must be clear that a shared system is essentially an open system. That is to say, that while the uses of the data on the military and civil sides may be different, if it is obviously a shared system then it should be clear that everyone knows what is in the space segment, even though the handling of the data from the space segment may be different by the two sets of users.

There also however has to be some provision for what I'll call "national emergency" or "high-level national security" control over the system. That is, while it would normally be operating as an open system just like a civil system with two kinds of users, one can see, it seems to me, that in times of special emergency it should be possible for it to become essentially a military system.

But I think that is no different from what is effectively the case with all systems now.

Senator SCHMITT. Do you see any significant distinction between the "civil agency" being a corporation established by statute, or a "governmental agency" under that kind of an arrangement?

Dr. FROSCH. I don't see any problem with that, provided there remains the element of regulation which then would be as suggested in S. 875. Clearly, we are moving in the direction of providing of many kinds of services for the military via leasing and other means of interaction with commercial enterprises.

Senator SCHMITT. Mr. Walsh, did you have any comment on the national satellite?

Mr. WALSH. We of course share the concerns which have just been expressed by Dr. Frosch. I would add one other thing that we are most concerned about.

I don't know whether it's a factor or a matter which must be dealt with in considering this sort of thing—and that is, of course, we are heavily involved with international users. Our satellite data, as I have mentioned, is used throughout the world.

We engage in joint experiments and joint operations with various countries, and we have to be concerned about the sensitivities of a single system that deals with both national security kinds of technology as well as civilian oriented needs. That is a matter that has come up.

It's not unlike the type of problems one has when you have a research vessel that can do deep sea drilling and the CIA operates it as a spy ship. It's the kind of concern we run into in NOAA at the Law of the Sea Conference. It's the kind of thing you can run into when you start discussing a joint system in the United States that also serves international users.

Senator SCHMITT. Dr. Frosch and Mr. Walsh, we will have some other questions for the record.

I particularly would be interested in NASA's analysis in gross terms of the budgetary impact of NASA being designated an operational entity for earth resources information versus the private sector designation, given the general kinds of NASA responsibilities outlined in S. 875.

Thank you, Mr. Chairman.

Senator STEVENSON. To maximize its potentials, would not any organization that transfers remote-sensing data to the public have to integrate classified and nonclassified data and also integrate data from classified methods which, if not handled properly, could result in unauthorized civilian use of these methods? If so, doesn't that argue initially for a government, as opposed to investor-owned organization?

Dr. FROSCH. I think there would be great advantages to the general usefulness of remote-sensing data in access to, or the ability to use, some products from classified systems. I think whether or not there is a distinction between a Government entity and an out-of-Government entity with regard to that use depends on what mechanism would be set up in the Government for taking classified information of that kind and making it available. The real problem comes in the interface between requests for data and the supplying of that data. My own guess is that the mechanisms that will have to be devised will be almost entirely Government mechanisms for deciding what data can be made available. But I think that the interface, the machinery for making that decision, would be deeply enough embedded in the Government so that I am not sure that the interface problems with a civil agency would be all that different from the interface problems with an outside-of-the-Government entity. In any case, it would be possible, I think, to satisfy the latter problems by asking some Government agency which had an interest in the civil use of the data to act as the interface for the outside-of-Government organization. That could be cumbersome, but it could also be made to work fairly smoothly.

Senator STEVENSON. And to eliminate redundancies and, again, maximize the potentials for such systems, won't the operating agency have to develop close relationships with other countries in order to pool resources to collect data harmoniously, as well as to distribute them? Aren't there a lot of potentials, at least, for international cooperation as well as needs for it?

Dr. FROSCHE. There is already a good deal of international interaction. I think with regard to the French, European, and Japanese interests in remote-sensing systems, it should be possible for those systems, while independent, to become integrated. I have had some conversations with the French and Japanese with regard to that possibility.

Since the product is data, the competition is most likely to be in the use of data for information, rather than in the provision of the data. So, I think it would be possible to do that. There is, of course, precedent for operational collaboration both by a governmental operation like NOAA and by a Comsat-like operation in international relations. It may be that S. 875 would serve not only to create a Comsat-like organization, but an Intelsat-like interrelation between the countries that are doing remote sensing.

Senator STEVENSON. That was going to be the next question, whether the possibilities for cooperation argued for a governmental agency as opposed to a private-investor agency.

Mr. Walsh, do you want to respond to this question, too?

Mr. WALSH. The question is?

Senator STEVENSON. On international cooperation, the potentials and also the implications for private versus public.

Mr. WALSH. It would seem to me that either a private or a public entity could engage in significant international cooperation.

The question would become: If you are a private entity, what is your compensation for? In terms of ours, on a governmental system, our compensation is international goodwill and the need to cooperate. However, it might well be that a private corporation would, of necessity, make a charge; and if that charge was fairly significant, some countries may have difficulty in paying for it or may be more reluctant than they would be otherwise to engage in those kinds of international activities.

There is a down side there, but as a technical matter, I don't see any problems between a Government or a non-Government system on the cost issue.

Senator STEVENSON. I think you're right. They're political matters.

Dr. FROSCHE. I was going to comment that there is a political problem namely in some international forums there is considerable sensitivity to international corporations, particularly when they deal in matters that bear on resources. So, that might be a problem to be taken into account.

With regard to the question of payment and affordability which Mr. Walsh has raised, there is some precedent for the international aid mechanisms entering the picture to provide the financial necessities to those countries that can't otherwise afford to use them. In fact, that has been involved in some of the setting up of Landsat stations overseas at the present time.

Senator SCHMITT. Would the chairman yield just on that point. The main reason we picked the Comsat model for this was in recognition of the potential difficulties internationally, but with the understanding that the Comsat-Intelsat relationship was a working relationship and has turned out quite well and had a user-based international organization for profit, and with political sensitivities and the free flow of information across national borders. It's just as sensitive in the international forum as is the matter of resource information. But, again, it is working as an operational entity, on an international scale, and our representative is an investor-owned corporation. It was not by accident that we chose that model.

I think the questions that have been raised are at least in part answered by S. 875. I am not going to say they're all answered, because communications and Earth resources information gathering are very different entities, with different markets, and different infrastructures are going to be required. But some of the questions have been answered by the Comsat-Intelsat relation.

Would you care to comment on my comments?

Dr. FROSCH. I think that's right. I think they have. Whether the Intelsat-Comsat model can apply very closely isn't clear to me in the sense that the communication business has the virtue that what is being transferred is neutral. It is only communication services and no product, in a sense, is being supplied—but only the facilitization of a transfer. And the fact that in the remote-sensing business a product is being sold—the data itself—may raise some other difficulties.

Senator SCHMITT. I think you're right, Doctor, but I also feel that an international organization could work that out, with each country investing to the degree they feel they can use the information provided by the international system.

Thank you, Mr. Chairman.

Senator STEVENSON. One last question: How much time is reasonably required by the administration to answer this interim institutional question? To put it slightly differently: How long should we wait?

Dr. FROSCH. Mr. Walsh says that's my question.

A simple question, Mr. Chairman, to which I don't really know the answer. But it seems to me that as we complete these Presidentially mandated analyses, we should have before us, with a fair degree of clarity, what the issues are and what the alternatives are. And it would then be a matter of deciding clearly how to proceed in the next several years. I don't see any reason why we could not make that decision as part of the 1981 budget cycle.

Senator STEVENSON. As part of the 1981 budget.

Dr. FROSCH. Along with the whole process of putting forward a 1981 budget, so that it could be reflected to the extent that is necessary in the 1981 budget, although I would not expect it to have a very large implication for the 1981 budget.

Mr. WALSH. The timeframe for that is traditionally for June for presentations to the OMB; Presidential decisions in December.

Senator STEVENSON. Any further questions?

Senator SCHMITT. Mr. Chairman, when the history of Earth Resources Information Service is finally written, whether it's private

or public, it will probably be one of the classic examples of bureaucratic inertia. Dr. Calio and I discussed this in 1973, which was not the first time it has been discussed. We had an identical discussion. I can almost remember the same phrases. I am sure they're the same phrases. Two years ago before this committee, the same thing was going on. We were still studying the issue; we were still trying to figure out how to do it. And I hope that somehow by the end of this year and by the 1981 budget we can finally realize that we've probably studied it enough and we ought to make a decision.

We can always change that decision, but I don't think anything is going to be hurt by making it. I just can't believe the inertia of this extraordinarily valuable resource, and the bureaucratic inertia in getting it realized as a resource. It's just sitting there now, literally, in terms of the total application that it might have for this country and for the world.

I hope that the Chairman—and I will certainly assist him in any way I can—will keep the pressure on the administration. I think that's probably the main value of our two bills, is that, "If you guys don't do something, we're going to," and I think we can reach agreement. I don't know whether the administration can reach agreement.

Senator STEVENSON. Well, I think we've made our position clear. The only question in my mind is whether we should wait as long as the beginning of the next session of Congress to start legislating. I certainly don't have any intention to wait any longer than that.

What do you say? You're more impatient than I am.

Senator SCHMITT. I have been pushing at the whale, Mr. Chairman, a little bit longer in this area, and it's like Gene Schumacher says, "Push and push and push at this friendly, benign whale, stranded on the beach. You finally step back to rest; and if you step back too long, even the dent disappears." You come back to the point that the NASA official made to Gene at the same time, which is that, "You ought to try pushing off from the beach from the inside."

Mr. WALSH. The whale is an endangered species. I wouldn't do that, or we'll have to arrest you.

Senator STEVENSON. Thank you, gentlemen. Your full statements will be entered into the record.

QUESTIONS OF THE COMMITTEE AND THE ANSWERS THERETO

Question. For the record, would you provide a detailed analysis of S. 875 based on NOAA's experience with the programs that you have managed?

Answer. We understand that the formal Department of Commerce comments on S. 875 will be provided separately to the Committee.

Question. Also, would you provide us with a list of users, both governmental and non-governmental of (satellite remote sensing) data from NOAA?

Answer. Satellite direct readout services are provided to approximately 850 organizations in more than 120 countries. In addition, over 400 organizations have requested specific data from NOAA's satellite data archives. Attachment 1 provides a gross categorization by use groups for most of the satellite data and products. Attachment 2 is a more detailed list.

ATTACHMENT 1

Satellite data or product	Number of users		
	U.S. Government	U.S. non- Government	Foreign
I. From polar-orbiting satellites:			
A. Direct sounder broadcast stations	1		1
B. High resolution picture transmission stations	8		14
C. Automatic picture transmission stations	8	142	351
II. From geostationary satellites:			
A. Visible and infrared scanner radiometer stations	9		4
B. Weather facsimile stations	20		19
III. Data collection systems:			
A. Geostationary satellite systems	574	25	41
B. Polar-orbiting satellite systems	719		584
IV. Global sea surface temperature computations	17	32	45
V. Charts and maps from satellite data:			
A. Snow maps	56	24	19
B. Ice maps:			
Polar sea ice	16	14	1
Great Lakes ice	4	8	1
C. Great Lakes surface temperature maps	10	9	
D. Gulf Stream maps	31	119	3
VI. General satellite data products:			
A. Cloud cover images	23	59	38
B. Data printouts, reprints, preprints	26	44	26
C. Video tapes, movie loops, etc	4	5	2
VII. Satellite data for research use	19	57	18
VIII. Electronic reception of satellite data:			
A. GOES-tap	92	24	
B. WSFO-tap	58	101	
C. FOFAFAX		33	
IX. Data from NOAA satellite archives	415 Organizations		

Users of Data Obtained from National Environmental
Satellite Service (NESS) Satellites

Data from NESS satellites are used by a wide variety of government, private, foreign, and domestic organizations. These data also are disseminated in a wide variety of forms. The following list includes users of satellite data and the format in which they are presented as of April 1, 1979:

Direct Readout Services
(Robert Popham, 301-763-8326)

Satellite direct readout services are provided to approximately 850 organizations and individuals in more than 120 countries. These services include transmitting high resolution analog and digital data from both polar and geostationary satellites, broadcasts of processed imagery relayed through geostationary satellites, and atmospheric data and low resolution images from polar orbiting spacecraft. Number in parentheses shows the number of stations.

I. Polar-Orbiting Satellites

A. Direct Sounder Broadcast (DSB) Stations (Temperature and Moisture Soundings)

- | | |
|------------------|-----------|
| 1. United States | 2. France |
|------------------|-----------|

B. High Resolution Picture Transmission (HRPT) Stations (Images)

- | | | |
|-----------------|----------------------|--------------------|
| 1. NOAA (3) | 2. U.S. Air Force(4) | 3. NASA |
| 4. China | 5. France | 6. West Germany(2) |
| 7. India | 8. Iran | 9. Japan |
| 10. Norway | 11. Saudi Arabia | 12. Sweden |
| 13. Thailand | 14. Scotland | 15. United Kingdom |
| 15. North Yemen | | |

China is believed to have two more HRPT stations. The number of stations in the Soviet Union and Soviet-bloc countries is unknown.

C. Automatic Picture Transmission (APT) Stations (Images)

U. S. Government

- | | |
|---------------------------------|------------------------------------|
| 1. Glomar Challenger | 2. Southwest Fisheries Center |
| 3. Patrick Air Force Base | 4. Naval Avionics Facility |
| 5. Naval Electronics Laboratory | 6. Naval Support Force, Antarctica |
| 7. Panama Canal Co. | 8. Kwajalein Island Missile Range |

U.S. Private - 142 Stations (Includes Companies and Universities)

- | | | |
|----------------------|------------------------|---------------------|
| 1. Massachusetts (7) | 2. New Hampshire (2) | 3. Maine |
| 4. Connecticut (2) | 5. New Jersey (6) | 6. New York (14) |
| 7. Pennsylvania (9) | 8. Maryland (8) | 9. Virginia (6) |
| 10. West Virginia | 11. North Carolina (4) | 12. South Carolina |
| 13. Georgia (4) | 14. Florida (5) | 15. Alabama |
| 16. Ohio (9) | 17. Indiana (3) | 18. Michigan (6) |
| 19. Iowa (2) | 20. Wisconsin (3) | 21. Minnesota (7) |
| 22. Illinois (2) | 23. Missouri (2) | 24. Kansas (3) |
| 25. Arkansas | 26. Oklahoma (2) | 27. Texas (9) |
| 28. Colorado (3) | 29. Idaho | 30. California (11) |
| 31. Oregon (3) | 32. Washington (4) | |

Foreign Stations - 351 Stations

(Most Stations University or Government Operated)

- | | | |
|------------------------|-----------------------|------------------------------|
| 1. Algeria | 2. Angola (2) | 3. Argentina (6) |
| 4. Australia (9) | 5. Austria (4) | 6. Bahamas (2) |
| 7. Bahrain | 8. Bangladesh | 9. Barbados (3) |
| 10. Belgium | 11. Bolivia | 12. Brazil (35) |
| 13. Bulgaria | 14. Burma | 15. Cameroon |
| 16. Canada (27) | 17. Chad | 18. Chile (13) |
| 19. China | 20. Columbia | 21. Costa Rica |
| 22. Cuba | 23. Czechoslovakia | 24. Denmark (5) |
| 25. Dominican Republic | 26. Ecuador (2) | 27. Egypt |
| 28. El Salvador | 29. Ethiopia | 30. Fiji |
| 31. Finland (3) | 32. France (6) | 33. West Germany (12) |
| 34. Guatemala | 35. Guyana (2) | 36. Holland (11) |
| 37. Honduras | 38. Hong Kong | 39. Hungary (2) |
| 40. Iceland (2) | 41. India (11) | 42. Iraq |
| 43. Iran (2) | 44. Israel (3) | 45. Italy (15) |
| 46. Ivory Coast | 47. Japan (3) | 48. Jordan |
| 49. Kenya | 50. Korea | 51. Kuwait (2) |
| 52. Lebanon | 53. Malagasy Republic | 54. Malaysia (2) |
| 55. Mauritania | 56. Mauritius | 57. Mexico (3) |
| 58. Mocambique | 59. Morocco | |
| 60. Nepal | 61. New Guinea | 62. New Zealand (4) |
| 63. Nicaragua | 64. Nigeria (2) | 65. Norway (4) |
| 66. Pakistan (3) | 67. Paraguay | 68. Peru (5) |
| 69. Phillipines (2) | 70. Poland (2) | 71. Portugal (3) |
| 72. Rhodesia | 73. Romania | 74. Saudi Arabia |
| 75. Senegal | 76. Sierra Leone | 77. Singapore |
| 78. Somalia Republic | 79. South Africa (2) | 80. Spain (2) |
| 81. Sri Lanka | 82. Suriname | 83. Sweden (3) |
| 84. Switzerland (5) | 85. Tahiti | 86. Taiwan (4) |
| 87. Tanzania | 88. Thailand (2) | 89. Trinidad |
| 90. Tunisia | 91. Turkey | 92. United Kingdom (60) |
| 93. Upper Volta | 94. Uruguay | 95. United Arab Emirates (2) |
| 96. U.S.S.R. (2) | 97. Yugoslavia | 98. Zaire |

Additionally, there are about 300 radio amateurs that are operating APT stations.

II Geostationary Satellites

A. Visible and Infrared Spin Scanner Radiometer (VISSR) Stations

- | | | |
|----------------------|---------------|-----------|
| 1. United States (9) | 2. Canada (2) | 3. Brazil |
| 4. France | | |

B. Weather Facsimile (WEFAX) Stations

- | | | |
|--------------------|-------------------|----------------|
| 1. U. S. Navy (17) | 2. U.S. Air Force | 3. NASA (2) |
| 1. Argentina | 2. Brazil | 3. Canada (2) |
| 4. Canal Zone | 5. Costa Rica | 6. Curacao |
| 7. Ecuador | 8. France | 9. Guatemala |
| 10. Honduras | 11. Martinique | 12. Mexico (2) |
| 13. Peru (2) | 14. Trinidad | 15. Uruguay |
| 16. Venezuela | | |

Data Collection System
(Merle Nelson, 301-763-8325)

Another service of NOAA's environmental satellites is its Data Collection System (DCS). This system collects and relays environmental data from remote platforms such as buoys, ships, automatic stations, aircraft, and balloons. Both the geostationary and polar orbiting satellites carry Data Collection Systems. On the geostationary satellite, it is called the DCS; and on the polar-orbiting satellite, it is called the ARGOS Data Collection and Platform Location System because it gives the location of fixed and moving platforms as well as relaying the data. The geostationary DCS relays only the data -- the position of the platform must already be known. The number in parentheses indicates the number of platforms.

I. GOES Data Collection System - 660 Platforms

A. U.S. Government (574)

1. National Weather Service (100)
2. Environmental Research Laboratories (27)
3. National Data Buoy Office (59)
4. U. S. Geological Survey (212)

5. Bureau of Reclamation (4)
6. Corps of Engineers (125)
7. National Center for Atmospheric Research (2)
8. Department of Agriculture (13)
9. White Sands Missile Range (9)
10. NASA (23)

B. U.S. Private - (25)

1. Raytheon Corporation (10)
2. Airlines (6)
3. Michigan State University (3)
4. Bonneville Power Administration (4)
5. Handar Corporation
6. General Dynamics

C. Foreign - 61

1. Canada (56)
2. Argentina (4)
3. Bolivia

II. Polar-Orbiting Satellite Data Collection System (ARGOS) - 1303 Platforms

- | | | |
|------------------------|-------------------------|-------------------------|
| 1. Australia (58) | 2. Canada (103) | 3. Denmark (11) |
| 4. France (255) | 5. India (17) | 6. Japan (17) |
| 7. New Guinea (3) | 8. New Zealand (14) | 9. Norway (64) |
| 10. Sweden (3) | 11. United Kingdom (12) | 12. United States (719) |
| 13. International (27) | | |

NOTE: These are primarily buoys and balloons provided in support of the First GARP Global Experiment.

Global Operational Sea Surface Temperature Computations (94)
(William Pichel, 301-763-7885)

The global sea surface temperature observations are obtained from the NOAA polar-orbiting satellite scanning infrared radiometers. The temperatures are derived by a fully automated computer technique. These data form the basis for developing climatology in areas of the World where sea surface temperature observations are scarce or lacking. These observations are placed on magnetic tape for transmission to product users and for archiving. The GOSSTCOMP is distributed to a wide variety of national and international

organizations; the number in parentheses shows the number of users in a single organization:

A. Domestic - (49)

1. NWS Ocean Services Unit, Seattle
2. NWS National Meteorological Center
3. National Environmental Satellite Service (12)
4. Environmental Research Laboratories
5. National Marine Fisheries Service
6. University of Washington (3)
7. San Diego State University
8. University of Dayton
9. South Carolina University
10. Oregon State University
11. University of Miami
12. University of Northern Colorado
13. Cranbrook Institute of Science, Michigan
14. University of Southern California
15. Texas A&M University
16. University of Hawaii
17. New York University
18. Atlantic Environmental Group, Rhode Island
19. Fleet Weather Facility, Suitland, Maryland (2)
20. Fleet Weather Central, Hawaii
21. Naval Ocean Systems Center
22. Defense Mapping Agency
23. Sea Grant Advisory
24. Naval Post Graduate School
25. Java Black Swann Marina
26. Value Engineering, Virginia
27. Southern Forest Fire Laboratory
28. Inter-American Tropical Tuna Commission
29. Individuals Subscribers (7)

B. Foreign (45)

1. Australia (7)
2. Brazil
3. Canada
4. Canary Islands (2)
5. Chile (4)
6. France (9)
7. Fiji
8. Honduras
9. India (3)
10. Ivory Coast
11. Japan

12. New Caledonia
13. New Guinea
14. New Zealand (4)
15. Peru (2)
16. Solomon Islands (2)
17. South Africa (2)
18. Spain
19. Thailand

Charts and Maps of Environmental Satellite Data (315)
(Russell Koffler, 301-763-8142)

Environmental data, derived from both polar-orbiting and geostationary satellites, are distributed to users in the form of analyzed maps. Maps of satellite-derived snowcover, icecover, and sea surface and lake surface temperatures are produced and disseminated routinely. The number in parentheses shows the number of users in a single organization:

I. Snowmaps

A. Domestic (80)

1. San Francisco SFSS
2. Kansas City SFSS (2)
3. National Weather Service (16)
4. NASA (7)
5. U. S. Soil Conservation Service (10)
6. U. S. Geological Survey (6)
7. U. S. Forest Service (2)
8. Bureau of Reclamation (2)
9. Corps of Engineers (6)
10. U. S. Department of Agriculture (2)
11. Jet Propulsion Laboratory
12. U. S. Army Cold Regions Research Laboratory
13. California Dept of Water Resources (2)
14. Washington Water Resources Division
15. Utah Geological and Mineral Survey
16. University of California
17. State University of New York (2)
18. Stanford University (3)
19. South Dakota State University
20. University of Wyoming
21. College of Forestry and National Resources
22. University of Colorado
23. University of Nevada
24. Oregon State University
25. Brigham Young University
26. Colorado State University

27. University of Minnesota
28. Bonneville Power Administration
29. Sierra Hydrotech
30. Chevron Oil Research Co.
31. Bendix Aerospace Corp

B. Foreign (19)

1. Canada (15)
2. Iceland
3. India
4. Sweden
5. World Meteorological Organization

II. Icemaps

A. Polar Sea Ice (31)

1. Alaskan Department of Fish and Game (4)
2. Anchorage SFSS
3. Pacific Marine Environmental Laboratory
4. Southwest Fisheries Center
5. Northwest Fisheries Center
6. Naval Oceanographic Office (2)
7. Naval Post Graduate School
8. U. S. Army Cold Region Research and Engineering Laboratory
9. NASA (2)
10. U. S. Fish and Wildlife Service
11. NMFS Marine Mammal Division
12. U. S. Coast Guard
13. Columbia University
14. University of Colorado
15. University of Washington
16. Northwest and Alaska Fisheries
17. Mobile Oil Corp (2)
18. LeSchack Associates
19. Environmental Research and Technology
20. Sea Ice Consultants
21. New Bedford Whaling Museum
22. Artec Incorporated
23. Canada

B. Great Lakes Ice (13)

1. NESS Environmental Sciences Group
2. U. S. Coast Guard
3. NWS Climate Analysis Center

4. Environmental Data and Information Service
5. Columbia University
6. University of Nebraska
7. Grand Valley State College
8. Ohio State University
9. Mesomet Inc
10. St. Lawrence Seaway Development Corp (2)
11. Ice Climatology and Applications Div., Canada

III. Great Lakes Surface Temperature Maps (19)

1. National Weather Service (7)
2. Environmental Data and Information Service
3. Ohio State University
4. State University of New York (2)
5. University of Nebraska
6. University of Wisconsin
7. University of Michigan
8. University of Detroit
9. Environmental Protection Agency
10. Corps of Engineers
11. Resources Surveys International, Inc.
12. Atmospheric Environmental Services, Canada

IV. Gulf Stream Maps

A. Government and Universities (47)

1. NESS (5)
2. National Marine Fisheries Service (4)
3. Ocean Engineering
4. National Weather Service (4)
5. Pacific Marine Environmental Laboratory
6. Sea Grant
7. Environmental Data and Information Service (2)
8. National Ocean Survey
9. NASA (4)
10. NOAA Data Buoy Office
11. National Science Foundation
12. U. S. Navy (5)
13. U. S. Coast Guard
14. Woodshole Oceanographic Institute (3)
15. South Carolina Wildlife and Marine Service
16. Oregon State University
17. University of North Carolina
18. University of Miami
19. Johns Hopkins University
20. Massachusetts Institute of Technology
21. University of Delaware

22. Skidway Institute of Oceanography
23. University of Maine
24. Tabor Academy
25. Nova University
26. Virginia Institute of Marine Science
27. Columbia University (2)
28. Canada (2)
29. Germany

B. Private (106)

1. George H. Dean Co.
2. J. H. Westerbeke Corp.
3. Raytheon Corp.
4. 40 Fathoms Inc.
5. J. Olsen & Associates
6. Anderson Seafoods Inc.
7. Boston Marine Society
8. Binsky & Snyder Inc.
9. Sea Education Association
10. M. V. Tackle Co.
11. Superior Steam Co.
12. EG&G Environmental Consultants
13. Landfall Navigation, Ltd.
14. Science Applications
15. Offshore Charter Inc.
16. Sippicare Corp.
17. Marlabs Inc.
18. Lafayette Data Control Inc.
19. Polaris Shipping Inc.
20. W. W. Norton & Co.
21. Saybrook Marine Service Inc.
22. Yacht Yard Sales Inc.
23. Satellite Business Systems
24. Optimist Yachts Inc.
25. Handy Boat Service
26. Nautical Marine Center Inc.
27. Douglas Orr, Winder & Associates
28. Bell Laboratories
29. Interstate & Ocean Transport
30. Private Individual Subscribers (77)

General Satellite Data Products
 (Lawrence Hyatt 301-763-8282)
 (Russell Koffler 301-763-8142)

Satellite data are disseminated to the users in a variety of other forms. This section lists the user as well as the types of general products provided. To make the list reasonably manageable, an attempt has been made to group certain types of products together. The number in parentheses lists the number of users in a single organization:

I. Cloud-Cover Images (120)

A. Government and Universities (59)

1. National Weather Service (8)
2. Environmental Research Laboratories (5)
3. U. S. Army (3)
4. U. S. Navy (4)
5. U. S. Air Force
6. U. S. Coast Guard
7. Environmental Protection Agency (2)
8. National Science Foundation
9. Federal Aviation Administration
10. North Carolina Department of Cultural Resources
11. Virginia Department of Environmental Sciences
12. Reno Desert Research Institute
13. Penn State University (4)
14. University of Hawaii
15. Ohio State University
16. Cornell University
17. Texas A&M University (3)
18. M. I. T.
19. Colorado State University (7)
20. South Dakota State University
21. University of California
22. University of Washington (3)
23. Scripps Institute of Oceanography
24. University of Miami
25. Louisiana State University
26. State University of New York
27. University of Delaware
28. University of Chicago
29. Portland State University
30. Trinity University
31. Columbia University
32. University of Kansas

B. Private (23)

1. General Electric Space Division
2. United Resources Development Corp.
3. ESCA-TECH Corp.
4. Tetra-Tech Inc.
5. Environmental Research and Technology, Inc.
6. F. J. O'Hara and Sons, Inc.
7. Conoco Shipping Co.
8. NALCO Environmental Services
9. Marine Consultants
10. Computer Sciences Corp.
11. MESOMET
12. Walter Bohan Co.
13. Lockheed Missiles & Space Co.
14. Kentron Hawaii Ltd.
15. Private Individual Subscribers (9)

C. Foreign (38)

- | | | |
|---------------------|-----------------|--------------------|
| 1. Canada (13) | 2. Germany(3) | 3. Netherlands |
| 4. Denmark (2) | 5. India (4) | 6. New Zealand (2) |
| 7. Japan (3) | 8. Chile | 9. England |
| 10. South Africa(2) | 11. Isreal | 12. Australia |
| 13. Spain | 14. Switzerland | 15. Ethiopia |
| 16. France | | |

II. Data Printouts, Reprints, and Preprints (96)A. Government and Universities (61)

1. U. S. Air Force (3)
2. U. S. State Department
3. NESS (2)
4. Environmental Research Laboratories (6)
5. Federal Aviation Administration
6. National Marine Fisheries Service
7. U. S. Army (2)
8. National Weather Service (4)
9. U. S. Department of Agriculture (3)
10. U. S. Navy
11. NASA (2)
12. North Dakota State University
13. Colorado State University
14. Kansas State University
15. University of Nebraska
16. University of California (2)
17. University of Georgia
18. University of Miami
19. Oregon State University

20. University of Alabama
21. University of Florida (2)
22. University of Wisconsin (3)
23. Indiana State University
24. Stanford Research Institute
25. St. Louis University
26. Trinity University
27. University of Kansas
28. Illinois State Water Survey
29. Savannah River Plant
30. Florida Forest Research Laboratory
31. Texas Agricultural Research Service (2)
32. Northern Great Plains Research Center
33. California Cooperative Forest Fire Control
34. Southern Forest Fire Laboratory
35. Texas Agricultural Experiment Station (2)

B. Private (9)

1. Lockheed Missiles and Space Co., Inc.
2. Allen Weather Company
3. Bonneville Power Administration
4. Earth Satellite Corp.
5. Anderson Clayton
6. Individual Subscribers (4)

C. Foreign (26)

- | | | |
|--------------------|---------------------|--------------------|
| 1. Canada (4) | 2. Japan (4) | 3. Switzerland (2) |
| 4. Brazil | 5. Spain | 6. India |
| 7. Nigeria | 8. Mexico | 9. Sweden |
| 10. England (2) | 11. Ethiopia | 12. France |
| 13. Australia | 14. Phillipines (2) | 15. Singapore |
| 16. United Nations | 17. Thailand | |

III. Video Tapes, Movie Loops, Slides, Films, and Documentation (9)

1. NWS (3)
2. NASA
3. University of Nevada
4. Gustavus Adolphus College
5. Jackson State University
6. Arkansas Museum and Cultural Commission
7. Lockheed Missiles and Space Co., Inc.
8. Chile
9. Canada

Satellite Data for Research Use (94)

(Harold Yates 301-763-5835)

Satellite data are sent to researchers in government, universities, private industry, and foreign institutions. These data consist primarily of radiation budget data, temperature and moisture sounding data, and wind data. The following list is broken down into the public, private and foreign sectors; the number in parentheses shows the number of user's within a single organization:

I. Government and Universities (65)

1. Environmental Research Laboratories (6)
2. NASA (4)
3. Bureau of Reclamation
4. U. S. Army
5. Defense Mapping Agency
6. U. S. Navy (3)
7. U. S. Air Force (3)
8. University of Alaska
9. University of California (2)
10. University of Colorado
11. Colorado State University (4)
12. University of Miami
13. Florida Technological Institute
14. Florida State University
15. University of Hawaii (3)
16. Iowa State University
17. Northern Illinois University
18. Purdue University
19. University of Maryland (2)
20. M.I.T. (2)
21. Harvard University
22. University of Missouri
23. St. Louis University
24. State University of New York
25. Columbia University
26. Polytechnic Institute of New York
27. University of Oklahoma
28. Oregon State University
29. Drexel University
30. Penn State University (3)

31. Texas A&M University (2)
32. University of Utah
33. University of Virginia
34. University of Washington
35. University of Wisconsin (6)
36. Scripps Institution of Oceanography (2)

II. Private (11)

1. Science Applications Incorporated
2. Stanford Research Institute (2)
3. National Center for Atmospheric Research (3)
4. Walter A. Bohan Co.
5. Illinois State Water Survey
6. Control Data Corp
7. Research Triangle Institute
8. Institute for Storm Research

III. Foreign (18)

- | | |
|---------------------|------------------------|
| 1. Australia (3) | 2. Barbados |
| 3. Costa Rica | 4. Finland |
| 5. West Germany (2) | 6. India (2) |
| 7. Israel (2) | 8. Japan |
| 9. Mexico | 10. Switzerland |
| 11. Russia | 12. United Kingdom (2) |

Electronic Reception of Satellite Data (Donald C. Winner 301-763-8126)

Satellite data are received through the GOES-tap system, Weather Service Forecast Office (WSFO)-tap system, and Forecast Facsimile (FOFAX) System. The GOES-tap system was started in 1975 for distributing geo-stationary satellite images to Federal, state, and local agencies, television stations, universities, and private enterprise firms. The National Weather Service (NWS) started providing this same service from its WSFO's in 1976. NWS also transmits satellite images over its FOFAX network. The number in parentheses indicates the number of users within a single organization:

I. GOES-tap (116)A. Federal (92)

- | | |
|-------------------------|---------------------|
| 1. NASA (6) | 2. U. S. Navy (6) |
| 3. U. S. Air Force (10) | 4. U. S. Army |
| 5. FAA (13) | 6. Dept of Interior |
| 7. Dept of Energy | 8. CIA |
| 9. NWS (53) | |

B. Non-Federal (24)

- | | |
|------------------------------|---|
| 1. WLS-TV, Chicago | 2. KMTV, Omaha |
| 3. WMAQ-TV, Chicago | 4. NBC-TV, New York |
| 5. WINK-TV, Ft. Meyers | 6. South Dakota Water Resources |
| 7. Harris Corp. | 8. Dames, Moore |
| 9. Ocean Routes | 10. Ontario Government |
| 11. Resources Survey | 12. IPS |
| 13. ACCU Weather | 14. Lanica Airlines |
| 15. Penn State University | 16. Earth Satellite Corp. |
| 17. Allen Weather Corp. | 18. Stanford Tech. Corp. |
| 19. Norther Tech. Service | 20. Environmental Research & Technology |
| 21. Pacific Gas and Electric | 22. Oceanographic Services Inc. |
| 23. Research Triangle Inst. | 24. Kansas State Network |

II. WSFO-taps (159)A. Federal (58)

- | | |
|---|--|
| 1. FAA (13) | 2. U. S. Air Force (14) |
| 3. U. S. Navy (26) | 4. Department of Energy |
| 5. Atmospheric Environment Services, Canada | 6. Environmental Research Laboratories |
| 7. U. S. Marine Corps | |

B. Non-Federal - TV and Radio (39)

- | | |
|--|--|
| 1. KSTP-TV, Minneapolis | 2. WHEC-TV, Rochester |
| 3. WMC-TV, Memphis | 4. Weather Central Wisconsin TV Network, Milwaukee |
| 5. May Broadcasting Co. Omaha | 6. KMTV, Oklahoma City |
| 7. WBZ-TV, Boston | 8. WTVT-TV, Tampa |
| 9. WGN Continental Broadcasting Co., Chicago | 10. KSD-TV, St. Louis |
| 11. WITI-TV, Milwaukee | 12. Boston Broadcaster Corp., Boston |

- | | |
|-----------------------------|--|
| 13. KTVY-TV, Oklahoma City | 14. WBRZ-TV, Baton Rouge |
| 15. WVUE-TV, New Orleans | 16. Broadcasting Weather Service, N.Y. |
| 17. KATU-TV, Portland, Ore. | 18. WLCY-TV, St. Petersburg |
| 19. WDIO-TV, Duluth | 20. WDSU-TV, New Orleans |
| 21. WAVE-TV, Louisville | 22. WFLA-TV, Tampa |
| 23. Koy Radio, Phoenix | 24. WCSH-TV, Portland, Maine |
| 25. KOIN-TV, Portland, Ore. | 26. WCCO-TV, Minneapolis |
| 27. WBBH-TV, Ft. Myers | 28. KSBW-TV, Silinas |
| 29. KSL-TV, Salt Lake City | 30. WSB-TV, Atlanta |
| 31. WTCN-TV, Minneapolis | 32. WOKR-TV, Rochester |
| 33. WTMJ-TV, Milwaukee (2) | 34. KNBC-TV, Burbank |
| 35. WPLG-TV, Miami | 36. KABC-TV, Hollywood |
| 37. KDFW-TV, Dallas | 38. WLKY-TV, Louisville |

C. Non-Federal-Private Meteorologists (15)

1. Nash C. Roberts, Jr., Consultants, Inc.
2. Weatherbank, Inc.
3. Resources Surveys International, Inc.
4. Weather Services Corp.
5. American Weather Forecast Service
6. Oceanographic Service, Inc.
7. Murray and Trettel, Inc.
8. Weather Corporation of America
9. Western Weather Consultants
10. Frank Borik
11. John Bujnock, Inc.
12. Weather Consultants Inc.
13. Battelle Pacific Northwest Laboratory
14. Los Alamos Scientific Laboratory
15. Francisco Montes

D. Non-Federal-Industrial Firms (35)

1. Alden Electronic & Impulse Recording Equipment Co., Inc.(4)
2. Southern California Edison Co.
3. Aeronautical Radio, Inc.
4. Muirhead Inc. (3)
5. Ford Aerospace Communications Corp.
6. Geophysical Research and Development Weather Center
7. Morris Cablevision, Inc.
8. Environmental Quality Research Inc.
9. Ocean Data Systems Inc. (2)
10. General Motors Tech. Center (11)
11. Systems Development Corporation (2)
12. EMR Co.
13. United Press International (2)
14. Fleetweather Inc.
15. Addison Airport
16. Frontier Airlines
17. Ozark Airlines

E. Non-Federal-Universities (12)

- | | |
|--------------------------------|-----------------------------------|
| 1. University of Utah | 2. Northeast Louisiana University |
| 3. St. Louis University | 4. Colorado State University |
| 5. University of N. Y., Albany | 6. Valparaiso University |
| 7. Villanova University | 8. University of Florida |
| 9. University of St. Thomas | 10. University of Wisconsin |
| 11. UCLA | 12. Jackson State University |

III. FOFAX Users * (33)

1. Pacific Gas & Electric Co.
2. Oceanroutes Inc.
3. Continental Airlines Meteorology
4. Oceanographic Services Inc.
5. Allen Weather Corp
6. American Meteorological Show
7. WJXT-TV, Jacksonville
8. Eastern Airlines
9. WFLA-TV, Tampa
10. WTVT-TV, Tampa
11. United Airlines
12. American Airlines
13. Murray & Trettel, Inc.
14. N. C. Roberts
15. Newworld Civil Defense
16. WDSU-TV, New Orleans
17. Environmental Research
18. Northeast Weather Service
19. Alden Electric and Impulse Recording Equipment Co., Inc.
20. Northwest Airlines
21. Hubbard Broadcasting Co.
22. Litton Systems
23. Metro Weather Service
24. Rudi Zervigon
25. American Airlines
26. Fleetweather, Inc.
27. Bendix Communications Service Corp
28. Northwest Natural Gas Co.
29. KATU-TV, Portland, Oregon
30. Denardo & McFarland
31. Wilkens Weather Technologies
32. Universal Weather Service
33. WFAA-TV, Fort Worth

*This is a list of users that copy FOFAX mainly or solely for the satellite pictures.

Archived Satellite Data
(Eugene Hoppe - 301-763-8111)

Satellite data are archived in many forms. These forms include images, data tapes, films, film loops, etc. These data are archived in NOAA's Satellite Data Services Division. Since there are numerous requests for archived satellite data, an alphabetical list of users is attached without regard to Federal, private, domestic, or foreign user. In most cases, it is obvious into which category the user belongs:

SATELLITE DATA USERS

* - Denotes more than one request.

Aerojet Electro Systems Company *
 Accu-Weather *
 Adventurebook Press *
 Aero-Nutronic Ford
 Aerospace Corporation *
 AgLac Industries Limited
 Airan Environmental Consultants, Inc. *
 Albuquerque Seismological Laboratory *
 A.M.S.I.
 Analytic Sciences Corporation
 Argentina Armada *
 Arizona State University *
 Arnold Genkins Studio
 Atlantic Weather Corporation
 Australian Consulate - General *
 Australian Embassy
 Battelle *
 Baylor University *
 Bendix Field Engineering Corporation *
 Ben-Gurion University *
 Bigelow Laboratory for Ocean Sciences
 Biologische Anstalt Helgoland
 Blackwell, Wealker, Etal. *
 British Antarctic Survey *
 British Embassy
 Bureau of Mineral Resources of Australia *
 California Institute of Earth, Planetary, and Life Sciences *
 Calspan Corporation *
 Canada Climate Center *
 Canadian Government - Defence Research Establishment Pacific *
 Canadian Pacific Biological Station *
 Canadian Pacific Weather Central
 Canadian Aerospace Meteorological Division
 Canadian Offshore Oceanography *
 Canadian Regional Library
 Canadian Forest Management *
 Canadian Arctic Weather Central
 Canadian Wildlife Service *
 Canadian Centre for Remote Sensing *
 Canadian Fisheries & Marine Service Biological Station
 Canadian Park Service *
 Canadian Centre for Geoscience Data
 Canadian Ocean & Aquatic Services
 Canadian Institute of Ocean Sciences *
 Canadian Marine Drilling, Ltd. *
 Canadian Wheat Board *
 CBS Inc., Technology Center
 CENTEC
 Center for Analysis
 Center for Environment and Man *
 Central Weather Bureau Taiwan *
 Centre d'Observatore Amateur
 CICESE

Attachment

Ciudad Universitaria *
 Clansse Publishers, Ltd. *
 C.N.R. *
 College of the Atlantic
 Colorado State University *
 Columbia University *
 COMPUMET *
 Computer Sciences, Inc. *
 Congressional Office *
 Continental Shelf Institute *
 Cook College
 Council for Scientific & Industrial Research South Africa *
 C.S.I.R.O. Australia *
 Dalhousie University *
 Dames & Moore *
 Danish Hydraulic Institute
 Deerfield Academy
 Defense Mapping Agency *
 Del Instituto Geografico Nacional
 DeNardo & MacFarland Weather Service, Inc.
 Department of Agriculture *
 Department of Industries South Africa
 Department of Interior *
 Department of State *
 Des Moines Registrar
 Deutsches Hydrographisches Institut *
 Direccion de Estudios del Territorio Nacional *
 Director of Sea Fisheries South Africa
 Dome Petroleum, Ltd. *
 Drexel University *
 Earth Satellite Corporation *
 EBON Research Systems
 Ecology & Environment Inc.
 Editorial/Visual Research *
 Edinberg University
 E.G.&G. *
 E.I. DuPont de Nemours & Company
 Embassy of India *
 Embassy of Israel
 Encyclopedia Britannica *
 Environmental Protection Agency *
 Environmental Research & Technology, Inc.
 ERNO *
 Esca-Tech *
 ESL, Inc. *
 ESSO Resources Canada, Ltd. *
 E.S. & T.
 European Space Agency *
 Everett Herald
 EXXON Production Research Corporation *
 Ezze, Garel & Saylor
 F. F. Slaney & Co., Ltd. *
 Fisheries Research New Zealand *
 Fleet Weather Central *
 Florida State University *

Ford Foundation *
 Food & Agriculture Organization of United Nations *
 Ford Aerospace & Communications Corporation *
 Forsvarets Forskingsanstalt *
 Freie Universitat Berlin *
 Frei Deutsches Hydrographisches Institut
 Furman University *
 Gentleman's Quarterly
 Geographic Magazine of Great Britain *
 Geological Survey
 GEO Magazine *
 George Nolts & Associates *
 G.I.S.S./NASA New York *
 Glassboro State College
 Goddard Space Flight Center *
 Gordon Blocker, Inc.
 Grantham College of Education *
 Great Lakes Basin Commission *
 Grolier, Inc. *
 Grumman Aerospace Corporation *
 GTE Sylvania
 Gustavis Adolphus College *
 Haight, Gardner, Poor & Havens *
 Hallmark Cards, Inc.
 Hallwag British Broadcasting *
 Hanscom Air Force Base *
 Harris Corporation
 Harvard University *
 Healy & Farrell
 Hill, Rivkins, Carey, Loesberg & O'Brien *
 Homestead Savings Corporation
 Houghton Mifflin
 Hunter College *
 Huntingdon County Planning Commission
 Hydrometeorological Service of the U.S.S.R.
 I.B.M. Norway *
 I.K.U. *
 Illinois Central College
 Illinois State University
 Illinois State Water Survey *
 Imperial Oil Limited *
 India Agriculture Research Institute *
 India Meteorological Department *
 Indiana University *
 Indiana State University *
 Ingenieursbureau *
 Insel-Film Produktionsgesellschaft *
 Instant Miracles
 Institute for Advanced Computation
 Institut fur Seefischerei
 Instituto de Fomento Pesquero
 Institut de Pasquias Espacialis *
 Instituto Nacional de Meteorologia e Geofisca *
 Intera Environmental Consultants *
 Interamerican Geodetic Survey *
 International Institute for Aerial Survey & Earth Sciences *
 International Weather Corporation *
 Intersea Research Corporation
 Iowa State University *

Iowa Valley Community College
 ISIS, Ltd.
 James Madison University
 Jet Propulsion Laboratory *
 Johannes Gutenberg University
 Johns Hopkins University *
 Johnson Space Center *
 Johnson State College *
 Joint Research Centre
 Jydske Bogimport
 Kenting Earth Sciences Ltd.*
 Kentron Hawaii, Ltd. *
 Koninklijk Meteorologisch Instituut *
 KSTP Television
 kvb Engineering
 Kyoto University *
 Laboratorio per Lo Studio Della *
 Lamamelle Art Center, Inc.
 Lamont-Doherty Geological Observatory *
 Langley Research Center *
 Lawrence Livermore Labs *
 Library of Congress *
 Lockheed Missile & Space Facility *
 Lockheed Palo Alto Research Laboratory *
 Los Alamos Scientific Lab *
 Louisiana State University *
 Lowell Observatory
 LTV Corporation
 Lundat-Thagard Oil Company *
 MacLaren Marex, Inc.
 Marine Biological Lab *
 Marine Environmental Data Service
 Marshall Space Flight Center *
 Marshalltown Community College
 Massachusetts Institute of Technology *
 Mechanics Illustrated Magazine
 Memorial University of Newfoundland *
 MESOMET, Inc. *
 Meteorological Office England *
 Meteorological Services, Inc. *
 Meteorological Service Surinam
 Ministerio de Agricultura y Ganaderia Costa Rica
 Ministerio dos Transportes e Comunicacoes
 Ministry of Agriculture, Fisheries & Food *
 Minnesota Mining & Manufacturing Company *
 Mobil Exploration & Producing Services, Inc. *
 Modern Maturity
 MONEX, Government of India *
 Morski Instytut Rybacki
 Mountain Realty Company
 Mt. San Antonio College
 McGraw-Hill Publishing Company
 Nacional de Pesca Mexico
 NASA Headquarters *
 Nash Roberts Consultants *

Nassau Community College *
 National Center for Atmospheric Research *
 National Centre of Scientific Research *
 National Defense Research Institute
 National Hemp
 National Institute of Polar Research *
 National Meteorological Library *
 National Research Council
 National Space Development Agency of Japan *
 Natural Hazards Research & Applications Center
 Natural History Magazine
 Naval Ocean Research & Development Activity *
 Naval Oceanographic Office *
 Naval Physical & Oceanographic Laboratory India *
 Naval Postgraduate School *
 Naval Research Laboratory *
 Naval Underwater Systems Center *
 Navy Yard D.C. *
 NBC News
 New Bedford Whaling Museum
 New York State Teachers College *
 New Zealand Oceanographic Institute
 Nippon-Electric Company
 North Carolina Marine Research Center
 North Carolina State University *
 Northern Illinois University *
 Norwegian Water Resources & Electricity Board *
 National Space Technology Lab *
 Oceans Routes *
 Oceanographic Services, Inc. *
 Oceanonics, Inc.
 Office de la Recherche Scientifique et Technique Outer-Mer *
 Ohio State University *
 Ohio University *
 Old Dominion University
 Olympic Astronomical Society
 Ontario Centre for Remote Sensing *
 Optical Electronics, Inc. *
 Oregonian
 Oregon State University *
 Organizacion de Los Estados Americanos *
 Organomic Research Foundation *
 Pacific Banker & Business Magazine
 Pacific Missile Test Center *
 Patrick Air Force Base *
 Penn State *
 Petro-Canada *
 Philadelphia Inquirer
 Photo Sciences Inc.
 Plenary Publications
 Princeton University *
 Provincetown Center for Social Studies *
 Purdue University *
 Qualley, Larson & Jones

Regina Weather Office Canada *
 Remoteec Applications
 Renfro Hosiery Mills *
 Research Report *
 Research Triangle Institute *
 Resource Planning Association
 Rice University
 Rockwell International *
 Royal Observatory *
 Salt River Project
 Schools (Elementary, Junior High, & Senior High - several hundreds)
 Science Applications, Inc. *
 Scott Polar Research *
 Scripps Institution of Oceanography *
 Servicio Nacional de Meteorologia e Hidrologia *
 Skidway Institute of Oceanography *
 Shipping Corporation of India Limited *
 Skyline College
 Smithsonian Institute *
 Societe D'Etudes et de Recherches D'Uranium *
 South Asia Institute *
 Son Flowers Discipleship Journal
 South Dakota State University
 Southern California Coastal Water Research Project
 South Florida Museum & Bishop Planetarium
 Space Applications Centre *
 Space N Tromsco *
 Stanford Research Institute *
 State of Alaska
 State Organization of Minerals Iraq *
 State University of New York *
 St. Cloud State University
 St. Joseph's College of Education
 Stowers, Roane & Carley
 Swedish Meteorological & Hydrological Institute
 Systems Applications, Inc. *
 Systems Development Corporation *
 Taft and Associates *
 TEAM, Inc.
 Technology Magazine *
 Teknekron
 Telegraph Sunday Magazine
 Tetra-Tech
 Texas A. & M. *
 Texas Instruments
 Thames & Hudson, Ltd. *
 Time-Life Books, Inc. *
 Tokai University
 Town of Valdese
 Traffic World
 Trends Publishing, Inc.
 Trident Engineering
 TWA Tours *

Union of Concerned Scientists
 United States Air Force *
 United States Army *
 United States Aviation Underwriters *
 United States Engineering Company *
 United States Fish & Wildlife Service *
 U.S.A. Inc. *
 United States Navy *
 United States Space Education Association *
 Universidad Autonoma de Madrid
 Universidade de Sao Paulo *
 Universidad Nacional de Colombia
 Universitat Innsbruck *
 Universite de Bordeaux III *
 University of Alaska *
 University of Arizona *
 University of Berlin *
 University of Bern *
 University of Birmingham England *
 University of California Berkley *, Davis *, Irvine *, Los Angeles *,
 San Diego *, Santa Barbara *
 University of Chicago *
 University of Colorado *
 University of Copenhagen
 University of Dayton *
 University of Delaware *
 University of Edinburgh
 University of Florida *
 University of Georgia *
 University of Guyana
 University of Hawaii at Monoa *
 University of Heidelberg *
 University of Ibadan
 University of Illinois *
 University of Kansas *
 University of Lancaster
 University of Manchester
 University of Maryland *
 University of Miami *
 University of Minnesota-Twin Cities *
 University of Nebraska *
 University of New England *
 University of New Mexico *
 University of North Carolina *
 University of Oklahoma *
 University Palais de Rumine *
 University of Pennsylvania
 University of Reading *
 University of Rhode Island *
 University of Roorkee *
 University of the South Pacific *
 University of St. Louis
 University of Texas *
 University of Utah *

University of Vermont *
 University of Virginia *
 University of Washington *
 University of West Indies
 University of Wisconsin *
 University of Wisconsin-Green Bay *
 Upjohn Company
 Utah State University *
 Vendeventer, Black, Meredith & Martin
 Verna Engineering
 Vincennes University
 Virginia Institute of Marine Sciences *
 VISTA Laboratories *
 VIVMO
 Vought Corporation *
 Walkup, Downing, Shelby, Bastian, Melodia, Kelly & O'Reilly *
 WAMAX
 Washington University *
 WBLI/FM
 Weatherbank *
 Weather & Marine Company, Ltd. *
 Weathermation Inc. *
 Weather Services Corporation *
 Westermann *
 West Virginia University
 Woods Hole Oceanographic Institute *
 World Book *
 World Meteorological Organization *
 WQEG TV
 Wright-Patterson Air Force Base *
 WRTV
 WQED TV
 Zeta Corporation *

Question. Would you comment on purchasing (Landsat) information from a private corporation?

Answer. NOAA's internal programs make limited direct use of Landsat data, primarily in the assessment of snow cover as part of its hydrology programs, and in a few research programs. To meet its needs, NOAA would have no objections to purchasing Landsat data from a private corporation, provided prices were reasonable and data delivery schedules met program needs.

Question. I am interested in your operational interface with COMSAT. Would you please comment?

Answer. NOAA has no operational interface with COMSAT, and thus can offer little that would be of value to the drafting of S. 875, The Earth Resources Information Corporation Act of 1979. The only direct discussions between NOAA and COMSAT have related to the use of NOAA Geostationary satellites as relays for the transmission of remote in situ environmental measuring systems to central processing facilities (The GOES Data Collection System). COMSAT was consulted early in the design of this environmental monitoring system to insure that there were no policy or program conflicts. None were found.

