

WORKSHOP FOR FEDERAL AGENCIES

On

DEFINING THE BASIC DATA SET

FOR THE NATIONAL SATELLITE

LAND REMOTE SENSING DATA ARCHIVE

Sponsored by

National Oceanic and Atmospheric Administration

and

United States Geological Survey

Wednesday, September 10, 1986

USGS National Headquarters
Reston, VA

TABLE OF CONTENTS

Executive Summary 1

Introduction. 3

Purpose and Objectives 7

Participants. 8

Workshop Overview 8

Workshop Record

 Agenda 11

 Presentation Outline 13

 Introduction. 14

 Legislative Background. 15

 Historical Background 16

 Consequences of Commercialization & P.L. 98-365 . . 17

 Agreement for Supply of SPOT Data to the Archive. . 18

 Federal Donations of Data to the Archive 19

 Basic Data Set Issues and Concepts. 20

Results. 23

 Summary of Discipline-Specific Discussion Groups. . 24

 Resolution for Preservation of Historic Landsat

 Data. 29

 Summary of Workshop Question and Answer Period . . 30

Appendices

 Attendees. 37

 Discipline-Specific Discussion Group Summary Reports . 41

 Discussion Materials 81

EXECUTIVE SUMMARY

On September 10, 1986 a Federal Agency Workshop on Basic Data Set Definition for the National Satellite Land Remote Sensing Archive was co-sponsored by NOAA and the USGS at the USGS National Center in Reston, Virginia.

The purpose of the workshop was to:

- seek critical, specific inter-disciplinary, scientific input regarding the long-term historical, scientific, technical, and sociological requirements of the Basic Data Set and related advice on such variables as types of data, frequency of acquisition, and areas of coverage required to meet those long-term requirements;
- inform Federal agency personnel of status and plans for the National Satellite Land Remote Sensing Archive;
- raise issues, give status, and provide for dialogues concerning related issues, such as: NOAA's proposed data donation by Federal users, NASA's plan to stop conversion of the early (1972 to 1978) MSS wideband video data to computer compatible tapes, etc.
- provide an opportunity for Federal Agencies to contribute more detailed input after the meeting.

The workshop was limited to Federal agencies in order to:

- work with a large potential user of the archive.
- initiate the preliminary definition of the Basic Data Set in a timely manner.
- gain experience with open-forum working groups.

The workshop started with an introduction to:

- the Land Remote Sensing Act of 1984,
- the requirements for data archiving, and
- the concept of a Basic Data Set.

After a question and answer period, Federal users participated in three hours of discipline-specific discussion groups. The disciplines covered were Agriculture, Biology (non-agriculture), Cartography, Environment, Geology, and Hydrology/Glaciology.

Within the proposed scope of the Archive Basic Data set:

- Repetitive Global Data Sets (with more frequent U.S.A. coverage as required),
- Detailed Study Site Data Sets,
- Catastrophic Phenomena Data Sets,
- Calibration Data Sets,

Each discipline focused on five areas:

- Phenomena and Related Information Requirements,
- Global Data Characteristics,
- Detailed Study Site Data Characteristics,
- Catastrophic Phenomena Data Characteristics,
- Calibration Data Targets.

Leaders presented the results of each discipline group's discussion to the entire workshop. These presentations resulted in six technical points and two political issues, all documented in the Summary of Discipline-Specific Discussion.

A resolution was passed encouraging NASA and NOAA to continue processing of the early Landsat MSS wideband video tapes to computer compatible tape format, thereby enabling the long-term preservation of this historic data set.

At the end of the workshop, additional copies of the discussion materials, including a questionnaire, were distributed to the participants to encourage more detailed agency inputs.

If you have comments about this report or wish to provide further comments with regard to the Basic Data Set, direct them to:

Ms. Peggy Harwood
National Environmental Satellite,
Data, and Information Service, NOAA
Room 2051, FOB-4
Washington, DC 20233
(202) 763-4522

If you need additional copies of this report, please contact:

Mr. Howard Warriner
NOAA Landsat Operations
EROS Data Center
Sioux Falls, SD 57198
(605) 594-6955
FTS 784-7955

INTRODUCTION

Section 602 of the Land Remote Sensing Commercialization Act of 1984 (PL 98-365) states that it is in the public interest for the United States Government to maintain an archive of Land Remote Sensing (satellite) data for historical, scientific and technical purposes, including long-term environmental monitoring. Further, it directs the Secretary of Commerce to provide for long-term storage, maintenance and upgrading of a basic global land remote sensing data set (the "Basic Data Set") and, to the extent practicable, use existing government facilities in carrying out the functions of Section 602. In determining the initial content or upgrade of the Basic Data Set, the Secretary is directed to consult with and seek the advice of users and producers of remote sensing data and data products.

To meet legislative requirements and guidelines for historical preservation of remotely sensed data, NOAA, acting on behalf of the Secretary of Commerce, and the USGS, United States Department of the Interior, signed a Memorandum of Agreement on May 22, 1986 to jointly establish and operate the National Satellite Land Remote Sensing Data Archive at the USGS EROS Data Center. Requirements for obtaining advice related to the content of the Archive Basic Data Set will be met through various mechanisms. Initially, NOAA and the USGS established an Ad Hoc Archive Study Group. Members of the group are identified in the Appendix. This Study Group will attempt to define the scope and content of the initial Basic Data Set, based on guidance and advice provided from workshops attended by users and producers of remote sensing data and data products. To meet long-term requirements for modifying the scope and content of the Basic Data Set, and to meet requirements for advice on general Archive operations, NOAA and the USGS presently plan to establish interfaces with the appropriate committee or committees of the National Science Foundation.

In addition to the requirements previously noted, Section 602 of PL 98-365 directs the Secretary of Commerce in determining the initial content or upgrade of the Basic Data Set to:

1. Use as a baseline the data archived on the date of enactment of the Act;
2. Take into account future technical and scientific developments and needs;
3. Consider the need for data which may be duplicative in terms of geographic coverage, but which differs in terms of season, spectral bands, resolution or other relevant factors;
4. Include as appropriate unenhanced data generated by the commercial Landsat system or other US commercial land remote sensing systems; and

5. Include, as appropriate, data collected by foreign ground stations or by foreign remote sensing space systems.

These particular guidelines primarily ensure the opportunity for access to various types and ample supplies of satellite data. They are not intended to constrain the scope or purpose of the Basic Data Set.

Constraints to the Basic Data Set in PL 98-365 include the fundamental principal that it is the policy of the United States government to avoid competition with the commercial Landsat system operator or any other U.S. commercial land satellite system operators. PL 98-365 requires commercial system operators to promptly provide data requested by the Secretary of Commerce to the Archive at prices reflecting reasonable costs for reproduction and transmittal. PL 98-365 places severe restrictions on access to such data placed in the Archive. The Act states that U.S. commercial system operators shall have the exclusive right to sell all data which that operator provides the Archive, for a period not to exceed ten years from the date of sensing. This exclusive right to sell is extended retroactively for a period not to exceed ten years to include all data generated by the Landsat system prior to implementation of the commercial marketing contract with the Earth Observation Satellite Company (EOSAT). System operators may relinquish this exclusive right to sell and consent to distribution from the Archive before the period of exclusive right has expired by terminating their offering to sell particular data. After the expiration of the exclusive right to sell, or upon relinquishment of such rights to sell, data provided to the Archive by U.S. commercial system operators shall be in the public domain and shall be available to requesting parties at prices reflecting reasonable cost for reproduction and transmittal. However, until one of these conditions is met, data in the Archive can only be stored; it cannot be released by the government.

PL 98-365 places no restrictions on distribution of data acquired from foreign satellite systems. It is expected that restrictions will be dependent largely on agreements negotiated with foreign system operators. Legislative restrictions on access to the Archive data clearly indicate that it was the intent of Congress not to allow the Archive to become an alternate source of new or recent data for use by the operational and scientific research communities. Implied intent for the use of the data is contained in the phrase "...historical, scientific, and technical purposes including long-term global environmental monitoring." The Archive is intended to function primarily as a data resource that will be particularly important to future generations as a unique source of information critical to their ability to study and assess long-term global processes and changes. Its purpose assists future generations in their ability to beneficially interact with the earth's processes and to manage its natural resources. The legislative guidelines and requirements are to

result in the establishment of the National Satellite Land Remote Sensing Data Archive. The legislation concludes that the Archive should function primarily as a data resource that will have particular significance for future generations as a unique source of information critical for their ability to study, access, and interact with important long-term global phenomena. The scope of the Archive Basic Data Set has been proposed to include:

1. Repetitive Global Data Sets (more frequent U.S. coverage as required);
2. Detailed Study Site Data Sets;
3. Catastrophic Phenomena Data Sets; and
4. Calibration Data Sets.

This report summarizes the Federal agency workshop held on September 10, 1986 at the USGS National Center, Reston, VA.

PURPOSE AND OBJECTIVES

On September 10, 1986 a Federal Agency Workshop was held in Reston, Virginia at the USGS National Center, to define the Basic Data Set for the National Satellite Land Remote Sensing Data Archive. The major purpose of the workshop was to obtain from the Federal land remote sensing data user community, critical, interdisciplinary input regarding the long-term historical, scientific, technical, and sociological requirements for the Basic Data Set.

One objective was to inform Federal agency personnel of plans for the National Satellite Land Remote Sensing Data Archive. On May 22, 1986, NOAA and the USGS signed a Memorandum of Agreement that establishes the Archive at the EROS Data Center (EDC) in Sioux Falls, SD. By doing so, the Archive will use existing government facilities as encouraged in Section 602 of Public Law 98-365. Further advantage is gained by collocating this Archive with the USGS aerial photographic and digital cartographic data bases along with sources of USGS research expertise, and the NOAA/USGS Federal Cooperative Land Remote Sensing Research Program at EDC.

A second objective included the opportunity for participants to raise issues and engage in dialogue about satellite land remote sensing issues, including the possibility of Federal users donating data to the Archive; NASA's plan to stop conversion of the Landsat 1, 2, and 3 MSS wide-band video to computer compatible tape, often termed "historical CCT-X conversion"; and the status of Landsat commercialization.

The final objective provided a means for wide Federal input to the Basic Data Set selection criteria. This was accomplished by a discussion-materials handout available to all participants. The handout was used during the workshop, allowing the participants to become familiar with it and providing them with the knowledge necessary to use it in their offices. The discussion-materials handout is attached to this report (see Appendix C). Any interested party is encouraged to complete the forms and to forward them to Ms. Peggy Harwood at the address indicated on the form. All input will receive careful attention at any date since the Basic Data Set will undergo periodic reevaluation based on experience.

PARTICIPANTS

The workshop was planned and conducted by the Ad Hoc NOAA/USGS Archive Study Group, an interagency team organized by the Director of the Landsat Transition Group, National Environmental Satellite, Data and Information Service of NOAA, and the Director of the National Mapping Division, USGS. The major purposes for this Study Group are to develop the preliminary definition of the Basic Data Set and to initiate consultation with data users. The eight Study Group members are identified with an asterisk on the list of attendees in the Appendices.

NOAA invited participation from Federal agencies with an interest in remote sensing applications, information systems, and/or scientific data archives. This invitation resulted in 63 attendees representing 28 agencies and bureaus.

Only Federal agencies were invited to participate in this workshop for several reasons. First, the Federal community could respond more quickly to our request for assistance in defining the Basic Data Set than could a group combined from academic, private, and public sectors. Second, the Study Group recognized that the extremely diverse satellite land remote sensing community is well represented by Federal agency interests. Third, the Federal government will likely become the largest user group for this Archive, both directly and indirectly through funded research in the land sciences and global environmental monitoring. The timely response, diversity of users, expected Federal users of the Archive, and small size of the Ad Hoc Study Group lead to the decision to limit the initial workshop. Additional workshops and other efforts to obtain public and private participation are planned in the near future.

WORKSHOP OVERVIEW

The workshop included an introduction to the Land Remote Sensing Act of 1984, the concept of a Basic Data Set, the requirement for data archiving, and participation by Federal users in three hours of small discipline-specific discussion groups. The disciplines covered were Agriculture, Biology (non-agriculture), Cartography, Environment, Geology, and Hydrology/Glaciology. Each discipline focused on five areas:

1. Phenomena and Related Information Requirements.
2. Global Data Characteristics.
3. Detailed Study Site Data Characteristics.
4. Catastrophic Phenomena Data Characteristics.
5. Calibration Data Targets.

The results of each discipline-group discussion were verbally summarized at the end of the workshop for all participants.

