

**Hurricane Andrew**

EROS DATA CENTER

**ANNUAL REPORT**

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FISCAL YEAR 1992

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U.S. GEOLOGICAL SURVEY  
NATIONAL MAPPING DIVISION

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## FOREWORD

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Worldwide concerns for the environment continue to occupy a major role in international affairs. The depletion of the polar ozone layer, deforestation of the major forests of the world, contamination of lakes and rivers due to acid rain, and other man-made conditions present challenges for Earth scientists who are attempting to respond to the increased need for information about the changing environment. Natural occurrences, such as the severe drought and famine pervasive throughout large portions of the African continent and the volcanic eruption of Mt. Pinatubo in the Philippines, have added to the tasks of global change research scientists. The EROS Data Center, as a data management and research field center of the U.S. Geological Survey's National Mapping Division, is proud to have contributed its resources in responding to the technical and information needs surrounding these and other important environmental issues.

From its inception in 1971, the EROS Data Center has maintained a commitment to provide remotely sensed land-surface data and technical assistance of the highest quality to national and international organizations involved in land management and environmental assessment activities. In keeping with this commitment, the Data Center responded to requests from the United States Agency for International Development (USAID) to help develop a Famine and Early Warning System (FEWS) for the severely-drought stricken regions of southern Africa, including the countries of Zambia, Zimbabwe, Malawi, and Mozambique. Other opportunities to meet land remote sensing information needs included the implementation of the Global Land Information System (GLIS), the establishment of an international network to collect and manage Advanced Very High Resolution Radiometer (AVHRR) 1-kilometer resolution data of the entire land mass of the globe for use by researchers worldwide, active participation with NASA in developing at the Data Center the Earth Observing Systems Data and Information System (EOSDIS) Land Processes Distributed Active Archive Center (LPDAAC), and continuing baseline studies for monitoring global climate change in the Arctic. These, and other activities are described in this report.

As we look to the future, the EROS Data Center will assume new and challenging roles as the EOSDIS/LPDAAC and the National Satellite Land Remote Sensing Data Archive, as directed by the "Land Remote Sensing Policy Act of 1992." These activities will be part of a comprehensive national satellite land remote sensing data management program.

To support these and several other major activities, the Center's team of skilled scientists, technicians, and clerical staff worked diligently to maintain the EROS Data Center's high level of excellence in the areas of data management, product generation, computer systems development, and spatial data research as reflected in this report.

We are pleased to provide this annual report for Fiscal Year 1992, which summarizes the activities and accomplishments of the EROS Data Center.

Donald T. Lauer  
Chief, EROS Data Center

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## I. OVERVIEW

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The Earth Resources Observation Systems (EROS) Data Center, located in Sioux Falls, SD, is a data management, systems development, and research field center of the U.S. Geological Survey's National Mapping Division. The Center was established in the early 1970's to receive, process, and distribute data from National Aeronautics and Space Administration (NASA) experimental Landsat satellites. As the National Satellite Land Remote Sensing Data Archive, a legislatively mandated responsibility, the Center maintains a high quality data base of space acquired images of the earth suitable for use in future study of global change and related scientific programs. It holds the world's largest collection of space and aircraft acquired imagery of the Earth. These holdings include over 3 million images acquired from satellites and 7 million aerial photographs. The Center is also a major focal point for information concerning the holdings of foreign Landsat ground reception stations and data acquired by other countries' Earth observing satellites, and receives and processes image data from the Advanced Very High Resolution Radiometers on polar orbiting meteorological satellites.

In carrying out its mission, the Data Center conducts a broad range of activities in the management of global Earth observations data, including the development and operation of advanced systems for receiving, processing, distributing, and applying land related Earth science, mapping, and other geographic data and information. These data support scientific studies, resource management, and environmental monitoring activities world-wide. The Center's own research activity is supported by a combined multidisciplinary scientific staff in geology, hydrology, cartography, geography, agronomy, soils science, forestry, meteorology and climatology with engineering expertise in systems development, telecommunications, and the computer sciences.

The Center is a key participant in NASA's "Mission to Planet Earth" and plans to process and archive land related data acquired by a family of sensors aboard the Earth Observing System (EOS) polar platforms, the first of which is to be launched in the late-1990's. In its capacity as the Earth Observing System Data and Information System (EOSDIS) Land Processes Distributive Active Archive Center (LPDAAC), the Center is assuming a major role in the management and distribution of land remote sensing data for use by the global change research community.

Co-located at the Center is the United Nations Environmental Programme/Global Resource Information Database (UNEP/GRID) North America Node office. This office is one of several throughout the world that form a network for the distribution of data and research techniques for timely environmental studies by member nations. The Data Center, under a joint partnership with NASA, is the primary source for these data.

The Center supports the Federal Land Remote Sensing Research Program. This Program allows Federal agencies, universities, and other organizations to assign scientists and researchers to the Center on a full-time basis with complete access to analytical equipment, data, and research facilities of the Center.

Facilities at EROS include advanced data and information analysis laboratories, production data processing systems and digitizing capabilities, business and scientific systems, software development, geographic information systems development and implementation, and on-line computerized access to data directory, catalog, and inventory information about the Center holdings and the land data holdings of other facilities.

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## II. RESEARCH AND DEVELOPMENT

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### Global Land Data Management and Research

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#### *Landsat Data Conversion and Archive Maintenance*

Preservation of historic Landsat data as a national resource remains a high priority in order to ensure the availability of these essential data to global change research and other earth science and land management applications. To preserve these data requires conversion of approximately one million Landsat Thematic Mapper (TM) and Multispectral Scanner (MSS) scenes (a volume of about 70 terrabytes) to a stable storage medium.

In FY 1992, the TM/MSS Archive Conversion System (TMACS) was delivered and installed at EDC. It is expected that 80 percent of these data will be converted by the end of FY 1994. The remaining 20 percent, Landsat MSS data on wideband video tapes (WBVT) acquired by Landsat 1 and 2 from 1972 to 1978, were inventoried. The feasibility of developing a system to convert these WBVT data was studied, and it was determined that a high percentage of the data can be rescued.

Industry proposals were solicited and evaluated for a baseline system to produce map-compatible, precision-corrected Landsat data products, replacing an obsolete system. The contract for this new product generation system will be available in early FY 1993.

#### *Global Land Information System (GLIS)*

The GLIS, an interactive PC-based metadata system, provides information about, and access to, land data needed by the global change research community. Descriptive information about data sets contained in GLIS are arranged by directories, user guides, and inventories, and includes online price and ordering information.

GLIS user activity increased by over 100 percent during FY 1992, with more than 700 registered users. During the year, the complete inventory of U.S. held Landsat MSS and TM data were entered into GLIS. In addition, at the end of FY 1992 over 21,000 images of AVHRR data were referenced in GLIS. Plans are being finalized and coordinated for the incorporation of additional USGS data sets available from Geologic Division and Water Resources Division.

Work continued on the development of an X-Window based graphical user interface to GLIS for UNIX workstations. A beta test of the workstation interface is planned for November with release to general users in January 1993. A fully operational GLIS Version 2.0 is expected to be released in June 1993.

#### *Global Data Set Development, Processing, and Distribution*

Global Data Set Development provides land data sets, such as periodic vegetation greenness condition data, to help researchers understand and measure global changes. The following projects were conducted during FY 1992.

**Conterminous U.S. Land Surface Characterization:** The U.S. Forest Service (USFS) and EDC completed the design of a national accuracy assessment of the U.S. Land Cover Characterization Data Base. A sample of 3,000 field sites were identified. USFS staff

will visit as many sites as possible and develop field descriptions of vegetation species composition and canopy structures. Analysis of the field data is expected to be completed by late-1993.

Research was initiated to assess the interannual variability of land cover patterns. Comparisons are being made between unsupervised classifications developed from 1990 and 1991 multitemporal AVHRR data.

Prototype North American AVHRR 1-km Data Set: EDC completed a 10-day (August 11-20, 1990) maximum periodic vegetation greenness condition composite of North America. The map was printed and published and made available at the Global Forum of the United Nations Conference on Environment and Development in Rio de Janeiro, Brazil, June, 1992. A journal paper and a symposium presentation which describe the data set are being prepared for publication.

MSS Historical Data Set Development: Landsat scenes over 17 sites throughout the world were selected from the EDC archive to demonstrate the use of historical Landsat data to record and analyze environmental change. A booklet, "Monitoring Change with Landsat Historical Data," and a Compact Disc Read Only Memory digital data set are scheduled for completion mid-October 1992. Figure 1 shows examples of three areas where environmental change has occurred.

North America Landscape Characterization Landsat Project: The data processing flow required to generate geocoded Landsat MSS triplicates (1973, 1986, 1992) for the conterminous U.S., Mexico, Central America, Alaska, and Hawaii was reviewed by EDC and Environmental Protection Agency (EPA) staff. The details of data processing and product generation were presented to EPA staff in Las Vegas, Nevada on September 22-23, 1992. EPA proceeded with scene selection and purchase of the 1992 data from the Earth Observation Satellite Company. EDC will begin generating triplicate products for the Chesapeake Bay watershed and southern Mexico pilot project areas. Approximately 200 Landsat Worldwide Reference System-2 path/row triplicate products are expected to be generated during calendar year 1993, which will be used by EPA to generate land cover classification and land cover change products.

Soil Interpretations for Global Change Modeling and Impact Assessment: Procedures were developed in cooperation with the Soil Conservation Service to generalize State Soil Geographic data from 1:250,000 to 1:1,000,000 scale. The procedures include (1) statistical clustering based on soil properties, (2) interactive selection of polygons using a geographic information system (GIS), and (3) development of a data structure that allows new sets of statistics to be computed for the generalized groupings. This strategy was reported at meetings of the International Society for Photogrammetry and Remote Sensing and the International Geographical Congress in Washington, D.C.

A prototype map of the Major Soil Regions of the World (figure 2) has been developed in cooperation with the Soil Conservation Service, World Soil Resources. It is classified at the suborder level of the U.S. Soil Taxonomy system. The map was developed so that interpretations of soil properties such as soil carbon and water holding capacity can be quickly produced for global change studies. The interpretations are developed by aggregating data from soil samples (the pedon data base) to the units of soil taxonomy shown on the map. The analyses will be repeated using more detailed soil maps when additional data are available. The World Soil Resources map of the Food and Agriculture Organization of the United Nations was adapted as a basis for this map.

Digital Elevation Model (DEM) Inventory and Access: Meetings with Defense Mapping Agency (DMA) focused on providing improved global topographic data to the science community through Digital Terrain Elevation Data-1 (DTED-1) and Digital Chart of the World (DCW). EDC completed generation of digital elevation data sets from DCW for four test sites and performed a comparison to DTED at one of the sites for DMA. EDC staff participated in two meetings related to topographic issues: (1) American Geophysical Union (AGU) Chapman Conference on Tectonics and Topography with a special session on topographic data, and (2) a NASA meeting to discuss alternatives for a potential topographic satellite mission.

#### *Land Characterization Research*

Land Characterization research is being conducted to develop multiple-scale digital descriptions of land characteristics in order to improve understanding of the spatial distribution of terrestrial conditions and processes, and to link this understanding to process modeling. Figure 3 illustrates this process. Several pilot research projects are linking geographic data to quantitative analyses of land processes and land-atmosphere interactions.

Baseline Studies for Monitoring Global Climate Change in the Arctic Environment: The Alaska and Circumpolar Ecoregions Mapping Project, conducted in collaboration with EPA and Environment Canada, is developing a map which will provide a consistent and comprehensive delineation and characterization of arctic, subarctic and boreal ecosystems around the globe based on the analysis of AVHRR-periodic vegetation greenness condition data, soils, landform, landcover, terrain, permafrost, geology, hydrology, and climatic data. The USGS Alaska Field Office (AFO) hosted a workshop for the EPA and Environment Canada to review a draft ecoregions map for Alaska and to establish a schedule for extending the project to include all circumpolar regions. The workshop was followed by 2 weeks of field observations to review the draft map and gather data for revision.