Senator STEVENSON. We now have a panel of four witnesses representing State and local governments. The next witnesses are: the Honorable Monroe Flinn, Majority Whip of the Illinois House of Representatives; Mr. Robert Wise, Director of the Council of State Planning Agencies, who will present the testimony of Sally Cornwall, the Chairperson of the Earth Resources Data Council, who was unable to get here; Mr. James Monaghan, Assistant to Governor Lamm of Colorado; Mr. Bruce Rado, of the Georgia Department of Natural Resources, who will speak for the National Governors Association; and Mr. Erling O. Mork, the City Manager

of Tacoma, Wash., who will give us the regional perspective based on the experience of their resource inventory project and experience with remote sensing.

I will call on the witnesses in the order of their appearance. I invite them to summarize their statements and ask them to keep it to 10 minutes in order to preserve time for questions. Their full statements will be entered in the record.

It is a special pleasure for me to welcome this morning an old and very good friend, a distinguished public servant from my own State and a graduate of my own alma mater, the Illinois House of Representatives, Representative Monroe Flinn, the Majority Whip of the Illinois House of Representatives.

Please proceed.

STATEMENTS OF MONROE FLINN, MAJORITY WHIP, HOUSE OF REPRESENTATIVES OF THE STATE OF ILLINOIS; ROBERT WISE, STAFF DIRECTOR, COUNCIL OF STATE PLANNING AGENCIES; JIM MONAGHAN, ASSISTANT TO THE GOVERNOR OF COLORADO; BRUCE RADO, DEPARTMENT OF NATURAL RESOURCES, STATE OF GEORGIA; AND ERLING O. MORK, CITY MANAGER, TACOMA, WASH.

Mr. FLINN. Thank you, Mr. Chairman and Senator Schmitt.

My name is Monroe Flinn. I am the majority whip of the Illinois House of Representatives. I am here representing the National Conference of State Legislatures, which serves all of the Nation's legislatures, and the NCSL Landsat task force, which is responsible, for formulating policy recommendations on satellite remote sensing. I am honored to have the opportunity to present the NCSL's views on the Earth Data and Information Service Act of 1979; namely, bill S. 663.

Overall, we feel this legislation is an important and constructive step forward in the development of a capability to inventory, monitor, and evaluate our Nation's and the world's resources and environment on a continuous, ongoing basis. We applaud the efforts of Senator Stevenson, other sponsors of S. 663, and Senators Ford and Moss before them, to provide an institutional framework to reap the benefits of satellite remote sensing.

Landsat data has been increasingly accepted and used within State and local governments over the past 7 years. My purpose here, however, is not to detail these past and other potential future Landsat applications, but rather to provide a State and local perspective on the future institutionalization of the technology as reflected in the Earth Data and Information Service Act of 1979.

The time to formalize the institutional responsibilities and relationships for an Earth Data and Information Service has come, and the NCSL Landsat task force strongly supports the development of an ongoing service to provide continuous, reliable and compatible data to public and private users. Over the last several years, many studies have been conducted and their consistently stated conclusions are generally compatible with S. 663. Indeed, the administration is currently conducting yet another study.

While the States, the Federal user agencies through the FCCSET Landsat study, and the private sector and others have clearly expressed their needs over the last several years, the Federal Gov-

ernment seems to be caught in a cycle of continuous interagency studies and task forces that never seem to get much of anything done.

We need an established, reliable service, and, hopefully, S. 663 will break the bureaucratic paper cycle that seems to be forestalling action rather than charting a course for the future of satellite remote sensing.

We are particularly supportive of the idea of developing the service within the Federal Government and the National Aeronautics and Space Administration. Over the last several years, NASA has clearly demonstrated its sensitivity and responsiveness through activities such as the regional remote sensing applications program and applications systems verification and transfer projects.

Furthermore, our task force feels the technology is still not accepted widely enough to be taken over entirely by the private sector, and that the needs of public-sector users would not necessarily be adequately met in an environment where profit and loss are the major considerations. In the longer run, once adequate markets have been aggregated and public- and private-sector users have developed the capacity to fully utilize Landsat-type data, the private sector might well be best qualified to manage and operate the system. Such a turnover, however, would clearly be premature at this time.

The major area of difference between NCSL Landsat task force policy positions and S. 663 relates to the philosophy behind the financing of the service. While a "pay as you go" system may be desirable from a Federal perspective and justifiable for certain classes of users, such as those deriving a profit through use of products of the system, from a State perspective, other arrangements would be more desirable.

Specifically, we feel that the service's charter should reflect a public-service concept, and that Landsat-type data should be considered in the same context as census, mapping, and weather data which are provided at cost of reproduction and distribution by the Federal Government.

Timely and accurate information on our resources and environment cannot help but improve the quality of our resource decision-making, which will lead, in turn, to improving the common good. An ongoing natural resource census provided through Landsat-type data can make a positive contribution to the information bases available to our natural resource decisionmakers, both legislative and executive, and its use should be encouraged whenever possible. Because of increasing demands for resource planning, spurred in large part by Federal programs, and since the advent of Proposition 13 and related actions, State and local data budgets have been stretched to the limit. The costs of a "pay as you go" system would effectively discourage use at a time when the user base needs to be expanded so that it can eventually become self-supporting.

I submit that no one fully understands the user costs associated with a self-supporting Earth Data and Information System. A data cost increase of 10-100 times—an estimate currently being used in some circles—would have a devastating effect on public-sector users. We shouldn't throw out the baby with the bath water, so to speak. We must recognize the public-good aspect of the service.

The role of State and local governments in providing input and advice on systems development and operation could be strengthened in S. 663. The bill currently gives the Administrator of NASA the responsibility to arrange for participation of user communities in such activities. An explicit statement defining "user communities" to include State and local governments and others would remove any potential ambiguities and assure adequate participation by the non-Federal public sector.

Another area the NCSL Landsat task force feels should be explicitly addressed in S. 663 concerns the technology transfer function of the service. As partners in the Federal system, the Federal Government has an obligation to assist the States in developing the capacity to manage their resources. Landsat-type data can make a strong contribution to the data base for natural resource decision-making—but only if the decisionmakers and other users have the capability to interpret and apply the vast stores of information space remote sensing can provide.

The Landsat task force, therefore, urges the committee to explicitly address technology transfer to State and local government—including orientation, training, demonstration projects, and technical assistance—in their revision and amendment of S. 663.

A final suggestion regarding the Earth Data and Information Service Act of 1979 concerns the ban on data reproduction of service products by users. While we are cognizant of the need to provide an adequate market to allow economies of scale to be realized within the service, we must also consider the fiscal implications of such a ban on our State and local governments. Many States have or are setting up centralized information services and clearinghouses to reduce the costs of data to State, regional, and local agencies, eliminate duplication of data-gathering expenditures, promote multiple use of data resources, pool existing hardware resources to limit capital outlays, and provide specialized staff capabilities.

A total ban on reproduction of service products will unnecessarily undermine such efforts. In modifying S. 3589, an exemption to the ban for educational purposes was recognized as being needed, and is reflected in S. 663. I would suggest that this exemption be extended to State and local governments for all noncommercial uses.

On behalf of the National Conference of State Legislatures and the NCSL Landsat task force, I would like to thank the committee for this opportunity to express our views on this important piece of legislation. I have taken the liberty of suggesting specific language to reflect NCSL's recommended changes, which you will find attached to my written statement. I trust you will find our suggestions to be both constructive and reasonable. If we can be of further assistance, please feel free to call upon us.

Departing from my written text, I would suppose that this committee is no different from the committees of the Illinois House of Representatives, in that when we hear something wrong, we would prefer to find out from constituents that something is right. When something is right, like this bill is, in my opinion, we are certainly always glad to hear that.

Thank you. We certainly appreciate talking to you.

[The material referred to follows:]

SUGGESTED AMENDMENTS TO S. 663—THE EARTH DATA AND INFORMATION SERVICE ACT OF 1979

Sec. 7(d)(7)—To conduct a technology transfer program directed at federal, state and local government users and consisting of training, demonstration projects and technical assistance activities.

Sec. 7(f)(2)—Arrange for the participation of the scientific, technical and user communities, including federal, state and local governments and the private sector, in planning the system, and in acquiring, processing, analyzing, and distributing data and basic information products to users; and

Sec. 9(a)—The Administrator shall establish a schedule of charges for products and services provided to users as required to carry out the provisions of this Act. The Administrator shall design such charges to be consistent with the provisions of Section 552 of Title 5, United States Code, and is restricted and limited to charges for reproduction and handling set forth in that section.

Sec. 9(e)—Delete.

Sec. 10 (insert after subsection (a) or (b))—Notwithstanding the provisions of subsection (a), the fair use of any data or basic information product, including such use by reproduction in copies or by any other means specified by the Administrator, for purposes in support of the missions of state and local government agencies, is not a violation of subsection (a) of this section.

Senator STEVENSON. Thank you, sir. We're grateful for the statement; and for the support.

Mr. Wise.

Mr. WISE. Mr. Chairman and members of the committee, my name is Robert M. Wise. I am staff director of the Council of State Planning Agencies, an affiliate organization of the National Governors Association.

Today I am speaking on behalf of the Earth Resources Data Council, which is a working group of State officials, appointed by the Council of State Planning Agencies in cooperation with the Governors Association on issues in the natural resource data area.

Sally Cornwell, from California, chairperson of that task force, is not here today and couldn't make the meeting, so I'm testifying in her place.

There are three important points I would like to make in summarizing my testimony.

First, in general, States are increasingly realizing the use and important benefits of a Landsat program; second, that the States seek assurances of continuity regarding the data collection and distribution system of that program; third, that Data Council does support the Earth Data Information Service Act of 1979, with some reservations—minor reservations regarding State uses.

I don't need to reiterate very long the numbers and types of Federal programs that require State and local data use, the coastal zone management program and the National Water Pollution Control Act, among others. Such programs are important and part of the responsibility of State and local government under Federal law. The most important widespread application of Landsat by the States has been in the inventorying of land cover information, which can be integrated with soils, geologic, and other resources development—a fairly comprehensive type of information base. In many cases, it was only through Landsat that states, at a reasonable cost, were able to develop the national resource inventories on a statewide basis.

There are numerous reasons for increasing the use of Landsat technology at the State level. They include the recurring coverage,

the monitoring potential, the ability to identify and isolate areas of specific interest (for example, fault lines and water resource areas); computer capability of the data, and the way it can be integrated with other types of data.

The use of these data from remote sensing can be easily traced to one or two main reasons:

The first is that it provides a tool to develop new and additional information, which was inaccessible through using traditional techniques—basically, information that couldn't be gathered in any other way.

Second, it allows the potential of pulling together information quickly and at a relatively low cost compared to some other systems. And in the written testimony there are examples of these two justifications.

The efficiency in gathering and managing research data has become extremely crucial to the States as they develop ways to utilize existing sources of data, so that costs can be lowered. We feel that cost is an important factor, at least in terms of State and local utilization of data.

The overwhelming opinion of the States at this time is that a Landsat program should continue on an operational basis, without interruption of the available data. And I might say, parenthetically, that continuity would encourage investment, from the State point of view. Whatever Federal system is established for the collection and distribution of Landsat data should proceed immediately.

We feel that there have been plenty of studies—too many studies. The States need assistance in information collection now. The energy issues, the resource issues—at the State level—don't allow us the time to contemplate where we're going to get this information.

We'd like to make a few recommendations, which I'll summarize very briefly.

On the Earth Data Information Services Act of 1979: We strongly support the Act. The first point is that we would like to reiterate the importance—the urgency—of establishing an ongoing, remote sensing data-gathering system. The reasons for this have already been outlined—State and local agencies have responsibility for increased burdens of implementing federally mandated programs which require the collection of data at the State level.

Second, we support a service-oriented program, one that is developed in cooperation with the community that the operational system is designed to serve. That means a specific reference in the legislation to the needs of State and local government as well as other users.

Third—and I think this is a point—which I personally feel strongly about—there is a consensus among the State and local governments that the nature of data and the services contemplated in this legislation are analogous to the services already offered in the Federal Government for the population census.

It's been surprising to me after the numbers of years of natural resource programs, that there's not a comprehensive Federal Government program for natural resource data. And we feel that Senate bill 663 provides the possibility of that important new com-

mitment. It needs to be made nationally if the country is going to deal with the major issues in energy, water resources, agriculture and timber production, and other areas.

On the role of the private sector, we believe that using the capabilities of the private sector in the design and construction of the system, plus the promotion of competition among suppliers of service and technical equipment, are the proper roles for private industry. It is normally not in the interests of the private sector to transfer technology, but rather to develop a complete line of pertinent service and equipment, which then are used in competition with other enterprises.

There should be ample market opportunity for industry during the initial 7-year interim period, and also later, should the service be retained in the Federal Government. The private sector can provide specialized data products for smaller clients and get them out much more quickly than any Government system, which would be designed to serve a larger constituency.

In summary, on behalf of the Earth Data Resources Council and the Council of State Planning Agencies, I strongly urge the immediate development of a system for continuing distribution of satellite-based, natural resource information, as outlined in the bill. With certain reservations, which have been mentioned, we can support this bill.

The data demands upon local and State government are rapidly increasing, while its pursestrings are rapidly tightening.

The time for action we feel is upon us.

Thank you, Mr. Chairman.

STATEMENT OF SALLY BAY CORNWELL, CHAIRPERSON, EARTH RESOURCES DATA COUNCIL, DIRECTOR, CALIFORNIA ENVIRONMENTAL DATA CENTER, COUNCIL OF STATE PLANNING AGENCIES, EARTH RESOURCES DATA COUNCIL

Mr. Chairman and Members of the Committee, My name is Sally Bay Cornwell. I am the Director of the California Environmental Data Center within the Governor's Office of Planning and Research. I am here today representing the Council of State Planning Agencies' Earth Resources Data Council, which I chair, in support of and in cooperation with the National Governors' Association Committee on Natural Resources and Environmental Management. The Council primarily represents the views of state governments, although it also reflects the data needs of local governments related to state mandated local programs and state local assistance efforts. My primary purpose is to present the views of the states on the establishment of an ongoing institutional framework to make data and basic information products on the Earth's resources and environment available to all users. There are three important points I want to make clear today:

- (1) In general, the states are increasingly realizing the uses and important benefits of the Landsat program;
- (2) Assurance to the states regarding the establishment of continuous, reliable data collection and distribution system for Landsat data is urgently required; and
- (3) The Data Council favors passage of the Earth Data Information Services Act of 1979, with some reservations to be expressed later in this testimony.

STATE USES

In recent years increasing awareness of the significance and lasting impact of decisions concerning land use, our environment and the utilization of our natural resources has developed. Responding to this awareness both state and federal legislation have increased the authority and responsibility of state governments to plan and manage the use of our land and natural resources. Federal programs such as Coastal Zone Management, the Federal Water Pollution Control Act, the Surface Mining Control and Reclamation Act of 1977 and others have demanded that states have access to large quantities of diverse data to describe and monitor conditions on the earth's surface. State programs, such as California's Coastal Zone Conservation

Act, Mississippi's Forest Practices Act, and the Maryland Wetlands Act, have further increased these data demands. To effectively execute these responsibilities within their limited budgets, state and local agencies have been forced to go beyond conventional data collection techniques which are often inadequate and too costly, in the search for better data gathering techniques. One of the most effective new tools, when used in conjunction with existing data in an established data base, is the Earth remote sensing satellite, Landsat.

The most important and widespread application of Landsat by the states has been the inventorying of land cover information which can be integrated with soils, geologic and other resources data to develop a comprehensive information base for planning and management of land use and natural resources. In many cases, it was only through Landsat that states were able to develop natural resource inventories on a statewide scale.

There are numerous reasons for the increasing use of Landsat technology, including the recurring coverage for monitoring purposes, the ability to identify and isolate areas where closer study is needed, computer compatibility, and its feasibility for use with other data sources. However, the use of satellite remote sensing by state governments can usually be traced to one of two main reasons:

(1) It provides a tool to develop new and additional information which was inaccessible with traditional techniques; and

(2) It has allowed the potential to obtain information more quickly and at a lower cost than conventional techniques, a factor rapidly growing importance in these post-Proposition 13 times.

I would like to give the committee just a few state examples to further elaborate on these two points.

Idaho's agricultural lands are heavily irrigated and comprise a significant and often changing demand on the state's water supply. In fact, it is estimated by the state's Department of Water Resources that around 10,000 additional acres became irrigated every year for the past ten years. However, the location and intensity of the irrigation which is of utmost importance to provide sufficient water have never been adequately known. Much of the existing data is up to ten years old and virtually useless for current planning and management purposes. To determine these unknowns, and to get a better understanding on the amount and kind of irrigated crops added each year, Idaho turned to Landsat. According to the Department of Water Resources planners, Landsat proved the most effective method of inventorying irrigated lands and establishing the optimum distribution of water. Landsat data was used to update the inventory of four million acres of irrigated lands along the Snake River—a task that had not been completed for the past decade. As a result of these benefits and anticipated future uses, Idaho uses Landsat in an operational mode to meet water planning and management needs.

The Texas Natural Resources Information System used Landsat data to map a small test area of the commercial timber zone in East Texas. The results of this pilot project indicate this 11 million acre region can be inventoried at considerable cost savings over other methods. For example, using traditional aerial photography, it is estimated that 10.7 man years would be required to map the entire region and thus, if completed by 1-2 people, the information would have been out-of-date and virtually useless. However, using Landsat, the same project would take only 4 man months to complete.

Landsat can also provide previously unobtainable data because of the large area covered by a single satellite scan. This broad perspective is practically impossible with any other data source. For example, wide area features such as faults or other geological features that are visible on Landsat would go undetected on aerial photos.

Cost-efficiency in gathering and managing natural resources data has become extremely crucial as the states seek ways to tap existing sources of data so that costs can be lowered without compromising data quality. As I have mentioned earlier, state and local agencies are faced with increasing demands for natural resources data. However, these same agencies are facing increasing scrutiny of their fiscal affairs, as particularly evidenced by California's Proposition 13, and now find themselves directly in the middle of the battle to balance the necessary conservation and protection of the environment and the fiscal responsibility and restraint demanded by the taxpayer. In short local and state agencies need more and better information at lower costs. The use of satellite remote sensing is one way to meet this problem.

For example, as part of the Pacific Northwest Regional Commission's Land Resources Inventory Project, the Washington State Department of Natural Resources used Landsat to inventory ten million acres of federal, state, and private forest reserve in western Washington. Conventional methods would have taken two years

and an estimated cost of \$2.0 million to accomplish this inventory. Using Landsat, a comparable inventory is being completed in one year at a tenfold reduction in cost.

In southwestern Illinois, the completion of a required land cover inventory using traditional methods took 8 years, covered 1,786 square miles and cost approximately \$106,000. Using satellite imagery, the same survey took 6 months, covered 3,782 square miles, and cost approximately \$16,000 resulting in a 14-fold cost reduction.

In the East Texas Commercial timber zone mapping I mentioned earlier, the extrapolated cost and timeliness of Landsat (\$10,200 in 4 man months) would be quite favorable when compared to the extrapolated estimates for serial photos (\$294,000 in 10.7 man years). The Maryland Department of State Planning realized a 13-fold cost reduction by using Landsat in preparing a state land use and development map and inventory.

REQUIRED ASSURANCE OF CONTINUANCE

There are other examples of time and cost savings too numerous to mention today. Obviously, many state and local government officials look to Landsat as an important aid in carrying out their mandated responsibilities. The overwhelming opinion of the states is that the Landsat Program should continue on an operational basis without any interruption in data availability. For the states to make a commitment to use the new Landsat technology, it is clear an operational system must exist.

Whatever federal system is established for the collection and distribution of Landsat data, it should proceed immediately. The states need assistance in information collection now. They need the reassurance that their time and dollar investment in Landsat is not part of a short-term fanciful experiment. It is obvious that Landsat data are needed and are useful. With federal legislation requiring the acquisition of more detailed data, it is the responsibility of Congress to see that the research investment in Landsat is not lost but carried through to a useful, ongoing status.

In the last year, several major reports representing state and local government perspectives have been issued; all unanimously endorse a firm federal commitment to an immediate establishment of an operational earth resources information system. In one such report, Governor Edmund G. Brown, Jr. of California stated, "The federal government must guarantee that the Landsat system be given long-term operational status rather than continuation as a short-term research program. Only on that basis can the state commit its own resources to the continued use of this technology." The hesitancy to commit to such a system is of great concern to the states, who are in critical need of a system that can be relied upon for data quality and continuity at reduced costs.

RECOMMENDATIONS ON THE PROPOSED EARTH DATA INFORMATION SERVICES ACT OF 1979

In view of the situation now facing state and local government, we would strongly urge the establishment of an operational earth resources information system, proposed in the Earth Data and Information Service Act of 1979. However, we would like to emphasize a few reservations we have regarding the bill, as well as those points we particularly support.

First, I would like to reiterate the importance and urgency of establishing an ongoing remote sensing system, as proposed in the Earth Data and Information Service Act of 1979. The reasons for this have already been outlined, but require further emphasis. State and local agencies have the responsibility for and increased burdens of implementing federally mandated natural resources and environment programs while simultaneously facing budgetary cuts and limitations. The establishment of the Earth Data and Information System assures continuity of Landsat data and would be very valuable as one way of helping solve this dilemma.

Second, we support and encourage the cooperation and direct involvement of the Service with state and local governments. Only through direct feedback with the states regarding their needs will a Landsat-type data distribution system effectively meet the varied and changing needs of the states. States will use the information and are currently organizing such programs. States and local governments willingly have participated in efforts—such as the ISETAP report¹ cited below—to provide advice and guidance for developing a distribution system, and have demonstrated a

¹"State and local Government Perspectives on a Landsat Information System," prepared by the Natural Resource and Environment Task Force of the Intergovernmental Science, Engineering and Technology Advisory Panel (ISETAP). June 1978.

responsible initiative in the use of integrated data systems which include remote sensing data. California, for example, established the Environmental Data Center (EDC) that is charged with the coordination of natural and environmental resource data among all levels of government in the State. The EDC also encourages the appropriate use of new technologies in data gathering, including remote sensing and information management systems in state and local agencies. California is only one state among many that already are moving in the direction of integrated data and information services in natural resources, and that eagerly await a similar federal commitment.

Third, it is the consensus of many state and local governments that the nature of the data and services contemplated in this legislation are analogous to services already offered by the federal government in the population census and meteorological data service areas. Information on a nation or state's natural resources is essentially a public trust. The establishment of a publicly supported "natural resources census" may be the inevitable conclusion reached during the interim period specified in Senate Bill 663 for effective implementation of federal and state mandated resources programs. If the federal government were to run the service, cost recovery would of course be an important objective, but the service function would be paramount. This would be especially important to state and local governments that would almost certainly require periodic applications assistance and other technology transfer services. The ongoing improvements and refinements of remote sensing technology through NASA research and development efforts—that have helped maintain this country's technological lead—would also be assured if the earth resources information service ultimately were operated by the federal government.

Fourth, we believe that using the capabilities of the private sector in the design and construction of the System plus the promotion of competition among suppliers of services and equipment are the proper roles for private industry. It is normally not in the interest of the private sector to transfer technology to state and local government, but rather to develop a complete line of pertinent services and equipment that would support technology transfer efforts.

There should be ample market opportunities for industry during the initial seven year "interim" period and also later should the Service be retained in the federal government. The private sector can provide specialized data products for a smaller clientele much more quickly than any government system which serves a larger constituency. Industry can also provide low cost hardware and software to be used by state and local agencies in their applications of remotely sensed data. Federal commitment to establish an earth resources information service would provide considerable stimulus to the market. Other agencies and even foreign nations would be more comfortable with the use of remotely sensed data and in dealing with private industry if they could be assured of continuity in the availability of basic data.

Because it is our hope that the System ultimately will be operated by the federal government as a public service, we do not support the Earth Resources Information Corporation Act of 1979, introduced last Wednesday as Senate Bill 875.

In summary, on behalf of the Earth Resources Data Council of the Council of State Planning Agencies, I strongly urge the immediate development of a system for the continual distribution of satellite-based natural resources information as outlined in this bill, with certain reservations as indicated in the testimony. The data demands upon local and state government are rapidly increasing while its purse strings are rapidly tightening. The time to act is definitely now.

Thank you.

Senator STEVENSON. Thank you, Mr. Wise.

Those suggestions will be helpful to us.

Mr. Monaghan.

Mr. MONAGHAN. Thank you, Mr. Chairman, Senator Schmitt.

Actually, two of us will be presenting testimony on behalf of the National Governors' Association. I believe that our statement has been tendered to the committee, and I'll simply summarize and amplify several points that I wanted to make.

First of all, my name is Jim Monaghan. I'm executive assistant to Governor Lamm of Colorado, and I chair the staff side of the NGA's Committee on Natural Resources and Environmental Management.

Governor Lamm is chairman of the Governors' committee itself. With me today is Bruce Rado representing Governor Busbee of Georgia.

Our involvement from NGA and my personal involvement in the Landsat situation really came through the ISETAP, which is the President's Intergovernmental Science, Engineering, and Technology Advisory Panel, which was established by legislation to advise the Office of Science and Technology policy.

We conducted a rather lengthy survey of Landsat application by State and local government in 1978. The study was headed by Governor Lamm, Governor Busby of Georgia, and Representative Tom Anderson of Michigan. And we will tender a copy of the report to the committee. It represents a rather extensive survey on behalf of the State government.

Senator STEVENSON. We're familiar with that report. We'd be glad to have another copy for our records. It's already an extremely useful source.

Mr. MONAGHAN. Thank you very much.

There are several points that we have to make. First of all, I think the NGA applauds both efforts to do essentially the same thing, which is to bring Landsat into an operational status.

As you stated, Mr. Chairman, there are differing opinions as to how one might do that, but certainly we're at the point in the States that the argument is how you should operationalize the system, not whether it should be operationalized or studied further.

With respect to the how, I think most of us that have been involved in the ISETAP study in NGA support a number of concepts in S. 663 and do find some problem with respect to the private versus public ownership of the system, which I'll go into.

From the State standpoint, the most important issues are, of course—firm commitment and predictability. Under that broad umbrella, the concept of a lead agency—knowing as soon as possible who's going to be in charge of the system from the Federal Government's side is very important.

Second, the issue of cost itself—S. 663 contemplates an interim period of 7 years, which we find extremely useful in taking the technology from essentially a demonstration level to a commercialization level.

And frankly, the umbrella of cost protection for States and local governments, being the users, is extremely important because as contemplated in the bill, it gives us the possibility of knowing, over a period of 5 to 7 years, basically what the costs would be and allows the States to then move ahead with the commitment, given that predictability.

The third point is, of course, the public versus private ownership. I think both bills contemplate at an end point a very heavy private sector involvement, if not outright private ownership and operation of the system; and I can find no fault with that.

Again, during a transition period, during an interim period, we need for the States to have some predictability, not simply in just the cost, but also in the type of data that will be available for the States.

I might opine that the energy users—energy companies—might be primary investors in a privately owned system. And while that data might be very important to that industry and important to the States, other data which might be used in agricultural manage-

ment, water resources management, might not be as quickly forthcoming under the private ownership as public.

A fourth point, a policy point, that I would like to make is the need to fully nurture the transferability of the system and of the data. The bill which I've reviewed, S. 663, allows for a commitment to transferability, transfer of technology. We think that must be aggressively pursued, so that the States can be mature in the use of the data.

I'd like to reflect just for a moment on Dr. Press' testimony, if I could, because it relates to a fundamental problem that we have. He really states a paradox. On the one hand, the administration asks that we do not institutionalize, through legislation, the Landsat program at this date. And on the other hand, there's incredible pressure upon the States to make firm commitments—a dollar commitment, a personnel commitment, a user commitment—in terms of the Landsat program.

And the States find it very hard to make those kind of commitments unless there is predictability, unless we know that there's going to be a lead agency, unless we know what the costs are going to be, unless we know who we're dealing with.

And therefore, we very much think that we should move ahead at this time and not wait. It seems to me that the administration's reluctance boils down to timidity in not being able to establish a lead agency at this period of time, and also the pressures from OMB. But we should surface those and talk about those very publicly.

OMB is obviously concerned about the cost of this program, and it seems to me that as we do restrict budgets, as we do cut down governmental expenditures, we have to exercise a great deal of discretion.

There are two trends that the States are very concerned about. One is obviously decreased capital for government expenditures. The other is the shift from Federal to State of a number of responsibilities dealing with national problems: Water resource problems, energy problems, hazardous waste disposal and handling, clean air.

Over the last several years, there's been a decided shift of responsibilities to the State level. And any programs which build the capacities of State and local governments to deal with those problems should be distinct from other forms of Federal assistance to States.

Therefore, while there is some hesitancy on my part, as a State official coming before a committee, asking for Federal support of a program that States enjoy and benefit from at the same time we're asking for a balanced Federal budget, et cetera, we distinguish this as a capacity-building program, a program that will allow us to deal with those national problems in a more conscientious and learned fashion.

And therefore, if you want to put off the question of cost, if OMB wants to put those questions off until 1980, 1981, 1982, the cost of operationalizing the Landsat system certainly will not decrease over the next several years.

So we, the State of Colorado, and NGA certainly support the two efforts to operationalize the system as quickly as possible.

Thank you.

Senator STEVENSON. Thank you, sir.

Mr. Rado, do you want to add something?

Mr. RADO. Yes.

In addition to Mr. Monaghan's comments regarding the issues of the uses and benefits of technology transfer, I'd like to speak to that subject in a little bit more detail.

The States are recognizing the need for responsible management of their national resources as important to controlling the future of the State and its development.

In response to the Nation's natural resource problems, both Federal and State legislation and regulations have increased the authority and responsibility of State governments to better plan and manage their natural resources.

To successfully execute these legally mandated responsibilities within limited budgets, State officials need geographically oriented data which are site specific, comprehensive, timely, and can be acquired at a reasonable cost and on a repetitive basis.

The States consider Landsat to be an important technology that is presently making, and will continue to make, significant—often unique—contributions to the information base required for State government management of natural resources.

Further, the States have concluded that Landsat is now cost effective in a number of applications. Many of the States responding to the ISETAP survey indicated they are presently using Landsat because it is proven to be more cost effective than other conventional techniques for certain types of projects.

Specifically, these types of projects include federally mandated programs which require data and analysis over the entire geographical area of the State.

As a reminder—as of the ISETAP survey, seven States had independent, ongoing, operational analysis capabilities. In addition, 12 States had completed demonstration projects and are close to an operational decision. An additional 16 States are in the early development phases. An often overlooked element in State analysis of Landsat data for resource management is the role of the Federal agency as a client for State-generated products. This allows State resource data to be incorporated into Federal agency decisionmaking affecting a State's resources, while also considering the multifaceted resource concerns which the States have. It may also be that State-generated projects could be accomplished in a more economical fashion.

The commitments of the States can be measured in the following statements:

Thirty-five States already have institutional mechanisms to facilitate Landsat use.

A minimum of 10 States have purchased, budgeted, or ordered equipment.

Over \$9 million in State funds have been spent, over \$8.5 million in State-controlled, federally provided funds have been spent.

Over 380 person-years of staff time invested, and over 1,500 State personnel have been trained.

The ISETAP study also found that a Federal commitment to data continuity is needed in order for State governments to significantly increase their use of Landsat data.

Further, I submit that this level of involvement, if encouraged and permitted to continue, will begin to rise at an exponential rate as the users, who are now only beginning to enter the pipeline, realize and accept the appropriate levels of technology now becoming available.

With regard to technology transfer, a perceived weakness of Senate bill 663 is the absence of a program for technology transfer. The Federal Government must make a commitment to the systematic and ongoing technology transfer program as a public service to assist State governments in the institutionalization of their capability for using Landsat.

Although NASA's technology transfer program has improved substantially over the years and is now extremely effective within the limited resources allocated, no Federal agency currently has the clear responsibility to transfer remote sensing satellite technology to the users.

One particularly important aspect of technology transfer is demonstration and validation projects. State governments have strictly operational applications. The States do not have funds for research and development or to adapt new technologies. Therefore the States require low cost, relatively low risk demonstration opportunities before they are able to commit State funds for new concepts. State users continually stress the importance of having the opportunity for hands-on demonstration projects tailored to meet their needs and conducted over test sites of their choosing. Such custom demonstrations are seen as the only realistic way to acquaint users with the technology and its applications in an operational setting.

This allows States to overcome any reservations about its effectiveness and to instill the confidence required to develop an ongoing program. If the Federal Government provides the opportunity for a validation effort, the States can then more easily provide funds for the operational use of the concepts.

Without a recognized and focused technical assistance program within the Federal Government, the use of satellite remote sensing will continue to be significantly constrained. Senate bill 663 should be amended to establish an adequately funded, ongoing technology transfer program.

One final point we would like to make is that it is essential to involve State and local governments and other users in the future development of an operational remote sensing system. The National Governors Association strongly recommends that the lead Federal agency develop a structured process for a continued involvement of State and local governments in Federal remote sensing plans and programs.

In closing, the NGA would like to stress that the time to act is now. We would like to thank this committee for the opportunity to present the view of State governments on what we consider a most important issue.

[The statement follows:]

STATEMENT OF JAMES MONAGHAN AND BRUCE Q. RADO, REPRESENTING THE
NATIONAL GOVERNORS ASSOCIATION

Mr. Chairman, members of the Subcommittee, I am James Monaghan, Executive Assistant to Governor Richard Lamm of Colorado. With me today, on behalf of

Governor George Busbee of Georgia, is Bruce Q. Rado. We are here today representing the National Governors Association

We appreciate the opportunity to appear before this subcommittee to share with you our views regarding legislation to establish an operational satellite remote sensing system.

The Intergovernmental Science, engineering, and Technology Advisory Panel (ISETAP), conducted a major study of Landsat from the perspective of State and local governments under the direction of Governors Lamm and Busbee and State Representative Tom Anderson from Michigan. We are submitting a copy of the full 335 page report for the record. ISETAP was established by the National Science and Technology Policy Act of 1976 to advise the Director of the Office of Science and Technology Policy, Executive Office of the President, on scientific and technical issues of concern to state and local governments. ISETAP is composed of state, regional, and local government officials.

In August 1978, the National Governors Association adopted a resolution at their annual meeting supporting the conclusions and recommendations of the ISETAP report and urging the Federal government to establish an operational Landsat Information System. We should point out that neither the statements today, nor the report, necessarily reflect the views of the Office of Science and Technology Policy nor those of the Executive Office of the President.

NEED FOR NATURAL RESOURCE DATA

States have recognized the need for responsible management of their natural resources as important to controlling the future of the State and its development. Also, in response to the nation's natural resource and environmental problems, both state and Federal legislation and regulations have increased the authority and responsibility of state governments to better plan and manage their natural resources. To successfully execute these responsibilities, state officials need spatially oriented data which are comprehensive, timely, can be acquired at a reasonable cost, and on a repetitive basis. Conventional data collection techniques are often too costly to meet many of these needs.

VALUE OF LANDSAT TO STATE GOVERNMENTS

States consider Landsat to be an important technology that is presently making and can continue to make significant, often unique, contributions to the information base required for state governments management of natural resources.

State governments have found Landsat to be valuable principally because of the following characteristics:

For many uses, Landsat provides the only feasible means for conducting natural resource inventories. The cost, time, and manpower involved in the use of conventional techniques are often prohibitive;

The repetitive coverage of Landsat permits state users to monitor changes occurring over time;

The multi-spectral and synoptic characteristics of Landsat provide a totally new means of viewing the environment, providing information virtually impossible to acquire with conventional techniques;

Landsat provides uniform standardized data in an all digital format which is easily incorporated into computerized information systems.

Landsat is now cost effective for a number of applications and should become more cost effective for an increasing number of applications. Twenty-three of the states responding to the ISETAP survey stated that they were utilizing Landsat because it is currently more cost effective than other techniques.

LANDSAT USE BY STATE, REGIONAL, AND LOCAL AGENCIES

Seven states are considered to have independent, on-going, operational Landsat analysis and application capabilities. Three of the seven states are extensively utilizing Landsat in the planning and management of their natural resources. Twelve states have completed (or nearly completed) demonstration projects and are close to deciding the applicability of Landsat to their on-going data requirements. Of these, nine are likely to have operational programs underway within the next several years. Sixteen states are in the early phases of demonstration programs to assess the applicability of Landsat to their needs. In only 15 of the 50 states are there no significant Landsat activities underway.

Thirty-five states have used Landsat in 157 applications in the planning and management of natural resources. The major uses of Landsat in the states are:

Land cover inventory for resource management (18 states).

Water quality assessment and planning (16 states).

Wildlife habitat inventory (9 states).

Lineament mapping (9 states).
 Surface water inventory (7 states).
 Flood control, mapping, and damage assessment (7 states).
 Crop inventory (7 states).
 Geologic mapping (6 states).
 Forest inventory (6 states).

An often overlooked element of state analysis of Landsat data is the role of the Federal agencies as users of state generated products. This allows state resource data to be incorporated into Federal agency decisionmaking effecting a state's resources. Given the multi-facilitated resource concerns of states, it may be that state generating products could be more economical.

State commitments.—Thirty-three States have established mechanisms to integrate Landsat. Ten states have purchased, budgeted, or ordered analysis equipment. Twelve states have Landsat programs which are legislatively recognized by enabling legislation, specific appropriations, or by resolution. Over 9 million dollars of state funds and nearly 380 person-years of staff time have been invested in Landsat technology. Nearly 8.5 million dollars in state controlled, Federally provided funds (e.g. EPA "208," HUD "701") have also been invested by the states. At least 1,500 state personnel have had some basic training in the use of Landsat data.

At least 76 local governments and regional agencies in 29 states and the District of Columbia that have utilized Landsat data. ISETAP found that a Federal commitment to data continuity is necessary in order for state and local governments to significantly increase their use of Landsat data.

NEED FOR DATA CONTINUITY AND COMPATIBILITY

The United States has made a very large investment in space research and development. Landsat technology has been demonstrated to be a useful tool in the service of mankind. Whether the benefits from practical uses of Landsat will ever approach full realization depends on our ability as a nation to organize ourselves to capitalize on these new capabilities. We believe that S. 663, the Earth Data and Information Service Act of 1979, is an important step towards recovering this nation's investment in space technology.

The primary recommendation of state and local governments in the ISETAP report was for the Federal government to make a firm commitment to assure Landsat data continuity and compatibility. We believe that it is time to progress towards achieving a truly operational satellite remote sensing system. The past two administrations have been reluctant to become overly committed to the operationalization of a Landsat system which did not have a proven track record of users. S. 663 provides a compromise where over a reasonable period the necessary institutional, financial, technical, and marketing capabilities can be developed.

Another attractive feature of S. 663 is that it provides the President with complete flexibility in developing the appropriate institutional framework for an operational system, whether it be public, private, or some combination. At the same time, the bill remedies the present ambiguous situation by establishing a lead agency for the interim period.

S. 663 is designed to overcome many of the barriers to the increased use of Landsat and the bill is consistent with most of ISETAP's recommendations. Therefore, the National Governors Association supports and urges the passage of S. 663, with the following reservations however.

There are two major issues which S. 663 does not adequately address—the public service nature of satellite remote sensing, and the need for technology transfer.

PUBLIC SERVICE NATURE OF SATELLITE REMOTE SENSING

The social and economic value of satellite remote sensing lies in the variety of ways this more effective and timely information can be utilized, such as water quality planning, drought mitigation, and agricultural disease and pest monitoring. Many of these values are difficult or impossible to quantify; the beneficiaries are often the public at large and the general national and state interests.

Therefore, the establishment and operation of an operational satellite remote sensing system should be considered in the same context as census, cartographic, geological, and meteorological data which are provided as a public service of the Federal government.

The issue of Landsat data cost is an obvious concern to state governments. No matter how well the satellite performs its job, agencies will use the data only if it can be obtained at a reasonable cost. In establishing a pricing policy, no attempt should be made to recover the research and development cost of the experimental earth resources satellite programs (including Landsat-D). It should be noted that the current cost to the states of purchasing the raw data is relatively inexpensive. The

processing and interpretation of this data into a usable produce, represents the major cost to state governments.

State governments are presently beginning to apply Landsat data to their problems. However, we are certain that state and local government usage of this demonstrably valuable technology will be severely inhibited if the Federal government adopts a policy of attempting to have state and local governments share in the full cost of Landsat. Establishing an equitable pricing policy may be one of the most difficult tasks of an operational system.

PRIVATE SECTOR ROLE

Currently, the private sector is the primary source for the design and construction of spacecraft, sensor technology, data handling, and provision of services and products based on the analysis of remotely sensed data. It should be the policy of the U.S. government to define and to foster opportunities for maximum participation of private industry in satellite remote sensing as both contractor and entrepreneur.

However, due to the public service nature of satellite remote sensing, it is recommended that the system be Federally owned and operated for at least the near term. The states' major concern, particularly in regards to the ground segment, is that a privately operated system could tend to develop standardized products in response to the needs of large, aggregated markets and reduce or eliminate marginal products for limited markets in an attempt to increase profitability. Although this approach would provide very efficient and responsive service to the large markets, it may reduce the amount of very useful service to a wide range of users, such as State and local governments.

If the private sector would at some time desire to own or operate the Landsat system, the Federal government would have to, of course, play a continuing role in assuring unbiased and open data acquisition and dissemination practices.

There exists, at the present time, an appreciable amount of private sector activity in providing equipment, software, and analysis of Landsat data and products to the ultimate users. Numerous firms have made substantial investments in equipment and expertise in this area, and are gradually, but consistently, penetrating the state and local user market. Due to the rapidly evolving and developmental nature of Landsat and related technology, the involvement of these private firms is important, since many smaller data users do not want to make large capital outlays for equipment in the face of a rapidly changing technology. At the same time, it should be emphasized that the vast majority of states are planning to develop their own internal Landsat data analysis capabilities and will not rely heavily on the private sector for these services. The states consider this the most rational and cost effective approach to their use of Landsat. With the exception of specialized interactive data processing equipment, most states can develop the necessary data processing expertise, core equipment, and application discipline knowledge to be able to effectively develop and integrate an in-house Landsat data processing system. From a cost point of view, the repetitive and the multi-purpose nature of Landsat use makes it significantly more economical to develop and in-house capability than to contract for services every time a need for the use of Landsat arises.

Landsat information is normally used in conjunction with an internally developed and operated resource information system. In addition, a successful Landsat project requires an integrated approach between ground truth collection and Landsat data processing. Private industries involved in providing services are often staffed by technical people who are not generally sensitive to state problems and applications and are not knowledgeable of the physiography and earth resources of the states to which they are providing services.

Based on experience with private industry, state and local officials view the following functions as comprising the most appropriate roles for private industry at this time:

- Provision of specialized equipment and software to the states;
- Provision of analysis service and Landsat products to local governments;
- Provision of specialized or unique product or service lines which state agencies and facilities would not be able to provide; and
- Consultation on systems design and development.

NEED FOR TECHNOLOGY TRANSFER

S. 663 does not address the need for a program for technology transfer. The National Governors' Association strongly recommends that the Federal government make a commitment to a systematic and on-going technology transfer program, as a public service, to help state, regional, and local agencies develop the capability for using Landsat.

Although NASA's technology transfer program has improved substantially over the years and is now extremely effective with the resources they have, no Federal agency currently has the clear responsibility to transfer remote sensing satellite technology to users.

The key elements of the needed technology transfer program are:

User awareness and comprehensive training;

Technical assistance and consultation; and

Continued demonstration and validation of products.

One particularly important aspect of technology transfer is demonstration and validation projects. State and local governments are strictly operational, they do not have funds for R&D or to adopt new technologies. Therefore, the states require low cost, relatively low risk demonstration opportunities before they are able to commit state funds for new concepts. State and local users continually stress the importance of having the opportunity for "hands-on" demonstration projects, tailored to meet their needs and conducted over test sites of their choosing. Such custom demonstrations are seen as the only realistic way to acquaint users with the technology and its applications in an operational setting, to overcome their reservations about its effectiveness, and to instill the confidence required to develop an on-going program. If the Federal government provides the opportunity for a validation effort, a state can then more easily provide funds for the operational use of the concept.

Without a recognized and focused technical assistance program within the Federal government, the use of satellite remote sensing will continue to be significantly constrained. S. 663 should be amended to establish an adequately funded on-going technology transfer program.

A final point we would like to make is that it is essential to involve states and other users in the future development of an operational remote sensing system. NGA recommends that the lead Federal agency develop a structured process for the continued involvement of state and local governments in Federal remote sensing plans and programs.

In closing, we would like to stress that the time to act is now.

We would like to thank this Committee for the opportunity to present the views of state and local governments on this important issue.

Senator STEVENSON. Thank you, sir, and Mr. Mork; Senator Magnuson had hoped to be here, but he couldn't get here because of a meeting with the Appropriations Committee which he chairs.

Mr. MORK. Mr. Chairman, I'm Erling Mork. I'm city manager of Tacoma, Wash., which is a city of 156,000 people, approximately 20 miles north of Olympia, which is the capital of the State of Washington. Tacoma has been involved in a number of technology transfer projects which utilize and demonstrate advanced applied research in aerospace technology in solving urban problems.

Our involvement in technology transfer has been beneficial and provided tools, to be of assistance to local communities—one of these projects is with the Pacific Northwest Regional Commission, Land Resources Inventory Demonstration. This project has allowed 45 State and local agencies in the Pacific Northwest to evaluate Landsat as one tool for producing improved inventory information on natural resources.

This project in Tacoma has shown that Landsat data can also be very useful to local governments. The cities are continually confronted with new problems and situations. Some of these problems are increasing urbanization, citizen demand for less taxes and more services, constant inflation, increasing Federal and State legislation demands on local governments, increasing demand for new and strengthened social programs, and a demand for increased citizen participation.

Because of these pressures, cities will need to implement new and better ways to solve these problems. They will need to turn to innovative and technological approaches, such as Landsat. In Tacoma we have used Landsat in several ways; we used Landsat to

identify the land use intensity difference within various areas of the city.

These capabilities allowed us to differentiate between the more intensely developed industrial-commercial areas and the lower intensity residential neighborhoods. Landsat data then was very useful in verifying the selection of these areas for generalized land use planning.

Another example was to identify vegetated land. This information is valuable as input to environmental impact statements associated with the community's plans and projects. In the future we can see the direct use of Landsat data in determining and monitoring changed land cover and identifying and quantifying further services for input to our storm drain system, determining the amounts of vegetation for the city programs aimed at improving air quality and determining hotspots from energy loss through infrared sensing from Landsat.

These future applications and their dissemination to local governments require a continuing mechanism for Landsat technology transfer.

In Tacoma, our experience with organizations and programs such as the Pacific Northwest Regional Commission, the National Science Foundation, and the Pacific Northwest Innovation Group, Public Technology, Incorporated, and NASA, have proved very beneficial in their attempts to transfer technology to local communities.

Our recommendations are that Landsat programs be continued and that the Federal Government make commitments to establishing an operational Landsat information system. The operational Landsat information system would be federally owned and operated for at least the near term. The Federal Government make a strong commitment to an ongoing technology transfer program as a public service to help State and local governments develop the capability for using Landsat. The Federal Government make a commitment for consulting State, local government, and regional agencies before making major policy or technical decisions on Landsat. The operational system be complemented by continuing research and development programs for remote sensing technology as well as data handling and analysis techniques and improved data processing and delivery systems.

The price of Landsat data would be limited to the cost of data reproduction and distribution and all data acquisition, processing, and storage should be considered Federal data expense.

In summary, we in local governments support Senate bill 663 and recommend that the Congress give favorable consideration to implementing an operational Landsat information system.

[The statement follows:]

STATEMENT OF ERLING O. MORK, TACOMA CITY MANAGER, TACOMA, WASH.

A. BACKGROUND

1. Tacoma Landsat technology transfer/utilization program

The City of Tacoma, a city of 48 square miles with a population of 156,000 located on Puget Sound in western Washington State, has been involved in applied research and aerospace technology urban planning and management projects since early 1975. This has been part of an overall city technology transfer/utilization policy and effort which began in the early 1970's. The objective of these planning projects has

been to demonstrate and verify the use of advanced technology in an urban environment. The four projects to date are: the Tacoma/LUMIS project, the Tacoma/PNRC Landsat project, the Tacoma/LUMIS Landsat project, and the Tacoma/Regional LUMIS project.

The Tacoma/PNRC Landsat project began in 1976. Tacoma became one of the state and local governments to become involved in the Pacific Northwest Regional Commission's (PNRC) Land Resource Inventory Demonstration Project. This project was structured such that Tacoma could direct its attention at solving certain data inventory and management problems through Landsat technology. Tacoma's project goal was "to develop a capability for accessing data, data interaction and land use-land cover change detection in the Tacoma area to solve urban planning problems through utilization of remote sensed data." Objectives of this project were:

a. To verify and reclassify the urban discipline classification scheme for Tacoma by correlating with existing land use data and U-2 aerial photography and by undertaking field investigation.

b. To aggregate Landsat land cover data and existing land use data by different districts within Tacoma for verification and correlation.

c. To analyze Landsat land cover data by different years to provide a means for land use change monitoring and updating.

d. To explore the feasibility of using Landsat land cover data in a local interactive graphics system environment.

e. To explore the use of Landsat data to solve urban problems and satisfy planning needs in areas such as land use planning, natural resources analysis, natural systems delineation, etc.

During this project Tacoma funded its full local participation in exploring and evaluating use of Landsat data. The PNRC funded Landsat data gathering, handling and analysis, and product delivery.

2. PNRC Landsat demonstration and application projects

The Pacific Northwest Regional Commission (PNRC) was established in 1972 for the purpose of initiating, coordinating and implementing regional programs designed to improve the overall regional economic well-being. The Commission consists of the governors of Idaho, Oregon and Washington plus a federal cochairman appointed by the President.

The PNRC's Land Resource Inventory Demonstration Project (of which the Tacoma Landsat experience is a part), over a three year period from 1975 to 1978, developed extensive demonstration projects. These projects allowed forty-five state and local agencies and three states to evaluate Landsat as one tool for producing improved inventory information of natural resources for planning and management. Objectives of this project were:

a. To provide an opportunity for resource planning and managing agencies to extract, utilize and evaluate information derived from satellite and aircraft remote sensing.

b. To conduct a comprehensive evaluation of the application of an advanced technology within the realistic setting of: governmental procedures, agency charters and responsibilities, information needs for management, budgetary processes, personnel training and technical requirements.

c. To achieve cooperation among federal, state and local agencies to transfer the necessary technology for resolving natural resource management problems.

d. To evaluate alternative institutional mechanisms which would be required for providing continued and effective use of remote sensing by user agencies.

The PNRC's Landsat Application Project (LAP) succeeds the earlier demonstration projects and will be undertaken for a three year period from 1979 to 1982. (Tacoma's LUMIS Landsat project is an application project being undertaken as part of this program.)

B. TACOMA'S PNRC LANDSAT PROJECT EXPERIENCE

Tacoma's experience has pointed up the importance of having the opportunity for "hands on" involvement, tailored to meet the needs of a state and/or local government. Following are the areas in which Tacoma demonstrated the use of Landsat data in an urban environment.

1. Urban land cover classification verification

To test the accuracy of the Landsat products, a number of tests were performed including (1) visual comparison of the City's land use map and the Landsat map, (2) comparison of the number of acres of land use represented by the City's file and the Landsat listing, and (3) comparison of an aerial photo of the City and the Landsat map. These tests indicated that the Landsat products were quite accurate; however,

Tacoma attempted to improve and refine the detail of the Landsat classification for urban use and were unsuccessful in this undertaking.

2. Vegetated area identification and measurement

Landsat was used in two area plans for Tacoma, both for determining the amount, general type and area boundaries for vegetated lands. One was particular to determining boundaries of urban open space areas, and the second was necessary to determine the amount of vegetation by area for input to an area plan environmental impact statement.

For this use, Landsat provided the only feasible means for conducting these natural vegetation inventories. The cost, time and manpower involved to undertake these surveys using conventional means would have been prohibitive.

3. Special district content identification

Tabular summaries of land coverage data for twelve special districts, i.e. development intensity areas, watershed areas, geological areas, census blocks, ZIP codes, fire districts, planning areas, legislative districts, councilmanic districts, city limits, generalized land use, police response areas, health districts, were provided to Tacoma. For this multiple data summary use, Landsat provided the only practical means of obtaining general land coverage data for these many areas, both from the standpoint of so many different areas and for free flowing boundary areas.

4. Development intensity area measurement

Input to the City's Generalized Land Use Plan and its defined development intensity areas were provided. The City's development intensities (high, medium, low and open space) areas (52) were compared with the Landsat land use map to verify the present development intensity and land use in these areas. This comparison confirmed the City's estimates of the land use in these various areas and their boundaries and through future Landsat images will provide a means to monitor the general type of growth in each area to determine if the plan is being carried out.

5. Land cover change detection and monitoring

1974 and 1975 Landsat scenes were registered to each other for a pixel by pixel comparison to note where and what type of land use changes had taken place. The two scenes were classified differently and thus prevented any useful results. Change detection still appears to be one of the most useful products that will be available in the future.

6. Vicinity area development map

The color dicomed (photo) Landsat maps that were developed of the Tacoma, Pierce County and Puget Sound areas were utilized by Tacoma for a number of meetings including City Council, Planning Commission, citizen groups and for many informational project displays. The Landsat maps were utilized because they clearly define the urban form of the region and provide a general land use and development base for data overlaying.

Tacoma's experience has demonstrated the increased benefits of and necessity to merge Landsat data with data from other sources. Each has its place in state and local decisionmaking and problem solving.

7. Geographic-based information system Landsat integration

Tacoma has been developing a geographic-based information system with the capability of merging data from many sources. Landsat has provided one of these data sources. This local undertaking has increased staff experience in geographic information systems as well as remote sensing in general and Landsat in particular.

