

EROS Data Center

Monthly Activity Reports

January 1, 1976 - December 31, 1977

EROS Data Center and
EROS Applications Assistance Facilities
Monthly Activity Report
January 1, 1976 through January 31, 1976

I. Accomplishments

A. EROS Data Center

1. The B6700 system was placed in full production status on January 5th to support the Inquiry, Order Processing, and Data Base applications previously supported by the IBM 360/30. All IBM 360/30 software except for 19 management report programs have been converted. The Management Reporting System is due for installation at EDC in mid-February. A total of 140 programs and subroutines have been converted by Burroughs and checked out and installed by the EDC staff. Parallel operation of both systems was maintained for all production processing from mid-December through mid-January to allow adequate checkout of all software prior to discontinuance of IBM 360/30 support. For the remainder of January, the IBM 360/30 data base was maintained to allow emergency use if required. Since this situation did not arise, the decision has been made to discontinue IBM 360/30 support for data production operations and use it for management reporting only until its scheduled release. A release plan has been generated specifying release of all leased peripheral components by March 1, 1976 and subsequent release of the remaining CPU, memory, and government-owned components by May 1, 1976. Appropriate actions are underway to recover some of the cost of the government-owned components or to use those components in other EDC computer systems.
2. Programming has been initiated to transfer the automated geographic data entry system using Graf/Pen digitizers from the PDP 11/20 to the B6700. This project will be implemented in two phases and allow support of multiple data entry stations each having a CRT and a Graf/Pen tablet. The first phase consists of a simple conversion of existing capability to the B6700 by mid-March 1976, which will allow support of multiple stations each having CRT units as data input media. The second phase will implement graphics software to make optimum use of plotter and CRT devices in presenting plots of geographic coverage.
3. Applications Assistance and training activities continued including:
 - 1) at the request of the Office of International Geology, two one-week training courses were given in Jiddah, Saudi Arabia for approximately 75 mineral and petroleum geologists;
 - 2) a two-week training course on remote sensing techniques applied to environmental assessment was presented at Harpers Ferry, Virginia to U.S. Army Corps of Engineers personnel;
 - 3) a one-day orientation session was

held for nine senior members from the USDA Soil Conservation Service (SCS) office in Huron, South Dakota. Discussions included both basic characteristics and capabilities of remote sensing systems as they pertain to SCS project requirements, availability and procurement of remote sensing data, both at the EROS Data Center and elsewhere, and possible areas of SCS/EDC cooperation on demonstration projects of mutual interest; 4) preliminary planning continued for the Sixth International Workshop to be held at EDC in May 1976. Student selection will be made in February; 5) as part of the cooperative project work between the EROS Data Center, PNR, and the University of Idaho, a one-week workshop was conducted for University of Idaho personnel using Landsat digital classification for a timber volume inventory of a large forested area adjacent to the Idaho Primitive Area. A seminar on the EROS Data Center and forestry applications was also given at a graduate seminar course at the University of Idaho; 6) personnel from NSTL Applications Assistance Facility spent two days at EDC developing training materials for an upcoming forestry workshop to be held at NSTL in February; 7) a meeting was held with representatives of SDSU for purposes of coordinating the EDC role in a three-day conservation workshop to be held at Brookings in March.

4. Effort continued on the EROS/Environmental Impact Analysis Program Cooperative Study in southeastern Idaho. Manual interpretation of U-2 color infrared aerial photographs for vegetation cover types is 90% complete for the upper Blackfoot Watershed. Transfer of vegetation cover types, ownership, permit areas for proposed mining sites, and critical habitats to transparent overlays at a scale of 1:24,000 was begun. Vegetative cover overlays are 30% complete; ownership overlays are 100% complete and critical habitat overlays are 40% complete. Change detection using Landsat data from September 1973 and September 1975 was performed on the Image 100 for the central portion of the Blackfoot Watershed.
5. Plans have been finalized with NASA, PNR, and the Idaho Department of Lands for a demonstration project using multilevel electronic data processing information, collection, extraction, and handling techniques for inventorying forest resource on state lands.
6. Plans have been completed for occupying the new Facility Support Building in early February. Special Assistant to the Director, William Schmidt will visit EDC February 4-5 to finalize the lease agreement for the building. The Rice Street warehouse has been vacated and the remains of the antenna were sold to the highest bidder by GSA completing the surplus action required.

7. A conceptual design review was held January 6, 7, 8, 1976, for the EDC Digital Image Processing system (EDIPS) with representatives from EDC, EROS Program Engineering Office, and Operations Research Inc. (ORI). The EDIPS requirements, conceptual system design, work flow plan, estimated costs, and schedule for system procurement and implementation were reviewed during this meeting. Preparation of the required functional specification for the system are in work and scheduled to be completed by mid-February. A final design review of the EDIPS system and work flow plan will be held in Reston February 24, 1976, and the total package is scheduled to be ready for Branch of Contracts by February 27, 1976.
8. Effort continued on the High Resolution Film Recording System (HRFRS). Review of the contractor submitted HRFRS Acceptance Test Procedure (ATP) was completed. A revised ATP has been generated and submitted to Branch of Procurement and Contracts for implementation by the HRFRS contractor. As a result of a meeting with the contractor to discuss certain technical and schedule problems the delivery of the system will be slipped one month to March 20, 1976.

B. EROS Applications Assistance Facilities

1. IAGS

- a. Seven hundred seventy-six (776) frames of ERTS imagery were processed and delivered to national EROS centers. One hundred twenty (120) frames of ERTS imagery were requested from EDC as the result of special orders. There were 4,154 pages of literature and 669 sheets of Sea Surface Temperatures forwarded to the Latin Centers. The microfiche processor was inoperable a portion of this month but is now in good shape and a large amount of microfiche will be duplicated and forwarded in early February.
- b. Representatives from NASA Ames Research Center held technical meetings with the IAGS EROS Coordinator, regarding possible U-2 aircraft data acquisition in March-April 1976 over selected sites in Central America and Panama. Photographic flights with various cameras and lens configuration will be obtained over national priority areas for development of soil classification studies, forest inventory and sampling, and mineral resources. Flights would also be conducted in several countries as an aid in developing geothermal potentials, using a high-altitude thermal scanner.

2. Phoenix

- a. Applications Assistance and Training activities included:
 - 1) presented a briefing on "Remote Sensing and Water Resources Studies in Arizona" at the annual meeting of the Wilbur-Ellis Company (Ag. Chemical Sales) in Phoenix, AZ. Approximately

55 people attended the meeting; 2) presented a briefing on Remote Sensing Applications and the EROS Program at the BIA Land Appraisal and Planning Conference that was held in Phoenix. This briefing was presented in response to a request by Mr. Art Woll of BIA; 3) Dr. Robert Colwell of University of California at Berkeley visited the Phoenix AAF with two representatives of the Jacques Cousteau Society to discuss the feasibility of using remote-sensor data over Maricopa County, AZ, including Phoenix, to show the displacement of agricultural lands by urbanization and other development. These data would be used as part of a series of films being prepared by the Society.

- b. A total of 106 computer searches were conducted during this reporting period. The conversion to the Burroughs B6700 computer system at EDC proved to be very smooth for this office due to the efforts of the Branch of Computer Services. Much less time is required to run searches and submit orders than before. In addition, during the first month of operation with the new system, we experienced fewer problems than was normally the case with the IBM 360/30.

3. Alaska

- a. The American Revolution Bicentennial Administration (ARBA) and the Department of Housing and Urban Development (HUD) have selected one of the Institute's remote-sensing projects as part of the "Horizons on Display" bicentennial program. This program theme focuses on America's activities which tend to improve the quality of life and is a major national activity aimed at highlighting community achievements that represent successful, on-going efforts to deal with community needs. ARBA and HUD have included the work that the Institute did on behalf of Doyon Ltd. as one of 200 projects, and it was chosen because it represents a recent example of the application of technology toward the betterment of the quality of American life. The Doyon project involved mapping timber areas and potential mineral areas covering over 8500 square miles with the purpose of assisting in selection of lands by Doyon Native Corporation under the Alaska Native Claims Settlement Act. The "Horizons on Display" program was announced at a national press conference on January 29, in Washington. At that time, the Institute was presented with a Bicentennial Flag and a Certificate of Recognition.
- b. A digital classification of Landsat scene #1455-20034 of the Yakutat area is being done as a cooperative project with the department of Environmental Conservation. The purpose is to map land use in the Yakutat area which is expected to be strongly impacted by oil exploration in the Gulf of Alaska.

4. Menlo Park

- a. Members of the Task Force of the Pacific Northwest Regional Commission Land Resource Inventory Demonstration Project met at NASA/Ames on January 7th and 8th to discuss various Geographic Information Systems. To provide for requirements of Phase IV of the Project it will be necessary for the Task Force to select a Geographic Information System and put it into use. For this purpose a number of different systems were described as follows: 1) James Jesske of NASA/Ames led off by describing all the elements that are required for a system to be useful and successful; 2) John Hill, from the NASA/Marshall Space Flight Center, described the programs that they had carried out for Tennessee and Alabama in cooperation with the Appalachian Regional Commission. This was a Land Use study similar in concept to the Pacific Northwest study; 3) Nevin Bryan, from the Jet Propulsion Laboratory, described the Geographic Information System that JPL has developed which includes two principal components; a) a Land Use Management Information System (LUMIS) to permit inexpensive user interrogation and display of land use and population statistics by census tract and block, and b) a Multiple Input Land Use System (MILUS) to construct geocoded data files from a variety of sources in a cost effective manner; 4) Bob Ray, from the University of Illinois, discussed the ILLIAC IV computer and what its capabilities were. An IBM 36067 would cost \$8,000 to perform one classification job, whereas the ILLIAC was able to do the same work for a cost of \$300, in spite of the fact that the ILLIAC cost ten times as much per hour to use as the IBM. He discussed the matter of digitizing the graphic information with emphasis upon using nodes instead of arcs; 5) Eric Anderson and Dick Witmer discussed the LUDA Program and the approaches used there in the Land Classification, describing the sequence of steps involved in the process, and the differences between the LUDA Program and the PNW Program; 6) Hugh Culkins from the State University of New York discussed base map problems, stating that it is a larger problem than had been previously emphasized, and discussed five systems that had been tried out for digitizing map bases, including University of Minnesota, Oakridge, Calscan, CGIS, and PIOS. He summed it up by stating that the cost of digitizing a map base is fairly high and will probably remain so.
- b. Applications assistance and training activities included: 1) Art Grantz, geologist with the Geologic Division at Menlo Park, requested information on the accuracy of scale in the Landsat images. His application was the need to determine the dimensions of a major ice island in the Arctic Ocean. The question was submitted to Colvocoresses and the response was that the accuracy on the 1:1,000,000 would be certainly better than 1%. It had been previously found that the 1:500,000 enlargement can be as much as 1% off scale, but this could be a matter of the paper base on which it is printed. This 1%

accuracy is sufficient to enable him to make his measurements and provide the only means by which he could do this in view of the inaccessibility of the ice island which is several hundred miles north of the North Coast of Alaska; 2) Andrew Davey of the Geological Survey of Tasmania requested information on satellite imagery and its application in geological investigations. Searches will be made for the coverage of Tasmania. He was especially interested in the potential use of diazo composites as this would enable him to make up his own custom-made composite images; 3) Dr. Francis Saupé of the Centre Nationale de la Recherche Scientific in France, requested application of satellite imagery for mineral exploration in Tunisia and in Spain. He has not used the imagery before, but basically feels that this will provide an over-all view which will assist in searching areas for more detailed investigations. He was provided with various papers and articles of applications in this field, and listings of the imagery available for Tunisia will be provided to him; 4) John Lahr, of Earthquake Research Center in Menlo Park, used the spectral data additive projector for making color composites of an area in southern Alaska to study the beaches and coastal areas. He obtain photographs of a number of combinations of the images to enhance features on the coastal plains.

II. Problems

None

III. Statistical Reports

The Data Production Statistical Summary for the month of January and year-to-date, and a Data Base Summary are attached.

EROS Data Center and
EROS Applications Assistance Facilities
Monthly Activity Report
February 1, 1976 through February 29, 1976

I. Accomplishments

A. EROS Data Center

1. Applications assistance and training activities included: A five-day remote sensing workshop was conducted for twenty-four representatives of the U.S. Fish and Wildlife Service. Principles of remote sensing were emphasized and workshop exercises utilizing satellite and aircraft imagery acquired over the phosphate strip mining areas in southeastern Idaho were examined in the sessions; a remote sensing workshop was given to Bureau of Indian Affairs personnel to illustrate the use of small-scale aircraft photography for updating forest resource maps. BIA personnel worked at EDC for 1 1/2 weeks; an orientation seminar was given to approximately 15 personnel at the U.S. Forest Service, Northern Forest Fire Laboratory at Missoula, Montana. The seminar included an overview of EDC and focused on discussions of applications of digital image analysis techniques to forest management; an orientation session was given to 60 honor students and faculty from the Colleges of Mid-America area colleges. An overview of EDC and a brief introduction to general applications of remote sensing data were presented in the sessions.
2. EDC representatives participated in discipline status reviews of the PNRG subprojects. These reviews, held in Seattle, Boise, and Portland, provided the first real opportunity to assess the status, direction, success, and problems of this project. The interpretation phase of the irrigated lands inventory in the Klamath River Basin of Oregon was completed. This work is being done in cooperation with the Oregon Department of Water Resources.
3. Two sound on slide-cassette training modules have been completed: 1) The Evolution of the Landsat Color Composite (7 minutes), and 2) Facilities of the Data Analysis Laboratory (14 minutes). Fifteen copies of each are ready for distribution to EDC viewing carrels, EDC Program Office, and the Applications Assistance Facilities. Rough draft scripts for three additional subjects have completed initial review and returned to contracted producers for rework and preparation of script and slides for final review.
4. EDC personnel visited NASA/Ames Research Center (ARC) and Electro-magnetic System Laboratories (ESL) to discuss the status of the LARSYS Conversion System Procurement. All hardware components have been ordered for the preprocessing system - Interactive Digital Image Systems (IDIMS), and are scheduled for installation in the EDC Data Analysis Laboratory during the last two weeks of April. System operation training will be held at ARC during April 19-30, 1976, for five EDC personnel. Installation of the maximum likelihood and clustering algorithms on the B6700 system is expected during July-August, 1976.

5. The new Facilities Support Building was accepted on February 5, with lease costs beginning March 1. All EDC materials have been removed from the three leased warehouse locations in Sioux Falls and all items should be out of the Garretson facility shortly. The Technical Support Contract with Technicolor Graphics Services, Inc. has been extended to December 31, 1976. The RFP for recompitation of this contract is almost completed and should be ready for Branch of Contracts by the fourth week in March.
6. Two software releases were prepared during this reporting period. The first was implemented on February 16th and consisted of revisions to thirteen programs in the Order Processing, Data Inquiry, and Data Entry Systems. New capabilities resulting from this release include acceptance and reporting of work orders defined as 'reorder', WRS scene, addition of a color composite selection parameter to the Inquiry System, reformatting of the Photo Lab Work Order, and acceptance of a ten character microfilm number. The second release was issued March 1st and implemented revisions in four programs to allow generation and distribution of work orders to remote photographic laboratories where the master reproducibles are located. With the exception of the processing center, these orders will be handled in much the same manner as those orders coming into User Services. Detailed instructions were prepared and disseminated in EDC Document Number 21, Order Entry Procedures for Remote Processing Centers.
7. All IBM 360/30 software remaining to be converted to the B6700 and Univac 90/30 systems has been identified and submitted for conversion. A delayed approval from GSA will prevent the Phase 1 equipment release from occurring on March 1 as scheduled; however, all IBM 360/30 components will be released by May 1st. This slip will cause EDC to incur 8K additional lease costs. The central computer center of Computer Center Division in Reston has indicated they may transfer some of the USGS-owned equipment.
8. Finalization of the specifications for the EDC Digital Image Processing System (EDIPS) is in work and should be completed by mid-March. A final design review of the EDIPS system and work flow plan was held in Reston February 24, 1976. Changes resulting from that meeting have been factored into the documentation. Because of overall systems cost uncertainties, the RFP will request bids for a fullup system (prime) and a scaled down system (alternate). The total specification package is scheduled to be ready for Branch of Contracts by the fourth week in March.
9. Effort continued on procurement of the High Resolution Film Recording System (HRFRS) from Goodyear. Modification number 3 to the contract was generated affecting some of the hardware design and changing the film to be used. A new set of test tapes have been produced for pre-delivery system checkout. The HRFRS safety and medical surveillance requirements document should be released in March.
10. An effort has begun to expand the Landsat World Reference System capability. This expanded capability will allow EDC to produce catalog listings sorted by path and row for each base map published

by the World Bank. This proposal will provide our customers with an improved retrieval index showing at a glance all Landsat scenes acquired over each nominal scene center. This improved index should virtually eliminate EDC's need for NASA published catalogs of Landsat data.

B. EROS Applications Facilities

1. Alaska

- a. The National Park Service 12-member Alaska Task Force participated in a week-long workshop at the Geophysical Institute. The goal of the workshop was to prepare vegetation maps at 1:250,000 scale of the National Park Service areas in Alaska. The workshop was broken into sixteen hours of visual photo interpretation of Landsat imagery followed by twenty-four hours of supervised mapping. At the end of the session eight of the ten areas of interest had been mapped in a preliminary form which will be taken into the field this summer for verification.
- b. A report "Range Resource Inventory from Digital Satellite Imagery of the Baldwin Peninsula, NW Alaska" was submitted to the Soil Conservation Service. The report assessed the feasibility of producing a range inventory from Landsat data and summarized the work done on the Baldwin Peninsula last summer. The report was well received and the Soil Conservation Service has now indicated that they would like to continue the effort over a larger area as an operational project. A final decision to go ahead with the project is dependent on reports from the NANA Regional Native Corporation.

2. Phoenix

- a. At the request of Senator Farr, Chairman of the Arizona State Senate Appropriations Subcommittee on ARIS, Schumann testified before the Subcommittee relative to the Arizona Land Use Experiment and the relationship of the ARIS Project (Arizona Resources Information System) to that effort. On February 3 and 18 aerial reconnaissance flights over the Salt-Verde watershed of central Arizona were conducted in support of the NASA/USGS Satellite Snowcover Mapping Project.
- b. A representative from the U.S. Fish and Wildlife Service was furnished with information concerning vegetation mapping from high-altitude aerial photography. Computer printouts of aerial photography for 12 areas in Arizona were also provided to enable selection of the most suitable coverage. A representative from the Cartography Section of the Salt River Project spent several days using the B&L zoom transfer scope to map vegetation from high-altitude color infrared photography which had earlier been ordered from the Phoenix AAF. The Salt River Project is also conducting a study of time savings that result from use of the ZTS relative to using conventional methods to transfer information from imagery to base maps.

3. IAGS

- a. Eleven hundred twenty-six frames of Landsat were received, processed and forwarded to various Latin centers. A great number of these Landsat images were shipped to Argentina as the result of a special request for assistance in mapping the Antarctic Region. One hundred eighty-six Sea Surface Temperature sheets and 980 pages of literature were shipped to the National Centers.
- b. An order for two Computer Compatible Tapes was completed and one each shipped to Ecuador and to Dr. R. J. P. Lyon at Stanford University. Dr. Lyon has written a computer program to be used with the CCT tapes. He is assisting the IGM of Ecuador in applying these tapes towards studies of the Ecuadorian Oriente.