WORKSHOP RECORD

DEFINING THE BASIC DATA SET
FOR THE
NATIONAL SATELLITE LAND REMOTE SENSING DATA ARCHIVE:
A Workshop for Federal Agencies

U.S. Geological Survey Auditorium
Reston, Virginia
September 10, 1986

Agenda

- 8:00 a.m. **Registration**
 (Coffee & Donuts available)
- 8:30 a.m. **Welcome and General Workshop Objectives**
- 8:45 a.m. **Background Information: Establishment of the**
 Archive and the need for ongoing advisory
 activities
- 9:15 a.m. **Introduction to Basic Data Set Concepts and Issues**
- 9:45 a.m. **Question and Answer Session: Basic Data Set**
 Concepts and Issues - Direction to Discussion
 Groups
- 10:15 a.m. **Break**
- 10:30 a.m. **Discipline-oriented Discussion Group Meetings**
 (Meeting rooms to be announced):
 Geology
 Biology (non-agriculture)
 Agriculture
 Environment
 Cartography
 Hydrology/Glaciology
- 12:00 p.m. **Lunch (USGS Cafeteria)**
- 1:00 p.m. **Continue Discussion Group Meetings**
- 2:30 p.m. **Break**
- 2:45 p.m. **Discussion Group Summaries (Auditorium)**
- 3:45 p.m. **Federal Donations of Satellite Land Remote Sensing**
 Data to the Archive
- 4:00 p.m. **Summary Comments/Distribution of Questionnaire**
- 4:15 p.m. **Adjourn**

PROPOSITION

PRESENTATION OUTLINE

WORKSHOP FOR FEDERAL AGENCIES

DEFINING THE BASIC DATA SET

FOR THE

NATIONAL SATELLITE LAND REMOTE SENSING DATA ARCHIVE

September 10, 1986

INTRODUCTION

THE LANDSAT TRANSITION GROUP IS CHARGED WITH IMPLEMENTING NOAA'S RESPONSIBILITIES UNDER PUBLIC LAW 98-365, INCLUDING:

- Managing EOSAT contract to commercialize the Landsat Program
- Licensing private operators of U.S. remote sensing systems
- Providing for U.S. Archive of land remote sensing data

On May 22, 1986, NOAA AND USGS EXECUTED AN AGREEMENT TO JOINTLY ESTABLISH THIS ARCHIVE AT THE EROS DATA CENTER IN SIOUX FALLS, SD

USGS PARTNERSHIP COMPLEMENTS NOAA'S EXPERTISE IN ENVIRONMENTAL SCIENCES & GLOBAL MONITORING:

- Existing Landsat MSS Archive at EDC
- USGS aerial photo and digital cartographic data & information management programs
- USGS research in Earth sciences
- Opportunity to develop cooperative remote sensing research program at EDC collocated with the Archive

THE LAW REQUIRES NOAA TO CONSULT WITH AND SEEK THE ADVICE OF USERS AND PRODUCERS OF LAND REMOTE SENSING DATA IN PLANNING THE ARCHIVE

- This workshop is the first. Other workshops will follow over the next year with PRIVATE SECTOR, ACADEMIC, AND OTHER GOVERNMENT INTERESTS (gives Federal agencies an edge in guiding definition of basic data set)
- As the Archive program matures, a more formal advisory and consultation mechanism will likely be needed, such as a formal Archive Advisory Group

LEGISLATIVE BACKGROUND

P.L. 98-365: THE LAND REMOTE-SENSING COMMERCIALIZATION ACT OF 1984

- o Establishes framework for commercialization of the U.S. Landsat Program (TITLE II & TITLE III)
- o Requires Dept. of Commerce (NOAA) to license private operators of U.S. remote sensing space systems (TITLE IV)
- o Directs NASA, NOAA, & OTHER FEDERAL AGENCIES to conduct continuing programs of research in remote sensing (TITLE V)
- o Directs Secretary of Commerce (NOAA) to provide for archiving of land remote sensing data (TITLE VI)

LEGISLATIVE GUIDANCE FOR THE ARCHIVE

- o EXPLICIT DIRECTIONS: "to provide for long-term storage, maintenance, and upgrading of a basic, global, land remote sensing data set (or basic data set) for historical, scientific, and technical purposes, including global environmental monitoring"
- o COMPREHENSIVE SCOPE:
 - Landsat provides baseline global data for this Archive, but can also include data from any remote sensing space system of value to "land applications"
 - Legislative "Charge" is to anticipate history: Must take into account future scientific technological developments and requirements for the basic data set
- o ACTIVE CONSULTATION WITH DATA USERS & PRODUCERS REQUIRED: in defining the initial content of, and in upgrading, the basic data set

HISTORICAL BACKGROUND

- o IMPORTANT TO REMEMBER THAT ARCHIVING REQUIREMENT AND OPPORTUNITY DERIVES FROM 14 YEARS OF "THE LANDSAT EXPERIMENT" - learning how & what to acquire, process, deliver, catalog & archive for future use
- 1972 - 1981: Initial experimental phase operated by NASA with Landsats 1, 2, and 3
- 1981 - 1985: "U.S. Govt. operational" phase managed by NOAA with redesigned Landsat 4 and 5 system
- 1985 - Present: "Franchised operational" phase conducted by EOSAT with Govt. provided equipment (GFE) under contract to NOAA - another kind of experiment: commercialization
- 1989 + : First truly commercial Landsat operation possible with launch of Landsat 6

ACCOMPLISHMENTS OF THE LANDSAT EXPERIMENT

- o "World Reference System" for locating individual Landsat scenes
- o Landsat catalog system at the EROS Data Center (EDC)
- o Accumulation of more than 675,000 Landsat scenes at EDC
- o International network of cooperating foreign ground stations
- o Family of "Standard Formats" for Landsat digital data products
- o Growing community of users and producers of remote sensing data

CONSEQUENCES OF COMMERCIALIZATION & P.L. 98-365 ON THE ARCHIVE

- RESTRICTED ACCESS TO ARCHIVED DATA SUPPLIED BY PRIVATE OPERATORS OF LAND REMOTE SENSING SPACE SYSTEMS FOR TEN YEARS
 - EOSAT FRANCHISE: The Archive cannot distribute Landsat data in NOAA's Landsat Archive on September 27, 1985 (date of contract signing) until July 1994
 - After ten years from date of sensing, the Archive can distribute copies of land remote sensing data supplied by private operators (including Landsat data sensed after September 27, 1985) for the cost of reproduction and transmittal
 - POSSIBLE EXCEPTIONS: Private operators may relinquish exclusive rights to sell archived data earlier or may agree to limited use for research and/or emergency disaster assessment purposes
- THE GOVERNMENT PAYS REASONABLE COSTS OF REPRODUCTION AND TRANSMITTAL FOR DATA SUPPLIED TO THE ARCHIVE BY PRIVATE SYSTEM OPERATORS WHEN REQUESTED BY THE SECRETARY OF COMMERCE

AGREEMENT FOR THE SUPPLY OF SPOT DATA TO THE ARCHIVE

- o SIGNED BY NOAA & SPOT IMAGE CORPORATION ON AUGUST 22, 1986
- o SPOT IMAGE CORPORATION NOT LICENSED BY U.S. GOVT. - SPOT Image Corporation has exclusive license to sell SPOT data from French Government-owned satellite and, therefore, does not have to comply with P.L. 98-365 regarding the Archive
- o HOWEVER, THEY HAVE AGREED TO:
 - Supply SPOT data to the Archive for six-year period
 - A reduced fee (\$600 per digital tape) for Archive requests
 - Permit the Archive to distribute copies of SPOT data after ten years from date of sensing for cost of reproduction and transmittal
 - Permit use of archived SPOT data for disaster assessment
 - Potential for separate agreements, e.g., for permission to use archived SPOT data for research purposes
 - Permit Federal agencies to donate SPOT data to Archive

FEDERAL DONATIONS OF DATA TO THE ARCHIVE

- NEW CONCEPT DURING NEGOTIATIONS WITH SPOT IMAGE CORPORATION
- OBVIOUS ADVANTAGES FOR ARCHIVE PLANNING
 - Extend funding for basic data set purchases
 - Constant reminder of changing scientific & programmatic requirements for land remote sensing satellite data
 - Stimulate Federal use of historical data base as data "emerges from ten-year eclipse"
- POTENTIAL ADVANTAGES FOR FEDERAL PARTICIPANTS
 - Savings in long-term storage, cataloging & retrieval costs
 - Remote sensing data previously used would be preserved for future comparisons with agency data bases and records
 - Opportunity to influence "special data sets"

REMEMBER! DATA DONATED TO THE ARCHIVE WILL NO LONGER BE YOUR DATA

- AFTER TEN YEARS, COPIES OF DONATED DATA WILL BE AVAILABLE FOR COST OF REPRODUCTION & TRANSMITTAL
- SOME DONATED DATA MAY NOT BE PRESERVED IF NOT WITHIN DEFINITION OF THE BASIC DATA SET
- TIMING OF DONATION SHOULD MEET AGENCY NEEDS
 - Within first ten years after sensing, relinquish rights to data and transfer all copies to the Archive only after immediate access no longer needed for agency requirements (Some may transfer data as soon as used once, others may wait several years)
 - FOR ARCHIVE PLANNING PURPOSES, REQUEST PARTICIPATING FEDERAL AGENCIES "PLEDGE" DATA AS SOON AS POSSIBLE AFTER PURCHASE

BASIC DATA SET ISSUES AND CONCEPTS

LEGISLATIVE GUIDELINES AND REQUIREMENTS

- CONCERNING CONTENT OF THE BASIC DATA SET
 - EXISTING DATA AS A BASELINE
 - FUTURE TECHNICAL AND SCIENTIFIC DEVELOPMENTS AND NEEDS
 - DUPLICATIVE GEOGRAPHICAL COVERAGE WITH DIFFERENT DATA
 - COMMERCIAL LANDSAT DATA
 - FOREIGN GROUND STATION DATA AND FOREIGN SPACE SYSTEM DATA

- AVOIDING COMPETITION WITHIN U.S. COMMERCIAL SYSTEM OPERATORS
 - REQUIREMENTS FOR PROVIDING DATA TO THE ARCHIVE
 - EXCLUSIVE RIGHT TO SELL THOSE DATA
 - FOREIGN SYSTEM DATA

- IMPLICATIONS OF LEGISLATIVE GUIDELINES AND REQUIREMENTS
 - ARCHIVE NOT INTENDED TO BE AN "ALTERNATE" SOURCE OF DATA
 - RATHER, INTENDED TO BE A UNIQUE RESOURCE OF HISTORICAL DATA, PARTICULARLY VALUABLE TO FUTURE GENERATIONS

BASIC DATA SET ISSUES AND CONCEPTS (continued)

PROPOSED SCOPE OF THE BASIC DATA SET

- IMPLICATIONS OF RESTRICTIONS ON DATA ACCESS
 - LITTLE POINT IN ATTEMPTING TO MEET NEAR-TERM NEEDS
 - RECORD LONG-TERM PHENOMENOLOGICAL CHANGE

- REPETITIVE GLOBAL DATA SETS
 - CONSTRAINTS
 - DETERMINING SPECIFIC CONTENT
 - INCREASED U.S. COVERAGE

- DETAILED STUDY SITE DATA SETS

- CATASTROPIC PHENOMENA DATA SETS

- CALIBRATION DATA SETS

DEFINING THE CONTENT OF THE BASIC DATA SET

- REQUIREMENTS

- APPROACH

- SIGNIFICANCE

RESULTS

With regard to the major purpose of the workshop: the solicitation of critical, inter-disciplinary, scientific input; agency representatives were able to provide their input to the definition of the Basic Data Set through the discipline specific discussion groups. This input was limited by the time available. Results of each discussion group were summarized and presented to all participants by the discussion group leaders.

The concept of the Archive and the requirements were communicated to representatives of 28 Federal agencies. The participants were able to discuss and question the concept and methods.

A resolution was passed by the Federal participants encouraging NASA and NOAA to continue to process Landsat 1, 2, and 3 Multi-spectral Scanner (MSS) Wide Band Video data to computer compatible tape (CCT) to enable long-term preservation of this early data set in digital form. Subsequent to the workshop, NOAA and NASA entered into an agreement to continue the CCT processing through March 1987. When this agreement ends, it is expected that some 14,000 scenes that had been selected for conversion to a digital data set will not be converted. They will be lost to the digital archive.

Response forms were distributed to all interested participants to encourage more detailed agency input. As the response forms were used by the discussion groups, all participants will be able to help other members of their agencies complete the forms.

SUMMARY OF DISCIPLINE-SPECIFIC DISCUSSION GROUPS

Discipline-specific discussion groups met for three hours to develop input to the five response forms; see the Discussion Materials handout attached. All groups reported that there was insufficient time to accomplish all response forms. Each discipline group responded to the phenomena and related information requirements. A broad characterization of the responses would be renewable resources, such as naturally functioning ecosystems, and nonrenewable resources, geology. The biology discipline identified the requirement to establish a worldwide baseline [B.R1].* All disciplines agreed to this requirement. The biology group stated that "...because the development of vegetative cover varies widely from boreal to temperate to tropical environments, specification of the optimum number of seasons and times of the year of coverage must be made on a geographic basis." All disciplines agreed to this baseline requirement.