Tacoma has demonstrated new local government applications of Landsat and the merging of Landsat information with data of other sources. Following are the projects involving these activities:

a. *Tacoma/LUMIS Project.*—The Tacoma/LUMIS Project was undertaken in conjunction with the Jet Propulsion Laboratory (JPL) of Pasadena, California, for the purpose of transferring an interactive graphics inventory system developed under their Land Use Management Information System (LUMIS) to Tacoma. This project was undertaken in 1975, and has been successfully completed with the transfer of LUMIS to the Boeing Computer Service, Inc. (BCS) of Seattle, Washington. The Tacoma City Planning Department currently has available through this system census, physical structure and environmental condition, and land use information.

b. *Tacoma/PNRC Landsat Project.*—This is the topic of this paper and is the demonstration of using Landsat data in a local government.

c. *LUMIS/Landsat Project.*—The City of Tacoma is currently involved in the Pacific Northwest Regional Commission Landsat Applications Project which began late in 1978. The Planning Department is transferring the LUMIS interactive

graphics system to the City's computer. The information contained within the System will be an updated version of that transferred under the Tacoma/LUMIS Project, with the exception of the addition of Landsat data which was satisfactorily accomplished in the Tacoma/PNRC Landsat project. This transfer will be an example of making Landsat information, via LUMIS, available through interactive graphics on the local government system.

d. *Regional LUMIS Project.*—The City of Tacoma presently is associating jointly with Public Technology, Inc. on a proposal to NASA to transfer LUMIS to five regional areas. This project is intended to provide to these areas the LUMIS interactive graphics inventory system developed by the Jet Propulsion Laboratory and successfully implemented by Tacoma. This project will be undertaken during the next two years. LUMIS at this point can include Landsat information at the census tract level.

8. *Anticipated future local government Landsat use*

Tacoma anticipates they will utilize Landsat data as they have in the past and also foresee other additional uses. These new uses include:

a. Tacoma is implementing a Storm Water Sewer Utility and for future planning can utilize Landsat land use data for identifying impervious areas in the City. These areas can be overlayed with a planning area map to obtain rainfall runoff figures for each area.

b. Assuming an infrared sensor is installed in Landsat "D", Tacoma could locate energy loss sources and "hot spots" for conservation programs.

c. Vegetation can help absorb air pollution, and Landsat data can be used to provide the location and general types of vegetation. It can also monitor the increase in new growth and landscape beautification efforts. Also, as vegetation increases, urban heat areas which prevent the flow of clean cool air into the city could be reduced.

d. With improved Landsat resolution and further development of change detection programs, a number of additional uses could be made of Landsat data. One of these uses would be to monitor development of the City to locate the fastest changing areas for checking compliance with the development plans.

C. FEDERAL OPERATIONAL LANDSAT INFORMATION SYSTEM (LIS)

1. *ISETAP Recommendations*

In March 1978, the President's Science and Technology Advisor, Dr. Frank Press, asked the Natural Resources and Environmental Task Force of the Intergovernmental Science, Engineering and Technology Advisory Panel (ISETAP) to provide the Administration with information and policy recommendations on remote sensing/Landsat from the perspective of state and local governments and regional agencies.

In June 1978, the Task Force published a report entitled "State and Local Government Perspectives on a Landsat Information System." The City of Tacoma as related to its Landsat experience supports the findings and observations, and recommendations of the ISETAP. Appendix A of this document lists the major recommendations of this report.

2. *Tacoma Landsat project observations and conclusions*

The general conclusion of Tacoma with regard to the use of Landsat as a data source has been that Landsat is considered to be an important technology and should be a significant and unique contribution to the information base of state and local governments and regional agencies. Its use as a data source has only been slightly identified and utilized. The future potential is enormous. In Tacoma, it has helped to add an innovation approach to the planning process.

In the Tacoma local government experience, issues and constraints have been identified which support certain recommendations of ISETAP and have a bearing upon S. 663, the Earth Data and Information Services Act of 1979. These are:

a. *Federal Commitment to an Operational LIS.*—This is considered the key in furthering the use of Landsat data in state, regional and local governments. A major problem hindering the increased utilization of Landsat data by state and local governments is the lack of a federal commitment to the data continuity and compatibility of Landsat-type data. The federal government lacks a clear mandate to provide transfer of Landsat technology to state and local governments. This stance inhibits state and local government from investing in Landsat capabilities and delays the incorporation of Landsat data into planning and management decision-making.

S. 663 appears to provide this federal commitment to an operational LIS. With regard to the question of public or private control of LIS, we support the ISETAP recommendations and S. 663 in calling for an interim public control of LIS under

NASA to maintain close ties between operational management of the system and continuing research and development activities.

The federal government should make a commitment to establish an operational Landsat Information System; the operational LIS should be federally owned and operated for at least the near term.

b. *Federal Technology Transfer of Landsat Data.*—Generally, state, regional and local agencies do not have sufficient technical or specific expertise in remote sensing and digital analysis techniques to utilize a new and sophisticated technology such as Landsat. Only a very small fraction of potential users are aware of or know how to use the information or services that Landsat could provide. Tacoma does have some limited expertise which is a direct result of the PNRC's Landsat demonstration and application projects. This method of furthering Landsat technology transfer and utilization has proven to be beneficial and should be supported, strengthened and expanded not only in the Pacific Northwest but nationally.

Even after a state or local government has developed an operational capability, continuing technical assistance is required for advice on analysis techniques, trouble shooting, systems development and new applications of the technology.

S. 663 does not address this issue sufficiently and should be included to allow certain application experimentation especially within state and local governments. To date, technology transfer has not seemed to be viewed as an important function of federal agencies.

The federal government should make a strong commitment to a systematic and on-going technology transfer program, as a public service, to help state and local governments develop the capability for using Landsat.

c. *State and Local Government Involvement in LIS Decisionmaking.*—To date, it has been the providers of Landsat who have devised what they believe are useful requirements and have proceed to build experimental systems. If the federal government wishes to encourage Landsat applications, it should involve state and local governments in furtherance of the operational aspects of Landsat technology. This user involvement has been the approach in the PNRC's Landsat demonstration and application projects which has worked quite well and had relatively promising results.

State and local governments generally know their needs regarding Landsat use and how it can help in solving resource management and decisionmaking problems. This knowledge should be incorporated in an institutional mechanism to assure user participation in systems planning and policymaking. At present there is no such institutional mechanism that provides this input.

S. 663 generally addresses this subject but not adequately. The federal government should consider and include the formation of a standing user advisory committee including a subcommittee composed of state, regional and local representatives. This subcommittee would work with the lead federal agency in the development of the operational system.

The federal government should make the commitment to consultation with state and local governments and regional agencies before making major policy or technical decisions on Landsat.

d. *Timeliness and Resolution of Landsat Data.*—At the current "state of the art" of Landsat data, only a part of the land cover and resource planning and management needs of state and local government are addressed. This is especially true in urban and metropolitan areas. At this level of information need, broad or generalized requirements are being met. The more detailed land cover classification information is not available.

The proposed increase in spatial resolution of Landsat-D should significantly increase its usefulness in urban and metropolitan area planning and management. This should bring a significant increase in the overall use and number of applications of Landsat data.

The importance of the timeliness of the data increases as state and local governments incorporate it into operational processes and must rely upon it in its land cover and resource decisionmaking. In Tacoma this became a problem when Landsat data was to be used in area planning. In many instances Landsat was used as a back-up to other local information because of this operational timing.

It is anticipated that the future capabilities of the NASA-EROS Data Center's digital data system would greatly enhance the timeliness of Landsat and thus the use of this data in resolving urban and metropolitan problems.

S. 663 addresses the timeliness of Landsat data as "rapid process of, and ready access to." Although not specifically addressed in this bill, the resolution of Landsat data could be included as an item within "the needs of the users as determined by the Service in consultation with the users."

The operational LIS should be complemented by a continuing research and development program for remote sensing technology as well as data handling and analysis techniques.

The operational LIS should have improved data processing and delivery systems.

e. *Funding of Landsat Data.*—The issue of Landsat data costs is concern to all user state, regional and local agencies. It is an operational fact that agencies will use Landsat data only if it is obtainable at a reasonable cost as compared to the costs of acquiring other similar data.

Most state and local governments view the establishment and operation of an operational LIS as a public service in the same context as census, geological and meteorological data which are provided by the federal government. In order to get Landsat data into operational status would require certain research and development applications. State and local governments have difficulty in obtaining funding for research and development activities.

Landsat operation costs to the state and local governments would be considered reasonable only as long as it were determined to be cost beneficial.

S. 663 addresses the funding of Landsat data as "at a reasonable cost to the users." The price of Landsat data should be limited to the cost of data reproduction and distribution and all data acquisition, processing and storing should be considered a federal data expense.

f. *Tacoma Anticipated Interaction with Landsat Application Projects and Operational Landsat Information System.*—It is anticipated that Tacoma's involvement in Landsat Application Projects and the proposed operational Landsat Information System, as appropriate, will continue similar to our involvement over the past several years. As new applications are identified where Landsat data can be of benefit and where this data can be used to supplement existing data or previously obtained Landsat data, we would initiate a request for information of involvement. Depending upon the availability of Landsat data, we would estimate that this could occur several times a year. This is where we see a benefit in the PNRC's proposed Landsat data analysis center to be established in the Pacific Northwest.

D. TACOMA RECOMMENDATION

1. Conclusion

The PNRC demonstration project in Tacoma has shown what many benefits there can be to local communities in using Landsat data, as well as other technological advances. With the increasing problems which local government must face, e.g., increasing urbanization, reduction in funds to local governments, decreasing manpower and operating funds caused by constant inflation, increasing federal and state legislation affecting local government and its work load, increasing need for furthering human and social involvement, and increasing need for citizen participation, there will be the need for local governments to turn to innovative and technological approaches such as Landsat.

In Tacoma, we have found Landsat data to be quite useful especially as an introduction to this technology. Our conclusion is that the Landsat programs begun by NASA should be continued and made available to local government. We feel the benefits are evident especially as new development continues to improve the state of remote sensing technology.

There does, however, continue to be the logistics and expertise problem of bridging the gap between applied research development activities and involving the users in state and local government. There appears to continue to exist a dilemma in expectations of federal agencies trying to disseminate the technology and users trying to understand and utilize it. State and local governments know what Landsat is and how it can be used, but generally they do not currently have the expertise or funds to really seek out and experiment with Landsat. In a sense, state and local government must still be closely assisted in applying Landsat information. This is where the PNRC's Land Resource Inventory Demonstration Project and Tacoma's involvement with it have been successful.

2. Recommendation.

Keeping in mind Tacoma's Observations and Conclusions, it is recommended that Congress give favorable consideration to S. 663 the Earth Data and Information Services bill sponsored by Senator Stevenson.

It is also recommended that the federal government continue to improve Landsat technology, especially as it applies to state and local government and to urban and metropolitan areas; and that Landsat applications be funded to improve governmental understanding and use of Landsat information.

APPENDIX A

(State and Local Government Perspectives on a Landsat Information System; President's Natural Resources and Environment Task Force of the Intergovernmental Science, Engineering and Technology Advisory Panel (ISETAP), Recommendations, June 1978.)

1. The Federal government should make a commitment to establish an operational Landsat Information System (LIS).
2. The price of Landsat data should be limited to the cost of data reproduction and distribution and all data acquisition, processing and storing should be considered federal data expenses.
3. The federal government should clearly define federal agency responsibilities with regard to the operational LIS including related user assistance activities.
4. The federal government should make the commitment to consultation with state and local governments and regional agencies before making major policy or technical decisions on Landsat.
5. The federal government should make a strong commitment to a systematic and on-going technology transfer program, as a public service, to help state and local governments develop the capability for using Landsat.
6. Federal agencies should be encouraged to use Landsat to meet their own data needs and to work with their state counterparts (. . . and local agency counterparts . . .) to utilize Landsat data as appropriate.
7. The operational LIS should be complemented by a continuing research and development program for remote sensing technology as well as data handling and analysis techniques.
8. The operational LIS should have improved data processing and delivery systems.
9. The operational LIS should continue the current line of standard products and operational services.
10. The operational LIS should be federally owned and operated for at least the near term; and federal policy should define and foster opportunities for maximum participation of private industry in the LIS as both contractor and entrepreneur.
11. State agencies should make a concerted effort to determine the extent of university expertise in their region and utilize it, as appropriate and mutually desirable, in the development of state programs.
12. State, local and regional agencies should take actions which will increase their ability to utilize Landsat.

APPENDIX B

(The Pacific Northwest Regional Commission's Land Resource Inventory Demonstration Project—the user's experience.)

ABSTRACT

This paper briefly reviews the Pacific Northwest Regional Commission's Land Resource Inventory Demonstration Project (LRIDP). This three year project developed extensive demonstration projects allowing forty-five state and local agencies and three states to evaluate Landsat as one tool for producing improved inventory information of natural resources for planning and management. This paper draws upon the experience of those agency personnel and their reactions on the utility of new technology. The primary objective of the paper is to explain to technology designers and producers the problems inherent in serving the ultimate users of their creations.

INTRODUCTION

Many of the decisions in designing remote sensing systems by the engineering community focus on the technology of acquisition and delivery without a thorough understanding of how the information will be used by the resource planner or manager. This group represents the ultimate users within state and local government for Landsat based information. Since there has not been the anticipated rush by state and local government representatives to use the technology, numerous efforts have been made to show these potential users the value of this technology—a process that has been called "technology transfer." However, most of these efforts with which I am familiar, have been only limited successes at best and very expensive. Most have simply not worked, and for the most part didn't work because the technology transfer personnel have not understood the environment in which resource managers function. Resource managers in the "real world" possess their own set of preferences or prejudices. They operate in an institutional setting which has far more to do with determining the receptivity of a new technology than most scientists recognize. The LRIDP was organized to provide agency personnel with a

full opportunity to test Landsat on real problems. The tests were real both in the sense of dealing with current, ongoing information needs and because they were carried out within the existing institutional setting.

THE LAND RESOURCE INVENTORY DEMONSTRATION PROJECT

The Pacific Northwest Regional Commission was established in 1972, under Title B of the Public Works and Economic Development Act of 1965⁴ for the purpose of initiating, coordinating, and implementing regional programs designed to improve the overall regional economic well being. The Commission consists of the Governors of Idaho, Oregon, and Washington plus a Federal Co-chairman appointed by the President.

The Commission established the "Land Resource Inventory Task Force" (later changed to "Technology Transfer Task Force") in the fall of 1974 in response to an expressed need for more accurate and current natural resource and land use information upon which to base planning activities and management decisions. The Task Force with representatives from Idaho, Oregon and Washington and Commission staff formulated a project which could contribute to the natural resource information needs within the three states. The project had four objectives:

1. To provide an opportunity for resource planning and managing agencies to extract, utilize, and evaluate information derived from satellite and aircraft remote sensing.

2. To conduct a comprehensive evaluation of the application of an advanced technology within the realistic setting of: governmental procedures, agency charters and responsibilities, information needs for management, budgetary processes, personnel training, and technical requirements.

3. To achieve cooperation among federal, state, and local agencies to transfer the necessary technology for resolving natural resource management problems.

4. To evaluate alternative institutional mechanisms which would be required for providing continued and effective use of remote sensing by user agencies.

The task force recognized the need for a considerable amount of technical expertise and analytical capability. They requested and received assistance of the National Aeronautics and Space Administration (through the EROS and the Geography Programs). Together with these federal agencies, the task force developed a five phase program extending from 1975 into 1978.

Phase I was a cooperative effort among several state agencies and universities of the region to produce a series of maps which provide a regional overview of soils, and land ownerships, drainage basins, energy related features, and land use.

Phase II provided agencies an opportunity to obtain an initial appreciation for resource mapping and inventory using remote sensing techniques, particularly Landsat technology. Tangible products were produced through small-scale demonstrations of digital analysis of agency elected test sites.

Phase III provided training to agency personnel in computer assisted analysis of data as they combined their knowledge of ground truth information with the satellite data to produce user defined information for larger test areas.

Phase IV/V was an assessment of resource information needs, an evaluation of remote sensing capabilities and formulation of recommendations on implementing an operational analysis capability within the region.

The greatest efforts were generated in Phases II and III. It was during these phases that agencies got their experience with the technology. From a modest beginning, the number of participating state and local government agencies grew to forty-five. Almost one hundred and fifty agency personnel received training and worked in Landsat analysis. The total contributions of all parties has been most recently estimated at more than six million dollars.

Phase II provided agencies with a feasibility study and Phase III served as the principal demonstration and technology transfer mechanism. Of primary importance was the participation of the state and local agencies in planning, executing, and evaluating data analysis projects. The projects originated with the agency, and the agency was responsible for providing the field data necessary for the satellite data analysis and for evaluation of the final product. Agency personnel also directly participated in the analysis procedure.

The majority of the analysis was performed at the NASA Ames Research Center, Moffett Field, California using in-house and contractor provided capability. Some analysis was performed using the data analysis facilities at the EROS Data Center, Sioux Fall, South Dakota. Phase II projects were usually single date land cover analysis of areas covering less than a single scene. Phase II projects involved very extensive tracts of land, highly sophisticated sampling procedures, and detailed tabulations of results by one or more sets of specified geographic area.

Each of the twenty-three individual demonstration projects was planned by the user and the technical experts to provide, within the limit of technical feasibility, the desired data. The use agencies made the final decision on proceeding with a demonstration project and were the sole judges of the utility of any results. It is important to note that none of the participating agencies received project funding from the LRIDP's commission funds for staff support. Each agency had to make an appropriate commitment to undertake the proposed project and independently support their staff involvement.

The demonstrations involved a broad spectrum of natural resources agencies having a representative range of size, responsibilities and available resources. A broad enough sample of agencies participated that one could reliably characterize this as a full community of state and local government users.

Demonstration projects have been developed in the discipline areas of: forestry, agriculture, range, urban, coastal zone, noxious weeds and surface mining. Agencies in each of the states have developed projects in each discipline category with the exception of the last three. A coastal zone project was conducted only in Washington; a surface mining project, only in Oregon. Noxious weed projects were conducted in both Idaho and Oregon.

Table 1 summarizes the demonstration projects undertaken. While over simplifying, projects are classed as either simple or complex. Those projects listed as simple projects only involved analysis of a single scene, free of the need to incorporate data from other sources, for a single date. All other projects are listed as complex.

USERS AND THE TECHNOLOGY

The user agencies in the LRIDP were subjected to a series of interviews as part of the Phase IV/V. The User Needs Study provides particularly good reference point to look at how users interact with remote sensing technology such as Landsat.²

The user agencies were almost universally optimistic about using Landsat data to satisfy their information requests. They were, nevertheless, cautious in translating information needs into specific near-term operational applications.

The profile of the user community emerged as a group of agencies which had assured, new, legislatively mandated activities. The required number of resources to complete these activities had not been provided in the legislation leaving the agencies unable to accomplish their charge using conventional methods. This was the case for state agencies as well as some local agencies. In some cases this only seemed to aggravate an existing large area inventory problem for some state agencies. Those having large data requirements could, if they so decided, become the major users and significantly impact the creation of an operational system within the region. This group was complemented by a much larger number of agencies who were prepared to adapt to the situation and use Landsat data to perform planning and management functions not possible with existing techniques. The optimism of these user agencies toward Landsat-based data was tempered by several concerns about using it operationally.

Cost was an underlying question in all cases. Most agencies put forth the caveat that Landsat derived data would have to cost less than alternative sources for the same information or information of equal utility, if such existed. Cost, however, was less an issue with large agencies than with smaller ones.

TABLE 1.—LAND RESOURCE INVENTORY DEMONSTRATION PROJECTS SUMMARY

Project	State	Size (acres)	Number of agencies	Project class	Discipline
Ada County land inventory	Idaho	600,000	1	Simple	Urban.
Central Puget Sound urban land inventory	Washington	5,100,000	11	Complex	Urban.
Crook County land cover	Oregon	560,000	2	Simple	Urban.
Douglas County forest condition	Oregon	3,000,000	2	Complex	Forestry.
East Columbia basin land cover classification	Washington	4,600,000	3	Simple	Agriculture.
Klamath irrigated lands	Oregon	3,600,000	2	Simple	Agriculture.
Mapping vegetation resources in Southeastern Idaho for range and wildlife management.	Idaho	2,500,000	2	Complex	Range.
Monitoring and inventorying leafy spurge in Idaho	Idaho	5,000	1	Simple	Weeds.
Monitoring and investigating tanzu reguart in western Oregon.	Oregon	16,000,000	2	Complex	Weeds.
Oregon rangeland resources mapping and inventory	Oregon	650,000	2	Simple	Range.
Portland land inventory demonstration	Oregon	600,000	5	Complex	Urban.
Puget Sound habitat inventory	Washington	420,000	2	Simple	Coastal zone.
Reservoir volume determination	Oregon	100,000	2	Simple	Agriculture.
Snake River irrigated land inventory	Idaho	35,000,000	2	Complex	Agriculture.
Southeast Washington big game habitat study	Washington	1,000,000	1	Simple	Range.
Spokane County-Kootenai County land cover inventory	Idaho and Wash- ington.	2,600,000	3	Complex	Urban.
Surface mine detection	Oregon	2,000,000	1	Simple	Surface mining.
Tacoma management information	Washington	125,000	2	Complex	Urban.
Teton Dam failure damage assessment	Idaho	600,000	1	Simple	Agriculture.
Washington rangeland resources mapping and inventory ..	Washington	1,000,000	1	Simple	Range.
Western Idaho forestry inventory	Idaho	9,000,000	2	Complex	Forestry.
Western Washington forestry inventory	Washington	20,000,000	1	Complex	Forestry.

Some large agencies never raised the cost questions. Large agencies were more concerned with questions pertaining to the reliability and future repeatability of the data and the role they might have in directing the design and operating priorities of an operational system. Their concerns related to risks involved in making a contemplated major investment in Landsat-based hardware, software and trained personnel to supplement conventional methods for resource inventory, provide input to models, or serve other analytical tasks of significant magnitude. Most agencies expressed some uncertainties about the utility of the data itself, and this varied by application to particular functions, as well as by agency.

State agencies generally had few reservations about the theoretical applicability of Landsat data to high priority management functions from either the standpoint of information content or accuracy. But this judgment was based on familiarity with Landsat data acquired in the course of the project. A number of users who had not yet received final output products for their own demonstration projects, expressed a reluctance to assume that these data would actually serve their needs on a continuing basis. To a lesser extent, agencies which had not had a demonstration of change detection, or a repeated analysis for the same geographic area, also shared this uncertainty.

There were also instances of agency uncertainty about its own ability to carry out a Landsat application operationally, especially where it involved a complex series of tasks which had been largely conducted within the project by personnel of a private contractor. For functions identified in the user needs study as having lower priority for Landsat applications, uncertainty about information content was sometimes a constraint. This was especially true if the agency's information need differed significantly from any of the kinds of information produced in the agency's demonstrations.

Some local agencies had reservations about data utility from the standpoint of classification detail and classification accuracy. The latter concern was evidenced by several planning agencies that anticipated using Landsat data products in map form as a visual communication tool in presentations to decision makers and the public. In these cases, obvious errors in classification of individual or small groups of pixels might threaten the credibility of the total analysis. After receiving final map products, and receiving or participating in the development of secondary products with only minor problems of individual pixel misclassification (i.e. tabular area summaries by analysis districts) this concern subsided.

A universal change in attitude toward Landsat data was experienced by users over the duration of the demonstration project. Initial, high expectations for a data source that would replace conventional sources (with advantages of low cost, efficiency, expanded geographic coverage, periodic update, etc.) were dampened when it was realized that Landsat-derived data was not the same as information derived from conventional sources. It differed in thematic content and it differed in classification detail and areal resolution. This generated a rethinking of the application

problems, resulting in redefinition of the analytical approach and the information need so as to better suit Landsat capabilities. This redefinition usually resulted in a better project.

The situation which has been attempted to be quickly presented is of a large, complex project which, admittedly, is difficult to perceive. However, there are some clear messages to those of us developing complex new technologies and thus required to justify them. Potential users are almost exclusively concerned with current data, its validity and ease of use. They feel they need understanding of how it was produced and need to have some experience in producing the data.

To be real to state and local government personnel, this experience must take place in the "real world" of state and local government. Each agency views themselves as unique and may not seriously or fairly evaluate something new until they have applied the techniques to their own situation. The fact that each agency views themselves as unique makes them unique. No one is going to have any success in convincing that agency of the utility of any technique until it has been tried in their environment. This is, I feel, one of the major deficiencies in most efforts at technology transfer where a "successful" demonstration in one jurisdiction is viewed as adequate for all similar agencies regardless of institutional and political differences. Most agencies simply aren't going to be convinced until they can evaluate their own experience.

User agencies are cautious about abandoning traditional information—institutional inertia if you please. But this is real whether it comes from irrational biases of managers who were trained in the potentially deposited information gathering methods, or from a lack of understanding of the technical requirements for optimizing the potential of the new techniques, or from an unwillingness to seek initial funding to the detriment of future long term efficiencies.

The experience with the LRIDP presents a picture of a fairly large number of diverse agencies within the northwest individually pursuing their individual objectives. Each one occupied with the importance of their own requirements but cooperating where it is convenient or to their advantage. It is an accurate portrayal. And the strength of the Demonstration Project was that the individual agency perspective was respected within the framework of a three state cooperative project. But a new community was created. A pool of agencies which had used Landsat as one available tool to help them do their jobs. It is important, however, to remember that this community was not nor will not be awed by the technical elegance of Landsat or any other system. They are only concerned with the validity they can see in the data and the ease with which it can be integrated into their ongoing data management system.

Are the reactions of the user agencies within the Northwest unique? All indication I have say they are not unique. The recent ISETAP report to the Office of Science and Technology Policy clearly establishes the uniformity with the growing community of users within state and local government.¹ The report identifies a growing interest among states to use, where appropriate, this new technology. The report identifies eight constraints to states' use of Landsat. I do not consider any of these constraints "technical" in character. They all reflect upon the character of state and local government and the way the federal government relates to this group of potential users. The report also makes six major recommendations which are well within the federal government's ability to respond. Without diminishing the importance of federal adoption of these recommendations for an ongoing, operational Landsat delivery program, there are signs that the current administration is positively moving toward a decision on Landsat. The constraints are:

1. A lack of a federal commitment to data continuity and compatibility which inhibits states from investing in Landsat capabilities and delays the incorporation of Landsat data into management decision making regardless of technical achievements.
2. Delays and uncertainty in obtaining data through the data dissemination system have often precluded its use.
3. The lack of a coordinated and structured federal technology transfer effort has constrained the state's use of Landsat.
4. The lack of coordination and well defined responsibilities among federal agencies has led to less than optimal services to state and local governments.
5. The failure of federal agencies to use and encourage Landsat use has discouraged or even prevented state and local use.
6. State and local governments have not been involved in the design process nor in making the policies under which the system operates.
7. Federal agencies have not recognized the operational nature of state and local agencies and the unique technical and institutional setting of each government.

8. The fragmentation of natural resource responsibilities within states and difficulty of coordination, the lack of trained staff, bureaucratic inertia, and difficulties in obtaining funds for new programs have constrained the use of Landsat.

Looking beyond the current situation, what does the experience in the Northwest, and mirrored in the ISETAP report, say to the scientists and technicians working with new or improved systems?

There are two elements which must be incorporated to achieve a fair test and, if appropriate, adoption of new techniques. First, you must understand the political and institutional setting where the users operate. You cannot expect to make any large rapid changes in either the user's system or the way the user interacts with that system. Your method of testing and evaluation must come to the user. There is a potential user community within state and local government but these people have neither the time nor the inclination to volunteer their input. Someone is going to have to go after it. Secondly, technology development has to become technology transfer. Traditionally these two have been treated separately. Indeed, the transfer emphasis was only added when additional support for continuing development was needed.

The operational character of state and local government precludes any meaningful research and development activities. Even the capacity to solve closely related technical problems is usually absent. One specific example experienced in the LRIDP related to the ability to interface Landsat classified data with other sets of information. And while the classification might reflect the finest technical results possible efforts at integrating these results with other data were inhibited or prohibited by software deficiencies in digitizing, overlaying or registration programs. Virtually all of the large, complex demonstration projects, experienced similar problems. Remembering that the data are usable information requiring ready access by decision-makers, it soon became apparent that data management was (and is) a larger, longterm problem. Even if you can produce the data, you have to operationally manipulate the data to make it ultimately useful.

The first example is one which requires additional technical assistance, perhaps beyond what was anticipated at the initiation of a demonstration. The second one is a related problem but one universally applicable to most current and future applications and which warrants immediate attention. Even within the resources available to the agencies participating in the LRIDP, only limited resources were available for the former, and the latter went begging throughout the project.

As a bureaucrat working with state and local government agencies, it is difficult to accept the intrinsic value of new technology development without equal attention to an effort to allow potential users an adequate opportunity to test and evaluate these new tools within the crucible of their own operational requirements.

It has been our experience within the Northwest that there are agencies willing to cooperate in testing new technology but the burden to making this connection rests with those who have chosen to pursue new technologies and seek state and local government support for their continued efforts.

REFERENCES

1. Natural Resource and Environmental Task Force of the Intergovernmental Science, Engineering and Technology Advisory Panel. "State and Local Government Perspectives On A Landsat Information System." Office of Science and Technology Policy. Washington, D.C. June, 1978.
2. Westerlund, Frank V. and Wilson, Donald. "Final Report: Phase IV User Needs Study, Pacific Northwest Regional Commission Land Resource Inventory Demonstration Project." National Aeronautics and Space Administration, Ames Research Center, Moffett Field, California. November 7, 1977.

Land Resource Inventory Demonstration Project



A Joint Cooperative Effort

National Aeronautics and
Space Administration

United States
Geological Survey

Pacific Northwest
Regional Commission

THE LAND RESOURCES INVENTORY DEMONSTRATION PROJECT

The Pacific Northwest is a full and varied land. An area with an almost embarrassing abundance of riches: agriculture, forests, mining, water, rangeland, wildlife and thriving urban centers. Yet these very attributes constitute an enormous planning and management problem for state and local government.

Over the past 3 years, 45 natural resource agencies have found out how to apply satellite data to resource planning and management decisions.

Responsible government endeavors to balance the economic realities of development with the need to conserve and protect the land and environment. In order to achieve this delicate balance, natural resource managers need a dependable source of information upon which to base their planning and management decisions. If this source of information can be updated relatively easily, so much the better.

To evaluate Landsat as a new information source, the PNRC, NASA, and USGS co-sponsored a 3-state program.

In 1975, under the leadership of the Pacific Northwest Regional Commission, and with support from NASA's Ames Research Center and the US Geological Survey's EROS and Geography Programs, the Land Resource Inventory Demonstration Project was begun. The primary objective of this Project was to provide an opportunity to a variety of natural resource planning and management agencies in Idaho, Oregon and Washington to extract, apply and evaluate information derived from Landsat multispectral data and other remote sensing sources. In addition to "Does it work?" the participants also wanted to know: "Does it add new information?", "Is it faster?", "Is it accurate?", "Is it cost-efficient?"

There were two key elements in the Pacific Northwest Project: User training and demonstration projects.

A Task Force, composed of representatives from each state, the PNRC, NASA/Ames and USGS/EROS, was appointed to administer the Project.

In order to answer the questions stated above, a two-pronged approach was selected. One important element was the training of the state and local agency participants, while the other was user-defined demonstration projects. In a very real sense, participating agency personnel were trained by both processes. They defined the information needs of their agencies, kept track of costs, and assisted in the actual analysis of the Landsat data. In addition, several formal and informal training courses and symposia were held in the states or at federal centers.

Demonstration projects were undertaken in several disciplines, including forest inventory, wildlife habitat, land cover analysis, irrigated lands inventory, urban area analysis, toxic weed occurrence, rangeland resources, reservoir volume and surface mining. These efforts were grouped under the broader headings of: Agriculture, Forestry, Range and Urban Studies. Discipline meetings were held at intervals throughout the Project so that participating personnel from each state would have an opportunity to discuss common problems and to share solutions.

State agencies examined the utility of satellite information in their day-to-day operations.

Based on early Project results, several state agencies made substantial commitments to large study area projects. But whether the project area was large or small, and whether the analysis technique was simple or complex, one basic rule remained constant — each agency carefully assessed the utility of the Landsat derived information in its own agency.

While the training and demonstration projects were going on, other activities were underway. A University Advisory Committee, with representatives from each of the major state universities, was formed to examine the role that they should play in the technology transfer process. An Economic Advisory Committee, with representatives from each state, was formed to assist the Task Force in assessing the economic questions posed by the Project. Each of these committees contributed significantly to the success and credibility of the Project.

Other studies were also underway within the Project. One major responsibility of the Task Force was to prepare recommendations to the Pacific Northwest Regional Commission concerning the utility and economics of the Landsat data analysis process. In order to have the basic information which would permit realistic and honest recommendations, additional questions needed to be answered. Principal among these were: What are the state agency information needs? What digital analysis systems are available which can address those needs? What computers are currently available in the three states? And finally, can the State agencies afford a Regional Data Analysis Facility? These questions were addressed in several studies sponsored by the Project. The results of these studies were closely analyzed by the Task Force and, together with the results of the state projects, were the basis of their recommendations to the Commission.

Each participating agency was required to document its activities. These and other Project publications, now totaling over forty documents, itemize the successes and problems of the Project. Some of the results are presented in the following pages; others can be obtained by contacting the PNRC, who will provide the name of the Technology Transfer Task Force member nearest you.

As a training and demonstration effort, this Project must be considered a success. Over 90 state and local government agency personnel from 45 agencies were directly involved. Each agency had a chance to determine for itself whether or not the information derived from satellite and aircraft imagery, and verified by on-the-ground examination, would meet their needs. Agency documentation revealed their satisfaction. The Idaho Department of Water Resources surveyed over 36 million acres of agricultural land at a cost of \$41,646, compared to a cost of \$65,800 by conventional means. Oregon Fish and Wildlife reported a cost savings of 43% using Landsat for wildlife habitat inventory. The Washington Department of Natural Resources reported an estimated cost savings of 48% in a forest inventory of some 13,422,100 acres. As an employee of that Department stated, the demonstration project was "a smashing success."

LAP, a three-year follow-on program, will lead agencies to operational use of Landsat.

Landsat is not a panacea. The system has certain shortcomings. The state and federal agencies are learning to work with the system and are discovering that it has tremendous potential, as well as proven capability as a tool for natural resource planning and management.

Based on the feedback from the agencies involved, and on the results of the other studies undertaken during the Project, the Technology Transfer Task Force went to the PNRC with a recommendation for a follow-on project. This new effort, called the Landsat Application Program (LAP), is significantly different from the previous Project. LAP requires matching funding from state agencies and is designed to implement the operational application of Landsat technology in state and local agency activities. The new Program includes many of the same cooperating agencies and offers opportunity for participation in operational and training activities to state agencies and universities alike.

Perhaps the most important provision of LAP is that it will transfer to the states the capability to perform digital analysis of Landsat data, on state computers, in an operational mode. This capability should help the participating agencies in each state in the Region to do a more efficient and economical job of planning and managing the use and development of the Region's abundant natural resources.

IDAHO



Idaho State Projects

1. Ada County Land Inventory
2. Vegetation Resources Mapping in Southeast Idaho
3. Monitoring Leaky Spurge
4. Snake River Irrigated Land Inventory
5. Teton Dam Failure Damage Assessment
6. Kootenai County Land Cover Inventory
7. Southern Idaho Forestry Inventory

Idaho Participating Agencies

- Division of Budget, Policy Planning and Coordination
- Department of Lands
- Department of Water Resources
- University of Idaho
- Department of Agriculture
- Ada County Planning Association
- Department of Fish and Game
- Kootenai County Planning Commission
- Panhandle Area Council
- Department of Health and Welfare

In Idaho, a total of eleven state and local agencies became involved in the Land Resource Inventory Demonstration Project (LRIDP). The agencies' involvement took place at various levels of intensity which, in the final analysis, could be directly correlated to the quality of the results each achieved. There are three specific efforts which are representative of the activities undertaken by the Idaho agencies. First is the agricultural investigation involving the Department of Water Resources (IDWR) with support from NASA/Ames, USGS/EROS and the University of Idaho. The State's largest industry is agriculture, with most crops grown on nearly four million acres of irrigated cropland along the Snake River. With urban encroachment and new lands coming under irrigation, a pressing need existed to develop a cost effective method to monitor yearly increases in irrigated acreages. Specific objectives developed by the IDWR include: identifying crop types, mapping and measuring irrigated acres, monitoring annual change in irrigated acres, and identifying methods of water distribution on cropland. These objectives were met with varying levels of accuracy. However, the effort was highly successful in terms of transferring the Landsat technology and integrating it into the ongoing planning and management activities of IDWR. (See facing page.) The urban application test site was the city of Boise, and the surrounding Ada County. The participating agencies were the Ada Planning Association (APA), USGS/EROS and NASA/Ames. The city of Boise is growing rapidly and that growth, to a significant degree, is taking place at the expense of prime agricultural land. At the same time, vacant land within the incorporated area of Boise is being by-passed by development. Problems such as these and the need for a timely, accurate and cost effective method of mapping and generating statistical summaries prompted APA's active participation in the project. The objectives of the investigation were: map vacant land within the urbanized area, identify current use of vacant land, delineate old and new residential areas, identify commercial and industrial areas and map the agricultural and wild lands within the county. APA has been very successful in utilizing the resulting map products and statistical summaries in public meetings and to demonstrate urban growth patterns and trends.

The third activity involved the Department of Fish and Game and Department of Lands, as well as the two federal agencies, in a rangeland investigation. The two departments were in need of data concerning type, location and condition of vegetative cover types on rangeland in Southeast Idaho. The information achieved from the test sites has provided insight into rangeland carrying capacities for livestock and big game animals. Results have been positive and are being utilized by the departments in their planning and management activities.

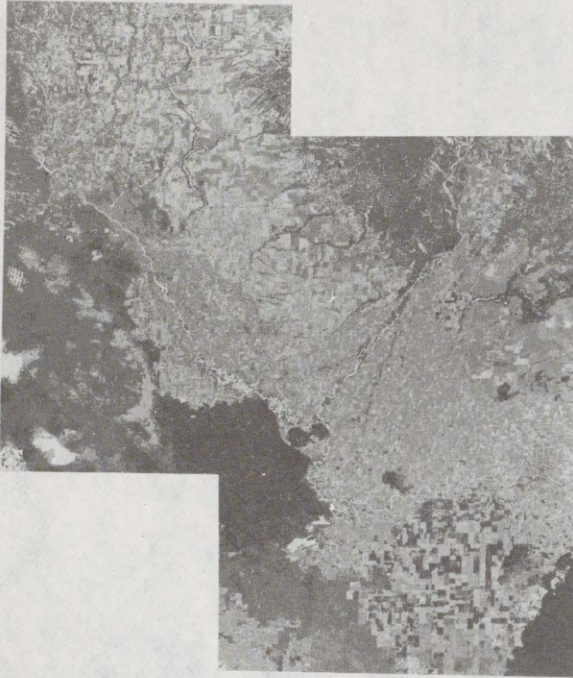
These are but three examples of Idaho agencies' involvement with the Landsat and the LRIDP which serve to represent the level of participation, cooperation, and enthusiasm of all parties.

SNAKE RIVER, IDAHO-IRRIGATED LANDS INVENTORY

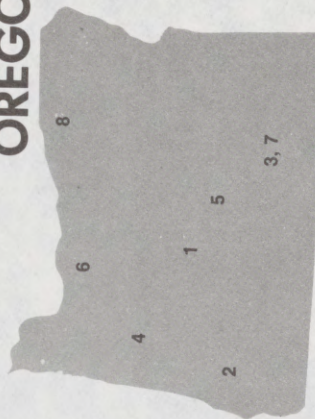
Color Legend and Inventory Statistics

Color	Class	Acres
Royal Blue	Urban and Built-Up	26,823
Lime	Irrigated Alfalfa	65,222
Sea Green	Irrigated Grain & Corn	33,076
Forest Green	Irrigated Potatoes	32,444
Chartreuse	Irrigated Alf / Hay / Pasture	225,812
Olive	Irrigated Peas	5,551
Medium Green	Irrigated Beets / Potatoes	13,329
Magenta	Irrigated Potatoes	60,648
Lavender	Non-Irrigated Alfalfa	124,247
Raspberry	Non-Irrigated Grain	95,368
Pumpkin	Non-Irrigated Fallow	100,510
Tan	Rangeland	417,025
Orange	Forest Land	69,375
Light Grey	Water	30,689
Purple	Wetland	4,628
Medium Grey	Sandy Areas	9,550
Dark Brown	Lava Flows	123,215
White	Clouds	10,457
Black	Shadows	5,762
		TOTAL 1,475,731

Shown here is a 2300 sq mile test area, one of the three chosen along the Snake River in a pilot project to inventory irrigated lands throughout southern Idaho. Idaho Falls (blue) appears at the southern border. The Idaho Department of Water Resources, with the University of Idaho, supplied ground checks of this area, using these data and the EDITOR image analysis system. USGS and NASA at Ames Research Center formed a multi-temporal Landsat classification image that distinguished irrigated from non-irrigated lands and identified crop types. This classification was used as one stage in a multi-stage statistical analysis to produce an improved inventory of irrigated lands.



OREGON



Oregon State Projects

1. Crook County Land Cover
2. Douglas County Forest Condition
3. Klamath Irrigated Lands
4. Tansy Ragwort Investigation in Western Oregon
5. Oregon Rangeland Resources Mapping and Inventory
6. Portland Land Inventory Demonstration
7. Reservoir Volume Determination
8. Surface Mine Detection

Oregon Participating Agencies

- Land Conservation and Development Commission
- Oregon State University
- University of Oregon
- Department of Forestry
- Department of Water Resources
- Department of Agriculture
- Department of Fish and Wildlife
- Department of Transportation
- Columbia Regional Association of Governments
- Multnomah County
- Portland City Planning Department
- Environmental Remote Sensing Applications Laboratory (ERSAL)
- Department of Geology and Mineral Industries
- Crook County

Oregon state agencies took an active role in the project. With the support of the Pacific Northwest Regional Commission (PNRC), Oregon State University, NASA/Ames Research Center and US Geological Survey's EROS and Geography Programs, several investigations were begun. Included were an irrigated lands inventory, an urban area land cover inventory and a noxious weed detection exercise.

The Oregon Water Resources Department must, by interstate compact, monitor the extent of irrigated agriculture in the Klamath River Basin. A combination of Landsat and high altitude aircraft imagery provided an efficient and cost-effective solution to this inventory problem. The results of the inventory were so promising that the OWRD has undertaken similar inventories for the remaining river basins in the state funded, in part, by the PNRC's Landsat Applications Program (LAP).

Tansy Ragwort is a noxious weed which now infests large areas and causes livestock losses of millions of dollars per year in the Pacific Northwest. The Oregon Department of Agriculture used computers to digitally analyze Landsat digital data to identify areas of likely Tansy Ragwort infestation. (See facing page.)

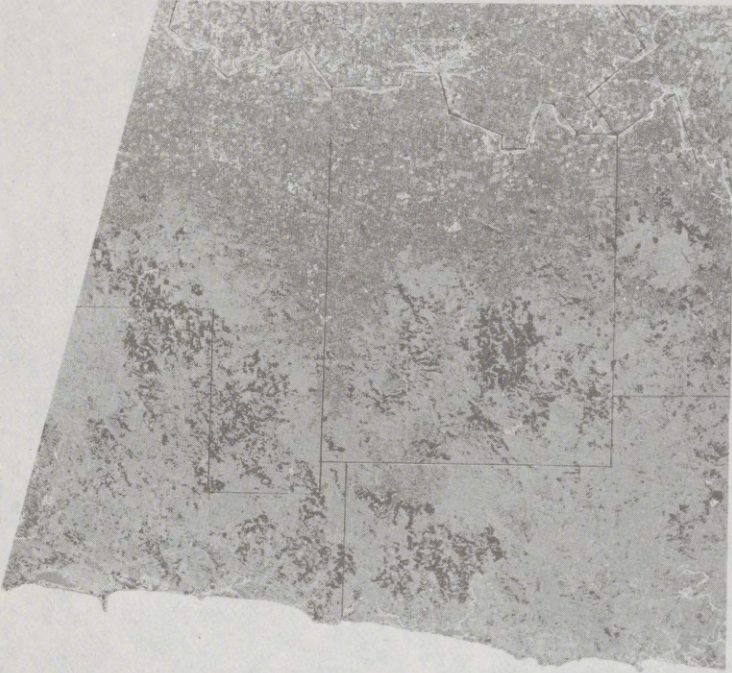
State and local government personnel from the Department of Transportation, Columbia Region Association of Governments, Multnomah County and the city of Portland used Landsat digital data to determine land cover in a 1325 square mile test site. Following computer classification of the Landsat data, census tract and traffic zone boundaries were overlaid on the classification to permit statistical summaries of land cover type by tract or zone. This capability proved to be of significant use in the planning processes of the represented agencies. As a follow-on, data from air pollution studies were added on a 2 km square grid basis. The integration of all these data gave the planners another new set of capabilities such as indexing air pollution by traffic zone or by census tract.

TANSY RAGWORT INVENTORY IN WESTERN OREGON

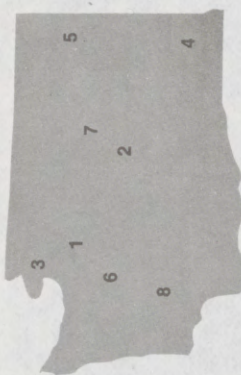
A noxious weed called tansy ragwort costs Oregon and Washington from \$3 to \$8 million a year, in direct livestock destruction and in eliminating large areas of rangeland from production. To determine the weed's location and density, and the success of eradication programs, the Oregon Department of Agriculture is working with Oregon State University and NASA/Ames Research Center on a project looking at tansy in 16 counties. Though individual plants can be counted on low-altitude photography, the cost of acquiring photos over such a vast area would be prohibitive. So the project team devised a statistical sampling scheme to allocate photo flight lines and ground data collection, and to identify tansy's likely growing areas on a Landsat classification.

Shown here is a portion of the 26,000 sq mile test area Polk County is in the center; county boundaries are indicated in black. In this classification, 85 ground cover classes have been summarized into these 8 tansy likelihood classes:

Color		Class	Tansy Likelihood	
Blue	Water, Urban, Miscellaneous		Near Zero	
Dark Green	Closed Canopy Forest		Near Zero	
Black	Recent Clearcuts		Near Zero	
Red	Irrigated Pasture		Low	
Yellow	Intensive Agriculture		Low	
Light Green	Open Canopy Forest		Medium	
Tan	Dryland Pasture		High	
Peach	Older Clearcut		Very High	



WASHINGTON



Washington State Projects

1. Central Puget Sound Urban Land Inventory
2. East Columbia Basin Land Cover Classification
3. Puget Sound Habitat Inventory
4. Southeast Washington Big Game Habitat Inventory
5. Spokane County Land Cover Inventory
6. Tacoma Land Use Management Information System
7. Washington Rangeland Resources Mapping and Inventory
8. Western Washington Forestry Inventory

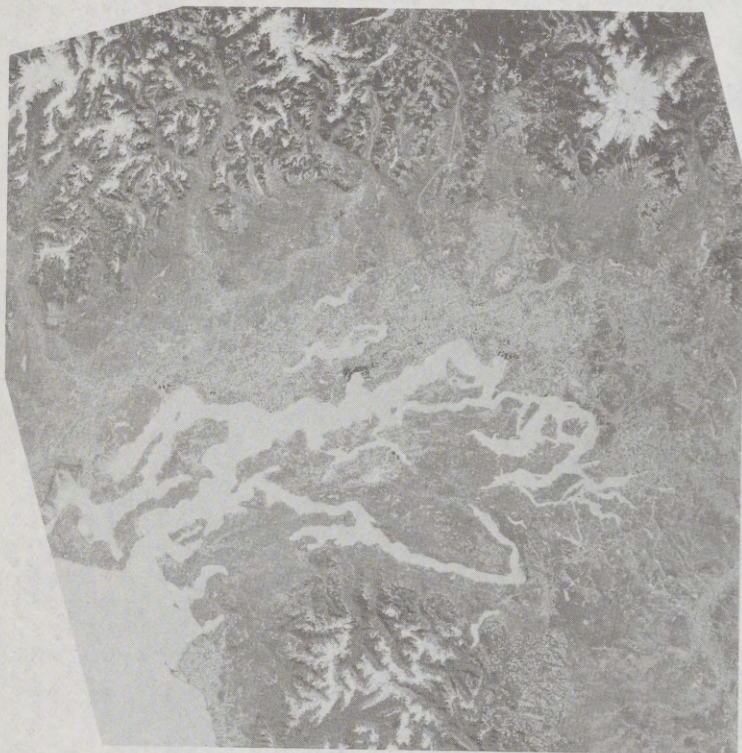
Washington Participating Agencies

- Department of Natural Resources
- Department of Ecology
- Planning and Community Affairs Agency
- Department of Game
- University of Washington
- Washington State University
- Tacoma Planning Department
- Pierce County Planning Department
- Thurston Regional Planning Council
- Mason Regional Planning Council
- Snohomish County Planning Department
- Kitsap County Planning Department
- Jefferson County Planning Department
- Puget Sound Council of Governments
- Municipality of Metropolitan Seattle
- Spokane County Planning Department
- King County Planning Department

In the State of Washington, seventeen resource management and planning agencies participated in demonstration projects. Agency personnel assumed responsibility for collecting and providing ground truth and for verifying Landsat analysis results. As was the case in Idaho and Oregon, agency personnel were involved in every step of the computer-assisted analysis. Over 30 state and local agency representatives received training in the computer techniques used to analyze Landsat digital data and the skills in remote sensing required to convert the Landsat results to the form of information of most utility to the agency. A major effort was the timber volume inventory conducted in Western Washington by the Department of Natural Resources. This project involved analyzing Landsat scenes covering 20,000,000 acres over the area from the crest of the Cascade Mountains to the Pacific Ocean. It employed data not only from the satellite, but from low and high altitude aircraft carrying special complements of cameras. DNR personnel also conducted extensive ground truth surveys over the test site area. Timber volume estimates made in this project have been used in the Washington Forestry Productivity Study. DNR is planning to expand the forest inventory with a new project in the Landsat Applications Program.

In the Central Puget Sound region, a multi-agency effort was established to examine the utility of Landsat data to urban planners. Regional, county, and city planners from the Central Puget Sound area joined together as a single user group to analyze the Landsat scene covering some 8,000 square miles from Everett to Olympia and from the Cascades to the Olympics. (See facing page.) The results from this project have been used by planning agencies in the region in determining urban land use, in transportation planning and in conducting special studies relating to water and air quality standards. The city of Tacoma has incorporated the land use and land cover information developed in the project into a computerized management information data base which serves every agency in the city. These agencies now have the capability to compare and manipulate special interest information by arbitrary boundaries such as school, fire, police, and engineering districts using a common base of land use and land cover within those districts. Repeat analysis of the Landsat data represents an efficient means of tracking change and updating the data base. The Tacoma Planning Department has already received approval to continue the data base development in the Landsat Applications Program (LAP).

PUGET SOUND LANDSAT CLASSIFICATION



Land Cover

	Residential
	Wooded Residential
	Mobile Homes
	Commercial/Industrial/Quarries
	Pavement
	Cropland
	Grass/Pasture
	Clear Cut
	Brush
	Deciduous
	Mixed Forest
	Regrowth Conifer
	2nd Growth Conifer
	Old Growth Conifer
	Water
	Sedimented Water
	Wetland
	Barren
	Ice/Glacial Debris
	Snow
	Shadow/Border

Senator STEVENSON. Thank you, sir.

Your full statements will be entered in the record. Thank you all again.

I gather that you all favor Federal operation and ownership at least initially of the remote sensing system. Are the reasons cost and continuity? Are there other reasons for that preference? Are there more comments on that subject?

Mr. RADO. In terms of ownership of the system, I believe there is a great concern that in the initial period of 7 years, should the system be operated by the Federal Government, it will give us the continuity with the MSS data that is required. In addition, we would hopefully get the data at a reasonable cost.

Also there's a concern that if the States are not the major purchasers of satellite data, that the system to the extent necessary for efficiency to serve the major purchasers, such as in either raw data or final products available—might be streamlined to our disadvantage, resulting in the States not being able to secure certain data products.

Senator STEVENSON. And if the Government is to own and operate it in this interim, what would be the most appropriate agency, in your opinion? As you know, the bill which most or all of you have supported creates a new service within NASA. Do you all agree that that's the appropriate way to do it? Are there more appropriate ways, other agencies?

NOAA is already operational. Do you all agree that NASA is the best agency?

Mr. FLINN. As far as I'm concerned, I think it's the most appropriate. Our experience so far in the experimental stages has proven that NASA knows what they're doing, and it seems to me that—while I've got the floor, incidentally, I owe an apology to Senator Schmitt. I was not made aware that his bill had been under consideration today, and I apologize on behalf of my task force staff.

I personally do not quarrel with the idea that the Government should not do something for us that we can do for ourselves. But I do have some reservations about starting off at the beginning with the private sector doing this job, from the standpoint that I'm almost sure that the State governments could not afford, nor the local or regional planning boards, for example, afford it, but sometime down the pike I would suspect that if we could show a savings for the so-called windshield surveyors, for example, we may phase in the private sector. Maybe that might be an area where the two bills could meet somewhere further down the pike.

Senator STEVENSON. We certainly contemplate that possibility in our bill. This is Federal ownership just at the outset; it's a deferred decision. But we clearly contemplate that possibility.

Mr. RADO. I think in support of Mr. Flinn's comments, it needs to be recognized that there is significant private sector involvement right now in the system in the area of the regional remote sensing centers.

At the centers, there is significant support contract presently occurring plus the involvement of the equipment manufacturers with the user community. I hope I did not give the impression during my previous comments that we are not interested in in-

volvement with the private sector because we genuinely are interested in their involvement.