4. NSTL

- a. Applications assistance and training activities included a forestry workshop for personnel from the U.S. Forest Service and State and private forestry organizations. The workshop included exercises that involved data from medium altitude aircraft and Landsat and subjects ranging from conventional photo interpretation techniques to more complex machine aided interpretation techniques; representatives from the University of Alabama's Marine Science Program used Landsat imagery and analysis equipment to determine point intensity measurements of sediment in Mobile Bay and surrounding Gulf waters; assisted the Louisiana Technology Transfer Office with a project concerning the Angola State Penitentiary located in Southern Louisiana adjacent to the Mississippi River. Analysis of imagery of pre and post flooding conditions revealed total acres of submerged land. The results will be used to locate new buildings in those areas where flooding is not likely to occur; a workshop was held for representatives from the National Park Service. Attendees were primarily senior park administrative personnel from the southwest region of the United States. A new exercise was developed by the EROS Coordinator from the National Park Service who is located here at NSTL. This exercise was designed to demonstrate how remote sensing inputs such as drainage patterns, relative relief, land use and transportation networks can be employed in an automated geographic information system such as that one being implemented at NSTL by the Park Service; representatives from a local map company specializing in the preparation of hunting and fishing maps for local sportsmen purchased several U-2 photographs of inaccessible salt marsh areas near the mouth of the Mississippi River. The data are needed to update their existing maps due to storm-produced changes. Their technique consists of enlarging U-2 transparencies to the scale of their map series, then delineating the ponds, mangroves, shorelines and other landmark features. This is an ongoing project for them, and they will attempt to do the same for other areas in the South in the near

future. A representative from the U.S. Geological Survey's Water Resources Division visited the facility. They have been collecting water quality and sedimentation information in 15 river basins in Kentucky for the Environmental Protection Agency. They were interested in quantifying the disturbed land within each of the 15 drainage basins. Using the VP-8 Image Analyzer and area measurement device they quickly calculated the disturbed land using black and white aerial photography which had been collected for the project by the U.S. Army Corps of Engineers. Total river basin acreages were compiled using our H. Dell Foster Digital Planimeter. The work on the 15 river basins was completed in three days.

- b. The administrative report entitled, "Trend Analysis of Vegetation in Louisiana's Atchafalaya River Basin," was completed and reproduced for the U.S. Fish and Wildlife Service. This report documents some two years of activity carried out by the AAF as part of an overall Department of the Interior effort to develop a land and water management plan for the Atchafalaya River Basin in Louisiana. This report along with several others will be combined as an Interior publication by the Fish and Wildlife Service.

5. Menlo Park

- a. Activities on the Pacific Northwest Regional Commission Demonstration Project included: The Urban Discipline Groups met in Seattle on February 4 and 5 to outline the progress that each had made on their projects. The first project reported on was the classification of Boise, Ada County, Idaho. The area is 75 square miles and the approach was to classify clusters of particular land use types. In this work they used the ARPA net, the ILLIAC IV, the IBM 360, and the CDC 6700. The next group was the Washington Urban group and the area of study included 8,000 square miles in the Puget Sound region. In developing valid categories of classification, this group used the EDITOR Program. In this, cluster values are correlated. These cluster values in effect result from plotting the ratios between different bands. The more bands or channels used the more selective the clusters will be. The Oregon group reported on the Portland area. They carried out their work partly at Sioux Falls. There a team of four persons tried two methods, one utilized the Image 100 and the other the LARS system. One problem with the Image 100 product noted was the distortion due to the square grid that is used to represent the rectangular grid of the original image. The resulting image must be rectified to fit the map. Mike McCormick pointed out that it is time to begin considering the cost benefit analysis that constitutes Phase V of the program. He suggested that the users should make a subjective appraisal of the benefits and relate these to costs. To make a fair appraisal the cost to be considered should be the continuing cost and not include the development cost as these have already been underwritten.

- b. Assistance activities included: Don Ross and Ken Kaufman of the Topographic Division visited the office to check on the density of band 7 in the San Francisco image that they are experimenting with for density slicing to separate water bodies from the land. The density sliced image they had was remarkably detailed and picked up even small ponds. The problem they had was in those water bodies that were turbid where the absorption was not complete. George Plafker of the Geologic Division requested Landsat images of the earthquake area in Guatemala for interpretation of structural features. He had visited Guatemala following the earthquake and photographed at close range the effects of the earthquake, including the fault that extends a distance of 160 km. The images he obtained were taken before the earthquake and do not indicate any structures that correspond to this fault. Bob Ankers of the Water Resources Department of the State of California in Sacramento, inquired regarding imagery of the Oroville area. Their department is interested in the possible relationship between the reservoir and the earthquake which took place in that area recently. They will use the images for geological interpretation of lineaments in the area.

II. Problems

None

III. Statistical Reports

The Data Production Statistical Summary for the month of February and year-to-date, and a Data Base Summary are attached.

EROS Data Center and
EROS Applications Assistance Facilities
Monthly Activity Report
March 1, 1976 through March 31, 1976

I. Accomplishments

A. EROS Data Center

1. Meetings were held with Bureau of Land Management personnel in Denver, Colorado to plan a comprehensive BLM remote sensing training program. A framework for scheduling training sessions for BLM personnel in remote sensing was developed. A series of four basic courses and one advanced course will be given by EDC staff to BLM personnel each year, whereby the BLM will be responsible for the instruction in approximately three years. A 3-day workshop was conducted for 15 representatives of the Inter-American Development Bank. During the workshop, special emphasis was given to techniques, economic effects, and legal aspects of remote sensing.
2. EDC involvement with LACIE (Large Area Crop Inventory Experiment) project continued with participation in a review of the technical aspects of the project at Johnson Space Center, Houston, Texas. This project, which is being jointly conducted by NASA, USDA, and NOAA, is investigating the potential for conducting worldwide crop inventories and developing appropriate data analysis techniques.
3. A paper has been completed for a symposium on subsurface geologic methods. This paper, entitled "Integration of Geological Remote Sensing Techniques in Subsurface Analysis", provides an introduction to geological remote sensing techniques and their applications to geological investigations in Tucson, Arizona and Silver City, Idaho. The paper will be utilized as a basic document in training courses related to mineral resources and civil works and has been submitted for USGS review and approval. A paper was delivered at the Tullahoma Symposium, Tullahoma, Tennessee outlining preliminary results of the Atlanta Regional Commission study. The ARC has tentatively concluded temporal overlays of Landsat imagery can be effective in determining change patterns.
4. Preparations continued for the Sixth International Remote Sensing Workshop scheduled to start at the Data Center May 3, 1976. Thirty-four applicants have signed up for the workshop. Major activities have included structuring the course agenda and sequence, syllabus modifications, imagery ordering, and logistics arrangements. Additions to this workshop will include training in the use of thermal infrared and radar data.

5. Specification of the EDC Digital Image Processing System (EDIPS) has been completed and given to the Branch of Contracts in Reston on March 29, 1976. The RFP is scheduled to be released for bids by April 21, 1976. A series of interim milestones have been agreed to that should result in a contract award by August 23, 1976.
6. Effort continued on procurement of the High Resolution Film Recording System (HRFRS). The final design review and verification testing is scheduled to occur at Goodyear the week of April 12-16, 1976. Delivery to EDC and installation of the HRFRS is scheduled for late April. A Sole Source Justification and Specification for the procurement of the second system has been generated that incorporates the final requirements of the EDIPS.
7. Effort continued to transfer the Digital Image Enhancement activity to the Univac 90/30 system. This activity is approximately 95% completed in that the new program for operating on the 90/30 has been completed and is currently being debugged. The system should be operating in the next couple of weeks.
8. With the release of the IBM 360/30 system, Computer Services will adopt a change in the format of data tapes to be shipped to users. Until now the IBM convention has been used for data tapes shipped to other agencies and to customers. Software is currently being revised to present all data in the format specified in the 1967 version of the American Standard Code for Information Interchange (ASCII).
9. The implementation of the interactive data entry system on the B6700, using Graf/Pen Sonic Digitizers as encoding devices, has been delayed due to software problems until mid-April. No additional problems are expected in software development, but an extensive production testing cycle must be completed prior to acceptance. Data Production Branch has made a Data Analyst available to conduct production testing under guidance of the CSB Production Analysis element.
10. Two software releases were prepared during this month. The first was implemented on March 22, 1976 and included eight program revisions resulting from ADP problems in existing production software. In addition, the software system used to monitor customer contacts was converted from the IBM 360/30 to the B6700. The second release primarily concerned system conversions from the 360/30 to the B6700.

B. EROS Applications Assistance Facilities

1. Phoenix

- a. At the request of Arizona State Government, the Phoenix AAF provided displays of remote sensing data and remote sensing techniques that were exhibited March 3-17 at the Valley Center in Phoenix. This effort resulted in many walk-in visits from people in the Phoenix area and other parts of Arizona. These displays were also exhibited at the Arizona Boy Scout Jamboree during March 26-28 in Scottsdale, Arizona. On March 17, Schumann was the featured

speaker at the March meeting of the Arizona Meteorological Society where he presented a 1-hour briefing on "Applications of Satellite-acquired Data to the Study of Arizona Snowpacks."

- b. During late March, the AAF furnished personnel of the USBR Central Arizona Project Office technical assistance in the review and selection of aircraft and space imagery for use in connection with the proposed Orme Reservoir site east of Phoenix. The USBR is particularly interested in obtaining high resolution imagery that will show the relationship of the proposed reservoir to adjacent urban lands and Indian lands. A representative from the Globe City Council visited the Phoenix AAF and reviewed high-altitude aerial photography of the Globe area for use in city planning and water-resources development. On March 5 and 29, Schumann conducted aerial reconnaissance flights over the Salt-Verde watershed in support of the ongoing NASA/USGS Satellite Snowcover Mapping Project.

2. IAGS

- a. In collaboration with the Colombian Government, the IAGS EROS Distribution Center and the Colombian National EROS Center are working with NASA Goddard Space Flight Center to obtain imagery of an area off the coast of Tumaco, Colombia where a 30,000 ton tanker sank in early March. The Landsat-2 camera was turned on over the specific area and the resulting imagery will be rushed to Colombia for study of the developing oil spill.
- b. The remaining 630 microfiche were processed and forwarded to the Latin Centers during March. There were 668 images delivered to our National Centers, and 945 pages of literature were copied and forwarded. Four hundred ninety-two Sea Surface Temperatures and GOSSTCOMP Charts were forwarded to the projects of Chile, Ecuador, and Peru who depend on this information for studies they are involved in.

3. Menlo Park

- a. On March 11th, Bill Hemphill and Jim Seitz met with members of the staff of the Conservation Division in Menlo Park to discuss the possible use of remote sensing methods in the operations of the Conservation Division on the West Coast. The Conservation Division's activities include responsibilities in lease management program and the resource classification and evaluation program, in supervising development of mineral resources on public lands, supervising mining activities on Indian lands, and monitoring exploration drilling activities for oil in the Outer Continental Shelf regions. Bill Hemphill described training courses that can be presented by EROS, which are designed to fit the users' needs. Most of these courses are given at EDC and the present schedule

includes a four-day workshop on strip-mining monitoring that is planned for the Bureau of Mines this summer. The Conservation Division staff indicated that one of the types of information that they would need is baseline or historic information on an area as a standard from which to appraise changes that affect the environment. For this they would look to aerial photography or satellite images obtained prior to the development of an area. A general consensus was reached at the meeting that remote sensing has definite applications to CD activities. Considering the wide range of Division programs in the Western Region, it seems necessary to limit initial programs application efforts to avoid confusion and excessive dispersion of attention. Thus, the next meeting scheduled for May 18, will be confined to discussion and planning of applications to our Outer Continental programs. Onshore applications should be investigated at later meetings as may be warranted. As this cooperative effort promises to be a productive activity, full attention will be given to planning for this meeting. Support will be needed from EROS/Reston and from EDC. This will be requested as the planning becomes more definitive. The request from the Conservation Division provides an excellent opportunity for the EROS Program to apply some of its capabilities by extending support to activities in new areas.

- b. Assistance activities included: Walt Attlesey of Occidental Petroleum Company, Bakersfield, California, inquired about Landsat imagery for use by that company in their exploration and development activities overseas. Much of their work is in South America where maps for many areas are inadequate or not available; Lance Senter of the U.S. Borax Company in Spokane, Washington, inquired about imagery available for tectonic studies in Alaska; Bill Burgett, Bendix Engineering Corporation in Grand Junction, Colorado, is conducting an aerial survey for radioactive deposits in Alaska as part of the contract that company has with ERDA to cover the entire U.S. in a search for uranium deposits. He requested all information available on Landsat data and uses that have been found for it to date; Ron Jackson, Utah Engineering Company, inquired about the availability of Landsat imagery his firm needs for interpretation of features in the rain forest regions of South America; Bill Evans, SRI Staff, spent considerable time at the Facility searching for sequential imagery in one locality in the Arctic Ocean. He intends to test the applicability of using time-lapse analysis to determine movement of ice floes; Hercules Mastroyannakis, staff member of the Greek Government Department of Forestry, inquired about methods by which Landsat imagery could be used to identify tree species in a forest and to determine forest areas destroyed by forest fires; Ron Lyon, Professor of Geology at Stanford U. visited the office and showed some computer-generated maps of

Landsat imagery at a scale of 1:62,500 in which sharp detail was retained. They have successfully produced maps at a scale of 1:24,000 also, which conform accurately to the 7 1/2 minute quad sheets of the same areas.

4. Alaska

- a. At the request of the Soil Conservation Service and the NANA Regional Native Corporation, two of our personnel attended a planning meeting at Kotzebue for the purpose of developing a domesticated reindeer management program for that area of northwest Alaska. As a result of the meeting further work will be performed on a range inventory of approximately five million acres on the Baldwin and Seward Peninsulas. This inventory will be done through digital analysis of three Landsat images. Preliminary work is being done now and field work is scheduled for July and August.
- b. An urgent request was received from NOAA/OCSEAP Headquarters in Boulder, Colorado for Landsat and NOAA images which illustrate certain patterns of sediment transport in the Gulf of Alaska, thus providing experimental evidence of sea-surface circulation patterns predicted by theoretical models. A prompt response to this request resulted because of the large library of hard copy Landsat and NOAA images that is maintained. It is understood that because of the results of this study presented to BLM it was decided to withdraw sixteen tracts from a scheduled oil lease sale in the area.

5. NSTL

- a. Assistance and training activities included: Personnel from Crown Zellerbach Corporation of Bogalusa, Louisiana, visited the AAF. They used color infrared, high-altitude photography and the Variscan Viewer along with their 35mm camera to take shots off the Variscan screen. They plan to print their photography to scale and make measurements of areas to be acquired; a representative from the National Park Service, Lakewood, Colorado, spent a day at the AAF. He was interested in the ecology of the Congaree Swamp in South Carolina and is hoping to use satellite data to monitor development activities in the swamp. This area is of interest to the National Park Service due to its representing a unique vegetation habitat--the Eastern seaboard, and the swamp harbors several champion trees; a representative from the Department of Earth Sciences at the University of New Orleans visited the Users Center of the AAF on March 4. He was looking for satellite information to be used for geologic analysis of an area in North Carolina. Also he was interested in arranging a summer class in remote sensing for his geology students; March 8-11 the AAF hosted a geology workshop at NSTL. Classroom examples used in this workshop

were centered around the Warrior Basin in Alabama. Recent petroleum exploration activity made this a very timely series of exercises. Landsat imagery was used extensively for lineament mapping, and guest lecturers included Ms. Karen Richter from the Geological Survey of Alabama's remote sensing team. Companies represented were: Union Oil, Texaco, Enserch, Harbison-Walker Refractories, Mississippi Geological Society and Curtis & Davis Consultants; a representative from Cities Service Company, Jackson, Mississippi, used the equipment in the Users Center. He was a geologist doing oil exploration in parts of Mississippi and Louisiana and was looking for satellite and aircraft photography to verify or extend geologic structures; a land use workshop was held March 23-25 at the AAF. This course was held primarily for the people from the Bluegrass Area Development District Planning Commission. The class was filled out with two people from the Louisiana Department of Corrections who were interested in applying remote sensing in connection with proposed expansion of the Louisiana farm prison system. The group from Lexington, Kentucky, had heard of our operation through the Economic Development Agency of the Department of Commerce, Atlanta Regional Office, who have scheduled a land use workshop in mid-May of this year; Representatives from the Louisiana Land and Exploration Company, Houma, Louisiana, visited the EROS facility at NSTL. They are civil engineers and are currently designing a massive agricultural reclamation project in the Louisiana swamps and are using aircraft photography to design drainage canals and dikes.

II. Problems

None

III. Statistical Reports

The Data Production Statistical Summary for the month of March and year-to-date, and a Data Base Summary are attached.

EROS Data Center and
EROS Applications Assistance Facilities
Monthly Activity Report
April 1, 1976 through April 30, 1976

I. Accomplishments

A. EROS Data Center

1. The second U.S. Fish and Wildlife Service Remote Sensing Training Course was conducted April 12-16, 1976. Twenty-three Service personnel attended representing 16 states, including 6 from Alaska. Principles of remote sensing were emphasized and workshop exercises utilizing satellite and aircraft imagery acquired over the phosphate strip mining areas in southeastern Idaho were examined in the sessions.
2. Effort continued on the PNRC project. Investigation began to determine the best way to aggregate statistics from digital classification of Landsat data into on-ground units such as traffic zones or census tracts. A five-day workshop was held at EDC for the PNRC Oregon Urban group during which a 4-date Landsat temporal overlay was analyzed using the LARSYS software package and Image 100 system to determine the best date or combination of dates for urban land use classification. Additionally, a two-date Landsat temporal overlay (1972, 1975) was analyzed to test the applicability of using Landsat data for urban land use change detection.
3. Text, illustrations and example map products developed for the cooperative EDC/EIA project entitled "Remote Sensing Techniques for Monitoring Impacts of Phosphate Production in Southeastern Idaho," have been sent to the E.I.A. Program Office. These materials demonstrate how manual and automated analyses of aircraft photos and Landsat images can contribute to preparing baseline resource information, and monitoring changes in the baseline due to strip mining activities.
4. The Geophotography and Remote Sensing Center of the State of Idaho is cooperating with EDC geologists in the development and implementation of a classroom stereoviewing capability at EDC and the development of a collection of stereoscopic slides illustrating landforms, topography, drainage characteristics, and patterns. These slides would include ground-based, low-altitude oblique, large-scale vertical, small-scale vertical, stereoscopic color, color infrared, and black-and-white photographs; and Landsat images of portions of the same areas. The illustrations will be utilized for training courses at EDC.
5. Effort continued on the preparation of workshop exercises and it is expected that 15 will be submitted by June 30, for USGS review and approval as Open File Reports. These exercises have been developed as part of Applications Branch training programs and will be available for use by the Program Office and the Applications Assistance Facilities. A team of staff scientists completes each exercise in a

- classroom setting to assure that the instructions are clear and concise, and that the exercise meets the stated objectives. Three exercises are now ready to be submitted for review. The titles of these exercises are as follows: 1) "Targeting Mineral Exploration in Central Colorado Using Landsat Satellite Imagery", 2) "Crop Identification in Central Arizona Using Multidate, Small-scale Aerial Photography", and 3) "Monitoring Agricultural Land Use Change in Central South Dakota Using Satellite Imagery".
6. The Interactive Digital Image Analysis System (IDIMS) was delivered to and installed at EDC by Electromagnetic Systems Laboratories, the last two weeks in April. System acceptance testing is scheduled to be completed by the middle of May.
 7. All data processing activity on the IBM 360/30 system has been discontinued. IBM will pick up the rental equipment early in May; most of the owned equipment (disk drives, line printer, card reader, and control units) will be relocated to the Computer Center in Reston. The magnetic tape units have not yet been claimed and will remain until a request is received or GSA removes them.
 8. The new EDC software system for User Services has been dubbed INORAC for INquiry, ORder, and ACcount processing system. A major analysis effort was conducted to resolve significant problems in the customer accounting area of INORAC. The software development teams have been given revised specifications for a much simplified accounting data base. Software system implementation is scheduled for mid-November.
 9. A series of questions and comments on the EDIPS specification were received from the EROS Engineering Office. These were reviewed and Errata Sheet #1 to the EDIPS Functional Specifications was prepared for dissemination to bidders. Efforts continued in detailed definition and design of the EDIPS interface to the B6700 MK II system. Specifications for the B6700 Tape Status File and Transcient Image File are nearing completion and are scheduled for release in the coming month. The EDIPS RFP was released to industry on May 3, 1976. A bidders conference will be held at EDC May 18-19, 1976.
 10. A one-week HRFERS Performance Verification Test (PVT) and technical progress meeting was held at Goodyear Aerospace Corporation, Phoenix, Arizona. Modification No. 4 to the HRFERS contract was written and released to Goodyear, to enhance the system imagery cosmetic capabilities and delay delivery to early May. Revision No. 2 to the HRFERS Acceptance Test Procedure (ATP) was written and submitted for approval. A justification for sole source procurement of the second HRFERS was written and submitted for approval. Programming for processing of calibration, control and test data for Optronics and Goodyear HRFERS film recorders is completed. A manual has been written to assist users of the system. During the performance verification tests of the HRFERS, several problems were evident, with laser noise and scan motor jitter being the most serious. The vendor is currently working on these problems, with a target date of mid-May 1976, for delivery of the system to EDC. A meeting is being arranged between Goodyear, Kodak, and EDC to discuss film selection for the HRFERS.