Integration of Simulation Modeling and Remote Sensing for Monitoring Primary Production in Natural Ecosystems: In July 1992, ground observations were taken concurrent with satellite acquisitions over the Estes Park, Colorado area for validating simulation model estimates of primary production from the several ecoregions within the area. At sites precisely located with the Global Positioning System, descriptions of woodland, forest, and shrub/grassland types were collected.

Large Area Estimation of Evapotranspiration with Satellite Data for Global Change Investigations: Two irrigation districts on the Lower Colorado River were used to test the use of AVHRR for evapotranspiration (ET) estimation of the entire district for three dates. Comparisons with USGS Water Reports show good agreement between the two methods. Land cover processing for the Willamette Valley, Oregon study was completed and will be combined with AVHRR to generate basin-wide ET estimates.

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### **Earth Observing System Data and Information System Support (EOSDIS)**

The EROS Data Center is the Distributed Active Archive Center (DAAC) for Land Processes data to be acquired and distributed in support of the Earth Observing System (EOS) Program. This responsibility requires storage and management of data acquired by four of the major land remote sensing instruments of the EOS Program. Project management activities are consolidated in the EOS Data Systems Project Office,

# GLOBAL LAND DATA

## Brazilian Rainforest



June 19, 1975



August 1, 1986

## Lake Turkana, Ethiopia/Kenya



February 1, 1973



January 12, 1989

## Dallas - Ft. Worth Area



March 12, 1974



March 22, 1989

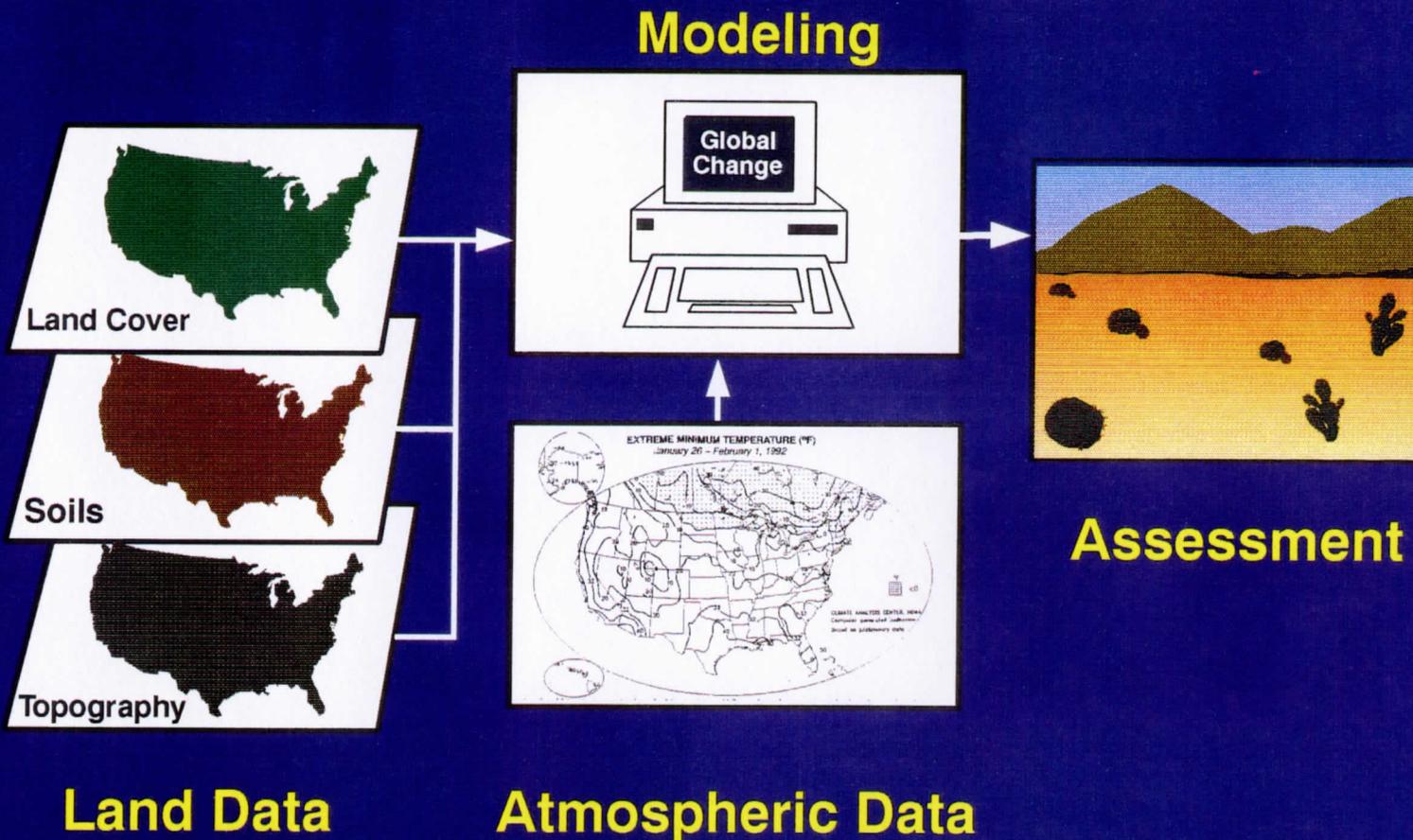
**Landsat Multispectral Scanner Data  
Monitoring Change**

NMD-166-92

Figure 1



# GLOBAL CHANGE RESEARCH -- IMPACT PREDICTION



NMD-148-92

Figure 3

and are generally devoted to long-range EOS planning and coordination and project management of near-term system and data set prototyping projects. Figure 4 shows the EOSDIS DAAC network and the associated processes for each center.

#### *EOS Planning and Coordination*

The USGS participated in the first EOSDIS Quarterly Review, held in August, 1992. The review was initiated as a continuing forum for all agencies involved in the Earth Observing System to meet, discuss priorities, develop plans for future programs, and establish more detailed coordination with all agencies that are participating in the EOS Program. At the review, endorsement was received for the USGS to continue with collection of the global AVHRR 1 km data set, the formulation of a program for global topography data collection and processing, establishing archives of spectrometry and synthetic aperture radar, and creating a central archive of consistently processed Landsat data.

#### *Land Processes DAAC Facility Expansion*

A contract was awarded to Spitznagel Architects of Sioux Falls in April 1992 to provide the architectural and engineering design for an addition to the Data Center's main building. The addition will house the data archives, computer systems, and technical staff associated with carrying out the Data Center's responsibilities as the land processes archive center for the EOSDIS. The design study will be completed in December 1992. Ground breaking is scheduled for the spring of 1993, with construction to be completed early in 1994. Figure 5 shows a perspective view of the existing and planned facility. Figure 6 shows the floor plan for the same facility area.

#### *EOSDIS Prototyping*

Development tasks were initiated in 1991 to begin early prototyping of capabilities required for implementation of EOSDIS. The major system development activity emphasized prototyping a distributed information management system to link the various archive centers into a "one-stop shop" for information about earth science data. In addition, other tasks were initiated to collect and process several types of global data to be used as precursor data sets for early research and development of algorithms and science scenarios, and to prepare for eventual data acquisition from EOS platforms in the late 1990's. These efforts to prototype system functionality and improved data sets is targeted to provide improved access to re-processed data by mid-1994, and are referred to collectively as the Version 0 Project.

**EOSDIS Version 0 Project:** A proposal to NASA for the planned Version 0 activities was prepared, submitted to, and accepted by the EOSDIS Project Office at the Goddard Space Flight Center. In addition to local support to system-wide EOSDIS Version 0 activities, the proposal also addressed activities and funding in the areas of the Global Land 1 km AVHRR Data Set, TIMS/NS-001 aircraft data transfer, topographic data generation and Synthetic Aperture Radar (SAR) data archiving, processing and product development activities.

**Global 1-km AVHRR Pathfinder Project:** In an effort to create and maintain an archive of full resolution (1-km) AVHRR data collected daily over the global land surface, an international network of data reception facilities was established with additional land coverage provided by tape recorders on the satellite. EDC was designated as the primary archive for these data. Therefore, all data acquired by the network are sent to EDC for preprocessing, archiving, and distribution. The data acquisition began on April 1, 1992. By the end of FY 1992, approximately 2,400 AVHRR scenes were received from stations in Australia, China, Japan, Saudi Arabia, Spain, Niger, Germany,

Norway, Kenya, and South Africa in support of the Global Land 1 km AVHRR project. EDC began to develop specialized data management and data processing techniques that will provide a source of consistently processed data for use by global change research scientists. Figure 7 shows the global network of data reception facilities, both actual and proposed, involved in this project.

Version 0 Radar: Procedures for the automated geocoding of ERS-1 Synthetic Aperture Radar imagery were implemented. A 21-scene mosaic of ERS-1 data in the vicinity of Fairbanks, Alaska was completed. The mosaic and other co-registered products were sent to several NASA investigators. A report to NASA and a paper describing the geocoding, terrain correction process are being drafted.

#### *Landsat Pathfinder*

EDC personnel participated in three Landsat Pathfinder Science Working Group (SWG) meetings (August, 1991; January, 1992 and June, 1992). The purpose of these meetings was to define the "science" which can benefit from the Landsat Pathfinder Program, identify Projects which both contribute to and benefit from a Pathfinder Data Set, and define the Landsat products to be produced for the Pathfinder Data Set. A draft copy of the Landsat Pathfinder Science Plan was completed and will be presented to the Landsat Pathfinder Science Working Group at their upcoming meeting at the University of New Hampshire in October 1992.

EDC entered into interagency agreements with both NASA and EPA to support two Pathfinder Projects; the Humid Tropical Forest Inventory Project (HTFIP) and the North American Landscape Characterization Project (NALCP). EDC and NASA are currently discussing mechanisms to formalize USGS's role as a DAAC in processing, archiving and distributing Pathfinder data products. This proposal identifies the tasks required to generate a Pathfinder Data Archive and an information and distribution system to facilitate access to the Pathfinder data.

#### *Landsat 7 Ground Data Processing System*

The USGS is participating in the development of the next generation of processing systems for the Landsat Program. Landsat 7 will be developed under a joint agreement between the Department of Defense and NASA, culminating in the launch of the Landsat 7 spacecraft in late 1997. At that time, the associated ground data processing system will be implemented to archive and manage all data acquired, and to process and distribute products from that archive to all users at cost of reproduction. To carry out the data management and distribution responsibilities for Landsat, NASA will rely on the facilities of the National Land Remote Sensing Data Archive at EDC. Planning for the design, development and implementation of the systems required for Landsat 7 was initiated between the EROS Data Center and the Goddard Space Flight Center.