The States have minimum criteria that we would like to see met. If that minimum criteria can be met at the conclusion of the interim period, we are most interested in going with whoever can provide us with the services we'll need and at the prices we can afford.

Senator SCHMITT. Would the chairman yield on that point?

I hope that all five of you will look closely at S. 875 because I think if you get down in the details you'll find that most of the problems you have said you foresee with the private sector are answered.

For example, there's a transition period that is not a definite period, except insofar as the board of directors is appointed 2 years after the enactment of the bill, and then an indefinite period of transition for that board of directors to form a corporation and become active. So the timeframe is something that certainly can be worked on.

Also the fear that all users might not be served we hope is addressed by the composition of the board of directors and could be addressed more specifically by amendment to the statute and we'll take that under consideration as we look at this further. As to the continuity of data, I see no reason to expect that data would not continue to flow. I don't think that would be a problem. I also would suggest that a portion of this area is public service. That's why it's so difficult to decide which way to go.

The weather service is traditionally public service; communications is traditionally private; and here we are somewhere in the middle. Both private and public services are appropriate. I would think that where State and local governments need to continue to be subsidized by the Federal Government in the use of this data, they could be. The advantage to a private corporation would be that you begin to pick up, I think, more of the total effort from the private sector where the resource has a value to other entities: mining, ranching, agriculture, and so forth.

So again it's more a statement by me, and you're welcome to comment. But if you look carefully at the details of the bill and advise us whether you think in those details at some future time a private corporation structured in that way would meet the kind of problems which you foresee.

Senator STEVENSON. We would, of course, be delighted to get your comments about Senator Schmitt's bill. Mine is cast as it is for some additional reasons in addition to those which you've mentioned and reasons which might not be thoroughly applicable to State and local users. But they involve international cooperation for local remote sensing systems and also the use of classified data and classified technologies, which aren't by virtue of their classification widely recognized or understood.

But I think from my perch in the Intelligence Committee, it has some very large civil potentials, and all those problems have to be sorted out. It would seem to me that an interim period might be appropriate. Hopefully, a system could be devised that would take advantage of all the data and all the technology in a way that's open and would make it available to the private sector.

Did you want to add something, Mr. Rado?

Mr. RADO. I just want to make a statement, if I may, in response to the point which Senator Schmitt brought up. I think the reason the continuity of data keeps coming up is most of the State users keep asking themselves a "what if" question. And that "what if" question is: as Landsat C starts getting into its third, fourth, and fifth years, and if anything happens to Landsat D when it's launched, Landsat D', it is my understanding, does not have and has not been funded for an MSS backup. There's a question then to be asked regarding the 1981-82 period. Since we do not see Landsat D' with an MSS; if something goes wrong with Landsat D' and the States have made significant commitments, then there could be a gap in the data. This issue must be addressed immediately since it takes several years, to my knowledge, to design and build a satellite, much less to incorporate it into the funding cycle.

Senator SCHMITT. I would just say that the chairman and I are quite concerned with that. We've asked the administration those kinds of questions on many occasions. It may have been my misunderstanding of your statement. We agree that's a major potential problem within what I would refer to as the present, nonoperational Landsat system, if only for the reason that you can't guarantee continuity of data, even though the Administration has said they're going to. If you look at the budgets and the plans, it doesn't guarantee it. All it takes is one failure, either up there or in the launch and you don't have continuity.

So that's an excellent point, and it's one which we will continue to try to do something about.

Senator STEVENSON. Several of you suggested that we should be more explicit about technology transfer to State and local governments; Representative Flinn did. And we'll do that, I think. That is than an oversight than anything else. We've dealt with it; we've dealt with it implicitly, and we ought to make it explicit.

Senator Schmitt?

Senator SCHMITT. Mr. Chairman, I think I have covered most of the initial questions. Do you have any feeling about what we should define as the difference between "raw," "preprocessed" and "processed" data? Do you run into that problem in our activities in any way?

Mr. RADO. Yes, I think the States are very interested in that entire issue. I think, generally speaking, we are interested in the raw data that allows us maximum flexibility because we in the States have multifaceted disciplines. We're dealing with forestry projects one day, agriculture another day, water resource efforts another day, and possibly industrial siting the next. And I think the States are most interested with that issue, and I think what the States are basically looking for is access to raw data and maybe preferably preprocessed raw data that is destriped, received haze removal, removal of distortion and rectified to the ground.

Senator SCHMITT. We're having a problem in S. 875 trying to define what is "raw" and what is "preprocessed" and what is "processed." By adding the spacial references you start to add some processing to the data. That's the thing we're trying to get at.

If there are any detailed comments you'd like to provide, we'd like them for the record.

Mr. RADO. The one comment I would make is I guess our definition of raw data is strictly that which you can buy through the data center or obtain through Goddard. Preprocessing would mean any type of geographic—

Senator SCHMITT. All of that data is preprocessed to some degree.

Mr. RADO. All that data—

Senator SCHMITT. All that you can purchase through their centers, if I'm not mistaken, is preprocessed to some degree in terms of format, and in terms of computer compatibility.

Mr. RADO. That's correct.

Senator SCHMITT. Spacial reference and other, not all of it, but some of it. So we're trying to figure out if we're going to have an operational entity and you've said that their charter is to provide raw data or preprocessed data or raw and preprocessed data, what does preprocessed mean? I guess your general answer is, well, it ought to mean what we are now getting; generally what we now get as raw data, what we view as raw data from the various data centers; is that correct?

Mr. RADO. That's correct; yes.

I was just going to say, I think to a great extent the jury is still out on that because in the user community there are definitional discrepancies.

Senator SCHMITT. That's one area where we would have some complexities in the corporate entity because we would have to define what their particular function was as a service so that it did not interfere with those other analytical services.

It should be competitive within the private sector. That is a delicate issue, and we're going to have to come to grips with it, when and if—I would say when rather than if—we go to a corporate entity for providing the service.

Mr. WISE. Mr. Chairman, I think this is a very critical point in the whole design of the system. A point in our testimony had to do with the need for continuity, as has been brought up a number of times, and in the sense of the U.S. census population and the other censuses which are formatted continually and provide a set of profiles of the country, our natural resource data system in the United States, in spite of all the elaborate technologies, is really in its infancy.

And one of the parts of the legislation I think which should be in the national interest is comparative data over time, which gives the Congress and the country a sense of the resource and the changes in the resource in America over many years, even decades.

That's something that's missing from our current natural resource data systems. This approach which you are supporting would help deal with—that's sort of a large scale format issue.

Senator STEVENSON. Thank you, gentlemen. The subcommittee is adjourned.

[Whereupon, at 12:15 p.m., the hearing was recessed to reconvene at 9:30 a.m., Wednesday, April 11, 1979.]

OPERATIONAL REMOTE SENSING LEGISLATION

WEDNESDAY, APRIL 11, 1979

U.S. SENATE,
COMMITTEE ON COMMERCE, SCIENCE, AND TRANSPORTATION,
SUBCOMMITTEE ON SCIENCE, TECHNOLOGY AND SPACE,
Washington, D.C.

The subcommittee met at 9:30 a.m., in room 457 of the Russell Senate Office Building, Hon. Adlai E. Stevenson (chairman of the subcommittee) presiding.

OPENING STATEMENT BY SENATOR STEVENSON

Senator STEVENSON. The subcommittee will come to order.

This morning we continue hearings on legislation to establish an institutional framework for an operational remote sensing system for gathering data by satellite on the Earth's resources and environment. The two bills under consideration are S.663 the Earth Data and Information Service Act of 1979, introduced by Senators Cannon, Ford, Riegle, and myself, and S. 875, the Earth Resources Information Corporation Act of 1979, introduced by Senators Schmitt, Pressler, and Young.

On Monday Dr. Press, Director of OSTP, testified that the administration is committed to the development of a operational remote sensing system. He also agreed that the administration is prepared to work cooperatively with Congress to establish the institutional structure for this system. It appears, however, that the Congress is more ready to settle the institutional question than is the administration. If there is much more delay, we will legislate an end to the apparent indecision in the executive branch.

Today we will receive testimony from the Department of State and the Department of the Interior. Both departments play important roles in managing the Landsat R. & D. system.

I'm particularly interested in exploring with the State Department the opportunities for a policy that involves foreign countries in the development, operation and use of remote sensing for peaceful purposes.

We will also receive testimony from representatives of different segments of the private sector involved in remote sensing technology.

Near the end of the 95th Congress a bill, S. 3589, the forerunner of S. 663, was introduced. The committee has received a number of letters discussing the present bill, S. 663 and that earlier bill. Without objection, those letters will be printed in the record.

Our first witness this morning is Joan Davenport, Assistant Secretary for Energy and Minerals of the Department of the Interior.

If you would like to summarize your statement, I'd be happy to enter the full statement into the record.

STATEMENT OF JOAN DAVENPORT, ASSISTANT SECRETARY FOR ENERGY AND MINERALS, DEPARTMENT OF THE INTERIOR; ACCOMPANIED BY DR. FRED DOYLE, ACTING DIRECTOR, EROS PROGRAM, U.S. GEOLOGICAL SURVEY

Ms. DAVENPORT. Thank you, Mr. Chairman.

First I would like to introduce my colleague, Dr. Fred Doyle, who is the Acting Director of the EROS program within the U.S. Geological Survey.

Mr. Chairman, I'm very pleased to be here this morning to discuss the Department of the Interior views on S. 663. We fully support the objective of assuring the timely and continuous flow of reliable and useful remote sensing data and basic information products to the users. In this respect, as Dr. Press has already indicated, the administration is committed to the continuation of remote sensing data through the 1980's. And furthermore, we are committed to the establishment of an operational system.

In the context of these commitments, we believe that congressional action to define the interim institutional framework for such a program is at this time premature. The use of remote sensed data offers unique opportunities to planners, managers and administrators to acquire, quickly, necessary data for making informed decisions. Of course, the Interior Department is the largest land manager in the Nation and is very interested and concerned with the operational use of such data.

We find that, particularly for inaccessible areas, remote sensing data may be the only reasonable approach for obtaining necessary data and information.

Demonstration projects are providing encouraging results, and there are a number of examples where remote sensed data are being used to meet the Interior Department's programmatic needs. For example:

- Mapping geologic structures for hazard assessments and for fuels and minerals explorations;

- Inventorizing surface waters and monitoring snow cover accumulation for water management purposes;

- Mapping wetlands to assess waterfowl habitat;

- Detecting and monitoring past and present surface mining activities which is an application we are developing; and

We are also exploring use of remote sensing for mapping vegetative zones in finer detail for land management purposes.

We anticipate that within 10 years there will be routine use of these data; however, refinement remote sensed data to meet various mission needs is still evolving.

An interim period for studying and developing the institutional, financial, technical, and marketing capabilities necessary to bring this technology to operational status is consistent with the administration's goal of achieving operational status. The President, in his fiscal year 1980 budget submission, announced that the Government will guarantee the providing of remote sensed data through the 1980's. The administration also has various studies under way to determine the best technological mix and institutional arrange-

ments to achieve operational status. We expect those studies to be completed prior to the next session of Congress.

I would like to add that of all Federal users, the Department of the Interior believes strongly that remote sensed data is important to the fulfillment of its missions. We are charged both with wise land use, largely multiple-use, management of an area covering approximately one-third of the Nation, and the conduct of scientific programs, such as topographic mapping and mineral assessment of the public lands.

Mr. Chairman, I stand ready to answer any questions that you may have.

Senator STEVENSON. Thank you.

The Department of the Interior isn't the only Department, in fact, I'm not certain it's the Department most interested in remote sensing for its purposes. I've checked them all. The Department of Defense has supported it. The Department of State has supported it. NASA, of course, is supportive. The Department of Agriculture is positive about the possibilities throughout the world. The Office of Science and Technology Policy is supportive.

Who else is there that we've talked to?

The Department of Commerce and it is very supportive.

Ms. DAVENPORT. Mr. Chairman, I didn't mean to imply that others in the Federal establishment are not supportive and enthusiastic. What I did mean to convey is, we believe remote sensed data, both satellite and other types, are particularly important to the Interior Department's mission.

Senator STEVENSON. That's what they all say.

Some of them see other possibilities. We will discuss some of these with Mr. Pickering from the State Department.

What I'm getting to is, if all the Departments and independent agencies we have identified are enthusiastic and have been for years, why don't we get going? What's the problem? We even had witnesses come before this committee saying that remote sensing is extremely important to their departments, and within hours, almost minutes, of their testimony, have OMB yank the last page off their statements and staple on a conclusion which says: "We're ecstatic, but we don't support your bill. We can't make a decision, and it's premature, and maybe in another 10 years we'll be able to make this decision."

What is wrong and why can't we at least get started by identifying a lead agency and begin making the decisions on details that will have to be made in the future?

Ms. DAVENPORT. I believe that Dr. Press has committed to having the series of studies which are currently underway finished by late summer.

Senator STEVENSON. I feel as if I was sitting here 2 years ago. Wasn't that what we were saying 2 years ago?

Ms. DAVENPORT. We were both sitting here 2 years ago, Mr. Chairman.

Senator STEVENSON. When are we going to stop studying and get moving?

Ms. DAVENPORT. Soon, we would hope.

I would add, however, that because the technical recommendations of the administration for moving to an operational system

have not been forthcoming as quickly as many of us would like them to be, that doesn't mean that we have not been developing and exploring the technology involved. We are exploring within our Department new uses and new purposes for the technology.

Senator STEVENSON. Don't you agree that there ought to be institutional decisions so that we don't put the cart before the horse? That is the way we went to the Moon. We made the institutional decision first. Comsat was established before all the technological questions were answered, and at the time some persons in industry were very skeptical about the relevance of geosynchronous satellites. But the decision was made, and we went ahead. The decision was made to go to the Moon, and we went ahead.

Now the decision seems to be to not go ahead until everything is resolved, and nothing gets resolved because there is no one in charge of resolving it.

Don't you think that the initial institutional decision has to be made before technological questions, international implications, and other factors, can be addresses?

Ms. DAVENPORT. Let me answer that question in two parts. Certainly, initial institutional decisions will need to be made and will need to be made in the near term. I do believe we will have some answers and recommendations in the not too distant future, so that the committee, the Congress and the administration can move forward together.

As it relates to another set of decisions which have been addressed in the proposed legislation, that is, at what time and in what form should this program be expanded and the possibility of the private sector taking it over, I think that question may need more time. Quite frankly, we are in a process of evolution.

The market for these kind of data is established and growing. But it will be a while yet, in our opinion, before the distribution of remote sensed data will be viable from a private sector point of view.

We do not find that alarming. We find this pattern in many new technologies which have been introduced into our economy and eventually have become a very important part of the economy.

Senator STEVENSON. I happen to agree with you about that. The definitive decision on the role of the private sector could be deferred. We can wait for that to be resolved. But in the meantime, we could be getting started in making some interim institutional decisions, which is the suggestion of my bill.

Do you think the Department of the Interior or a Department of Natural Resources would be an appropriate lead agency?

Ms. DAVENPORT. I certainly think that the Department of Natural Resources will give us a unique opportunity to gather together many of the Federal users of remote sensed data, although by no means all of them. We would envision, in whatever final institutional arrangements were made, that NASA, of course, would retain the R. & D. and space segment, at least for quite a while, of actually putting the satellites into orbit.

On the other hand, today I believe we are the only Federal distributor of Landsat data, through the EROS Center in Sioux Falls. I think it would be appropriate for the Department of the

Interior, and hopefully shortly the new Department of Natural Resources, to take the lead responsibility.

I would quickly add that is a personal opinion.

Senator STEVENSON. Thank you.

Senator Schmitt?

SENATOR SCHMITT. Thank you, Mr. Chairman.

Secretary Davenport, what do you see as the purpose of your office in the Department of the Interior, or possibly—but hopefully not—in the Department of Natural Resources. What is the overall purpose?

Ms. DAVENPORT. The overall purpose of the Office of Energy and Minerals within the Interior Department?

Senator SCHMITT. Right.

Ms. DAVENPORT. That is difficult to explain briefly. One, we are major Federal regulators, as I am sure you are aware. Two, through the Geological Survey, we are the major Federal source of Earth science research and data. We have a large water research program, large mineral assessment programs. And lastly, through the U.S. Bureau of Mines, we participate in research related to health and safety of mining systems, other factors associated with hard-rock mining, and also are responsible for development of mineral policy within the administration.

Senator SCHMITT. Hasn't the enabling statute related to your office obligated you to the development and utilization of the natural resources of this country?

Ms. DAVENPORT. To the wise development of the resources.

Senator SCHMITT. There is nothing wrong with adding "wise" to that, but isn't that the principal function of the Office for Energy and Minerals, in addition to everything else you said? Isn't the principal function for wise or reasonable development and utilization of the natural resources of this country?

Ms. DAVENPORT. I would agree with that, Senator.

Senator SCHMITT. Then why do you think that congressional action to define the institutional framework of the section for Earth resources programs is premature? You are charged with that effort, and you have testified, as has Interior testified on many different occasions, that remote-sensing Earth resources information and gathering is a fundamental tool for the wise utilization of natural resources of this country.

Ms. DAVENPORT. Well, Senator, we do use this technology currently in our operations, not only in the energy and minerals area of Interior, but the Fish and Wildlife Services uses it, the Bureau of Indian Affairs uses it, and perhaps the people with the largest potential use are the Bureau of Land Management who also use it.

We use it in discharging our daily responsibilities. We would prefer, however, that the institutional arrangements for an interim program be deferred until several studies presently underway within the executive are completed. I am informed those studies should be completed this summer.

Senator SCHMITT. The nature of the institutional framework won't necessarily affect your activities, your charter, one bit, so long as the data remains available; right?

Ms. DAVENPORT. That's correct, Senator.

Senator SCHMITT. So, from your own parochial point of view, and that of the Department of the Interior, all you need to have is the availability of the data. Congressional action to establish an institutional framework, so long as it is consistent with data availability, shouldn't affect you a bit, unless, of course, you were charged with creating that institutional framework.

Ms. DAVENPORT. We are interested from an operational point of view, and from a program point of view, in the use of this data and its continued availability. We know we have assurance of its continued availability. We are the largest user of this sort of data of any agency within the Federal Government.

On the other hand, the Department of the Interior has been very interested and very supportive of the development of remote-sensing technology for many years, really since the days of Dr. William Pecora, who was a Director of GS and also Under Secretary of the Interior Department. We are interested in the institutional arrangements.

We think that both the timing and the ultimate viability of this technology will largely be dependent on those institutional arrangements.

What I am saying is that our interest goes beyond our parochial concerns, if you will, to broader questions.

Senator SCHMITT. Dr. Pecora was a very good friend of mine, one of the country's most outstanding scientists as well as an outstanding administrator, a rare combination. And I think he is probably turning over in his grave, Mr. Chairman, at the kind of testimony we have been receiving from the administration, and particularly from the Department of the Interior. If there's one thing Bill Pecora believed in, it is the use of remote sensing and the belief that we should move as rapidly as humanly possible to make that kind of information generally available.

He was an inspiration behind the Sioux Falls operation and many other activities related to Earth resources information. So, I think Bill Pecora would support both of our endeavors in this, and I don't think he would be at all happy with the kind of testimony we're receiving.

As a matter of fact, I think he believed that his duty and the requirement of Interior was the wise utilization of the resources of this country, not the nonutilization of resources of this country. And there are many indications that the present management of the Department of the Interior is interested in the nonuse of resources, and it may be, Mr. Chairman, that their acceptance of the administration on this is tempered by the knowledge that Earth resources information does assist in the use of natural resources. Its availability will obviously accelerate the wise use of natural resources, rather than prevent them.

Ms. Davenport, do you see any problem if we were to eventually create a private investor-owned corporation for the gathering and distribution of raw and preprocessed data? Do you see any problem in the Department of Interior and your office working with such a corporation, for getting the data that you need for your operations?

Ms. DAVENPORT. Senator, that would depend on the specifics related to that corporation.

Senator SCHMITT. Some specifics have been outlined in S. 875. Maybe you could speak to those.

Ms. DAVENPORT. We are quite concerned with the suggestion that distribution functions be turned over to the private sector in the near future. It is apparent, from our operation of the EROS Data Center that, at this time sale and distribution of products do not cover operating costs. We believe that in the future, as that market develops, the sale and distribution will cover operating costs.

On the other hand, we're concerned that turning the system of distribution over to the private sector before we believe it's likely to be a viable economic venture would lead to a situation in which either the Federal Government would have to further subsidize such a corporation beyond purchase of stock or the prices of the products would be adjusted upward to such a point that what is really just a nascent, evolving market might be restricted.

Senator SCHMITT. Well, I think people interested in management issues would say that there are some good reasons why the prices or the income at the Data Center do not meet operating expenses.

What is the average processing time now for a request for information?

Ms. DAVENPORT. Let me ask Dr. Doyle to address that.

Dr. DOYLE. Excuse me for my voice this morning.

The average processing time through the EROS Data Center is now less than 7 days. That's dependent upon our getting the information in from NASA, and that doesn't always happen very expeditiously.

Senator SCHMITT. So, if I send you a request for data that you have in your data bank, on the average I can expect to have that request filled within 7 days?

Dr. DOYLE. That is correct, Senator; yes.

Senator SCHMITT. If that's true, that's a remarkable improvement, over the last couple of years, and you are to be congratulated for it.

Dr. DOYLE. I think you will find that that is true, Senator. There are occasions, of course, when we don't provide that kind of service. Things go wrong in the order-taking or in the processing. But on the average, orders get out in less than 7 days.

Senator SCHMITT. What is your estimate of the time that it takes NASA to get computer-compatible information to your data center, the time from collection to the Data Center?

Dr. DOYLE. Senator, that's been quite bad in recent months. We have been planning since last year a completely digital interface between ourselves and NASA, with the information transmitted to us by Domsat. Our part of the system has been operating. The Domsat link is in, and it is being checked right now. The NASA part of the system does not always operate. We have never had the actual throughput for which the system was designed.

There is a backlog building up at the Goddard Space Flight Center of information that has not come to us from the EROS Data Center.

Senator SCHMITT. Doesn't this sound like one of the major reasons why you can't make operating expenses? If people can't get reliable data reliably in a timely fashion, they're not going to use your center.

Dr. DOYLE. Senator, I think that has probably been overplayed. For the majority of users the data is not time-critical. There are certain data users who have a real requirement for data in a short time. But the majority of our sales are not to that kind of user.

Senator SCHMITT. Well, one reason you may not be seeing the time-critical users is that they know they can't get it.

Dr. DOYLE. I don't believe that, Senator.

Senator SCHMITT. Are you saying that there are no time-critical users?

Dr. DOYLE. No, sir, I am not saying that.

Senator SCHMITT. They're certainly not going to ask you for data that they can't get.

Dr. DOYLE. We are the only place where they can get the data now.

Senator SCHMITT. If they get data directly from NASA, are they serving the purposes?

Dr. DOYLE. That is not the present operating plan. All data distribution is supposed to be through the EROS Data Center. There is a certain amount of data that goes out by what we call the "back door" of NASA which is provided free to NASA investigators, to the Department of Agriculture and a couple of other agencies.

But in principle and in terms of the agreements that we have between the Department of the Interior and NASA, the EROS Data Center is supposed to be the only distributor of data to the general users.

Senator SCHMITT. Let me ask my question again, then.

You say your average processing time is 7 days. What is the time, the average time, it takes to get data from a satellite to the Data Center for distribution in that 7-day period?

Dr. DOYLE. I can't tell you exactly, Senator, but my expectation is that it's more like 30 days from the time of the satellite acquisition until it comes to us.

Senator SCHMITT. Thirty days.

Dr. DOYLE. As I say, right now, a backlog of data is being built up.

Senator SCHMITT. Could you try to supply the accurate average time and, say, a 3 sigma time for the data?

Dr. DOYLE. Surely.

[The following information was subsequently received for the record:]

The average time from acquisition by the Landsat satellites to delivery of film data by NASA to the Interior Data Facility has been 26 days for the past 2 years. NASA delivery of CCT's to Interior has averaged 30 days but has been 6 to 9 months or longer on occasion.

The average time from customer order to product delivery by Interior has been 1 week for black and white images, 2 weeks for color products, and 48 hours for CCT's if Interior has the data from NASA. When a user orders a CCT that is not in the EDC archive, it has to be ordered from Goddard, and the average turn around time has been 21 days.

Senator SCHMITT. I think it's just not a reasonable argument to say that because the Government can't make a system like this operate so it pays for itself that a private entity or some other management entity could not make it operate. That's been a classic problem with Earth resources for many, many years. Many, many

users feel that they just can't get the information when they need it, whether it's old information or new. So, I am not persuaded by that argument.

I also think there is a bit of reluctance, let's just say a reluctance on the part of some agencies to be willing to let go of something that might be more efficiently operated in the private sector.

I think we're going to hear from Comsat that they think the market can be developed. They're out there trying to develop markets in other areas. I won't say that is persuasive, either. But nevertheless, there certainly is a difference of opinion on whether or not the markets exist and whether they can be developed on a commercial basis.

Dr. DOYLE. Senator, I think that the Department of the Interior has been a major proponent of Earth resources satellite data. The system would not exist if the Department of the Interior had not provided the initiative for it.

I think we are firmly and fundamentally committed to the provision of that kind of data. I can tell you that we have a \$24 million investment in the EROS Data Center. It came out of the operational budget of the Department of the Interior in one way or another. We are the largest single user within the Government of the data from the Earth resources and from Landsat.

Senator SCHMITT. Doctor, I don't argue with that. I am a great fan of the Department of the Interior's operational agencies, in many respects. But I don't think any of us can be dogmatic. There may be a better way to do it. That's what we're trying to examine in these hearings.

Dr. DOYLE. I am aware of that, Senator, and I wish you all good fortune in doing that, because an efficient operational system is a fundamental goal of this Department. I can tell you that the total Landsat sales from the EROS Data Center are averaging about \$2 million per year. That does not pay the freight for operating the center. But we are committed to supplying that support from our operational budget in the Department.

Senator SCHMITT. What is the value of the data that you supply to Government agencies without cost?

Dr. DOYLE. We do not supply any data from the EROS Data Center without cost. Data coming to the Department of the Interior is \$225,000 per year, bought by the Geological Survey. Also, when we use data in the EROS Data Center for our training programs, and for our technology demonstration programs, we buy that data just as any other customer would. That's an additional \$160,000 per year, that we buy from ourselves.

Senator SCHMITT. What about the data that the Agriculture Department uses?

Dr. DOYLE. Our estimate of the amount of data that Goddard gives away is about \$1½ million per year. And that's data that is not paid for.

Senator SCHMITT. So that's getting close to \$4 million worth of data, total, Landsat data that's utilized?

Dr. DOYLE. That's correct, Senator.

Senator SCHMITT. Could you try to give us a more detailed breakdown of the value of the data that—the cost value, the replacement

value of the data that's used by the private sector, by Government agencies and other entities?

Dr. DOYLE. Yes, sir, I can do that.

[The following information was subsequently received for the record:]

Since 1972, over 1,000,000 imagery frames and more than 10,000 computer compatible tapes (CCT scenes) have been sold to worldwide users for more than \$8,000,000. For the past few years, Landsat data sales have been 60-65 percent of the gross sales of the EROS Data Center. In fiscal year 1978, user demand for imagery data was 110,723 frames at \$1,441,368 and computer tape scenes was 2,853 and sold for \$534,700.

The fiscal year 1978 user profile for imagery data is distributed rather evenly between the Federal users at 30 percent, and the non-U.S. users at 35 percent, while the industry sector demand is 21 percent. The academic group tallies about 8 percent of data, individuals 5 percent, with the State and local government being 1 percent. CCT sales for fiscal year 1978 were: 33 percent Federal, 31 percent industry, 24 percent non-U.S., 10 percent academic, and 2 percent State/local.

Landsat data has been used by over 100 countries of the world. Typical uses made of the data are: land use mapping, mineral and petroleum exploration, crop inventories, water resource evaluations, vegetation analysis, land and forest resources inventories, strip mine monitoring, site selection and construction planning, and third world natural resource inventories.

Dr. DOYLE. I think what you're asking for is the charge that is made to that data, not the value of it. Our belief is that the value of the data far outweighs the price.

Senator SCHMITT. I agree with you, and that's why I said "replacement costs of the data," or some measure that we can use to estimate what the total market value or the minimum market value of that data may be, either to a governmental operational entity or a private operational entity.

Dr. DOYLE. I can give you the actual prices for the data that is distributed.

Senator SCHMITT. And a breakdown in some way of the quantity and value of the information used by the private sector and by the Government agencies and by State and local governments.

This committee really needs to have a better understanding right now than I think we have of just how much of this data is being used and what is the potential market, and with a more rapid, more efficient operational entity how would that market grow. We will be trying to get testimony from a variety of individuals to find that out. I appreciate your inputs on it.

Senator STEVENSON. Weren't you prevented by law from charging for data more than reproduction costs?

Dr. DOYLE. Senator, I am not exactly sure of the law, but I know that has been our operational practice, that we sell the data for the cost of reproducing it.

Senator STEVENSON. I think that's the law.

Dr. DOYLE. There has been a lot of evidence collected during the studies that Senator Schmitt shakes his head about, but at least the indication from those studies is that the cost of the data or the charge for the data could be increased by a factor of five without severely affecting the market.

However, as you say, our practice has been to sell the data at the cost of reproduction. That's the way we operate with the aircraft data. It's the same way we operate with the Landsat data. We do not try to recoup the cost of the satellite or the Goddard Center or of any of the rest of that.

Senator SCHMITT. Mr. Chairman, could you also supply for the record some estimates of the operational costs of the Landsat system?

Dr. DOYLE. Yes.

[The following information was subsequently received for the record:]

The yearly operating cost of the EROS Data Center for the current fiscal year is \$12.7 million. Approximately \$3.7 million of this total is for reproduction and dissemination of data to satisfy user orders. This is offset by \$3.4 million in revenue received by the Government for these products. The remaining \$9.0 million in expenses is for Interior-required research and development, for training and user assistance activities, for data processing and archiving costs, and for operation of a national data availability information network. \$8.8 million of the \$9 million is provided by congressional appropriation with the remainder recovered from revenue from user training. We consider that our activities in providing training courses in the use of remote sensing data and in conducting demonstration projects in cooperation with other government agencies are critical parts of our activity. They are highly instrumental in developing the market for expanding use of Landsat-type data.

Senator SCHMITT. Particularly of the data center or other components of it, so we can get some idea how close to operational costs you're coming. And if you charged a factor of five more, would you approach that operational cost?

Ms. DAVENPORT. Excuse me, Mr. Chairman.

Senator, you should be aware that the Sioux Falls center distributes not only Landsat data but a great deal of more conventionally acquired remote sensed data. So we would have to break those costs down for you.

Senator SCHMITT. I understand the breakdown report, but both the Chairman and I feel that Earth resources information gathering is not just a satellite gathering problem. It's a synergistic problem with aircraft ground stations and satellites, putting together a whole system, which is what generally you do.

We need all three components in order to have maximum value from any one part.

Dr. DOYLE. Senator, I'm not even sure of what my rights are in talking to this committee; but you and I have worked together in the past, and I want to speak purely as a scientist.

I think the Department of the Interior is clearly interested in having operational responsibility for an Earth resource satellite system.

Senator SCHMITT. It wouldn't surprise me a bit.

I know most of the people would like to operate it.

Senator STEVENSON. If NOAA can get weather and other timely information to users in a matter of minutes, why can't Interior do the same with Landsat?

Dr. DOYLE. NOAA has operational responsibility for their satellite system. They designed the system; they know exactly what they're getting; they have their own data reception stations, their own data processing system, their own distribution system. That is something that has not yet existed in the Earth resource satellite business.

Senator STEVENSON. You're making a strong argument for making NASA the operator of the remote sensing system.

Dr. DOYLE. I don't think that is correct, sir. NASA's role, by charter, is research and development. I think they do that fairly

well. But we are not 100 percent complacent with the systems that NASA is putting into space for Earth resource observation.

We think that those systems are overblown with respect to the viability and the cost of the data. If the Department of the Interior were operating that system, we would not have something that looks like Landsat D.

Senator STEVENSON. You would not have something that looks like Landsat D?

Dr. DOYLE. That is correct, sir.

Senator STEVENSON. What would you have?

Dr. DOYLE. A much simpler system, more like the proven multi-spectral scanner that is currently on Landsat 1, 2, and 3. We could combine that capability with the stereosat capability and provide that information in a much more timely fashion than we are going to be able to do with the Landsat D data.

Senator STEVENSON. Are you concerned that the increase in volume of data available through Landsat D will increase your delivery time?

Dr. DOYLE. We are working at that problem very seriously with NASA. We are trying to find budgetary support for a completely digital interface between ourselves and NASA for the Landsat D data.

The estimate of that interface, for the Department of the Interior, at the EROS Data Center is between \$6 and \$10 million—that's the capital investment just to receive the Landsat D data in digital form.

If we get it that way, we are confident that we can turn it out of the EROS data center in less than 2 days. If we have to go back to a film interface, which is what NASA has currently proposed to us, that time will not be any better than it is now. It is, on the average, 7 days. That's only passing through the EROS data center; it's not taking into account the processing time at Goddard Space Flight Center.

Senator STEVENSON. Is that \$6 million budgeted?

Dr. DOYLE. Not at the moment, Senator.

Senator STEVENSON. Well, maybe I'm wrong. Your argument implied that NASA should not be the operator, but it certainly implies that somebody should be the operator.

Dr. DOYLE. It certainly implies somebody should be the operator; yes, sir.

Ms. DAVENPORT. Mr. Chairman, I would like to make a comment on that.

Because of the stage at which we find this evolving technology, we find two separate, intertwined and very important goals involved. One is the continued research and development of better systems to improve quality, to improve use.

The other is the needs of the user community for what has been, in essence, proven. NASA has—and I believe Administrator Frosch would agree with me completely—seen its mission as basically being in the research and development area.

The user agencies, on the other hand, view Landsat and future Landsat satellites in the context of what can be applied best and what can be used now or tomorrow. So there is somewhat of a creative tension between the two organizations.

I think that that may be a healthy situation for the program in general.

Senator STEVENSON. Thank you, Ms. Davenport, and you, Dr. Doyle.

Ms. DAVENPORT. Thank you, Mr. Chairman.

[The statement follows:]

STATEMENT OF JOAN M. DAVENPORT, ASSISTANT SECRETARY FOR ENERGY AND MINERALS, DEPARTMENT OF THE INTERIOR

Mr. Chairman and members of the Committee, I am pleased to have the opportunity to present the views of the Department of the Interior on S. 663.

We support the objective of assuring the timely and continuous flow of reliable and useful remote sensing data and basic information products to the users. In this respect, the President has committed the continuation of remote sensing data through the 1980's, moreover, the Administration has announced its commitment to the future establishment of an operational system. In the context of these commitments, we believe that congressional action to define the interim institutional framework for such a program is premature. The use of remote sensed data offers unique opportunities to planners, managers and administrators to acquire, quickly, necessary data for making informed decisions. With regard to inaccessible areas, this may be the only reasonable and economical approach for obtaining such information.

Demonstration projects already begun are providing encouraging results, and there are a number of examples where remote sensed data are being used to meet the Department's programmatic needs. For example:

- Mapping geologic structures for hazard assessments and for fuels and mineral explorations,

- Inventorizing surface waters and monitoring snow cover accumulation for water management purposes,

- Mapping wetlands to assess waterfowl habitat,

- Detecting and monitoring past and present surface mining activities, and

- Mapping vegetative zones to finer detail.

We anticipate that within 10 years there will be routine use of these data; however, refinement of using the data to meet various mission needs and other user operational needs is still evolving.

An interim period for studying and developing the institutional, financial, technical and marketing capabilities necessary to bring this technology to operational status is consistent with the Administration's goal of achieving operational status. The President, in his fiscal year 1980 Budget Submission, announced that the Government will guarantee the providing of remote sensed data through the 1980's. The Administration also has various studies underway to determine the best technological mix and institutional arrangements to achieve operational status. We expect those studies to be completed prior to the next session of Congress.

The President in his Science and Technology Message emphasized the need for private sector involvement in the development of an operational system. The Department supports that concept. We have long held that it is the user community that can best identify its requirements with regard to designing system equipment.

However, an operational system is unlikely to become a profitable venture in the near future. At present, the market for Landsat data is insufficient to meet EROS Data Center operating cost. The EROS Data Center sells approximately \$4 million annually in data products. The Center's annual operating expenses for data processing are about \$8 million. Initially, there was a surge in the demand for the data products. However, the demand has leveled off since much of the initial demand was for one-time coverage. Until there is a substantial improvement in data quality, it is unlikely that those users will require new coverage.

To increase market demand, much effort will need to be devoted to identifying new uses and refining data interpretation. We believe the interpretation area is where the greatest opportunity currently exists for the private sector involvement. A separate study is also underway on how to obtain broader involvement of the private sector. A report on that effort is to be completed this summer.

The Administration is considering various options regarding institutional structure. Until the Administration's deliberations are completed and evaluated, we believe that it is premature for the Congress to consider legislation at this time. While the bill is well conceived, we believe the studies underway should be completed and evaluated prior to considering legislation.

In summary, we look forward to working closely with the Congress to develop an operational system at the earliest practical date, a system that will best use our existing resources and facilities and support our national interest in the most economical manner.

That concludes my formal remarks, Mr. Chairman. I would be pleased to answer any questions that you may have.

Senator STEVENSON. Our next witness is Mr. Thomas Pickering, the Assistant Secretary of State for Oceans and International Environmental and Scientific Affairs.

If you'd like to summarize, Mr. Pickering, I'd be happy to enter your full statement in the record.

Thank you for joining us, and please proceed.

STATEMENT OF THOMAS R. PICKERING, ASSISTANT SECRETARY OF STATE, BUREAU OF OCEANS AND INTERNATIONAL ENVIRONMENTAL AND SCIENTIFIC AFFAIRS; ACCOMPANIED BY DR. IRWIN PIKUS

Mr. PICKERING. Thank you, Mr. Chairman, and Senator Schmitt.

I would like to provide at this point a summary and begin by saying I'm accompanied by Dr. Irwin Pikus, of my staff, who is seated to my left.

The State Department is in agreement with the broad objectives of the proposed bill, S. 663, on remote sensing. As you know, the President has committed the administration to the continuation of remote sensing data for several applications through the 1980's for both domestic and foreign use.

This we believe will provide needed assurance to the foreign users of the supply of U.S. remote sensing data. Moreover, the administration is committed to an operational system. The administration also has made clear that it believes that it is premature to consider legislation at this time.

Remote sensing, both as a development tool and as a basis for international cooperative agreements, has assumed in recent years increasing importance in our relationship with many countries, particularly the developing countries.

Yet an underlying concern on the part of those cooperating with us now or interested in cooperating in the future is the lack of a formal assurance that the United States will continue to make available data for cooperative programs in remote sensing.

The President's statement on science and technology gives that assurance. Our commitment to an operational remote sensing system addresses this important concern.

Specifically, an operational system would place access to remote sensing data on a permanent, guaranteed basis—in effect, providing to users an assurance of continuity in the flow of data.

From the perspective of the international community, it would replace the existing experimental system with the greater reliability of a permanent system as the context for the negotiation of a bilateral and a multilateral agreement on remote sensing.

It would thus provide developing countries the assurance they need to commit their scarce resources to ground stations, training programs, and the more extensive application of remote sensing data to their development problems and needs.

Further, it would provide the basis for a long-term system of cost recovery. I note that NASA has taken some useful steps in this

direction by requiring that cooperating countries establishing Landsat ground stations do so at their own expense and pay a nominal \$200,000 access fee per ground station each year.

There is need, however, for a more systematic and predictable approach over time as part of a permanent operational system.

In view of the importance of remote sensing to developing countries, we plan to include remote sensing as a major element in the United States presentation to the United Nations Conference on Science and Technology for Development, to be held in Vienna in August of this year.

We intend to highlight this initiative through exhibits and film showings. And we are now studying a number of possible Conference proposals for improved international use of remote sensing technology.

For these reasons, Mr. Chairman, the State Department not only shares the administration's commitment to an operational remote sensing system, but has a very strong interest in the development of such a system, which would:

(A) Improve the context for the negotiation of international agreements on remote sensing and, hence, for cooperation in this area; and

(B) Build the base of existing international agreements as well.

As I remarked earlier, the administration believes it would be premature at this time—while various space policy studies are underway—which examine options for an integrated national system and to explore the appropriate role for the private sector involvement in the future of remote sensing—to comment on specific legislation.

In my view, we should not so comment until we are in a position to define the technical and institutional arrangements for an operational and remote sensing system. That would include such factors as how best to take into consideration the interests and needs of the international community.

In the various studies now underway in the administration we, in the State Department, will continue to contribute our views on the international aspects of remote sensing and, as these emerge, on the institutional arrangements for an operational system.

We look forward to working with you and your committee on these issues as the space policy studies are completed.

Thank you, Mr. Chairman.

Senator STEVENSON. Thank you, sir.

There's already a good deal of international activity. Seven Landsat ground stations will soon be operating in foreign countries. The European Space Agency has established the "Earthnet" system to receive and process data from the Landsat system. France is developing its own SPOT satellite. Japan and India are considering similar capabilities. The European Space Agency is studying a land applications system and an ocean monitoring system.

And of course there are our own tentative efforts, and they still are the most advanced. Don't all of these activities here and abroad open up opportunities for an integrated effort to avoid technical redundancies and a pooling of resources; and second, a significant opportunity for cooperation among nations, for peaceful purposes, in this environment?

As it is, the United States and other countries—principally, the Soviet Union—are the objects of a good deal of resentment, suspicion, and fear because of their uses of space for clandestine purposes.

Now, if there's any basis for what I'm saying, what are we waiting for? And let me add, I've talked to representatives of some of these foreign countries, and they're waiting for us.

Within ESA, they recognize this kind of intention. They are eager to go to the U.N. Conference with not a show-and-tell or a slide show, but with a proposal by the developed nations for participation by the lesser developed nations. In addition to the technical and economic benefits there is the potential for international dialog being raised to a much more hopeful plane.

What is holding us up? What do you see as the international obstacle? Could you speculate a little about the possibilities for integrating some of these national efforts in a new international effort?

Mr. PICKERING. Thank you, Mr. Chairman.

You have drawn, I think, a very persuasive case—and one that I would not fundamentally disagree with in any respect—for increased international cooperation and activity in this area. I might note that you began by remarking on the opportunities that recent developments now present to us.

First the question of consultations that might well lead to greater understanding, and second, to cooperative endeavors in this area, in the sense that cooperation and complementarity in the ongoing systems is not only a useful and important objective in itself, but could be very valuable in avoiding mutual interference, redundancy, wastage of funds, and all the other benefits that I think are likely to arrive as a result of these sorts of cooperative endeavors.

We have, as you well know, underway in this administration an integrated remote sensing study, which we hope will be ready by this summer, which will address some of those problems and questions on the national plane. We are participating in this study. Concurrently with our participation in this study, we believe it would be useful—from our perspective in the Department of State—to take the sort of initiatives and to follow up with the sort of opportunities that you have so well laid out in your remarks to me in addressing this question, and we have begun the process of doing so.

It's too early to report to you any progress on this. I've had some of the same conversations that you've had, I'm sure, with foreign representatives who have indicated the same sort of acceptance—indeed, need—of the kind of cooperation that you have discussed here this morning.

And I'm hopeful that this activity can lead to more than just a show-and-tell exercise, as you pointed out, for our presentations and for our discussions in Vienna.

Indeed, in my statement I remarked that we had under very active study a number of possible steps that the United States could take beyond the question of really showing what we are now doing, which is not in itself, I think, to be minimized.

We have taken the leadership in this area for many years, and I am hopeful, from the perspective of my department, that we will continue to do so in a very active way. It's an important program; it contributes to very important goals in the developing countries in particular; and we are supportive of international cooperation in this area, in the best sense.

Senator STEVENSON. I know you are. I commend you for your recognition of the opportunities and your efforts to fulfill them.

Maybe you'll be in a position to help me in Vienna. I expect to be a part of that delegation. I'm trying to convince and persuade Senator Schmitt to go with me, and maybe we'll make a presentation to the Conference if you don't.

Mr. PICKERING. We'd be delighted to see you there, and I'm hopeful we can both make the same presentation.

Senator STEVENSON. So are we. The legal subcommittee of the United Nations Committee on the Peaceful Uses of Outer Space has included in a report a section on remote sensing, with an annex of principles indicating areas of agreement and disagreement.

Could we get these materials—the report, the annex, and the principles—for our records?

Mr. PICKERING. Yes, we have them here with us this morning and we'd be glad to make certain you have those.

Senator STEVENSON. Thank you.

[The information follows:]

UNITED NATIONS GENERAL ASSEMBLY, COMMITTEE ON THE PEACEFUL USES OF OUTER SPACE—REPORT OF THE LEGAL SUBCOMMITTEE ON THE WORK OF ITS EIGHTEENTH SESSION (MARCH 12–APRIL 6, 1979)

Adoption of the report

15. The Sub-Committee adopted the present report unanimously and concluded its work at its 319th meeting on 6 April.

I. LEGAL IMPLICATIONS OF REMOTE SENSING OF THE EARTH FROM SPACE, WITH THE AIM OF FORMULATING DRAFT PRINCIPLES

16. The Chairman made an introductory statement on agenda item 3 (Legal implications of remote sensing of the earth from space, with the aim of formulating draft principles) at the 303rd meeting of the Sub-Committee on 13 March 1979. He referred to the work of the Sub-Committee on this item at its seventeenth session.

17. The Chairman drew attention to the fact that the General Assembly at its thirty-third session, in resolution 33/16 dated 10 November 1978, had recommended that the Sub-Committee should at its present session continue, as a matter of priority, its detailed consideration of the legal implications of remote sensing of the earth from space, with the aim of formulating draft principles.

18. The Sub-Committee noted that all texts of draft principles formulated by the Sub-Committee's Working Group on remote sensing, as of 1978, were set out in an appendix to the report of the Chairman of the Working Group on remote sensing at the seventeenth session of the Sub-Committee.

19. The Sub-Committee noted further that the Scientific and Technical Sub-Committee, at its recently concluded sixteenth session, continued, in accordance with the recommendations of the Committee on the Peaceful Uses of Outer Space as approved by the General Assembly in resolution 33/16, to stress the importance of co-ordination of its work relating to remote sensing of the earth by satellites with the work of the Legal Sub-Committee. The Scientific and Technical Sub-Committee, accordingly, drew the attention of the Legal Sub-Committee to the views expressed in this connexion in annex I to its report (A/AC.105/238).

20. As noted in paragraph 7(b) above, the Sub-Committee, at its opening meeting on 12 March 1979, re-established its Working Group on remote sensing as Working Group III.

21. At the 312th meeting of the Sub-Committee on 28 March 1979 the following working papers were submitted to the Sub-Committee by the delegation of Romania:

a working paper proposing an alternative text for principle XII (A/AC.105/C.2/L.122, reproduced in annex IV to this report); and a working paper proposing an alternative text for principle XIII (A/AC.105/C.2/L.123, reproduced in annex IV to this report).

22. At the 317th meeting of the Sub-Committee on 4 April 1979, the Chairman of the Working Group reported to the Sub-Committee. The Sub-Committee took note, with appreciation, of the report and work of the Working Group. In accordance with the decision, taken by the Sub-Committee at the same meeting, the report of the Chairman of the Working Group is reproduced in annex I to the present report.

ANNEX I—REPORT OF THE CHAIRMAN OF WORKING GROUP III

1. The Sub-Committee, on 12 March 1979 at the first meeting of its present session, re-established its Working Group III on remote sensing.

2. The Working Group noted that the Legal Sub-Committee was required, under paragraph 4 (a) of General Assembly resolution 33/16 of 17 November 1978, to continue as a matter of priority its detailed consideration of the legal implications of remote sensing of the earth from space, with the aim of formulating draft principles.

3. The Working Group held its first meeting on 13 March and concluded its work on 3 April 1979, having held a total of eight meetings.

4. The Working Group had before it the report of the Legal Sub-Committee on its seventeenth session in 1978 (A/AC.105/218). The Working Group noted that all texts of draft principles formulated by the Sub-Committee's Working Group on remote sensing, as of 1978, were set out in an appendix to the report of the Chairman of the Working Group at the seventeenth session of the Sub-Committee (A/AC.105/218, annex III).

5. The Working Group also had before it the report of the Scientific and Technical Sub-Committee on its sixteenth session in 1979 (A/AC.105/238). The subject of remote sensing of the earth by satellites was an item on the agenda of the Scientific and Technical Sub-Committee. Chapter I and annex I are the relevant sections of the report of the Sub-Committee.

6. The Working Group continued consideration of the formulation of draft principles on remote sensing of the earth from outer space on the basis of the texts set out in the appendix to the report of the Chairman of the Working Group on remote sensing at the seventeenth session of the Legal Sub-Committee. Specific proposals and suggestions made by delegations with respect to particular principles in the course of the discussions of the Working Group at its present session were also discussed. Working papers submitted by delegations, in the course of the deliberations, on which consensus could not be reached and which were not subsequently withdrawn are reproduced in appendix B to this report.

7. *Principle I.*—The Working Group agreed that the square brackets around the words "primary" and "analysed" in the present text of the principle were to be removed. In the course of discussing other principles, some delegations considered that the definition of remote sensing should be confined to the space segment of remote sensing. It was decided to retain the existing foot-notes. The view was expressed, however, that the content, definition and necessity of the term "analysed information" is still to be clarified. It was agreed that an additional foot-note to that end should be inserted.

A working paper which was submitted by the delegation of the USSR proposed an alternative text for the definition of the term "remote sensing of the earth from outer space" (WG.III (1979)/WP.9). Because of lack of time there was no discussion of this text. The working paper is appended to this report.

8. *Principles II–VII.*—These principles were not discussed.

9. *Principle VIII.*—The delegation of Romania proposed that the scope of this principle be extended so as to apply also to data and/or information obtained by remote sensing *during* and *after* a natural disaster. In the course of the discussion on this proposal, the delegation of Iraq introduced an amendment to the existing text of this principle, which, in its view, would achieve the same effect as the amendment suggested by the delegation of Romania. There was no agreement on this amendment. A working paper (WG.III(1979)/WP.11) setting out the existing text of the principle with the amendment suggested by the delegation of Iraq is appended to this report.

No consensus was reached on the proposal by the delegation of Romania. It was decided to add the proposal of Romania as the second paragraph to the existing text of this principle and to put this new paragraph in square brackets. Some delegations were of the view that further clarifications as to the exact meaning of the term "during a natural disaster" were needed. The delegation of Argentina submitted a working paper (WG.III(1979)/WP.10) proposing that data and/or information ob-

tained by remote sensing of the earth indicating an impending natural disaster should be disseminated as promptly as possible to all States, priority being given to those likely to be affected. There was, however, no agreement on the proposal and it was decided to add in square brackets the words proposed by the delegation of Argentina to the existing text of this principle. The view was also expressed that the scope of this principle as a whole should be further studied and that the principle should apply only to data identified as relevant and in the possession of States. The Working Group agreed that for the purpose of this principle an exception should be made to any agreed international constraints on dissemination of remotely sensed data of the earth's natural resources and environment. At the end of the discussion on this principle there was agreement in the Working Group that although specific language could not be agreed upon, the retention of a principle on natural disasters was warranted because of its humanitarian nature.

At the invitation of the Working Group, the representative of UNDRO, Gen. Anderson, made a statement in connexion with the deliberations concerning this principle. The Chairman, speaking in the name of the Working Group, expressed his appreciation for the willingness of UNDRO to help the Working Group on remote sensing in its work.

10. *Principle IX.*—Agreement was reached to remove the square brackets around the words "in a manner compatible with" and to delete the words "not" and "to the detriment of". It was further agreed to retain the foot-note and to change the existing reference to principles I and II to a reference to principles II and III. The view was expressed, in this connexion, that this principle should be considered as a function of principle II (international co-operation) and principle III (international law). It was decided to insert an additional foot-note to that effect.

11. *Principle X.*—This principle was not discussed.

12. *Principle XI.*—This principle was discussed extensively in the light of the proposal of some delegations to omit a principle on international responsibility. In the view of these delegations, this principle was unnecessary if intended to cover no more than article VI of the Outer Space Treaty. Some of these delegations stated that under their legal systems they could not exercise State responsibility for ground segment activities. Other delegations did not consider it acceptable for there to be a reservation of non-responsibility by a given State with respect to its private operators. Other delegations wished this principle to be retained, possibly with changes in its present language. Attempts to reach a compromise by changing the text of this principle were not successful. Since no consensus could be reached, this principle was put in square brackets.

13. *Principle XII.*—The Working Group felt that this principle should also be seen in the light of principle XIV. The Working Group discussed a working paper submitted by the delegation of the USSR (WG.III(1979)/WP.3) with respect to principle XIV which, in the view of that delegation, should also include principle XII. (See also relevant parts of this report concerning principle XIV). Some delegations were of the view, however, that a principle expressing the right of sensed States to timely and non-discriminatory access to data obtained by remote sensing should be retained. The delegation of the USSR subsequently agreed that its proposal should only pertain to principle XIV and that the contents of principles XII and XIV could be contained in separate principles.

The Working Group also considered a working paper submitted by the delegation of Romania (WG.III(1979)/WP.6).¹ Some delegations supported the ideas contained in the proposal of Romania. In the course of the discussions on this working paper some delegations raised the question as to the necessity of having a reference to the principle of permanent sovereignty of States over their wealth and natural resources in the text of this principle. Those delegations stated in this connexion that the principle of permanent sovereignty does not relate in any way to remote sensing activities. Other delegations stated that this principle was closely related to remote sensing activities and therefore should be retained in the text. Other delegations, speaking on the working paper by Romania, felt that the concept of timely and non-discriminatory access to data should also be reflected.

Since there was no consensus on the proposal, it was decided to defer further discussion of this principle and to append the working paper by Romania to this report.