11. Data sales for the month of April reached an all-time high of \$281,597. One of the reasons for this is the increase in articles appearing in newspapers, periodicals, and radio stations that have mentioned remotely sensed earth resources data products available from the EROS Data Center. Another factor is the significant increase in sales of computer compatible tapes (CCTs). These totaled 502 scenes for the month of April.

B. EROS Applications Assistance Facilities

1. Alaska

- a. A new service is scheduled to be available next month to users of Landsat digital data. An optical recorder which simultaneously produces up to four high-quality black and white photographic images from a digital magnetic tape has been purchased with State of Alaska funds from ESL Inc., Sunnyvale, California and is being installed at the Geophysical Institute. The multiband image can be reconstituted into a false-color image with specialized darkroom techniques. The prime use of the new optical recorder is expected to include generation of color-coded maps from classified tapes prepared by computer-aided analysis techniques and enhanced false-color images from raw Landsat data tapes. The lack of high quality color or black and white products on a timely basis from digital analysis of Landsat data has been a problem in the past. This added capability is expected to vastly reduce the time required to provide output products to users.
- b. Work is continuing on the range inventory in the Baldwin and Seward Peninsulas. Color and black-and-white products were received from EDC and preliminary mapping is being done by visual photointerpretation of these images. CCTs of the area also were received and personnel will be traveling to California in May to perform analyses of these digital tapes. Several members of the U.S. Forest Service visited the facility and were given a tour and demonstrations of the available data processing equipment. They were particularly interested in aerial photography of their study areas but seemed to be impressed with the whole operation. This month brought the oil companies out in full force with five oil companies and one pipeline service company contacting us concerning the availability of data. BP-Alaska, which plans to drill for oil on a group of islands at the mouth of the Sagavanirktok River, had been unable to locate recent aerial photography of the area. This was a real problem to them as the islands tend to change rapidly and surveyors currently working there were having problems trying to locate the islands by drilling through the ice and snow accumulated through the winter months. Since we have on file transparencies of U-2 aerial photography of their specific study area we were able to make enlargements in our own photo lab for their use in locating the islands and filing an application for a drilling permit due the following week. The hard copy Landsat and aerial photography

that we have has proven invaluable in many instances. Several users were able to make preliminary sketches and vegetation maps using our transparencies while ordering prints from EDC to back their statements. Several times the time element has been so short for deadlines of filing impact statements that without our readily accessible imagery users would have been unable to make use of the most recent data available in preparation of their reports.

2. Phoenix

- a. Robert Myrick of the WRD District Office in Tucson, Arizona, met with Schumann to discuss final plans for installation of the Land/GOES data-collection platforms at the Black Mesa coal mining site. The new platforms are expected in early May and hopefully will be received in time to allow collection of hydrologic information during the summer storm period. On April 7 and 19, Schumann conducted aerial reconnaissance snow flights over the Salt-Verde watershed in support of the NASA/USGS Satellite Snowcover Mapping Project. During the late April storm period, snowcover information--developed from satellite observations together with telemetry data on snow-water equivalents and streamflow rates furnished by the Landsat data-collection system--were used by the Salt River Project in near-real time. Careful analysis of these data together with hydrologic data by SRP indicated it would not be necessary to spill the reservoirs on the Verde River as had been feared.
- b. Other activities included: Eleven Arizona State University students from the remote-sensing class used equipment and imagery for interpretation of land use in the Phoenix area; assistance was furnished to members of the U.S. Fish and Wildlife Service who used imagery interpretation equipment and imagery at the AAF to study vegetation distributions and wildlife conditions at the proposed Butte dam site on the Gila River.

3. Menlo Park

- a. Planning continued for the May 18th meeting to brief staff members of the Conservation Division on remote sensing methods. Because of the increasing amount of information to be presented, it was decided to extend the meeting to two days. Nairn Albert, geologist with the Alaskan Branch, is making an extensive study of enhanced Landsat imagery for selected areas in Alaska to determine areas that may be more favorable for mineral deposits. In this investigation the imagery is computer ratioed, stretched, and otherwise enhanced and produced as 1:250,000 scale color prints. The computer enhancing and photo work is being carried out at the USGS Center in Flagstaff by Larry Soderbloom and others. The question of availability of the enhanced imagery to the public when the work is published has arisen. Since EDC has a program for special imagery and has agreed to incorporate it into their system so anyone can order copies, this should not be a problem.

- b. Assistance and training activities included: Two geologists with Burmah Oil and Gas Company, spent several hours in the facility inquiring about possible ways in which they could use Landsat data and other types of remote sensing information in their operations; Ronald McLeod, teaching fellow in geography at San Diego State University, visited the facility for information on land use studies based on Landsat data; a geologist visited the office to search for imagery of an area in Venezuela where his company plans to develop a coal mine. The coal field is in a syncline and the image would be used to check for a suspected fault through the center. As this is in rain forest country, it was suggested he contact IAGS for possible radar coverage in this area; geologists from British Petroleum Company visited the facility for information urgently needed in their operation on the North Slope of Alaska. They hoped to determine the channel and island pattern of a river in the Beechey Point area. To shorten the lead time, the images projected on the viewer were photographed; Ken Craib of Resources Development Associates contacted the office to inquire about imagery available for Sri Lanka. His firm has a contract for an agriculture resource inventory and he wished to use Landsat imagery as one of the tools in making the study; Kay Wylie, a geography student at U.S. Berkeley, visited the office for information on applications of remote sensing to geographic studies.

II. Problems

None

III. Statistical Reports

The Data Production Statistical Summary for the month of April and year-to-date, and a Data Base Summary are attached.

EROS Data Center and
EROS Applications Assistance Facilities
Monthly Activity Report
May 1, 1976 through May 31, 1976

I. Accomplishments

A. EROS Data Center

1. The sixth International Workshop was conducted May 3-28, 1976. It included twenty-seven participants from twelve different nations. The basic training emphasis in the workshop was on manual interpretation of remote sensing data. A combination of lecture, homework and workshop exercises and field study was used to accomplish the training. The four-week course was divided into four general sections: 1) Fundamentals, 2) Principles and interpretation techniques, 3) Field study in the South Dakota Black Hills, and 4) Discipline study with specific work on imagery of the students' country. The combination of studies prepares students to establish proper data bases and methodology for analysis projects.
2. Text and illustrations prepared for the Environmental Monitoring Project (a cooperative project between EDC and EIA Program) were delivered to EIA personnel. These materials, which will be integrated into an EIA report, illustrate and discuss how manual and automated image analysis techniques can provide information for preparing baseline resource inventories and for monitoring changes in the resource base and the environment as a result of phosphate production in southeastern Idaho. A briefing for EIA personnel is scheduled in Reston in mid-June.
3. System activities in the Data Analysis Laboratory included: a) The Interactive Digital Image Manipulation System (IDIMS) completed acceptance testing May 15. Upon acceptance, an inhouse training effort was begun for Applications Branch personnel. Also, a land use classification project is being developed for demonstration of system capabilities. b) A PDP 11/20 (released from Data Management) was installed in the DAL during the third week of May and interfaced to the ISI-170 system. The hardware interface and A/D converter are currently being tested together with newly developed system control software. This system will provide analog image enhancement, digital enhancement, and film recorder output.
4. The EDC Digital Image Processing System (EDIPS) RFP was released to industry May 3, 1976. A Bidders Conference was held at EDC May 18 and 19, which included representatives from 16 companies. Approximately 100 technical questions were raised by prospective offerors. Contract award is scheduled for mid-September.

5. Delivery of the High Resolution Film Recorder System (HRFRS) is scheduled for June 25, 1976. Activities regarding this system included: a) The second performance verification test of the laser recorder was completed in early May. Several problems were still present which prevented the system from meeting specifications. Tests run since that time, however, have shown considerable progress towards reducing the image spread previously observed. Micro-densitometer traces of several test patterns were made which indicated MTF in excess of 90%. b) A meeting was held on May 20, with personnel from EDC, Goodyear Aerospace, and Eastman Kodak. The past and present status of the laser recorder program was discussed, with primary emphasis on the film problems. As a result, both Goodyear and Kodak are performing additional tests to isolate the source of the halation and blooming problem. Kodak recommended that 2421 and 2460 type film be considered for the production system. It was agreed that 2460 would be the film used to perform the EDC acceptance tests.
6. Two operational Graf/Pen digitizing systems have been interfaced with the B6700 system. The PDP 11/20 system that had been used has been moved to the Data Analysis Lab. Even though both systems were not up for the full month, 7,851 frames of imagery were digitized. There is a noticeable decrease in time required to digitize each frame which is due in part to the use of the CRT terminals and the increased speed that programs are completed by the B6700 system. A full month of operation in June should provide more accurate production figures, plus the initial start-up problems have been worked out.
7. An audit was conducted on repeatability of the Incoming Landsat Inspection System. Twenty bonded archival rolls were randomly selected and two inspectors were assigned the task of re-evaluating each roll. The rolls contained 1,956 total frames. The re-inspection assessed 120 quality changes, which is approximately 6% of the total frames. There were 10 cloud cover changes, which is approximately 0.5% of the total frames. This shows a high degree of repeatability within the Incoming Landsat Inspection System. It should also be noted that the first assessment was performed between one and two years ago. The non-Landsat Incoming Inspection System was revised during May. All forms and data collecting procedures were reviewed and modified to become more effective wherever possible. This is part of Quality Assurance's continuing effort to "streamline" all systems for efficiency and cost effectiveness.
8. The EDC terminal network continues to grow. Recent terminal installations include the Texas Natural Resources Institute in Austin, Texas, and the World Bank in Washington, DC. Additional requests for terminals being considered are the U.S. Forest Service in Fort Collins, CO.; Inter-American Development Bank in Washington, DC; Canadian Centre for Remote Sensing, Ottawa; and Standard Oil Company, Chicago, IL. The Standard Oil request involves a commercial installation and will require LIA assistance in developing a policy guideline for commercial requests of this type.

9. Numerous hardware and software problems were encountered with the Univac 90/30 system, resulting in a delay in the generation of an acceptable enhanced digital image tape for use in acceptance testing of the high resolution film recorder systems. Because of these problems, the 90/30 system was declared inoperative and Univac technical personnel called in for a period of five or six days to fix the problems. The system is now operational although some problems, not critical to production support, have not yet been corrected.
10. The memory and central processor upgrade to the B6700 system scheduled for June 1, has been delayed until late June, due to a delay in the shipment of the central processor. Current plans call for acceptance testing to begin June 21, and continue for thirty days. A plan to ensure thorough testing of all new components has been defined and distributed.

B. EROS Applications Assistance Facilities

1. Reston

- a. Activities included: Acquiring the use of a video tape recorder and television to be used in playing the video tapes that will come from the EDC Applications Branch; prepared exhibit boards for the Bicentennial displays in Florida; completed the Remote Sensing course at Washington Technical Institute. The course, a one-semester, three credit course was completed by six students including two from Africa. This course was done under the auspices of the USGS minority education in Earth Science; progress was made in providing money and exhibit material for the 2nd International Conference on the New Basement Tectonics, to be held in Delaware, July 12-16; and Fitzhugh Clark successfully made cibachrome prints scale 1:244,000 on the I²S viewer for the Algerian project.

2. Alaska

- a. A proposal for the continuation of our participation in the NOAA/BLM Outer Continental Shelf Environmental Assessment Program (OCSEAP) is in progress and will be submitted this month. This study has enabled us to obtain all the cloud-free Landsat, NOAA and aircraft data available for the continental shelf of Alaska and has made our facility of greater use to OCS investigators who are studying these coastal zone areas. A Phase I proposal has been submitted to BLM to assist in an assessment of surface resources of Naval Petroleum Reserve No. 4 (Pet 4). This area was formerly the responsibility of the U.S. Navy and only recently was transferred to the USDI/BLM. Their data base is very limited for this large section of Alaska and imminent development activities require that an inventory of its surface resources be made. The only feasible way to do this inventory is through remote sensing and we have proposed to begin this study under Phase I.

- b. Assistance activities included: Early in the month two men from a climbing party came in and studied our aerial photography of Mt. McKinley. They plan to attempt a climb of the nation's highest peak this summer in celebration of the bicentennial and were looking for a "new" route; aerial photography to demonstrate how fast logging areas have revegetated within the Fairbanks North Star Borough; a comparison of vegetation in the Nelchina Basin area of Alaska to distinguish possible wolf dens; and a request for aerial and Landsat imagery to help determine possible archaeological sites that have been eroded away by time and elements along the Alaskan coast.

3. NSTL

- a. Applications assistance and training activities included: Mr. Eric Lacefield of the Louisiana Wildlife and Fisheries Commission used the Variscan Viewers for detection and identification of Indian middens in southern Louisiana. He is coordinating his efforts with the Archeology Department of Louisiana State University; three fishery biologists from the National Marine Fisheries Service in Pascagoula, Mississippi, used the VP-8 Image Analyzer to do color enhancement and density slicing on images of sea shells to determine growth rates of these mollusks from various ocean locations; Mr. Lawson Smith, a graduate assistant from the University of Southern Mississippi's Geography Department did land use mapping from high altitude aerial photography over Hattiesburg, Mississippi, using the Variscan Viewer and the Zoom Transfer Scope; Mr. Mark R. Moran, a forester with the YMD Levee Board at Clarksdale, Mississippi, visited to assess the Users Center facilities available to him for mapping of Cottonwood plantations in the Mississippi River area around Clarksdale. The Cottonwood trees in that area are dying due to excessive flooding caused by natural and man-made damming of the river and its tributaries; Mr. Chess Adams of the Crown Zellerbach Corporation, Bogalusa, Louisiana, used the Variscan Viewer to do forest stand mapping. He photographed selected sites from the viewer using high altitude photography. An overview Workshop of Remote Sensors and their Applications for Geoscience was held on May 4-7. Participants included personnel from the Bureau of Land Management, the Corps of Engineers, Department of Army Engineering Detachment and a local law enforcement officer. A special series of Landsat interpretation exercises was used on the last day of the workshop; Mr. Jerry Wristors of McMoran Exploration, New Orleans, Louisiana, visited to select high altitude aircraft photography over the southern Louisiana area for oil well location and access to pipelines; Martin Golden of the USGS/WRD's Gulf Coast Hydroscience Center used the digital planimeter to calculate the area of sand thickness in square miles (sand intervals of 100 feet at below mean sea level depths--6,000 to 16,000 feet using interval of 1,000 feet); Mr. W. R. Sizemore of Sizemore and Sizemore, Tallahassee, Alabama, visited to inquire about the capability of our facility plus the new technologies in analyzing forest resources with Landsat digital data. His forestry consulting firm employs many digital techniques

in forest inventory and evaluation; On May 18-22 a test workshop was held for the Economic Development Agency of the Department of Commerce. Personnel from State and Federal Economic Development Agency sponsored programs were evaluating the utility of the workshop for personnel in their field of endeavor. A follow-on training workshop is slated for late October. This particular program stressed Geography Applications Program Land Use and Data Analysis products and the supporting geographic information systems. Products were displayed and handout materials were given the participants. A high interest was expressed by the participants in these products. Landsat land use exercises were also employed in this workshop; and On May 25 and 26, Mr. Gerald S. Grainger of Southern Services, Inc., Birmingham, Alabama, evaluated various aircraft and satellite data over the southeast United States for power plant locations. His company serves all major power plant companies in the southeast in selecting site locations, preparing environmental impact statements, doing engineering studies, and acquiring properties for new power plant development. He was interested in the facilities available and capabilities of our office for future applications.

4. Menlo Park

- a. In response to a request by Bill Gere, Conservation Manager, Conservation Division, Western Region, meetings were held May 18 and 19, to discuss remote sensing methods which might be applied to off-shore activities carried out by the CD. Bill Gere summarized the CD activities and defined some of the needs. One of the more important needs is to acquire baseline data for any area to be leased. This would then be the basis for determining any change in the environment. The need to recognize geologic hazards is essential and remote sensing could help on that. The need to determine the presence of oil seeps prior to development of an off-shore area is also essential. The CD must make environmental analyses and assessments, acquire baseline data and carry out surveillance. It will therefore be of great interest to determine the extent to which remote sensing methods can apply in these activities. He stated that in the Santa Barbara channel at present a visual inspection is made every day by helicopter, but that this is an expensive operation. Bill Hemphill described EROS capabilities, activities and services, and Jim Seitz described the support that could be given to CD at the local level by the AAF. Tom Pochari, from NASA, described the activities at Ames that could relate to the tasks of CD and gave special emphasis to the various NASA aircraft and the instrumentation available for them. John Estes, from the University of California at Santa Barbara, told of the various means that have been used to detect oil spills in the Santa Barbara channel. Ron Lyon gave a talk and demonstration at Stanford University on the processing of Landsat data by a computer to produce accurate maps at scales of 1:62,500 and 1:24,000; following the presentation, staff members of CD and

EROS discussed the activities of CD and how remote sensing techniques might be applied to advantage in their operations. The subsequent follow-up by CD indicates that this will be a rapidly expanding activity. The Coast Guard has agreed to fly its sensors at no cost as an initial step in introducing CD to several methods of monitoring oil spills. CD plans to hold further meetings to consider applications of remote sensing in other areas of their activities, and are relying on close cooperation with EROS and the Menlo Park AAF to support them in this.