# NASA EARTH OBSERVING SYSTEM (EOS) EOS Data and Information System (EOSDIS)

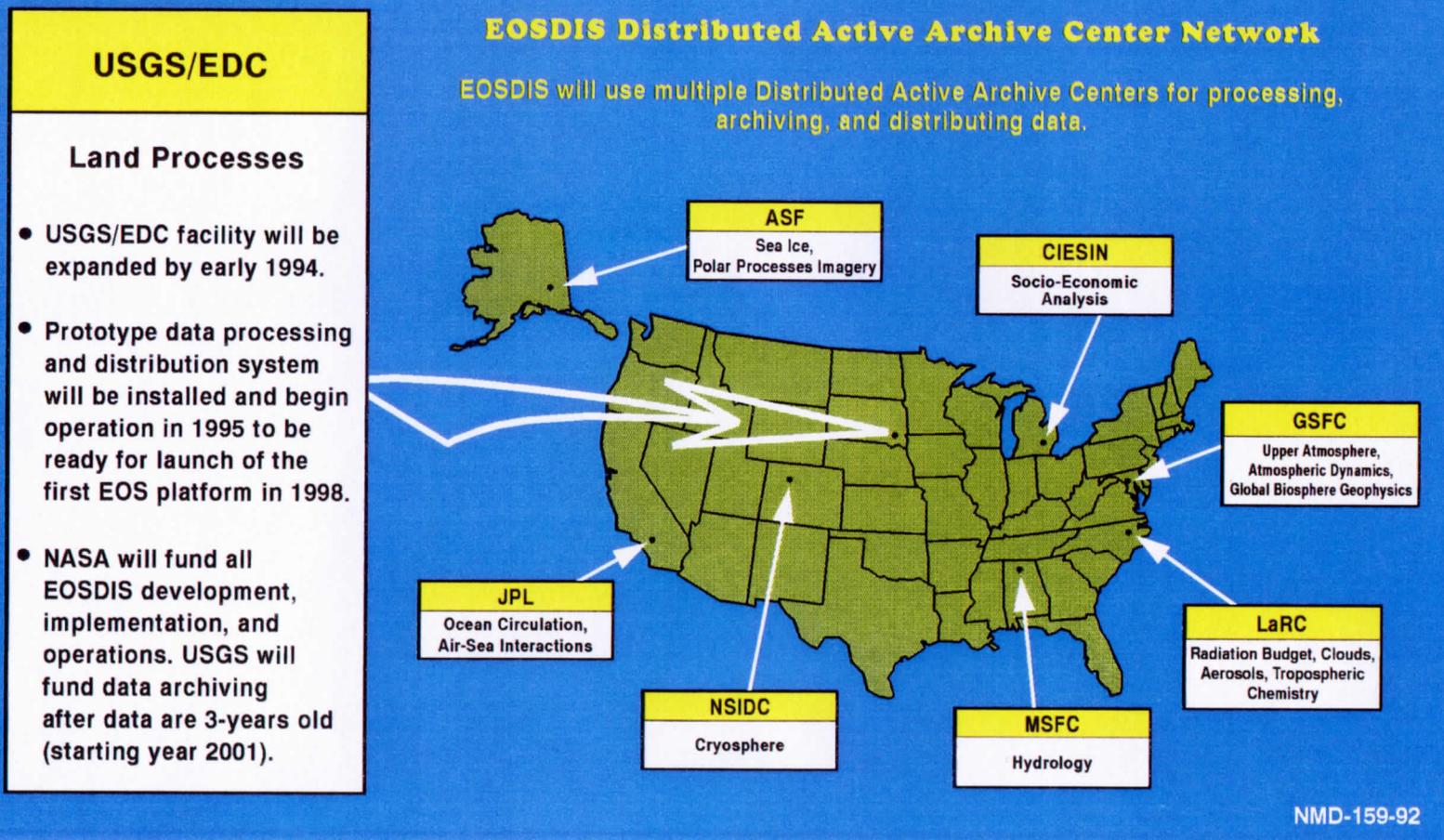


Figure 4

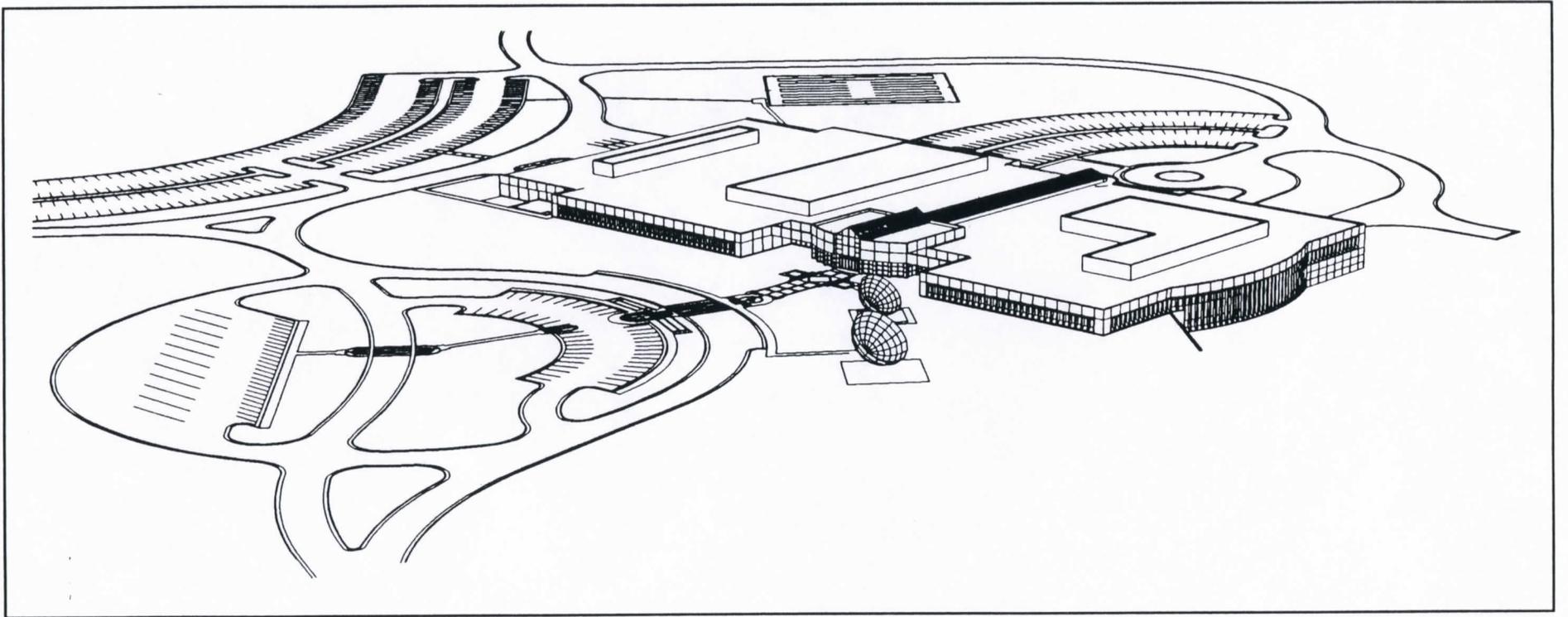


Figure 5

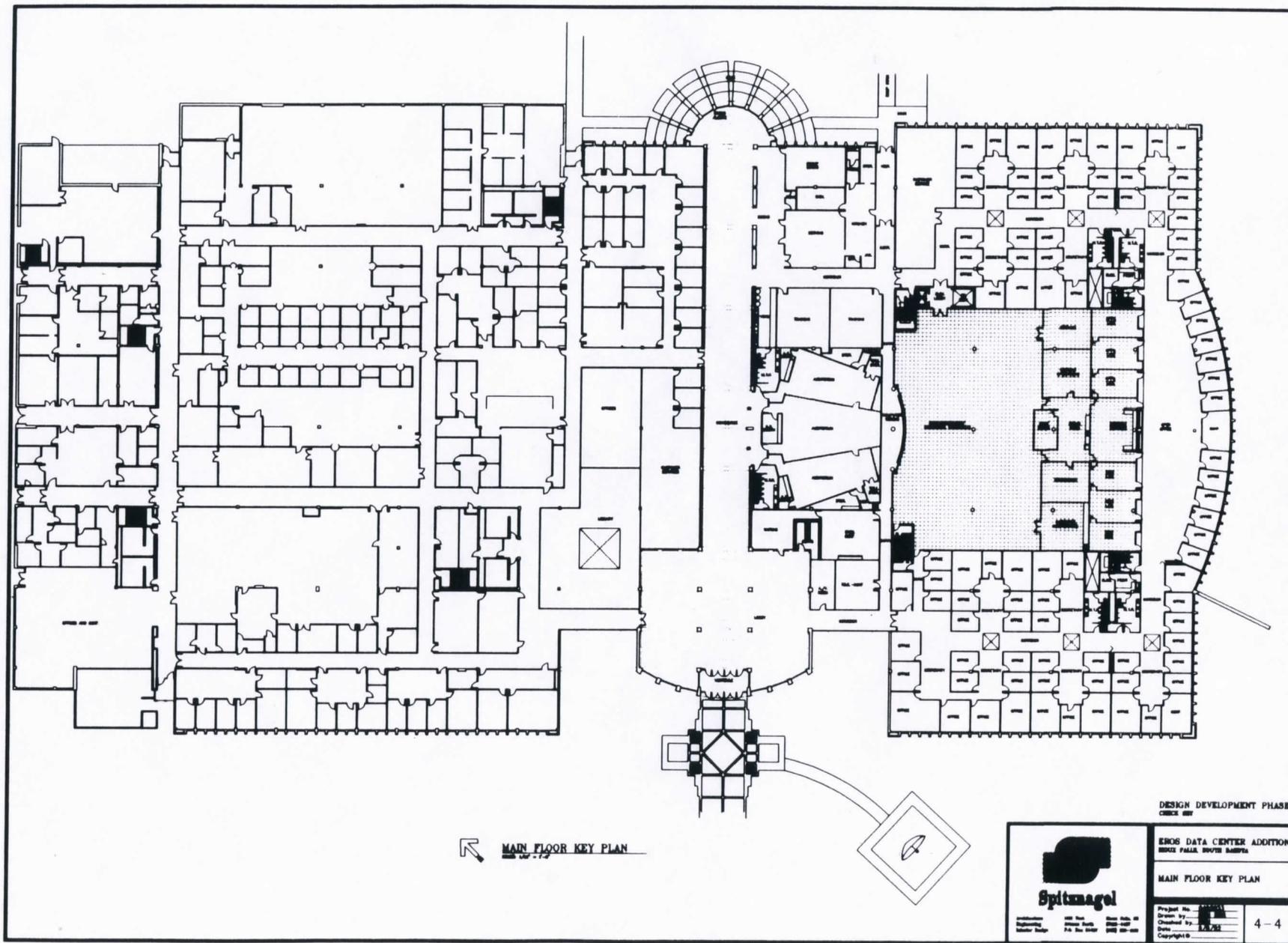


Figure 6

# Global Land 1km AVHRR Data Set Project

## HRPT Ground Stations (Operational and proposed) and NOAA LAC Coverage Areas

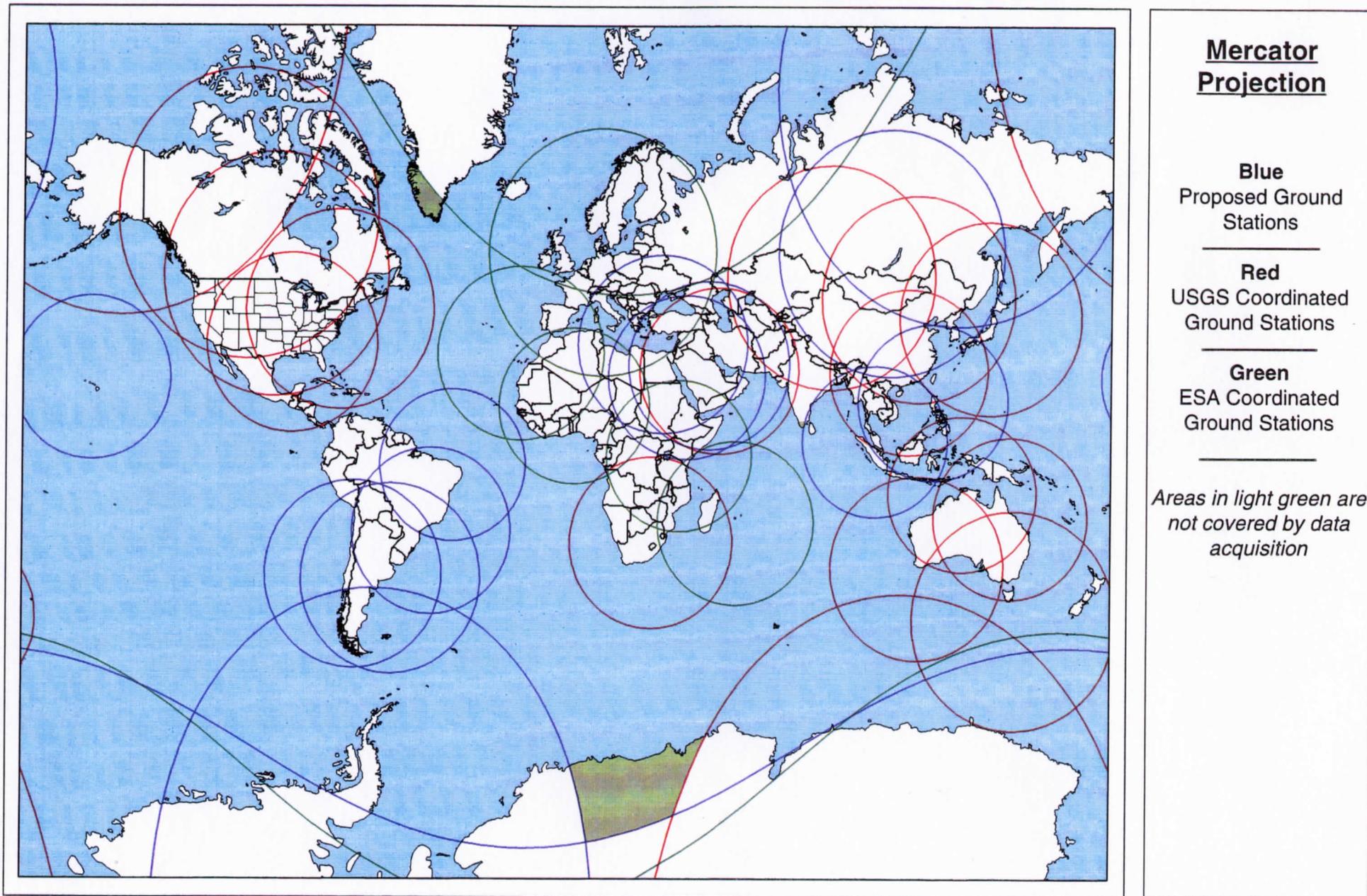


Figure 7

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**Agency for International Development Technical Assistance**

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*Famine Early Warning System (FEWS) Southern Africa Drought Project*

A severe drought condition occurred in Southern Africa during 1991-1992, resulting in regional food shortages and placing millions of people at-risk of famine. EDC was requested to support emergency USAID efforts to reduce the impact of the drought on the people of Malawi, Mozambique, Zambia, and Zimbabwe. Working with USAID's FEWS Project, EDC scientists used satellite remote sensing to map rainfed food producing areas, and to assess 1992 growing conditions to help target the most vulnerable communities.

Figure 8 is a periodic vegetation greenness condition image produced from NOAA-AVHRR time-series data collected over Southern Africa. The image shows the relative extent and severity of drought by comparing vegetation greenness conditions from March 1992 (normally the most verdant time of year) to the average March greenness conditions from the 1982-1991 period. In the image, orange and red colors indicate areas that are much drier than the average, providing FEWS analysts with a spatial tool to help target populations at-risk of famine. The image was particularly useful for impacted countries like Mozambique where crop production figures are unreliable or entirely lacking. Since 1986, greenness difference images have become a standard FEWS tool for drought monitoring in Sahelian Africa. Such assessments provide the knowledge and technological skills to apply to similar conditions in other parts of the world, including the United States.

*Agricultural-Hydrological-Meteorological (AGRHYMET) Activity*

The Niamey Field Office (NFO) agrometeorologist terminated his tour of duty in Niamey, Niger and returned to Sioux Falls, South Dakota in order to finalize the development of the climate data base software, CLIMBASE. A replacement for the NFO Production Supervisor was hired to work closely with AGRHYMET staff in the integration of GIS analysis procedures into the day-to-day operations of the AGRHYMET Regional Center.

Planning for the next 6-months' activities took place in Niamey in September 1992, in meetings between USGS/EDC, AGRHYMET, and USAID. Negotiations to finalize the Participating Agency Service Agreement amendment to extend EDC support until December 31, 1993, also occurred.

*Intergovernmental Authority for Drought and Development (IGADD) Early Warning Remote Sensing Support*

Plans were implemented to extend the project performance period from September 1992 to March 1993. The extension will allow EDC to continue to collaborate with the FAO/IGADD Remote Sensing Project in Nairobi, Kenya and to offer another advanced training course on environmental monitoring for IGADD staff.

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**Department of Defense and Intelligence Technical Assistance***Defense Advanced Research Projects Agency (DARPA)*

As part of the Defense Advanced Research Projects Agency (DARPA) technical assistance project staff, EDC worked with Western Mapping Center (WMC) on scanning and orthophoto correction of two quarter quadrangles in the Fort Irwin and Tiefert Mountains quadrangles and gave briefings to EDC staff on a WMC process for creating Digital Orthophoto Quadrangles (DOQ). Staff members implemented a 3-dimensional geometry model file format and routines to read-in and display the data. Project members began developing an X-Windows based user interface for "Looker" using the "Builder Xcessory" package.