14. *Principle XIII.*—The Working Group also had before it, in connexion with its consideration of this principle, a working paper submitted by the delegation of Romania (WG.III(1979)/WP.8).¹ Since no consensus was reached on this proposal, it

¹ The delegation of Romania later submitted this proposal to the Sub-Committee as document A/AC.105/C.2/L.123.

was decided to retain this principle in its present form in square brackets and to append the working paper by Romania to this report.

15. *Principle XIV.*—There was an extensive discussion of this principle. Informal consultations were also held with a view to achieving a compromise. The Working Group considered working papers submitted by the delegations of the USSR and the United States (WG.III(1979)/WP.3 and WG.III(1979)/WP.7, respectively). Written proposals were also exchanged in the course of the informal consultations. It was, however, not possible to reach agreement on a specific text. Some delegations referred to the importance of prior notification of remote sensing programmes, while other delegations held the view that notification should only be effected once sensing data had actually been received by the sensing State. Delegations holding the latter view said that it was not practical to give advance notification since the actual results of the remote sensing activities depend on various factors, the effects of which could not be predicted. Those delegations who referred to the importance of prior notification stated that those States that were to be sensed should have prior knowledge of this intention in order to maximize the possibilities of co-operation between sensed and sensing States and access to data. In this connexion, the question was raised if the term "remote sensing programmes" was appropriate.

As attempts to reach a compromise were not successful, it was decided to study this question further and to retain this principle in its present form, in square brackets, the aforementioned working papers of the USSR and the United States (WG.III(1979)/WP.3 and WG.III(1979)/WP.7) being appended to this report.

16. *Principle XV.*—This principle was not discussed.

17. *Principle XVI.*—The Working Group had for its consideration a working paper presented by the delegation of the USSR (WG.III(1979)/WP.1/Rev.1). There was an extensive discussion. Some delegations pointed out that it was necessary—for economic, political and security reasons—to set aside for a different approach all sensitive data. Any data belonging in this category should only be disseminated to third States with the consent of the sensed State. In the view of these delegations, the criterion for establishing data as sensitive data should be the spatial resolution as outlined in the working paper of the USSR. These delegations believed that such a criterion would be the most objective, convenient and simple one to follow. Other delegations, while supporting the idea of limiting the dissemination of certain types of data, expressed the opinion that the question of the criterion to be used for that purpose should be further studied. Some other delegations held the view that the placing of mandatory international constraints on remote sensing data dissemination would result in administrative, financial and technical burdens detrimental to programmes designed for remote sensing of the earth's natural resources and environment. Some delegations pointed out that such data would still be available to States conducting remote sensing. Some of those delegations which did not favour the proposal of the delegation of the USSR also pointed out that spatial resolution was not a reliable or standard reference. The view was also expressed that legal difficulties could arise with regard to a declaration limiting the dissemination of certain data in the light of classical international law. Reference was made in this connexion to paragraphs 3, 8 and 9 of section A of annex I to the report of the Scientific and Technical Sub-Committee on its sixteenth session (A/AC.105/238).

Since no consensus could be reached in the course of the discussion, the principle was retained in its present form in square brackets. The aforementioned working paper by the USSR is appended to this report.

18. *Principle XVII.*—In discussing this principle, the view was expressed that the present formulation of this principle does not clearly define the scope of application of the dispute settlement procedure provided for in this principle. With a view to reaching consensus, a working paper was introduced by the delegation of Austria (WG.III(1979)/WP.4). There was, however, no agreement, the view being expressed that consultations should not have priority over other forms of established procedures for the peaceful settlement of disputes. It was decided to retain this principle in its present form in square brackets, to incorporate, in square brackets, the alternative formulations contained in the Austrian working paper, and to place a foot-note stating that this principle should be reviewed in the light of the full set of principles.

19. The Working Group decided to follow the suggestions of some delegations to rearrange the sequence of the principles in such a way that principles XII, XIV and XV would follow immediately after each other. Present principle XIII would be placed immediately after present principle XVI and would be renumbered accordingly.

20. The Working Group held its final meeting on 3 April 1979 when it considered and adopted the report to be made by its Chairman to the Sub-Committee. The texts

of the principles as agreed upon by the Working Group are reproduced in appendix A to this report.

APPENDIX A—TEXTS OF DRAFT PRINCIPLES AS CONTAINED IN THE REPORT OF THE LEGAL SUBCOMMITTEE ON THE WORK OF ITS SEVENTEENTH SESSION (A/AC.105/218, ANNEX III, APPENDIX), WITH CHANGES MADE AT THE PRESENT SESSION

PRINCIPLE I¹

For the purpose of these principles with respect to remote sensing of the natural resources of the earth and its environment:²

(a) The term "remote sensing of the earth" means "remote sensing of the natural resources of the earth and its environment."³

(b) The term "primary data" means those primary data which are acquired by satellite-borne remote sensors and transmitted from a satellite either by telemetry in the form of electromagnetic signals or physically in any form such as photographic film or magnetic tape, as well as preprocessed products derived from those data which may be used for later analysis.

(c) The term "analysed information"⁴ means the end-product resulting from the analytical process performed on the primary data as defined in paragraph (b) above combined with data and/or knowledge obtained from sources other than satellite-borne remote sensors.

PRINCIPLE II

Remote sensing of the earth from outer space and international co-operation in that field [shall] [should] be carried out for the benefit and in the interests of all countries, irrespective of their degree of economic or scientific development, and taking into consideration, in international co-operation, the particular needs of the developing countries.

PRINCIPLE III

Remote sensing of the earth from outer space [shall] [should] be conducted in accordance with international law, including the Charter of the United Nations and the Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and other Celestial Bodies.

PRINCIPLE IV

1. States carrying out programmes for remote sensing of the earth from outer space [should] [shall] promote international co-operation in these programmes. To this end, sensing States [should] [shall] make available to other States opportunities for participation in these programmes. Such participation should be based in each case on equitable and mutually acceptable terms due regard being paid to elements * * *
2. In order to maximize the availability of benefits from such remote sensing data, States are encouraged to consider agreements for the establishment of shared regional facilities.

PRINCIPLE V

Remote sensing of the earth from outer space [should] [shall] promote the protection of the natural environment of the earth. To this end States participating in remote sensing [should] [shall] identify and make available information useful for the prevention of phenomena detrimental to the natural environment of the earth.

PRINCIPLE VI

States participating in remote sensing of the earth from outer space [should] [shall] make available technical assistance to other interested States on mutually agreed terms.

¹ The question of the application of these principles to international intergovernmental organizations will be considered later.

² The formulation "with respect to remote sensing of the natural resources of the earth and its environment" will be reviewed in light of the title to be given to the principles.

³ This term is still subject to further discussion. In the view of some delegations, it would be necessary in the future work to further define the meaning of the words "remote sensing of the earth and its environment".

⁴ The content, definition and necessity of the term "analysed information" is still to be clarified.

PRINCIPLE VII

1. The United Nations and the relevant agencies within the United Nations system should promote international co-operation, including technical assistance, and play a role of co-ordination in the area of remote sensing of the earth.

2. States conducting activities in the field of remote sensing of the earth [shall] [should] notify the Secretary-General thereof, in compliance with article XI of the Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and other Celestial Bodies.

PRINCIPLE VIII

Data and/or information obtained by remote sensing of the earth indicating an impending natural disaster shall be disseminated as promptly as possible to those States likely to be affected [all States, priority being given to those likely to be affected].

[This provision shall also apply to data and/or information obtained by remote sensing during and after natural disasters, in order to help affected States combat such disasters.]

PRINCIPLE IX⁵

Taking into account the principles II and III above, remote sensing data or information derived therefrom [shall] [should] be used by States in a manner compatible with the legitimate rights and interests of other States.^{6 7}

PRINCIPLE X

States participating in remote sensing of the earth either directly or through relevant international organization [shall] [should] be prepared to make available to the United Nations and other interested States, particularly the developing countries, upon their request, any relevant technical information involving possible operational systems which they are free to disclose.

PRINCIPLE XI

[States [shall] [should] bear international responsibility for [national] activities of remote sensing of the earth [irrespective of whether] [where] such activities are carried out by governmental [or non-governmental] entities, and [shall] [should] [guarantee that such activities will] comply with the provisions of these principles.]

PRINCIPLE XII

A sensed State [shall] [should] have timely and non-discriminatory access to data obtained by remote sensing of the earth from outer space, pertaining to its territory on reasonable terms [to be mutually agreed upon with the sensing State] and to the extent feasible and practicable, [shall] [should] be provided with such data on such terms [on a continuous and priority basis] [and in any case no later than any third State].⁸

PRINCIPLE XIII

[[A State which intends to conduct remote sensing of the earth from outer space shall give advance notification to the States whose territory will be sensed.] [A State [intending to conduct] [conducting] remote sensing activities of the earth from outer space shall notify the Secretary-General of the United Nations and [upon request] the States whose territory is intended to be covered by such activities [to the fullest extent feasible and as soon as practicable] of the intended launch, [nature of the] mission, duration and coverage of such activities. The Secretary-General shall publish information thus received.]]

PRINCIPLE XIV

[A State carrying out remote sensing of the earth [shall] [should] without delay consult with a State whose territory is sensed upon request of the latter in regard to

⁵ Should be considered in connexion with the formulation of a principle on dissemination of data or information and subject to later discussion of the terms "information" and "data".

⁶ Some delegations were of the view that, for the sake of consistency it was necessary to consider this principle in the light of draft principles II and III.

⁷ A delegation reserved its position on removing the square brackets around the words "in a manner compatible with" and on the deletion of the words "not" and "to the detriment of".

⁸ Subject to review in the light of the discussion on access by third States.

such activity, [in particular dissemination of data and information,] in order to promote international co-operation, friendly relations among States and to enhance the mutual benefits to be derived from this activity.]

PRINCIPLE XV

[States carrying out remote sensing of the earth shall not, without the approval of the States whose territories are affected by these activities, disseminate or dispose of any data or information on the natural resources of these States to third States, international organizations, public or private entities.]

PRINCIPLE XVI

[Without prejudice to the principle of the freedom of exploration and use of outer space, as set forth in article I of the Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and other Celestial Bodies, remote sensing of the earth [should] [shall] be conducted with respect for the principle of full and permanent sovereignty of all States and peoples over their own wealth and natural resources [with due regard to the rights and interests of other States and their natural and juridical persons in accordance with international law] [as well as their inalienable right to dispose of their natural resources] [and of information concerning those resources].]

PRINCIPLE XVII

[Any dispute that may arise with respect to the application of [activities covered by] these principles [shall] [should] be resolved by prompt consultations among the parties to the dispute. Where a mutually acceptable solution cannot be found by such consultations it [shall] [should] be sought through other established procedures for the peaceful means of settlement of disputes mutually agreed upon by the parties concerned.]⁹

Senator STEVENSON. Could you tell us a little about the principles, the areas of disagreement, and what you perceive to be the problems that are developing at the United Nations?

Mr. PICKERING. Yes. I'd like to make a few brief remarks. Dr. Pikus has just returned from that meeting and if it's agreeable with you, I might turn to him for some amplification.

As you know, we've had discussions for a number of years. There are a great number of principles on which we have reached agreement, but others which remain under dispute. Some of these questions turn on some states' perceptions of their sovereign rights with respect to space, rights that at this point, as I said earlier, remain in dispute, they relate both to the question of whether there should be prior consent, not only for remote sensing activities themselves with regard to particular countries, but also with regard to the release of data.

And those views might well impinge on the future, if they continue to exist in the international community, on activities that we might undertake either as a Government, or that institutions or firms or companies might undertake in a private way.

That's in a very broad brush sense the nature of some of the difficulties that are experienced in the U.N. form.

But Dr. Pikus might want to amplify and fill in and supply specific detail to some of those questions.

Senator STEVENSON. Dr. Pikus?

Dr. PIKUS. Thank you, Mr. Chairman. Without going through an extensive catalog of all of the detailed questions that have arisen and the detailed differences of opinion, I would say that there are

⁹This principle should be reviewed in the light of the full set of agreed principles, and a decision on the legal nature of the principles.

several important problems that have been with us, actually, for a few years.

One concerns the question of sovereignty over information pertaining to natural resources. We find that many developing countries guard their natural resources quite jealously and are considerably concerned that advanced countries, and companies within advanced countries, might be able to exploit them to their disadvantage.

That has motivated a number of countries to assert sovereign control and sovereign claims over information and data concerning their natural resources that is in the hands of others.

This is a claim that, of course, we can't agree with and it is a claim put forth rather strongly by a number of developing countries.

Along somewhat different lines, the Soviet Union about 3 years ago proposed that data that is of high spatial resolution and therefore, potentially, in their view—

Senator SCHMITT. Could I interrupt before you get into that? Did we consider that issue of prior consent and sovereignty negotiable?

Dr. PIKUS. No. We do not consider the question of sovereignty negotiable. That is the question of the sovereignty over information in the hands of others.

The question of prior consent for dissemination of data, based on resolution criteria raises for us a number of difficulties and a number of questions that we haven't answered satisfactorily.

First of all, it presumes that there is inherent in fine quality data the possibility for application to the detriment of the state. That's never been demonstrated. Although, to be perfectly objective, one would have to acknowledge that that possibility exists.

But as I say, that detriment has never come forth. We've never seen an example of such detriment.

On the other side of the coin, we think that the benefits from such data would be far greater, in fact, than any detriments that we might imagine at this time. It's conceivable that there would be some detriments, but it has not occurred to this point.

Senator SCHMITT. Is that point negotiable?

Dr. PIKUS. The question of a cut-off or limitations on dissemination based on resolution?

I think we want to know more about that proposal before we decide whether it's something that we can live with or not. It's clear that there are certain data that we would like to see widely disseminated because the benefits from this data may be tremendous. Data, for example, having to do with natural disasters.

Senator SCHMITT. There's also the principle of the free flow of information involved here. If we allow a precedent to be set here, then we're undermining our position on conferences like WARC and the UNESCO conference, and so forth.

So I hope that there is not much negotiation latitude here.

Dr. PIKUS. Senator, I think we have to understand more about the process before we come to a conclusion as to whether this does, in fact, affect the free flow of information. It's clear that with respect to scientific data, we want to promote its free flow as widely as possible for a number of reasons.

With respect to data having some national security relevance, I think it's clear that we do not want to promote free flow of that data. So there's a question—you see, the Soviets have made the assertion that data of fine resolution will have not only economic relevance, but relevance to military security. If that happens to be the case, perhaps we should consider the possibility of controls over dissemination of that sort of data.

As I say, we are uncertain at this point, and we need more information to make up our minds.

Those are basically the main questions on remote sensing principles. There's a question as to the scope of applicability of the principles that we're negotiating. We, and I think most countries, agree that the scope of applicability is to civil systems and not to military systems. But that's never been made explicit.

I think that's all that I can add at this level of amplification. If you'd like to go into further detail, I'd be happy to do that.

Senator STEVENSON. Thank you. Senator Schmitt?

Senator SCHMITT. Thank you, Mr. Chairman.

Mr. Pickering, I have had the unique opportunity on behalf of the White House in 1973, and the State Department, to travel around the equatorial regions of the world visiting 11 countries of the developing world.

I had a chance to view first-hand down the tunnels of poverty and disease and ignorance and hunger during that trip, but also had a very stimulating experience in that in every country, the group of Apollo 17 astronauts that I was with were recognized as ambassadors of mankind.

That was said explicitly or implicitly in every country one way or another.

But also recognized as ambassadors of the one area that they fully respected us for as Americans, and that's high technology. And they believed then, and I think still believe, that through technology, they can enter the 20th and 21st centuries much more rapidly than we entered it technologically.

When I came back, I began to try to discuss some of the ideas, some of which the Chairman has articulated here this morning also, of how can we take advantage of this reservoir of goodwill that we, the United States, take advantage of this reservoir of goodwill for our own international purposes, well meaning, as well as for the benefit of mankind.

I got so far as to discuss this with individuals in the middle levels of the State Department, at AID and higher, Don White of NOAA, John McDonald, then with the State Department U.N. desk. And I worked quite hard to try to get some kind of proposal. As the Chairman has indicated, it might be nice to offer this year, to offer it at the Nairobi conference of the UNET.

We got nowhere. We hit a stone wall. Everybody said great idea, but it won't work.

The bureaucratic inertia was unbelievable, and it's still there, and that's still what we're seeing.

And not only that. I have to grit my teeth every time I read statements like on page 5 of your testimony, including how best to take into consideration the interests and needs of the international community.

Mr. Pickering, it's the interests and needs of the United States that are at stake, as well as the interests and needs of mankind.

And one reason we need a policy in this area, and it is one of the few areas in which I believe we can develop an international community cooperation, and I believe that the developing countries are more than willing to work with us in this area. They have been. We've proved it to them by going to the Moon. They believe it. But we have done almost nothing to tap this reservoir of goodwill.

Senator Inouye said yesterday that what we need at the State Department is an American desk.

Senator SCHMITT. And I think there's no area that shows that more than the lack of perception, or at least the apparent lack of perception of why it is in the interests of the United States to develop operational remote sensing technologies that can interface with the international community.

We can't afford to continue to allow the increased polarization between ourselves and the developing world, and it doesn't have to polarize.

At the same time we can afford that, I don't think that we can afford to go back on our basic principles—open skies, free flow of information, and so forth.

There are areas we'll have to discuss and, indeed, are willing to discuss. But I see no way that we can give up what we think are the basic, fundamental principles by which mankind can operate best as a society, and that's the free flow of information and other related topics.

Now with all of that out of my system, I would like to ask you to tell me why you would feel that a Comsat-like organization could not operate the gathering and distribution of remote sensing information for this country, and still cooperate with the international community as Comsat does through Intelsat.

Mr. PICKERING. Thank you. I think the answer to that is that from a foreign affairs perspective, I don't see at this point major problems in the operation of something like Comsat in this particular area. Against, however, the backdrop of the inability of the U.N. Outer Space Committee and the legal subcommittee of that committee to agree on a number of principles, we would have the problem of the disagreement over the operation of the organization, whatever it might be—whether it's Government or private—in connection with the disagreement on those principles. The major issue, as I see it, is not whether it's public or private from the foreign affairs perspective; only that we be able to operate in accordance with some agreed set of international principles negotiated out with, I hope, our best interests as well as those of the international community in mind.

I think the two in this area are very much coterminous.

I'd like to add one other point.

I was in an equatorial country at the time we landed on the Moon and I sensed and felt that, indeed, it was the greatest outpouring of interest in and sympathy for and respect of the United States that I saw in my total of 4 years in that particular country.

And I'm strongly committed to the view that we have to move in directions which take advantage of that interest. I don't believe the

interest is dead, by any means. It continues. And in some sense, my new responsibilities in the State Department for science and technology and for a number of allied questions, put me in that American desk which you talked about.

From that perspective, there is a great deal that we can do.

I don't minimize the questions of bureaucratic inertia. They exist in our Government. Nevertheless, I feel that there are areas here where we can make progress. I'm delighted to see that you took leadership in that area years ago and share that set of views.

Senator SCHMITT. I appreciate those comments and encourage you to make your endeavors. But I still have a feeling that had we gotten into these kind of discussions when the Congress was considering Comsat legislation, we probably never would have done it. And it is not in the best interests of the developing world to continue to delay the development of a world-wide Earth resources information system.

But I'm afraid that if we continue to negotiate within the U.N., we'll never have it. We're going to end up in the same position that we are with the law of the sea. If we keep working the law of the sea the way we're working it, they're never going to tap those resources.

And the exciting thing from a modern perspective of Intelsat is that it is another way to do it. It's a user-based operational organization that can get things done, to take advantage of new technologies to the benefit of all the member countries, and there are plenty of member countries.

Now I don't understand why a comparable organization cannot be set up with respect to Earth resources information gathering and distribution.

I would like to have you go into a little more detail of what are the show stoppers, other than the U.N. discussions?

Are there any technical or basic legalistic show stoppers in setting up an Earth satellite corporation?

Mr. PICKERING. Let me say that from the foreign affairs perspective, as I said before, I see little difference in the problems of whether one goes private or public in this area.

We have dealt with and existed alongside Comsat for a number of years. Your legislation in S. 875 is very close to theirs with respect to the treatment of international negotiations, as we've studied it. I do see the need, however, and this has been articulated by other administration witnesses who are much more competent in this area to speak to the problems than I am, to move ahead now. There is the question of, for example, our ongoing study on how the private sector fits into this process.

In fact, we hope to have that study finished by the summer. We participate in that study, but to a limited extent, in the sense that I don't see major problems developing from a foreign affairs perspective from which I can speak best.

Nevertheless, I believe that we ought to await the results of that study before we give you a comprehensive view on what the executive branch thinks about this problem.

Senator SCHMITT. That's not what I'm asking you. I'm only asking you on the basis of the State Department experience with Comsat and Intelsat, are there any show stoppers to a comparable

international organization with the U.S. operating entity being an investor-owned corporation?

Are there any problems with that?

Mr. PICKERING. Absent the disagreements in the U.N. about the questions of access to data, which I said would apply to both kinds of organizations, I've tried to answer your question by saying I do not. But from a foreign affairs perspective, let me add, not adding the other perspectives you're talking about.

Senator SCHMITT. I understand and I'm not trying to put you on the spot with respect to those other things. I'm just trying to get to the details of this.

Would you comment on the question of national satellites, that is, of say, remote sensing satellites that collect both defense-related and civil sector-related data? Do you think that that can be done without serious degradation of efficiency or serious international problems of reception as well as operation?

Mr. PICKERING. Let me say that in terms of the international problems, the key factors will be free access to open data on a real time basis. And the issue here, I believe, from what I have seen, is not insuperable in discussing that question in regard to international satellites. I believe that those two objectives can be achieved, that is, the real time application of remote sensing data for the civil sector from a national satellite.

As you know—and I think this has been remarked on earlier—there is also a study on integrated remote sensing going forward within the administration, which is designed to answer that question. Our role in it is to make certain, to the extent that we can, that those particular principles, which we believe are very important in our international relations, the ones that I articulated a minute ago, are preserved in that study.

Senator SCHMITT. Has the State Department examined the potential international market for Earth resources information on a commercial basis or on a reimbursable basis to the United States?

Mr. PICKERING. We have not. There have been some initial looks at this, and the spokesmen from the private sector have made known their points of view. Our general impression is that about one-third of the data now collected is for foreign use and a much larger proportion, which covers overseas geography, is shared for both foreign and domestic use.

U.S. firms have told us in our initial looks at this that they recommend continuation of the open data policy, nondiscriminatory access, continuation of the arrangements for foreign ground stations for direct data reception, under terms that they would pay for the real economic price for access to U.S. satellites, and in order to prevent foreign data disseminators from undercutting U.S. data prices. That's the view of a number of spokesmen we have talked to from the U.S. industry side on that question.

We have not gone beyond that at this point in looking extensively at what the foreign market possibilities are.

Senator SCHMITT. Isn't this part of the study this summer? Is that a necessary part?

Mr. PICKERING. It's a necessary part of this study.

Senator SCHMITT. So you are undertaking those kinds of market surveys.

Mr. PICKERING. That will have to be looked at in order to reach an end to that study.

Senator SCHMITT. Finally, Edward Teller, in another context, before this committee advocated a completely open skies policy for civil as well as defense-related remote sensed data.

Would you care to comment on that proposal, the advantages and disadvantages of it?

Mr. PICKERING. I will only say that I think Dr. Pikus in his discussions of the U.N. context pointed out the question of the sensitivities and the preservation of national security information on the one hand, particularly in the interests of many states and the necessity to have an open dissemination of remote sensing data that contributes to the civil welfare and the domestic development of a large number of countries on the other.

I don't think there is an easy answer to this particular problem, and many countries remain deeply concerned, as I'm sure our country does. And I share the view that our national security interests are extremely important in this area and ought to be preserved.

Senator SCHMITT. Yes, but what if we took it upon ourselves to tell the world we are going to have an open skies policy; all the information is going to be available to everybody. What would be the effect of that.

Mr. PICKERING. I think you would find that a program which you and I have felt in many parts of the world was of tremendous importance would come under increasing attack. The chairman remarked on this point at an early stage in his discussions with me here this morning. And I think it's clear that I would be safe in saying we would predict an adverse reaction from a number of quarters, perhaps not from all. And I haven't sat down and cataloged this. So I'm speaking from my knowledge of what positions other states have taken and some intuition on the subject, not from a fully staffed-out studied proposition.

Senator SCHMITT. Well, what would be the adverse reaction? Would they stop using data because we made it available?

Mr. PICKERING. I think the adverse reactions would be in things like U.N. forums, in public, in private pressures, that kind of thing.

Senator SCHMITT. Those are adverse anyway.

Mr. PICKERING. They're adverse anyway in some circumstances, but not always so.

Senator SCHMITT. Thank you, Mr. Chairman.

Senator STEVENSON. In conclusion, I want to commend you and suggest, in response to what Senator Schmitt said about the Department's study, that it really isn't the fault of the Department of State. I think all the departments, and agencies and the Office of Science and Technology see the opportunities and the problems, and they want to get moving.

The Carter administration wants to get on with remote sensing, except for one part of it—Carter.

The problem is not with the Department of State. It's within—it's not within the bureaucracy; it's the technocracy.

Thank you, Mr. Pickering, and thank you, Dr. Pikus.

[The statement follows:]

STATEMENT OF THOMAS R. PICKERING, ASSISTANT SECRETARY OF STATE, BUREAU OF OCEANS AND INTERNATIONAL ENVIRONMENTAL AND SCIENTIFIC AFFAIRS, U.S. DEPARTMENT OF STATE

Mr. Chairman and Members of the Subcommittee, the State Department is in agreement with the broad objectives of the proposed bill, S. 663, on remote sensing. The President has committed the Administration to the continuation of remote sensing data for civil applications through the 1980's for both domestic and foreign use. This we believe will provide needed assurance to the foreign users of U.S. remote sensing data. Moreover, the Administration is committed to the goal of an operational system. However, I share the Administration's view that it is premature to consider legislation at this time.

Remote sensing, both as a development tool and as a basis for international cooperative agreements, has assumed increasing importance in our relations with many countries, particularly developing countries, in recent years. Yet an underlying concern on the part of those cooperating with us now or interested in cooperating in the future is the lack of formal assurance that the United States will continue to make available data for cooperative programs in remote sensing. The President's statement gives that assurance and the commitment to an operational remote sensing system addresses this important concern.

Specifically, an operational system would place access to remote sensing data on a permanent, guaranteed basis—in effect, providing to users assurance of continuity in the flow of data. From the perspective of the international community, it would replace the existing experimental system with the greater reliability of a permanent system as the context for negotiation of bilateral and multilateral agreements on remote sensing. It would thus provide developing countries the assurance they need to commit their scarce resources to ground stations, training programs, and more extensive application of remote sensing data to their development problems.

Further, it would provide the basis for a long-term system of cost recovery. I note that NASA has taken some useful steps in this direction by requiring that cooperating countries establish Landsat ground stations at their own expense and pay a nominal \$200,000 access fee per ground station per year. There is need, however, for a more systematic and predictable approach over time as part of a permanent operational system.

To illustrate the importance of remote sensing to developing countries, I would like to cite some examples of beneficial applications derived from data made available through our international cooperative programs.

Bolivia has made extensive use of Landsat data for geologic mapping, pipeline routing and to assist in the discovery and mining of high concentrations of the energy-related metal lithium.

Brazil uses Landsat for a wide variety of applications including map making, crop surveys and land-use/land capability studies.

Egypt has used Landsat data in iron ore prospecting and for preparing surface water and drainage maps.

India is conducting land-use capability and ground water studies using Landsat data.

Thailand is mapping and assessing its forest resources and conducting rural land-use studies using Landsat data as one input.

Upper Volta, in cooperation with the World Bank, has used Landsat data to help identify new areas for agricultural and village settlements.

In view of the importance—as demonstrated in these few examples—of remote sensing data to developing countries, we plan to include remote sensing as a major element in the U.S. presentation to the U.N. Conference on Science and Technology for Development in Vienna. We intend to highlight this initiative through exhibits, film showings and possibly conference proposals for improved international use of remote sensing technology.

For these reasons, the State Department not only shares the Administration's commitment to an operational remote sensing system, but has a strong interest in the development of such a system, which would:

(a) Improve the context for negotiation of international agreements on remote sensing, and

(b) Build on the base of existing international agreements in this area.

As I stated earlier, it would be premature at this time—while various space policy studies are underway to examine options for an integrated national system and to explore the appropriate role for private sector involvement in the future of remote sensing—to comment on specific legislation. In my view, we should not comment until we are in position to define the technical and institutional arrangements for an operational remote sensing system including how best to take into consideration the interests and needs of the international community. In the various studies now

underway we will continue to contribute our views on the international aspects of remote sensing and, as these emerge, on the institutional arrangements for an operational system. We look forward to working with you on these issues once the space policy studies have been completed.

Senator STEVENSON. Our next witnesses are: Dr. John McLucas, executive vice president of Comsat; Daniel J. Fink, vice president and group executive of General Electric at its Valley Forge Space Center; Mr. W. A. Stevenson, president of Lockheed Electronics Co.; Dr. Robert K. Vincent, president of Geospectra Corp.; and Dr. Fred Henderson, president of the Geosat Committee.

Let me ask all of you, as I have the other witnesses, to summarize your statements, and the full text will be entered into the record. We'll proceed with all of the statements, and then we'll turn to the full panel with questions. May we begin with you, Dr. McLucas.

STATEMENTS OF DR. JOHN McLUCAS, EXECUTIVE VICE PRESIDENT, COMSAT CORP.; DANIEL J. FINK, VICE PRESIDENT AND GROUP EXECUTIVE, GENERAL ELECTRIC CORP., VALLEY FORGE SPACE CENTER; W. A. STEVENSON, PRESIDENT, LOCKHEED ELECTRONICS CO., INC.; DR. ROBERT K. VINCENT, PRESIDENT, GEOSPECTRA CORP.; AND DR. FRED HENDERSON, PRESIDENT, GEOSAT COMMITTEE, INC.

Dr. McLucas. Thank you, Mr. Chairman. We appreciate the invitation to be here.

I will summarize my statement briefly.

We've heard a lot about the benefits of remote sensing. We believe that those benefits will be achieved best by an operational system, so the potential users can rely on the availability of the data which they need, and service suppliers will have an incentive to improve services and data and will come up with new applications.

We've heard statements from the administration that they are committed to an operational system. It seems to me that the strongest commitment that could be made would be to put an operational system in place. After all, we know that one administration cannot commit a succeeding administration.

We've also heard about the initiatives in Western Europe and Japan to bring remote sensing into being. While it's unrealistic for us to assume that we can maintain a U.S. monopoly on Earth sensing, I think we should at least aspire to maintain a leadership role.

My comments will be directed mainly toward how I think we should establish an operational system. Incidentally, we have also supplied our comments in response to questions from NASA and other agencies of the administration who are working on the studies which you have already heard about.

The reasons why we think the private sector should get an early role are borne out in your S. 663, one of those being that the market is not fully aggregated and developed, and we believe that the private sector, with its commercial incentives, is the best agent to bring about this market aggregation and development.

We believe that private ownership and operation provide a number of benefits to the Government. For one, it would avoid financial outlays that would otherwise have to be appropriated by

the Government. Also, it puts the risk of failure on private shoulders, because the Government would pay only for services actually received, and the Government would pay less because a larger market would be sharing the costs. And finally, I would say that private industry would be paying taxes on earnings, and that is a benefit to the Government.

We're all familiar with the policy which has been propounded by OMB many times in Circular A76, to the effect that it is the Government's policy to procure from the private sector all services, and hardware, which the private sector can supply. We think this reinforces further the large role that the private sector ought to play.

The Government had the choice back in 1962 of having communications satellite services provided by the Federal Government, and it chose to go to the private sector through the Satellite Act. We think that that was a good decision.

Similarly, last year the Navy, with some urging from the Congress, decided to procure their communications satellite services by lease from private industry, as opposed to buying their own satellites. We think that that Leasesat program which resulted was also a demonstration of the Government's attempt to live up to the provisions of OMB circular A76.

There are a number of differences, as you know, between the effects of S. 663 and S. 875. It seems to us that S. 663, while it appears to favor a large private role, may not turn out to do so in actual practice.

Under S. 663 NASA owns and operates the system. The fact that NASA is directed to establish it under S. 663, and to cover the costs means, as I see it, that there is no mechanism for achieving a fair rate of return. Therefore, there would be an abrupt transition from a system which was meant to derive only a return of costs to a privately owned system and yet there would be no history of pricing to earn a fair rate of return.

Furthermore, although there is a provision for private inputs, we're not sure how loud the private voice would be at various stages in the operation of such a system under NASA. S. 663 also says that nothing will preclude the takeover or turnover to private enterprise after the 7 years. While there's nothing that would preclude or prevent turnover, it seems to me that the mere existence of such a system for 7 years might make a turnover infeasible, because many decisions would have been taken, many options would have been foreclosed, and those decisions would not have been made on a commercial basis.

Another thing about S. 663 which caught my eye is that it implies that NASA might provide services that are now supplied by the private sector. For example, it talks about platforms other than satellite platforms, which I presume includes aircraft. You can get aerial photography through the private sector now.

S. 875 calls for the creation of a new corporation and establishes an early private role. But it seems to me there are a number of questions in connection with it which require further addressing. We're not sure who could participate, for example; what types of companies would be allowed to own stock in such a company. We've had some experience with the Department of Justice on

things that they consider anticompetitive. Many of the potential suppliers of satellites might want to be in this business. Would that be permitted or not? It's not clear.

So I would like to suggest an alternative, which appears in my prepared statement, whereby we could have the best of both bills. We'd have a continued role for NASA and we'd also designate a private entity.

We think that Comsat is a logical candidate for such a designation. We do not envision the quick transfer of responsibility from NASA to Comsat. Rather, we would envision an interim period where NASA would continue to operate the Landsat D system, Comsat would concern itself with coming up with more capable systems that would parallel Landsat D, and also prepare for the transition of Landsat D and follow-on systems to private ownership. We believe that such an approach would achieve most of your objectives.

Comsat is, after all, a quasi-public corporation. It is not a manufacturer of satellites. It does have frequent and extensive Government oversight. It is involved in international operations and it has a very large stockholder base.

One question we might ask ourselves: Suppose Congress were amenable to acceptance of the suggestion; could we carry out as a private company the mission that is described herein? Well, I think we'd have to say there are a number of additional provisions that would have to go along with this.

For one thing, the Government would have to commit itself to buy its needs from such a system and not do them by a parallel program. The Government would have to agree not to compete, and the Government would have to agree to buy from us a minimum amount, so many dollars per year, for example, so we'd have some assurance of that type of revenue.

At the same time, we would not expect that the Government would guarantee a free ride to whichever company, Comsat or otherwise, might be the operating entity. We would expect that a certain amount of income would be assured, from sales to the Government but not enough to operate the system fully. Therefore, this private entity would have to go out and scrounge up enough business elsewhere to meet its total operating costs and earn a return on investment.

We would expect that the provisions already in S. 663 with respect to data rights would have to be fully implemented. And, as was addressed by Dr. Pickering, there are questions before the U.N. Committee on the Peaceful Uses of Outer Space which need to be resolved, having to do with the marketing of data which was derived in other countries.

Finally, I believe that maintaining U.S. leadership is a very critical factor, and I believe that the establishment of an early operational system and creating a mechanism whereby the private sector can play a large role is the best way to maintain that U.S. leadership.

Thank you, Mr. Chairman.

[The statement follows:]

STATEMENT OF DR. JOHN L. McLUCAS, EXECUTIVE VICE PRESIDENT, INTERNATIONAL COMMUNICATIONS AND TECHNICAL SERVICES, COMMUNICATIONS SATELLITE CORPORATION (COMSAT)

Mr. Chairman and members of the Subcommittee, I appreciate this opportunity to testify on the important subject of the establishment of an operational remote sensing satellite service. Satellite remote sensing has been demonstrated to have many useful applications, and the data which can be acquired through a remote sensing satellite system can contribute to the well-being of the United States and of all mankind. The Committee's efforts to consider the need for an operational system and how such a system should be established will contribute greatly to the achievement of important national objectives in the area of space technology and its utilization.

ADVANTAGES OF AN OPERATIONAL SYSTEM

The benefits to be achieved through satellite remote sensing are many. But the full achievement of those benefits will not be reached until an operational system is put into place. With an operational system in place, potential users will know they can rely on the continued availability of data, which will act as an incentive to users to fully exploit the data. Also, data and service suppliers will have additional incentives to improve data products and services and to develop new and useful applications of the data. A commitment to an operational system, therefore, will greatly expand the application of remote sensing satellite data to the solution of a myriad of problems of substantial importance to the United States and the international community.

A further factor affecting the need for an operational system in the United States is the likelihood of initiatives in Western Europe and Japan in the area of remote sensing satellites. The European Space Agency (ESA) is establishing an Earthnet System for the reception, distribution, analysis, and sale of remote sensing data obtained from United States remote sensing satellite systems. Also, the French national space center is planning to launch a remote sensing satellite, SPOT, and has made a proposal to the Geosat Committee, whose members are mostly U.S. corporations interested in natural resource exploration, to modify the SPOT satellite to meet the stereoscopic data requirements of the Geosat Committee members. Furthermore, ESA has recently announced that it is planning to establish additional remote sensing satellite systems to meet the needs of "Europe and the developing countries." The net effect of these initiatives could be a reduction of U.S. technological leadership in space and the U.S. commercial position in the provisions of space services.

While there appears to be widespread agreement on the need for an operational system, the manner in which such a system should be established remains an open question. Therefore, our remaining comments herein are devoted primarily to the essential but unresolved issue of how to establish an operational remote sensing satellite system in the United States. In this connection, we have provided extensive comments to NASA in response to its inquiry resulting from the President's directive to study means by which to encourage private investments and direct participation in civil remote sensing satellite systems. Copies of these comments have been provided to Committee staff members.

REASONS FAVORING AN EARLY PRIVATE SECTOR OPERATIONAL ROLE

Mr. Chairman, there appears to be general recognition that the primary obstacle to establishing an operational system at this time is the lack of a sufficiently aggregated and developed market, governmental and private, for remote sensing satellite data. This lack is recognized in the introduction to S. 663, wherein it is stated that market development "must be the driving force in determining the characteristics of a permanent operational system." If market development is to be the driving force in the development of an operational system, we submit that responsibility for the operational system should be placed in the private sector. The challenge of developing the market would best be met by the private sector operating in response to commercial incentives and using its extensive marketing experience. Therefore, we believe it is essential that responsibility for an operational remote sensing satellite system be placed in the private sector if the full benefits of such a system are to be achieved.

In addition, private ownership and management of an operational system would, we believe, offer substantial direct benefits to the Government. First, the Government and the taxpayer would not be burdened with requirements for substantial capital outlays to establish and operate a system. Second, the financial risk of system failure would be borne by the private entity establishing the system and supplying the information products and services. The Government, as well as other

users, would pay only for information products and services actually received. Third, the cost of products and services to the Government and taxpayer would be less since a private entity would better be able to do the marketing to develop other users to share the costs of the system and to achieve the economies inherent in a multiuser system. Finally, the Government would derive financial benefits from such a private venture through payment of substantial taxes on corporation income.

A further reason supporting a private sector management and operational role is the long-standing national policy favoring procurement by the Government of goods and services from the private sector. If the Government has requirements for remote sensing satellite data and services, it should meet those requirements from the private sector, wherever possible, in accordance with those long-standing procurement policies. In the area of communications satellite services, for example, it was decided that a Government satellite system to satisfy Government requirements for international satellite communications services should not be established, even though it was expected that the Government would be a major user of such a system. Also, recently the Congress followed the long-standing Government procurement policies and directed the Department of the Navy to procure maritime communications satellite services from the private sector rather than proceeding with the proposed construction of a new governmental system to meet the Navy requirements. We believe these policies also should apply with respect to the establishment of an operational remote sensing satellite system.

THE PRIVATE SECTOR ROLE IN S. 663 AND S. 875

The two bills before the Committee, S. 663 and S. 875, differ substantially in the role contemplated for the private sector in the ownership and management of an operational system. S. 663 contains findings and policy statements to the effect that "innovative institutional arrangements [are required] that encourage initiative by, and participation of, the private sector" and that "the capabilities of the private sector shall be used, to the maximum extent practicable, to achieve the purpose of this Act and especially in the design and operation of the system." We agree with these findings and policy statements; however, we have serious doubts whether the operative sections of S. 663 conform to the above-stated findings and policies.

S. 663 would create a "Service" in NASA to establish an Earth Data and Information System. This System is to be developed and managed by the Administrator of NASA "to achieve the timely and continuing flow of reliable and useful data and basic information products to users at the earliest practical date." While the Administrator is authorized to plan, own, manage and operate the System either directly or in conjunction with private businesses and others, including foreign countries, other provisions of S. 663 raise substantial questions whether a joint undertaking with private business would, in fact, be feasible. For example, S. 663 would appear to require that user charges be set to cover the costs of the Service, which would render joint participation by private business infeasible. (Private business would have to establish user charges on the basis of recovering expenditures, cost of money, taxes, and profits.) Other provisions raise questions whether any joint participant other than the Administrator would have a meaningful voice in the management and operation of a jointly funded System. Consequently, we are unable to conclude that S. 663 will create "innovative institutional arrangements that encourage initiative by, and participation of, the private sector," other than as suppliers of hardware and certain services to NASA as the system owner and operator.

We also recognize that S. 663 provides that nothing therein is to be construed as precluding ownership and operation of the Service by private business at the end of a seven-year interim period following enactment of S. 663. Also, S. 663 provides that whenever the President deems it feasible during the interim period, he may recommend to the Congress that the functions of the Service be carried on by a private corporation. While those provisions would appear to retain the option of eventual private sector ownership and operation, we believe such option is more illusory than real. In view of the mandate in S. 663 requiring establishment of the System at the earliest practical date, we believe that consideration would be given to a transfer of ownership and responsibility to the private sector only after the System is established and in operation. By that time, many decisions would have been taken which may, in effect, preclude a transfer to the private sector.

Given the institutional and other arrangements envisioned by S. 663, it is not likely that the Service will make decisions on a commercial basis and the result is likely to be the establishment of an operational system which would not form an appropriate basis for an undertaking by a commercial entity. Further, the Service is authorized to enter into agreements with foreign countries relating to the functions and activities of the Service and, from the perspective of a private entity, it may be inappropriate, undesirable or impossible for such an entity to be substituted for the

Service. Finally, the scope of activities authorized to the Service, of which more will be said in the next paragraph, is so broad that it is unlikely that any decision would be taken to place responsibility for such services in a private corporation.

A further concern with S. 663 is that it would authorize NASA to provide certain services to the public in competition with private entities which currently are providing or are planning to provide such services. For example, the definition of "data" and "basic information products" might be interpreted to permit NASA to engage in remote sensing from aircraft and in the collection of data from remote data collection platforms using communications satellite systems. Additionally, these definitions might permit NASA to engage in extensive analytical services which currently are being provided by private entities or are in the planning stages. It would appear inappropriate for NASA to engage in the provision of any such services being offered, or likely to be offered, by private entities. Furthermore, if NASA decides to offer aerial photography, data collection and analytical services, S. 663 would appear to make it illegal for others to provide such services, which would appear even more inappropriate in view of ongoing private undertakings in these areas.

S. 875, unlike S. 663, would designate a newly created private corporation to have responsibility for the establishment, ownership and management of an operational remote sensing satellite system. This designated entity approach recognizes the advantages of early private sector responsibility for the establishment and management of an operational system. However, it also raises potential concerns, including uncertainties in capitalization of the new corporation and the potential for additional expenses and delays in the creation of such corporation. As is described in the following section, we believe there is an alternative concept which retains the advantages of the designated entity approach while avoiding the concerns mentioned above.

AN ALTERNATIVE APPROACH

An alternative approach is available which would avoid the concerns expressed with respect to both S. 663 and S. 875. This approach draws on the significant features of S. 663 and S. 875, namely, the designation of a private entity to undertake eventual establishment of an operational system, as contemplated in S. 875, and the continued involvement of NASA in the provision of remote sensing satellite data in an interim period, as contemplated in S. 663.

Our proposed approach would be to designate the Communications Satellite Corporation (Comsat) as the entity responsible for the establishment of an operational remote sensing satellite system and the provision of basic data products. (Analysis of the basic data products would continue to be performed by the users themselves or by service companies on a competitive basis.) However, designation of Comsat would not necessarily imply an abrupt transfer of existing remote sensing programs and systems to Comsat. Rather, there could be an interim period during which NASA could maintain responsibility for its presently approved Landsat programs, including Landsat-D. But since there are significant data requirements in the user community that the Landsat series of satellites will not satisfy (e.g., high resolution stereoscopic data), Comsat (assuming appropriate resolution of essential issues discussed later) would proceed to establish a system as soon as possible to satisfy those requirements, as well as any other requirements which might be satisfied by additional payloads sharing the same spacecraft. At the same time, Comsat could begin the planning and other actions necessary to establish the operational follow-on to the Landsat-D system. This approach would result in the continuation of the Landsat-D system and the additional satisfaction of requirements for high resolution stereoscopic data. It also would provide valuable experience on which Comsat could plan, in cooperation with the Government, a fully operational commercial follow-on to the Landsat program.

The alternative approach we have suggested maintains continued Government involvement in the operation of remote sensing satellite systems during an interim period, as is the case in S. 663, but removes uncertainty as to the eventual role of the Government and the private sector. As a result, both the Government and the private sector will have the incentive to devote their full efforts to the accomplishment of their assigned responsibilities.

Our suggested approach also has many of the desirable features of the designated entity approach contained in S. 875. Our proposed approach would involve a private entity in an operational role in the initial stages and would permit marketing activities by a private entity to begin at the earliest possible date. Comsat has many of the same attributes as the new corporation contemplated in S. 875, including three directors appointed by the President, oversight by the Government, require-

ments for annual reports to the President and the Congress, and wide public ownership of Comsat stock.

Additionally, Comsat has considerable expertise and experience in space and satellite technology that could be applied immediately to the establishment of an operational system. Designation of Comsat would avoid uncertainties associated with the capitalization of a new corporation and would result in substantial economies through the avoidance of additional expenses which would be incurred by the creation of a new corporation. Also, our approach would avoid delays which are likely to be incurred in establishing a new entity and bringing it to a state of readiness to pursue its objectives. Comsat is not a manufacturer of satellites, which would promote competition in such major procurements and which would avoid potential legal issues regarding the joint ownership of a new corporation by such manufacturers.

Finally, in view of increasing activities in other countries in the area of remote sensing satellites, we believe Comsat offers particular advantages because of its unique international experience and reputation as a result of participation in Intelsat (whose charter permits it to engage in remote sensing satellite activities) and other international satellite system ventures and undertakings. This experience would be most valuable in future consideration and any subsequent implementation of an internationally owned and operated remote sensing satellite system.

We believe the concept presented above would contribute in a major way to continued U.S. leadership in space, to a secure U.S. commercial position in the provision of satellite remote sensing systems and services and to greater beneficial use of satellite remote sensing technology. In view of the likely foreign initiatives in this area, as is evidenced by the French proposal to the Geosat Committee, we believe the approach we have suggested would place the United States in the best position to retain its present leadership position in space.

RELATED ISSUES REQUIRING RESOLUTION

While it appears to us that the potential market for remote sensed data products and services in the long term is sufficient to encourage the assumption on our part of reasonable risks of investing in and establishing systems to supply remote sensing satellite basic data products and services, there are a number of factors which would affect the success of any such venture and which require resolution. The most important of these are (1) whether the Government will decide to satisfy its civil remote sensing data requirements from a private system operator, (2) the extent to which the Government will purchase data products and services provided through such systems, and the price it will pay for such products and services, and (3) whether the Government will decide not to compete with a private system operator in the provision of comparable data products and services either through the establishment of its own system or through the release of data obtained through national security-oriented systems.

The large unknown factor in assessing the market for satellite remotely sensed data is the extent to which the U.S. Government would purchase such data from a private system operator, rather than competing with a private operator, and the price the Government would pay for such data. While suggestions have been made to the effect that it will be necessary for the Government to "guarantee" the entire revenue requirements to a private system operator, we do not agree with such suggestions. We recognize that any such guarantee would provide little incentive to operate efficiently or develop new markets and services. On the other hand, the Government is expected to be a major user of remotely sensed data and the nation as a whole would obtain significant benefits through the establishment of systems to provide such data. It would appear appropriate, therefore, that the Government make a minimum commitment to purchase data products and services during the first several years of the private system operation, in the form of a minimum dollar purchase per year. This minimum commitment should take into account overall system costs, the potential revenues from other market sectors (e.g., industrial and commercial forms, state and local governments, and foreign customers), the benefits of the availability of such data to the nation as a whole, and the degree of risk incentive the private operator should assume in the development of the market in general.

A further significant factor affecting the willingness of a private entity to invest in the establishment of a civil remote sensing satellite system is the expectation that such entity will have of continuing its involvement in such systems and services. Given the risks inherent in the establishment of such systems, the large investments required and the fact that continuing investments and expenditures will be required over the lifetime of a system in order to ensure the development

and success of the system, a reasonable expectation of continued involvement is essential.

Another matter of major importance is the question of protection of rights in data. In order for any system to be commercially viable, the system operator's rights in basic data products to be supplied must be protected in order to ensure against others reproducing and reselling the data. If such resale were permitted, the customer base for the data would be undermined and the commercial viability of the system would be destroyed. S. 663 recognizes this concern and would protect the Service in NASA from such resale.

A further matter of importance is the question of principles which might be adopted internationally pertaining to remote sensing satellite systems. Certain of the principles currently being considered by the U.N. Committee on the Peaceful Uses of Outer Space could result in a substantial reduction in the market for remote sensing satellite data and in unnecessarily burdensome requirements on system operators. The final principles adopted will be an important factor affecting the success of any remote sensing satellite system, governmental or private.

Comsat is mindful of the substantial governmental interests associated with remote sensing satellite systems. We note that the President's Civilian Space Policy encourages involvement of the private sector in satellite remote sensing pursuant to Government authorization, control and supervision. The substantive features of such control and supervision have not been specified in any detail and, of course, would significantly affect the success of an operational remote sensing satellite system. Recognizing that we are in the formative stages of commercial remote sensing satellite services and that not all problems can be resolved or anticipated, we believe that the framework adopted for supervision of a private system operator should (1) leave room for growth and development by establishing only rules protecting well-defined national interests, (2) provide maximum incentives to invest, (3) permit maximum flexibility in the establishment of systems and services, and (4) avoid unnecessary delays. As experience is gained, and as public interest concerns become clearer, this framework could be refined.

A further concern to which we are very sensitive is the satisfaction of the requirements of the "public user" community. Satisfaction of the needs of this community may, in the public interest, require subsidy. The extent of such subsidy, who would be eligible for it and who would bear the burden are questions that must be carefully considered. Given the risks associated with establishing a remote sensing satellite system, it would appear at this time that the Federal Government should play a principal role in the satisfaction of the needs of the public user community, perhaps through the procurement of data on behalf of such community. Such approach is, we understand, being considered by the Government in connection with its consideration of how to satisfy the needs of the public service satellite community for communications satellite services.

CONCLUSION

Mr. Chairman, we continue to be extremely interested in the area of remote sensing satellite systems and in participating in the establishment and management of an operational system. We believe Comsat offers many advantages as the entity to undertake the establishment and management of such a system. Also, we believe the alternative approach we have suggested herein would promote the achievement of the policies and objectives of concern to this Committee, including the maintenance of the U.S. leadership position in space technology and the furtherance of the U.S. commercial position in the provision of space services.

Mr. FINK. Last year Senator Stevenson made a notable statement in the Congressional Record about what is required to move the space program forward. He said, "The missing ingredient is not more analysis or additional interagency meetings, but a decision to act."

I believe we are here today because the subcommittee has taken this charge at face value, and is continuing its initiative to place within a practical institutional framework the tremendous technical competence we have created in Earth resource observation. I consider it a privilege to participate in this process by commenting on S. 663. I will give my general impressions in this testimony, and will include for the record some suggestions for a few clarifying amendments to policy-setting sections.

The subcommittee has made remarkable progress in defining the enabling mechanism for full operational development of the Earth Data and Information Service. It has properly assigned this responsibility to a lead organization which is given wide latitude to carry out its charge.

It has placed this organization under NASA's cognizance, a wise decision for two reasons: First, the accumulated experience and technical competence of the space agency can be made available to the new organization most efficiently; and, second, the direction of the R. & D. program, which NASA will sustain to increase the capability of the system, can be managed best through this direct organic relationship.

As I studied this bill, I was struck by the degree to which its fundamental policy baselines are determined by its definitions of the key terms. The subcommittee was very astute, for example, in defining "basic information products" as those applicable to the needs of a broad spectrum of users. This properly limits the charter of the service to functions analogous to those of the wholesaler in commercial practice, reserving the retail market—that is, the specialized services—for exploitation by the users, both Government and private. In my mind, this is a critical distinction in the assignment by the bill of proper roles in the system.

The subcommittee has also recognized that the data and information output of the system must be assigned sufficient financial value to sustain the system's operation. It has given the users their needed avenues to policy determination for the operation of the system.

I was pleased to see also that the provisions for private sector participation are both stronger and more explicit than in earlier drafts, and that the benefits of open competition are acknowledged. Cooperation with, and competition from, foreign nations are anticipated in this bill, and provisions are made to accommodate both.

The codification of all of these factors into effective legislation is a task which we do not underestimate. In my view, this task has been well done, and the result is a policy document solidly conceived in its principles and well executed in its draftsmanship, a consistently reasonable and logical solution to the institutional problem. On these merits, S. 663 ought to achieve wide acceptance in Government, in the Earth resources observation community, and by users. With minor modifications, it is a bill which I, as a directly concerned industry executive, can conscientiously endorse.