The second general requirement identified and accepted by all disciplines was selected periodic coverage. The maximum time period between successive data points identified was every ten years. In general, the non-renewable resource groups specified five to ten years, while the renewable resource disciplines identified more frequent coverage, a minimum of every year with two scenes per growing season preferred [A.R1]. The environmental discussion group related frequency of coverage to spatial resolution [E.R5]. Low resolution systems coverage such as (AVHRR) would be daily. Medium resolution systems (MSS, TM, and SPOT) coverage would be 3 to 5 years with more frequent coverage of areas of interest. High resolution systems (SISEX and HIRES) coverage would be of very restricted areas and frequency.

Four groups addressed catastrophic coverage: biology, cartography, geology, and hydrology/glaciology. The hydrological group recommended the most sweeping coverage, "...all available data from all available sensors [H.R4]". The Chernobyl incident demonstrated the wisdom of this recommendation as many investigators or users did not anticipate the information available in TM Bands 5 and 7. The cartographic group identified any landform displacement of 10 meters or greater [C.R4]. The geology group identified earthquakes and volcanic activity. They noted that the data required should include data from up to 25 years after the event [G.R4]. They also identified a more limited frequency of coverage for their events: two to four acquisitions per year for the first

* In this discussion, specific reference to the written workshop report is made such as [A.R1] for: Agriculture, Response Form 1; where B = Biology, C = Cartography, E = Environment, G = Geology, and H = Hydrology/Glaciology. Complete group reports appear in Appendix B.

five years followed by one acquisition per year for 20 years [G.R4]. All disciplines agreed that certain "sites" would require more frequent coverage, some as often as every available opportunity. No reliable definition of the size of a "site" was made. Estimations ranged from 50 Km² [A.R3] to a continent. During the final discussion period, there appeared to be a general consensus that site selection would be determined when something changed; i.e., when a phenomenon or feature was identified to monitor. Examples of change noted included such things as population, climate, and disaster (natural or man-induced). The hydrological group noted that the global coverage requirement could be fulfilled by using combinations of available data in any combination of sensors and resolution [H.R2].

Spectral requirements parallel the existing satellite systems, requesting that reflected electromagnetic radiation be augmented by additional emitted thermal data and microwave (Ka, X and L Bands) [G.R2].

Spatial resolution requirements ranged from the 1 kilometer of AVHRR and the 80 meters of Landsat MSS, to 10 meters. The cartography discipline indicated that spatial resolution of one centimeter may be desired [C.R2].

Cartography noted that vertical control or resolution was important to their discipline. The cartographers identified vertical control of 0.1 meter [C.R2].

Conflicting requirements exist between the renewable and non-renewable resource communities as to time of year for data collection. Geologists recommend leaf-off coverage, preferably during the late summer or fall season [G.R1]. The agricultural community recommends coverage at flowering/peak greening and at the planting/emergence period; i.e., during the spring season [A.R1]. The agriculture group does not require leaf-off coverage every year [A.R1].

The renewable resource community made very general recommendations directed to specific types of areas [A,B.R4]. However, at the workshop, they did not identify any specific area to be included in the initial definition of the Basic Data Set. The geological group made specific recommendations by phenomenological-type [G.R4]. The cartographic group noted that cultural boundaries, major metro areas (population greater than 1,000,000) and specific areas where landform displacement of 10 meters or more had occurred, should be monitored on a global basis [C.R4].

Sensor calibration was not addressed. The environmental discussion group [E.R5] used response form 5 to present a concept of frequency coverage.

One concern of the Archive Study Group was: Is there a need for more extensive coverage over the United States? The biology and cartographic discussion groups did not identify such a need [B,C.R2]. The agriculture group did identify a "crop calendar" requirement for increased U.S. coverage [A.R2]. The geological group identified extra U.S. coverage for neotectonics and mass movement phenomena [G.R2].

In the closing review of all discipline groups, six technical points and two political issues emerged. The technical points were:

1. Obtain the earliest reference scene that is available.
2. Obtain data where and when things are changing, including:
 - a. population centers,
 - b. climatological phenomena,
 - c. disasters, etc.
3. Frequency of coverage and best time of selected coverage are discipline-dependent:
 - a. renewable resources: minimum of three times per year with site-specific characteristics. Leaf-off condition desired for vegetation monitoring is spring.
 - b. non-renewable resources: acquire data every 5 to 10 years on a global basis. Leaf-off condition desired is fall.
4. Frequency of disaster coverage is determined by the disaster. Recommendations came from the cartography, geologic, and hydrology discussions.
5. The context of the spectral and spatial requirements are what users are familiar with today. They have the following general guidelines:
 - a. The AVHRR, MSS, TM, and SPOT spectral, spatial and repeat coverage are the basis of users' expectations;
 - b. The users believe that some low resolution data must be acquired frequently. The example given by the user group was the daily acquisition of AVHRR at one kilometer resolution;

- c. As the spatial resolution increases, the renewable resource community proposed that the number of spectral bands can decrease and the frequency of observations can be very site-specific.
 - d. the non-renewable resource community has an extensive interest in higher resolution data in the emissive thermal infrared region.
 - e. certain phenomena require an active sensor; i.e., microwave data.
6. The discipline groups identified a fourth system parameter--vertical control--required to support their activities. Vertical control was identified as an adjunct to spatial resolution. The vertical control requirements ranged from 10 meters to 1 centimeter.

The political issues were:

1. Donated data. NOAA proposed that Federal users could donate data to the Archive with the constraint that access to the donator would be restricted for ten years after sensing, in accordance with PL 98-365. Federal users expressed grave reservations about buying data and, after donating, being unable to use it again for ten years. This resulted in a proposal that an ownership flag be incorporated into the Archive. The flag would allow copies of "owned" data to be returned to the donor. This concept would parallel the existing ownership flag of the National High Altitude Program (NHAP) data. The Federal users indicated that such a concept was reasonable to them if it could be done. Subsequent to the meeting, the EROS Data Center (EDC) has informally agreed that an ownership flag could be incorporated into the Archive database. EDC noted that a policy decision would be required as to "level of ownership within a Department, Bureau, Division, etc. SPOT has agreed that the concept of ownership is acceptable. SPOT has reservations about the interpretation of ownership. Presently, details are being discussed with them. EOSAT has indicated that they are willing to explore the concept. Benefits accrue to both the Federal users who will not have to pay storage costs, and to the Archive, because the data will be in the Archive and the occasional request for "owned" data will insure that the data from the Archive is fully useable.
2. Interface to National Archives. Two concepts occur in the interface:

- a. PL 98-365 states that "...it is in the public interest for U.S. to maintain an archive of land remote sensing data for historical, scientific, and technical purposes...." PL 98-365 designates the Secretary of Commerce as the responsible agent. The Act does not specify interaction with the National Archives. Historically, the concept of the Landsat data becoming a portion of the National Archive has been recognized. The informal understanding of the agencies involved in the past has been that because the archival form of the present data has required sophisticated hardware to process it to a form that the user needed, the data would remain with the hardware until it became an inactive data set. When that point and time were reached, the data was to be transferred to the National Archives. This was an acceptable arrangement between the agencies involved. At the present time, the agreement entered into between NOAA and the USGS to locate the National Satellite Land Remote Sensing Data Archive at the EROS Data Center can continue the previously-agreed-to-arrangement. However, this arrangement leads to the second concept:
- b. If the National Satellite Land Remote Sensing Data Archive were under a part of the National Archives, then it would be accorded a recognition and a degree of protection which should insure that it is preserved. At the present time, this is not the case. Issues such as funding are being worked jointly by NOAA and USGS. NOAA agreed to become the focal point for this issue and will explore with the National Archive this possibility.

The Ad Hoc NOAA/USGS Archive Study Group is developing a proposed initial "basic data set" for the Archive based on this workshop.

RESOLUTION REGARDING PRESERVATION OF HISTORIC LANDSAT DATA

The following resolution was adopted by strong consensus of the participants at the "Workshop for Federal Agencies - Defining the Basic Data Set for the National Satellite Land Remote Sensing Data Archive", held on September 10, 1986 at the U.S. Geological Survey National Center, Reston, Virginia. Sixty participants from 28 Federal agencies attended the Workshop. As part of the open discussion during the Workshop, there were questions about the status of conversion by NASA of Landsat 1, 2, and 3 wideband analog Multispectral Scanner data from 1976-1978 to CCT-X formatted digital data. It was explained that internal NASA budget adjustments have resulted in the decision to terminate this conversion process at a point where more than 17,000 scenes remain to be converted from the 58,000 scenes that were selected for priority conversion and addition to the Landsat archive. It was explained that the unique hardware used for this conversion at the NASA Goddard Space Flight Center would be dismantled, so that it would be very unlikely that the conversion process could be renewed in the future.

RESOLUTION:

"We acknowledge that 17,000 priority selected Landsat 1, 2, and 3 Multispectral Scanner scenes from 1976-1978 remain to be converted by the National Aeronautics and Space Administration (NASA) from wideband analog format to CCT-X format, and that NASA has decided to terminate this conversion process and dismantle the conversion hardware. These Landsat data constitute almost one-third of the scenes that were selected for priority conversion based on their global coverage and high quality. They constitute an important part of the basic Landsat data archive that will be lost to future generations if not converted now.

Therefore, we urge NASA to reconsider its decision to cease data conversion and to dismantle the hardware used for this purpose. Furthermore, we urge the National Oceanic and Atmospheric Administration (NOAA), who has responsibility for Landsat data archiving, to work closely with NASA to resolve this issue in a manner that will result in the conversion of the remaining 17,000 scenes."

SUMMARY OF WORKSHOP QUESTION AND ANSWER PERIOD

AREA AND FREQUENCY OF COVERAGE

Should areas not covered by Landsat, such as high polar latitudes where AVHRR or DMSP coverage exists, be included?

Answer: Yes. Any sensor/data information will be incorporated into the Archive if it is deemed useful.

Will the Archive contain data over land-water interface areas, such as coral reefs and coastal areas?

Answer: Yes. Attempts will be made to capture data where land is identifiable, including shallow sea areas.

In the real world, it is possible that certain unknown phenomena will occur in a shorter period of time than the proposed long-term period (i.e., up to ten years) between sensings to be retained in the Archive. Should the discussion group challenge the assumption that coverage should not be in decades but interseasonal?

Answer: Yes. Use the collective wisdom of the discipline group. Also use the group's experience to judge if remote sensing would be able to detect any examples of such phenomena.

TYPES OF DATA/DATA CHARACTERISTICS

Are there specific data sets that can be excluded so that the discipline groups can narrow their workload? Any guidelines?

Answer: No, the goal today is to identify phenomenology and sensor characteristics required to capture the phenomena.

Is the scope of the Archive to preserve only digital data and can commercial data such as Large Format Camera (LFC) data be included in the archive?

Answer: The scope is not limited to digital data. The Archive will try to preserve any data deemed relevant in any format. The Archive will include commercial data such as LFC and the shuttle photographic collection(s) if they are appropriate to the identified phenomenology. Agreements will be accomplished between the Archive and the appropriate agency to include the data. Today, focus on the process and not concern with the format of the data.

Will cloud cover and quality be specified for data entering the Archive?

Answer: Yes. The initial recommendation is cloud free and highest quality; i.e., the best possible data.

BUDGET AND POLICY ISSUES

Is there any cost constraint with respect to the data or the maintenance of the data of which the discussion groups should be aware?

Answer: There are none for the purposes of this discussion. Because commercial interests will respond to market demands, and by law there will be no access to the data for ten years, the discussion groups must assume a realistic approach and they must try to scope their discussion "for decades." Clearly, there will be budget or cost constraints. That will be applied in future discussions of the Archive. However, today's effort should be directed toward a scientific determination of the requirements for the Archive.

What legal protection for the acquiring, funding, and maintenance of the Archive exists? Can the Archive be managed and operated by NOAA and the USGS under or in cooperation with the National Archive so that it has an assured future? Legislation similar to that for the National Archive could insure a permanent program.

Answer: Presently it does not have the legislative protection afforded the National Archives. The concept will be explored by NOAA.

How long will EOSAT retain Enhanced Thematic Mapper (ETM) data in its archive?

Answer: At the Preliminary Design Review (PDR) in April 1986, EOSAT indicated that it would retain all data for 45 days and would also retain a subset of the data as a working inventory for periods to be determined by its marketing staff. This period may change. By terms of the contract, the U. S. Government has the right of first refusal for all ETM data. The U. S. Government/EOSAT interface for the ETM data going to the Archive will be discussed in future PDR's.

CALIBRATION DATA

Please elaborate on calibration data sets being incorporated into the Archive. Will related ground data sets be included?

Answer: One of the expected benefits of the Archive is to allow the study of an area over time. It is expected that we would pick areas to be archived, along with the frequency of archiving data such that the frequency would correspond to the measurement of existing systems or areas of research. We expect comments or inputs from this Federal group identifying areas where on-going studies are being accomplished. These comments would be used to help define the archive's acquisition strategy. Incorporation of ground truth data sets has not been envisioned. It may be possible in the case of calibration data but the expectation is that the user will be able to link with other databases and networks for supplemental data.