*Dual Use Program*

EDC has entered into an Memorandum of Understanding (MOU) with the Central Intelligence Agency (CIA) for the purpose of transferring dual use technology developed by agencies of the intelligence community to Federal civil agencies. EDC is the direct recipient in two areas of technology: Feature Recognition Database, referred to as Infobase, and SoftCopy Quality Control. The National Information Display Laboratory (NIDL) at the David Sarnoff Research Center, Princeton, New Jersey will conduct the development for both areas and deliver software/procedures/training within 24 months. EDC also contributed to an MOU between the USGS and the Agency on the imaging spectrometer program called HYDICE.

The Infobase Project, after several months of planning, was initiated in August 1992, with a 2-year timeline for completion. The project will develop tools to allow EDC to manage and search large image databases based on data content and to manipulate interactively multidimensional data. Two meetings at EDC and two at the David Sarnoff Research Center were held during the last quarter of FY 1992 to define the initial toolset for Infobase. The toolset will be centered around Versant, an object-oriented data base, and will contain the following elements: (1) data exploration, (2) data transformation, (3) registration, (4) data base access and manipulation, (5) control of processing, and (6) visualization. The delivery of Phase I software is scheduled for February 1993.

The SoftCopy Quality Control Project, also began in August 1992. This 2 year project will provide EDC with the capability to produce color hardcopy output more efficiently through workstation-based interactive optimization of multispectral image data. Several technical exchanges have occurred between EDC and NIDL. Test data were provided to NIDL, and the Land Analysis System (LAS) software was installed on NIDL computers to gain familiarity with EDC's image processing procedures.

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**United Nations Environment Programme/Global Resource Information Database (UNEP/GRID) North America Node**

The Memorandum of Agreement between NASA, USGS, and the United Nations to establish and operate the North American Global Resource Information Database (GRID) Center at EDC in Sioux Falls, South Dakota was extended until December 31, 1993, by mutual agreement of all parties. Two workstations, donated to the United Nations

# Drought Assessment Map Southern Africa

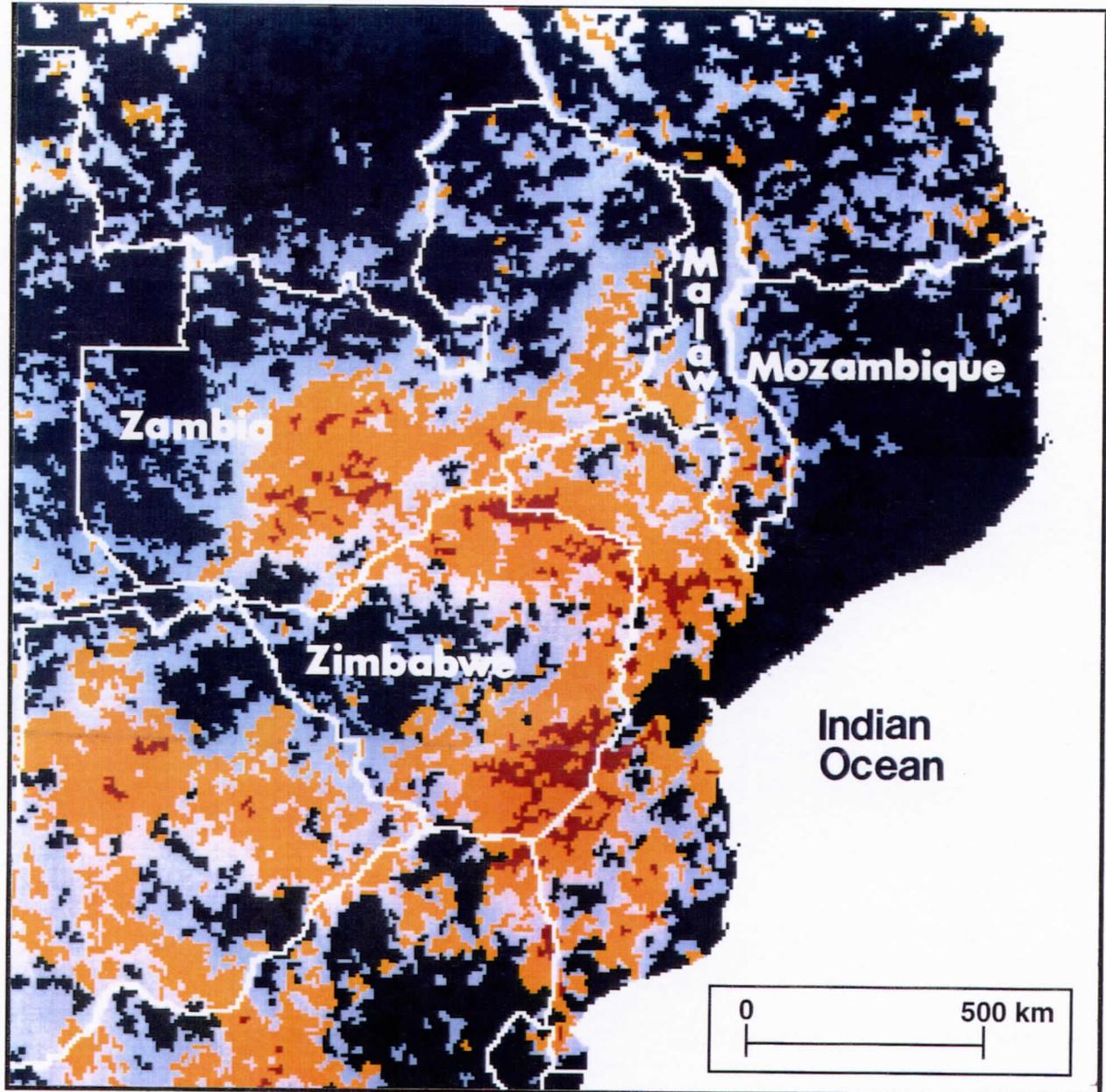


Figure 8

Environment Programme (UNEP) by Sun Microsystems, Inc., were received and installed in the GRID work area.

A demonstration of UNEP/GRID data sets along with EDC's Global Land Information System and NASA's Master Directory was presented at the Global Forum of the United Nations Conference on Environment and Development in Rio de Janeiro, Brazil, June, 1992.

Mr. Wayne Mooneyhan, Director, GRID-Sioux Falls, retired on June 30, 1992, from the United Nations Environment Programme (UNEP), and Dr. Ashbindu Singh was reassigned from GRID-Nairobi to serve as the UNEP/GRID Programme and liaison person at GRID-Sioux Falls. Arturo Sanchez-Azofeifa, Fulbright Scholar, University of New Hampshire (UNH), completed his internship (June 1-August 12, 1992) at GRID-Sioux Falls. Dr. Daniele Ehrlich, University of California-Santa Barbara (UCSB), joined GRID-Sioux Falls on July 13, 1992, for a period of about 3 months.