I would like to describe those suggested modifications briefly. The first I would suggest is a provision explicitly stating as a policy that both during the interim period and thereafter, private business sector participation is the preferred mechanism for system and market development. This can avert the danger that the program may grow in Government hands until the logical level of entry for private investment capital is needed.

A corollary suggestion is that the interim period should not be used merely as a time for the development of general system capabilities, as now stated in the definitions section, but also as a period in which specific plans and schedules for transition to the final operating configuration are developed.

Third, I would like to see more specific provisions requiring that the price of the data and information products be established at such a level as to induce investment by the private sector while the market is being developed. As the market grows, pricing can be determined by the capital investment requirements of the private sector in enlarging its participation in the system.

Fourth, the provisions drawn to induce heads of Government agencies to participate in the program could be more specific. We need to survey resource data requirements and practices in all principal Government agencies, and to establish as policy that agency heads who can accomplish their missions more efficiently by use of remote sensing should do so.

And the last general principle which should be recognized is that which prohibits government bodies or government-chartered bodies from competing with private enterprise. A large government user which would have processing equipment, for example, is not now prohibited from distributing its output, on a paid or unpaid basis, to other government bodies. Since the initial opportunities for value-added services will be found in government, we should safeguard the integrity of this market, and I have suggested in my submittal a simple modification to accomplish this.

Now for a few words about the minority draft, which shares the aims of S. 663, but would try to attain them through a decidedly different organizational approach. The first variance is the provision for FCC regulation. The fact that any data-gathering satellite may transit radio frequency signals does not move it into the operational domain for which FCC regulation was instituted. I seriously doubt that this kind of jurisdiction would add anything to the success of the program.

I also note that the minority bill would disassociate the Earth resources observation program from a direct organic relationship with NASA. In my view, this could lead to stagnation in the continuing research and development program. Another provision which troubles me would allow any civil agency which has what are called "unique needs" to set up an Earth resource sensing system of its own, creating strong tendencies for proliferation and overlap.

Last, I feel that the minority draft would cast the organization and operation of the proposed Earth resources information system in the Comsat mold. I have taken the position, before this subcommittee and elsewhere, that what was good for the communications business, with its long-established markets, mature user operating practices, and accepted international agreements, would most likely be bad for Earth resources observation, a new, untried venture with technology and markets that are still developing and proliferating. The systems are quite different.

S. 663, then, is my choice as the bill which best adapts remote sensing technology to today's environment and tomorrow's promise. It's 7-year interim period happens to coincide with the time since the launch of Landsat 1, and look how far we've come since then. The next 7 years may see the Space Shuttle fly large space platforms to support multiple missions.

Since many missions, such as crop yield predictions, are weather and climate-related, it may also be advisable to integrate appropri-

ate remote sensing data bases. Also, the President, in his Space Policy statement, asked for study of the advisability of integrated military and civil space programs.

In my view, we should go ahead with the Earth Data Information Service, confident that it has the necessary management adaptability and flexibility to meet these anticipated demands for multidisciplinary and multifunctional missions.

I will sum up by referring to my letter which I wrote to the Chairman in comment on the first version of this bill, introduced during the last session of Congress. I said at that time that there were four things which this bill should address:

First, that provisions should be made to prevent government control during the interim period from projecting its modus operandi into the operational phase which is to follow.

Second, I said that an operational system cannot come by step-function change or executive edict. Efficient transfer of management responsibility by government, and orderly assimilation of system benefits by users, should be evolutionary processes to achieve the highest order of program benefits.

Third, I said that the success of any such system will be determined by how well it meets the needs of the user, particularly in such matters as marketing and pricing policy.

And fourth, that the market mechanism of the private sector must enter the transition process at its beginning. Government users dominate the market, and are likely to continue to do so. The most critical market test for the system will be its ability to induce these users to purchase enough data to make the system economically viable. The acknowledged abilities of private business to stimulate usage as part of the marketing process should be utilized to the fullest.

It seems to me that the present bill could now meet all these criteria with minor policy clarification. I congratulate the subcommittee for a job well done, and I enthusiastically endorse this vital legislation.

Thank you.

[The material referred to follows:]

SUGGESTED CHANGES TO S. 663

A. *Substitute for Subsection 5(a)(3).*—"In achieving the purposes of the Act, both during the interim period and thereafter, the capabilities of the private business sector shall be used to the maximum extent practicable in the design and operation of the system and in marketing and distribution of data and basic information products."

B. Change the last sentence of Subsection 5(a) by adding the following italicized language: "Nothing in this Act shall be construed to preclude the ownership and operation of the Service, or of a subsequent organizational arrangement that achieves the functions of the Service, by private business at the end of the interim period, or to preclude the ownership or operation by private business of any part of the Service during the interim period."

C. Change Subsection 5(b)(1) by adding the following italicized language: "the Service shall provide rapid processing of, and ready access to, the data and basic information products produced by the System, at a reasonable cost to the users, which shall be established so as to induce the participation of the private business sector."

D. Change Subsection 6(d) by adding the following italicized language: "Whenever the President determines that it is feasible to do so, during the interim period but not later than one hundred and eighty days prior to the end of the interim period, the President shall prepare and transmit to the Congress recommendations, together with the supporting justification, on the appropriate organizational arrangement

best designed to continue the functions of the Service, either as a function of a Federal agency (either as an independent Agency or as a unit of an existing agency), a Government corporation, *within private business, or as a combination of any two or more of these. In accordance with the policy stated in subsection 5(a)(3) of this Act, such organizational arrangement shall include the participation of the private business sector to the maximum extent practicable.*"

E. Change the second sentence of Subsection 9(a) by including the following italicized language: "The Administrator shall design such charges to assure, insofar as practical, *that reasonable opportunities are presented which will attract participation by the private business sector, and that by the end of the interim period, the income from such charges, combined with any other income to the Service, will cover the costs of the Service exclusive of costs incurred by the Administration for research, development, and testing on remote sensing systems, subsystems, and components carried out under the National Aeronautics and Space Act of 1958.*"

F. Change Subsection 9(b) by adding the following italicized language: "Each department or agency of the Federal Government needing data and basic information products of the kind that are provided by the Service, shall procure such data and basic information products from the Service. The Administrator with the agreement of the President shall establish the fees charged to such departments and agencies for such data and basic information products, *and shall assure that such fees are consistent with the provisions of Subsection 9(a).*"

G. Substitute the following for Subsection 9(c): "The President shall periodically survey the operations of each department or agency of the Federal Government to assure that it uses the data and information products, and other products and services of the Service, to the maximum extent found consistent with technical and economic applicability to its functions and needs, and shall direct the heads of such departments and agencies to take actions as are necessary to assure such usage."

H. Change Subsection 9(f) by deleting the word "distribution" in the first sentence, and adding the italicized second sentence, as follows: "Nothing in this section shall be construed to limit or otherwise affect the information and analysis functions of any department or agency of the Federal Government. *However, the head of each such department or agency shall within one year after the date of enactment of this Act and annually, thereafter, in consultation with the Administrator, review and recommend to the President whether it would be economically or otherwise advantageous to have any of such functions performed under arrangements established by the Service.*"

Senator STEVENSON. Thank you, Mr. Fink.

Mr. Stevenson?

Mr. STEVENSON. Thank you. Mr. Chairman, Senator Schmitt, members of the committee:

I appreciate this opportunity to testify before you today. The question of civil uses of remotely sensed data is important to the Nation as a whole, and the private sector in particular.

With me today is Robert E. Tokerud, manager of Lockheed's Remote Sensing Applications Laboratory, who has had the pleasure of working with members of the subcommittee staff on earlier occasions.

Although I am speaking as a member of a panel representing private sector interests, let me assure you that the national interest and the benefits of remote sensing to mankind are major considerations in our evaluation of the legislation that is the subject of these hearings. We applaud the efforts of this subcommittee and look forward to the day when there will be a viable and operational remote sensing service.

The United States should continue to be the leader in remote sensing technology and particularly in the application of that technology to the management and control of the Earth's environment and natural resources. It is our belief that this objective can best be accomplished by maximum participation of private industry, especially in the development and distribution of "value-added" information derived from the remotely sensed data.

We in industry—at Lockheed and elsewhere—are examining the potential for profitable ventures in earth resources data processing and analysis. Using existing capabilities, we can produce a valuable end product from the original satellite-acquired data. This increase in value comes from simple data corrections and enhancements to comprehensive information derived from sophisticated analyses and modeling. The result is “value-added” information useful in decisionmaking for environmental and Earth resources management.

We believe that the technology is available and the data value is well enough understood to justify creation of an operational capability at this time. Furthermore, the type of actions now under consideration can assure Americans of continued technical leadership in the face of increasing foreign competition and, at the same time, increase our gross national product. The national need to locate, conserve and manage our natural resources, while protecting our environment alone justifies the Nation’s commitment to continuing this program.

We have carefully reviewed the Earth Data and Information Service Act, S. 663, and the Earth Resources Information Satellite Act, S. 875. We would support modified versions of either proposed act. However, before commenting on each of the bills, I will describe the current business scenario for the use of remotely sensed environmental data as it is now perceived by Lockheed.

I want to first point out that Federal agencies are currently the largest volume user of Landsat data. We do not anticipate that this will change, at least for the next 4 to 5 years. Therefore, the major user of any service will continue to be governmental agencies.

NASA-related remote sensing projects are developing numerous information procedures and products for multiple users and I am proud to say that Lockheed Electronics is a major contractor for these efforts. Through these programs, major advances in the application of remote sensing technology have been demonstrated in agriculture, forestry, wetland mapping, and petroleum and mineral exploration, to name a few.

As this technology has evolved, it has become apparent that Landsat data is seldom used by itself. However, when the information derived from Landsat data is combined and integrated with other sources of data in information data bases, the value and utility of the end product is significantly increased. An excellent example of this was the Large Area Crop Inventory Experiment, LACIE, which used Landsat data, meteorological data and historical data to estimate the production of a major agricultural crop on a global basis.

In spite of the potential value of earth satellite remote sensing, it is interesting to note that the companies involved in value-added product sales are not yet overwhelmed with business. We think there are good reasons for this, and I will describe a few:

One, many in the user community are only now developing an understanding of the information derived from satellite-acquired remotely sensed data. The number of knowledgeable users is increasing because of the technology transfer and training programs being provided by NASA and the EROS Data Center. A major benefit of these projects is the increased user acceptance and trust

of the information derived from the data. This is essential before decisionmakers will implement this technology into their day-to-day operations.

Two, many Federal agencies are implementing their own pilot systems to convert raw data into value-added information products. While this limits the current market, the in-house training it provides the Federal resource managers is developing a more knowledgeable customer for industry when these programs become operational.

Third, private industry has often found itself competing with Federal agencies when the Government offers a service or data product similar to those we offer for profit.

Four, Landsat data has not been available on the continuous, reliable and timely basis required to develop a market in the private sector.

And finally, industry has not had a mechanism to effectively participate in the planning or policymaking process to influence the factors that affect our ability to develop a stronger market for the technology.

But a market for Earth resources data and information products is developing and the value-added information industry we represent is carefully assessing this market. Based on past involvement with applications development and our current understanding of user requirements, Lockheed has made the initial commitments to enter the information brokerage market. Many factors—such as the President's space policy, your legislation, OMB and other Federal agency policies—will determine our future role and the role of the value-added information product/service industry.

Now for some comments on the proposed legislation. First, I would like to comment on S. 875, the Earth Resources Information Satellite Act.

Our first impression of the proposed act was very favorable. It established an institutional arrangement that separated the "corporation" from both private industry and the Federal Government.

After more thorough consideration, however, we conclude that despite obvious merit, S. 875 may not be an optimum approach at this time. Our problem is that in the near future, we do not foresee a raw data volume requirement from non-Government users which could support the proposed corporation.

In addition, the corporation would own and operate its satellites, ground stations and, insofar as possible, its communication services, with perhaps limited contractual arrangements with American industry.

For these reasons, we believe S. 663 may offer a more compatible solution to the realities this new market faces.

Next, I would like to comment on S. 663, the Earth Data and Information Services Act of 1979.

Having set aside the private corporation concept as a near-term means of establishing a comprehensive remote sensing information service, the next question is: Where in the Federal Government should this service be developed? We support the decision expressed in S. 663 to place it initially within NASA's organization. Since NASA's prime charter is for research and development, we believe that NASA should be more inclined to posture the service

for future transfer to either a private, Government-regulated corporation or to private industry. Every effort should be made to shorten this interim period to less than the maximum 7 years.

We would like to see Section 6(d) revised to stress the transfer to a Government corporation or a private corporation as a major objective of the service.

Our principal objection to the proposed legislation is related to the charter of the service to develop and distribute "basic information products." This conflict with our industry may well preclude the development of the value-added product/service industry. If it is the desire of the Congress to see industry assume a major role in this program—other than design and operation of the spacecraft, facilities and equipment—this bill must not only limit this conflict, but must encourage industry's role in the development and distribution of value-added products for profit.

Our suggestions concerning other specific word changes in the proposed S. 663 bill are contained in the marked-up copy provided for the record.

In summary, we believe the role of the "value-added service" industry can be significantly enhanced by your proposed legislation. The potential market for the private sector can thereby be developed. However, this will occur, in our opinion, only if the service created is user-oriented, from both a Government and private industry viewpoint, and does not compete with the private sector in the sales and distribution of value-added products. NASA appears to be the optimum Federal agency for initially implementing and operating the proposed service.

I would like to acknowledge the dedication of the subcommittee in pursuing this subject. We believe this type of dialog is necessary as a prelude to the action required to maintain the technological position of the United States in environmental satellites and their related applications. The establishment of an operational remote sensing system will, without question, be a major benefit to mankind.

Thank you for giving Lockheed the opportunity to present this testimony.

[The material referred to follows:]

PROPOSED MODIFICATIONS OF S. 663

[S. 663, 96th Cong., 1st Sess.]

A BILL To establish and Earth Data and Information Service, in the National Aeronautics and Space Administration; and for other purposes

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That this Act may be cited as the "Earth Data and Information Service Act of 1979".

PURPOSE

SEC. 2. It is the purpose of this Act to establish the institutional framework that will acquire and make available to users, on a timely and continuing basis, reliable data and the betterment of all mankind through cooperative programs with other countries or groups of countries;

(4) the successful development of such an institutional framework is dependent on the establishment of systems requiring innovative institutional arrangements that encourage initiative by, and participation of, the private sector *sufficient to lead to a commercially viable system;*

(5) an interim period is required to develop the institutional, financial, technical, and market structure to achieve the purpose of the Act; and every effort

should be made to shorten this interim period to less than the maximum of seven years which it may not exceed;

(6) continuing research and development of remote sensing systems is essential; and

(7) technology and data transfer between military and civilian space activities, to the maximum extent practicable, will enhance the benefits to be realized from remote sensing technology.

POLICY

SEC. 5. (a) The Congress declares that it is the policy of the United States that—

(1) the United States acknowledges the fundamental right of all countries to acquire data from space;

(2) the United States shall provide for the development and operation of active and passive remote sensing systems on a global basis in support of national needs, and to meet the needs of other users;

(3) the capabilities of the private sector shall be used, to the maximum extent practicable, to achieve the purpose of this Act and especially in the design and operation of the system;

(4) all United States Earth-oriented remote sensing satellites shall be regulated by the Federal Government;

(5) technological advances in the remote sensing of the Earth from Space shall be *encouraged* pursuant to appropriate governmental controls which shall be based upon an assessment of civil benefits, national security, and foreign policy;

(6) the Administrator, under supervision of the President, and with the guidance of the Secretary of State, shall cooperate with other countries and groups of countries in carrying out the provisions of this Act; and

(7) remote sensing data shall be used for the benefit of all mankind.

Nothing in this Act shall be construed to preclude *and every effort shall be made to facilitate* the ownership and operation of the Service, or of a subsequent organizational arrangement that achieves the functions of the Service, by private business at the end of the interim period.

(b) The Congress of the United States directs that—

(1) the Service shall provide rapid processing of, and ready access to, the data and basic information products produced by the System at a reasonable cost to the users;

(2) the Service shall be developed so as to encourage and promote competition among suppliers of equipment and services for the System *to promote participation by private business* and to promote maximum use of remote sensing data and basic information products; and

(3) the products provided by the Service shall be made available to all users, both domestic and foreign, on the basis of charges to be established by the Administrator.

EARTH DATA AND INFORMATION SERVICE

SEC. 6. (a)(1) There is established in the Administration the Earth Data and Information Service.

(2) The functions of the Administrator under this Act shall be administered through the Service.

(3) The Service shall consist of the integrated institutional, managerial, financial, technical, marketing, and other operations necessary to make available the timely and continuing flow of reliable and useful data and basic information products to the users.

(b)(1) The Service shall be headed by a General Manager, who shall be appointed from civilian life by the President.

Dr. HENDERSON. Mr. Chairman, I'd like to briefly read a few paragraphs from my statement and submit the full statement for the record.

Senator STEVENSON. All of the full statements will be entered into the record, as will also those of Mr. Pickering and Ms. Davenport.

Dr. HENDERSON. I would also, Mr. Chairman, like to ask permission to admit as part of the record a statement on the space policies bills, a paper from Dr. Mike Halbouty on the future programs and prospects for resource exploration from space by the

year 2000—it has many arguments that are pertinent to formation of a remote sensing service.

I would like to also submit two studies by the Geosat Committee that are pertinent.¹

Mr. Chairman, I am pleased and appreciate the opportunity to testify before this subcommittee on issues related to S. 663 and S. 875. Both of these bills would lead to the development of a self-supporting earth resource information service which would provide worldwide users with continuing access to timely and reliable data on the Earth's resources and environment.

It is my hope that today's hearings will lead to the passing of legislation in this session of the 96th Congress which will create the mechanism to establish an operational Earth resources information service which is the intent and purposes of these two bills, and also the previous 1977 Ford bill.

Any further Government delay can only serve to further delay the availability of this valuable remotely sensed data which we believe may be of great value in dealing with the growing crises associated with diminishing U.S. reserves of energy and mineral resources and increasing U.S. dependence on foreign sources.

The Geosat Committee represents some of the ultimate users of this data, and I'll have some comments later on that statement. We represent 100 oil, gas and mining companies who utilize geology in their effort. We believe that satellite remote sensing data may prove to be a tremendous addition to our problems of exploration geology. We have testified previously and I again say I am speaking for the geological community.

I am also speaking from our experience in the Geosat Committee regarding the marketability of a specific Earth remote sensing system called Stereosat.

There are several developments that have taken place recently which are of major importance, which the committee has reviewed.

Last year, for the first time, we actually have received a Presidential directive which clearly mandates the private sector involvement and a civilian space policy. The resulting studies under Dr. Frank Press' office, the Integration Study, and the Private Sector Involvement Study have received input from the Geosat Committee.

I might make one comment, though, regarding Dr. Press' testimony on Monday. He stated that the users were getting the data they wanted. I assure you, if we were getting the kind of data we needed in geology, the Geosat Committee would not be in existence.

The bills that you have presented last year and this year deal specifically with getting on with the job of creating a mechanism to provide this sort of service.

The French, as you are well aware, are also going to provide a similar service through their SPOT program. Also, it is encouraging to me to hear the rather positive statements being made now by the Comsat Corp. and their interest in providing this general service.

I'd like to review very briefly some comments—I have a number of comments in the text of my testimony which I will not read, but

¹ The material referred to is available in the committee files.

I would like to reference a few major points regarding our consideration of the two bills.

Regarding the purpose of both bills—namely, the purpose and intent of both bills to provide, on a nondiscriminatory basis, reliable data in useful formats in a timely and a continuing manner, we strongly endorse this basic purpose.

We also endorse the intent of both bills to go as far as possible in any case regarding the private sector involvement. I would emphasize here, though, that although perhaps it is not something that is written into those bills, we must also consider that we really are not just talking about transferring the entire system necessarily. It may be judicious to transfer portions of it to the private sector.

We agree wholeheartedly with most of the findings in S. 663. We believe that adequate technology does exist and is continuing to evolve. We believe a broad user market has begun to evolve also. We hope to see that any kind of legislation and administrative action that will take place to encourage this development and not limit it until the technology is completed, or we don't think it ever will be.

So we are supportive of the intent of these bills to create institutional mechanisms to encourage private-sector involvement in the transfer of the technology.

In that sense, were S. 875 to be the surviving legislation I am sure that the Geosat Committee would strongly endorse it and utilize it. However, we speak for only roughly a third of the users of Landsat data based on the EROS Data Center count. We do not speak for the large nongeological users, and of course we do not speak for the Government users, the major users.

Therefore, whereas we would be able to use this system, we could not support the corporation concept by ourselves immediately. Clearly governmental support would have to be required in some forms of direct subsidies, guaranteed loans, or guaranteed purchases.

I think this is a major requirement, no matter how this technology is transferred and no matter how far it is transferred. But I think this governmental support should be considered in light of the national interest because of the potential value of this data in light of our growing energy and mineral resource problems.

Regarding the operational mechanisms as outlined in S. 663 where the role would be placed in NASA's hands for the 7-year interim period, our primary concern about the wording of that document is that there is no guarantee that the private sector will be part of the final decision as to what happens to the service.

For this purpose, in our testimony we recommend that a board of directors, appointed by the President, be created and that the representation on this board of directors be equally from the private sector and the Government sector, and that the chairman of the board would be the administrator of NASA.

That board of directors would carry out all these assignments, duties and responsibilities in S. 663 as assigned to the administrator.

We believe that the interim period should be no longer than 5 years, to speed up the process. Equally, as well, we believe that the wording regarding the annual report of the administrator should

be structured such that it reports each year to the Congress on the status or progress, if you will, of the transfer of this service to the private sector.

In other words, it shouldn't be left until the end. The private industry would probably not be ready to take over the service if left only to the last 180-day period as in the bill.

I want to comment here briefly, because I promised to do so, in testifying about the NASA budget 2 weeks ago, on our experience in the marketability of Stereosat.

I think Stereosat is worthwhile considering in light of the overall system, although it is a much smaller project of certainly a much smaller market than, say, an operational Landsat.

This is, however, because Stereosat is something that's needed now. It is also something that has probably a better defined and better aggregated user market.

We, as you know—and I've submitted a copy for this hearing—have conducted a market study which convinced us that there probably is a market as some fixed price for Stereosat products.

Again I say that Stereosat provides a high resolution, multi-spectral visual stereo imagery of the world in the near time frame, rather than waiting for a longer development.

Since I spoke with you, we have had a meeting of the Geosat Committee members with some other interested people, on the marketability of Stereosat in Houston, on the 4th and 5th of April. At that meeting were Geosat users, Geosat service companies, banks, insurance companies and others, and certainly NASA, exploring the problem of: Could we create a marketable Stereosat?

I think we cleared the air on an awful lot of problems that yet remain.

I will read some of the Government required actions which came out of that meeting—whether you happen to take them for Stereosat or the Earth remote sensing systems proposed in these two bills.

One of them is a definition of commitment. This word has been overused by all parties. We do not know what people consign for the future of this data in terms of getting a commitment to finance the system. There's no commitment coming forth from the Government, and unfortunately we cannot see commitments—when I say "commitments," they're signed contracts to purchase data in the 1980's. That's a very difficult problem and we're working on it.

I want to emphasize the other items that came out of the meeting which I think have been mentioned by some of the other speakers this morning, but I'd like to simply read them to you. These things I think must take place in some form before the private sector will become involved financially in any of these systems.

1. The Government must commit to providing and maintaining timely and continuous access to reliable and useful remotely sensed data. On that comment, I want to say that it is encouraging to hear Dr. Press and other administration witnesses speak in terms of a commitment to continual use of providing this data. But, I would like to know how and when they are going to do it.

2. Government must work with the private sector to help establish which part of an operational Earth resource information serv-

ice, from all to nothing, should be transferred to the private sector; but in so doing, Government must not delay the development of the service itself.

3. If a private sector Earth resources information service is established, Government must agree to purchase its data from the private sector service.

4. If a private sector Earth resources information service is established, Government must assist the private sector service in dealing with non-U.S. users, both as to source and as to potential international restrictions.

5. Under no circumstances should Government attempt to compete internally or publicly with any segment of an established private sector Earth resources information service.

6. Government should establish the necessary national and international copyright laws and regulations to assure appropriate data security for any self-sufficient—Government or private sector—Earth resources information system, when it is sold to bring back the cost of the entire system.

7. Government would have to assist a Government or private sector Earth resources information service in establishing fair and equitable pricing policy for all users.

I think it is extremely important that wording be included in the two bills to provide an equitable pricing policy. I don't think the market will grow very rapidly if the Government gets one price and the private sector has to pay some other price for basically the same product.

Finally, the Government must recognize in any transfer period by any mechanism that the Government is going to have to carry a good part of the financial load for the time being. It has done this in many other areas before.

In conclusion, I want to make a couple of brief comments. We are concerned about the energy crisis and the mineral crisis. It was very disturbing to me to be writing testimony talking about creating a system such as you are talking about—or, for that matter, trying to develop a system like Stereosat, which has tremendous benefit in our opinion in helping us do our exploration job. It will solve no problems. It won't solve the crises. But it will help us do our job more efficiently and more effectively, and hopefully to find more oil, gas, and minerals.

But it is disturbing to listen and read the newspapers about the Government's concerns about energy policy. The President's wish to, in a sense, produce more and conserve more—we agree with those, certainly. But here are systems that would help us do that more efficiently and more quickly, and yet here we see in 2 years almost no movement of the administration.

They're "moving toward" doing something in this area. Also, we're sitting around waiting for legislation to take place in itself which inhibits the private sector use of this data.

I encourage this committee in what it is doing. We would like to help in any possible way we can, and I hope that you, Senator, will not take too long to move ahead, as you said.

I thank you.

[The statement follows.]

STATEMENT OF FREDERICK B. HENDERSON III, PH. D., PRESIDENT OF THE GEOSAT COMMITTEE, INC.

Mr. Chairman, I am pleased and appreciate the opportunity to testify before this Subcommittee on behalf of The Geosat Committee on the issues related to S. 633 and S. 875. Both of these bills would lead to the development of a self-supporting earth resource information service which would provide worldwide users with continuing access to timely and reliable data on the earth's resources and environment. It was my privilege to have testified in support of a similar bill, S. 657, the Earth Resources and Environmental Information System Act of 1977. It is my hope that today's hearings will lead to the passing of legislation in this session of the 96th Congress which will create the mechanisms to establish and operational earth resources information service which is the intent and purpose of these three bills. Any further government delay can only serve to further delay the availability of this valuable remotely sensed data which we believe maybe of great value in dealing with the growing crises associated with diminishing United States reserves of energy and mineral resources and increasing United States dependence on foreign sources.

In addition to testimony at the earth resources information services hearings, I have been privileged to testify in 1978 and earlier this year before your subcommittee on the 1979 and 1980 NASA budgets as they related to the needs of the geological community and to the recommendations of The Geosat Committee. Also, The Geosat Committee submitted to you a brief statement regarding the Space Policy bills S. 212 and S. 244 which were introduced earlier this year. Because this statement is also pertinent to today's hearings. I would like to submit a copy for the record. I would also like to submit for the record the following additional documents.

1. A paper entitled "Future Programs and Prospects for Resource Exploration From Space by the Year 2000" which was presented to the American Astronautical Society in November 1978 by Dr. Michel T. Halbouty, a Director of The Geosat Committee. This excellent paper presents many arguments which support the growing need for an earth resource information service which utilize the potentials of space satellite remote sensing.

2. Correspondence between C.N.E.S. (Centre National d'Etudes Spatial) and The Geosat Committee regarding the recent C.N.E.S. proposal to provide high resolution, multispectral, stereoscopic imagery of most of the world's land masses through their SPOT program in 1984. This correspondence demonstrates the sincerity of C.N.E.S. in providing such data and the interest of the geological industries in obtaining such data as soon as possible.

3. Two reports produced by The Geosat Committee in November 1978 entitled "Management of Satellite Acquired Earth Resource Data—Recommendations from The User Community" and "Stereo Satellite Data Product Market Assessment." These reports pertain to portions of the earth resource information service bills.

THE GEOSAT COMMITTEE

The Geosat Committee, Inc., as sponsored by 100 U.S. and non-U.S., international oil, gas, mineral and engineering geological companies who produce more than half of this nation's non-renewable energy and mineral resources. This Committee is a unique industrial initiative to present to NASA the considered geological recommendations of the nation's largest single industrial group of users of satellite imaging data, a role which, I believe, will continue to expand significantly. Since 1976, The Geosat Committee has worked diligently with various branches of NASA and the United States Geological Survey and others in order to determine what supplemental remote sensing capabilities, when added to NASA's present and planned Landsat and other satellite remote sensing systems, would optimize the combined systems for geological remote sensing from space.

The principal recommendations of The Geosat Committee are the primary development of two such Landsat supplemental systems: (1) Stereosat, a proposed 1981 NASA new start program that would provide near term, world-wide, digital, Landsat compatible, high resolution (15 meter pixels) stereoscopic coverage; and (2) the addition of the 2.2 micron spectral band on the Thematic Mapper to be flown on Landsat D, which will provide spectral data specifically responsive to rocks, minerals, and soils.

The Geosat Committee also strongly supports two additional sensing systems: (1) the Large Format Camera which would eventually provide high resolution, stereoscopic, film imagery of cartographic quality of the world; and (2) the Shuttle Imaging Radar (SIR-A) which would provide worldwide topographic and surface data, especially in cloud covered areas, of value to geological and other disciplines.

In 1979, The Geosat Committee produced the two reports submitted above for the record. These reports provide additional recommendations regarding the ground segment of an earth resources information system and the timeliness, continuity and form of data needed by the users, as well as comments on the development of a user supported earth resource information system, in particular, Stereosat.

These Geosat Committee recommendations are offered in the belief that they are in the best interests of our geological industries, other Landsat users, and to this nation and the world in that they will assist us in the exploration for and the development of our increasingly scarce non-renewable energy and mineral resources, and in reaching solutions to many pressing engineering and environmental problems.

RECENT DEVELOPMENTS AFFECTING THE CREATION OF AN EARTH RESOURCES INFORMATION SERVICE

During 1978 and 1979, the following important developments have occurred regarding satellite remote sensing systems.

(a) In 1978, the President signed two critical classified Presidential Directives. P.D. 37 dealt with the classified and non-classified areas of all satellite remote sensing. P.D. 42 dealt specifically with stating a civilian space policy. This policy clearly mandates the increase of private sector investment in satellite remote sensing.

(b) Under Dr. Frank Press' office, (O.S.T.P.), two studies are being conducted. One of these is called the Integration Study, which is looking at potential savings in integrating both classified and non-classified systems for remote sensing. The second is the PSIS, or Private Sector Involvement Study. This study is looking specifically at possible private sector involvement in operational remote sensing satellite systems.

(c) Senators Stevenson and Schmitt have introduced bills in 1978 and 1979 dealing with space policy and operational earth-remote sensing systems. although the Stevenson and Schmitt bills both for policy and operational remote sensing systems differ in content, their spirit is to encourage a stronger civilian space policy and greater participation by private industry.

(d) In 1978, the French Government elected to formally approve and fund the SPOT Program, which will provide data somewhat similar, though not directly competitive with stereosat. Because the Geosat Committee companies will undoubtedly buy a fair amount of this stereo, multispectral, high resolution, digital data, which the French will provide in 1984, we have agreed to help determine what portions of the world the resource companies may wish to buy in the form of SPOT stereo imagery.

(e) The Communications Satellite Corporation (Comsat) and The Comsat General Corporation (Comsat General) have recently submitted testimony and statements which indicate an interest on their part of providing an earth resources information service.

(f) The Geosat Committee has actively been studying, through some of its subcommittees, the question of the funding of Stereosat, and, to a broader degree, our position with respect to the operational earth remote sensing systems, the Senate, bills, and the President's space policy.

GENERAL REVIEW OF S. 663 AND S. 875

Because the two bills are similar in the purpose and intent to develop a self-supporting, operational earth resources information system and service, the strong and weak points of the bills are reviewed in general herein together. Our specific recommendations as to changes or additions to the texts of the bills are appended separately as Attachments A and B.

Purpose

The Geosat Committee strongly endorses the basic purpose of both bills, that is, to establish the mechanisms to create an earth resource information service utilizing satellite remote sensing among other technologies. S. 663, introduced by Senator Stevenson, would create such a service (The Earth Data and Information System, or EDIS) initially as an operational service within NASA. S. 875, introduced by Senator Schmitt, would create a similar service (The Earth Resources Information Corporation, or ERIC) by directly creating a private corporation within two years. The relative merits of both organizational approaches are discussed below. However, The Geosat Committee strongly supports the purpose and intent of both bills to provide on a non-discriminatory basis, reliable data useful formats and in a timely and continuing manner. We also strongly endorse the intent of both bills to transfer

part or all of the service to the private sector as soon as such a transfer can be shown to be institutionally and economically sound.

Findings

The Geosat Committee is in agreement with the findings enumerated in S. 663. We certainly agree that adequate technology does exist and is continuing to develop so that a broad user community has and is continuing to evolve and mature as a market for earth resource information data. The commitment to making reliable and useful data available to the user on a timely and continuous basis is strongly endorsed by The Geosat Committee.

Furthermore, we earnestly support the creation of institutional mechanisms which will encourage private sector involvement in the transfer of this technology from the government to the private sector. We concur that some sort of interim period is required for this transfer and that it will involve a period of some form of governmental support during the transition. This support might consist of the operational government role as in S. 663, or several forms of financial assistance during the early years of a private corporation as in S. 875. This governmental assistance might be in the form of direct subsidies, guaranteed purchases, guaranteed loans, or other pertinent fiscal instruments.

Finally, The Geosat Committee strongly supports the continuation of research and development in remote sensing within both the government, particularly within NASA, and private sectors irrespective of the ultimate private vs. government organization of the operational earth resources information service.

Policy and organizational implementation

S. 663 and S. 875 differ in the way they express their stated policies and their organizational implementation. In considering the implementation of the two bills, the organizational frameworks must be taken into account. The Geosat Committee wishes to emphasize that its primary reason for testifying in today's hearing is to encourage the speed up in the availability and continuity of the data to be provided by the earth resource information service. Whereas The Geosat Committee would prefer to see the eventual transfer of the Service to the private sector because we believe it would be more efficient, we wish to stress the importance of obtaining the data as soon as possible irrespective of the organizational and institutional problems in the transfer of this technology from the government to the private sector.

S. 663 would create the Earth Data and Information System as an operational Service initially within NASA for an interim period of seven years. Before or at the end of this period, the President must recommend to the Congress whether the Service should remain in NASA, become a separate government agency, a government corporation, or a private corporation. During this time, the operation of the Service would be entirely under NASA and specifically under the authority of the Administration of NASA.

The Geosat Committee is concerned that this approach will limit the opportunity for the Service to be transferred into the private sector because there are no specific guarantees within the bill that the private sector will have any meaningful say in this important decision. We recommend that consideration be given to the specific recommendations listed in Attachment A. In particular, we recommend that if the Service is placed within NASA on an operational basis, the duties and responsibilities of the Administrator should be assigned to a Board of Directors consisting of Directors chosen equally from government and private sector users, and chaired by the NASA Administrator. Such a Board of Directors would assure that the voice of the private sector will be heard in deciding the operational and institutional future of the earth resources information service. If the Board of Directors concept cannot be implemented as such, we strongly urge that some form of a meaningful overseeing body be created to guarantee the input of the private sector during the interim period and technology transfer decision making process.

The Geosat Committee also believes that the duration of the interim period is too long and that the annual report process to Congress is sufficient. Specifically, we recommend that the interim period not exceed 5 years. With regard to the annual report from the Administrator, (for the recommended Board of Directors) we strongly urge that that report contain an evaluation of the degree towards which the Service is moving with respect to transferring all or portions of the Service into the private sector. The private sector would need more time than the final 180 days provided in the current bill to be prepared to take over the Service. An annual assessment of where the Service stands with respect to such a transfer is essential to the adequate preparedness of the private sector.

S. 875 would create a private corporation, the Earth Resources Information Corporation (ERIC) within two years of the passage of successful legislation. This corporation would be governed by a Board of Directors selected from both the government

and private sectors and regulated by the Federal Communication Commission (F.C.C.). The original financing of the corporation would be through the sale of stock and other fiscal instruments as deemed necessary and appropriate. Government ownership by the Federal Government would be limited to 20 percent (for which \$20,000,000 is authorized for in the 1981 budget) and individual stockholder ownership and foreign ownership limited to 10 percent and 20 percent respectively. In general, the duties and powers of the corporation appear consistent with and necessary for the creation of the private corporation as described.

Because The Geosat Committee supports the ultimate transfer of an earth resource information service to the private sector we should be strong supporters of the creation of the Earth Resources Information Corporation, if S. 875 is the surviving legislation. However, we recognize that the geological industries, although the largest industrial user group by far, are only part of the overall user community on an earth resource information service. The industrial community represented by The Geosat Committee could not by itself provide a sufficient market for the creation of ERIC. Other user markets would have to be aggregated. Certainly the government would have to provide early-on financial support through previously mentioned mechanisms such as guaranteed purchases, guaranteed loans, or direct subsidies. We believe, however, that such government support should be evaluated in the National Interest because of the potential value of the data in light of our growing energy and minerals resource problems as well as many other applications in the interest of the United States.

Pricing policy

Both S. 663 and S. 875 are somewhat vague on the pricing policy for an operational earth resources information service. The pricing policy of S. 663 (i.e., user charges) is established by the Administrator (or the recommended Board of Directors), whereas the pricing policy of S. 875 would be set by the Board of Directors and approved as to rate structure by the F.C.C.

Whereas the above pricing policies may be adequate, neither bill guarantees that they will be equitable amongst all users. The user market will not grow sufficiently to sustain either Service system if some user segments are unfairly or unequitably charged with respect to other user groups. In particular, the private sector should be charged equally as the government sector, except under specific and acceptable areas of direct national security.

The Geosat Committee supports both bills where they exclude further NASA or other related government costs for research and development in remote sensing from the pricing policies of the earth resources information service.

In order to protect the marketability of the data products, The Geosat Committee supports those portions of both S. 663 and S. 875 which deal with the security of the data. It is not in our area of expertise to recommend how these sections of the bills should be worded, but we recognize the problem inherent in any product pricing policy (other than cost of reproduction) of establishing adequate copyright protection. In addition, the provision in S. 663 to waive the rights of public access to the earth resource information service data under the Freedom of Information Act is imperative in the development of any Service or portion of the Service that is or remains within the government sector.

STEREOSAT, EDIS, AND ERIC

As you are aware, The Geosat Committee has been working with NASA and other legislative and administrative bodies to obtain the development of Stereosat. Stereosat, at an incremental 1978 cost of about 13 percent (\$100,000,000) of the total Landsat program through Landsat D (\$750,000,000 or more), would increase the three dimensional interpretive quality of all past, present, and future Landsat imagery several-fold to all Landsat users including the geological community. To be able to more than double the value of all Landsat interpretation to most users by adding an incremental 13 percent for Stereosat is a compelling argument in itself. This country spends an amount equal to the total cost of one Stereosat each day in incremental cost of imported foreign oil, an expenditure for which we accrue absolutely no benefit. Reflection on that relationship gives some idea of the potential benefit/cost ratio for Stereosat which would provide two of the three main Geosat Committee requirements—high resolution and stereoscopic, worldwide, Landsat mergeable, digital imagery.

In the spring of 1978, in response to the urging of the House and Senate Subcommittees on Space during NASA's 1979 budget authorization appropriations hearings and as requested by NASA's Office of Space and Terrestrial Applications, The Geosat Committee agreed to examine the feasibility of user participation in the development and funding of Stereosat. The initial Stereosat market study was submitted for the record at the beginning of this testimony.

In brief, this market study indicates that, given several market assumptions and governmental actions, there is at some fixed price, a market for Stereosat data which could amortize the 1978 \$100,000,000 program over a 6-10 year period utilizing a product pricing system for U.S. private and government users. The relation of a Stereosat market to the proposed, self-supporting, operational EDIS and ERIC earth resources information systems is not clear at present. However, it would appear that the Stereosat product and user market is closer to definition than that of the more general EDIS and ERIC multiple user markets.

At a recent informational Stereosat market study meeting and Geosat Committee Board meeting in Houston, Texas, April 4-5, 1979, the current marketability of Stereosat was reviewed. Whereas the marketability of Stereosat appears to be near at hand, (see submitted report: "Stereo Satellite Data Product Market Assessment"), this factor has caused Stereosat to become somewhat of a political test case of the private sector involvement for the broader EDIS and ERIC type earth resources information services by NASA and other government bodies.

The current "test case" status of Stereosat is unfortunate because this data would add the needed high resolution, stereoscopic, digital data to the Landsat digital data base which would significantly upgrade the value of the overall Landsat-Stereosat data.

The developing political "test case" nature of the Stereosat program in light of the increasing needs for this data in improving exploration discovery odds in a period of growing energy and mineral resource deficiencies and costs is deplorable. The Geosat Committee strongly urges that the Stereosat program be continued towards a 1981 New Start while the institutional problems regarding private sector involvement are being resolved. The near term availability of Stereosat data is potentially too valuable in dealing with our non-renewable resource problems and should not be delayed further by a legislative-administrative impasse over the development of an operational earth resource information service.

Similarly, the mechanisms suggested by the EDIS and ERIC bills should be initiated so that data from these systems can become available in the near-time frame. It is apparent that the satellite remote sensing technology developed by NASA and others in advancing well ahead of our industries abilities to assimilate and utilize it. This will change with time, but in the meantime, the operational mechanisms for the transfer of this technology from governmental research and development to private sector operational utilization should be encouraged. This can be achieved by the coalescence of the S. 663 and S. 875 bills and passage of legislation embodying the purposes and intent of these two bills in 1979.

ACTIONS REQUIRED BY GOVERNMENT TO ENHANCE PRIVATE SECTOR INVOLVEMENT IN A EARTH RESOURCE INFORMATION SERVICE

In the testimony presented above and in that presented by various other witnesses at these and other related hearings, several governmental actions have been recommended and must occur, either by legislative or administrative action, in order that an operational earth resource information service can be established and that such a Service involve the private sector to whatever degree is finally determined to be economically and institutionally in the best interests of the United States. Whereas most of the required government actions are listed below, their order is not necessarily in order of importance.

1. Government must commit to providing timely and continuous access to reliable and useful remotely sensed data.
2. Government must work with the private sector to help establish which part of an operational earth resource information service, from all to nothing, should be transferred to the private sector, but in so doing; government must not delay the development of the service itself.
3. If a private sector earth resources information service is established, government must agree to purchase its data from the private sector Service.
4. If a private sector earth resources information service is established, government must assist the private sector Service in dealing with non-U.S. users, both as to source and as to potential international restrictions.
5. Under no circumstances should government attempt to compete internally or publically with any segment of an established private sector earth resources information service.
6. Government should establish the necessary national and international copyright laws and regulations to assure appropriate data security for any self-sufficient, earth resources information system, whether in the government or private sectors.
7. Government should assist a government or a private sector earth resources information service in establishing fair and equitable pricing policy for all users.

CONCLUDING COMMENTS

In conclusion, The Geosat Committee reiterates its strong support of the rapid establishment of an operational earth resources information service. In addition, we strongly urge our government to move forward with legislation and administrative cooperation to encourage the early development of remote sensing systems such as Stereosat and EDIS/ERIC without unnecessary delays while longer term institutional issues are being defined and decided.

It is difficult to accept that, in a time when our current administration is desperately seeking ways to put forth a meaningful energy program, it chooses to delay the development of useful systems such as Stereosat and an operational earth resource information service because the administration continues to want to study such technology transfer from the government to the private sectors and to determine appropriate research and development and operational systems interfaces.

It seems that a lot of misunderstanding about the exploration process exists within our government. There appears to be many communicative reasons for such a situation on both the government and private sector sides. Proven exploration expertise exists within the private sector in the United States, where it belongs. But, accordingly, we have no equivalent of a Department of Resource Exploration to support developing technologies for resource acquisition over the next thirty years. Whereas, the Geosat Committee member companies would adamantly not want such a government entity for exploration to be created, clearly, in the national interest and in the interest of a realistic energy policy, some department, or lead agency must stand forth and support within the government budgetary circles of OMB, etc., developing resource acquisition technologies, such as satellite remote sensing.

The United States is rapidly becoming a have-not nation for energy and mineral resources. This, combined with the fact that the United States is the largest consumer of energy and mineral resources, points to a near-term crisis of availability and demand that will dwarf the current problems of inflation and lead to a rapid reduction in the standard of living of our society.

The United States, through its national and multinational corporations has been the leader in the exploration, production, and refining of energy and mineral resources in recent decades. But this leadership is being challenged at present by other industrialized countries. This challenge exists because of the growing international competition in the exploration for energy and mineral resources that are increasingly available only on a global scale. The United States cannot afford to lose the remaining advantages that have come from developing technologies that have allowed us to become the primary finders and developers of the world's non-renewable resources.

An important step in maintaining U.S. leadership is the acquisition of global data applicable to the search for energy and mineral resources. Landsat has provided one of the first global data sets that is used in this search. The Geosat Committee believes that the development of such systems as Stereosat and an operational earth resources information service will help to maintain our exploration technology leadership.

The Geosat Committee commends the efforts of this subcommittee in its efforts to establish an earth resources information service as soon as possible. We offer to assist you any way that we can in this vital effort.

ATTACHMENT A—ADDITIONAL SPECIFIC RECOMMENDATIONS FOR S. 663 THE EARTH DATA AND INFORMATION SERVICE ACT

1. Page 6; Sec. 5(a), line 20-23: The wording of this segment should be changed to encourage the private sector ownership and operation of part or all of the Service if such private sector participation is ultimately recommended by the President and agreed to by Congress.

2. Page 7; Sec. 5(b)(1), lines 1-4: Wording should be added which requires the cost to be fair and equitable as well as "reasonable."

ATTACHMENT B—ADDITIONAL SPECIFIC RECOMMENDATIONS FOR S. 875, EARTH DATA AND INFORMATION SERVICES ACT

1. Page 6; Sec. 201(b)(4), lines 20-24: It would appear that the marketing function of the corporation would be best "insured" under the direction of the President (Sec. 201(a)) or the Commission (Sec. 201(c)), rather than by the Administration.

2. Page 10; Sec. 201(c)(10), lines 6-9: This section appears to be too restrictive. The future scope of operation and service now performed by the EROS Data Center would presumably expand with the establishment of the Earth Resources Informa-

tion Corporation. Wording of this section should anticipate and permit such probable expansion.

3. Pages 11-12; Sec. 303(a): This section needs to be rewritten to clarify several confusing points. In its present form, the wording does not make clear how many directors there are in total. In addition, it is unclear how many should be elected from the private sector.

Senator STEVENSON. Thank you, Dr. Henderson.

Dr. Vincent?

Dr. VINCENT. Thank you.

I think that perhaps the most unique comments that I can make as president of a small service company created primarily to use Landsat data for oil, gas, and mineral exploration would be along the line of letting you know how the existing system is affecting businesses that provide services for Landsat remote sensing.

The system that now exists is totally inadequate to support an industry in remote sensing, and I will give two examples to demonstrate this point.

First, I would like to call your attention to the fact that any computer tape of Landsat data which is not archived at the EROS Data Center takes us 2 to 3 months to obtain, which is considerably longer than what Dr. Doyle says is average. Now this presents a cash-flow problem for a small company, or even for large companies, I would presume. If the tape is archived at the EROS Data Center—and only a small percentage of the total Landsat tapes are archived there—it is possible to obtain it in something like 1 to 2 weeks.

Second, during this past year there was a 5-month hiatus in tape production. We were totally unaware that this was going to happen, because it was unannounced. The problem, I understand, resulted from a software changeover in the NASA/Goddard Space Center system. The hiatus produced the worst half-year financial period in my company's 5-year history. This type of thing would probably not have occurred if private industry had been in charge of data dissemination because no company could afford to withhold its major product from the market for 5 months.

These are my major reasons for believing that the existing system is totally inadequate. My opinion is that it will always be inadequate as long as it remains a Government agency function.

I feel strongly that the Earth data and information system called for in S. 663 should be come a function of private industry. Consequently, I would like to recommend that you omit the phrase "a function of a Federal agency, either as an independent agency or as a unit of existing agencies," from lines 22 through 24 of page 8 of S. 663.

I strongly support the user-charges section on pages 12 and 13 of S. 663, because I think it is important that the data dissemination company be self-supporting. I like the idea that the President of the United States would decide what type of corporation should disseminate these data, be it a Government-backed corporation or one or more existing corporations that would like to take over data dissemination.

In the minority staff working draft, I would like to draw your attention to lines 18 through 22, page 15, which restrict the value-added market of the Earth Resources Information Corp. to one wholly owned subsidiary. I would rather see such a corporation, if

it does come into existence, be restricted to a 20-percent ownership in any number of service companies. The reason I say this is because capital is very difficult to obtain for small businesses. If a Government corporation was formed which shared its available capital with only one subsidiary, that subsidiary would have a tremendous advantage over other service companies, just from the standpoint of working capital. Capital is needed in service companies, and 20-percent ownership by the Earth Resources Information Corp. is one of the ways that it could be provided.

In conclusion, I would like to say that I greatly appreciate the fact that you Senators are interested in moving this problem toward a conclusion. We cannot continue to exist as a remote sensing industry under present conditions, with two Government agencies involved in data dissemination.

I think the spectre of what is before us is that this may be the first high-technology industry ever to be spawned by the Federal Government, that is swallowed up again by that Government, which would be the most dangerous precedent I can imagine in business history. Thank you.

[The statement follows:]

STATEMENT OF DR. ROBERT K. VINCENT, PRESIDENT, GEOSPECTRA CORP.

As president of a small company that I founded for the purpose of utilizing satellite remote sensing data for remote sensing services, I am appreciative of this opportunity to testify on Bill S. 663 and its related Minority Staff Working Draft. I will begin by giving you a brief history of Geospectra Corporation's business operations over the past five years and demonstrating the need for a bill such as S. 663 for our industry. This will be followed by specific recommendations concerning both S. 663 and the Minority Staff Working Draft.

Without the launchings of Landsats I, II, and III, Geospectra would never have been created. In its five year history, our company has provided Landsat data processing and interpretation services on all the continents of the Earth, except Antarctica. Approximately 95 percent of our work has been performed for industry and foreign governments, and at least 90 percent of our work has involved Landsat data. Our clients have included five of the ten largest oil companies and two of the five largest mining companies in the world. We feel that our company has been a major transfer agent for remote sensing technology. Perhaps more than any other segment of the remote sensing community, companies such as ours may be the most important bellwether concerning the fortunes of existing and future remote sensing technology and its attendant institutions.

The most severe problem that our company has faced in the past five years have resulted from the non-operational nature of Landsat data dissemination and unfair, though inadvertent, competition by U.S. government agencies for remote sensing services, particularly involving work for foreign governments. Because two government agencies, NASA and USDI, are involved in the data dissemination train, it normally takes us two to three months to obtain a Landsat computer compatible tape for frames that have not yet been archived at the EROS Data Center. This presents us with difficult cash flow problems in even the best of times. Superimposed on these normal time delays are unscheduled delays in data handling that have proven to be the most severe problem of all. For example, there was a hiatus in Landsat computer tape delivered for five months of 1978 that was totally unannounced to the user community prior to its occurrence. This produced the worst six-months period in Geospectra's history and caused our fifth year to be the only one that did not show an increase over the previous year's revenues and profits. The government competition for remote sensing services has, in my opinion, resulted primarily from a lack of guide-lines concerning how government agencies should use this new technology for the assumed benefit of U.S. taxpayers.

For the remote sensing industry to survive and for this new technology to make a lasting beneficial impact on the world's resources, it is imperative that a bill similar to S. 663, with elements of the Minority Staff Working Draft, be passed by the Senate and House of Representatives. Furthermore, if the United States is to maintain its lead in this important technology, it is necessary that a bill such as this be passed as quickly as is politically possible.

I strongly feel that practically all of what S. 663 calls the Earth Data and Information System should become the function of private industry, outside the responsibilities of NASA or any other government agency, except for advice and consent on national security matters and scheduling of satellite launches. My reasons for this are four-fold.

First, industry's profit motive and competitive nature will assure better performance than any government agency or non-profit institution. What company would permit a complete loss of revenue for five months for such a small reason as software change-over, which NASA claimed was the cause of last year's tape delivery hiatus? Would not cash flow considerations likewise insure the delivery of satellite data tapes to the user community in a few days, rather than a few month's time?

Second, since the U.S. federal government is a large user of Earth resources data, it is a conflict of interest for a government agency to disseminate the data. A data dissemination company that is not itself a user of satellite data can prevent such things as this year's change in Landsat data format, which was dictated primarily by U.S. government uses of the data to the exclusion of the rest of the user community.

Third, the assignment of data dissemination responsibilities to NASA would be a corruption of their role as our country's leading scientific explorer. Even my small company has displayed pictures of the latest NASA photos of the satellites of Jupiter to maintain the image of U.S. technological supremacy in the eyes of potential foreign clients, who increasingly are being offered remote sensing services by non-U.S. firms. Asking NASA to maintain even overseer-type responsibility for satellite data dissemination would be like asking Daniel Boone to become a merchant.

Fourth, the American taxpayers already have too many civil servants to support. Were the proposed Earth Data and Information System to become a government agency, more civil service positions would likely be required.

S. 663 is a good bill which I believe would be strengthened by a commitment to make the Earth Data and Information System into a regulated, private corporation of the type described in the Minority Staff Working Draft. I recommend omitting the phrase "... a function of a Federal agency (either as an independent agency or as a unit of an existing agency): from lines 22-24, page 8, of S. 663.

I strongly support the user charges section on pages 12-13 of S. 663. It is important that the data dissemination company be self-supporting.