Is donation of data by Federal agencies a possible method to increase the amount of data in the Archive?

Answer: Yes, SPOT has agreed to accept the concept of Federal agencies donating SPOT data to the Archive. The agreement with EOSAT has not been completed. It is an issue under discussion.

Without access to donated data before the ten year restriction ends, Federal researchers and data users have no incentive to donate data to the Archive. What incentive can the Archive offer to the current Federal user?

Answer: A certain degree of altruism is required because the Archive is truly for future generations. In addition, there may be advantages to the Federal user because all data has storage costs associated with it. With regard to access by the donor, it may be possible to mark the ownership of the donated data, much like the National High Altitude Program (NHAP) data is marked today at EDC. If this ownership concept is acceptable to EDC, as they would have to accommodate the marking; and to the vendors, as it would have to agree to the organizational level of ownership; department, bureau, division, etc., then it is in the Federal manager's interest to donate the data in lieu of storage costs. Orders for owned data would also assist the Archive in demonstrating that data can be recovered. Subsequent to the workshop, EDC was asked to evaluate the possibility of marking donated data. Informally, EDC indicated that the marking can be accomplished and that it would be willing to do so when asked. SPOT has agreed that the concept of ownership is generally acceptable if the interpretation of ownership is reasonable; for example, the data is obtained for reuse by the agency that originally purchased it on a related project. EOSAT indicated that it will consider the situation, also with the provision that the interpretation of ownership be reasonable. Informal discussions between National Archive and NOAA personnel indicate that a solution can be reached.

Should Federal users pledge data as soon as it's purchased, thereby insuring that it is not repurchased for the Archive?

Answer: Yes, this would assist in determining the Archive's short-term acquisition strategy.

What are the legislative guidelines for determining what is research with respect to using the Archive? Will the private operators relinquish their right in the data to allow research?

Answer: Research and Development is covered in Title V of PL 98-365. In section 501(b), the Secretary of Commerce is directed to conduct a continuing program of: research in applications of remote sensing; monitoring of the Earth and its environment; and development of technology for such monitoring. On May 22, 1986, NOAA and the USGS signed a Memorandum of Agreement, establishing a Federal Land Remote Sensing Research Program at the EROS Data Center (EDC). Discussions are underway to develop procedures for

granting research approval, obtaining archive access permission from private operators when required, and all other mechanisms related to the operation/interface of the research effort with the Archive. The access will be at EDC. It will be limited. Since it is in the interest of the private operators to support research as it may lead to additional markets; and it is in the interest of the Archive to supply limited data to the research effort to insure that the Archive can reproduce the data in the Archive, and to demonstrate that the quality of the data is preserved, we expect that all necessary agreements can be made. Therefore, we believe that we will have proper controls on what is research, and we expect only minor problems when interfacing the Archive with the Research function.

NASA's Space Science Data Center saved a great deal of early space data; however, problems exist today such that some of the data cannot be recovered. With the ten year restriction to access, it appears that the same problems may happen again. What provisions are being made to insure timely and accurate access to the Archive?

Answer: The Archive will be allowed to process and provide data for emergency situations. It will also support the Research function. It is expected that these efforts will demonstrate that the data can be recovered from the Archive. The conceptual difference between the Archive as it exists today and in the future is one of processing throughput. In the future we do not expect to process a large number of scenes in a short period of time. We also intend to rely on NASA's experience to help us avoid problems.

EARLY LANDSAT DIGITAL DATA PRESERVATION

What is the status of the current program to digitally preserve selected MSS scenes from Landsat 1, 2, and 3 from 1972 to 1979?

Answer: Due to budget constraints, NASA intends to discontinue the preservation effort at the end of October 1986. The effort requires funding of approximately \$100,000 per month. NASA is not interested in month-by-month funding; quarterly funding increments are acceptable. Users (public and private) have been notified and NASA and NOAA have solicited funding to continue the program. No one has indicated a willingness to assist with the funding. Dr. Bailey noted that the USGS/EROS Data Center had selected scenes for processing by calendar years 1972 through 1978. The selection process was based on a climatological approach which required 1, 2, or 4 scenes per year per path/row. This approach resulted in a goal of approximately 28,000 scenes per year to be selected from an average collection rate of about 55,000 scenes per year. The actual selection of acceptable scenes based on cloud cover and quality, ranged between 7 and 8 thousand scenes per year. Presently, years 1972, '73 and '74 are effectively complete. Some 5,000 scenes remain to be done from the '75 and '76 period and about 5,000 scenes remain to be done for 1977 and 1978, respectively.

Can the USGS accept the responsibility for completing the historical CCT-X program?

Answer: Three areas need to be considered: the hardware required, the facility space, and the cost. Presently, the hardware is at GSFC. It is between 10 and 20 years old. It probably would not survive a move. The people familiar with maintaining the hardware are all at GSFC. NASA has informally noted that the hardware as it is currently used/configured covers about 2,000 square feet of computer floor space. This much computer space is not available at EDC. No investigation of funding the cost has been made by USGS. Ms. Harwood stated that the early Landsat data is becoming a victim of the aging hardware. This situation should be used as a lesson for the future.

Note: Subsequent to the workshop, NOAA was able to provide funding for operation of the conversion program through March 1987. It is estimated that when the funding ends, some 14,000 of the selected scenes will be lost.

WHAT HAPPENS AFTER THE WORKSHOP

What will happen to define the Basic Data Set after these discussion groups?

Answer: First, we will review each discipline group's response here, this afternoon. This will help us gain a collective viewpoint. Then we will publish a report on this meeting, and solicit your comments again. More generally, it is the intention of NOAA and the USGS to use several mechanisms to gain advice about the Archive. One method will be through workshops similar to this. A second method is through you; a copy of relevant material will be available after today's discussion for you to take to your workplace; then those who were unable to attend will be able to fill out the response forms and forward them to Ms. Harwood. To control and accomplish these processes, NOAA and USGS have formed a NOAA/USGS Ad Hoc Archive Study Group to guide the effort.

The NOAA/USGS Study Group members are your discussion group leaders today. They will also be identified in the Attendees List. If, after the workshop you discover other things to contribute, please contact one of them. It is expected that they will continue in their current roles until a formal mechanism is in place.

APPENDICES

ATTENDEES

Adams, L. Lewis
6001 Executive Blvd.
WSC#1, Room 710
Rockville, Maryland
FTS 443-8641

Allison, Ray
USDA/FS
P.O. Box 2417
Washington, DC
FTS 235-8184

Anderson, Arthur
Office of Surface Mining
(Attn: L. Street - Room 5101)
1951 Constitution Ave., NW
Washington, DC 20240
(202) 343-1504

Bacher, Gene
Department of Energy (EP-40)
1000 Independence Ave., SW
Washington, DC 20585
(202) 252-5174

Bailey, Bryan *
U.S. Geological Survey
EROS Data Center
Sioux Falls, SD 57198
FTS 784-7001; (605) 594-6001

Becker, Herb
CIA/OGI, 1820 N. Ft. Myer Dr.
Washington, DC 20505
(202) 351-2551

Bockes, Olin
U.S. Dept. of Agriculture
Soil Conservation Service
P.O. Box 2890
Washington, DC 20013
FTS 447-5322

Bossler, RAdm. John D.
Director, Charting & Geodetic
Services (N/CG)
NOAA, Room 1006, WSC-1
60001 Executive Blvd.
Rockville, MD 20852
(301) 443-8204

Brownworth, Fred
Chief, Branch of Requirements
USGS National Mapping Division
Department of the Interior
512 National Center
Reston, VA 22092
(703) 648-4136

Carter, Virginia *
Water Resources Division
U.S. Geological Survey
430 National Center
Reston, VA 22092
(703) 6485897
FTS 959-5897

Clark, David *
Solid Earth Div., National
Geophysical Data Center
NOAA/NESDIS (E/GC1)
Room 100, World Weather Bldg.
Washington, DC 20233
(301) 763-8021 or
NGDC (303) 497-6521
FTS 320-6521

Condes, Al
USGS National Center
Reston, VA 22092
FTS 959-5251; (703) 648-5251

Cunliffe, William H.
Director, Special Archives Division
National Archive & Records Admin.
Room 18E, 7th & Pennsylvania Ave., NW
Washington, DC 20408
(202) 523-3208

Dahl, Thomas E.
National Wetlands Inventory
U.S. Fish and Wildlife Service
Department of the Interior
Room 415, 1375 K. Street, NW
Washington, DC 20005

Donagny, Jim (Glen Trochelman) **
General Accounting Office
6001 Executive Blvd.
Washington Science Center, Bldg. 1
Room 710, Rockville, MD
FTS 443-8691

* (Ad Hoc NOAA/USGS Archive Study Group)

** Mr. Donagny attended the workshop; was replaced by Mr. Trochelman

Durland, Robert
Geography Division
Office of Field Operations
Bureau of the Census
Washington, DC 20233
(301) 763-7214

Ehrenberg, Ralph
Geography and Maps Division
Library of Congress
Washington, DC 20540
(202) 287-8525

Farnsworth, Dr. Richard K.
Hydrologic Research Laboratory
(W/OH3)
National Weather Service, NOAA
Room 519, 860 13th Street
Silver Spring, MD 20910
(301) 427-7640

Fisher, Leo J.
National Marine Fisheries Service
NOAA
Room 810, 1825 Connecticut Ave., NW
Washington, DC 20235
(202) 673-5359

Guss, Phil
USGS-PAO
National Center
Mail Stop 119
Reston, VA 22092
FTS 959-4460; (703) 648-4460

Guthridge, Guy G.
DPP National Science Foundation
Washington, DC 20550
(202) 357-7817

Hansen, Robert
Head, Remote Sensing Section
Bureau of Reclamation (Code 1524)
Denver Federal Center
Denver, CO 80225
FTS 776-4298

Hart, Galen
Remote Sensing Laboratory
Agricultural Research Service
Department of Agriculture
Bldg. 007, BARC-West
Beltsville, MD 20705
(301) 344-2822

Harwood, Peggy *
Landsat Transition Group (Ex1)
NOAA/NESDIS
Room 2051
Washington, DC 20233
(301) 763-4522

Hennig, Tom
Defense Mapping Agency Hydrographic/
Topographic Centers (REA)
6500 Brookes Lane
Washington, DC 20315
(202) 227-3320

Howard, Gordon E., Jr.
USEPA/EPIC
P.O. Box 1587
Vint Hill Farm Station
Warrenton, VA 22186
FTS 557-3110

Johnson, A. J.
CIA, 1820 N. Fort Myer Drive
1116 Ames Building
Rosslyn, VA 22209
(202) 351-2122

Johnson, L. Kae
DMA - Hydrographic/Topographic
Centers (PPT)
6500 Brookes Lane
Washington, DC 20315-0030
(202) 227-2622

Kelmelis, John
Program Mgr. for Polar Operations
USGS National Mapping Division
Department of the Interior
515 National Center
Reston, VA 22092
(703) 648-5119

Ledzian, Robert
Bureau of Reclamation (Code 220)
Department of the Interior
Room 7617, 18th & C Streets, NW
Washington, DC 20240
(202) 343-6703

Lichy, David
Water Resources Support Ctr. (WRSC)
U. S. Army Corps of Engineers
Kasey Building
Ft. Belvoir, VA 22060
(202) 355-3052

Maccini, John
Division of Earth Sciences
National Science Foundation
1800 G Street, N.W.
Washington, DC 20550
(301) 774-0848

Madill, George
Depty Chief
NCIC
Department of the Interior
509 USGS National Center
Reston, VA 22092
(703) 648-5963

McArdle, Richard C.
World Agricultural Outlook Bd.
Department of Agriculture
Room 5143, South Bldg.
Washington, DC 20250
(202) 447-5913

McCluggage, Graeme
National Archives
NNSC
Washington, DC 20408
(202) 756-6700

McDonnell, James
Federal Highway Administration
Department of Transportation
400 7th Street, SW, Room 3306
Washington, DC 20590
(202) 366-5017

McGinnis, David *
Land Sciences Branch
Office of Research & Applications
(E/RA12), NOAA/NESDIS
Suitland Professional Ctr., 3rd Floor
Washington, DC 20233
(301) 763-4240

Miller, Mike
National Archives and Records
Administration, NIRC
Washington, DC 20408
(202) 724-1409; FTS 724-1409

Milton, Dr. Nancy *
Geologic Division
U.S. Geological Survey
927 National Center
Reston, VA 22092
(703) 648-6373, FTS 959-6373

Molnia, Bruce
USGS (NMD)
National Center
Reston, VA 22092
Mail: Polar Research Bd.
2101 Constitution Ave. NW
Washington, DC 20418
(202) 334-3479

Murphy, Dr. Robert E.
Chief, Land Processes Branch
NASA - Code EEL
Office of Space Sciences & Appl.
Washington, DC 20546
(202) 453-1720