- b. The Pacific Northwest Mapping Coordination group held a workshop on May 25 and 26, in Portland, Oregon. The purpose of the workshop is to provide for the exchange of information on map needs and new mapping techniques among representatives of State and Federal agencies. At the invitation of the Chairman, Jim Seitz attended the workshop as a member of the remote sensing panel; the Alaskan Geology Branch has been given responsibility for providing information on Alaska to be used in hearings by a Congressional committee on the disposition of government-owned land in Alaska according to Article D2 of the Alaska Claims Settlement Act. To provide a base map for this purpose, a mosaic of Landsat imagery will be compiled from pseudo-natural color images produced by the group at Flagstaff. The cost is estimated to be about \$75,000, and the resulting mosaic should prove useful to many more than the committee; L. T. Larson, Mackay School of Mines, University of Nevada, requested information to assist him in ordering Landsat coverage of Nevada. He is ordering the scenes used by Flagstaff in compiling the color mosaic of Nevada. These will be used in interpreting structures as part of the ERDA project to search for radioactive minerals; and Enders gave a briefing to Carol Ann Hodges and George Reid, geologists from the GD, in regard to the diazo process. They have since made extensive use of the process to make color composites of the entire central valley of California to be used in a study for locating reactor sites. They found the sun exposure method produced much better images than the Arkwright machine. Some of their composites were among the best produced here to date.

II. Problems

None

III. Statistical Reports

The Data Production Statistical Summary for the month of May and year-to-date, and a data base summary are attached.

EROS Data Center and
EROS Applications Assistance Facilities
Monthly Activity Report
June 1, 1976 through June 30, 1976

I. Accomplishments

A. EROS Data Center

1. EDC responded to a request for assistance by the Idaho Department of Agriculture in assessing damage caused by the Teton Dam collapse. Low-altitude, 35mm, oblique photographs were obtained within 48 hours of the disaster, and 9" x 9" vertical, color infrared photographs were taken within 96 hours. Ground verification data were collected three days after the flood. Following processing and photo duplication, EDC staff met with a number of Federal and State agencies (Idaho Department of Agriculture, Idaho Department of Water Resources, USGS-WRD, U.S. Bureau of Reclamation) to assist in the planning of photo interpretation projects for damage assessment and inundation area mapping.
2. An intensive two-day briefing session was given to six representatives from the Defense Mapping Agency. Subjects covered in the briefing included: Present capabilities and future plans of the EROS Data Center, the Landsat system, and digital analysis. This session was oriented toward the application of Landsat data to oceanographic and coastal problems, particularly bathymetric mapping. Plans were made for an August meeting with DMA management personnel.
3. Several workshop exercises have been prepared and are in review at EDC. These exercises, which will be used in EDC training activities, include "Targeting Groundwater Exploration in Tucson, Arizona, with Landsat Data", "Targeting of Sand and Gravel Exploration in Coastal Environments with Landsat Data", and "Targeting of Mineral Exploration Effort in Central Colorado". Upon completion of review, they will be sent to Reston for review.
4. Extensive effort was spent developing software for Data Analysis Lab (DAL) Systems. A Gould plotter program, showing a two-dimensional signature of a parallelepiped was completed. Effort continued on the ISI-170 operating system, and a multiquadric program for edge detection was started. Several software and hardware problems with the IDIMS system were worked out with ESL during the 90-day warranty period. The DAL conducted several workshop analysis sessions this month, including one for the Defense Mapping Agency and another for Carl Winikka (Arizona Resources Information System) and Herb Schumann. Extensive use of the systems in the DAL continues to be made by both EDC personnel and outside users.

5. Memory and central processor upgrade to the B6700 general purpose computer system continued. The central processor, disk drives, and additional memory have been delivered and installed. Acceptance testing of the new systems is scheduled to start in early July. This upgrade will allow software development activities to increase significantly.
6. The development of the new software system for inquiry, order, and account (INORAC) processing is proceeding on schedule. Design efforts have concentrated primarily on definition of all general ledger accounts and batch reports to be generated. Documentation is behind schedule for the interactive portion of INORAC; however, all interactive modules should be complete and documented by August 30th. Meeting this milestone is necessary to allow adequate testing and preparation of user manuals. Also, recovery software will be implemented in early July for initial testing. A phase two terminal security system is in operation which implements passwords and user codes together with file and access authorizations to secure EDC customer data against unauthorized access.
7. Delivery of the High Resolution Film Recorder System (HRFRS) has been delayed further because of out-of-specification performance of the mirror scanning motor which in turn causes an out-of-spec microbanding condition in the imagery. Because of the criticality of this motor to the system, an air-bearing motor will be used to replace the ball-bearing motor originally used.
8. All three Graf/Pen digitizing systems are operational and interfaced to the B6700 general purpose computer system. Two of the data entry stations are configured for use with microfilm readers and the third is set up to use the roll film digitizing unit. Completion of these systems will significantly increase capability to enter data into the EDC data base.
9. A briefing regarding EDC's current and future operations was given to two visitors from the Office of Management and Budget and Messrs. Phil Cohen and John Winslow, from LIA. The briefing included indepth discussions about the magnitude of the task of making remotely sensed data available to the public, providing assistance and training in the use of such data. Past and projected sales, both in dollar volume and number of frames, pricing philosophy, the profile of the user community and the current and planned systems for processing Landsat data were also discussed. A copy of the briefing was sent to Mr. Cohen for transmittal to OMB per their request.

B. EROS Applications Assistance Facilities

1. Phoenix
 - a. Between June 8 and 11, Schumann visited the EROS Data Center with Carl Winikka and Mike Castro of the Arizona Resources Information

System. During this visit the Arizona State personnel used the Image 100 System to extract land use, geologic and vegetation information for Landsat digital data over several different sites in Arizona. During this visit Schumann was able to evaluate approximately 1 million square miles of Landsat imagery over central Arizona and made snowcovered area measurements over the Salt River Watershed from all available Landsat imagery.

- b. Other assistance activities included: During late June local U.S. Bureau of Reclamation representatives visited the AAF to discuss possible applications of space and high-altitude imagery to USBR activities in Arizona. They used imagery to study vegetation along the Gila, San Pedro, and Verde Rivers in preparation for an Environmental Impact Study of vegetation for endangered species in these areas; and a representative from Southwestern Exploration Associates in Tucson was given assistance and used the facilities for several days during June, using the microfilm imagery of Nevada and Arizona to prepare for mining exploration in Nevada and Arizona at selected sites.

2. Reston

- a. Assistance activities included: Met with personnel of the National Cartographic Society to develop plans for five film strips on elementary geology; met with Allan Carpenter of Chicago, an author of geography books. He is revising his series on the fifty states and will illustrate each volume with a Landsat or aircraft image of each state; met with international geology personnel and people from Nigeria involved in planning a new Capital City for the country. They are interested in using remote sensing.

3. NSTL

- a. Assistance and training activities included: A presentation on remote sensing and the EROS Program to a group of summer students (forestry) and their professor from Louisiana State University; Dr. E. M. Wilson and Dr. Aaron Williams, University of South Alabama, spent a day at the AAF to analyze Landsat imagery on the VP-8 Image Analyzer and Color Additive Viewer to help locate and define unusual limestone features in Guatemala and the Yucatan. They are planning to make their third field trip into that area and were using the Landsat imagery to define specific areas of study; Dr. Tony Lewis and Dr. Don Kupfer of the Louisiana State University Department of Geography and Anthropology and a group of their students visited. AAF personnel gave students a first-hand look at various types of remote sensing equipment and various types of remote sensing data. Each student applied a type of data as well as a specific piece of equipment to a project he was conducting; Messrs. Tom Thompson and Walter Nelson of the Mississippi Highway Department, Jackson, Mississippi requested assistance in the use of aerial photography to be used to update their county maps. They were pleased with the equipment and data available; Mr. S. B. Roane, Manager of the St. Mary Sugar Co-Op in Jeanerette, Louisiana, examined high-altitude aircraft photography

to determine if one of his sugar mills in Louisiana was polluting one of the nearby marsh lands. The claim of the environmentalists was that it was degrading the water in the nearby marsh and lake. On June 23, Dr. Ed Wood, Bureau of Land Management, New Orleans, Louisiana, a recent graduate of one of our workshops, performed sediment studies on the Mississippi River and the Atchafalaya River using Landsat data and the VP-8 Image Analyzer. The results will be a part of an upcoming report on sediment transport.

II. Problems

None

III. Statistical Reports

The Data Production Statistical Summary for the month of June and fiscal year, and a data base summary are attached.

Attachments

EROS Data Center and
EROS Applications Assistance Facilities
Monthly Activity Report
July 1, 1976 through July 31, 1976

I. Accomplishments

A. EROS Data Center

1. A three-day digital analysis workshop was given for the Pacific Northwest Regional Commission's Land Resources Inventory Project (Oregon Working Group). An October Landsat scene was analyzed using the G.E. Image 100, Purdue LARSYS, and ESL IDIMS systems. Comparison of ground data with the results from all three analysis activities led to the conclusion that the LARSYS classification of the Portland metropolitan area was the most satisfactory (approximately 85 percent accurate). The resultant classification tape will now be sent to the Jet Propulsion Laboratory where the Landsat data will be digitally aggregated by traffic zones and census tracts.
2. All forestry projects involved with digital image analysis have been converted to the IDIMS system for all subsequent analyses. The Graf/Pen digitizer, registration software, and image preprocessing software on IDIMS have been successfully used to stratify Landsat data prior to image classification, perform geometric correction of Landsat data to map products with residual errors of less than .5 pixels, and rectify images with bad data lines and severe striping. Maximum likelihood classification without stratification has been completed for approximately 1.9 million acres in North Dakota. Classification with stratification will be completed in August. Significant improvements in classification accuracy are anticipated. Analysis of forest insect damage is continuing, with emphasis on classification methodologies involving stratified, controlled clustering techniques for training set generation, and sampling procedures for post-classification evaluation.
3. A presentation was made at the Symposium on Applied Remote Sensing at Colorado State University on "Targeting of Mineral Exploration Effort in Southwestern Idaho". A two-day orientation session was held on surface mining analysis for the PNRC in Portland. This meeting was to evaluate Landsat data for statewide monitoring and inventorying of surface mining activity, and members of the USGS Geologic and Conservation Divisions were in attendance and expressed interest in developing a cooperative training program.
4. Training activity and general use of the Data Analysis Laboratory (DAL) increased this month. Major training efforts were expended for the PNRC and the Commission for Scientific Industrial Research Organization (CSIRO) groups. Average use of the DAL systems exceeded two shifts this month, necessitating some third shift work. Programs were

implemented on the Image 100 to perform Fourier and Multiquadric transforms for spatial frequency and boundary displays. Work continues on plotting theme boundaries on maps via the Calcomp Plotter.

5. Software development continued for the Inquiry, Order and Account (INORAC) system. Several programs were completed to allow building of test data files for system testing. The INORAC system is scheduled to be implemented by mid-November 1976. The remaining software efforts were directed toward a large release scheduled for August second that involved changes/additions to the World Reference System (WRS) retrieval system, standing request system, the order processing system, data inquiry (both interactive and batch), and CCT activity reporting.
6. Acceptance testing of the memory and central processor upgrade to the B6700 general purpose computer system was completed. One hundred seventy-one hours of processing time were accumulated on the B6700 system during this reporting period. The bulk of the processing time was attributed to production processing and INORAC software development.
7. Technical evaluations of the proposals submitted for the EROS Digital Image Processing System (EDIPS) have been completed. Evaluations and narratives were transmitted to the Technical Evaluation Team Chairman (Chief, EROS Engineering Branch). The final report is scheduled to be given to the Branch of Contracts by the first week in August 1976. Contract award is scheduled to occur before the end of September 1976.
8. The final performance verification test of the High Resolution Film Recorder System (HRFRS) was successfully completed at Goodyear Aerospace Corp., Litchfield Park, AZ. The system was shipped July 30, and is scheduled to be installed at EDC the first week in August. Acceptance testing and training should be completed by the end of August resulting in the system being available for image processing by the 1st of October.
9. The Digital Image Enhancement programs have been transferred to the Univac 90/30 system for processing. Use of the 90/30 system will significantly decrease the time required to digitally enhance a Landsat scene, plus certain improvements have been made to the algorithms. One of these is a new method for destriping which uses a histogram equalization technique to correct the Landsat detector responses. The Needles scene has been processed on the 90/30 system and recorded on the HRFRS. This later scene is being compared with the Needles scene processed through the old enhancement system. First results are encouraging.
10. Final reports were made on the FY 76 Financial Operating Plan. A total of \$1,989.5K was carried forward into the Transitional Quarter largely in support of the EDIPS procurement. Initial FOP's for FY 77 were submitted to Headquarters based on the current budget mark and an alternate plan if the proposed one million dollar add-on becomes effective.

11. The World Bank maps have been received at the EROS Data Center. In conjunction with these maps, a computer card deck sorted by country was compiled using each Landsat Path-Row point indicated on the map. From the card deck computer listings were generated which indicate available Landsat coverage. These listings are now being assembled into microfiche. The objective is to provide customers with a quick reference package consisting of microfiche listings accompanied with a Path-Row map for their area of interest.

B. EROS Applications Assistance Facilities

1. Alaska

- a. Tom George is in the Kotzebue area for three weeks gathering ground truth data for a reindeer range study. He has available for his use while there some excellent color products and color-coded classified images prepared on the new digital optical recorder which is now in full operation. This added capability to the facility promises to be most useful in interpretation of Landsat imagery.
- b. At the request of the BLM district office in Anchorage, the best Landsat scenes available for the southern half of Alaska from latitude 58°N to 64°N were selected. Of the forty-four scenes needed to cover the area, twenty-six are already available at EDC in color. There are a few areas of Alaska that still have considerable cloud cover for summer imagery, and we are hopeful that this summer's coverage will fill in these gaps.
- c. Through the OCS activities we are able to place a standing request with EDC whereby we automatically receive all Alaskan coastal zone data as they are entered into the data base. The time elapsed from acquisition by the satellite until the data are in our files is now approximately five to six weeks which is far better than it was formerly.

2. NSTL

- a. A workshop on the basics of remote sensing for urban/regional planning was held July 12-16. Eleven graduate students from the Department of Urban and Regional Planning at the University of Mississippi were in attendance. Guest lecturers included Mr. Volney Cissna of the Southern Mississippi Planning and Development District (Gulfport, Mississippi) and Mr. Bill Smollen, Federal Advisor to the Regional Planning Commission for Jefferson, Orleans, St. Bernard and St. Tammany Parishes (New Orleans, Louisiana). College credit was received for attendance to the workshop.

- b. Other assistance and training activities included: A tour of the EROS Facilities was given to attendees of the Mississippi Entomological Association Meeting held at NSTL. Color infrared photography was displayed on various viewers, and discussions were held on its uses--specifically applications in entomology; a presentation on EROS Program activities was given to 16 people from the Mississippi Forestry Association Seminar held at NSTL; Mr. E. C. Burkhardt of the Anderson-Tully Company, Vicksburg, Mississippi, worked in the Users Center. He took 35mm color slides of the Mississippi Delta plain off the VP-8 Image Analyzer screen. Mr. Burkhardt has been a regular user of our data for the past three years; a presentation on remote sensing and the EROS Program was given to a group of 46 gifted students (advance science) and four professors from the University of Southwestern Louisiana; Barney Congdon attended a six-hour course sponsored by the Naval Oceanographic Research and Development Activity at NSTL July 26-27. Dr. Milton Dobrin of Rice University presented this course entitled, "Geological Interpretation of Geophysical Data"; Mr. Ron Hood of the U.S. Fish and Wildlife Service, Lafayette, Louisiana, worked in the Users Center on July 28. He used the Variscan Viewer for enlarging high-altitude aircraft photography and made 35mm shots off the screen; Messrs. Chess Adams and Darrell Fuller of the Crown Zellerbach Corporation, Bogalusa, Louisiana, visited the AAF. They were interested in taking 35mm shots off the Variscan Viewer for land acquisition purposes; also on July 28, Ms. Karen Wicker and Mr. Ben Small of Coastal Environments, Inc. of Baton Rouge, Louisiana, worked in the Users Center. They used NASA low-altitude photography over coastal Louisiana to aid them in their muskrat mound project.

3. Phoenix

- a. Mr. Wes Holden, Associate Editor of Arizona Highways Magazine, visited the Phoenix AAF and reviewed film copies of Landsat, Skylab, and NASA high-altitude color imagery of Arizona. He was very impressed with the imagery and plans to include selected copies in future issues of the magazine.
- b. Schumann met with Carl Winikka of the Arizona Resources Information System and Jim Gardner of the Salt River Project to review copies of land-use maps of northeastern Phoenix that were developed by Dr. James Wray from Landsat digital data. The Salt River Project is interested in developing maps of land-use change in the Phoenix area from Landsat data. Schumann met with Mr. William Warskow of the Salt-Verde watershed in central Arizona.
- c. Assistance activities included: Mr. Dana Slaymaker of Southwestern Exploration Associates, Tucson, Arizona, spent 2 days at the facility viewing imagery concerning Nevada mineral areas; Mr. William House of Arizona Public Service visited to review all available aircraft imagery of west-central Arizona for use in the selection of power plant sites; representatives of a local engineering firm working for BIA visited the AAF to review maps and imagery of the Navajo Indian Reservation for use in the development of housing projects on the reservation.

4. Menlo Park

- a. Effort continued in the development of a remote sensing program for the Conservation Division. These plans proposed that CD (Conservation Division) would fund a WAE to be primarily responsible for investigating the requirements of the CD in the Outer Continental Shelf regions and determine what, if any, methods of remote sensing would be applicable to their needs. This will include determination of the type of sensor systems, the costs associated with their operation, and the cost of analyzing the data. Contact with other agencies which have responsibilities in related monitoring activities will be essential in eliminating possible duplication of effort and in obtaining information on techniques that have been utilized by the other agencies.

- b. Other activities included: Ron Collis of Stanford Research Institute came to the Facility to inquire about information available regarding operational use of satellite data. SRI is interested in a project in Saudi Arabia, and Collis will be briefing engineers from SRI on possible applications of satellite data in the Saudi Arabia project; Vladimir Trifonov of the Geological Institute of the Academy of Sciences, Soviet Union, visited to inquire about activities in remote sensing applications and to discuss the results of his work with satellite imagery at different levels of resolution. Trifonov stated that the lower the resolution of the imagery the deeper the structural features that could be detected. The Soviets use three levels of resolution; the Landsat and equivalent with the highest resolution, a lower resolution system with a resolution element of approximately 500 meters, and the lowest resolution such as obtained from their meteor satellite which has a resolution of approximately 1 km. He stated that they were seeing 3 different sets of structural elements or features from these 3 sets of data, and that the elements visible in the lowest resolution imagery were definitely not apparent on the other two. The Soviets have made use of this interpretation in their drilling program in a known oil field and apparently have located oil as a result of this interpretation; John Albers of the Geologic Division inquired about the use of Landsat imagery as a base for compiling information in a new study he is undertaking that will relate the different types of mineral deposits in the State of California to the geology; Howard Wilshire of the Geologic Division inquired about the use of Landsat data for a study planned in determining the extent of damage to the environment by motorcycles and other vehicles in the desert regions of Southern California; Paul Van Dyke, of the Sandia Laboratory at Livermore, inquired regarding the use of Landsat imagery to accurately locate a particular reef in mid-Pacific Ocean which has been reported in a number of locations ranging over an area of approximately 10,000 sq. miles. He was informed of the pilot study of this type of application in the Bahamas, St. Thomas Islands and the Maldives, where the MSS is used at the high gain level for penetration to depths of 40 meters; Chuck Pound of Metcalf and Eddy Engineering, Palo Alto, inquired regarding the availability of Landsat imagery in the central part of the Saudi Arabian peninsula. This company

may be undertaking a mapping project in this region and is interested in obtaining complete coverage of the area to provide a base for planning their operations.

II. Problems

None

III. Statistical Reports

The Data Production Statistical Summary for the month of July and a data base summary are attached.