The Earth Resources Information Corporation described in the Minority Staff Working Draft is an acceptable prospect for the data dissemination company, with a minor change. Lines 18-22, page 15 of the Minority Working Draft should restrict the "value-added" market of the Earth Resources Information Corporation to a 20 percent ownership of any number of service companies, rather than permit it to own a subsidiary corporation for "value-added" services. This would enable the service companies to share in the government-aided capital funds, increase competition, and still allow the Earth Resources Information Corporation to share in the profits of "value-added" services. To keep this section as it is would place existing service companies at a disadvantage for raising capital funds. The idea in both S. 663 and the Minority Staff Working Draft that the data dissemination company should itself refrain from offering value-added services is laudable from the standpoint of fair play for existing service companies.

In conclusion, it is indeed heartening to this small company president from the hinterlands of Michigan that Senators Stevenson and Schmitt have so well recognized the need for this type of legislation and have taken the pains to seek our company's opinions on this matter. Remote sensing technology is working well from a technical standpoint and, with help from you in providing a better institutional framework for satellite data dissemination, I believe that scientists and businessmen in this field can improve the human conditions substantially, regardless of political boundaries.

Senator STEVENSON. Thank you, sir.

Mr. Fink, in addition to being a vice president of General Electric, you're the Chairman of the Space Applications Board, and I understand you've had some interaction with the administration in the process of considering an operational remote sensing service.

Is the administration getting adequate outside advice, in your opinion? Are the views of the private sector, including users and suppliers, being adequately considered? And, do you really think the administration is committed to an operational system?

Mr. FINK. Taking the last question first, Mr. Chairman, are they committed—I read Dr. Frosch's and Dr. Press' testimony, which made the statement that they are committed. I'd have to agree with Dr. McLucas that it's somewhat difficult for me to see how they can commit to an operational system via actions that may occur beyond the time of their own administration.

So the important commitment is the one that involves action by this administration. I guess we have a "commitment," but its depth does concern me.

So far as the advice of the outside world, industry and others, there is quite a bit of it provided to many parts of the administration via a host of sources. The Space Applications Board is a rather unique board in the National Research Council in the sense that it's comprised principally of users and people who interface with the using world for all sorts of space applications, not just remote sensing.

And we have just a few aerospace people on that board.

On the other hand, I have to say that the Board's communication is most heavy with NASA. And many of the issues that we're talking about really have to be addressed at a different level of government, OMB, and the administration itself.

And while we do communicate to some degree with them, it is not really what I would call a heavy interface.

Senator STEVENSON. Dr. McLucas, you suggested that Government should agree not to provide data products and services through its own systems, or release data obtained through defense or classified systems, in order not to compete unfairly with the private sector.

I have been hopeful that the classified sources would provide data for the civil sector, for the civil side I have been working to assure that intelligence and similar collection systems are being developed with a view to civil application.

We are doing that now on the Intelligence Committee. We've just started the development of these systems. We've studied the possibilities for civil applications. And many of the scientists we've consulted say that the potentials are significant.

That process is beginning somewhat tentatively. If I understand correctly, you're saying that we ought to foreclose any such possibility.

Wouldn't we be depriving ourselves of the use of this classified data and technology if we make the private corporation, at least at this point, the operator? And if so, do we also deprive ourselves of an additional benefit from tax-supported technology?

Dr. McLucas. This is a very complicated question you're dealing with, I think, Mr. Chairman. You'll notice in my bio sketch, I spent some time in the Pentagon and wrestled with this question for something like 7 years as to the extent and the best way to make the military products available to the civil side.

And I guess where I come out is that although there are some data gathered by the military that should be made available, the military shouldn't collect data in the first place if it is the type that ought to be made available to the civil sector.

Specifically, the reason for carrying out Defense Department collection activities is to be prepared for some kind of a military

contingency, or to know more about what adversaries are doing. Typically, the uses for data on the civil side are not in the same parts of the world. So if you say that military systems could be tasked to generate large data banks covering other areas of the world, that may be desirable. But you wouldn't get it free.

So there's that issue to deal with. And another one, it seems to me, is that the military wants to get as accurate data as they can, which drives them toward getting higher and higher resolution information. The foreign policy and national security implications of going for that higher and higher resolution data and releasing it are sort of a Pandora's box. We really don't know what would happen if we made a lot of information which is presently highly classified, available freely. This has many national security implications.

So I am led to the conclusion that a two-tiered system such as was recommended by the committee that was set up by Dr. Press a year or so ago, is really the only way to go. You need some data which is of high quality, the release of which may raise foreign policy implications and data of lesser quality, which can and should be made freely available. I think you can state fairly clearly what the dividing line between the two is.

Senator STEVENSON. Well, some of the data is just picked up routinely in the pursuance of the most traditional tasks for military and strategic purposes. But those purposes are also changing. We have strategic interests in the world's resources, and geographically, the interests focused in some of our collection efforts can change. The technologies are being revolutionized. It's not just a question of resolution.

Dr. McLUCAS. There is no doubt, Mr. Chairman, that the military can take excellent quality pictures of the whole world. I'm not sure whether you want the military to do that or not.

Senator STEVENSON. No. You're missing my point. I am not suggesting that the military ought to be tasked for commercial purposes. I am trying to suggest that the military and the intelligence tasks—for military and intelligence purposes—are going to acquire much more data than in the past that have civil purposes. The technologies that develop for these military intelligence purposes, which are heavily classified, not just for reasons of resolution, could be used for civil purposes. But you can't use them for civil service purposes if to do so is to disclose your existence and your capabilities. So it seems to me, at least for the interim, until some of these questions get sorted out, we're going to have to forgo the data and certain collection technologies, unless there is some way of integrating the technologies and the information in a way that protects classification and security, but still makes data available on the civil side.

Again, I can't see how that can be done through a private corporation. Maybe it can. Or, maybe we foreclose what I think is a significant opportunity on the civil side.

It's a difficult area to discuss because everything is classified, and most of those on the civil side don't know what it is we're talking about. But there are some who do.

Now let me throw out another aspect I raised with Mr. Pickering earlier. The world is changing. It's a highly unstable, highly inter-

dependent world. Colonies are gone. Nationalism is on the rise. Countries are proud of their sovereignty and fiercely protective. And in this case, it's not just communications; it's remote sensing. There are new jealousies and sensitivities and also new, powerful interest in resources. So how does the corporation also represent itself in the United Nations, in Tanzania, or at the U.N. Conference in Austria to sort out and negotiate a resolution of this very touchy political problem, including some in the Soviet Union?

Dr. McLUCAS. There's no doubt that what you say is a matter of concern. At the same time, I think, as Senator Schmitt has pointed out, that Comsat has been able to operate in international fora rather successfully. Typically, when we go to meetings, there are State Department people there. There are others carrying the flag of the United States Government, and we work very closely with those Government representatives.

Senator STEVENSON. That, Dr. McLucas, is why I emphasize the change. This is the 1970's. And that this is not communications. I think it's a very different set of facts.

Dr. McLUCAS. I agree that there are quite a few things that are different between Earth resources and communications.

Senator STEVENSON. And between the 1970's and the 1960's, when Comsat was created.

Senator Schmitt?

Senator SCHMITT. Mr. Chairman, thank you. I will just take a few moments. I have to make a phone call to a group of students about planetology.

I think the chairman has brought up a very important point on the question of is there available information that could be declassified in some form and utilized as part of an operational Earth resources information system?

I think it can. I tend to think, although I agree conditions have changed and there are differences between communications and remote sensing, major technical differences and market differences, I still feel that the process of declassification would have to occur anyway, wherever the operational entity is. And once that's occurred, it's just a question of who gets the information and what price do they pay in order to make use of it?

So I think that could be handled. I agree with the chairman's concern, but I think it can be handled under either concept.

The thing that has concerned me this morning with this panel, with a couple notable exceptions, the apparent reluctance of a number of panelists to deal with the private sector in this area. They seem to want to continue to deal with the Government, as they have for some time.

I don't fully understand some of the objections to S. 875. I think they're easily explained or easily modified. It just basically seems to be reluctant to deal with the private sector.

Dr. Fink, could you elaborate a little bit more on that? Would you have opposed the organization of Comsat in 1962 for comparable reasons?

Mr. FINK. Not at all, Senator Schmitt. And I really hope you haven't interpreted my comments as being opposed to the private sector participation.

I was basically opposed to the Comsat analogy. And as I pointed out to Dr. McLucas, I used Comsat with a small "c." Comsat is a company. Of course, it's an excellent company, and one that is a viable competitor for taking over the private role, whatever the private role might be in Landsat.

But I do think you're made an analog with the telecommunications business. In my estimation, it's not a good one.

Senator SCHMITT. That's not the analog, if I may interrupt. We're talking about a managerial analog, not a technological analog.

Mr. FINK. There were too many similarities in that bill to the Comsat bill for me to view it that way. But I did view it very much as a Comsat mode.

Senator SCHMITT. It was used——

Mr. FINK. It's the FCC, Senator Schmitt, that in part did that for me.

Senator SCHMITT. The point is for any kind of commercial operation, there's going to have to be a regulatory role, a refereeing role that exists for Comsat, whether it's the FCC or some other organization, independent or otherwise.

That's not as critical as I think the fact that you have to recognize some regulatory role exists if you went on that concept.

Mr. FINK. I don't believe that there are vast differences between you and any panelist. It seems to me that we're all trying to get private participation faster.

As a matter of fact, in both my statement, as well as that given by Mr. Stevenson, I think we all recognize the value of the chairman's submission and tried to get away from this waiting until the end of the period before turning it over to private sector.

I think each of us said that such transfer should happen right from the beginning to whatever extent we could make it happen.

So we're all anxious to get the private sector involved more heavily. The question is do we do it in one fell swoop by setting up a new corporation, or should it be done more gradually by private industry biting off pieces?

Remember: Everybody recognizes the fact that the private offering initially has to serve principally the large Government market. Nobody, Comsat or anybody else, is stepping up without recognition that the Government must get its act together, and essentially agree to purchase enough to make the initial entry viable.

That has to happen.

Senator SCHMITT. We recognize that. And so maybe I misunderstood. You have no inherent theoretical problem with dealing at some point with a corporately managed Earth resources collection and distribution of data system.

It's just a question of timing.

Mr. FINK. Exactly.

Senator SCHMITT. And the details of how that corporation or how the private entity would be set up—is that correct?

Mr. FINK. Exactly.

Senator SCHMITT. OK. It didn't quite come across that way in your testimony. I'm glad that's been clarified. And the chairman and I, I think, agree on that also. His bill makes allowances for that transition; mine makes allowances on the front end, namely, a

2-year period for setting it up and an indefinite period for the corporation to get its act together.

So I think, as I said before, I think we're going to be able to reach accommodation, conceptual accommodation on the ideas, and I appreciate those comments.

Mr. Chairman?

Senator STEVENSON. I just wanted to concur. I would like to see as much involvement as possible, and as early as possible by the private sector and still contemplate in whatever the interim period is, operation of the system in the private sector.

But my main interest is to get started. Because there are many problems—some we just mentioned, others, including pricing, we heard yesterday from State and local government representatives—it just seems to me that to get started, the system has to be Government-owned and operated. And as we go along, we can move under a congressional mandate toward operation by the private sector.

If that isn't clear enough in my bill, we could try to make it clearer that that's a desirable objective. So I don't think there's much disagreement here, and it's largely a matter of time.

Senator SCHMITT. Mr. Chairman, I agree with you. You propose a 7-year transition period; I propose a 2-year and then spell out the kind of corporate entity I think we could transition to.

Now the details of that are certainly arguable; otherwise, we wouldn't be having hearings.

I think that clearly we could work it out and maybe all we have to do is agree to a 4½-year transition period and we'll spend the first 2 years figuring out what kind of corporate entity we ought to transition to.

But there are a number of ways to work out the compromise, and I think this testimony has been particularly useful, particularly the last comments—that there really is no inherent reluctance to deal with the private entity. It's just a concern and an uncertainty about how do you get from here to there.

But everybody agrees, except for the administration witnesses, that we ought to act now. And, Mr. Chairman, I feel that way. It's time. We've studied this thing to death. Anybody who's been involved in the business for any length of time at all believes that we've been at dead center for many, many years. And it's really not going to change much until we force the issue of operational systems, develop those markets, find out what really is viable, what you can do if you accelerate the rate at which the data is available, and move those kind of 5-month uncertainties that would crop up, and to determine just what the cost, the real value of the product is going to be.

Clearly, that's important to do it.

Senator STEVENSON. Do you have anything further at this point?

Senator SCHMITT. No.

Senator STEVENSON. I also think after hearing the testimony from the administration, that the only way we'll get it to act, is to act ourselves. That means reconciling what differences there are in our proposals and report a bill soon from the Commerce Committee. We could withhold action on the Senate floor for a month or two until the administration acts. But the only way to get the

administration to act is to present them with a clear-cut alternative. If they're cooperative, well, some positive agreements can be worked out this fall. We've waited a long time already. I think it would be irresponsible for us to wait any longer.

The Congress, in a sense, is ready, and the institutional problems, at least in the interim, should not be very difficult for anybody to resolve.

We ought to go ahead. And if they want to join us, they'll have a chance to do so. If they don't, then the Congress will have the opportunity to act early in the next session, at the latest, and I'd be very surprised if it didn't.

Senator SCHMITT. Mr. Chairman, I think the intent of the subcommittee is clear. I certainly concur with those remarks to move as rapidly as possible and to keep their feet in the fire over there.

I would ask before I run here that if the four panel members other than Dr. McLucas would provide for the record, if they have the time and information, the comment on the McLucas Comsat alternative that you discussed, I think it would be useful to have your comments on that, which most of you did not address. Thank you, gentlemen. I'm sorry I have to run.

I appreciate your testimony.

Senator STEVENSON. Dr. Henderson, would you elaborate on the relation of proposed data from SPOT and that of Stereosat? Will SPOT reduce the market for Stereosat data and effect your earlier conclusions about Stereosat's value?

Dr. HENDERSON. There's no question, Senator, of that. However, Stereosat is a big system which will provide us with a worldwide data base over a 3-year period. The SPOT program is going to be more selective.

Speaking of obtaining Stereosat-related data marriageable with Landsat, Stereosat is directly convertible with Landsat and has Landsat's orbit. It's designed to create this data base.

The French data will be very valuable also. The intent of their proposal, as I understand it, is to determine how much of the world countries would like to see in stereo, that they could get by inserting that in their worldwide program.

In other words, they have 3 years to decide that also, but it doesn't get stereo except by flying on more than one orbit. It has to be programed to do that. And they have other priorities, and ours is not necessarily number one on their list.

But if that grows to be a large requirement, and perhaps it will become that, we're trying to poll our companies to find out, so to speak, what they want.

Also, right now, it's going to be at least a year before Stereosat, unless something dramatic happens. There is some overlap, but they're different band—width bands.

We tend to view this as another system to try to get worldwide coverage in stereo that has different bands, that would be interchangeably used with Landsat imagery.

That's an important point.

There are some who would just use it as—they would buy one or another, whichever is better. But neither of these systems is going to give worldwide coverage. So it's an advantage to get more data and coverage.

So I think it's an important consideration. I don't think it will diminish the value of either system, and we support both of them, or at least support getting the data from them.

Senator STEVENSON. Thank you, gentlemen. It's been very helpful. It was a good hearing.

The subcommittee is adjourned.

[Whereupon, at 12:10 p.m., the hearing was adjourned.]

ADDITIONAL ARTICLES, LETTERS, AND STATEMENTS

STATEMENT OF DR. BRUCE FRIEDMAN, CHAIRMAN, DISTRICT FIVE ENERGY COMMITTEE OF B'NAI B'RITH

The Landsat experimental program has proved its value as a remote sensing satellite system for obtaining earth resources information. It is thus appropriate and urgent that an operational earth resources information service should be established now. The District Five Energy Committee of B'nai B'rith has evaluated both bills, that of Senator Stevenson and that of Senator Schmitt, which have the objective of establishing such an operational system. B'nai B'rith prefers the legislation of Senator Schmitt and strongly desires that this legislation be enacted as soon as possible.

The District Five Energy Committee of B'nai B'rith sincerely appreciates this opportunity to present its views concerning the proposed legislation to establish an operational remote sensing satellite system. District Five of B'nai B'rith comprises the Washington, D.C. area, Maryland, Virginia, North Carolina, South Carolina, Georgia, and Florida.

The author of this testimony finds it to be a source of wry humor that while Senator Stevenson and Senator Schmitt are so eagerly (and B'nai B'rith believes this eagerness to be completely justified) urging taking the experimental Landsat program of the National Aeronautics and Space Administration (NASA) into an operational framework, many members of the electorate of the United States of America, even quite possibly most of this electorate, are unaware of the existence of the Landsat program and what this program has accomplished and continues to accomplish. Lacking knowledge and understanding of the on-going work on remote sensing satellite systems, this part of the electorate cannot comprehend the great value an operational system would have for the life of every citizen in many basic ways. This thought was in the mind of the author as he perused the Washington Post on the very day, Saturday, March 24, 1979, that he commenced to write this testimony. As he read this newspaper for that day, he looked at a number of articles from the point of view as to how remote sensing satellite system capability could aid in remedying the situation reported on in each article. Let us, first, summarize these articles.

On the first page, the headline, stretched across the entire width of the sheet, reads "Prices Rise 1.2 percent, Biggest Leap in 4½ Years." Under this headline, the article by John M. Berry carries the subtitle "Food, Gas, Home Costs Cited." According to this article, consumer prices in this nation went up at a 15.4 percent annual rate in February 1979. Alfred Kahn, the advisor to President Carter on inflation referred to the 1.2 percent rise in February 1979 in a dissatisfied manner. Officials of the Administration of President Carter said food prices would be rising more slowly in the second quarter of 1979. Kahn also stated that the acceleration of inflation in December 1978, January 1979, and February 1979 was due to a large extent because of the food, oil, and gasoline price increases, with the Organization of Petroleum Exporting Countries (OPEC) being mainly responsible for the rises in the latter two items. In December 1978, January 1979, and February 1979, gasoline retail prices went up at a 25 percent annual rate. With regard to the 1.6 percent increase in food prices in February 1979, 57 percent of this increase was due to higher values obtained by farmers for their products, 35 percent was due to higher marketing costs, and 8 percent was accounted for by higher costs for fish and imported foods.

Art Pine has an article on page A4 entitled "Economy Dilemma: Few Options" which article is an attempt at analyzing the inflation problem which is facing the nation. Pine strikes a somewhat pessimistic note. The proposal of Treasury Secretary W. Michael Blumenthal that inflation be further attacked by a more restrictive fiscal policy, a policy which translates as trimming of new proposals for the 1980 federal government budget, is emphasized in this article. Pine notes that even if this restrictive policy were to be adopted it would take several months for the impact of this policy to be felt by which time the nation could be in the midst of a recession and this type of fiscal restraint would not be wanted.

On page A9, is an article by Thomas O'Toole "2 Coal States Allied in Funding Struggle Over Synthetic Fuel". This article describes how Kentucky and West Virginia are cooperating to get funding from the Department of Energy and the Office of Management and Budget for synthetic fuel plant in both of their states. The Kentucky approach is to take high sulfur content coal and convert it into a solid fuel that contains neither ash nor sulfur while the West Virginia approach starts with low sulfur coal and converts this into liquid fuel. The West Virginia process produces gasoline as a by-product. There is a good chance that both projects will be approved.

Two articles, one by Gary De Loss on page A5 entitled "A Solar Tax Credit With a Serious Flaw" and one by David F. Salisbury on page E25 entitled "What Counts For a Solar Tax Credit?" deal with the housing aspects of solar energy. The first article deals with the fact that the Energy Tax Act of 1978 grants tax credits only to those people who purchase solar water heaters but not to those who lease or rent such heaters. De Loss contends that this is a regressive subsidy which is of benefit to only a small part of the public, namely, primarily, well-to-do homeowners. The second article notes that solar tax credits are to be given only for active solar systems such as solar water heaters and not for passive approaches such as the use of thick, heat-absorbing walls. Salisbury reports that a number of people including Senator Gary Hart of Colorado are working to change this situation.

The Washington Post articles just described are thus seen to deal with such areas as the economy, inflation, energy, food, and the environment, all of which areas are of great importance in the everyday life of everyone of us. The experimental Landsat program of NASA has already demonstrated its utility of benefits in these areas and others. These benefits from the Landsat program will be detailed in the course of this testimony. It seems appropriate, however, at this point before discussing these benefits and presenting the case for moving on to an operational system now, to first describe just what Landsat is and how it operates.

The first Landsat was launched on July 23, 1972 into an orbit 492 nautical miles above the earth and makes one revolution of the earth every 103 minutes, completing about 14 orbits in 24 hours. When this satellite was still in operation, its sensors covered a swath of about 100 nautical miles on each orbit, with each orbit being separated from the next by about 26° at the equator. Over a period of about eighteen orbits the Landsat sensors will have essentially scanned the entire world and the process repeats. The satellite is in a sun-synchronous orbit, that is, the orbit is such that the satellite is situated over designated areas for observation at time of satisfactory illumination.

The first Landsat is a modification of the Nimbus weather satellite design. The Landsat weighs about one ton and has two solar cell panel arrays to provide energy, in conjunction with eight nickel-cadmium battery modules for the onboard equipment. The attitude control subsystem is located in the upper section of the spacecraft, while the sensor systems are situated in the lower portion of the satellite. There are two sensory systems, one being a multispectral scanner and the other being a television camera system composed of three units. The optical mechanical multispectral scanner utilizes four spectral bands, namely those bands situated between $.5$ to $.6 \mu$, $.6$ to $.7 \mu$, $.7$ to $.8 \mu$, and $.8$ to 1.1μ . The first two bands are green and red, respectively, while the latter two are in the near infra-red. The return beam vidicon camera system generated data in three spectral bands, each band coming from a separate camera, one band being between 0.475 and 0.575μ (blue-green), the second band being between 0.580 and 0.680μ (green-yellow), and the third band being between 0.698 and 0.830μ (red and infra-red). This camera system utilized a picture frame having more than 4,000 lines as opposed to the commercial television system which utilizes about 500 lines.

All of the satellites in the Landsat series which have been orbited to date are equipped with a data collection system, in addition to the multispectral scanner and television camera systems, that relays data from remote automatic data collection platforms to ground stations when the satellite can simultaneously view a platform and any one of the three United States ground stations which stations are located in Greenbelt, Maryland, Goldstone, California, and Fairbanks, Alaska. The Landsat data collection system comprises remote data collection platforms, satellite relay equipment, ground receiving site equipment, and a ground data handling system. The investigator or user agency chooses sensors suited to its own needs that are connected to the data collection platforms. These platforms monitor such factors of the local environment as temperature, stream flow, snow depth, and soil moisture. These platforms in turn send the sensor data to the Landsat which spacecraft relays the data to a receiver on the ground via an onboard receiver and transmitter. Upon its receipt at the ground site, the data is decoded and formatted for transmission to the ground data handling system at Greenbelt, Maryland. When the data arrives at

the Operation Control Center in Greenbelt, it is reformatted and transcribed on magnetic tape and then either transmitted direct to the user or forwarded to the information processing facility at the Goddard Space Flight Center in Greenbelt for the additional processing and cataloging which is required for dissemination to the user agencies. Within twenty four hours after the sensor measurements are relayed by the satellite to the ground, the data from any platform is available to the user.

The second Landsat which was launched January 22, 1975 is similar to the first satellite. However the third spacecraft, Landsat-3, which was launched on March 5, 1978 incorporates some significant improvements. This most recent spacecraft utilizes two panchromatic television cameras that produce two adjacent images of a given scene instead of three spectral superposed images as are produced by the camera systems of Landsat-1 and Landsat-2. In order to provide increased ground resolution for area mapping, the Landsat-3 cameras cover about half of the area on the ground as do the camera systems in the earlier satellites. Each of the two cameras has a broadband spectral response of 0.505 to 0.75 μm which covers the spectrum from green into the near infra-red. Response to a fifth special band in the thermal infra-red region between 10.4 to 12.6 μm was incorporated into the scanning system by including two additional detectors. This new band allows Landsat-3 to be used for urban land-use identification by determining temperature differences between human artifacts and natural objects, for observing temperature gradients in the water discharges from power plants, for determining primary heat sources in the urban environment, and to make other studies that are not possible with the earlier Landsat scanning systems.

In going from the first two Landsat systems to Landsat-3, a number of changes have been made in the information processing facility at the Goddard Space Flight Center. For example, the original 70-mm film used for recording the television and scanner systems data is now replaced by high density digital tape. Before recording the data on tapes, radiometric and geometric corrections are made for this data. These digital tapes are then used to produce all of the film and computer-compatible tape products for the users. (The author used information from a 1977 NASA publication "Application of Remote Sensing to the Chesapeake Bay Region" and the book "Remote Sensing: A Better View" by Robert D. Rudd for the description of the Landsat system.)

It is now suitable after this brief outline of how the Landsat system works to return once more to those stories in the Washington Post. It was noted in the first article by Berry that food and energy price increases are a major factor in the inflation problem. By sampling some of the available Landsat literature it will be seen how this satellite technology can be of aid in alleviating the situation.

In the proceedings published by NASA entitled "Symposium On Significant Results Obtained From the Earth Resources Technology Satellite-1" which symposium was held at Goddard Space Flight Center on March 5-9, 1973 the value of Landsat was seen to emerge clearly quite shortly after the first launch. (The first Landsat was originally named Earth Resources Technology Satellite-1.) A large number of reports at this symposium dealt with agriculture, forestry, and range resources.

At this symposium, Williams, Morain, Barker, and Coiner reported that they had successfully identified winter wheat over a test area in Finney County, Kansas, basing their conclusion upon data supplied by the scanners. Using a 56,612 acre sample, they correctly classified 89 percent of the acreage as wheat or non-wheat with estimated wheat acreage being 99 percent of the actual acreage of wheat in the designated area. Johnson and Coleman demonstrated that they could detect a crop recently introduced into the Imperial Valley of California by using successive images from Landsat-1. They felt that this result was of great value to the agencies supplying water to the valley, results which would also be valuable to packers, shippers, market specialists, and loan bankers. Horton and Heilman performed a digital analysis on Landsat-1 imagery for an area of southeastern South Dakota upon which area was being grown corn, soybeans, and oats. In one set of their data, they were able to discriminate between fallow land, corn, and soybeans with greater than 90 percent accuracy. Sagredo and Salinas of the Polytechnic University of Madrid identified large masses of citrus fruit and rice fields in eastern Spain. Anderson, Shapiro, and Belon used Landsat-1 imagery to perform vegetative mapping of the western Seward Peninsula. Their investigation resulted in the determination that seven major vegetation types exist in that area, although previously used techniques had revealed only four types. The detail from the Landsat-1 data was also an improvement over the detail shown on the then existing maps. Tueller and Lorain used Landsat-1 imagery to inventory crested wheat grass seedlings over the entire state of Nevada. They reported that most of the data for this inventory and other inventories that they were pursuing was unavailable from what they termed conventional sources. Parks and Bodenheimer used Landsat-1 imagery to

accomplish the delineation of a major soil association in the loess region of Obion County, Tennessee. They felt that their results showed the feasibility of delineating major soils through common vegetative cover characteristics of the soils involved. Bizzell, Wade, Prior and Spiers of the Johnson Space Center reported on their analysis of the multispectral scanner data from Landsat-1. Their results showed that even with this early Landsat technology it was possible to identify and to determine the extent of agricultural lands and field crop types. Baver and Cipra used computer processing of Landsat-1 multispectral scanner data to successfully classify corn and soybeans in the counties of Dekalb, Lee and Ogle in northern Illinois. Baumgardner, Kristof, and Henderson utilized a computer analysis of Landsat-1 multispectral scanner data to identify such features in Lynn County, Texas as row crops, unimproved and improved range-lands, bare soil, hydrologic characteristics, and major geologic and soils features.

Draeger in his symposium paper pointed out why Landsat data is so valuable to agriculture. There is a need, he notes, for regional, national, and global inventory and evaluation data. Because of the particular capabilities of the Landsat system, this system offers special promise in this area where important benefits could be realized by the use of this technology. It appeared to Draeger that the principal obstacle, and at the very least a very significant one, to supplying enough food for the global population is the problem of allocation and distribution.

In order to intelligently allocate and distribute food, it is necessary to know the location and quantity of the food now in being and to ascertain the temporal fluctuations involved with crop production. Until the arrival of Landsat upon the scene, taking an agricultural inventory required an enormous amount of effort on the part of earthbound enumerators, with a concomitant amount of data compilation being required. However, a remote sensing Landsat system wherein large land areas can be entirely surveyed in one image and by which a relatively small number of images can supply global coverage, offers great promise by greatly reducing the magnitude of the task confronting enumerators to date. In addition, since agriculture is not a static occupation, but is indeed a dynamic one, being confronted continuously with such factors as the growth, life, and death of crops, updating of knowledge of conditions is always required. This means that a Landsat system, which system can supply regular and frequent observations of local conditions can supply a service which would be infeasible using conventional techniques.

One more example, and also an example more recent than those published from the 1973 symposium, of the utility of Landsat data for agriculture appeared in 1977 in volume 6, number 4, of the periodical "Remote Sensing of Environment." In this article, Heilman (who contributed to the 1973 symposium in a paper previously mentioned in this testimony), Kanemasu, Bagley, and Rasmussen evaluated soil moisture and the yield of winter wheat for a five state region of the Great Plains with the aid of Landsat estimates of the leaf area index. Soil moisture availability is a major factor in determining the growth and yield of wheat in the Great Plains. This study demonstrated that satellite data can be validly used to evaluate soil moisture conditions and the growth of winter wheat since the predicted yields from the 22 sample segments agreed favorably with the average county yields estimated by the Statistical Reporting Service.

Enough has been said about agriculture. Let us now consider another factor in the inflationary situation namely energy, and see how Landsat can improve the posture of this nation with regard to energy. One way is to use the system to determine where fuel lodes and deposits are located within the earth. In the proceedings of the 1973 symposium held at Goddard Space Flight Center, Saunders and Thomas presented a report wherein they discussed the use of Landsat-1 imagery for applicability to searching for petroleum and other resources. Using the satellite photographs for lineament and geomorphological evidence they were able to define the petroleum-productive Central Basin Platform of West Texas. They also noted that in the vicinity of Hobbs, New Mexico the loss of platform identity and the change in oil production coincides well with the sudden trend change in lineaments and fracture traces. There are, of course, other mineral resources other than fuel which have significant roles in the energy picture. In the April 1978 issue of "Remote Sensing of Environment," Smith, Green, Robinson, and Honey, reported on the use of Landsat-1 imagery to explore Keweenaw-type copper deposits in the Hamersley Basin of Western Australia. Copper is a commercially important electrical conductor. The Australian researchers concluded that the Landsat approach is a very rapid technique for assessing the alteration character of part of the north side of the basin over a strike length of 350 km, providing information that had not been apparent from aerial photography of that region. Also, under favorable circumstances individual layers of hydrothermal alteration can be distinguished within a pile of lavas and this is particularly pertinent as a step in the search for hydrother-

mal mineral deposits. Landsat data can be used to search for many other mineral resources other than oil and copper.

A major area of Landsat use is that which deals with the environment and the pollution of that environment. Again, the proceedings of the 1973 symposium indicate even early in the state of the technology development how valuable Landsat is for environmental studies. The first paper in the environmental section of these proceedings, by Wier, Wobber, Russell, and Amato, is particularly interesting because it shows how Landsat imagery can be used to improve mine safety in underground coal mining by mapping fractures. They also found that this imagery could do a good job of plotting the area of strip mining of coal and concluded that Landsat coverage would provide an excellent monitoring system to map a new strip mining area on a periodic basis. Chase and Pettyjohn used Landsat to investigate the environmental impact of coal strip mining in eastern Ohio. The satellite data allowed them to prepare a disruption map which map shows recently mined and unreclaimed earth and the standing water found in the mined area. Alexander, Dein, and Gold utilized the satellite multispectral scanner data to map coal strip mines in Pennsylvania. By using digital processing of this data they were also able to ascertain the pattern of acid drainage from these mines. Gilbertson was able to locate and identify mine dumps in South Africa and to ascertain patterns of vegetative growth associated with these dumps via the utilization of Landsat data. Cope-lands, Bandy, Kindle, Blais, and Hilton, photogrammetrically and densitometrically examined Landsat multispectral scanner data to demonstrate the feasibility of this approach when coupled with other data to identify and survey smoke plumes from fixed particulate emitters. Wightman demonstrated that sequential Landsat imagery for southern Africa provides information needed to detect and map grass fires and to observe their rates of spread in this area during the late dry season. Anderson, Carter, and McGinness concluded as a result of their study that Landsat can provide an excellent tool for many types of coastal mapping. Using test sites in Chesapeake Bay, Maryland and Ossabaw Island, Georgia, they were able to determine the upper wetland boundary, the wetland drainage pattern, plant communities, agricultural ditching activities, and the formation of lagoons from water-side home development.

Of particular interest to the author of this testimony, since at the time of this writing of this testimony he resides in Annapolis, Maryland, is the application of Landsat data to the study of the environment and geology of Maryland and the Chesapeake Bay area. At a conference held at Coolfont Conference Center on April 12-15, 1977 and jointly sponsored by NASA, the Environmental Protection Agency (EPA), and the University of Maryland, some early results from Landsat applied to the Chesapeake Bay region were presented. The proceedings of this conference were published by NASA under the title of "Application of Remote Sensing to the Chesapeake Bay Region." James Manley of the Regional Planning Council of Baltimore, Maryland reported at this conference on the use of land cover data obtained from Landsat sensors to aid in water quality planning. Kenneth N. Weaver noted in his paper that features such as fold culminations, linear belts of geologic units, and contacts between geologic units in local areas could be discriminated with the aid of Landsat data. Also, he remarked, mining activities in Maryland have been mapping by utilizing digital data processing of Landsat computer-compatible tapes. Edwin L. Thomas of the Maryland Department of State Planning in Baltimore, Maryland reported on the Maryland Automated Geographic Information (MAGI) System and remarked that in 1975 his department published a report with the title "Investigation of Application of ERTS-1 Data To Integrated State Planning in Maryland" which report discusses the potential for interfacing remotely sensed data with the MAGI System.

Another example of the use of Landsat multispectral scanner data to observe the environment is given by Strong in the volume 7, number 1, 1978 issue of "Remote Sensing of Environment." In this case, Landsat observed chemical precipitation of calcium carbonate or whiting in the Great Lakes and Stron concludes that this phenomenon can be monitored by Landsat.

Now look back again at those summaries of articles from the Washington Post. Now the reader of this testimony can see why these articles brought to mind how an operational remote sensing satellite system could do so much for the people of this nation. This system can improve the food status of this country by helping to inventory crops, and even help promote the procurement of fish from the aquatic environment. It can help the farmer by letting him know how his crop is growing and supply necessary information to let him figure out why his crop is growing the way it does. This remote sensing system can help determine where all sorts of mineral resources, such as coal, are located. It can help make life easier and safer for those people whose job it is to procure these minerals. This system can aid in

determining the impact of human activities upon the environment such as might occur when coal is burned by keeping track of pollutants, and if this coal is instead converted into other types of fuel the system could determine how the process and the by-products of the process interact with the ecology of the vicinity of the conversion plant. With regard to those two solar energy articles, a remote sensing satellite system certainly cannot decide whether or not tax credits should be given in a particular situation or even change the existing tax structure but it should certainly eventually be able to supply the businessman and homeowner with the information needed as to what solar energy approaches, active or passive, or mix of approaches is most suitable for the particular circumstances.

Beyond these Washington Post articles and the uses of Landsat that have so far been mentioned in this testimony, an operational remote sensing satellite system will be able, among many other applications to give the urban planner information as to how a city is developing and provide information necessary to improve the health of the modern city. The article by Art Pine in the Washington Post analyzing the economic situation is far too pessimistic and this article reflects an ignorance of how the advance of the human frontier into the space beyond the earth can supply, in the very near future, services and products to add to the productivity, hence fighting inflation, of the people on this planet.

However, the Landsat program as an experimental development can only provide just so much. The infrequent launches and the limited sensor capabilities still leave much unanswered. Federal and State agencies and private enterprise organizations are reluctant to put money and personnel over the long term into operations that would make the most of data from space since it would always be possible for this experimental program to be terminated at the whim of some Federal government officials. Putting the remote sensing satellite program into an operational framework would simultaneously lead to improved services from the space-borne part of the operation while expanding the size and capabilities of the ground processing facilities and simultaneously lead to a build up of their own facilities on the ground by the various user institutions.

The June 1978 report, "State and Local Perspectives On A Landsat Information System" which was prepared by the National Resource and Environment Task Force of the Intergovernmental Science, Engineering and Technology Advisory Panel (ISETAP) gives a detailed picture of how state and local governments perceive Landsat and the further steps to be taken in the remote sensing satellite area. The Task Force states that Landsat is an important technology that is making and can continue to make significant and often unique contributions to the management of natural resources by state and local governments. The state governments use Landsat for land cover inventory for resource management, water quality evaluation and planning, inventory of wild-life habitats, lineament mapping, surface water inventory, mapping and damage assessment for flood control, crop and forest inventory, and geologic mapping.

The Task Force, however, finds a number of hindrances to the utilization of Landsat by state and local governments. These hindrances are the lack of a federal commitment to be continuity and compatibility of data, delays and uncertainty in getting data from the ground system, inadequate technical assistance from the federal government, lack of coordination among federal agencies, prevention of states by federal agencies to use federal funds for Landsat processing, lack of state involvement in the decision making process for Landsat planning and operation and federal government ignorance of the nature and operation of state and local agencies.

The Task Force recommends that the federal government make a commitment to the continuity and compatibility of data, support the Landsat information system, make a commitment to involve the states in the decision-making process, define federal agency responsibilities, and provide a comprehensive technology transfer program which is continuous. Further, a more advanced data processing and delivery system should be established.

In a report for NASA entitled "Space Industrialization" published in 1978, Science Applications Incorporated (SAI) summarized two studies, one by Earth Satellite Corporation and one by ECON, Incorporated, relating to the potential benefits in the area of land and water resources from a regular Landsat system. The Earth Satellite Corporation study assumes a two-satellite system. This study looks at benefits to be accrued from such a system in the period from 1977 to 1986, said benefits being annualized to give a steady benefits stream. In their report, SAI assumes that the revenue would equal the level of benefits. The probable annual benefits, expressed as a range of values, are listed for various applications. The results are (the figures in parentheses are the range of values in millions of dollars for a year) agriculture production (1.7-3.9), water resources management (3.9-12.2),

rangeland management (5.2-22.8), forestry (0.8-2.9), land use planning and management (9.7-17.2), geological mineral resource management (0.1-0.6), and marine resources and ocean survey (0.5-1.1), for a total of \$21,900,000 to \$60,700,000. The ECON, Incorporated study yields a significantly greater value for the benefits. The results are, for a typical year (1986), agriculture (252.5-554.5), forestry, wildlife, and range (62.2), inland water resources (57.2), land use (53.5), minerals and fossil fuels (1.6-3.9), atmosphere (1.5-10.5), and oceans (1.75-4.25) for a total of \$430,000,000 to \$746,000,000. The benefits that SAI reports can only appear, however, with an operational remote sensing satellite system. In any event, the applications of an operational system will tend to grow with time as new uses develop.

It is appropriate at this juncture to consider the legislation of Senator Stevenson and that of Senator Schmitt to bring the Landsat program from an experimental state to being an operational proposition. The major difference between the two bills is that Senator Stevenson desires that Landsat undergo a transitional stage as a part of NASA while Senator Schmitt would like to see it become operational immediately by utilizing the medium of a corporation, which corporation would be patterned along the lines of the already existent Communications Satellite Corporation (Comsat).

Now, B'nai B'rith sees considerable merit in the idea of a transitional stage by the end of which stage a decision could be made as to the most suitable form for an operational entity to take. It is possible that a Comsat style corporation might not be the best form for a permanent Landsat operation to take although B'nai B'rith feels now that the Comsat approach is most likely correct. However, in order to determine whether or not an interim phase is desirable, it is necessary to consider the legislation of Senator Stevenson and that of Senator Schmitt in the context of the entire space program and the attitude of the electorate to this space program. Many people, perhaps even most people, wish to maintain the NASA budget at its current level and perhaps even reduce this budget because they see no great value to space exploration and industrialization. All that matters to some people is keeping the nose to the grindstone and concentrating on the here and now. "Let the future take care of itself," say these people.

B'nai B'rith, on the other hand, feels that space represents an unused resource, an environment that can provide new products and services and new sources of wealth for the people of the world and those who will eventually be living in the extra-terrestrial domain developing this resource both for themselves and for the earthbound. Humanity lives now on a globe of finite extent and limited resources and within an environment that can withstand just so much impact from human activities. Expansion of the realm of humanity beyond this planet increases the options available to humanity and provides opportunities both for the individual and for the nation which cannot even be imagined at this point in time. If the nation surrenders to the political mythos expressed in the phrase "fiscal restraint" then this country is selling its birthright for less than a mess of pottage. Even if "fiscal restraint" is looked at simply from the point of view of combating inflation, this approach is considered by B'nai B'rith to be a highly suspect way of combating inflation. The author of this testimony has seen the view expressed that if the federal budget were to be reduced enough to have any significant effect on inflation, the increase in the unemployment rate would be so large as to be generally unacceptable and the result would be figurative suicide for those responsible for the situation. Money spent on welfare programs, although it is the moral and proper thing to do and B'nai B'rith completely supports this sort of spending, is essentially having an inflationary effect because it gives money to those who cannot contribute to the productivity of the nation. Spending on science and technology is essentially anti-inflationary because these endeavours enhance the productivity of the nation. It is necessary to invest money in activities that enhance the productivity of the nation because these activities supply wealth to support activities such as welfare.

Because the promise of space industrialization is so great, B'nai B'rith strongly advocates significant and continued increases in the civil space program budget. Specifically, B'nai B'rith urges that this space budget be increased by 20 percent each year for the next ten years. B'nai B'rith fears that with the current political climate to keep the total NASA budget at its current level, attempts would be made to get the increase in funding required for an interim remote sensing agency within NASA by taking away funding from other, equally worthy NASA programs. This business of "robbing Peter to pay Paul" is less likely to happen if an operational entity is organized independently of NASA as Senator Schmitt proposes although using NASA personnel and facilities wherever necessary to carry out the objectives of this remote sensing satellite corporation. B'nai B'rith feels that the Comsat-type of organization that Senator Schmitt envisions will have sufficient flexibility in its structure and its operations to remedy any defects that might appear in the organi-

zation in an evolutionary manner. Consequently, B'nai B'rith prefers the legislation of Senator Schmitt to that of Senator Stevenson.

The argument has been heard that taking the experimental remote sensing satellite program and making it into an operational entity now would halt any further research and development on the system now and freeze the technology involved into its current "Model T" stage. Upon perusal of the bill of Senator Stevenson and that of Senator Schmitt it is readily seen that this argument and fear is completely unjustified. In the bill of Senator Stevenson, the Administrator of NASA is to make recommendations for a continuation of research and development by NASA on the various remote sensing components and other systems required for both the ground and the space portions of the operation. In the legislation of Senator Schmitt, NASA is directed to cooperate with the corporation to an extent which is considered appropriate by NASA taking into account the public interest. Further, in the bill of Senator Schmitt, NASA, is directed to aid in the conduct of the research and development program of the corporation itself by supplying to the corporation, upon request, on a reimbursable basis, those satellite launching and associated services that NASA considers necessary to most expeditiously and economically develop the Earth resources information service of the corporation.

The nation does have one example of a civil space research and development program being turned into an operational commercial system. That example is Comsat. Turning communications via satellite into a commercial proposition certainly did not freeze the technology of the state-of-the-art, at the inception of the corporation, into the operations of Comsat. Comsat was started on the basis of knowledge obtained, for example, from the passive Echo communications satellite and the first active communications satellite Telstar, but the satellites that Comsat now utilizes are far more sophisticated and have far more capabilities than those early developments. The same is true for the ground facilities of Comsat. The history of Comsat solidly buttresses the statement of B'nai B'rith that to make remote sensing satellites operational now, would in no way hinder further and continuing research and development in this area, but that this operational status would indeed serve as a stimulus to research and development and move this research and development to a higher plateau of activity.

B'nai B'rith believes that the creation of an operational remote sensing service will stimulate the development of spacecraft far more sophisticated than the current series known as Landsat with these new generation of space craft utilizing a greater range of sensors than does Landsat. These new sensors would include active types in addition to the passive sensors that have been used on Landsat. An example of this type of sensor has already been tried out on the Seasat-1 spacecraft orbited on June 26, 1978. The Synthetic Aperture Radar (SAR) system of Seasat-1 operated effectively over both the land and the ocean, according to the January 1, 1978 issue of *Reflections*, although SAR was designed mainly for gathering information about the ocean surface. Initial results from SAR, with an estimated resolution of about 80 meters, included striking scenes of Baja California, the central Appalachians, and the Beaufort Sea and demonstrate the utility of SAR to, among other users, geologists, cartographers, and land use specialists.

As an example of what could be done right after the last of the Landsat series, Landsat-D (scheduled for launch in 1980), is the earth observation platform described in the 1978 Rockwell International (RI) report for NASA entitled "Space Industrialization." This platform would initially be part of the research and development program of the satellite remote sensing service corporation as this corporation is conceived by Senator Schmitt and then be incorporated into regular operations. The platform would have a greatly increased spectral capability as compared to Landsat-D because the platform would have three thematic mapping installations, two multispectral camera locations, and two return-beam vidicon equipment locations. (A thematic mapper is an advanced type of multispectral scanner.) The platform would be launched by the space shuttle and the platform would weigh considerably more than Landsat-D. Although the platform would utilize space-tested equipment from the landsat spacecraft series, improved data handling, recording, solar array power generation and attitude control subsystems would all contribute to a significant increase in the mean-time-between-servicing and multi-frequency information retrieval capabilities.

B'nai B'rith is confident that an operational remote sensing satellite system, as opposed to merely an experimental program, will lead more quickly to the realization of such possibilities in remote sensing satellites as are discussed in an article in the March 26, 1979 issue of *Aviation Week and Space Technology* magazine. In this article, one spacecraft mentioned is the geosynchronous earth observation system (GEOS) which system would use a three-meter resolution large telescope to allow rapid looks of the earth for disaster assessment in optical wavelengths. GEOS could

prove to be a very useful device in such a situation as the nuclear power plant accident in Pennsylvania which occurred at the time of the writing of this testimony. Several of the spacecraft mentioned would utilize very large space structure technology. The Microsat spacecraft having dimensions of $600- \times 1,200$ meters would supply one kilometer resolution soil moisture measurements with a passive L-band radiometer. The Texturometer spacecraft would use three arrays of mirrors on its structure, each mirror array having dimensions of $150 \text{ meters} \times 1.5 \text{ meters}$, to obtain ground texture data. The Parasol radio-meter spacecraft would employ a phased array radiometer concept and would be a ten kilometer diameter version of Microsat. The Ferris wheel radar spacecraft would use a 30 to 300 megacycle range ground penetrating radar to measure subsurface boundary layers for geological investigations. These large space structures could be developed in conjunction with other space projects run by NASA that require large space structures for their accomplishment.

This illustrates the B'nai B'rith statement that the civil space program budget must sharply and continuously expand in order to effect, most efficaciously and most expeditiously, the fulfillment of the promise of space industrialization for the inhabitants of the world. More specifically, an operational remote sensing satellite system would provide the framework for the most rapid incorporation of such research and development spacecraft into an already existent system for providing routine services for this planet.

In conclusion, B'nai B'rith feels strongly that there is an urgent need for the creation now of an operational remote sensing satellite organization. B'nai B'rith has examined the current legislation aimed at attaining such an organization. As a result of this examination, B'nai B'rith feels that the legislation of Senator Schmitt comes closest to what B'nai B'rith envisions for the creation of an operational entity. Hence, B'nai B'rith prefers the legislation of Senator Schmitt to that of Senator Stevenson and advocates the expeditious enactment of the legislation of Senator Schmitt.

COMSAT GENERAL CORP.,
Washington, D.C., March 6, 1979.

Mr. JOHN STEWART,
Staff Counsel, Subcommittee on Science, Technology, and Space, Senate Commerce, Science, and Transportation Committee, Annex Building, U.S. Senate, Washington, D.C.

DEAR JOHN: We wish to amplify some of the comments we made at our February 28 meeting and to provide additional thoughts on certain aspects of S. 3589 which we did not have time to discuss fully. While the comments herein point out areas of concern in S. 3589, we will continue to examine S. 3589 from the standpoint of minimal additions or modifications which would alleviate those concerns. In that context, we appreciate your offer to let us review the bill prior to introduction into the Senate.

1. U.S. international leadership in remote sensing satellites.

S. 3589 is likely to leave unsettled for seven years or more the question of ultimate responsibility for establishment and operation of remote sensing satellite systems and for the provision and development of services to users. This uncertainty will restrain the United States from taking necessary positions or actions in the international arena to ensure a U.S. leadership position, particularly if there are initiatives to form an international institutional structure to carry on satellite remote sensing. Since private entities will have no defined role under S. 3589 in establishing and operating such systems and services, they will not have the necessary credibility to deal with foreign entities on institutional matters. Also, the Earth Data and Information Service to be established in NASA under S. 3589 (the Service) will have no assured long-term role and, even though it may have authority under S. 3589 to enter into international arrangements and agreements, will be reluctant to take initiatives which will bind a successor U.S. entity that is not even defined.

Given the U.S. technological superiority in the remote sensing satellite area, and the existence of the Landsat system, it is likely that other countries will try to find other means to promote their interests in this area and to offset the U.S. technological lead. One such means is to promote the establishment of international institutional structures for satellite remote sensing. In the area of maritime satellites, for example, the Europeans and the Soviet Union assumed the initiative in the political/institutional area and lead the efforts to establish, in accordance with their interests, the institutional structure for international maritime satellite systems.

Since the U.S. had not yet decided which entity or entities in the U.S. would have responsibility for such systems and services, it was in a reactive position and its leadership role was reduced. A similar situation resulted in the area of aeronautical satellites. In that case, the failure of the United States to resolve the question of responsibility permitted the Europeans to choose the U.S. entity for a combined United States/European/Canadian venture through a competitive bidding process among U.S. companies.

2. Development of remote sensing satellite data products and services

The likelihood that S. 3589 will create uncertainty as to the long-term responsibility for establishment and operation of remote sensing satellite systems, and for the provision of services to users, will suppress incentives to devote funds and resources to such effort. Since private entities will have no assurance as to whether they will have a role in the provision of services in the future (as opposed to the sale of hardware), they will have little incentive to devote any resources to developing such services and to expanding the market for such services. Also, the Service will not be assured of its future role and for this reason, in the later stages of the seven-year period prior to decisions as to which long-term course to follow, may be reluctant to make any commitments to establish new systems or expand existing systems and services. Users, of course, also will be sensitive to this uncertainty and, in view of the unsettled nature of many important elements (e.g., costs, system capabilities, availability of products), are likely to postpone investments necessary to utilize the products of remote sensing systems.

3. Private sector opportunities during the interim period

During our discussions, it was mentioned that private entities would have the opportunity under S. 3589 to propose to the Service that they be permitted to establish and operate their own remote sensing satellite system and to provide services on an operational basis directly to the public. We do not believe it possible under S. 3589 for the Service, or for the Government for that matter, to authorize a private entity to establish and operate its own remote sensing satellite system and provide service directly to the public. S. 3589 clearly charges the Service with establishing the Earth Data and Information System (Sec. 7(a)). Obviously, the Service could acquire goods and services from suppliers in constructing and operating the system, but we do not believe it could authorize a private entity to establish and operate its own operational system. To do so would be contrary to Section 6(d) which requires the President to forward recommendations to the Congress whether a private entity should carry on an operational service. Therefore, during the interim period and until Congress takes a decision, no private entity will have the opportunity to establish and operate its own remote sensing satellite system and services.

It also was mentioned that we and others could supply goods and services to NASA and that TDRSS is an example of a significant role for the private sector which also could be followed with respect to remote sensing satellite systems. While this opportunity may exist under S. 3589, it should be recognized as an opportunity with respect to which hardware manufacturers have significant inherent advantages which others may find impossible to overcome. In this respect, TDRSS must be viewed as a special case in which the successful bidder was able to offer services from the same satellite to NASA as well as to other customers. This is not likely to be possible with respect to the provision of remote sensing satellite capacity or services to the Service. Also, and perhaps more importantly, while S. 3589 might permit the private sector a role as contractor to the Service, as we read S. 3589, the provision of services to the public would still be the exclusive domain of the Service.

4. Eventual role for the private sector

We believe S. 3589 would effectively preclude a role for the private sector in the establishment of privately owned and operated remote sensing satellite systems. S. 3589 requires the Service to establish an Earth Data and Information System (Sec. 7(a)) consisting of satellites, associated ground equipment, data reception, aggregation, preprocessing and processing equipment and archiving capabilities. Also, S. 3589 may be so broad as to permit the Service to engage in aerial photography, the establishment of communications networks, the provision of data collection services via communications satellite and the analysis of remote sensing satellite data. In order to accomplish this mandate, it is likely that close to the full seven-year interim period be required.

Given the mandate for the Service, we question the feasibility of transferring responsibility for the operational service to the private sector, even if it were desired to do so. The complications of transferring facilities and people, as well as rights and obligations under domestic and international contracts and agreements,

will inevitably raise questions of such complexity and political sensitivity as to result in inertia favoring retention of governmental responsibility. Finally, we note that under Section 7(d) the President is only authorized to recommend to the Congress that operational responsibility be transferred to a private entity. Therefore, the seven-year interim period may well be extended by a significant additional period required for consideration by the Congress as to how a transfer would be effected.

5. Scope of activities of the Service Under S. 3589

We are concerned with provisions of S. 3589 which would mandate that the Service provide certain services which are now being offered and developed by private entities. We read S. 3589 as directing the Service to engage in aerial photography and ground data collection via communications satellites, as well as analysis of satellite remote sensing data. The definition of the term "data" in Section 3(3) supports this conclusion.