Needham, Bruce H.
Technical Asst. to Deputy Asst.
Adm. for Info Services (Ex2)
NOAA/NESDIS
1825 Connecticut Ave., NW, Rm 506
Washington, DC 20235
(202) 673-5255

Nyquist, Dr. Maurice
Chief, Remote Sensing Branch
Geographic Information Systems
Field Unit
National Park Service
P.O. Box 25287-GIS
Denver, CO 80225-0287
FTS 776-8774 or 776-7939

Osberg, Thomas
USEPA/EPIC
P.O. Box 1587
Vint Hill Farms Station
Warrenton, VA 22086
(703) 557-3110; FTS 557-3110

Ouseley, Frank
USGS, National Center
MS 508
Reston, VA 22092
(703) 648-5773; FTS 959-5773

Pettinger, Larry *
USGS, National Mapping Division
MS 590 National Center, Rm 2A326
Reston, VA 22092
(703) 648-4519; FTS 959-4519

Podwysocki, Mel
USGS, National Center, MS 927
Reston, VA 22092
(703) 648-6376; FTS 959-6376

Price, Dr. Robert
NASA, Image & Information Analysis
Center (Code 630.3)
Goddard Space Flight Center
Bldg. 28, Room 135-A
Greenbelt, MD 20771
(301) 286-9041

Rappaport, Carl
Department of Transportation
Office of Commercial Space
Transportation (F50)
400 7th Street, SW, Room 10401,
Washington, DC 20590
(202) 366-5770

Reinsel, Edward
Department of Agriculture
Economic Research Service
1301 New York Ave., NW, Room 1212
Washington, DC 20005-4788
(202) 786-3310

Repsher, Richard C.
U.S. Bureau of Mines
Denver Research Center
Denver Federal Center, Bldg. 20
Denver, CO 80225
FTS 776-0742

Rowan, Larry
USGS, National Center, MS 927
Reston, VA 22092
(703) 648-6381; FTS 959-6381

Scull, David C.
Department of Transportation
Communications & Radio Navigation
Program Manager
Research & Special Programs Adm.
400 7th Street, SW, Room 8405
Washington, DC 20590
(202) 366-4355

Siever, Fred
Department of the Interior
Branch of Environmental Studies
c/o Minerals Management Service
USGS National Center, MS 644
Reston, VA 22092
(703) 648-4504, FTS 959-4504

Spiers, Bobby
Foreign Agricultural Service
Department of Agriculture
Room 6545, South Ag. Bldg.
Washington, DC 20250
(202) 475-5126

Strickland, Harold L.
Assistant Director of Engineering
USDA/Forest Service
RPE, Room 2208
P.O. Box 2417
Washington, DC 20013
(703) 235-8046

Theisen, Eldon
National Agricultural
Statistical Service
Department of Agriculture
South Building, Room 4833
Washington, DC 20250
(202) 447-6783

Vesterby, Marlow
Economic Research Service
Department of Agriculture
1301 New York Ave., NW,
Room 408
Washington, DC 20005-4788
(202) 786-1422

Warriner, Howard *
Production Program Manager
NOAA/NESDIS
EROS Data Center
Sioux Falls, SD 57198
(605) 594-6955, FTS 784-7955

Watts, Ray
USGS/ National Center
Mail Stop 104
Reston, VA 22092
(703) 648-4450, FTS 959-4450

Weiss, Irvin
Environmental Protection Agency
Waterside Mall
401 M Street SW
Washington, DC 20460
(202) 382-2430, FTS 382-2430

Yates, Harold
NOAA/NESDIS
World Weather Building
Room 701
Washington, DC 20233
(202) 763-7190, FTS 763-7190

Young, Jeanne
National Archives and
Records Administration
NIRC
Washington, DC 20408
(202) 724-1400, FTS 724-1400

DISCIPLINE-SPECIFIC

DISCUSSION GROUP

SUMMARY REPORTS

AGRICULTURE

Leader: Peggy Harwood/NOAA-NESDIS

Recorder: Richard McArdle/USDA/WAOB

Members: Marlow Vesterby/USDA-ERS
Galen Hart/USDA-ARS
Bobby Spiers/USDA-FAS
Eldon Thiessen/USDA-NASS
Hal Strickland/USDA-FS
A. J. Johnson/CIA
Ed Reinsel/USDA-ERS
O. D. Bockes/USDA-SCS

Response Form 1. Phenomena and Related Information
Requirements for Agriculture

Phenomena

Required Information Parameters

1. Vegetation Growth

Crop phases/history (In priority)

1. flowering/peak green
2. planting/emergence
3. episodic events (risk areas)
4. harvest
5. greening up

(General Comments: Vegetation requires "time series" approach. More important to watch specific sites (critical areas) intensely, than concentrate on wall-to wall coverage. Some (less frequent) global coverage needed to catch unforeseen yet "massive" shifts in vegetation growth. Some data every year required; prefer at least 2 scenes during growing season; do not need leaf-off coverage every year.)

2. Land Treatment

overgrazing
irrigation
fertilizers
pesticides
tillage techniques
fire prevention planning/access
sodbusting

What was applied?
How much applied?
Where applied?
When applied? (affects degradation rates)

3. Land Base Monitoring

Short- and Long-term

urbanization
desertification
inc. salinity in soils
surface mining
drainage
deforestation
afforestation (reforestation)
wetland conversion
karst formation (sink holes)
subsidence
reclamation
tectonic uplift
delta building

(General Comments: Looking for changes in arable land or renewable resource base)

Response Form 1. (cont'd)

Phenomena

Required Information Parameters

4. Episodic Events
(catastrophes)

classic natural disasters, e.g., hail, flood, frost/freeze, tornadoes, fire, earthquakes, drought, etc.

man-made disasters, e.g., nuclear accidents, toxic waste spill, war

(General comments: Can't be predicted. Need greater frequency of coverage during and after event until situation returns to "normal." Characterized by limited geographic extent and relatively short duration. Need some "normal" coverage prior to event for comparison.)

5. Erosion and Deposition
water

sheet
streambanks, meanders, sand bars
rills
shorelines of lakes, oceans
siltation in lakes

. wind

dunes

6. Special Crops
(drug enforcement)

unusual location for: cultivated fields
airstrips
roads, etc.

likely areas: natural habitat
compatible crops, etc.

7. Animal Census
Livestock
Aquaculture
Wildlife

Animal units per acre

Response Form 2. Global Data Characteristics

<u>Phenomena</u>	<u>Data Types</u>	<u>Repeat Frequency</u>		<u>Time of Year</u>	<u>Other Comments</u>
		<u>Maximum</u>	<u>Desired</u>		
1. Vegetation Growth	Optimum slices thru spectrum: visible (R,G) thermal near-IR shortwave IR microwave (for soil moisture)	Annual	3x/yr	1. max. green (single best) 2. emergent 3. harvest	increase acquisitions for episodic events & for USA coverage (crop calendar driven)
2. Land Treatment	same as 1.	Annual	3x/yr	same as 1.	crop calendar driven
3. Land-based Monitoring	same as 1.	Annual	3x/yr	same as 1.	crop calendar driven
4. Episodic Events	same as 1.	3x/yr.	more TBD	same as 1.	
5. Erosion & Deposition	same as 1.	3x/yr.	event driven	event driven	
6. Special Crops	same as 1.		policy driven	policy driven	
7. Animal Census	same as 1.		same as 1.	same as 1.	

Response Form 3. Detailed Study Site Data Characteristics for
Agriculture

General Comments: Characteristics same as global (Form 2), except more spatial resolution required (also, as spatial resolution increases, need for spectral diversity decreases)

Research-specific comments: Instead of wall-to-wall coverage of USA, need only selected USA sites with intensive (multi-sensor, all possible acquisitions) - type coverage; selected sites need not exceed 50 square kilometers.

BIOLOGY
(Non-Agriculture)

Members of the Discussion Group on Biology

Leader: Larry Pettinger, USGS

Members: Ray Allison, USFS
Tom Dahl, USFWS
Maury Nyquist, NPS
Robert Price, NASA

Report of the
Biology (Non-Agriculture) Discussion Group
at the Federal Agency Basic Data Set Workshop
September 10, 1986

Group Leader: Larry Pettinger (USGS)

Participants: Ray Allison (USFS)
Tom Dahl (USFWS)
Maury Nyquist (NPS)
Bob Price (NASA)

This discussion group spent most of the allotted time discussing Phenomena and Related Information Requirements (Response Form 1) and Global Data Characteristics (Response Form 2). The following comments amplify on the attached summaries provided on Response Forms 1-3.

Phenomena and Required Information Parameters

The basic phenomenon identified by the group was defined as "naturally functioning ecosystems". This term is intentionally broad to encompass the diversity of environments found throughout the world. Such ecosystems are defined by the plant associations they contain, and by such parameters as extent and structure (vegetation density, crown closure, etc.). "Naturally functioning" ecosystems are ones in which natural processes such as plant succession operate without significant influence by man. By this characterization we exclude agricultural lands, seeded pastures, and similar ecosystems that are largely man-controlled. Natural ecosystems are the baseline units that are subject to the natural and human-caused changes listed on Response Form 1.

Global Data Characteristics

It is important to preserve a baseline data set for characterizing the ecosystems previously defined. Since vegetation cover is the dominant surface feature of most ecosystems, multiple-season coverage is desired to capture appropriate phenologic stages. Because the development of vegetation cover varies widely from boreal to temperate to tropical environments, specification of the optimum number of seasons and time(s) of year must be made on a geographic basis.

Once a baseline data set is obtained, annual data coverage at a single optimum season (based on climatic zone, general ecosystem type, etc.) would provide a suitable basis for monitoring. We acknowledged that some ecosystems (such as forests) change rather slowly and that other ecosystems (shrub and grass) develop more quickly, so the frequency of coverage should be varied depending on the dominant cover type. However, many of the changes that alter patterns of plant succession are caused by catastrophic or rapidly occurring processes, and annual data collection would be necessary.

The group could not identify any basis for requesting more frequent coverage over the United States than for worldwide coverage.

General Comments

As shown on the response forms, we did not develop any input on specific data characteristics, nor did we define any detailed site recommendations beyond the general comments shown. Significant effort from a larger constituency is needed to develop a more complete response. Nevertheless, the effort of this small but enthusiastic group does provide a starting point for future work in this topic area.

RESPONSE FORM I

Phenomena (I) and Related Information Requirements (II)

Phenomena

Naturally functioning ecosystems



Natural Changes

- Fire
- Insect/disease infestation
- Catastrophic events
- Vegetation stress
(geobotany/mineralization)
- Natural deposition
(nutrient cycling)
- Weather/climate
- Desertification
- Plant succession

Human-Caused Changes

- Fire
- Environmental deposition
- Land use change
- Urbanization
- Timber harvesting/land clearing
- Grazing
- Spread of introduced species
- Desertification

Required Information Parameters

- Plant associations
- Areal extent
- Vegetation structure
(density, overstory/
understory composition, etc.)
- Biomass (vegetation
index)
- Albedo

- Plant associations
- Areal extent
- Damage levels (stratify
by intensity)
- Soil moisture
- Wind speed/direction
- Topography (elevation, aspect,
slope)
- Temperature

RESPONSE FORM 2

Discussion Group Biology
(non-agriculture)

Global Data Characteristics (III)

Phenomena	Data Types	Spectral (wavelength, # of bands, bandwidths) or Other (specify) Characteristics		Spatial Resolution		Frequency of Repetitive Acquisition		Recommended Time of Year for Acquisition		Comments: Increased U.S. Coverage; Other
		Minimum	Desired	Max.	Des.	Max.	Des.	Single Best	Other*	
Naturally functioning ecosystems					High resolution		Baseline = first year of available data (multiple-season coverage depending on ecosystem and climatic zone)			Increased U.S. coverage not needed.
Natural and human-caused changes					Depends on type of monitoring		Annual coverage for most monitoring tasks		At single optimum time of year specific to ecosystem and climate zone	

53

*Complete only if single acquisition per repetitive cycle is totally unacceptable.

RESPONSE FORM 3

Discussion Group Biology
(non-agriculture)

Detailed Study Site Data Characteristics (IV)

Prioritized Phenomena	Data Characteristics* (type, spectral and other, spatial resolution)	Frequency of Repetitive Acquisition	Number of Acquisitions per Rep. Cycle; Time of Yr. for Acquisition	Site Recommendations (latitude/longitude)	Comments: Extrapolation Potentiality; Other
(Specific phenomena not identified due to short- age of time)	Higher spatial (and possibly spectral) resolution for certain applications		More seasons per year for certain types of change monitoring	National Parks Biosphere reserves Specific sites for particular studies (established research areas)	

*Complete only if different from global data recommendations.