Mr. Sanchez worked with a 3 arc-second DEM provided by DMA to generate drainage network and delineate catchment boundaries for the Upper Reventazon river basin in Costa Rica, Central America. Dr. Ehrlich contributed in the development of 1-km AVHRR periodic vegetation greenness condition 10-day composites for Mexico. The Mexico data set will complement the vegetation condition composite development effort for the study of land cover characterization which is already underway for the conterminous U.S. and Canada.

Preparation of a 1-km AVHRR base image for South America was initiated. This effort included: a) preliminary scene selection of cloud free AVHRR data, b) map projection and parameter selection, and c) acquisition of preliminary DCW in ARC/INFO coverage for registration.

The Eastern Europe and former USSR periodic vegetation condition data set, developed by EDC using 1-km AVHRR data, was sent to GRID-Geneva for distribution to the international global change research community.

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### III. DATA PRODUCTION AND DISTRIBUTION ACTIVITIES

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#### **National Mapping Program Support**

##### *Map Production Support*

EDC's POD goal for reformatting 1:100,000-scale Digital Line Graphs (DLG's) of 72 quadrangles was met this fiscal year. This completed EDC's participation in the DLG reformatting effort. The computer equipment (Gould 32/9750) used for this activity will be excessed or transferred to another Mapping Center in the near future.

##### *Enhancement of Digital Orthophoto Quadrangles (DOQ)*

Science and Applications Branch staff and personnel from the Modernization Program Office discussed the application of digital image enhancement techniques to DOQ's in order to expedite and improve the revision of Digital Line Graph data. In August 1992, staff members traveled to the Rocky Mountain Mapping Center (RMMC) to meet with map compilers from each of the Mapping Centers. The purpose of the trip was to present a brief tutorial on image enhancement and to demonstrate some initial examples of their work on the enhancement of DOQ's. They also gave the demonstration to participants of the Revision Product Generation Technical Exchange Meeting (RevPG TEM) which was also being held in Denver, Colorado.

##### *Digital Line Graph - Enhanced (DLG-E) Support*

DLG-E activities included working with the Revision Product Generation (RevPG) team at RMMC to begin the process of defining the image processing requirements to do mono revision using DOQ's. EDC staff worked with the Product Generation Rules for the Automated Mapping (PGRAM) team at NMD headquarters concerning knowledge engineering and traveled to WMC to learn more about softcopy stereo.

##### *Census Project*

In response to an Memorandum of Understanding (MOU) between NMD and the Bureau of the Census signed in July 1992, EDC will provide DLG-E software design support for the Census 2000 project. Plans include sending Census staff personnel to EDC to work with the DLG-E development team. The goal is to coordinate software development between the two organizations so that both can utilize the resultant systems with minimum duplication of effort. Based on the MOU, the Bureau of the Census will provide "value added" data from the 2000 census to the National Digital Cartographic Data Base (NDCDB).

##### *Modernization Product Generation (MPG) Geologic TM Product Generation - Alaska*

The Alaska MPG initiative addressing standardization of geologic TM projects progressed with the installation of DIS-II workstations in the Branch of Alaska Geology (BAG) Office with a LAN hookup to the AFO. BAG staff are focusing on the use of ARC/INFO and C-shell scripts to develop thematic design layout tools. AFO staff participated in the weekly National Mapping Division Modernization Program Office teleconferences and in reviewing the interim release of the RevPG software.

### *National Aerial Photography Program (NAPP)*

New National Aerial Photography Program (NAPP) acquisitions were entered into the NAPP data base. At the request of the Department of Agriculture and APFO, data base updates (9-track tapes) were shipped weekly instead of semi-monthly. Several requests for NAPP data base records were handled by use of SQL queries and off-loaded to floppy disk for shipment to the requestor.

NAPP map plots were produced for next year's contract flying season. A total of 172 plots have been produced to date. This activity is seasonal and generally runs from August through November.

DORRAN orders were placed for duplication of NAPP photography for the archive. The film was cleaned and marked with sensor readable ink for use in Photo Lab's automatic printers. Over 5,000 master reproducibles were staged to the Photo Lab for reproduction of customer orders and 300 film rolls were cleaned during FY 1992.

### *Side Looking Airborne Radar (SLAR)*

Several shipments of USGS Side Looking Airborne Radar (SLAR), digital data and film were received, inspected for contract acceptance, and archived. SLAR digital data were converted from 9-track to 3480 cartridge tape. Many of the earlier contract data had not been entered into a data base because of header annotation problems. Information from physical 9-track tapes was copied and entered into the data base prior to the conversion.

### *Image Mapping/Custom Digital Production*

A 73-scene MSS image mosaic of the country of Pakistan was completed. The product was originally prepared as two subsets then joined to produce an image covering the entire country. Final photographic prints are being prepared for the Office of International Geology (OIG).

Twenty-six 1:200,000-scale image quadrangles were produced from an 18-scene MSS mosaic of Burkina Faso. Information interpreted from these images will be digitized and individual and full country Crop Use Intensity (CUI) plots will be produced.

Enhanced color transparencies were produced of Hurricane Andrew's path across Florida through the Gulf of Mexico and Louisiana. A total of nine AVHRR images were produced.

Two perspective views of Mt. Logan, Yukon Territory, Canada looking from Yakutat Bay, Alaska. TM data were registered to DEM data and reprojected. These perspective views were placed in the Public Affairs Office file.

The Southern Africa project was completed during the fourth quarter, FY 1992. CUI coverages were completed for the countries of Zimbabwe, Zambia, Malawi and Mozambique. Information from a total of 91 MSS scenes was digitized and 109 CUI plots were produced. All products were supplied to the International Projects staff who sent the products to Africa for in-country use.

The EDC continues to produce on a routine basis comprehensive time series data set of calibrated, georegistered biweekly vegetation greenness condition data products produced from AVHRR satellite data. These products are useful for monitoring vegetation condition in a number of ecosystems including forests, agriculture crops and grasslands. Digital files of the final image data and statistics are distributed on CD-

ROM media. Figure 9 shows a U.S. Vegetation Seasonal Profile from April through October, 1991.

#### *The Network Data Access Experiment*

Phase two of the network data access experiment was completed in September. Thirty AVHRR Level 1B image files were ordered, staged, and downloaded by an experiment cooperator at the University of Maryland. Based on the experiment results, the decision was made to offer network delivery of AVHRR data as standard products to the public. These image products will be staged on EDC computers and downloaded by the customer using Internet. Operational procedures are being finalized and software modification requests necessary to offer this new product have been submitted for both DORRAN and GLIS.

#### *Information System Development and Maintenance*

Information System scientists helped in staffing the USGS information booths at both the United Nations/International Space Year (UN/ISY) Conference in Boulder, Colorado August 17-20, and the International Society of Photogrammetry and Remote Sensing (ISPRS) Conference in Washington, D.C., August 3-7. GLIS demonstrations were provided to booth visitors throughout the week at both conferences, and Earth Science Information Center (ESIC) personnel were provided with GLIS training during the ISPRS meeting.

The 1990 and 1991 Alaska Twice Weekly AVHRR Composites CD-ROM's were published in the fourth quarter of FY 1992. The tapes for the first two of six 1992 Conterminous U.S. Biweekly AVHRR Composite CD titles were in production. Two Historical Landsat Change Pairs CD-ROM's are ready for publication early in the first quarter, FY 1993.

#### *Distributed Ordering, Researching, Reporting, and Accounting System (DORRAN) Support Activities*

Activities for DORRAN included general system support, new GLIS product type/DORRAN product codes were released to the network and NAPP tables were modified for contributor changes. Primary work load for the staff during fourth quarter revolved around development of new software required for moving the Landsat archive from the B6900 system. The B6900 functionality will then be provided by the DORRAN system. Discussions with representatives from the Office of Financial Management were held concerning combining accounting functions in DORRAN and the Federal Financial System (FFS).

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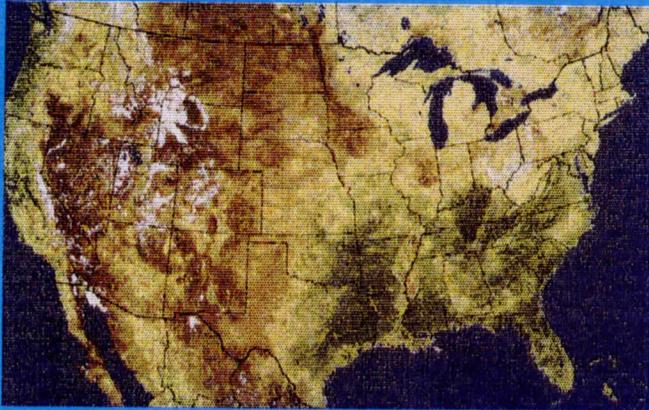
## **Satellite Data Operations**

### *Landsat Data Acquisition, Processing and Archiving*

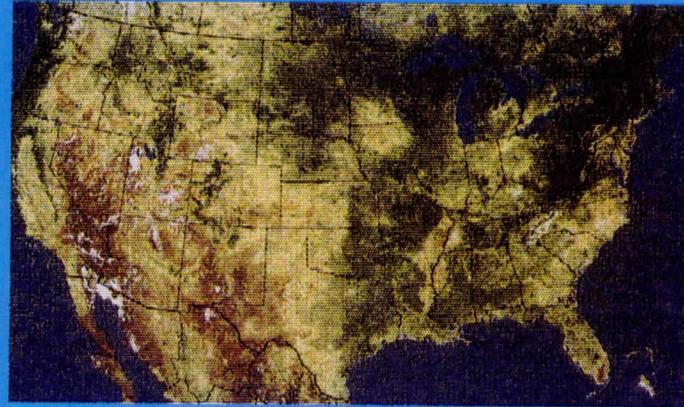
**Landsat 4-5 Operations:** Landsats 4 and 5 continue to operate nominally although both have far exceeded their design lifetimes. The Earth Observing Satellite Company (EOSAT) will begin funding Landsat 4/5 operations October 1, 1992, as a concession for the six month launch slip of Landsat 6. EOSAT completed construction of its Norman, Oklahoma, Data Receiving Facility and is receiving Landsat 4/5 data. The Transportable Ground System antenna has been shipped from the NASA Goddard Space Flight Center (GSFC) to Norman for use as backup.