EROS Data Center and
EROS Applications Assistance Facilities
Monthly Activity Report
August 1, 1976 through August 31, 1976

I. Accomplishments

A. EROS Data Center

1. The High Resolution Film Recorder System (HRFRS) was shipped to and installed at EDC during the first week in August. Acceptance testing and training for system operation have been completed. The HRFRS is now ready to be used with the Digital Image Enhancement system that has been implemented on the Univac 90/30 system. Optimization of the system should allow EDC to produce 3-5 enhanced Landsat scenes per day.
2. Effort continued in the development of the Inquiry, Order and Account (INORAC) system. A requisition has been sent to Branch of Contracts for acquiring CRT terminals in time for INORAC testing, training, and implementation, both for EDC requirements and for the NCIC offices in the mapping centers. Specifications for all batch programs and programs required for conversion of the existing system to INORAC have been completed and assigned to the programming staff. Significant progress was made in reducing the documentation backlog and in testing system restart and data base recovery techniques. User Services personnel have been using some portions of the interactive system for familiarization and development of a training program. All major software components of INORAC are scheduled for integration testing by mid-October.
3. The first phase of a comprehensive study of the geology of the Black Hills of South Dakota, using satellite and aircraft imagery, has been completed. This study involved analysis of Landsat mosaics and imagery at 1:250,000 scale. A series of overlays was developed, including drainage patterns, cover patterns, landform patterns, and lineaments. These overlays will be used in international training courses and a final report is being prepared for open file release. The second phase of this activity will be undertaken this fall, when sites for high-altitude aircraft imagery analysis will be selected and subsequently analyzed. Field work to geologically map along a major lineament in the southern Black Hills will occur next summer.
4. Preparations are under way for the Atlanta Regional Commission Project Phase II Workshop, including IDIMS preprocessing and creation of Image 100 subscenes. The IDIMS preprocessing work includes on-track scene mosaicking, control point location, temporal scene registration, geometric correction, and map registration. Down-time of the IDIMS system forced postponement of the workshop from August to September.

5. The project work on studying crop-soil relationships done in cooperation with South Dakota State University has been completed. The final report has been reviewed and approved (Draeger, W. C., 1976, Machine Assisted Analysis of Landsat Data in the Study of Crop-soils Relationships: U.S. Geological Survey Open-File Report No. 76-603). A revised draft entitled, "Remote Sensing Techniques for Monitoring Impacts of Phosphate Mining in Southeastern Idaho", has been sent to the Environmental Impact Analysis Program for inclusion in their Environmental Monitoring Report.
6. A preproposal conference was held at EDC on August 26, for the Technical support contract which becomes effective January 1, 1977. Bidding specifications were forwarded to the Branch of Contracts for guard service for the period beginning December 1, 1976, to November 30, 1977.
7. Visitors to EDC included eighteen management representatives from the Defense Mapping Agency to discuss current and future EDC operations, assistance and training activities and plans for the Landsat digital image processing system; Mr. Hansen, International Atomic Energy Agency, Vienna, to discuss the applications of remote sensing for uranium exploration; Siamak Agah, National Iranian Oil Co., Tehran, Iran, to discuss applications of remote sensing to oil exploration; Bob Douglas, U.S. Forest Service, to discuss their remote sensing training needs; Doug Glendinning, Senior Officer, Surveyor Generals Office, Western Australia, to discuss remote sensing data applications and processing; Dr. Ed. Chao, USGS, Reston, to discuss geologic applications of remote sensing, and digital analysis systems and their capabilities in preparation for his trip to China; and Gana Diagne, Director General, International Organization for the Control of Migratory Locusts in Africa, Bamako, Mali, to discuss applications of remote sensing data to determine flood effects along the Niger River and to determine locust breeding areas.
8. Final preparations have been completed for the seventh International Remote Sensing Workshop which will be conducted at EDC September 13-October 8, 1976. Approximately 25 students are scheduled to attend the workshop.

B. EROS Applications Assistance Facilities

1. Alaska

- a. Activities included: The joint Federal-State Land Use Planning Commission (LUPC) requested an up-to-date mosaic of the state both in color and black and white at a scale of 1:500,000. The best black and white Landsat coverage of the whole State of Alaska has been completed and work is continuing on the selection of color scenes; Mike Morford, NOAA/Environmental Assessment Division of National Marine Fisheries asked that we search through

the NOAA imagery file for imagery to either confirm or deny the existence of a possible geostrophic gyre east of Kodiak Island in the northern Gulf of Alaska region. Since there is little, if any, sediment transport discerned on the imagery we will have to use digital enhancement techniques to delineate the gyre, if it does exist; and two OCS investigators from Menlo Park stopped on their way to Prudhoe Bay and asked for our assistance in navigation in the Beaufort Sea. It is imperative that they have up-to-date information on sea ice conditions to be able to make measurements from their ship on various ocean floor phenomena. We were able to make arrangements for them to have daily contact with the National Weather Service via the Coast Guard Station at Barrow who monitors sea-ice conditions by NOAA Weather Satellites.

2. IAGS

- a. Landsat-2 has been activated by NASA to acquire MSS and RBV data on three cycles of the heavily flooded areas in central Venezuela at the request of the Government of Venezuela. Imagery will be reproduced at EDC and forwarded to Venezuela via the DMA IAGS Project office. The floods of the Azure and Orincro River basins are the greatest during this century. Crop damage is estimated to be in excess of \$40 million while livestock losses are approximately 300,000 head. Black and white IR photography is being obtained over the flooded zones and will be utilized with Landsat images to provide agencies information to access damage in the area and aid in the development of policies to lessen the impact of future disasters of this type. DMA IAGS appreciates the fine cooperation extended to the Government of Venezuela by EDC and NASA.

3. Phoenix

- a. Approximately 40 people visited the Phoenix AAF, and about 70 telephone inquiries were received, 146 computer searches were placed with EDC, 90 were for imagery of Arizona, 42 for the areas in the United States, and 14 for areas in South America and Asia. A total of 19 orders were placed with EDC in the amount of \$1,155.
- b. Other activities included: Discussed potential geologic applications of Landsat imagery with Mr. Gaylon Lee of Fugro, Inc.; Schumann and Bob Myrick of the Water Resources Division reviewed pre- and post- development aerial photography of the Black Mesa coal mining area in northern Arizona. Operational applications of the SMS/GOES data collection system on this project were also discussed.

II. Problems

None

III. Statistical Reports

The Data Production Product Summary for the month of August and a data base summary are attached.

EROS Data Center and
EROS Applications Assistance Facilities
Monthly Activity Report
September 1, 1976 through September 30, 1976

I. Accomplishments

A. EROS Data Center

1. The Seventh International Remote Sensing Workshop started during this reporting period. The workshop included twenty-five scientists, representing 17 countries. The first week was devoted to the fundamentals of remote sensing and the basic considerations of the Landsat system. The use of EDC facilities, discipline studies, and regional environmental analysis were covered during the second week. A field excursion was made to western South Dakota during the third week, where the team problems and discipline exercises were field-checked and verified. Later in the week, thermal infrared and radar systems were studied. The course will conclude in October with work on imagery of the participants' country.
2. Other workshops conducted during this reporting period included: A Phase II workshop was given for Atlanta Regional Commission personnel. The workshop included preprocessing of Landsat digital data and uses of the Image 100 for temporal analysis of land use change in the greater metropolitan area of Atlanta, Georgia. A two week workshop on remote sensing was conducted at Anaheim, California, by the University of California, Berkeley. The workshop, sponsored by the United Nations and the International Astronautical Federation, was attended by 29 scientists, engineers, and managers from 25 foreign countries. A wide range of subjects was discussed during the workshop by an instructional staff from the United States, South America, Canada, and Italy. EDC personnel presented lectures and workshop exercises on geologic and hydrologic applications.
3. Planning for future workshops and training courses included: An EDC representative participated in a final meeting (held in Buenos Aires, Argentina, from September 4-11) to discuss and coordinate plans for the upcoming Latin American course in remote sensing. The course will be presented in Buenos Aires during the month of November by the EROS Program. Representatives from the U.S. Fish and Wildlife Service met with Applications Branch personnel and final plans were made for an upcoming U.S. Fish and Wildlife Service training course to be conducted at EDC during October 18-22. Approximately 25 individuals from all parts of the U.S., including Alaska, are expected to participate in the course. The Data Center's first comprehensive digital techniques workshop has been designed and is scheduled for late November. Lecture outlines, course materials, and workshop exercises are being prepared on the following topics: analysis planning, preprocessing, image enhancement, image classification, statistical sampling techniques, information

system integration, and output product generation. Eight students and two observers from the Bureau of Land Management and NASA will participate in the workshop.

4. An EDC representative participated in the American Mining Congress' Annual Mining Convention in Denver, Colorado, during September 27-30. In addition to the NCIC and Topographic exhibits, the EROS Program provided display materials, a terminal, and mini-browse facility. Several thousand persons were in attendance at the convention, including representatives from most major mineral and petroleum exploration firms.
5. A two-day executive session on the new INORAC (Inquiry, Order and Account) system was held at the Data Center. The purpose of the session was to familiarize NCIC Chiefs and other terminal users with the new system and aid them in their selection of candidates for the detailed operator training courses scheduled for the first two weeks in November.
6. Technical evaluation of the EROS Digital Image Processing System (EDIPS) proposals was completed during the month including review of the options required. The source selection board was held September 27th and a contract was awarded to TRW, Inc., Redondo Beach, California, September 30th for the design, development, and fabrication of the system. The system is scheduled to be delivered to EDC in about 15 months and operational in early 1978 in time to process data from the third Landsat satellite.
7. Visitors to EDC included: Clizerio Gonzalez and three other scientists from Mexico who were interested in discussing the applications of remote sensing to land use and hydrology; Chris Nanaykkara, Sri Lanka, who wished to learn about the applications of remote sensing to cartography/mapping; Dr. Alexander Dgingov of Bulgaria, who discussed the uses of remote sensing for erosion studies of grasslands in Bulgaria; Al Marmelstein and Dennis Parker, U.S. Fish and Wildlife Service, to discuss upcoming training activities; Gavin Byrne, Senior Research Scientist, CSIRO, Canberra City, Australia, who was seeking information on remote sensing applications to crop and pasture environments, determination of surface and plant canopy temperatures and soil water, and ground truth techniques; Ed Starkey, National Park Service, Corvallis, and Jim Lahey, Department of Geography, Oregon State University, Corvallis, who were inquiring about the capabilities of digital analysis of resources within Crater Lake National Park; Mr. Bottrill, Senior Geologist, International Nickel Co. (INCO), Toronto, who was interested in the geological applications of remote sensing and training activities; Richard Paulson, USDA/SCS, St. Peter, Minnesota, seeking advice on the applications of remote sensing to soils and training activities; Gilbert Weill, Center for Atmospheric Studies, French National Research Council, to determine the uses of Landsat data and training/assistance activities; Dr. Wa-Nsanga of Zaire, Visiting Professor of Economic Geology, University of Amherst, to discuss training, the applications of remote sensing data to geology/

mineral resources, and the advanced techniques of analysis/interpretation; Erwin Klaas and Bob Frederick, Iowa State University, Ames, for information on the techniques used in vegetation and cropland mapping -- rangeland ecology.

B. EROS Applications Assistance Facilities

1. IAGS

- a. Activities included: One hundred eighty-eight (188) frames of ERTS imagery were ordered from EDC; one hundred fifty (150) frames of ERTS imagery were processed and forwarded to National Centers; one hundred thirty-eight (138) sheets of Sea Surface Temperatures were transmitted to Latin Centers; and a tentative proposal has been submitted to NASA for a LANDSAT-C investigation on cartography in Latin America.

2. Phoenix

- a. Schumann met with Mr. Glen Goodwin, a special consultant representing the Governor of Arizona, to discuss the State's remote-sensing programs in Arizona and how these relate to the operation of the AAF and EROS Program activities related to the Arizona Land Use Experiment. The feasibility of housing the Arizona Resources Information System (the principal State remote-sensing unit) in various State operational agencies now under consideration by the Governor's office was also discussed.
- b. Visitors included: Mr. Byrne Gavin from Australia to discuss the various hydrologic applications of space imagery and satellite data collection systems; Mr. Billie Smith of BIA to review available aerial photography over the eastern part of the Navajo Indian Reservation for use in soil-mapping projects; Mr. Paul Nunan of Ashgrove, Queensland, Australia, to review space imagery over Australia prior to placing an order for selected Skylab imagery; and officials from the Bureau of Indian Affairs in Tucson and the U.S. Forest Service to review microfilm and hard copies of selected imagery before placing orders for imagery coverage over their project areas.

3. Alaska

- a. Activities included: The State Geological Survey has asked for assistance to produce an Alaskan Landsat mosaic. This will be done in five sections to match the new geologic maps compiled by Beikman at a scale of 1:1,000,000. The scenes have been selected and the mosaic will be constructed for them. Orders for custom Landsat prints matched in scale and density will be placed with EDC. These mosaics have been a much-needed product in Alaska; the Federal-State Land Use Planning Commission has also ordered a complete set of black and white Landsat prints for the state and will construct regional mosaics at 1:500,000 scale. They are also ordering color prints to cover a large portion of the state; field work for the Baldwin Peninsula reindeer range study has been

completed and analysis begun. Results on the project look very favorable for success in determining suitable habitat for reindeer herds through the use of satellite imagery; and the NASA/Ames U-2 aircraft arrived in Fairbanks on September 28, 1976, for a two week period. Although its primary mission is stratospheric sampling, arrangements have also been made for the acquisition of photographic data over the Alaskan coastal zone and the greater Fairbanks and Anchorage areas.

4. Menlo Park

- a. The bulk of this reporting period was used to acquire information for development of a program for the Conservation Division to determine how their operations in the Outer Continental Shelf region could be augmented through the use of remote sensing data. To acquire this information trips were made with Jack Estes, UC of Santa Barbara, to hold discussions with staff members of NOAA in Boulder, Colorado, CD in Los Angeles, NOAA and the University of Alaska in Fairbanks and CD in Anchorage regarding activities of those organizations.

II. Problems

None.

III. Statistical Reports

The quarterly and monthly Data Production Product Summary and a Data Base Summary are attached.

EROS Data Center and
EROS Applications Assistance Facilities
Significant Activities Report
October 1, 1976 through October 31, 1976

I. EROS Data Center

William T. Pecora Memorial Symposium. The second annual symposium was held in Sioux Falls, October 25-29. Approximately 225 individuals attended the symposium of which 135 visited EDC during the tours held on Wednesday, Thursday and Friday.

Workshops and Training Courses. The seventh International Remote Sensing Workshop, which included 25 participants from 17 countries, was completed during October. The third U.S. Fish and Wildlife Service Remote Sensing Applications Training Course was held October 18-22. This course included 20 participants from 14 states and included workshop exercises on land form mapping, water shed boundary/drainage mapping, vegetation cover mapping, Landsat cover type mapping and large-scale photo interpretation as applicable to the U.S. Fish and Wildlife Service.

Pacific Northwest Regional Commission Land Resources Inventory, Demonstration Project. Landsat data used to quickly and inexpensively estimate irrigated land area in the Klamath River Basin of Oregon has been completed. Two interpreters independently estimated the irrigated area on two dates during the 1975 growing season. Their adjusted estimates were 285,000 acres and 267,000 acres, respectively, with corresponding 95% confidence intervals of $\pm 19,500$ acres and $\pm 34,700$ acres. The estimated cost of the survey, exclusion of management costs and training, was \$1,500.

EROS Digital Image Processing System (EDIPS). Coordination meetings were held with both Goodyear Aerospace and TRW, Inc. personnel to ensure complete understanding of the interfaces required between the various components of EDIPS. A base line system requirements document has been drafted that includes the consolidated requirements of the RFP and subsequent negotiations. Preparation of the specification for the second High Resolution Film Recorder (HRFR) has been completed.

Operations Contract. Technical evaluation of the proposals submitted for the EROS Data Center operations contract have been completed. Contract award is scheduled for December 3, 1976.

II. EROS Applications Assistance Facilities

NSTL Workshops. Two were conducted, the first for the Louisiana Department of Fish and Wildlife which dealt with conservation applications of remote sensing and portions were taught by their own officers. The second workshop dealt with Land Use Applications and included participants selected by the Economic Development Agency of the U.S. Department of Commerce's Atlanta office from planning agencies in South Carolina, Georgia and Alabama.

Phoenix EROS Data Reference File. Schumann met with Mr. Robert Hesse, Acting Administrator of the Arizona Resources Information System (ARIS) to discuss the feasibility of ARIS taking over the operation of the EROS Data Reference File (DRF) in anticipation of the closing of the Phoenix AAF. ARIS has indicated they want to assume operation of the DRF.

Alaskan Aircraft Imagery. Aircraft imagery acquired in July 1976, by the National Ocean Survey for the Outer Continental Shelf Environmental Assessment Program has been received, catalogued and filed in the Alaskan facility. Most of this photography was flown at an altitude of 18,000' and covers the entire coastline from the Yukon Delta to Cape Lisburne, also various short lines in the Gulf of Alaska, and is available in color and color infrared.

III. Statistical Reports

Data Production and Data Base summaries are attached.

EROS Data Center and
EROS Applications Assistance Facilities
Significant Activities Report
November 1, 1976 through November 30, 1976

I. EROS Data Center

CALTECH/JPL CONFERENCE. Watkins and Lauer presented papers on EDC Image Processing Technology, and Today's User - How Do We Give Them What They Need, at the Conference on Image Processing Technology, Data Sources and Software for Commercial and Scientific Applications. The conference was sponsored by CALTECH, JPL and NASA's Office of Applications and was designed to disseminate information about recent advances in image processing technology and to describe new applications to the user community.

FIRST LATIN AMERICAN COURSE IN REMOTE SENSING OF NATURAL RESOURCES. Two EDC personnel participated as instructors in this course which was presented to 30 students in Buenos Aires, Argentina in cooperation with the Commission Nacional de Investigaciones Espaciales, Fuerza Aera Argentina. Course content was similar to that of the International workshops given twice each year at EDC.

BUREAU OF LAND MANAGEMENT TRAINING. EDC personnel conducted two one week training courses for the BLM. The first course was held in Denver for 28 participants from Colorado, California, Montana, South Dakota and Utah. The second was held in Phoenix for 24 participants from Arizona, California, Nevada and New Mexico. Both courses emphasized manual analysis techniques using aerial photos and Landsat imagery.

INORAC TRAINING. A two week training course was conducted at EDC on the new INORAC (Inquiry, Order and Accounting) system that is being implemented in January 1977. Attending the course were terminal operators from regional NCIC and EROS facilities.

EROS DIGITAL IMAGE PROCESSING SYSTEM (EDIPS). Final plans and the agenda for the EDIPS Preliminary Design Review scheduled for December 13 and 14 at TRW, Redondo Beach, have been completed. The Statement of Work, technical specification, procurement justification and purchase requisition for the second High Resolution Film Recording System (HRFRS) have been prepared and submitted for approval and procurement action.

II. EROS Applications Assistance Facilities

ALASKAN ASSISTANCE ACTIVITIES. Several meetings have been held with Fairbanks BLM personnel regarding the application of remote sensing to the environmental assessment of surface conditions in the PET-4 petroleum reserve in Northern Alaska. The Alaska Division of Lands and local BLM personnel have requested training courses on uses of remotely sensed data. The first course is tentatively scheduled to start in mid-December.