CARTOGRAPHY

Members of the Discussion Group on Cartography

Leader: David Clark/NESDIS-NGDC

Members: Jenne Young/NARA
Graeme McCluggage/NARA
Guy Guthridge/NSF
F. S. Brownworth/USGS
D. C. Scull/DOT-RSPA
John D. Bossler/NOAA-NOS
Carl S. Rappaport/DOT
Tom Hennig/DMA
Ralph Ehrenberg/LC
William Cunliffe/NARA
Robert Durland/Census
John Kelmelis/USGS
David E. Meier/BLM
Lew Adams/GAO
George Madill/USGS

Cartography Working Group Report

The Cartography Working Group was made up of fifteen individuals representing a wide range of Federal Government agencies. Representation from the various major line components of the Departments of Interior, Commerce, Transportation, and Defense as well as the National Science Foundation, Government Accounting Office, National Archives, and the Library of Congress resulted in an in-depth discussion on the diverse applications of remote sensing for cartography. This variety in participants and diversity in applications initially resulted in a rather loose and protracted debate on the exact nature of the Basic Data Set. However, after some basic assumptions were defined, a consensus was reached as to the important remote sensing requirements for cartographic applications.

Two basic assumptions were made that focused the group's discussion. First, Earth remote sensing virtually always requires mapping of the observed thematic data i.e. relating the observed data to standard maps of the Earth. Since there were other working groups concerned with this thematic data, the group concluded that our discussion would be limited to considering only the "base map" requirements. This base map information is the criteria by which the thematic data is registered. Second, an implied boundary condition for the Basic Data Set is that the user will not have access to the archived data for ten years after collection. One of the major tasks in the field of cartography is change studies. This is the correction, updating and modification of existing maps (in our case base maps) to depict changes due to dynamic natural or man-made processes. Therefore, our working group had to focus on changes (short and long term) that would be of significance a decade after occurrence.

RECOMMENDATIONS

Elements of a Global Baseline Criteria.

These are the "base map" information referred to above and are grouped below in priority.

1. Control. The most fundamental consideration in map making is the geodetic control. This includes the vertical control (variation above or below the Earth's geoid), and the horizontal control (error in geographic or spatial positioning).
2. Hypsography/Hydrography. Hypsography is essentially the relief of the Earth's solid surface. Hydrography represents the fluid portion of the Earth's surface (streams, rivers, lakes, and oceans) by their boundaries and depths.
3. Transportation/Culture/Boundaries. Transportation is the roads, railroads, pipelines, etc. Culture is the many man-made influences on the Earth's surface such as cities, airports, etc. Boundaries are the political and administrative divisions related to culture that have a common natural feature visible by remote sensing. An example is country boundaries coincident with coastlines, rivers, etc.
4. Land Use/Land Cover/Other Thematic and Geological Data. These were added so as to remind our group and the other working groups of the eventual use of the baseline data. These were the subjects of the other working groups.

Characteristics of the Global Baseline Criteria.

This part of the discussion focused on the remote sensing characteristics that would maximize the usefulness to cartographers.

Criteria	:Spectral :Characteristics	: Spatial : Resolution : Min/Max	: Frequency of : Acquisition	: Best Time for : Acquisition
Control				
Horizontal	:Multispectral	: 10m/1cm	: <u>Once</u>	: Spring, max.
Vertical	:(Min. 3 bands)	: .1m/—	:(one good scene needed as a baseline)	: leaf off, no snow cover, normal water level
Hypsography	: "	: 200m/10m	: "	: "
Hydrography	: "	: 1:250K/1:100K (Nat'l Mapping Standards)	: "	: "
Transportation:	: "	: "	: "	: "
Culture	: "	: "	: "	: "
Boundaries	: "	: "	: "	: "

NOTE: No special coverage needed for U.S. if one good global coverage is compiled as defined by characteristics listed above.

Detailed Study Site Characteristics.

This topic was discussed in the context of change studies. In general, these are made every ten years for the Culture/Boundaries/Transportation criteria. An exception is major metropolitan areas with a population over one million. These should be done every five years. Another major cartographic requirement is that dynamic geophysical/geological change greater than ten meters should be recorded for map updating. Examples of this are major landslides, earthquakes, and volcanic eruptions.

David M. Clark
National Geophysical Data Center

ENVIRONMENT



Members of the Discussion Group on Environment

Leader: Dr. Nancy Milton/USGS

Members: Arthur Anderson/OSM
Gene Bacher, DOE
Jim Donaghy/GAO
Leo Fisher/NOAA
Robert Hansen/USBR
Gordon Howard/EPA
Bob Ledzian/USBR
Jim McDonnell/DOT
Mike Miller/NARA
Nancy Milton/USGS
Robert Murphy/NASA
Tom Osberg/EPA
Fred Sieber/MMS
Irvin Weiss/EPA
Harold Yates/NOAA



United States Department of the Interior

GEOLOGICAL SURVEY
RESTON, VA. 22092

In Reply Refer To:
Mail Stop 927

October 29, 1986

MEMORANDUM

To: Peggy Harwood, NOAA/NESDIS
From: Nancy Milton, USGS *NM*
Subject: Report on "Environment" discussion group

Fifteen group participants met to define phenomena to be monitored and sensor requirements for the Basic Data Set. As environmental problems tend to range from very local (in both time and space) to global, data set requirements were difficult to pin down precisely. Basically a tiered data set was preferred: local coverage of very small areas daily for a year, seasonal for several succeeding years, annual for several more years, then decadal. In addition, periodic global coverage was considered essential, at 10 year intervals if possible, though the 10-year interval was thought overly optimistic.

Enclosed are response forms from the questionnaire, a list of group participants, and a list of questions asked from the floor during the morning session of the Workshop.

RESPONSE FORM 1

Phenomena (I) and Related Information Requirements (II)

<u>Phenomena</u>	<u>Required Information Parameters</u>
<u>(AIR)</u>	
Global weather	Backscatter
Air Pollution acid rain	Cloud coverage
particles	Air movement
Stress gradients across	temperature
ecosystems	content (moisture, particle)
	Particle movement
<u>(Land)</u>	
Land Use	urbanization
	deforestation
	surface mining
	erosion
Waste treatment and Disposal	Inventory of surface materials
Changes in physical/climatic	Land use/cover changes
affecting land	Changes in topography
	Stress in vegetation
desertification	Changes in biomass,
Large-scale engineering	seasonal display, composition
New Salt Lake	
Stress gradients	Changes in albedo, surface
	roughness, moisture capacity
	Spectral characteristics
<u>(Water)</u>	
Coastal dynamics	Vegetation-type, biomass
Sedimentation	Sedimentation and drainage
Continental shelf	Urban — wetland areas
Inland-wetlands-changes	Seasonal changes
Water quality	Temperature
Large scale engineering	Surface films (eg. oil seeps, spills)
	Currents, turbidity

RESPONSE FORM 5

Calibration Data Targets (VI)

<u>Data Types</u>	<u>Recommended Calibration Target Materials</u>	<u>Potential Target Sites (geographic locator)</u>
<u>Reflected EMR -</u>		
0.4 - 0.7 μm :	Low spatial AVHRR	Daily -- seasonal annual -- decadal
0.7 - 3.0 μm :		
3 - 5 μm :		
<u>Emitted EMR -</u>		
3 - 5 μm :	Medium MSS TM SPOT	3-5 yr U.S. coverage frequent coverage of "hot spots" - seasonal of some - annual of some
8 - 14 μm :		
<u>Microwave -</u>		
0.8 - 1.1 cm (Ka):	High spectral SISEX HIRES	very restricted areas
2.4 - 3.8 cm (X):		
15 - 30 cm (L):		
<u>Others (designate):</u>		

General questions from the floor (during morning discussion)

1. Land-water interface areas (coral reef, e.g.). Are such excluded from archive?
2. McArdle: Are there specific data sets we will exclude?
Classified?
Ans: want to identify sensor characteristics
3. Digital only?
No, LFC, shuttle photographic collection
4. High polar regions - not covered by Landsat? AVHRR, etc.
Yes, we could include them
5. Donations of Eosat data by federal agencies?
Haven't finished agreement with Eosat yet, but probably yes.
6. Bob Murphy: Elaboration of calibration data sets.
7. Robinove: difference between library and archive.
8. Cloud coverage and quality?
Best possible
9. Current potential loss of data from MSS?
1 mo. extension (ans. by Murphy); need \$100,000/mo. to keep processing tapes
10. Can USGS step in and provide \$ and facilities?
Facilities, no; \$, who knows?
11. Ray Allison: cost of archive? Maintenance Cost?
No constraints on today's objectives
12. Robinove: Legal protection for archive? Can it be under National Archives so it has their protection?
13. Private operators relinquishing data? How is "scientific research" defined? (Questions says everything is research).
14. Ray Watts: 10 yr deadline should not preclude seasonal and other short-term looks.
15. Will be more agreement within than between groups. What happens after these groups? (Refers to workshop discussion groups)
16. Bob Price: Nasa used to have a similar change. How are we doing things differently? Will access really be possible after 10 years?
17. Bob Murphy: No incentive to help with archive
Ans- for future generations.
18. John Bossler: Is there a difference in how federal agencies and private firms buy data now? Order through USGS BPA

GEOLOGY

Members of the Discussion Group on Geology

Leader: Dr. Bryan Bailey/USGS

**Members: Herb Becker/CIA-OGI
John Maccini/NSF-Div. of Earth Sciences
Richard C. Respher/Bureau of Mines
Larry Rowan/USGS
Charles M. Trautwein/USGS-EDC**

GEOLOGY DISCUSSION GROUP SUMMARY

The Geology Discussion Group spent approximately the first one hour of the time allotted discussing geologic phenomena of potential long-term significance to future generations. It was generally agreed that the term phenomena, in the context of geology, must be taken to include the long range objective of more fully understanding and characterizing the Earth's crust, because meeting such an objective has great potential significance for the future. Such significance includes, but is not limited to, the ability to meet future requirements for petroleum and mineral resources, including strategic minerals.

The phenomena defined as the second priority was one termed neotectonics or tectonic geomorphology, which relates particularly to the long range requirement of safely and appropriately disposing of waste materials in subsurface disposal sites that do not pose a threat for leakage and contamination.

Fluvial processes were designated as the third phenomena. Such processes are significant because they influence the redistribution, through erosion and deposition, of surface materials important to man. These processes were deemed particularly significant as related to delta development and, through flooding, delta destruction.

Eolian processes were identified as the fourth phenomena of significance, particularly as related to desertification in various parts of the world, and to their effects on land use, such as in the sand hills of the western Great Plains.

The phenomena identified as the fifth priority was structural instability. This was noted as being important as relates to earthquake prediction, as well as in such activities as dam siting, mine development, and pipeline construction. Other geologic phenomena of potential significance identified by the group included mass movement, as may relate to identification of land slide prone areas and various construction siting considerations; heat flow, as relates to geothermal resource exploration, monitoring of volcanic activity, and various other scientific problems of global scope; and coastal processes, particularly as relate to their influence on beach development and erosion and on reef destruction.

The group also identified additional geologic-related phenomena of long-term significance, which we assumed would be identified and addressed by other disciplinary groups. These included glaciation, sea level fluctuations, pollution, geobotanical phenomena, floods, and reclamation activities.

Following identification of the geologic phenomena previously noted, the group spent most of the remaining time discussing and identifying information parameters required to detect and study the phenomena and data types and characteristics required to address the information parameters and study the phenomena on a global basis and at selected detailed study sites. Results of those discussions are tabulated on Response Forms 1-3.

Time permitted only limited discussions on catastrophic geologic phenomena which should be considered in defining the basic data set. Two phenomena were identified: earthquakes and volcanic activity. Brief discussions on data characteristics important in the study of these phenomena and the processes that may operate in their aftermaths are summarized in Response Sheet 4. Time did not permit the topic of calibration data to be addressed by the Geology Discussion Group.

Participants in the Geology Discussion Group were:

G. Bryan Bailey, (Chairman) USGS/EDC
Herb Becker, CIA/CGI
John Maccini, NSF/Div. of Earth Sciences
Richard C. Repsher, U.S. Bureau of Mines
Larry Rowan, USGS
Charles M. Trautwein, USGS/EDC.