# GLOBAL LAND DATA

April 12 - 25, 1991



June 07 - 20, 1991



August 02 - 15, 1991



October 11 - 24, 1991



**U.S. Vegetation Seasonal Profile**

NMD-160-92

Figure 9

# SATELLITE DATA PROCESSING

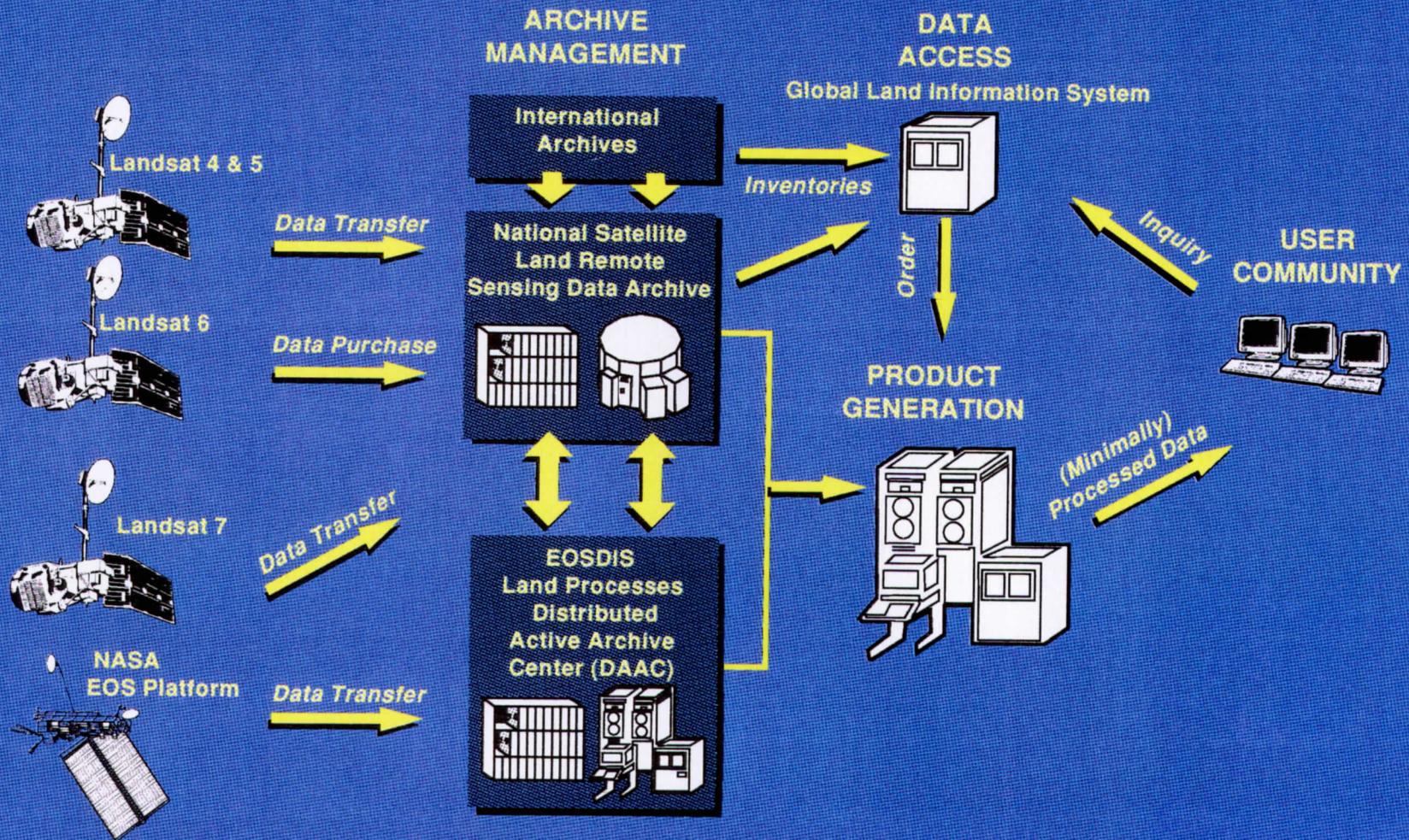


Figure 10

Landsat 6: All indications are that Landsat 6 is on schedule for the planned launch, January 23, 1993.

Landsat 7: Department of Defense (DOD) issued the RFP for the Landsat 7 Space Segment, Flight Operations Segment, and System Engineering, Integration and Test functions on June 1, 1992. A single bid was received from G.E. EDC staff participated in proposal technical evaluation and negotiations during July and August. A contract was not awarded FY 1992 because legislation had not yet been passed.

NASA has the responsibility for the Ground Segment and plans to implement the data processing and archiving and production generation and distribution parts of the system at EDC. NASA and EDC are currently defining requirements for the system to be located at EDC.

Landsat Legislation: H.R. 3614, Congressman Brown's "National Land Remote Sensing Policy Act of 1992," and S. 2297, Senator Pressler's "The Land Remote Sensing Policy Act of 1992" continued to move through Congress. Extensive negotiation has occurred to assure that S. 2297, which has single tier pricing for Landsat 7 data, is acceptable to the House. The legislation had not been passed by Congress as of the end of the fiscal year.

#### *AVHRR Data Acquisition, Processing, and Archiving*

AVHRR data continue to arrive from cooperating receiving stations in support of the Global Land 1-km Project. The scenes generally are good quality and the coverage is improving; however, tapes have been received with fewer files than reported, bad image files, bad start and stop time stamps, repeated image lines, and other anomalies which were tracked and noted. Since the initiation of the project in April 1992, approximately 2,400 scenes were received on 578 tapes and via Internet from 12 data receiving stations worldwide.

A total of 639 images were shipped to the European Space Agency (ESA). At the request of the ESA, certified tapes are being used and tapes are being organized by receiving station.

#### *Satellite Data Processing*

As the number of satellite platforms increase to support the range of data requirements of the global change research community, satellite data processing at EDC becomes a critical link in meeting those needs. Figure 10 shows the interrelationships of various processes and system configurations required to collect, process, archive, and distribute satellite data to the user community.

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## IV. OTHER ACTIVITIES

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### *Concept of Operations*

In June, 1992, a Concept of Operations (ConOps) Study Team was formed to consider alternatives and make recommendations for improved management processes and more effective organizational structures at EDC. The purpose for ConOps was to investigate those processes and structures that would permit the Data Center (1) to be more responsive to future assignments, (2) to emphasize the role of data management activities, (3) to improve methods to prioritize and allocate resources, (4) to improve methods to tie program funding to program content, and (5) to facilitate project management. The Study Team completed its work in September and submitted a draft document to the Acting Center Chief for his review. In FY 1993, an Operation's Design Team will take the recommendation of ConOps and initiate appropriate implementation processes.

### *Agreements Coordination*

During FY 1992, EDC coordinated and managed over 60 agreements with other Federal, State, and international organizations. These agreements facilitated the exchange of data and technical assistance that was determined to be of mutual benefit to the participating organizations. At the end of FY 1992, four agreements were being reviewed: European Space Agency, National Space Agency of Japan, The Consortium for International Earth Science, and California Institute of Technology Jet Propulsion Laboratory.

### *China Protocol*

The report on the first 5 years of the Protocol between the USGS and the National Bureau of Surveying and Mapping, the People's Republic of China, was published as USGS Bulletin 2033. Two scientists from EDC have been designated to travel to China in November 1992 for further technical collaboration on change detection with Landsat data and mosaicking of AVHRR data.

### *University of Colorado--Prototyping High Resolution Imaging Spectrometer Analysis Techniques Using Airborne Visible and Infrared Imaging Spectrometer (AVIRIS) Data*

Collaborative research with the Center for Study of Earth from Space, Cooperative Institute for Research in Environmental Sciences, University of Colorado was completed. The results from this research will be presented as an invited paper at the fall meeting of American Geophysical Union in December 1992, and a manuscript is being prepared for publication in a refereed journal.

### *International Geosphere Biosphere Program (IGBP)*

EDC contributed to the recently published IGBP Global Change Report Number 20, "Improved Global Data for Land Applications." The report, describing core project data requirements, emphasized the need for EDC's collection of a global daily 1-km AVHRR data set.

*United Nations/International Space Year (UN/ISY) activities*

NASA, NOAA, and USGS cooperated with the United Nations to present an international conference on "Satellite Remote Sensing for Resource Management, Environmental Assessment, and Global Change Studies: Needs and Applications of Developing Countries," in Boulder, Colorado, August, 1992. EDC presented an invited plenary paper on global land data sets and a poster paper on the EDC/USAID Senegal project. A large exhibit featured a GLIS demonstration and a display of global land data set products, including the 1-km global AVHRR data set acquisition program.

*Interior Geographic Data Committee (IGDC)*

EDC participated in the quarterly meeting of the IGDC, subcommittee, held in Denver in April. EDC reported on the AVHRR Companion Disk, the status of the DCW, progress on a North American DEM, SDTS raster profile, and the assembly of LUDA data for Colorado, Oklahoma, and Texas.

*South Dakota Symposium on Geographic Information Systems*

EDC participated in the First Annual Symposium on GIS in Pierre, South Dakota. Over 120 people attended the symposium from various local, State and Federal agencies that use GIS in South Dakota. The objectives of the symposium included building of working relationships among GIS institutions in the State, and the promoting of information exchange at several levels. EDC provided information on digital data sources and availability, and participated in a panel on "GIS Issues and Interagency Cooperation."

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## V. STATISTICAL DATA

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### Introduction

A summary of EDC's data services activities for FY 1992 is presented here. Included is information on sales and distribution of products and services, revenues, customer profiles, historical trends, and the contents of EDC archives and data bases. The report contains information on both the USGS data distributed by EDC and those Earth Observation Satellite Company (EOSAT) products and services that are produced or processed by EDC under its agreement with the National Oceanic and Atmospheric Administration (NOAA) and EOSAT.

### Overview

In FY 1992, EDC provided over 4.5 million dollars worth of USGS products and services (including sales from MSS data older than 2 years) and processed over 2.8 million dollars in EOSAT transactions for a total in excess of 7.3 million dollars. More than 21,000 user inquiries were received during the year, and over 15,000 individual orders were filled.

	FY 1992			
	USGS		EOSAT	
	#	\$	#	\$
Photographic Products	192,044	2,916,346	1,523	73,658
Digital Products/Processing	10,685	1,497,596	2,759	1,738,810
Reference Aids	N/A	9,020	N/A	8,641
Service Charges	N/A	N/A	1,764	-150
Miscellaneous	1,247	79,685	553	1,026,233*
<b>TOTAL</b>	<b>203,976</b>	<b>4,502,647</b>	<b>6,599</b>	<b>2,847,192</b>

\*Primarily products produced at EOSAT but billed by EDC.

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### Tables and Graphs

- Section I. USGS Products and Services
- Section II. EOSAT Products and Services
- Section III. EDC Archives and Databases

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**Section I: USGS Products and Services**

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This section summarizes EDC FY 1992 activities dealing with the sale and distribution of USGS products; i.e., exclusive of those EOSAT products produced by EDC under its agreement with NOAA and EOSAT.

In fiscal year 1992, EDC produced and distributed over 4.6 million dollars worth of USGS products and services, including \$287,000 in sales of Landsat MSS data greater than two years old. Of this total, 2.23 million dollars were direct repay sales and 1.52 million dollars were products and services provided through full repay EDC projects totaling over 3.7 million in reimbursable dollars. The remaining \$750,000 were for products and services distributed to users within EDC, other National Mapping Division centers, and other divisions of the USGS.

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**Tables and Graphs**

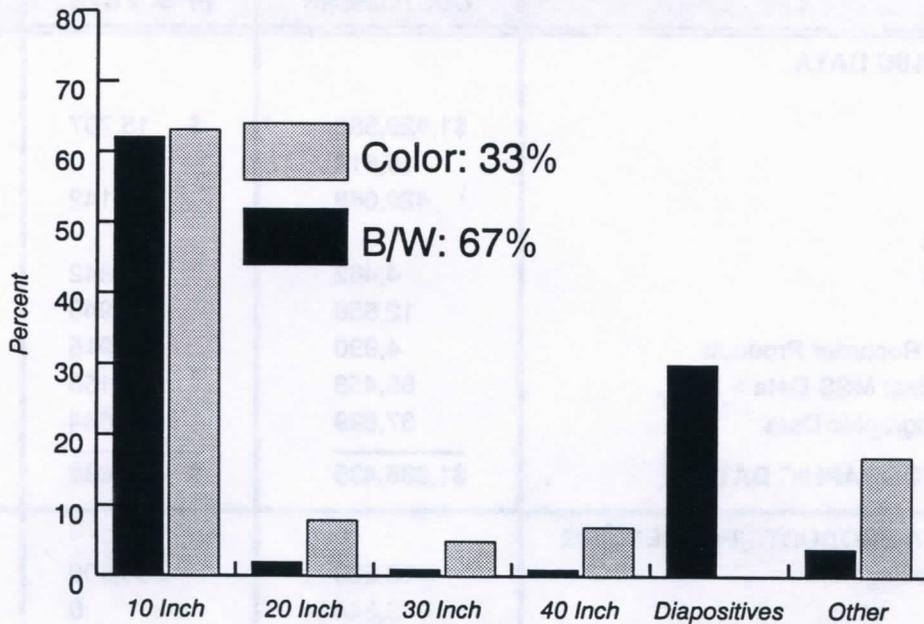
- o Annual Sales Report
- o Product Profile - USGS Photographic Data
- o Customer Profile - USGS Photographic Data