INTERNATIONAL TECHNOLOGY TRANSFER EXHIBIT. The NSTL facility provided materials which were incorporated into the Louisiana Technology Transfer Offices exhibit displayed in the Partners of the Americas meeting held in New Orleans. The Partners are composed of Latin American countries and a host state from the U.S. Louisiana is teamed with El Salvador. Approximately 26 countries and 30 states were represented.

III. Statistical Reports

Data Production and Data Base Summaries are attached.

EROS Data Center and
EROS Applications Assistance Facilities
Significant Activities Report
December 1, 1976 through December 31, 1976

I. EROS Data Center

DIGITAL TECHNIQUES COURSE. EDC's first comprehensive Digital Techniques course was presented to Bureau of Land Management personnel from Denver and Anchorage. Course length was two weeks and included intensive lecture, study and "hands on" equipment use, a case study on classification of vegetation and terrain types over Denali, Alaska, optimum classification schemes, image enhancements, sampling procedures, and output products. A second course for BLM personnel will be given in mid-January.

NASA/AMES RESEARCH CENTER WORKSHOP. EDC personnel participated in a workshop for Oregon State Bureau of Mines and Mineral Resources personnel. Objectives of the Workshop were to provide training in digital image analysis techniques and to demonstrate the feasibility of using remote sensing technology for detection and inventory of surface mines.

APPROVED REPORTS. Two manuscripts received Director's approval for release into the USGS Open File: Draeger, W. C., 1976, Monitoring Irrigated Land Acreage Using Landsat Imagery: An Applications Example, USGS Open File Report #76-630; and Nickerson, J. A., 1976, Determining Availability of Landsat Imagery at the EROS Data Center: A Slide-Cassette Training Module, USGS Open File Report #76-21.

EROS DIGITAL IMAGE PROCESSING (EDIPS). An EDIPS preliminary design review was held for EROS & EDC personnel at TRW, Redondo Beach, California. An RFP was issued to Goodyear Aerospace 12/15/76 for the second High Resolution Film Recording System (HRFRS). A proposal is due for the system by mid-January and contract award should occur no later than the end of February.

II. EROS Applications Assistance Facilities

DATA COLLECTION PLATFORM (DCP) WORKSHOP. The USGS in conjunction with co-sponsoring agencies in Bolivia and Chile, are planning to give a DCP workshop in Chile beginning January 17 and in Bolivia beginning January 24. IAGS is providing logistical support for both of these workshops.

ENVIRONMENTAL PROTECTION AGENCY WORKSHOP. Representatives from the NSTL AAF and EPA's Vint Hill Farms Photo Interpretation Center conducted a remote sensing workshop. The workshop was geared to the use of remote sensing to solve EPA problems and was attended by 22 participants from the New England area.

PHOENIX APPLICATIONS ASSISTANCE. Members of the National Remote Sensing Agency, Department of Science and Technology, Republic of India, visited the Phoenix AAF to receive training in snowcover mapping from satellite imagery and to discuss the use of satellite data collection systems for telemetry of water resources information. This training effort included field visits to

remote hydrologic data collection sites in central Arizona that are equipped with Landsat and SMS/GOES data collection platforms and a tour of the Salt River Project Irrigation District.

III. Statistical Reports

Data Production and Data Base Summaries are attached.

EROS Data Center and
EROS Applications Assistance Facilities
Significant Activities Report
January 1, 1977 through January 31, 1977

I. EROS Data Center

ALASKAN TRAINING COURSE. EDC personnel conducted a short course on remote sensing and Landsat data for the Alaskan chapters of the American Society of Photogrammetry and the American Congress for Surveying and Mapping, in Anchorage, Alaska. Over 80 participants attended the three-day course which stressed manual techniques for image analysis using Landsat and color infrared aerial photographs. Personnel from the Geophysical Institute, University of Alaska, also participated in the program presenting examples of the uses of Landsat, aerial photo, and radar imagery for addressing resource inventory problems in Alaska.

EDC PERSONNEL PARTICIPATE IN NASA REVIEWS. An applications scientist served on the Orbital Flight Test - Spacelab Proposal Evaluation Panel in Alexandria, Virginia, during the week of January 24-28. The purpose of the panel was to assist NASA in evaluating proposals for experiments to be flown on the Shuttle Spacecraft during 1979 and 1980. Also, an applications scientist participated in the LACIE Project review at NASA/JSC in Houston during January 26-28. The review brought outside scientists together to help NASA/USDA/NOAA assess the progress of the LACIE Project and work out any technical difficulties.

DIGITAL IMAGE PROCESSING WORKSHOP FOR BLM. The second digital image processing workshop was conducted for 18 participants from the BLM. The workshop provided an overview of the Landsat system, characteristics of Landsat data, and radiometric and geometric correction techniques. Various techniques for image enhancement and image classification were presented and laboratory exercises were conducted to provide the participants with hands-on experience in performing the digital image processing techniques with equipment in the Data Analysis Laboratory.

ENERGY CONSERVATION RESULTS. In October 1974, the President of the United States directed all Federal agencies under FPMR, Part 101-20 to take measures in government facilities to reduce the use of energy by a minimum of 10%. Following this urgent request by the President on energy conservation, the Department of the Interior, U. S. Geological Survey, started an extensive Energy Management Program using the EROS Data Center as an example. In 1974 and 1975, the EROS Data Center conducted energy management reviews as to what has been, can be and should be done to reduce the use of energy. During fiscal year 1976, the EROS Data Center implemented energy conservation modifications. The first quarter of fiscal year 1977, has shown a reduction of energy use as follows:

Electricity:	FY 76	27.62 billions of BTU's
	FY 77	27.56 billions of BTU's
Fuel Oil:	FY 76	3.19 billions of BTU's
	FY 77	2.86 billions of BTU's

This reduction of energy used occurred during a quarter when the average mean temperature was 5.8 degrees colder, and the EROS Data Center had expanded its operation by the addition of a 15,000 sq.ft. building and an upgraded computer operation.

INORAC. Operation of the new Inquiry, Order and Accounting (INORAC) system was simulated during this reporting period to allow both internal and remote terminal operators to become familiar with the new system before it goes on line February 1, 1977. Beginning February 1, for 30-45 days, only the new INORAC terminals will be able to access the EDC data base. At the end of this period, the system will be upgraded to allow access by other TTY compatible terminals also. This expanded access will be limited to inquiry and order, but will allow access by a wide range of remote computer terminals.

EROS DIGITAL IMAGE PROCESSING SYSTEM (EDIPS). A detailed EDIPS program review was held at EDC to discuss current status, problems associated with late delivery of the Government Furnished Equipment (GFE) High Resolution Film Recorder (HRFR) and late definition of the configuration of the High Density Tapes provided by NASA/GSFC. The (HRFR) proposal was received and evaluated by the technical evaluation team. Contract award is scheduled for the end of February.

VISITORS. Visitors to EDC included individuals associated with: Gulf Research, Pittsburgh, PA; Brigham Young University; Cornell University; Texas A&M University; Plan, Organization, and Budget Division, Tehran, Iran; and State of Montana Research and Information Systems Division; South Dakota School of Mines; OIG Denver and OIG Reston; U.S. Bureau of Reclamation; Defense Mapping Agency; Water Resources Division; and COMSAT General.

II. EROS Applications Assistance Facilities (AAFs)

PHOENIX ACTIVITIES. Schumann conducted aerial snow reconnaissance flights over the Salt-Verde Watershed in support of the USGS/NASA Satellite Snowcover Observation Project. Visitors included individuals from NOAA/NESS to discuss the use of NOAA's satellite imagery for snowcover mapping in Arizona; Environmental Research and Technology, Inc., to discuss NASA Snowcover Observations Project; Lands Directorate - Environment Canada, Ottawa, Canada to discuss remote sensing applications in Arizona for hydrologic and land use studies.

ALASKA NASA/BLM DEMONSTRATION PROJECT. Several staff members from the Geophysical Institute are involved in the preparation of a proposal relating to the NASA/BLM demonstration project in the Denali Planning Unit in Alaska. This is a major effort in the NASA Applications System Verification Test program which will demonstrate the usefulness of satellite data, high-altitude aircraft photography, and specialized ground data collection techniques for a wildland vegetative inventory and the mapping of geomorphologic and structural geology features in a 2 million acre test area in southcentral Alaska. Included in the scope of work is the development of sampling methodology for verification of classification accuracies using satellite data and air photos, and the extensive technology transfer during which BLM personnel will receive extensive hands-on indoctrination into the operational aspects of this application of

remote sensing technology. This project would be a logical follow-on to the digital data processing training course conducted recently by EDC for BLM personnel and the short course in remote sensing presented in Anchorage in January.

FORESTRY WORKSHOP. A forestry workshop was conducted at NSTL that included participants from the U.S. Forest Service; OPT, Inc.; Southern Company Services, Inc.; Westvaco; International Paper Co.; U.S. Naval Oceanographic Offices; and OECS Corporation.

MENLO PARK ACTIVITIES. Assistance provided to visitors included: Application of remote sensing to locate a linear feature not plotted in the area of NASCA and Palya, Peru; locating imagery or photography over Saudi Arabia that could be used to locate ground water; and use of remotely sensed data to study man's affect on the Mojave Desert in California.

III. Statistical Reports

Data Production and Data Base Summaries are attached.

EROS Data Center and
EROS Applications Assistance Facilities
Significant Activities Report
February 1, 1977 through February 28, 1977

I. EROS Data Center

ANNUAL MEETING OF THE SOCIETY FOR RANGE MANAGEMENT. Papers entitled "Monitoring Change in the Rangeland Base from Satellite and Aircraft Imagery" by W. C. Draeger, and "Manual Analysis Techniques for Extracting Information from Earth Images Acquired from Aircraft and Spacecraft" by D. M. Carneggie, were presented at the subject meeting in Portland, Oregon, February 14-18, 1977.

TECHNOLOGY TRANSFER. A series of briefings were given to personnel of the EROS Program Office, Land Information and Analysis Office, and Office of Applications, NASA Headquarters, regarding a conceptual plan for increasing the Department of Interior's involvement in the transfer of remote sensing technology to resource management agencies. Components of the plan include regional training and assistance field offices, increased involvement by universities, priority cooperative projects, on-site liaison positions at EDC, long-term residency program at EDC, and a visibility and awareness program.

NATIONAL PARK SERVICE COOPERATION. Personnel from the National Park Service, Denver Federal Center, visited EDC to discuss Park Service training and cooperative project requirements. A major project effort is being planned by Park Service personnel that is very similar to the BLM/NASA/EROS project; however, the Park Service's plan is in its initial stages of development, and EDC personnel will assist in its formulation.

BUREAU OF LAND MANAGEMENT COOPERATION. A meeting was held in Denver with BLM personnel to discuss training requirements and cooperative project work. It was agreed that the number of courses to be presented by EDC for BLM next year will increase from five to six courses, and the six courses will be conducted on a full cost recoverable basis. These will include four one-week remote sensing courses stressing applications in vegetation analysis, one course on geological applications, and one advanced course on digital image analysis techniques.

EROS DIGITAL IMAGE PROCESSING SYSTEM (EDIPS). Effort continued to baseline EDIPS which will be accomplished with Contract Change Notice (CCN) Number 3 to TRW. Technical and cost negotiations for the second High Resolution Film Recorder (HRFR) were completed with Goodyear Aerospace Corporation. Contract award should be accomplished by March 31, 1977. The contract will include the basic system, spares, on-site support, and a 6-month warranty.

INORAC. Operation of the new Inquiry, Order and Accounting (INORAC) system began February 1, 1977. The first month's operation produced a series of problems that can be expected with implementing a new complex computer system. All major processing software performed successfully. Critical operations such as recovery after failure, security control, inquiry, etc.,

performed acceptably or with minor problems that could be corrected. The major problems centered around frequency of short system downtimes, slower than expected response times, and complexity of computer terminal operation at the regional facilities.

VISITORS. Visitors to EDC included individuals from WRD; Iowa State University; Oregon State University; University of Lesotho, Africa; Harris Corporation; Swedish Mapping Company; National Park Service; Geologic Division; EROS Program; Bureau of Reclamation; and the U.S. Forest Service.

II. Eros Applications Assistance Facilities (AAFs)

ALASKAN ACTIVITIES. Assisted Atlantic Richfield Oil Company in obtaining up-to-date Landsat 1 and 2 imagery of the sea-ice conditions and near shore features north of Prudhoe Bay. This data will be used for field surveys from mid-February until breakup. Effort continues on the five-section mosaics being prepared for the Alaska Geological Survey which should be completed and distributed by mid-March.

PHOENIX ACTIVITIES. High-altitude and satellite imagery was used by Salt River Project personnel to plan power line routing for a proposed nuclear power plant in Western Maricopa County. A new satellite data collection platform was installed at the Baker Butte snow monitor site in central Arizona. This unit will relay information on snow-water equivalents and temperatures via the SMS/GOES data collection system.

LAND USE WORKSHOP. A Land Use Workshop was conducted at NSTL February 8-11, that included participants from the Tangipahoa Parish Assessor's Office (Louisiana), Burk and Associates (Louisiana), Peabody Coal Company (Pennsylvania), and the U.S. Forest Service (Georgia).

III. Statistical Reports

A data base summary is attached. Because of problems associated with converting to the new accounting system, the Data Production Statistical Summaries for February are not attached.

EROS Data Center and
EROS Applications Assistance Facilities
Significant Activities Report
March 1, 1977 through March 31, 1977

I. EROS Data Center

TECHNOLOGY TRANSFER MEETING. Representatives from NASA's Technology Transfer Centers met with EDC personnel on March 11. Dr. Phil Cressy, GSFC; Mr. Wayne Mooneyhan, ERL; and Mr. Ben Padrick, Ames presented information on NASA's present and future plans for carrying out training and assistance in remote sensing techniques within their respective regions of the country. Mr. Mooneyhan presented an overview of the machine processing capabilities available at ERL. A presentation was made on the new initiative package being developed at EDC, which includes opening field offices, involving universities, engaging in cooperative projects and initiating liaison positions and a residency program at EDC.

MINING ENFORCEMENT AND SAFETY ADMINISTRATION (MESA) ORIENTATION. A remote sensing technology orientation session was conducted for the Mining Enforcement and Safety Administration (MESA) at the Denver Federal Center. The orientation was attended by seventy MESA personnel from various regions throughout the U.S. The principle interest of the attendees was ground stability problems in surface and underground mines. MESA is currently applying remotely sensed data to lineament analysis and relating the results to roof stability problems in underground mines.

U.S. BUREAU OF MINES WORKSHOP. A remote sensing workshop was held for personnel of the U.S. Bureau of Mines and associated State agencies during March 7-11, 1977. Nineteen scientists and engineers from nine states and the District of Columbia attended the workshop.

DIGITAL ANALYSIS TECHNIQUES TRAINING. Representatives from the Bureau of Land Management's Desert Planning Staff in Riverside, California attended a week-long training/working session in digital analysis techniques. Several of the participants had attended a previous digital analysis techniques course at EDC and desired further hands-on training. Specifically, their purpose was to develop further understanding of available analysis techniques and to derive a general idea of what desert resource information can be derived from digital analysis of Landsat data. They performed enhancement, classification, and geometric correction with Landsat data of the Mojave Desert in southern California.

PUBLICATIONS. Five reports were released by the USGS: "Monitoring Irrigated Land Acreage Using Landsat Imagery: An Application Example" by William C. Draeger; "A Selected Bibliography: Remote Sensing Applications in Agriculture" by William C. Draeger and David T. McClelland; "A Selected Bibliography: Remote Sensing Techniques Applied to the Collection and Analysis of Soil Information" by William C. Draeger and David T. McClelland; "Assessing Flood Damage to Agriculture Using Color Infrared Aerial Photography" by William H. Anderson and "Training and Assistance at the EROS Data Center - A Slide Cassette Training Module" by William J. Redmond.

EROS DIGITAL IMAGE PROCESSING SYSTEM (EDIPS). A contract change notice (CCN) was issued to TRW, Inc., to add a geometric correction and destripping capability to EDIPS. A contract was awarded to Goodyear Aerospace Corp. for the High Resolution Film Recording System (HRFRS) on March 18, 1977, for \$491,025. An interface clarification meeting was held at Goodyear on March 25, 1977, including representatives from EDC, Goodyear, and TRW to ensure that all interface requirements between EDIPS and the HRFRS had been identified and are understood.

VISITORS. Approximately 1,000 individuals visited the Data Center including: Dr. Tom Bates, LIA, to review Applications Branch capabilities and activities; Victor Holm, Union Carbide, Brazil, to discuss applications of Landsat imagery to geology; Neil Pfulb, Director, and Mr. Walt Isaacs, Chief of Resources, Desert Planning Staff, BLM, Riverside, CA; Six Congressmen from the state of South Carolina; Bill Lenoir, Astronaut from NASA/JSC; Mr. Kubo from the Japanese Industrial Policy Research Institute; Mr. M. Lenco, French statistician and remote sensing advisor to discuss Landsat data applications; Blaine Wiseman and several other members from AMOCO Minerals of Standard Oil, Chicago, to discuss the applications of Landsat imagery; Ms. Jackie Bouck and others from U.S. Bureau of Reclamation, Denver, to work on a DAL analysis session; Mr. Charles L. Rudder, President of TEAM International, Huntington Beach, CA, and two individuals from Taiwan to discuss the applications of remote sensing; National Park Service personnel to conduct an analysis session in the DAL; Mr. Harry Smedes, USGS, Denver, to understand the functions and activities of EDC. Special tours were given to 156 high school students and to 101 members of farmer/business organizations. General information presentations were given to three civic/fraternal organizations, a total audience of 160.

II. EROS Applications Assistance Facilities (AAFs)

CENTRAL AMERICA ACTIVITIES. The Inter American Development Bank is providing approximately \$370,000 for training and production of cartographic and computer-generated products for five Central American Republics, utilizing Landsat data. The countries involved are Costa Rica, El Salvador, Guatemala, Honduras and Nicaragua. Training of country participants will be accomplished at EDC, Sioux Falls, South Dakota, and LARS facilities, Purdue University.

NSTL TRAINING. During March 8-11, a Forestry Workshop was conducted for representatives from the National Park Service, U.S. Forest Service, Corps of Engineers, International Paper Co., Weyerhaeuser Co., and Delta Wildlife and Forestry Inc. During March 28-31, a Vegetation and Wildlife Habitat Mapping Workshop was conducted for representatives of the Air Force, Corps of Engineers, Georgia Southwestern College, and Tenneco Oil Co.

ALASKA MOSAIC. An uncontrolled Landsat mosaic of Alaska was completed for the State Division of Geophysical and Geological Surveys (DGGS). The mosaic is composed of summer imagery and was constructed in five sections at a scale of 1:1,000,000 to conform to existing geologic maps of Alaska. DGGS will use the mosaic for research and planning purposes.

III. Statistical Reports

A data base summary is attached. The Data Production Statistical Summaries for March are not attached because the necessary software required for the new accounting system has not been completed.

EROS Data Center and
EROS Applications Assistance Facilities
Significant Activities Report
April 1, 1977 through April 30, 1977

I. EROS Data Center

U.S. FISH AND WILDLIFE TRAINING. A remote sensing applications training course was given to twenty-six U.S. Fish and Wildlife Service personnel from twenty-two different states. Subjects covered in the course included introduction to remote sensing, characteristics of films/filters, principles of image interpretation, vegetation cover mapping, and remote sensing applications for range habitat/wildlife management problems.