RESPONSE FORM 1

Phenomena (I) and Related Information Requirements (II)

<u>Phenomena</u>	<u>Required Information Parameters</u>
1. Crustal Characterization (including energy/mineral resources)	Detailed compositional (lithologic) and structural (faults, fractures, strike and dips) information Geobotanical information
2. Neotectonics (Tectonic Geomorphology) - crustal stability/movement - natural compaction - fluid withdrawal - karst	Baselevel change Drainage patterns/positions Terrace warping Subsidence/doming Lateral/vertical displacements
3. Fluvial Processes	Size, shape, composition of deltas, terraces, bars, etc. Detection and identification of suspended sediments Detection and measurement of erosion
4. Eolian Processes	Detection and location of vegetated/non-vegetated boundaries Detection and location of sand dunes and sheets Dune size, shape, and orientation Identification, location, and characterization of desert basins
5. Structural Instability	Detection, location, and characterization (esp. density) of faults and fractures Detection and location of sand channels Vegetation detection and characterization
6. Mass Movement	Detection, identification, and characterization of landslides, scars, rock glaciers, etc. Detection and location of vegetation/non-vegetation boundaries Fracture and fault detection Compositional information

RESPONSE FORM 1

Phenomena (I) and Related Information Requirements (II)
(continued)

<u>Phenomena</u>	<u>Required Information Parameters</u>
7. Heat Flow (Geothermal)	Surface temperature measurements Detection and location of precipitates/ alteration Detection of vegetation stress
8. Coastal Processes	Detection and characterization of beach development and erosion Detection and characterization of reef development and destruction

Important Geologic-Related Phenomena with Overlap with Other

Disciplinary Discussion Groups

- Glaciation
- Sea Level Fluctuations
- Pollution
- Geobotanical Phenomena
- Floods
- Reclamation Activities

RESPONSE FORM 2

Global Data Characteristics (III)

Phenomena	Data Types	Spectral (wavelength, # of bands, bandwidths) or Other (specify) Characteristics		Spatial Resolution		Frequency of Repetitive Acquisition		Recommended Time of Year for Acquisition		Comments: Increased U.S. Coverage; Other
		Minimum	Desired	Max.	Des.	Max.	Des.	Single Best	Other*	
Crustal Characterization	Reflected EMR	TBD	TBD	80m	10-20m	1-time (repetitive acquisition related to sensor technology advancements)		mid-late summer		Not necessary
	Emitted EMR	"	"	120m	10-20m					
	Microwave	"	"	80m	20m					
Neotectonics	As above, plus positional	TBD	TBD	80m	10-20m	10-15 yrs.	3-4 yrs.	late summer/fall		Yes, over certain areas: 7 yrs. max/ 2 yrs. des.
		4m	1-2cm	-	-	5 yrs.	1 yr.			
Fluvial Processes	Reflected EMR	TBD	TBD	80m	10-20m	10-15 yrs.	3-4 yrs.	As above	spring for sediment load	Not necessary
	Emitted EMR	"	"							
	Microwave	"	"							
Eolian Process	As above	TBD	TBD	80m	10-20m	10 yrs.	3 yrs.	As above		Not necessary
Structural Instability	As above	TBD	TBD	80m	10m	1 time		As above	early spring for vegetation indicators	Not necessary
Mass Movement	As above	TBD	TBD	80m	10-20m	10 yrs.	3 yrs.	As above		Yes, 5 yrs. max/ 2 yrs. des.

* Complete only if single acquisition per repetitive cycle is totally unacceptable.

RESPONSE FORM 2

Global Data Characteristics (III)

Phenomena	Data Types	Spectral (wavelength, # of bands, bandwidths) or Other (specify) Characteristics		Spatial Resolution		Frequency of Repetitive Acquisition		Recommended Time of Year for Acquisition		Comments: Increased U.S. Coverage; Other
		Minimum	Desired	Max.	Des.	Max.	Des.	Single Best	Other*	
Heat Flow	Reflected EMR	TBD	TBD	80m	10-20m	15 yrs.	5 yrs.	As above		Not necessary
	Emitted EMR	TBD	TBD							
Coastal Processes	Reflected EMR	TBD	TBD							Yes, 5 yrs. max./ 2 yrs. des.
	Emitted EMR Microwave	"	"	80m	10-20m	10 yrs.	3-4 yrs.	As above		

* Complete only if single acquisition per repetitive cycle is totally unacceptable.

RESPONSE FORM 3

Detailed Study Site Data Characteristics (IV)

Prioritized Phenomena	Data Characteristics* (type, spectra, and other, spatial resolution)	Frequency of Repetitive Acquisition	Number of Acquisitions per Rep. Cycle; Time of Yr. for Acquisition	Site Recommendations (latitude/longitude)	Comments: Extrapolation Potentiality; Other
Neotectonics	Same as for Global	2-3 years	1 - late summer/fall	Mississippi, Alabama, Arkansas, California	Possible
Fluvial Processes	As above	1-2 years	2 - spring/fall	SW United States Major deltas of the world	High Probability
Eolian Processes	As above	1-2 years	1 - summer/fall	Sahara Monolia Western Nebraska	High Probability
Coastal Processes	As above	1-2 years	1 - summer/fall	South and East Coasts of the United States	High Probability

* Complete only if different from global data recommendations.

RESPONSE FORM 4

Catastrophic Phenomena Data Characteristics (V)

Catastrophic Phenomena	Important Information Parameters	Required Data Characteristics (type, spectra, or other, spatial resolution)	Frequency of Repetitive Acquisition	Duration of Repetitive Acquisition	Comments: Effects on Global Coverage; Other
Earthquakes	Fault/fracture detection Displacement measurements Various cultural Others TBD	TBD	2/yr. for 5 yrs. 1/yr. for 20 yrs	\pm 25 years, depending on severity	Increase in selected areas as a contributor to earthquake prediction
Volcanic Activity	Heat flow measurements Extrusive rock detection and mapping Effects on vegetation Effects on streams and lakes Various cultural Various natural recovery Others TBD	TBD	4/yr. for 5 yrs. 1/yr. for 20 yrs	\pm 25 years, depending on continued activity and speed of natural recovery	As above, as relates to volcanic eruption prediction

HYDROLOGY/GLACIOLOGY

Members of the Discussion Group on Hydrology/Glaciology

Leader: David F. McGinnis, Jr./NOAA-NESDIS

Members: Bruce H. Needham/NOAA-NESDIS
Richard Farnsworth/NOAA-NWS
Guy G. Guthridge/NSF
David Lichy/Army COE
Charles J. Robinove/USGS-LIA

September 23, 1986 E/RA12:DM

TO: Ex1 - Peggy Harwood
FROM: E/RA12 - David F. McGinnis, Jr.
SUBJECT: Summary of Input from Hydrology/Glaciology Working Group
for National Satellite Land Remote Sensing Data Archive

The attached tables list the parameters that must be considered when gathering hydrologic/glaciologic information for the remote sensing data archive. Also presented is the list of working group members who contributed input for the generation of the tables.

Please contact me at (301) 763-4240 should you require additional data.

Attachments

Table 1. Phenomena and Related Information Requirements for Hydrology/Glaciology

<u>Phenomena</u>	<u>*Required Information Parameters</u>
<p>A. <u>Water Supply</u></p> <ul style="list-style-type: none"> o Construction o Domestic, Industrial, Municipal Supply o Flood Control o Hydro-Power o Irrigation o Navigation o Recreation o Water Allocation 	<ul style="list-style-type: none"> Erosion Evapotranspiration Demand Ice Location and Extent Land Cover Change Land Use Change Permafrost Perviousness Precipitation Sediment Snow Water Equivalent Soil Moisture Soils/Topography Solar Radiation
<p>B. <u>Water Quality</u></p> <ul style="list-style-type: none"> o Environmental Protection o Industrial & Irrigation o Public Health o Recreation 	
<p>C. <u>Snow & Ice</u></p> <ul style="list-style-type: none"> o Climate o Conservation o Navigation o Water Supply 	
<p>D. <u>Catastrophic Events</u></p> <ul style="list-style-type: none"> o Drought o Flood o Pollution Events o Storm Surges o Surging Glaciers 	

* Every parameter listed does not necessarily apply to each of the four phenomenon categories. However, because of the extensive overlap, no attempt was made to provide separate lists.

Table 2. Global Data Characteristics

General Philosophy:

The Working Group approach these requirements looking at existing or near-future satellite systems. As such, data would be available from Landsat, SPOT, NOAA, GOES and DMSP satellites at resolutions from 10 m to 4 km in wavelengths from visible, near-IR, thermal IR through microwave.

<u>Phenomena</u>	<u>Frequency of Repetitive Acquisition</u>		<u>Comments</u>	
	<u>Maximum</u>	<u>Desired</u>		
Water Supply and Water Quality	AVHRR	Twice/yr	4 times/yr	AVHRR: Global coverage MSS/TM/SPOT: Combined or any combination for global coverage
	MSS/TM	Twice/yr	Twice/yr	
	SPOT	Twice/yr	Twice/yr	CZCS: Global coverage SSM/I: Global, from combination of DMSP/N-ROSS
	CZCS	Twice/yr	Twice/yr	
SSM/I	Twice/yr	Twice/yr		
Snow/Ice	As above	As above	AVHRR: At least twice monthly during the melt season in polar regions	
Catastrophic	As above	As above	All available data	

Table 3. Detailed Study Site Data Characteristics

None required

Table 4. Catastrophic Phenomena Data Characteristics

See Table 2 for requirements

DISCUSSION MATERIALS

FOR

FEDERAL AGENCY WORKSHOP

ON

"BASIC DATA SET DEFINITIONS"

Relevant Background Material
Related to
Defining the Scope and Content of the Basic
Data Set for the National Satellite Land
Remote Sensing Data Archive

Wednesday, September 10, 1986

Reston, VA

National Oceanic and
Atmospheric Administration

U. S. Geological Survey

INTRODUCTION

These materials represent one of a number of mechanisms that the National Oceanic and Atmospheric Administration (NOAA) and the U.S. Geological Survey (USGS) will implement to obtain important scientific and technical information and advice in the process of meeting their responsibilities to define the scope and content of a basic data set for the national Satellite Land Remote Sensing Data Archive (the "Archive"). Included are relevant background information and a discussion of issues and concepts related to defining the Archive basic data set.

Your assistance in contributing to efforts to define an Archive basic data set that will have a broad and long-term scientific and historical relevance is respectfully requested. Please review the following materials and answer the questionnaire, particularly from the perspective of your own technical and scientific expertise and interests. Please return your completed Response Form to:

Ms. Peggy Harwood
NOAA/Office of Landsat Commercialization
Federal Building 4, Room 2051
Washington, DC 20233

Your valuable assistance in this important effort is greatly appreciated.

BASIC DATA SET ISSUES AND CONCEPTS

In order to define the scope and content of the Archive basic data set, certain factors that substantially determine the overall goals of the National Satellite Land Remote Sensing Data Archive and strongly influence the ability to generate a scientifically relevant basic data set to meet those goals must be considered. These factors include legislative guidelines and requirements, as well as certain practical constraints imposed by fiscal and technological circumstances.

In addition to the requirements and guidelines previously noted, Section 602 of PL 98-365 directs the Secretary of Commerce, in determining the initial content of, or in upgrading, the basic data set, to 1) use as a baseline the data archived on the date of enactment of the Act; 2) take into account future technical and scientific developments and needs, 3) consider the need for data which may be duplicative in terms of geographical coverage but which differs in terms of season, spectral bands, resolution, or other relevant factors; 4) include, as appropriate, unenhanced data generated by the commercial Landsat system or other U.S. commercial land remote sensing systems; and 5) include, as appropriate, data collected by foreign ground stations or by foreign remote sensing space systems. These particular guidelines primarily ensure the opportunity for access to various types and ample supplies of satellite data and do not seem to constrain the scope of the basic data set or its intended purpose. However, other requirements of the Act do.

A fundamental principle of PL 98-365 is that the policy of the United States Government shall be to avoid competition with the commercial Landsat system operator or any other U.S. commercial satellite system operators. Consequently, while PL 98-365 requires commercial system operators that fall under the jurisdiction of the law to promptly provide data, requested by the Secretary of Commerce, to the Archive at prices reflecting reasonable cost for reproduction and transmittal, it also places severe restrictions on access to such data placed in the Archive. The Act states that U.S. commercial system operators shall have the exclusive right to sell all data which that operator provides to the Archive for a period not to exceed 10 years from the date the data are sensed. This exclusive right to sell is extended retroactively, for a period not to exceed 10 years, to include all data generated by the Landsat system prior to implementation of the commercial marketing contract with the Earth Observation Satellite Company (EOSAT). System operators may relinquish this exclusive right to sell and consent to distribution from the Archive before the period of exclusive right has expired by terminating their offer to sell particular data. After expiration of the exclusive right to sell, or upon relinquishment of such right, data provided to the Archive by U.S. commercial

system operators shall be in the public domain and shall be available to requesting parties at prices reflecting reasonable cost for reproduction and transmittal. However, until one of these conditions is met, data in the Archive can only be stored; they cannot be released by the Government.

Restrictions on distribution, from the Archive, of data acquired from foreign satellite systems are not addressed by PL 98-365 and will be dependent largely on agreements negotiated with foreign system operators. A recent agreement with SPOT Image Corporation establishing guidelines for the provision of SPOT data to the Archive also prohibits distribution of those data from the Archive for a period of 10 years. It is unlikely that restrictions on distribution of any other foreign system data acquired by the Archive will ever be less than 10 years, because earlier release could be viewed as constituting competition with U.S. commercial system operators.

Legislative restrictions on access to Archive data clearly indicate that it was the intent of Congress not to allow the Archive to become an "alternate" source of new or recent data for use by the operational and scientific research communities. Rather, use of the phrase "for historical, scientific, and technical purposes, including long-term global environmental monitoring" supports a conclusion that the Archive is intended to function primarily as a data resource that will be particularly important to future generations as a unique source of information critical to their ability to study and assess long-term global processes and change, and thus to their ability to most beneficially interact with the Earth's processes and manage its natural resources.