We have for some time now been developing a data collection communications/information service and have presented a comprehensive proposal for such a service to the U.S. Geological Survey. A copy of that proposal is attached hereto. We expect to enter into negotiations with USGS for the provision of such a service in the near future and hope to develop other customers for this type of service. S. 3589 would place the Service in NASA in direct competition with us, and perhaps with others, as well as with numerous suppliers of aerial photography and analyses of remote sensing satellite data. We believe such a role for the Government to be inappropriate and unnecessary in view of the private sector activities already being undertaken in these areas.

6. Advantages of a private sector operational decision at this time

The principal advantages of a private sector operational decision at this time are that it would remove uncertainty, assign responsibility, establish objectives and provide incentive to all entities to accomplish stated objectives. We believe transfer of operational responsibility to the private sector would better result in expansion of data products and services to users and would better enable the United States to maintain an international leadership position and to meet foreign competition.

At this time, a decision to transfer operational responsibility to the private sector admittedly requires that difficult issues be addressed and that hard decisions be made. On the other hand, postponement of these decisions will not make them any easier at a later time and is likely to have adverse consequences for U.S. interests in space technology and for the development and utilization of remote sensing satellite data products and services.

In response to NASA's recent inquiry on this subject, we are in the process of developing in some detail an approach for early transition of operational responsibility to the private sector through utilization of Comsat to perform this role. We continue to believe this approach has many advantages. When our comments on the NASA inquiry are completed, we will provide you with a copy for your consideration.

I hope the above comments have served to amplify and clarify the concerns we expressed at our meeting. We look forward to exploring this subject further with you.

Sincerely,

THOMAS M. ZIMMER.

DEPARTMENT OF STATE,
Washington, D.C., March 20, 1979.

Hon. ADLAI E. STEVENSON III,
Chairman, Subcommittee on Science, Technology, and Space, Committee on Commerce, Science and Transportation, U.S. Senate, Washington, D.C.

DEAR SENATOR STEVENSON: On November 7, 1978 you wrote to the Counsellor for Science and Technology of the Canadian Embassy seeking Canadian views on the Earth Data and Information Service Act. Mr. MacDowall has now responded with the request that we forward to you his attached letter with Canadian comments.

Sincerely,

DOUGLAS J. BENNET, JR.,
*Assistant Secretary for
Congressional Relations.*

Enclosure.

CANADIAN EMBASSY,

1746 Massachusetts Avenue, N.W., Washington, D.C., March 14, 1979.

Hon. ADLAI E. STEVENSON,

Chairman, Subcommittee on Science, Technology, and Space, Committee on Commerce, Science, and Transportation, U.S. Senate, Washington, D.C.

DEAR SENATOR STEVENSON: In response to your letter dated November 7, 1978 I enclose Canadian comments on the Earth Data and Information Service Act.

Should you or your staff need any elaboration I would be happy to discuss how this may be accomplished.

Yours sincerely,

JOSEPH MACDOWALL

Counsellor (Science and Technology).

Enclosure.

CANADIAN COMMENTS ON THE SENATE'S DRAFT BILL S. 3589, "TO ESTABLISH AN OPERATION EARTH DATA AND INFORMATION SERVICE IN THE NATIONAL AERONAUTICS AND SPACE ADMINISTRATION, AND FOR OTHER PURPOSES."

INTRODUCTION

The Government of Canada welcomes the opportunity to provide comments on the "U.S. Senate Draft Bill S. 3589 to Establish an Operational Earth Data and Information Service in the National Aeronautics and Space Administration; and for other Purposes." In particular, we are pleased to note the importance placed on cooperation with other nations. We consider, however, that the Bill if implemented could have a major and possibly serious impact on such cooperation for present users, such as Canada, and for developing countries.

NEED FOR AN OPERATIONAL SYSTEM

A period of evolutionary interim development of operational remote sensing capabilities as proposed in the Bill is both wise and necessary, particularly if it were to demonstrate one or more major applications of remote sensing. To date, the major expenditures of money and effort have gone into the front end of the system (sensors, satellite, ground handling data, digital analysis). What is required now is development of an integrated system from the satellite to the end user. This would be of assistance in convincing potential operational users of the value of the system. The Earth Data and Information Service Bill seems to embrace a philosophy of such a demonstration as well as a realization that the recovery of costs at a realistic level can be done only as the applications are confirmed.

COST RECOVERY POLICIES

Canadian experience indicates that it is likely that remote sensing satellites will not be commercially viable without Government subsidies. This contrasts with communications satellites where there is a developed market and where certain applications are able to pay their own way. For remote sensing to be commercially viable, a base of major users who rely on it on a day-to-day basis would be needed. This would require that the reliability and continuity of the service be guaranteed and that the cost be affordable.

Our experience to date has shown that the revenue which can be collected from the sale of Landsat data is inadequate to cover even the NASA user charge, let alone the cost of operating ground stations.

Under Canadian Government industrial policy, Canada prefers to contribute to international remote sensing programmes in kind, rather than in cash. For example, the preferred situation would be to have direct access to the satellite data to contribute in kind through supplying part or all of a satellite or ground station. A less preferable situation would be direct access with a reasonable user fee. The least preferable method of access to remote sensing data from the Canadian point of view would be the cash purchase of basic information products from a foreign organization. In part, this third alternative would appear to be inconsistent with the draft principles on remote sensing being considered in the U.N., which call for equal, timely and non-discriminatory access to primary data acquired by remote sensing satellites, and for data to be freely and promptly disseminated. Both Canada and the United States have supported these draft principles. In addition, this could cause serious economic dislocation.

These issues have arisen recently particularly with regard to NASA's proposal to use the data relay satellite Tracking and Data Retransmission Satellite System. Canadian authorities would be interested in discussing with U.S. authorities con-

cerns about the implications this system could have for present users of the Landsat system.

INTERNATIONAL COOPERATION

Canadian authorities are pleased to note the importance place in Bill S. 3589 on international cooperation as this should be considered an integral part of activity in space.

In his introductory remarks to the Bill Senator Stevenson has noted that its purpose is: "Establishing a framework to move in an orderly way from experimentation to a permanent operational system." Viewing this from an international perspective, the creation of a U.S. Earth Data and Information Service could be the first step toward a global information system, a course which Canada would be willing to pursue, particularly if there were wide international support for the establishment of a system with data freely available (but not necessarily free). However, there seems to have been little or no discussion at the international level as to whether this would be the course preferred by nations potentially interested in a global system. In Canada's opinion, there exists an urgent need to establish an international body for discussion and development of these issues, and Canada would be pleased to work with the U.S.A. and other interested nations to organize it.

Another aspect of international concern is the developing countries. They have demonstrated a need for access to remote sensing satellite systems, but it is unlikely they will be able to pay compensatory prices for the service. The only means we can see at present for them to acquire these services is through cooperation by the technologically advanced nations in providing ground stations and training. An example of this is the Upper Volta Project in which the U.S.A., Canada and France are cooperating to provide West African nations with the means of utilizing data obtained from remote sensing.

CONCLUSION

Canadian authorities would like to express their appreciation for this opportunity of provide a brief explanation of Canadian views and would be interested in further discussing these issues with U.S.A. authorities. As a neighbour, a partner in numerous cooperative space projects and a major user of the Landsat system, Canada closely follows and is deeply interested in any changes in U.S. space policy.

LOCKHEED ELECTRONICS CO., INC.,
Houston, Tex., December 8, 1978.

Mr. JIM GEHRIG,
U.S. Senate Staff, Committee on Commerce, Science, and Transportation.
Washington, D.C.

DEAR JIM: We appreciate the opportunity to express Lockheed Electronics Company's viewpoints on the Senate Bill S. 3589, "Earth Data and Information Service Act of 1978," submitted by Senator Stevenson to the Committee on Commerce, Science, and Transportation on October 12, 1978.

While we are in agreement with Senator Stevenson on the necessity of creating an on-going operational system, we are concerned that the contents of the bill facilitates increased government participation with lesser involvement by private industry.

Our comments and viewpoints on the bill stress our belief that what is needed is greater involvement by the free enterprise system, with nonprofit and university organizations being involved where required. The attachment discusses our concept in some detail; however, several aspects of our position are highlighted as follows:

A. Within a total system, the major focus should be on the data collection, processing, archiving, and dissemination phase. It is recommended that an industrial organization such as COMSAT or an industry-government contractual relationship such as the Tracking and Data Relay and Satellite System (TDRSS) be established to have this responsibility. Timely distribution of data in required formats to a wide variety of users is essential to a successful program. To ensure reliability, a back-up system will be required should the data gathering satellite fail.

B. The program must have a greatly expanded industrial (commercial) constituency to be successful.

C. A policy office and an advisory committee should be established under the President. The policy office would represent the government position and goals, and the advisory committee would represent the user community.

D. Duplication in government Landsat functions should be reduced without destroying the necessary agency autonomy.

E. Moreover, the concerns of the private citizen about government spending can best be served by demonstrating the cost-effectiveness and responsiveness of such a critical national policy by having the implementation and operation of this needed service performed by a federally regulated industrial organization, rather than creating another government service.

F. Too much power is vested in the Administrator. Explicit procedures should be provided to ensure government and private industry participation during the formation of the service.

Thank you again for the opportunity to review and comment on the bill by Senator Stevenson. If desired by the committee, we can expand our viewpoints and are available to discuss our comments at your convenience.

Sincerely yours,

R. E. TOKERUD.

Attachment.

LOCKHEED ELECTRONICS CO., INC., COMMENTS ON SENATE BILL S. 3589, "EARTH DATA AND INFORMATION SERVICE ACT OF 1978"

I. INTRODUCTION

Lockheed Electronics Company (LEC) agrees with the necessity of establishing a long-duration, government-supported, operational Earth Data and Information Service. The government and private sector users presently rely upon the data available from the existing remote sensing satellite platforms only as supplemental data in their existing operational systems. This is due to the implicit uncertainty of government plans and the experimental nature of the Landsat program. Reluctance by foreign governments has also been witnessed for these same reasons. However, the potential value of operational systems seems obvious in light of our dwindling natural resources.

We strongly agree with the bill's purpose and that an operational system should be implemented. We do, however, have a different opinion on the institutional arrangements for implementation of the system. Section II lists our thoughts regarding the contents of the bill. Our alternative concept is discussed in detail in Section III.

Although our comments were created in some haste, we feel eminently qualified to provide comments on the bill. The Systems and Services Division of LEC has been involved in programs using remotely sensed data over the last thirteen years. Specifically, we have been involved in applications of Landsat and other remotely sensed data for NASA, EPA, USDA, U.S. Forest and other federal agencies. Our skills and capabilities have also been achieved through our association with foreign and private customers. Recently, LEC established a Remote Sensing Applications Laboratory (RSAL) in Houston, Texas which provides a full spectrum of remote sensing applications capabilities. Currently our scientists, engineers, and technicians support earth resources programs at NASA's Johnson Space Center (JSC) and the Earth Resources Laboratory (ERL) and EPA's Environmental Monitoring Support Laboratory (EMSL). For those members of the Committee who may not be familiar with LEC, the attached Appendix A provides greater detail of our capabilities and experience.

In reviewing and developing these comments on Senate Bill S. 3589, we realized that the bill was draft prior to the release of President Carter's U.S. Civil Space Policy on October 11, 1978. Much of our opinion on the bill was formed in conjunction with our evaluation of the U.S. Civil Space Policy.

II. CRITIQUE OF SENATE BILL S. 3589

The establishment of an operational Earth Data and Information Service is absolutely necessary and is required as soon as practicable. It is recognized that the Federal Government will, of necessity, have to provide the necessary regulation and much of the research and development and financial impetus. However, the bill now specifies that the service will be totally established and operated by NASA. In our opinion, this will create a business environment that guarantees the need for continued NASA operation of the service after the 7-year period. This also guarantees NASA's continued need for operational personnel in their present R&D environment.

There are no explicit procedures in the bill to insure that intra-agency, inter-agency participation will occur during the formation of the service. Specifically, there are user agencies (USDA, USGS, DOT, EPA, HEW, Congress, etc.), and technological agencies (DOD, NSF, NOAA, etc.), that should provide meaningful input to the goals, design, implementation, and operation of the service. A program of this magnitude requires a logical, step-by-step approach. It is suggested that attainable

goals and objectives be established, by a team comprised of government personnel representing user and supplier organizations. This team should collect additional information from the total user and supplier community including private industry. The total system should be carefully designed, sized and costed so that Congress can be provided with some choices of approach, cost and time to do the job. The advantages to this approach are that technical and administrative checks and balances will be provided to ensure realizable goals.

The bill encourages private industry participation, however, industry's role is not explicit and we doubt industry will take on the responsibility of implementation and operation of the service. Industry will not fund development of technological expertise where there is no market for their services. If the recent U.S. Civil Space Policy and Congress expects to stem the tide toward bigger government while creating a larger role for industry, then this bill is contrary to this interpretation. In other words, the bill does not address the U.S. Civil Space Policy, i.e., it does not specifically provide for the private sector to take its necessary place in the planning, design, and operation of the service.

Enormous power will be vested in the Administrator. NASA will become firmly entrenched as the arbiter, dictating space policy as it relates to earth resources data gathering, analysis, processing, and dissemination. Of particular concern is the latitude given the service to define and produce basic information products. NASA's present efforts to transfer technology to the state and local sector is evidence of the problems they will face with a future and larger customer base.

III. RECOMMENDED ALTERNATIVES TO SENATE BILL S. 3589

Definition of the system

The Earth Data and Information Service (EDIS) should provide a capability for rapid repetitive data acquisition and dissemination with global "earth looking" coverage. The system should be defined as an earth looking remote sensing, data processing and dissemination system. Other data such as that acquired by aircraft and ground truth should be considered for inclusion in the operational EDIS. The system should be designed for sensing land, sea, and air mass characteristics. Present technology is moving toward multipurpose sensor systems that will economically measure a wide range of global characteristics. It is of paramount importance that user requirements dictate the design of all system elements including satellite operations, sensor design, data processing and format, and data distribution techniques. A cost analysis should be performed to determine the most effective way of assuring that existing technology, the tracking and data relay satellite system and the existing international remote ground terminal systems are used to the maximum extent practicable.

To accommodate all present and future users, it is envisioned that the requirements of the system should be developed by an office, under the President, composed of government users including Federal, State, and Local representatives plus a variety of private sector users.

The establishment of requirements at the Presidential level is necessary because user requirements cross not only several branches of the Federal Government but also international lines, and affords an opportunity for private sector participation in accord with the President's U.S. Civil Space Policy of 1978. The total EDIS system requirements developed by this office can then be used by industry to design the EDIS, develop an implementation plan, and determine resource requirements. The findings would be presented to the President for review and submitted to the Congress for agreement as to system establishment and implementation via legislation.

Arrangements for implementation

A Policy Office and Advisory Committee should be established under the Executive Office of the President. The Policy Office would be responsible for the overall regulation and control of EDIS. The Advisory Committee would be composed of representatives from the user organizations, i.e., USDA, USDC, DOI, AID, NASA, EPA, state/local governments, and private industry users (for example Geosat). Together they would establish priorities, ensure commonality of systems, minimize redundancy, and contract private industry for implementation of EDIS.

Arrangements for operations

The Policy Office would be the focal point for the control of the operational system and have the responsibility to (1) coordinate all user data product requirements, (2) set policy, (3) modify the operational system as new requirements are developed, (4) fund the government agency responsible for all satellite operations, and (5) administer the contract with the industry or industry team responsible for EDIS implementation and operation.

The satellite operations should be carried out by a single government agency such as NASA or the Department of Commerce. This agency would coordinate all the present satellite systems and accommodate all future ones. It is recommended that a single industrial organization similar to Comsat or an industry-government contractual relationship such as the Tracking and Data Relay and Satellite System (TDRSS) be established to have the responsibility for all data reception, processing, archiving and dissemination.

This industrial organization would provide data collection and preprocessing in various stages, according to the timeliness and specialized requirements of the user. In the case of a near real-time requirement, this organization would provide a direct data link with the participating user organization. This would eliminate preprocessing equipment requirements of all governmental agencies except for any preprocessing research and development performed by NASA.

Private industry would provide the subsequent data processing and all associated public domain functions. They would receive the preprocessed data from the industrial organization, operate user service centers, and provide processed data products to governmental agencies, private industry, the general public, and foreign governments. These data products should include both computer-compatible tapes and images.

Responsibility for data collection, preprocessing, and data transmission functions could be centralized in the single industrial organization, which would be responsible for the preprocessing of the raw data to various stages and to a common format for all users. The data transmission functions could utilize existing communications systems and could make the data available for transmission to users. Those users requiring rapid access and highly specialized processing could be provided a direct data link to their processing areas.

The subsequent refined data processing and dissemination of the data products to the users requiring the data under normal time constraints could also be provided by private industry. Private industry could also provide for other functions such as specialized processing, user training and technology transfer, and operation of user service centers.

In this scenario, government user organizations will generate their output product requirements through the Policy Office and participate, in an advisory capacity, in the management and overall control of the system. They could receive the preprocessed data from the single industrial organization, perform specialized processing and analysis as required for their programs and projects, then transfer the resulting end products and technology to the public domain for further distribution. The user organizations should involve both private industry and nonprofit/university organizations by the continuation and expansion of contracts and/or grants for data analysis, information extraction functions, and research and development. The grants and research funds from the government should not be limited to nonprofit and university organizations, but should be also be made available to private industry to develop useful applications and promote utilization of the system.

To eliminate direct competition with industry and encourage the free enterprise system, government agencies should be encouraged to use industry for providing analysis, technology transfer, or training to any organization (including other government agencies) not directly involved in their projects or programs. Additionally, government agencies should be responsible only for program management functions. As in the past, private industry should provide products or services, i.e., hardware/software systems, facility maintenance and operations, training, technology transfer, or value-added services.

Foreign government participation as a user should be similar to the involvement of U.S. customers for products and services. For those contemplating their own satellites, a joint venture or exchange of data could be arranged through the Policy Office.

Cost

All costs of acquisition of the raw data should be borne by the government and funded by the Policy Office. Contractual arrangements would be made for the use of TDRSS for transfer of raw data to the single industrial organization and for the use of DOMSAT for the transfer of both preprocessed data in a common format and the processed end products to the users.

Costs for preprocessing the raw data, timely transmission of these data, and data processing beyond the preprocessing stage will be paid by the participating user organizations under a contractual arrangement according to their timeliness and volume requirements. All other customers would pay for their data according to the products and/or services requested.

APPENDIX A

LOCKHEED ELECTRONICS CO., INC. CAPABILITIES IN EARTH RESOURCES AND ENVIRONMENTAL APPLICATIONS OF REMOTE SENSING

The Lockheed Corporation is a broadly-based aerospace company involved in translating the discoveries of science and engineering into advanced products and systems for national defense and human progress. Its various companies cover the entire aircraft, missile, and space fields and extend beyond into such areas as ocean systems, shipbuilding, remote sensing, propulsion, electronics, communications, heavy construction, pollution control, special purpose ground vehicles, and a variety of programs aimed at improving the quality of life.

Three major segments of the Lockheed Corporation—Lockheed Electronics Company (LEC), Lockheed Missiles and Space Company (LMSC) and Lockheed California Company (CALAC), have developed an in-depth technical expertise which is being applied to both the civilian earth resources and military remote sensing applications.

The Systems and Services Division of Lockheed Electronics Company (LEC) possesses relevant capabilities and skills related to earth resources and environmental applications of remote sensing technology. These skills and capabilities have been achieved through our association with government and private customers over the past thirteen years. Recently, LEC implemented the Remote Sensing Applications Laboratory (RSAL) in Houston, Texas. RSAL provides a full spectrum of remote sensing applications to include digital image analysis, computer processing and computer-aided interpretation technologies and services on a worldwide basis to both the private and government sectors. There are currently more than 400 scientists, engineers and technicians supporting earth resources programs at NASA's Johnson Space Center (JSC) and the Earth Resources Laboratory (ERL) and at EPA's Environmental Monitoring Support Laboratory (EMSL). Additionally, LEC has performed small but comprehensive remote sensing contracts in support of the Iranian government's Earth Resources Program, the Mississippi Research and Development Center's Statewide Land Use Mapping Program, and the Mexican government.

At NASA/JSC, LEC provides remote sensing program support to the Earth Observations Division. The Earth Observations Division is responsible for the definition and execution of the Earth Resources Program. It is the focal point for all JSC activities related to the application of remote sensing techniques to surveys of the Earth's resources. Direct applications are made in the fields of agriculture, forestry, geography, geology, hydrology and oceanography. Two of the major applications programs are: (1) Large Area Crop Inventory Experiment (LACIE)—the forerunner of an operational wheat production estimating system to improve the accuracy and timeliness of foreign wheat production estimates; (2) Forest Applications Program to quantitatively assess the accuracy and precision of automatic data processing of Landsat data for forest surveys. As the prime support contractor on these programs, LEC provides management and technical expertise in all phases of these programs.

At NASA/ERL, LEC provides total remote sensing program support to the ERL. The mission of the NASA/ERL is to conduct research in the development and experimental demonstration of the uses of remotely-sensed data acquired from aircraft and satellites. ERL is actively engaged in transferring earth resources technology to the Southeastern United States and is emphasizing three major applications areas: (1) techniques for land use inventory, (2) techniques for the study and monitoring of wetlands, and (3) techniques for the study and measurement of the characteristics of coastal waters. The goals of the investigations being conducted by the ERL are to develop the techniques required, to conduct demonstration projects, to document the procedures and techniques so that they can be applied to the needs of the user community, and to assist in the transfer of this technology to the user community.

At EMSL, LEC provides technical expertise and assistance to the EPA. The EMSL aerial monitoring program provides EPA regional users with information concerning land, water, and air pollution. This information is acquired by LEC image analysis personnel utilizing remote sensing imagery including aerial photography and multi-spectral or thermal infrared line scan data. These data are useful in regulation compliance monitoring, environmental damage assessment, and environmental planning activities. Photographic and cartographic services are also provided by LEC for project planning, image evaluation, and report compilation.

LEC feels that our major involvement and contribution to the development of earth resources technology plus our Corporate commitment to transfer this technol-

ogy to the user community provides us with the necessary background to comment on Senate Bill S. 3589.

ECON INC.,
Princeton, N.J., December 11, 1978.

Subject: Earth Data and Information System Act.

HON. ADLAI E. STEVENSON,

Chairman, Subcommittee on Science, Technology, and Space, U.S. Senate, Russell Senate Office Building, Washington, D.C.

DEAR SENATOR STEVENSON: The Earth Data and Information System Act is a direly needed initiative in order to put earth data and information systems services on a medium or long-term basis with assurance domestic as well as worldwide, that these services will be provided and continued with some degree of certainty. The proposed Act provides such a framework.

General comment

The single major comment and concern I have is the need for accountability and private initiative in providing such services. Given the lack of initiative in space applications by the Federal Government, I believe that Federal policy and legislation ought to maximize, if not require, private or semi-private institutions to carry out such activities in the framework of a financially efficient and equitable set of rules. For this reason I attach a more detailed memorandum where some considerations are presented for moving immediately to a semi-private institution in providing space observation services. Other comments include the following:

Specific comments

1. Is it wise to provide for a period of entering development and is NASA the best Agency to operate the system in this interim?

In the absence of the creation of a semi-private institution, as was done for space communications with Comsat-Intelsat, the next best option indeed is to provide for an interim development period at the end of which, or during which, these activities should be turned over to a private or semi-private domestic and international organization (called "Obsat" and "Globsat" in the attached memorandum). During such an interim period, if indeed needed, NASA is the best choice among Federal agencies capable of performing this function. However, these services involve such a fundamentally different role and function than those normally performed by NASA (services to a totally disaggregate market, a myriad of different uses, application possibilities in developing countries, issues of domestic and international law and trade policy) that the creation of a private or semi-private institution for such services at the end of the interim period seems mandatory. If this conversion to such an organizational form is not stated now, I am afraid it will never come about, despite the best intentions by all parties involved today.

2. The value of remotely sensed data to the private sector and to Federal, state and local governments versus revenues from such data services.

Very detailed and specific estimates as to the value of remotely sensed data have been made and in some cases involve a significant change for the better on how we can manage our resources both domestic and worldwide in a free market environment. A case in point is food crop information.

However, one has to distinguish between benefits that accrue to the public at large (consumers, farmers, food distribution systems) and benefits that accrue to specific institutions (individuals, corporations, Federal, state and local governments). The value of such services in some cases should not, and does not, lead to equivalent revenues.

A case in point is food information: While there is no doubt that substantial cash revenues could be exacted from a variety of users and speculators for such information (if accurate) such a procedure might both be inequitable and inefficient. Inequitable, since the holder of that information could exact payments from a few specific institutions, far in excess of the benefits that these institutions would derive if the information was simply made publicly available to everybody. This is due to the fact that these institutions could use the monopoly of information on their side to intervene in commodity markets and exact monopolistic gains at the expense of others contrary to the principles of free markets which are based on equal (free) access to information by all. The best case in point of the monopolistic gains is given by the Soviet Union and its intervention in world commodity markets.

Exactng a "full cost price" from any and all users may be equally inequitable:

While the price would be the same for all users, it would exclude a potentially large portion of the public from the benefits from such information, such as small

farmers and housewives. Which leads to the next point: The "full cost price" for such services may also be inefficient. The incremental cost of distributing information to one more user is exceedingly small, if not close to zero. For example, on food crops such information can simply be published in newspapers and advertisements. Clearly, the wider the information is available, the greater the benefits to such information if this added distribution occurs at little or no cost to the public or to individuals. Yet, such distribution makes it impossible to recover the full cost of the services provided.

The inequity of recovering full costs for such services does not mean that there is no value to such information. Quite to the contrary. This is a most difficult issue for the Office of Management and Budget to deal with; some seem to hold to the view that the value of any service is simply determined by the ability to raise cash revenues from such services. It is this point that I believe has held up the Earth Resources Information Program and its transformation into an operational system.

Finally, the inequity of recovering the full costs through prices (user charges) for some of the most useful services from such systems does not rule out the feasibility of private or semi-private forms of organizations for such activities. However, different mechanisms of financing equitably and efficiently such a private or semi-private organizations have to be thought of. This is not without precedent (libraries, technical information services, etc.).

3. Prohibition of Free Production for Sale and Distribution of Data and Basic Information Products.

I may misunderstand the intent of Section 10(a) but I believe it to be superfluous in any case. First, any such prohibition I believe to be contrary to the public good (see section above).

Also, there exist ample laws, regulations, and other provisions which are more than sufficient to cover the sale or distribution of data and information products: copyright laws, patent laws, etc. If the distribution or sale of the data are not covered by these provisions, then they certainly should not be prohibited from distribution under this statute. If they are covered, these laws, agreements and regulations should suffice.

If the intent of this section was to guard against "undue gains" by few from publicly provided data, then the correct provision against such undue gains is an insistence of public access to such data and "free entry" by all who want to provide such services. This adequately excludes the possibility of such monopolistic gains.

4. Reports to Congress.

The President should be required to submit an initial plan for the implementation of the service as well as its turn-over to a private or semi-private institution. This requirement should be made mandatory rather than left to the accidents of bureaucratic pressures and interests.

In conclusion, let me again stress how important the Earth Data and Information System Act is to the continuity and the increased uses of space data systems. The lack of such a framework has been one of the key bottlenecks to the full development of these space application opportunities.

With best regards,

KLAUS P. HEISS.

Attachment.

ECON INC.,

Princeton, N.J., December 11, 1978.

MEMORANDUM

Subject: Institutional choices for Earth data and information systems: The "Comsat-Intelsat" option.

A semi-private corporate approach in the form of an "OBSAT" corporation, along the lines of "Comsat-Intelsat", should be thought of as the key alternative to the recommendation advanced in the "Shapley" report to the OSTP, which on the domestic side recommends a federal lead agency (expanded NASA role), while accepting and recommending (correctly) an "Intelsat" type solution with regard to international earth observation systems services (say a "Globsat" Corporation). The above recommendation is based on the following criteria:

(1) Accountability

Whichever institutional form is chosen for an operational earth observation system (including Landsat, Seasat, other earth observation systems) a foremost criterion for such an institution has to be accountability visibility of the funds committed and invested, and the return that these activities are able to obtain from industry, public agencies, private and foreign users.

(1.1) Accountability for funds expended

A key drawback of assigning to any federal agency a lead role, in matters of earth observation services, or expanding NASA's role into operational systems responsibility, is the great difficulty to truly track and account for the funds that would go into such operations, vs. the "overhead" support activities of that same agency (NASA), and subsidizations under the title "research, development, demonstration" of new and more advanced technology.

For reasons of cost accountability, if none other, the concept of a federal lead agency should be opposed in favor of an institutional approach (Obsat-Globsat) that has worked in the United States and internationally, namely the Comsat-Intelsat approach to developing and bringing about space communications.

The only notable exception as to following that precedent, is to retain the R&D role of NASA and the Department of Defense in earth observation systems, something that was not done in the communications field where now, rightly, NASA is reentering the research and technology development role.

Figure 1 shows roughly the interactions of "Obsat" (domestic) and "Globsat" the international arm of Obsat:

(1) The research and development role would be retained by the federal government (NASA, DOD).

(2) "Obsat" would be responsible for the space segment and ground segment down to the "pre-processed data tapes". It would be a semi-private corporation, with substantial federal and industry participation, possibly by simply assigning this role to Comsat Corporation, or by creating a new organization called "Obsat Corporation".

(3) The third state in this process—the analysis, interpretation, and user services—could occur in a complete "free market" environment where user services companies, federal user groups, state and local user groups, Globsat, as well as individual foreign, private and public user groups could interact with Obsat. Obsat may be excluded by statute from entering vertically the analysis and interpretation field, or may be allowed to compete in a separate subsidiary with all the other open market participants in that field.

(1.2) Accountability as to ability to raise funds

As to the raising of funds, any federal lead agency can, through appropriate negotiations in the budgetary process, always exert tremendous pressure on OMB, the Congress, other executive branches, to continue an institution and operation that, for all economic purposes, may be meaningless or useless. On the other side, if the functions fulfilled would require substantial added investment, any such request by a federal agency would be "suspect" since it is difficult to precisely estimate benefits, as well as risks and costs in space system operations and among all other government operations.

The "accountability" advantage of Obsat is that Obsat cannot spend more money than flows into Obsat, and the flow of funds to Obsat would be, like any corporate entity, open to audit, accounting, government review and, most important, termination if Obsat proves to be a failure.

FIGURE 1

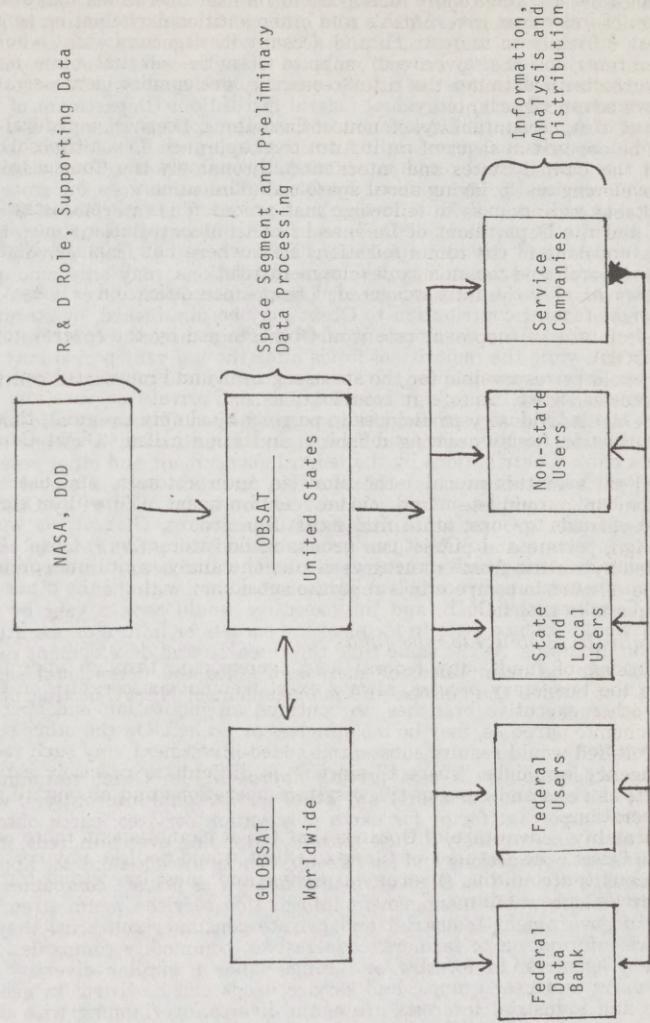


Figure 1: Data and information flow for Earth Data and Information Services through OBSAT-GLOBSAT institution.

A key difference of Obsat to Comsat will be the form in which revenues are raised by Obsat: it would be a process more analogous to Intelsat operations today where the contribution of individual governments and other entities participating in Intelsat are negotiated from year to year. That is, Obsat will negotiate with individual user groups the contribution they have to make to Obsat in order to obtain for the next year(s) preprocessed data tapes in a time, quantity and quality to be negotiated with these user groups. Clearly, individual federal institutions (Department of Interior, Department of Agriculture, Department of Commerce, Department of Defense, and others) would be principal users right from the beginning. In addition, federal agencies could use user services companies and through their offices negotiate contributions and services to be rendered by Obsat. The same goes for state and local user groups as well as individual foreign institutions. The interface of Globsat and Obsat will have to be similarly defined, and financial contributions negotiated.

Initially the funds raised outside of federal contributions, i.e., from private user groups, state and local governments, and foreign institutions, may only amount to say 25 to 30 percent of the total funds needed to operate Obsat. Over a ten year period the outright federal contribution to Obsat may be diminished, by statute or by the simple dynamics of the development of Obsat, to a minority contribution of say 25 to 30 percent while the majority of funds after the ten year period may well come in from user services companies, private users, individual negotiated contracts with federal agencies, as well as foreign contributions.

In addition to the individual user services to be performed Obsat may also have a national or worldwide function in establishing and maintaining a global earth observation data bank. Contributions by the federal government and other research institutions as well as international institutions to maintain such a global earth observation data bank would be one additional function to be fulfilled by Obsat as well as a source of funds to Obsat for fulfilling that function.

The "return to investment" of Obsat can be established using fair rates of return criteria used today in setting rate structures of public utilities, and in communications. It is not an unsurmountable problem—although a challenging one.

In any case, Congress, the OMB, and the executive would have a year by year accounting that would obscure little in terms of the success or failure of operational earth observation programs. At the same time the research and development role of NASA and DOD can be maintained, or increased, since the operational service functions would not burden the outlook and management of NASA, or that of any other federal lead agency.

(2) Market aggregation

In addition to accountability a semi-private approach like Obsat recommends itself strongly (to the exclusion of nearly any other institutional alternatives) when one recognizes one important factor for earth observation services: earth observation services occur in an extremely diffuse market, extending over hundreds, if not thousands, of different applications and user groups. These include land use applications by the federal, state, and local governments, as well as private companies and individuals; they include water management information services, again stretching over a variety of government industrial and private consumer concerns; they include agriculture information to farmers, cooperatives, commodity companies, and federal and state agencies. In forestry and range lands a similar diversity and multiplicity of users and user groups, and service needs can be listed. In geology federal, private and industrial interests are again diverse, overlapping with other users in some cases, and totally different in other cases. If ever there was a diffused, disaggregated, and totally undefined market, earth observations services clearly is a prime example of such a market.

It is a fact that no federal agency has ever been successful in implementing and operating the benefits of new technology programs in markets, even where the markets are well defined. There exist only two exceptions, the Department of Defense and the Department of Agriculture. In the case of the Department of Defense the research agency is also the final user, hence a definition of needs to match the research and technology development requirements to the market are "self contained". In the second case, the USDA, the establishment over many decades of the Agricultural Extension Service—comprising 20,000 to 30,000 "in field" people—was the only, and effective way, of distributing the fruits of research and technology development in the area of agriculture. All other efforts by federal agencies to enter market services in technology fields, or for that matter most others, can only be called unmitigated disasters of public enterprise. This is even the case where clear functions and markets are defined, for example in the case of mail services. The idea to develop earth observation services in a diffuse, undefined market through a federal institution must truly be called a "nightmare."

The aggregation of diffuse markets typically has best been done by private institutions and companies, relying on private initiative and risk taking. Day to day decisions have to be made, new service markets developed ad hoc, other service markets closed down where revenues and services do not develop. An aggressive marketing policy is part and parcel of development of new service markets. Advertising, marketing, aggressive service developments maybe, and are, the key to a tremendous new service potential that may exist in earth observation data. By giving this role to any federal agency, however capable, this market may well be destroyed, and certainly delayed.

The aggregation of the market is not simply a domestic but also a worldwide opportunity and problem. The development of that market through Obsat requires such extensive and diffuse interactions with so many user groups and institutions, corporations and individuals, that certainly NASA would spend an inordinate amount of time simply coordinating such activities with other federal agencies who have responsibility for international interaction, cooperation and treaties (State Department, Department of Commerce, the Treasury, the Department of Defense). A semi-private institution is free to pursue these opportunities aggressively, with the best national interests in mind.

(3) The public good aspects of information

The need—or public interest—exists to have knowledge and information spread as widely as possible, in order that individuals user groups, decision makers, and the general public can make efficient, timely and “informed” decisions. This widespread “diffusion of information” need calls for very low, if any, user charges. On the other side, the operations of earth observation systems clearly require substantial funding to cover the fixed as well as variable cost of operations and service deliveries. A totally private operation, that is with no federal or government involvement, even on the space segment and ground receiving end, would be close to unfeasible, due to the impossibility to safeguard information, or data, once they had been put into a form where they are easily duplicated. This contradiction between the value of information—in total—to an economy and its many users on one side, and the ability to duplicate such information and distribute it to users, whether or not they have paid for obtaining that information, has raised difficult problems in other areas pertaining to information and its distribution (publishing rights, copyrights, patents, etc.).

In this case, with the creation of a semi-public, (semi-private) institution such as Obsat in effect the government would create a monopoly, accountable to the public through the federal government and through “fair rates of return” criteria; at the same time the government assures beyond the “preprocessed data tapes” open and full competition, where indeed specific user needs, analyses, interpretation requirements, can be met and are met by a free market, open entry approach. The incremental cost at that stage can be borne and should be borne by individual user groups if they require such interpretive data services.

At the same time, the total system cost can be recovered through the Obsat organization by having that organization negotiate with user groups individually, and before-hand, their fair contribution to Obsat operations on a year or multi-year basis. Hence, with this scheme total cost recovery and return on investment on such expenditures year by year and over a decade can be achieved without recurring to a new federal institution, or lead agency, where issues of cross-subsidization, accountability, and market aggregation simply will prove to be unmanageable.

To summarize, the Obsat corporation, due to the monopoly granted to it for domestic uses as well as interaction with international users can assure through cost contribution negotiations the recovery of the funds needed for the space segment and ground segment up to preprocessed data tapes. Beyond this stage the free market approach to providing services to a variety of users seems to be assured, given the multiplicity of service companies that are developing in this field. At the same time, this approach also assures that through the service companies the information is made available to the widest possible market, with the possibility of different approaches to different service requirements. For example, in the area of crop information, it may well be that the Department of Agriculture—after acquiring the data from Obsat, and having interpreted these data for crop interpretation needs—will continue to publish crop data free, to everybody, though SRS and FAS bulletins.

The contract cost incurred to obtain such information shall and will be negotiated between the Department of Agriculture or the designated service companies with Obsat. In other areas, such as geologic interpretation services for specific companies, these will pay for obtaining the Obsat data under the same rules and conditions as those granted to any other resource company.

The public good aspect of improved information as well as the role of public information in markets can be guaranteed and achieved, without compromising on the principle on accountability and the need of quick and comprehensive market aggregation (criteria 1 and 2).

(4) National security issues

Obsat is limited to the use of earth observation systems of the Landsat, Seasat, and related types. Clearly excluded from Obsat would be, at least for some time to come, other observation systems such as those operated by ELINT.

Next comes the questions of "resolution." Initially Obsat may be restricted to data and interpretation capabilities in the Landsat area, of say, down to ten meter resolution, and corresponding criteria also for Seasat data services. Information down to that level should be clearly within the charter of Obsat to develop markets for, not only on a domestic but also a worldwide basis—say through Globosat.

Some other nations might object to the free distribution of such information to everybody who wants to obtain such information, but in this case basic principles of U.S. society should be lived up to in international matters, even if that were to the dislike of some. It just happens to be that our system is based on broad-as-possible, non-discriminatory availability of information to all. It seems that down to a resolution level of ten meters indeed most other nations would agree to that principal anyhow.

As to resolution levels below ten meters I find it difficult to see how any such information can truly harm anybody else, with the assumption that through other strategic observation systems much higher resolution levels are available to the key strategic powers anyhow. This issue is not central to delegating the role to a semi-private institution like Obsat down to ten meter resolution levels to begin with; the issue of higher resolution for civilian purposes can be relegated for later decision.

As to whether "public information" is harmful to U.S. interests in some specific cases for example crop information, abundant evidence has been developed, particularly on this topic, that public worldwide crop information is to the benefit of the United States, as well as other nations. I believe this to be the case even for the Soviet Union, where that nation through monopoly of crop information on its own territory has in the past interfered adversely in international commodity markets to the disadvantage of others. The improved information capability to the Soviet Union through such systems vastly outweighs any benefit the Soviet Union may have gathered in international commodity markets through its current information monopoly on its own crops. (In many instances the central government there does not know much more than we do about what's going on in the fields, and suffers from a similar information gap until very late in the crop year, say October, November.)

In summary Obsat-Globosat seems an attractive workable approach to providing Earth observation services in an accountable and efficient way while safeguarding at the same time the public and the U.S. interests.

STATE OF COLORADO,
EXECUTIVE CHAMBERS,
Denver, Colo., December 23, 1978.

MEMORANDUM

To: Jim Gehrig, Steve Flasjer.
From: Leonard Slosky.
Re S. 3589 informal comments.

1. Involvement of State and local governments

Amend Section 7(d)(2) by inserting after the word "communities," the following words: ", including federal agencies, state and local governments, private industry and universities."

Although the bill calls for the involvement of "users," state and local governments would be much more supportive if they are explicitly included. There is still a tendency for federal agencies to talk only to other federal agencies. For the last several years state and local governments have fought to have a voice in Landsat planning. A specific reference in the bill would be the formal recognition that state and local governments should be involved. The specific reference is needed for reasons beyond formality. There is not universal recognition that state and local governments are (or may be) significant users or that they should be included in system planning. Witness Art Morrisey's attitude until a week ago that state and local governments need not be involved in the integrated remote sensing plan called for in the President's Space Policy.

2. Need for Federal technology transfer program

Amend Section 7(d) by the addition of a new subsection (4) to read: "conduct a comprehensive and continuing technology transfer and technical assistance program to foster the widest practical and appropriate use of the data and basic information products by the federal and non-federal public agencies."

The ISETAP report (p. 18-23) documented that the availability of data alone is not sufficient for most state and local governments to be able to utilize satellite remote sensing data. If the 43 states which now do not have operational Landsat programs are to become users, they must be provided a low risk, low cost opportunity to test the utility of Landsat data within their own milieu. Even after states have established operational programs they will require assistance as more advanced technology comes on line.

NASA is presently conducting a highly effective (although underfunded) technology transfer program. However, it is necessary to clarify the responsibility for technology transfer for at least two reasons. First, since NASA has a R&D charter a number of the agency's top management are not comfortable providing such services. OMB also questions the authority and appropriateness of NASA performing such a function. Second, some federal officials believe that USGS should be conducting the technology transfer program for Landsat.

State and local governments believe that technology transfer is an essential element of a national remote sensing program and should be explicitly recognized as such. They further consider it necessary for some federal agency to have the clear mandate to perform technology transfer. NASA would appear to be the logical choice.

The technology transfer program need not necessarily be in the "service" it could remain under the Assistant Administrator for Space and Terrestrial Applications. However, the user charges for data should not be expected to cover the costs of technology transfer. Technology transfer could continue to be funded in the present manner or by a line item authorization and appropriation.

3. Use by Federal agencies

Amend Section 5(a) by the addition of a new subsection (6) to read: "to foster the maximum practical and cost effective use of remotely sensed data."

Amend Section 5(b) by the addition of a new subsection (4) to read: "all federal agencies with natural resource and environmental programs assess the feasibility of utilizing satellite remotely sensed data to fulfill their data needs."

In the course of the ISETAP study it was discovered that the federal agencies have been slow to assess the feasibility and institutionalize the use of Landsat data. If federal agencies are using Landsat data their state counterparts will also be encouraged to do so. We discovered instances where federal agencies would not allow a state or local agency to utilize federal grant funds for Landsat data.

With these modifications, particularly the first two, I believe that state and local governments will enthusiastically support Senator Stevenson's bill. If you have any questions please feel free to call on me.

THE COUNCIL OF STATE GOVERNMENTS,
April 3, 1979.

Senator ADLAI E. STEVENSON,
Russell Senate Office Building,
Washington, D.C.

DEAR SENATOR STEVENSON: This letter is in support of S. 663—the Earth Data Information Service Act. We have reviewed the proposed legislation and found it to be an important step toward making satellite remote sensing a reliable source of natural resource data for use by federal, state and local governments.

The Council of State Governments has been active in research on state natural resource data needs and information systems development for a number of years. Our most recent effort is aimed at determining state utilization of data provided by remote-sensing satellites in concert with other more "traditional" sources of information. Preliminary findings indicate that states have coordinated use of this data for a variety of programs in natural resource management and environmental protection. This use has occurred within an institutional framework, such as a state data coordinating center or geographic information system.

Many states have made substantial commitments, both in terms of the budget and manpower, to develop this capacity to use data from space. However, before further investments are made at the state level, there must be assurances from the federal

government that it intends to establish an institutional framework for a long-term remote-sensing satellite program. We believe that S. 663 makes this necessary federal commitment and urge that it be enacted.

Sincerely,

H. MILTON PATTON,
*Associate Director
for Environmental Resources.*

OFFICE OF THE GOVERNOR,
Salem, April 17, 1979.

Senator ADLAI A. STEVENSON III,
Chairman, Subcommittee on Science, Technology, and Space, Committee on Commerce, Science, and Transportation, Washington, D.C.

DEAR SENATOR STEVENSON: I understand your subcommittee is considering Senate Bill 663, which would establish an Earth Data and Information Service within the National Aeronautics and Space Administration. I support the purpose of this bill.

For more than four years state and local natural resource and planning agencies in Oregon have learned and are learning to derive and apply useful information from satellite remote sensing data. This experience results from two projects supported by the Pacific Northwest Regional Commission (PNRC) with significant cooperation from NASA and USGS.

The first of these projects, the Land Resources Inventory Demonstration Project, permitted these agencies to investigate and evaluate the utility of satellite remote sensing data to their agencies' needs. Studies were undertaken in forestry, agriculture (noxious weeds), wildlife habitat, water resources, urban and rural land cover, and surface mining. This project successfully demonstrated both a means of technology transfer and the utility of Landsat remote sensing to Oregon agency programs.

The second project shifted emphasis from investigation to practical application and operational use of satellite remote sensing data. This second project includes a training component in order to more thoroughly transfer remote sensing technology to the state of Oregon.

Effective resource management is a key to Oregon's economic well-being, as it is to the nation. It is anticipated that by 1981 a number of state and local agencies will be relying significantly on remote sensing data as a tool in such management. An institutional framework such as the one provided by S. 663 would provide continuous availability of reliable data and basic information products for these agencies.

Oregon's experience in both the Land Resources Inventory Demonstration Project and the Landsat Application Program has given us valuable insights into both the usefulness of satellite remote sensing and the transfer of this technology. In the event that Senate Bill 663 passes, we offer our experience as an aid in the development and operation of this Service.

Thank you for the opportunity to present these comments.

Sincerely,

VICTOR ATIYEH,
Governor of Oregon.

BATTELLE MEMORIAL INSTITUTE,
Washington, D.C., April 30, 1979.

Hon. ADLAI E. STEVENSON III,
Chairman, Subcommittee on Science, Technology, and Space, Committee on Commerce, Science, and Transportation, U.S. Senate, Washington, D.C.

DEAR SENATOR STEVENSON: We appreciate the opportunity to comment on the Earth Data and Information Service Act of 1979, S. 663. We endorse the concept of commitment to an operational system and the choice of NASA as the focal point for the development of a new approach. We would like to comment more specifically on the mechanism you are proposing for the Earth Data and Information Service (EDIS), as a means of developing and realizing the benefits of satellite-based remote sensing.

In looking at the proposed EDIS, we see several possible problem areas: (1) the vagueness of the mandate for EDIS, (2) possible conflicts in NASA's management of EDIS, and (3) the lack of private sector involvement.

(1) EDIS mandate

Purpose, goals and objectives of EDIS.—Although the intent of S. 663 is clearly to establish the institutional framework for acquiring and providing useful satellite

earth resources information in a timely and operational manner, a supporting set of goals and objectives is not explicitly identified. This could pose a problem in NASA identifying and implementing required actions and activities, as well as in subsequent efforts (by Congress or others) to evaluate EDIS accomplishments. For example, is it desired to make the Landsat program self-sustaining? To maximize use of Landsat data? To stimulate new technology use by state and local governments? To assist developing nations? To assist U.S. private industry in developing domestic and foreign business areas? The objectives will no doubt be some mixture of these, but it would be helpful if they were enumerated.

Battelle's view is that the principal criterion for success of the EDIS should be movement of the data utilization technology out of the Federal sector. If, for example, the EDIS could create a situation in which Senator Schmitt's Earth Resources Information Corporation could be formed and begin successful operation, this would constitute successful discharge of the EDIS mandate. Naturally, a number of other criteria will have to be met in the process, but eventual commercialization should be the principal objective.

Scope.—Another problem relates to the scope of EDIS informational responsibilities. At present, NASA is studying more than 20 potential satellite-based remote sensing initiatives. Several of these will reach the operational stage during the interim period envisioned in S. 663. Also, NASA is considering an Applications Data Service (ADS), a concept of tying all satellite data systems together so that any data user can have quick access to data from any satellite. The role of EDIS relative to these new operational developments is not clear. If EDIS is to be a Landsat-only operation, it should be so stated in the bill. If it is to have broader responsibilities in the future, criteria should be given as to the types of programs EDIS should consider.

Battelle feels that confining the EDIS to Landsat-type satellites would be a useful experiment. However, in view of the existing technology trends, it will become increasingly harder to separate Landsat from other data. We would envision the EDIS as a "halfway house" for remote sensing projects having no other Federal patron and which potentially could become private sector activities. We suggest the scope of EDIS activity should be to assume management of all U.S. satellite-based remote sensing systems and associated data distribution systems which meet the following criteria:

System is intended to provide for beneficial application of remotely sensed data rather than just developing or demonstrating remote sensing capability.

System has potential for becoming self-sustaining through data sales, user fees, etc.

System is not primarily designed to meet needs of one Federal organization.

(2) EDIS management

Turning now to the second question. In NASA's management of EDIS, we see some possible cause for concern. We feel that NASA is the best place to lodge this interim responsibility. However, NASA is a research and development organization, and has avoided operational roles wherever possible because of the feeling that such operational programs tend to become sacrosanct, and any budget cuts would have to come out of the R&D programs. This feeling seems to us to be well-founded. Accordingly, it can be wondered how vigorously NASA would pursue the EDIS program. To minimize this problem, it is important that the EDIS function be separated from the rest of the NASA operation, as S. 663 provides. Separate budgets, separate manpower ceilings, and separate personnel policies would also help to portray the experimental and exceptional nature of the EDIS program.

(3) Private sector role

S. 663 encourages the Administrator of NASA to solicit the assistance of the private sector as appropriate in carrying out the functions of EDIS. However, no formal private-sector responsibilities are identified. Because of the need to commercialize more remote sensing data dissemination and utilization functions, Battelle recommends that some mechanism be incorporated in S. 663 to assure private sector inputs in the planning and evaluation of EDIS activities and in the decisions involving recommendations as to the permanent operational system.

We and those we talk to in the data user community feel that change in the institutional arrangements for Landsat is mandatory. We hope that an institutional structure can be formed to facilitate the application of this rapidly changing and promising technology. Your efforts to achieve this objective are important.

Sincerely,

GEORGE B. JOHNSON,
Vice President,
Government Relations.

The first part of the report deals with the general situation of the country and the progress of the work during the year. It is followed by a detailed account of the various projects and the results achieved. The report concludes with a summary of the work done and the plans for the future.

The second part of the report deals with the financial situation of the organization. It gives a detailed account of the income and expenditure for the year and shows how the funds have been used. It also includes a statement of the assets and liabilities of the organization.

The third part of the report deals with the personnel of the organization. It gives a list of the staff and their duties and shows how they have contributed to the work of the organization. It also includes a statement of the salaries and other benefits paid to the staff.

The fourth part of the report deals with the work of the various committees and sub-committees of the organization. It gives a detailed account of the work done by each of these bodies and shows how they have contributed to the overall work of the organization.

The fifth part of the report deals with the work of the various departments of the organization. It gives a detailed account of the work done by each of these departments and shows how they have contributed to the overall work of the organization.

The sixth part of the report deals with the work of the various projects and the results achieved. It gives a detailed account of the progress made on each of these projects and shows how they have contributed to the overall work of the organization.

The seventh part of the report deals with the work of the various committees and sub-committees of the organization. It gives a detailed account of the work done by each of these bodies and shows how they have contributed to the overall work of the organization.

The eighth part of the report deals with the work of the various departments of the organization. It gives a detailed account of the work done by each of these departments and shows how they have contributed to the overall work of the organization.

The ninth part of the report deals with the work of the various projects and the results achieved. It gives a detailed account of the progress made on each of these projects and shows how they have contributed to the overall work of the organization.