NATIONAL PETROLEUM RESERVE ORIENTATION. An orientation session was held for personnel from the LIA/EIA Program, LIA/GAP Program, Geologic Division, Water Resources Division, Bureau of Land Management, U.S. Fish and Wildlife Service, and State of Alaska, participating in the National Petroleum Reserve of Alaska environmental assessment project. The capabilities of Landsat technology, the utility of Landsat data and small scale aerial photographs for making regional resource assessments of the 23,000 mi.² NPRA, a demonstration of machine-analysis of digital data, and an examination of EDIES products were among the topics covered during the session.

DIGITAL ANALYSIS. Representatives from the Bureau of Reclamation visited the Data Center to work in the Data Analysis Laboratory from March 28 through April 8. The IDIMS analysis system was used to evaluate aircraft scanner data for mapping of phreatophytic vegetation along the lower Colorado River in Arizona and California. The project was designed to determine the feasibility of using these data and analysis methods in an operational mode for other areas of interest to the Bureau.

ELEVENTH INTERNATIONAL SYMPOSIUM ON REMOTE SENSING OF THE ENVIRONMENT. The following papers were presented at Ann Arbor, Michigan: "Late Wisconsinan Deglaciation of the Northern Midwest Interpreted from a Springtime Landsat Color Mosaic" by James R. Lucas and James V. Taranik; "EROS Data Center Digital Enhancement Techniques for Landsat Data" by Wayne G. Rohde, James V. Taranik, and Keith A. Maas; "Remote Sensing in Rangeland Management: An Overview of Applications and Benefits" by David M. Carneggie; "An Overview of Remote Sensing Technology Transfer in Canada and the United States" by William M. Strome and Donald T. Lauer; and "Monitoring Irrigated Land Acreage Using Landsat Imagery: An Application Example" by William C. Draeger, open-file report number 76-630.

PUBLICATIONS. The following reports were approved by the Director's Office: Anderson, W. H., 1977, Color infrared aerial photography for assessing flood damage to agriculture in the 1975 Red River Valley Flood of North Dakota and Minnesota: an application example, U.S. Geol. Survey Open File Report No. 77-175; Draeger, W. C., and McClelland, D. T., 1977, A selected bibliography:

remote sensing techniques applied to the collection and analysis of soils information, NTIS release No. N75-16421; Draeger, W. C., and McClelland, D. T., 1977, A selected bibliography: remote sensing applications in agriculture, NTIS release No. N75-16421; Redmond, W. J., 1977, Training and assistance at the EROS Data Center, a slide-cassette training module, Open File Report No. 77-122.

INORAC. Extensive effort has been expended to improve the performance of the new INORAC system. Hardware changes accomplished included replacement of certain core memory components. In addition, most of the characteristic software problems have been corrected, resulting in improved system reliability. Also, a major data base redesign and reorganization was completed to improve the efficiency and response time characteristics of the system. The major component of the reorganization involved the separation of low quality, low usage image accessions from the more frequently used, high quality accessions in the main image file. An estimated 25-30 percent improvement in inquiry-processing is expected.

VISITORS. Approximately 1,900 individuals visited the Data Center including: Senator Lowell Weicker and Congressman Larry Pressler as part of their visit to South Dakota; Mr. Chuck Mathews, past Associate Administrator for Applications, NASA, to better understand EDC operations and capabilities; Mr. William Lenoir, NASA astronaut; Gary North and John Woods, NCIC Headquarters, Reston, VA; 100 members of the South Dakota Press Association; William Fischer, EROS Program Office, Claunch, New Mexico project; Jerry Proffit, Burlington Northern Minerals, Billings, Montana, utilization of remotely sensed data in uranium exploration in Eastern Montana and Western North Dakota; Jerry Schlesinger and Tom Loveland, State Planning Bureau, to discuss cooperative projects; Ulrich Wlaczorek, Institute of Geography, University of Munich, applications of remote sensing; George Patrides, Professor of Fisheries and Wildlife, Michigan State University, application to range and agriculture; D. I. J. Mallick, Institute of Geological Sciences, London, to discuss geological and hydrological applications of remote sensing; Tony Andrews-Jones, geologist from Denver, to discuss the applications of remote sensing to mineral exploration in Paraguay; Dr. Carl Glass, Professor of Geophysics, University of Arizona, to discuss geological applications.

II. EROS Applications Assistance Facilities (AAFs)

ARIZONA ACTIVITY. Two aerial reconnaissance flights were conducted over the Salt-Verde watershed in support of the USGS/NASA Snow-cover Observations Project during March. The second flight included temperature measurements over selected areas during an overflight by a NASA U-2 aircraft equipped with a thermal scanner. Schumann attended the Western Snow Conference held in Albuquerque, New Mexico, April 18-21, 1977, and presented a paper on Applications of Aerial and Satellite Snow-Mapping Techniques for Multi-Purpose Reservoir System Operations in Arizona.

ALASKA ACTIVITY. The facilities at the Geophysical Institute were moved closer to the library and Geosciences Archives which provides the user access to greater variety of remote-sensing data, i.e., magnetospheric, atmospheric, seismic data etc. Side looking airborne radar (SLAR) imagery along the Beaufort and Chukchi Sea coasts was obtained by Army aircraft for the Outer Continental Shelf study program. This film is being plotted and catalogued and will be archived in the AAF.

III. Statistical Reports

A Data Base Summary is attached.

EROS Data Center and
EROS Applications Assistance Facilities
Significant Activities Report
May 1, 1977 through May 31, 1977

I. EROS Data Center

EIGHTH INTERNATIONAL REMOTE SENSING WORKSHOP. The four-week workshop included 28 representatives from 16 countries. Emphasis during the workshop was on manual interpretation of remote sensing data. Aircraft photography and Landsat imagery were used in the lectures, homework, workshop exercises, and field studies. General sections devoted to fundamentals, principles and interpretation techniques, field study in the South Dakota Black Hills, and discipline study directed toward specific assignments using the students' country imagery provided the students with work in relevant analysis techniques.

BUREAU OF LAND MANAGEMENT WORKSHOPS. Two one-week remote sensing workshops were presented to personnel from the Bureau of Land Management. There were 30 participants from Alaska in the course presented at Anchorage, and 20 participants--Idaho (13), California (4), and Oregon (3)--at the course presented at Boise. Basic principles of remote sensing theory and analysis were presented, and a variety of workshop exercises were completed that addressed drainage mapping, landform analysis, vegetation cover mapping, and plant species mapping and measurement. A one-day field trip allowed for field verification of image analysis.

EROS DIGITAL IMAGE PROCESSING SYSTEM (EDIPS). The EDIPS Preliminary Design Review was held at TRW May 11-13, 1977. System design and fabrication are progressing on schedule. The Critical Design Review is scheduled for the end of July. The MK II High Resolution Film Recording System (HRFRS) Design Review was completed at Goodyear May 5-6, 1977. HRFRS design and fabrication are on schedule also and will be delivered to TRW in January 1978, for interface with the EDIPS System.

PAPERS AND PUBLICATIONS. A paper was presented on "Targeting Natural Resources Exploration Using Standard and Enhanced Landsat Data," at the 1977 Pacific Northwest Metals and Mineral Conference sponsored by the American Institute of Metallurgical Engineers in Seattle, Washington, May 4, 1977. A report on work performed on the 1975 Red River Valley Flood, entitled "Inventory and Mapping of Flood Inundation Using Interactive Digital Image Analysis Techniques," by W. G. Rohde, J. V. Taranik, and C. A. Nelson, was approved by the Director.

VISITORS. Visitors to EDC included representatives from Japan, Italy, Egypt, Australia, Brazil, Afghanistan, Peru, France, Canada, and Tanzania. Domestic visitors included representatives from the United Nations, U.S. Soil Conservation Service, Cold Regions Research and Engineering Lab, ERIM, and the Office of International Geology.

II. EROS Applications Assistance Facilities (AAF's)

NSTL WORKSHOPS. Two remote sensing workshops were given during May. The first concerned forestry applications and was given jointly with the continuing education programs of Louisiana State University and Mississippi State University. The second workshop concerned applications for mosquito control. Mosquito breeding areas were successfully interpreted and mapped using high-altitude aerial photography. Students were from mosquito control departments in southern Louisiana and Mississippi. Guest lecturers were: Mr. Mike Carroll, Department of Entomology, Louisiana State University; and Mr. Eric Lacefield, Louisiana Wildlife and Fisheries Commission, Oyster Division. Dr. Dayton Steelman is writing a paper describing this technique whereby mosquito breeding areas for two disease-carrying mosquito populations can be detected and identified in water areas completely concealed by marsh grasses. This technique was developed during preparations for the workshop.

ALASKA ACTIVITIES. John Miller attended a meeting of the Bristol Bay Native Corporation (BBNC) and village leaders at Dillingham to discuss timber resources and its possible commercial value to that area. Other state and federal agencies represented at the meeting were the U.S. Forest Service, State/Federal Land Use Planning Commission, State Forestry Office, and the Office of Economic Development. Color enlargements of four Landsat scenes covering the BBNC area were displayed and a presentation given on the feasibility of using Landsat to delineate areas of commercial timber. Several meetings have been held with BLM and ESL concerning the Denali ASVT program. Preliminary work is being done now and plans for the field work are well underway. The National Wetlands Inventory Coordinator for Alaska, Art LaPerriere, has asked that we archive the Landsat and aircraft imagery that he receives in connection with the wetlands inventory. This would provide a ready reference for his agency and other Alaskan users. We have been working with Peter Myers, an OCS investigator, on a technique for computer-aided ecosystem mapping utilizing multispectral and multi-temporal digital data from Landsat. Dr. Myers needs accurate and detailed information on bird habitat in a small area south of Barrow.

PHOENIX. Since Departmental approval has been granted to transfer the EROS function to the Arizona Resources Information System (ARIS) office, effort has been expended to accomplish that end.

III. Statistical reports

Data Production and Data Base Summaries are attached.

EROS Data Center and
EROS Applications Assistance Facilities
Significant Activities Report
June 1, 1977 through June 30, 1977

I. EROS Data Center

LATIN-AMERICAN REMOTE SENSING COURSE: EDC staff assisted in teaching the Second Latin-American Course in Remote Sensing which was held in Buenos Aires, Argentina, June 6 - July 1, 1977. The class consisted of 24 professionals, representing a variety of disciplines, and included fundamentals of remote sensing, a survey of applications, practical interpretation exercises, team problems on Landsat imagery, and a field trip to the province of San Luis, Argentina. It was possible to emphasize Landsat interpretations integrated with field visits to produce multi-disciplinary analysis of the imagery as an input to landuse planning decisions.

EROS DIGITAL IMAGE PROCESSING SYSTEM (EDIPS): System design and fabrication for the EDIPS and the High Resolution Film Recording System (HRFRS) continued on schedule. The issues surfaced during the EDIPS Preliminary Design Review have been resolved. Specifications for the EDIPS 3X reduction printer have been prepared. The printer will be fabricated in-house and will be used to reduce EDIPS 241mm imagery to 70mm.

DATA ANALYSIS LABORATORY (DAL) ACTIVITY: The DAL supported a variety of users during June, including development of new techniques and data compositing routines. Image enhancement for hydrologic and geologic interpretation of the BLM's Denali test site in Alaska was completed in preparation for follow-on training courses. Data from Landsat, aeromagnetic, gravity, and topographic sources were composited for interpretation for geological anomalies. Various color coding, density slicing, and isometric display techniques provided new and useful information to Geologic Division personnel working with the composited area.

IDAHO FOREST INVENTORY PROJECT: A review of the Idaho Forest Inventory Project was held at NASA/Ames on June 14-15. The project is on schedule, with no major problems. USGS/Menlo Park is digitizing all township, geographic, and ownership boundaries for use in allocating sample units for the inventory and preparation of output products. A thorough review of the sample design was presented. A workshop for Idaho Department of Lands is to be held at EDC on July 29-August 1, to demonstrate the image classification techniques used in the inventory project.

OFFICIAL VISITORS: Foreign visitors included representatives from Australia, Egypt, the Philippines, South Africa, Chile, Venezuela, Brazil, Columbia, India, and Morocco. Domestic visitors included representatives from the University of Wisconsin, American Cooper and Nickel Co., The Nature Conservancy, U.S. Forest Service, NASA Earth Resources Lab, Department of Agriculture, Mineral Research Service and University of Nebraska.

II. EROS Applications Assistance Facilities (AAF's)

NSTL WORKSHOP: A remote sensing workshop was presented June 14-17 to members of the Environmental Protection Agency's Region IV at Athens, Georgia. This workshop included 22 attendees from EPA and several state planning agencies. The next EPA workshop will probably occur in Region III.

PHOENIX ACTIVITY: Continued coordinating the AAF phase-out with NCIC and the Arizona State Government. Notices were sent to AAF users including State and Federal agencies and private individuals informing them of the transfer of the EROS function to the State. The EROS Data Reference File was physically moved to the offices of the Arizona Resources Information System (ARIS).

III. Statistical Reports

Data Production and Data Base Summaries are attached.

EROS Data Center and
EROS Applications Assistance Facilities
Significant Activities Report
July 1, 1977 through July 31, 1977

I. EROS Data Center

DENALI ALASKA PROJECT: A meeting was held on July 6 with Ralph Marker and Bill Bonner of the Bureau of Land Management, Denver, to discuss final plans for completing the Denali, Alaska Project. A summary was given on the geology and vegetation overlays to be produced. Plans were finalized for a two-man team from EDC to conduct field work necessary for verifying the classification overlays in the Denali area during the period August 10 to August 21, 1977.

COMPARISON OF ANALYSIS TECHNIQUES: An evaluation was completed to determine the accuracy of mapping stripmine disturbance in a hardwood forest environment with Landsat data. A standard Landsat color composite, digitally enhanced Landsat data, and CCT data processed on the IDIMS system and the M-DAS system were evaluated. Accuracy estimates at the 95% probability level were: $65.6\% \pm 12.0\%$, $90.2\% \pm 7.5\%$, $82.0\% \pm 9.7\%$, and $80.3\% \pm 10.1\%$, respectively. Manual interpretation of digitally enhanced data yielded the most accurate results and required less computer time than the machine classification on IDIMS and M-DAS.

PNRC IDAHO FORESTRY INVENTORY PROJECT: EDC representatives attended a review of the PNRC Idaho Forest Inventory Project meeting with participants from NASA, ESL, USGS Topographic Division, and the Idaho Department of Lands. Overall project status and progress was discussed, including: USGS digitizing of land survey units, counties, and ownership tracts; sampling design for estimating timber volume; progress of photo interpretation and field data collection efforts; and documentation efforts. Also discussed were plans for a training workshop on digital image classification for Idaho Department of Lands personnel which will be held at EDC on August 31-September 2, 1977!

DATA ANALYSIS LAB (DAL) ACTIVITY: Bureau of Mines personnel began analysis work for classification of the Navajo Mine in New Mexico. A reclassification was started on the Kelso study area of the Mojave Desert, and a non-linear contrast stretch was developed for the Chesapeake Bay sea-ice imagery. Professor Yates Borden of Pennsylvania State University presented a series of seminars on multivariate statistics as they relate to data analysis and image enhancement for multispectral and multitemporal data during his summer work at EDC. These seminars presented a general understanding of linear transformation with emphasis placed on principal components and canonical analysis. Actual results and interpretations were presented by Mel Podwysocki, Geologic Division, USGS Reston. The transformation capability has been implemented on both the I-100 and IDIMS systems.

NCIC INTERFACE: EDC personnel provided assistance in bringing the Arizona Resources Information System (ARIS) facility on line as an NCIC State affiliate. A meeting was held with NCIC personnel in Reston to discuss items of mutual interest including brochures, order forms, public awareness programs, status of data reference files and application assistance facilities, the INORAC System and data pricing policy. The existing inquiry and order forms will be revised, and a joint NCIC/EDC brochure will be prepared describing the services and cartographic products available through EDC and NCIC offices and affiliates. It was agreed that public awareness needs to be increased; therefore, portfolios and displays of cartographic products (imagery and maps) will be compiled for display at places like National Parks and major U.S. airports.

EROS DIGITAL IMAGE PROCESSING SYSTEM (EDIPS): EDIPS and the MK II High Resolution Film Recording System (HRFRS) design and fabrication continues on schedule. The design of both systems was completed August 1, 1977. The EDIPS System Verification Test Plan was submitted by TRW, reviewed, and necessary changes sent back to TRW for implementation. The specification and sole source justification for upgrade of the MK I HRFRS to a MK II configuration was sent to Denver Branch of Contracts. Contract award to Goodyear is scheduled for the fourth week of September.

OFFICIAL VISITORS: Foreign visitors included representatives from Brazil; Australia; Department of Petroleum and Mineral Resources, Saudi Arabia; University of Tulsa, Yugoslavia, University of Louvain, Belgium; U.S. Embassy, Mexico City. Domestic visitors included representatives from Goddard Space Flight Center, State Department, U.S. Forest Service, Humboldt State University, H.D.R. ECO Sciences, NOAA, IBM, USDM, WRD, State University of New York, Ohio State University, BLM-Denver, EROS Program Office, and Hunt Oil Company.

II. EROS Applications Assistance Facilities (AAF's)

ALASKA ACTIVITY: Field work for the Denali ASVT program is in full swing after most of the month of June was spent in project planning. Two University of Alaska staff members are in the Denali area doing field sampling and another will travel to California to assist in digital classification of several Landsat scenes in early August. The facility and technical assistance were provided for a training session as an introduction to Landsat digital classification for representatives of USGS, BLM and F&WS. This session was held the last week of July prior to a field trip to the Naval Petroleum Reserve-A area by these agencies. The first of the U-2 aerial photography acquired over Alaska by NASA/ARC in June 1977 has been received, plotted and archived. This aerial photography covers the northern half of the Alaska pipeline. Additional data of other areas is expected shortly.

IAGS ACTIVITY: IAGS EROS has been requested to present papers in Guatemala at the "Utilizacion de la Percepcion Remota en la Evaluacion y Manejo de los Recursos Naturales para el Desarrollo, en un Area Pilot"; in Columbia at the II Colombian Congress on Cartography and in Venezuela. Although it has not been determined if personnel will be attending, papers will be prepared for these meetings. Coordination and preparation continues with USGS International Operations Office concerning the presentation of the

Landsat Mosaic Course that will be given at the DMA IAGS Cartographic School between September 12 and 23, 1977. Of a total of 25 requests, 15 photogrammetrist/photographer teams have been accepted in the course.

III. Statistical Reports

Data Production and Data Base Summaries are attached.

EROS Data Center and
EROS Applications Assistance Facilities
Significant Activities Report
August 1, 1977 through August 31, 1977

I. EROS Data Center

IDAHO WORKSHOP: A three-day workshop was given at EDC for Idaho Department of Lands personnel. The objectives of the workshop were to: 1) demonstrate alternative approaches to developing training statistics for maximum likelihood classification; 2) demonstrate effects of varying several clustering parameters on development of training statistics for forestry applications; 3) demonstrate procedures for allocation of samples within ownership strata for estimation of timber volume; and 4) illustrate several techniques for producing various output products, i.e., map overlays and film products.

SOUTH DAKOTA SCHOOL OF MINES/EDC COOPERATIVE PROGRAM: EDC geologists conducted a four-day training program in the utilization of remote sensing techniques for mineral exploration for faculty and selected graduate students of the South Dakota School of Mines and Technology at Rapid City. This training is part of a no-cost cooperative program between South Dakota School of Mines and Technology and EDC to develop a continuing education course for training of geologists in the mining exploration industry.

NATIONAL PARK SERVICE PROJECT: A meeting was held in Denver with personnel from the National Park Service to discuss details of a proposed cooperative demonstration project. EDC personnel traveled to Lake Mead National Recreation Area on August 22 and 23 to consult with on-site personnel and further clarify site conditions and information requirements. A session to complete project plans will be held in early September.