These premises have significant implications for defining the scope of the Archive basic data set. Because Archive data will not be routinely available for a 10-year period following date of acquisition, there is little point in scoping the basic data set to meet near-term requirements, such as yearly seasonal coverage needed for annual crop production estimates or similar requirements of other near-realtime research and operational applications. Rather, it must be designed to record relevant phenomenological changes that occur over time, and which are measured in terms of years rather than seasons or months. The basic data set must be designed to meet a broad spectrum of long-term, interdisciplinary scientific (and operational) requirements which depend upon the eventual availability of time-sequential acquisitions of relevant data.

It is impossible to predict from where on the Earth's surface data will be required in the future to investigate relevant surficial changes, study important natural processes, or meet other worthy scientific and sociological requirements.

Therefore, to meet potential worldwide requirements and to be responsive to legislative guidelines, repetitive global coverage must be the primary goal of the Archive basic data set.

The frequency with which repetitive global coverage can be achieved and the characteristics of the data collected certainly will be influenced by budgetary considerations, meteorological constraints, and technical capabilities of available satellite systems. However, determination of these characteristics and acquisition frequency must first be based on projected scientific requirements of the data. Consequently, it is important to attempt to identify specific phenomena (natural processes and/or human activities), such as desertification and urbanization, that will almost certainly affect the quality of life of future generations and/or will be of continued wide scientific interest. Such phenomena, and the types of information required to study them, will provide a basis for defining the characteristics of the data that should be acquired globally, as well as how frequently those data should be acquired. That is, they will provide a basis for defining the content of the Archive basic data set.

Because the Archive will be funded by U.S. taxpayers, the basic data set may be defined to include more frequent repetitive coverage of the United States than for the rest of the Earth. Such increased coverage would expand the scope and detail with which long-term phenomena of significance to future generations of Americans could be investigated.

To optimally study, understand, and beneficially interact with some of the phenomena that will be of significance to future generations, repetitive satellite data acquired more frequently than will be possible to achieve globally may be required. Consequently, a goal of the basic data set will be to include more frequent acquisition of data, with optimized characteristics when possible, over selected "detailed study sites" where specific phenomena, of anticipated long-term significance, are known to operate and are expected to continue indefinitely. Such data will improve capabilities to achieve detailed study and assessment of important phenomena and their effects on the specific detailed study sites. More importantly, however, results of such investigations likely can be extrapolated to improve capabilities to study and assess the same or similar phenomena elsewhere on the Earth, using less frequently acquired global data sets.

The scope of the basic data set must also be defined with recognition that catastrophic phenomena (such as volcanic eruptions, floods, infestations, etc.) will occur in the future and that frequent repetitive coverage, for a period of time, may be required to optimally study the effects of such phenomena and

the processes that operate in their aftermaths. Consequently, it is important to identify potential catastrophic phenomena and the information parameters important to their assessment, so that when such phenomena occur, data with appropriate characteristics and collected at appropriate intervals will be acquired for the basic data set.

The basic data set will eventually be comprised of data collected over many decades by different types and generations of satellite sensors. In general, it will be impractical and unnecessary to acquire separate and complete global data sets from sensor systems that provide data with similar spectral characteristics and spatial resolution. Rather, a global data set collected during any given repetitive cycle will include data acquired by all such sensors operating during that time frame. Consequently, an important component of the basic data set will be specially acquired sets of calibration data that will be collected by existing and future satellite sensors over selected sites characterized by surface materials determined to be optimum for calibrating specific types of sensor data.

In summary, legislative guidelines and requirements have resulted in the establishment of the National Satellite Land Remote Sensing Data Archive and in the conclusion that the Archive should function primarily as a data resource that will have particular significance for future generations as a unique source of information critical to their ability to study, assess, and most beneficially interact with important long-term global phenomena. In response to those legislative guidelines and to anticipated long-term scientific requirements, the scope of the Archive basic data set has been proposed to include:

- I. Repetitive Global Data Sets
 - A. More frequent U.S. coverage
- II. Detailed Study Site Data Sets
- III. Catastrophic Phenomena Data Sets
- IV. Calibration Data Sets

The principal challenge that remains to be met is one of defining the specific content of the Archive basic data set. That is, what types of data, with what specific characteristics, collected over what areas, and with what repetitive frequency are required, within the proposed scope of the Archive basic data set, to meet anticipated long-term scientific research and operational needs for historical satellite remotely sensed data? The significance of this challenge is not trivial. For in no small way will the wisdom displayed in defining the Archive basic data set, and the success achieved in acquiring and preserving those data, impact the quality of life of the generations to follow.

QUESTIONNAIRE

Please answer the followign questions, particularly from the perspective of your own technical and scientific expertise and interests.

- I. Identify specific phenomena (natural processes and/or human activities) that you believe will be important to future generations because of their impact on the quality of life available to those generations and/or because of basic scientific interest and value. Prioritize these phenomena based on probable future significance. Please use Response Form 1.
- II. For each phenomenon identified in response to question I., list the information parameters (e.g., identification of vegetation stress, detection of specific natural boundaries, determination of water level, etc.) that are required to effectively identify, monitor, and evaluate the phenomenon and/or observable changes related to that phenomenon. Please use Response Form 1.
- III. In the context of repetitive, global coverage for the basic data set, discuss and answer the following questions as they relate to each specific phenomenon identified in response to question I., and to the corresponding information requirements identified in response to question II. Please use Response Form 2.
 - A. What types of existing or planned satellite sensor data (e.g., reflected electromagnetic radiation [EMR], emitted EMR, temperature, altimetry, magnetic, gravimetric, etc.) are required for meaningful time-sequential monitoring and evaluation studies of the phenomenon and/or related observable changes?
 - B. For the data types listed in response to question III.A, what are the minimum spectral (wavelength, number of spectral bands, and bandwidths) or other (e.g., sensitivity) characteristics required for such studies? What are the desirable characteristics?
 - C. For the data types listed in response to question III.A, what is the maximum (largest) spatial resolution useful to such studies? What is the desirable spatial resolution?

- D. What specific geographic locations well exemplify the phenomenon and should be considered as potential detailed study sites? Recommended sites should not exceed 5° latitude by 5° longitude. Please use Response Form 3 or the attached world map.
- E. Briefly, explain how more frequent coverage with the data you recommend could be extrapolated to better study the same phenomenon elsewhere, using less frequently acquired global data sets.
- V. Identify specific catastrophic phenomena that may warrant special acquisition of data to study the phenomena and/or the processes that operate in their aftermaths, and answer the following questions that relate to them. Please use Response Form 4.
- A. What information parameters will be important for studying the phenomenon and the processes that operate in its aftermath?
- B. What satellite sensor data types and characteristics will be required for such studies?
- C. How frequently should such data be acquired after the event (phenomenon) and for how long?
- D. Should areas more prone to catastrophic phenomena be given higher priority for routine global coverage? If so, why?
- VI. Future investigations of long-term phenomena will rely on data collected over many decades by different types and generations of satellite sensors, and will thus require various calibration data. Consider the provided list of sensor data types and, as possible, recommend corresponding calibration target materials, and specific sites representative of those materials, that should be considered in collecting data for sensor calibration. Please use Response Form 5.

Name: _____
Affiliation: _____
Address: _____

RESPONSE FORM 1

Phenomena (I) and Related Information Requirements (II)

Phenomena

Required Information Parameters

RESPONSE FORM 2

Name: _____

Global Data Characteristics (III)

Phenomena	Data Types	Spectral (wavelength, # of bands, bandwidths) or Other (specify) Characteristics		Spatial Resolution		Frequency of Repetitive Acquisition		Recommended Time of Year for Acquisition		Comments: Increased U.S. Coverage; Other
		Minimum	Desired	Max.	Des.	Max.	Des.	Single Best	Other*	

*Complete only if single acquisition per repetitive cycle is totally unacceptable.

RESPONSE FORM 3

Name: _____

Detailed Study Site Data Characteristics (IV)

Prioritized Phenomena	Data Characteristics* (type, spectral and other, spatial resolution)	Frequency of Repetitive Acquisition	Number of Acquisitions per Rep. Cycle; Time of Yr. for Acquisition	Site Recommendations (latitude/longitude)	Comments: Extrapolation Potentiality; Other

*Complete only if different from global data recommendations.

RESPONSE FORM 4

Name: _____

Catastrophic Phenomena Data Characteristics (V)

Catastrophic Phenomena	Important Information Parameters	Required Data Characteristics (type, spectral or other, spatial resolution)	Frequency of Repetitive Acquisition	Duration of Repetitive Acquisition	Comments: Effects on Global Coverage; Other

Name: _____

RESPONSE FORM 5

Calibration Data Targets (VI)

Data Types

Recommended Calibration
Target Materials

Potential Target Sites
(geographic locator)

Reflected EMR -

0.4 - 0.7 μm :

0.7 - 3.0 μm :

3 - 5 μm :

Emitted EMR -

3 - 5 μm :

8 - 14 μm :

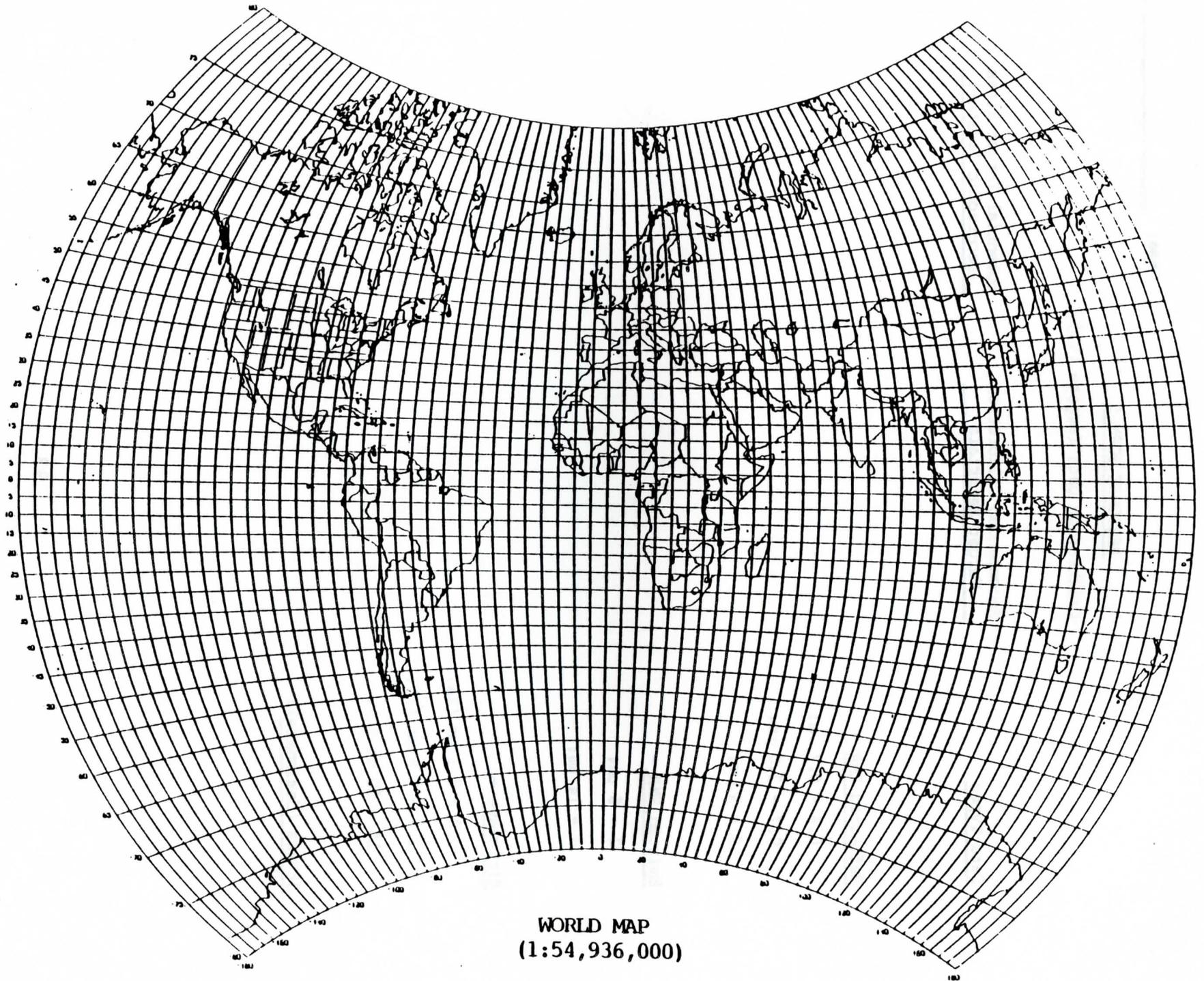
Microwave -

0.8 - 1.1 cm (Ka):

2.4 - 3.8 cm (X):

15 - 30 cm (L):

Others (designate):



WORLD MAP
(1:54,936,000)