# EDC Annual Sales Report Fiscal Year 1992

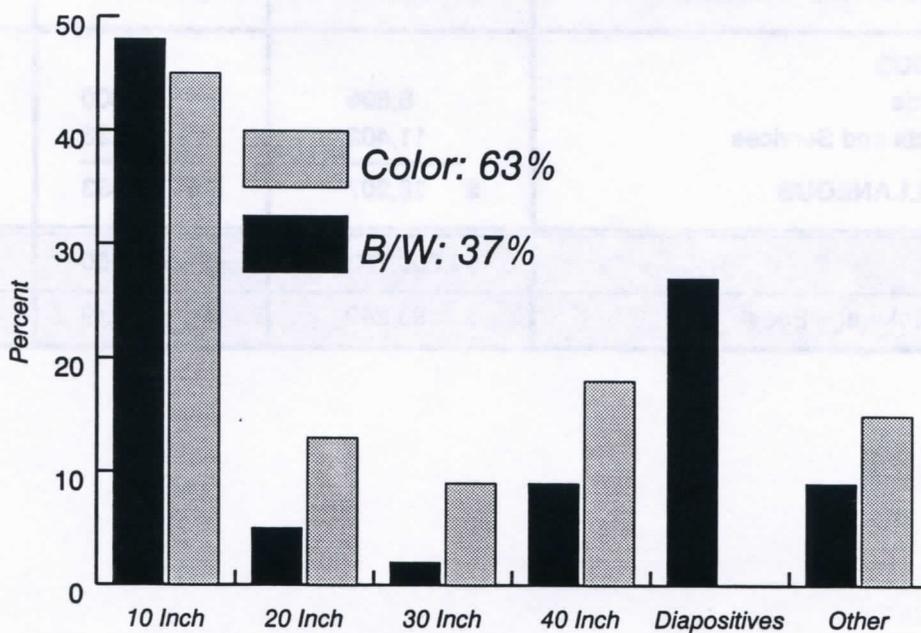
	DIRECT REPAY CUSTOMERS	EDC REPAY PROJECTS	USGS CUSTOMERS
<b>PHOTOGRAPHIC DATA</b>			
AERIAL			
NAPP	\$1,420,588	\$ 15,797	\$ 341,148
SLAR	10,614	0	6,509
Other	429,068	1,142	19,571
SATELLITE			
AVHRR	4,462	44,842	1,005
Other	12,556	943	67
Digital Film Recorder Products	4,990	156,915	12,800
USGS Landsat MSS Data > 2 yrs.	65,458	51,155	6,087
Other Photographic Data	37,699	201,844	71,087
<b>TOTAL PHOTOGRAPHIC DATA</b>	<b>\$1,985,435</b>	<b>\$ 472,638</b>	<b>\$ 458,274</b>
<b>DIGITAL DATA PRODUCTS/PROCESSING</b>			
Data Processing	-10,539	595,500	219,514
SLAR	3,344	0	1,040
AVHRR	53,713	315,207	36,016
NDCDB	57,610	127	4,355
USGS Landsat MSS Data > 2 yrs.	108,800	46,800	8,600
NURE Data	1,680	160	0
Other Digital Data Products	15,524	24,785	15,360
<b>TOTAL DIGITAL DATA/PROCESSING</b>	<b>\$ 230,132</b>	<b>\$ 982,579</b>	<b>\$ 284,885</b>
<b>MISCELLANEOUS</b>			
Reference Aids	6,805	300	1,915
Other Products and Services	11,402	65,133	3,150
<b>TOTAL MISCELLANEOUS</b>	<b>\$ 18,207</b>	<b>\$ 65,433</b>	<b>\$ 5,065</b>
<b>GRAND TOTAL</b>	<b>\$2,233,773</b>	<b>\$1,520,650</b>	<b>\$ 748,224</b>
Satellite Data Brokerage Fees	\$ 93,249	\$ 32,219	\$ 2,111

# Product Profile: USGS Photographic Data Fiscal Year 1992

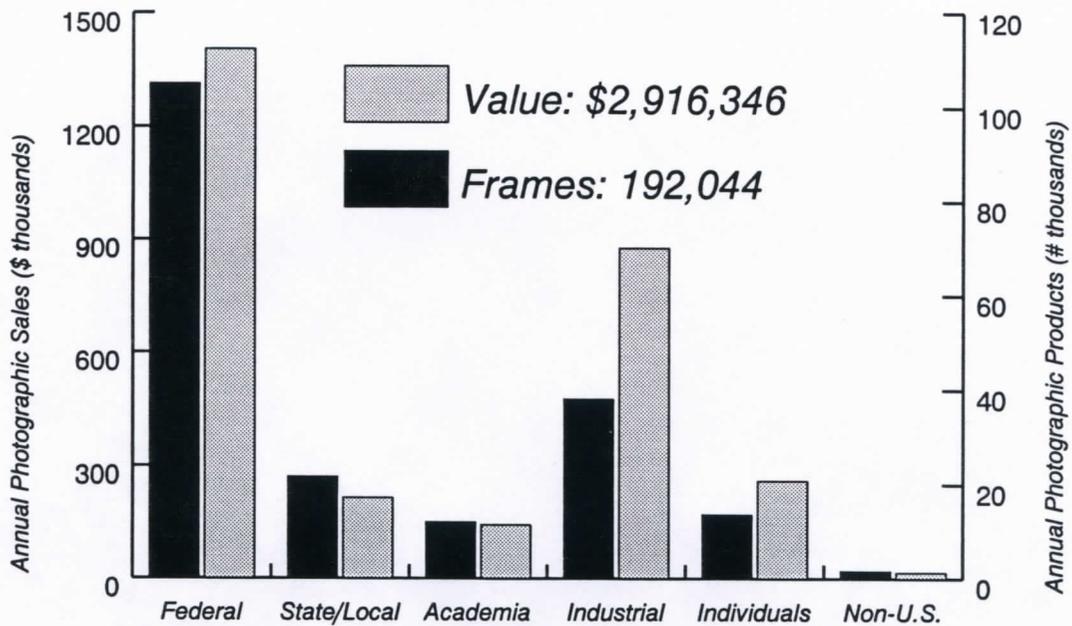
**Total Frames: 192,044**



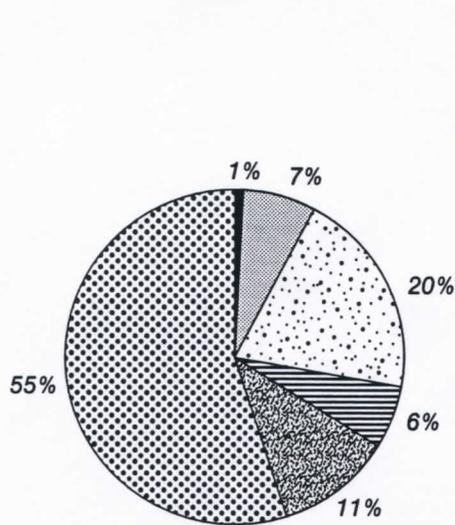
**Total Data Value: \$2,916,346**



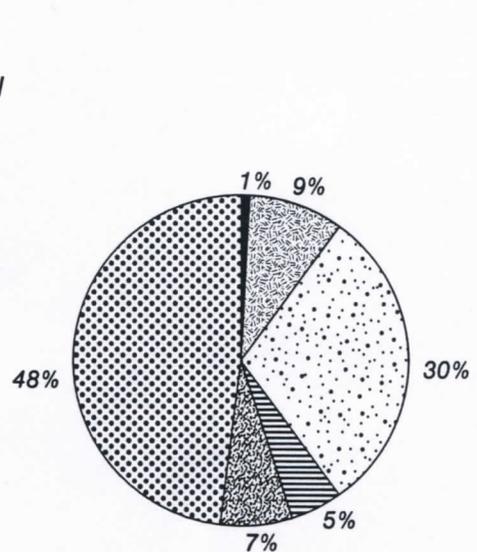
# Customer Profile: USGS Photographic Data Fiscal Year 1992



## Frames



## Dollars



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**Section II: EOSAT Products and Services**

The following summarizes EDC's FY 1992 activities in support of the USGS agreement with NOAA and EOSAT for the production and distribution of Landsat products and services. These figures do not include USGS sales of Landsat MSS data more than two years old, nor EOSAT TM production.

Landsat sales reported in this section refer only to data distributed by EDC, or distributed by EOSAT but billed through EDC. Some products produced and billed directly by EOSAT do not appear in EDC records.

In FY 1992, total revenue from EOSAT products and services processed through EDC was over 2.8 million dollars. Of that amount, over 1.7 million dollars was for EDC-produced digital products and \$74,000 was for EDC-produced photographic products. A miscellaneous category, which consisted primarily of data produced and distributed by EOSAT but billed through EDC, accounted for over 1 million dollars. The remaining \$16,000 was for accession aids, postage charges, and service charges.

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**Tables and Graphs**

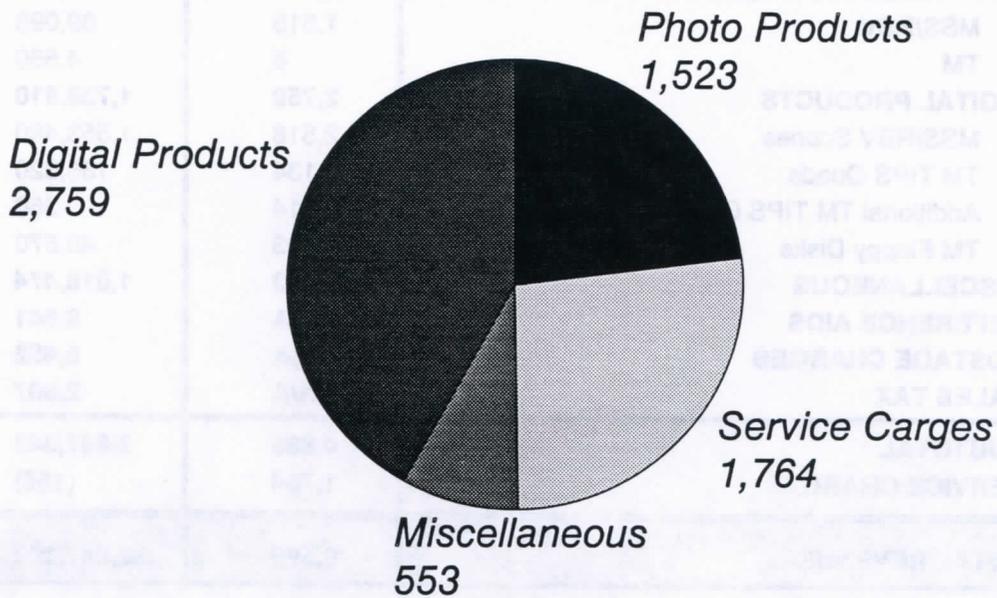
- o EOSAT Products, Services and Revenue
- o EOSAT Product Summary
- o Customer Profile - EOSAT Data

# EOSAT Products, Services, and Revenue Fiscal Year 1992

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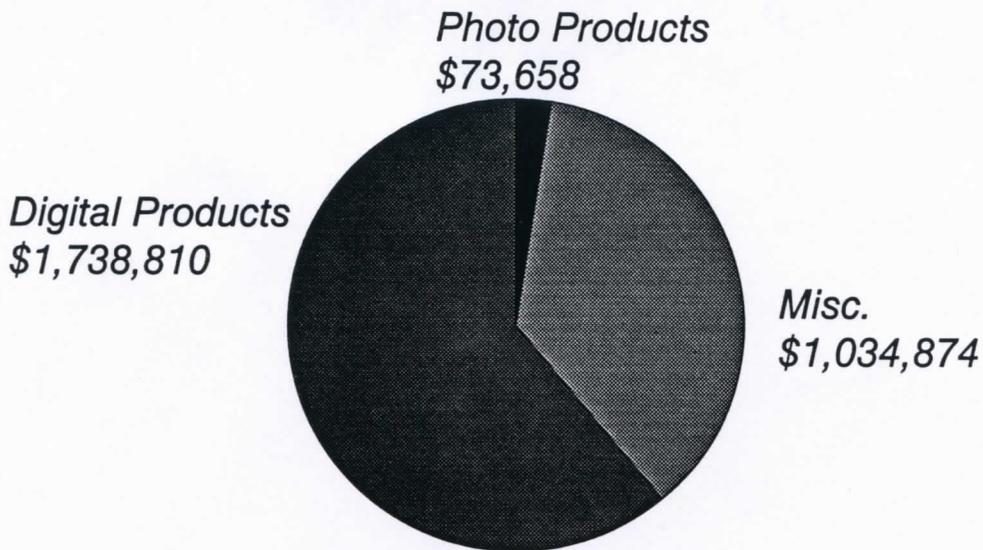
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**Total Products/Services: 6,599**



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**Total Revenue: \$2,847,192**



(Service Charges: -\$150)

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# EOSAT Product Summary

## Fiscal Year 1992

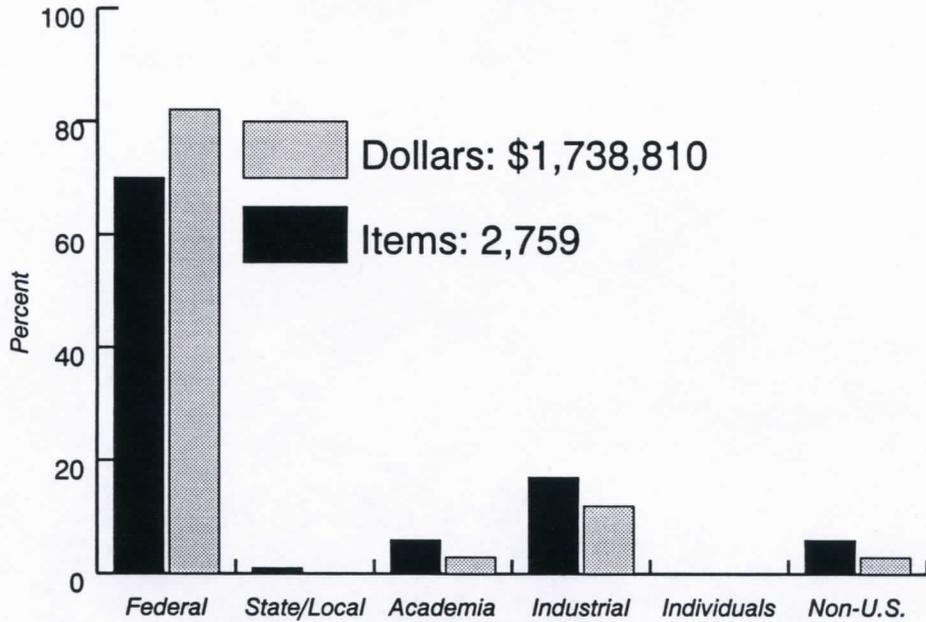
PRODUCTS/SERVICES/CHARGES	ITEMS	DOLLARS
<b>PHOTOGRAPHIC PRODUCTS</b>	<b>1,523</b>	<b>\$ 73,658</b>
MSS/RBV	1,515	69,098
TM	8	4,560
<b>DIGITAL PRODUCTS</b>	<b>2,759</b>	<b>1,738,810</b>
MSS/RBV Scenes	2,518	1,553,460
TM TIPS Quads	134	136,320
Additional TM TIPS Copies	14	360
TM Floppy Disks	93	48,670
<b>MISCELLANEOUS</b>	<b>553</b>	<b>1,018,474</b>
<b>REFERENCE AIDS</b>	<b>N/A</b>	<b>8,641</b>
<b>POSTAGE CHARGES</b>	<b>N/A</b>	<b>5,452</b>
<b>SALES TAX</b>	<b>N/A</b>	<b>2,307</b>
<b>SUBTOTAL</b>	<b>4,835</b>	<b>2,847,342</b>
<b>SERVICE CHARGES</b>	<b>1,764</b>	<b>(150)</b>
<b>TOTAL REVENUE</b>	<b>6,599</b>	<b>\$2,847,192</b>

# Customer Profile: EOSAT Data Fiscal Year 1992

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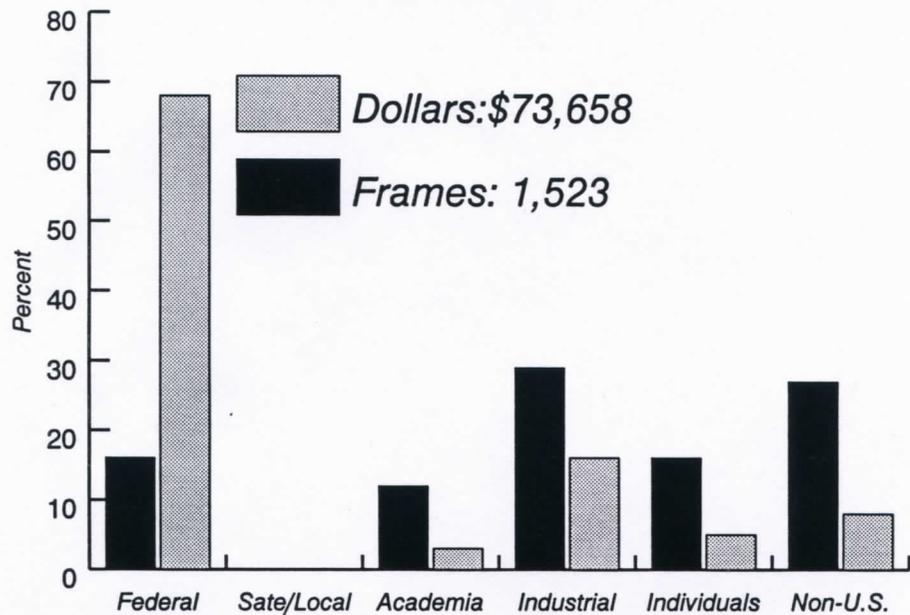
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## Digital Products



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## Photographic Products



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**Section III: EDC Archives and Data Bases**

This section describes the status of those data archives, both digital and photographic, that are maintained by EDC to preserve and reference remotely sensed, cartographic, or earth science data held by EDC. In addition, several data bases are maintained by EDC to reference or catalog data held elsewhere that is of interest to EDC customers.

As of the end of FY 1992, EDC archived over 7.1 million frames of USGS photographic data and over 45,000 tapes containing USGS digital data. In addition, EDC archived over 2.8 million frames of photographic Landsat data and nearly 80,000 tapes of digital Landsat data. The International Landsat Data Base maintained by EDC referenced over 2.2 million scenes of Landsat data held by foreign ground stations.

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**Tables**

- o USGS Photographic Data Archived at EDC
- o USGS Digital Data Archived at EDC
- o Landsat Data Archived at EDC
- o Landsat Data Referenced in EDC Data Base
- o Summary of Data Archived at EDC

# Data Archive Report As Of September 15, 1992

## USGS PHOTOGRAPHIC DATA ARCHIVED AT EDC

AERIAL PHOTOGRAPHY		
SOURCE	ROLLS	FRAMES
US Geological Survey	17,298	2,580,892
NAPP	7,570	1,158,951
Bur. of Land Management	625	124,992
Bur. of Reclamation	301	60,181
National Park Service	81	13,653
Bur. of Indian Affairs	49	9,913
<b>TOTAL DEPT. OF INTERIOR</b>	<b>25,924</b>	<b>3,948,582</b>
Army Map Service	1,680	213,873
US Air Force	3,378	330,643
US Navy	6,321	431,170
Corps of Engineers	82	22,924
<b>TOTAL DEPT. OF DEFENSE</b>	<b>11,461</b>	<b>998,610</b>
Ames Research Center	4,067	528,675
Johnson Space Center	7,622	1,009,763
Other	1,413	125,427
<b>TOTAL NASA</b>	<b>13,102</b>	<b>1,663,865</b>
<b>OTHER SOURCE AGENCIES</b>	<b>2,022</b>	<b>347,332</b>
<b>TOTAL AERIAL PHOTOGRAPHY</b>	<b>52,509</b>	<b>6,958,389</b>

SATELLITE PHOTOGRAPHY		
SOURCE	ROLLS	FRAMES
SKYLAB	634	44,845
APOLLO/GEMINI/APOLLO-SOJUZ	127	18,372
SHUTTLE (LFC 8 ROLLS)	1,413	116,091
<b>TOTAL SATELLITE PHOTOGRAPHY</b>	<b>2,174</b>	<b>179,308</b>

# Data Archive Report As Of September 15, 1992

## USGS Digital Data Archived at EDC

SOURCE	MAGNETIC TAPES
<b>AERIAL IMAGE DATA</b>	
NASA Data	
TMS 8-Channel Data	765
TMS 12-Channel Data	575
TIMS 6-Channel Data	269
M2S 11-Channel Data	77
AOCI 10-Channel Data	40
National Park Service	93
Side-Looking Airborne Radar (SLAR)	<u>1,775</u>
<b>TOTAL</b>	<b>3,594</b>
<b>SATELLITE IMAGE DATA</b>	
AVHRR	
EDC-HRPT Data	14,019
LAC Data Received via DOMSAT	17,394
LAC Data Received From Other Sources	4,973
Federally-Owned Landsat Data (FOLD)	3,251
SPOT Data	293
Department of Defense MSI Data	<u>811</u>
<b>TOTAL</b>	<b>40,741</b>
<b>NDCDB DATA</b>	
Digital Elevation Model (DEM)	76
1:2 Million Digital Line Graph (DLG)	<u>4</u>
<b>TOTAL</b>	<b>80</b>
<b>EARTH SCIENCE DATA</b>	
National Uranium Resource Evaluation(NURE)	957
Geophysical Research Program	<u>15</u>
<b>TOTAL</b>	<b>972</b>
<b>TOTAL DIGITAL HOLDINGS</b>	<b>45,387</b>

# Data Archive Report As Of September 15, 1992

## Landsat Data Archived at EDC

PHOTOGRAPHIC DATA	ROLLS	FRAMES
MSS 70 MM Film, Landsat 1,2,3	7,708	1,342,187
MSS 9" B&W Film	9,741	1,322,542
TM 9" B&W Film	2,968	177,118
MSS Color Composites	N/A	18,152
TM Color Composites	N/A	1,866
<b>TOTAL</b>	<b>20,417</b>	<b>2,861,865</b>
DIGITAL DATA	1/2" Mag.Tapes	HDT's
MSS/TM	47,626	32,093

## Landsat Data Referenced In EDC Landsat Data Base

LOCATION	SCENES
<b>DATA HELD IN U.S. BY EOSAT AND/OR EDC</b>	
MSS/RBV	784,260
TM	190,599
<b>TOTAL</b>	<b>974,859</b>
<b>DATA HELD BY FOREIGN GROUND STATIONS</b>	
Argentina	10,790
Australia	210,671
Brazil	96,467
Canada	529,507
Earthnet (Europe)	612,104
Italy	503,952
Japan	182,659
Pakistan	7,839
South Africa	70,085
Spain	26,903
<b>TOTAL</b>	<b>2,250,977</b>

# Data Archive Report As Of September 15, 1992

## Summary of Data Archived at EDC

PHOTOGRAPHIC DATA	FRAMES
AERIAL	6,958,389
SATELLITE	179,308
LANDSAT	<u>2,841,847</u>
<b>TOTAL</b>	<b>9,979,544</b>

DIGITAL DATA	MAGNETIC TAPES	HDT's
AERIAL IMAGE DATA	3,594	—
SATELLITE	40,741	—
NDCDB	80	—
EARTH SCIENCE DATA	972	—
LANDSAT	<u>47,626</u>	<u>32,093</u>
<b>TOTAL</b>	<b>93,013</b>	<b>32,093</b>

**EROS Data Center**  
U.S. Geological Survey  
National Mapping Division  
Sioux Falls, SD 57198  
(605) 594-6511