NATIONAL PETROLEUM RESERVE OF ALASKA ACTIVITY: EROS personnel, along with BLM, Geography Program, and University of Alaska personnel, involved with vegetation mapping within the National Petroleum Reserve of Alaska, conducted a two-day remote sensing orientation course in Fairbanks and embarked upon a field survey within the Reserve to collect the necessary ground cover information to perform digital classification of vegetation cover using Landsat data. Geography Program personnel have performed preliminary clustering of the Landsat data from ten scenes that cover the Reserve and produced preliminary line printer maps and color-coded vegetation maps to field check. A BLM/Geography Program field team will collect field data from July 29 until weather prevents further field work.

INORAC TERMINALS: RFP #5937 for INORAC terminals has been released to industry; proposals are expected in late September. This procurement will result in lease/purchase of approximately 50 terminals over the next three years, for EDC and NCIC offices. This contract will replace the existing sole source contract with Burroughs Corporation.

CENTRAL COMPUTER SYSTEM CHANGES: The reconfiguration plan for the central computer system was completed and approved. Actions to be taken include cancellation of data communications and terminal equipment, replacement of disk and tape components, addition of planar memory, and acceptance of the third central processor specified by the original contract. Upon completion of these activities, the entire workload of the Univac 90/30 will be shifted to the Burroughs B6700 system. Approval has been requested from GSA for the release of the 90/30 system during the February-March 1978 time frame. The major activity to be completed prior to release is the installation of tape drives on the B6700 to handle the CCT workload and conversion of some U90/30 software.

II. EROS Applications Assistance Facilities (AAFs)

ALASKA ACTIVITY: Alaska had a very hot and dry summer which, unfortunately, resulted in over five hundred forest fires in July and August, fifty-three of these in the Fairbanks district were over a hundred acres in size and many of them covered thousands of acres. The total acreage burned so far this year, statewide, is estimated to be two million acres. As a result of a reindeer range inventory done previously by AAF personnel using Landsat imagery of northwest Alaska, BLM knew which land was prime range and should be protected, and which areas should be left burning while concentrating on protecting the better range land. The AAF also provided imagery showing several of the fires in progress and have initiated a standing request for imagery of all fire areas. BLM has indicated that they plan on using Landsat imagery at 1:1M scale to map the boundaries of the 1977 forest fires since this will be the most economical and accurate method of mapping these burned-over areas. The remaining U-2 aerial photography acquired by NASA/ARC in June 1977 has been plotted, catalogued and archived. This imagery covers the southern half of the trans-Alaska oil pipeline, the railbelt, and the proposed relocated capitol of Alaska.

NSTL ACTIVITY: Mr. Robert Holmes, Environmental Scientist with the Technical Support Division of EPA Headquarters in Washington, DC, spent a day at NSTL reviewing joint EROS-EPA training plans for the 1978 and 1979 fiscal years. Also met with Dr. William Schroeder, University of Southern Alabama's Dauphin Island's Sea Lab program to plan next fiscal year's workshop in remote sensing of coastal environmental processes. This workshop development is in response to local and regional demand. The National Marine Fisheries, the Earth Resources Lab, and the Sea Grant Program at Louisiana State University will be contacted for additional support.

III. Statistical Reports

A Data Base Summary is attached; however, due to computer programming problems, Data Production statistics for August are not available at this time.

EROS Data Center and
EROS Applications Assistance Facilities
Significant Activities Report
September 1, 1977 through September 30, 1977

I. EROS Data Center

NINTH INTERNATIONAL REMOTE SENSING WORKSHOP: Twenty-eight representatives from 19 countries, plus one representative from the National Cartographic Information Center in Denver, participated in the Ninth International Remote Sensing Workshop conducted at EDC. Emphasis in the Workshop was on manual interpretation of remote sensing data. Although special attention was given to Landsat data, work was also done with aircraft photography, manned satellite imagery, thermal infrared, and radar imagery. The workshop was divided into four basic sections: 1) fundamentals of sensing systems and principles of interpretation techniques, 2) discipline studies using remote sensing data, 3) field studies in the South Dakota Black Hills, and 4) specific exercises using the students' country imagery.

VEGETATION WORKSHOP: A workshop in remote sensing for vegetation analysis was presented during September 19-23, which covered the fundamentals of remote sensing, principles of manual and digital image analysis, applications examples in the plant sciences, approximately 12 workshop exercises, accuracy assessment and sampling design, and a one-day field trip. The session, held in the Black Hills of South Dakota to facilitate access to field demonstration areas, was attended by 29 persons representing Federal, State, and private organizations.

DIGITAL ANALYSIS WORKSHOP: A workshop was given during August 30-September 2, to Idaho Department of Lands personnel to familiarize them with digital analysis techniques, generation of timber volume estimates for the first stage of a multistage sampling design, sample allocation procedures, and techniques for generating film products and map overlays of classification results.

NATIONAL PARK SERVICE PROJECT: Personnel from the National Park Service met with EDC personnel on September 1, to discuss the scope of work, schedule, and staffing requirements for the Lake Mead National Recreation Area Cooperative Demonstration Project. A final project plan was developed which includes computer classification of Landsat data over the Lake Mead National Recreation Area and certain surrounding areas. The main project objective is to test the operational feasibility of using Landsat data and associated remote sensing techniques in park management.

LANDSAT DIGITAL TAPE STORAGE PLANS: Plans have been finalized for building a Landsat digital tape storage area in the basement of the Mundt Federal Building. The defined area will provide five or six years of storage capacity for Landsat high density tapes, the necessary complement of conventional half inch tapes, and will include space for operation of tape cleaning and handling equipment. Specifications have been submitted to the Sioux Falls Development Foundation, work is expected to begin about November 1, and continue for approximately two months.

COMPUTER OPERATIONS: The software required for CCT reproduction has been transferred from the Univac 90/30 to the B6700 computer system. This conversion allows the Univac 90/30 to be fully utilized for EDIES algorithm development and EDIES production. The INORAC system has been modified to provide more effective and accurate statistical data for Data Production and Center management. This revision required reformatting the General Ledger and generation of new report formats for data sales.

EROS DIGITAL IMAGE PROCESSING SYSTEM (EDIPS): Fabrication of EDIPS and the MKII High Resolution Film Recording System (HRFRS) continues on schedule. The detailed EDIPS System Verification and Test Plan should be finalized and approved by the end of October. A contract was awarded to Goodyear Aerospace Corp. to upgrade the MKI HRFRS to a MKII configuration. Upgrade of the MKI system will provide redundant film generation during EDIPS operation.

NCIC INTERFACE: EDC assisted NCIC in bringing the Technology Application Center (TAC), a division of the Institute for Applied Research Services at the University of New Mexico in Albuquerque, onto the INORAC network as an NCIC affiliate. Draft copies of the revised order form were forwarded to NCIC for approval. Work on the joint NCIC/EDC brochure continued. At a meeting of NCIC/EDC personnel, the status of Network Control Board was discussed. A Network Manager was appointed, as was an Assistant to the Chief, NCIC, for NCIC Operations. An EDC representative on the Network Control Board was also named.

OFFICIAL VISITORS: Foreign visitors included representatives from Baghdad, Iraq; Compo, Italy; Mar del Plato, Argentina; Nepal; Japan; and Germany. Domestic visitors included representatives from the National Park Service; U.S. Bureau of Mines; South Carolina Land Resources Commission; HDR Systems, Inc., Omaha, Nebraska; MESA, Denver; Department of Soils Science, University of Minnesota; BLM, Denver; WRD; National Geographic Magazine; USFS, Lakewood, Colorado; Metre Corporation; DMA/Aerospace Center, St. Louis, Missouri; and Environmental Protection Agency.

II. EROS Applications Assistance Facilities (AAFs)

IAGS ACTIVITY: Four hundred and eighty-one frames of ERTS imagery and eight color composites were processed and forwarded to our National Centers. Fifty-eight sheets of Sea Surface Temperatures were duplicated and forwarded. A Remote Sensing Seminar using Landsat imagery for Geological and Mineral Applications is planned for December of this year in Bolivia.

ALASKA ACTIVITY: The Outer Continental Shelf Environmental Assessment Program provided several rolls of National Ocean Survey aerial photography acquired this summer. This photography covered the Alaskan coast from Cape Beaufort on the Chukchi Sea to Cape Halkett on the Beaufort Sea and supplements the coverage received last year from the Yukon Delta to Cape Beaufort. This photography was obtained in natural color and color infrared and has now been plotted, catalogued and archived in our files. Much interest has been shown in it since a large part of the coverage

encompasses the coastline of the NPR-A area. Several personnel from the Geophysical Institute attended the 28th Alaska Science Conference held in Anchorage, September 22-24 and presented four papers.

III. Statistical Reports

Data Production and Data Base Summaries are attached.

EROS Data Center and
EROS Applications Assistance Facilities
Significant Activities Report
October 1, 1977 through October 31, 1977

I. EROS Data Center

FIFTH LANDSAT GROUND STATION OPERATIONS WORKING GROUP (LGSOWG) MEETING:

The fifth LGSOWG Meeting, chaired by Leonard Jaffe, Deputy Associate Administrator for Applications, NASA, was held at EDC, October 27, 28, and 29, 1977. Items discussed included: Status of ground station operations in the U.S., Canada, Brazil, Italy and Iran; plans for stations in Argentina, Chile, and Zaire; plans for Landsat C and D; plans for the European Space Agency Earthnet program; establishing a CCT format; and commonality of data bases and tapes for information exchange. The meeting included participants from NASA, EDC, Canada, Argentina, Chile, Brazil, Italy, Iran, and Zaire.

PECORA III: The third William T. Pecora Memorial Symposium was held in Sioux Falls, October 30 - November 2, 1977. The symposium was sponsored by the American Association of Petroleum Geologists in cooperation with the USGS and NASA and focused on the Application of Satellite Data to Petroleum and Mineral Exploration. Over 600 people attended the symposium to hear the papers presented and over half of these toured the EROS Data Center.

SALE OF LANDSAT DATA TO THE DEPARTMENT OF AGRICULTURE: On October 6, 1977, Messrs. Radlinski, Cohen, and Watkins of the Geological Survey, met with Don Gillis and Floy Payton of the Department of Agriculture (ASCS), to discuss EDC prices for Landsat data to satisfy USDA data needs. Mr. Gillis accepted the USGS proposal to provide black and white negative transparencies from Landsat data to USDA for \$5.00 when the new EDC Digital Image Processing Systems are operating in mid-1978. Under this arrangement, USDA would no longer provide Landsat data to the general public and would refer requests for data to EDC. The \$5.00 price is based on efficiencies resulting from the large USDA standing order. Current planning is that Agriculture would transfer a sum of money to take care of their data needs on an annual basis. It was further agreed that Payton and Watkins would generate a draft Memorandum of Understanding and a Funds Transfer Document for review and approval by the agencies.

BUREAU OF LAND MANAGEMENT TRAINING COURSES: One-week, photo interpretation training courses were conducted for Bureau of Land Management personnel at Denver, Colorado (October 3-7) and Riverside, California (October 17-21). Twenty-two BLM personnel attended the Denver course while 31 attended the Riverside course. Both courses emphasized the principles of image interpretation and included six interpretation exercises using both Landsat and aircraft imagery. A one-day field trip was also included for the purpose of verifying photo interpretation, photo-reading, and discussing field techniques. The Riverside course was given in response to numerous requests for assistance in utilizing remote sensing techniques, especially from the Desert Plan Program staff who are currently developing a plan for the orderly management and preservation of resources in the Mohave Desert.

CENTRAL AMERICA TRAINING: Preliminary planning was begun on a four-week training course to be presented in cooperation with the Inter-American Development Bank, to a group of scientists from Central America at the EROS Data Center in February 1978. This training will be conducted with assistance from personnel of the EROS Program, Reston, and the USGS Topographic Division, and will concentrate on the preparation of Landsat mosaics and small-scale thematic mapping.

EROS DIGITAL IMAGE PROCESSING SYSTEM (EDIPS): EDIPS development continues on schedule without any major problem areas. All hardware except the high resolution film recorder (scheduled for delivery in January) is at the contractor site and in system testing. Software modules are in coding and/or testing as scheduled. Meetings were held at TRW to resolve problems in the Definitive Test Plan and review the EDIPS/HRFRS interface. There remains only one issue on the System Verification and Test Plan which should be resolved by mid-November. A rough draft of the characteristics of computer compatible tapes (CCT's) generated by EDIPS was issued and reviewed by EDC during the month. A revised review copy will be distributed in mid-November, with final comments due in December. Present plans are to have the final CCT document available in January 1978 to provide as much lead time information to the users of Landsat digital data as possible.

OFFICIAL VISITORS: Foreign visitors included representatives from Inter-American Development Bank; Argentina; Australia; India; Brazil; Italy; Iran; Chile; Zaire; and Canada. Domestic visitors included representatives from NASA; EROS Program; WRD, Florida; BLM; U.S. Air Force, Omaha, Nebraska; South Dakota State Highway Department; NPS, Denver; and Corps of Engineers.

II. EROS Applications Assistance Facilities (AAFs)

NSTL WORKSHOPS: The following workshops were conducted by the NSTL AAF: An Advanced Forestry Workshop, September 6-8, 1977, in cooperation with the LSU/MSU Logging and Forestry Operations Center; a Mosquito Control Workshop, September 20-23, 1977; and a Geology Workshop was held October 25-28, 1977.

III. Statistical reports for the month of October are not completed at this time and will be available at a later date.

EROS Data Center and
EROS Applications Assistance Facilities
Significant Activities Report
November 1, 1977 through November 30, 1977

I. EROS Data Center

U.S. FISH AND WILDLIFE TRAINING COURSE: A remote sensing applications training course for U.S. Fish & Wildlife personnel was conducted at EDC November 7-11. Twenty-three participants representing fifteen states attended the course. Subjects covered included an introduction to remote sensing, characteristics of films/filters, principles of image interpretation, terrain and mapping, Landsat image analysis, and remote sensing applications for range habitat/wildlife management problems. A new exercise in habitat assessment received favorable response and will be expanded for use in the next FWS course (January, 1978).

INTERNATIONAL SOCIETY OF PHOTOGRAMMETRY MEETING: The EROS Data Center hosted a meeting of Working Group II/3, instrumentation for remote sensor data reduction, of Commission II, International Society of Photogrammetry. Scientists from the Canadian Center for Remote Sensing, the National Aeronautics and Space Administration, U.S. Geological Survey, and remote sensing equipment manufacturing firms attended the two-day meeting. Each scientist was asked to deliver a report on current developments in instrumentation for remote sensor data reduction within his own organization. The Working Group will deliver an interim report to a meeting of the Commission II, ISP in Paris next fall. The Working Group meets quarterly and the next meeting will be at the Canadian Center for Remote Sensing, in March.

LEGISLATIVE WORKSHOP ON SATELLITE REMOTE SENSING: A presentation entitled "Services Available at the EROS Data Center" was made on November 8, 1977, in Reno, Nevada, at the Legislative Workshop on Satellite Remote Sensing. The Workshop was sponsored by the National Conference of State Legislatures and approximately 125 legislators, legislative aids, and state agency personnel attended the session. The purpose of the Workshop was to make the elected officials of fourteen western states aware of the availability and uses of remotely sensed data obtained from the Landsat satellites.

FEASIBILITY OF INVENTORYING AND MONITORING IRRIGATION PRACTICES USING LANDSAT DATA: EDC personnel met with USGS (WRD Miami) and Suwannee River Management District personnel on November 9th at White Springs, Florida, to discuss the feasibility of using Landsat imagery for inventorying and monitoring irrigation practices in the Suwannee River basin area. A strategy was outlined to assess whether Landsat imagery can provide the basis for determining the number of fields being irrigated during the northern Florida agricultural growing season. Two test sites were chosen within the SRWMD, each having a good representation of irrigated fields, non-irrigated fields, forestland, and pasture. These test sites are approximately 20 miles square and can be easily ground checked. To aid in the agricultural assessment

of the Suwannee River basin area, GAP land use series data will be used in conjunction with Landsat image data. Two representatives from the SRWMD and Aaron Higer will visit EDC in January to evaluate the project accomplishments.

EROS/BLM INTERFACE: EDC personnel met with representatives from the Bureau of Land Management in Denver, Colorado, on November 29-30, 1977. The following resulted from the meeting: (1) output products for the work done in Denali, Alaska were delivered; (2) it was agreed that six BLM/EROS remote sensing training courses will be presented in FY 1978 at an estimated total cost of \$45,000 to the BLM; (3) tasks to be performed under the BLM/EROS Memorandum of Understanding were negotiated, and it was agreed that the work to be performed by EROS will involve vegetation/terrain classification over 2.5 million acres within the BLM's Arizona strip district, and (4) an agreement was made on the joint technical specification for the image analysis equipment to be installed in Denver by EROS, Bureau of Land Management and Bureau of Reclamation.

OFFICIAL VISITORS: Foreign visitors included representatives from Australia and Nepal. Domestic visitors included representatives from NASA; Soil Conservation Service; EROS Program; Houston Oil and Mineral Corp.; Bureau of Reclamation; Calumet Co.; NCIC; Inter American Bank; Bureau of Land Management; and the University of Michigan.

II. EROS Applications Assistance Facilities (AAFs)

NSTL ACTIVITY: Met with the Assistant Secretary of Interior for the Southeastern Region and briefed him and his staff on the EROS/AAF. Participated in a remote sensing workshop in Athens, Georgia, for managers in cooperation with EPA. There were ten attendees at the workshop, eight from EPA and two from the Soil Conservation Service. Addressed the Project Shorebird meeting held in New Orleans, November 30 - December 2. This meeting was presented by the Louisiana Office of Science, Technology, and Environmental Policy and funded by a grant through the Environmental Protection Agency. The purpose of the meeting was to introduce coastal state legislators to Federal resources available to them for environmental maintenance and improvement. A Land Use Workshop was held November 8-11. Attendees included representatives from the Corps of Engineers, Florida Gas Transmission Co., St. Bernard Planning Commission, University of Illinois, and Louisiana Department of Transportation and Development.

ALASKA ACTIVITY: Approximately 1,000 people visited the Alaskan AAF this year, which is almost twice the number that visited in 1976. Data sales totalled approximately \$51,000, which also doubles last year's volume. A large display was set up for a bird and mammal review meeting in connection with the Outer Continental Shelf Environmental Assessment Program which was held on campus in October. Several panels were prepared depicting the role remote sensing could and does play in this application of the environmental program. Tom George spent two weeks in California working on digital classifications on several projects currently being undertaken by University personnel. While there he also inspected the USGS Geography Program's NPR-2 mapping

project. John Miller attended an Alaska Rural Development Council meeting in Seward in October which centered around the D-2 land proposal and its impact on Alaska.

III. Statistical Reports

Data Production and Data Base Summaries are attached.

EROS Data Center and
EROS Applications Assistance Facilities
Significant Activities Report
December 1, 1977 through December 31, 1977

I. EROS Data Center

WATER RESOURCES REMOTE SENSING WORKSHOP: A Workshop was given at the Data Center to acquaint participants with practical applications of Landsat imagery and high altitude aerial photography for water resources. The Workshop was designed primarily for hydrologists from USGS Water Resources Division and their cooperating agencies and included eighteen participants. The workshop included lectures and discussions on the basic principles of remote sensing and on the feasibility and economic aspects of using these methods in ongoing studies and two workshop exercises to demonstrate how image analysis and interpretation could provide hydrologic information.

U.S. FOREST SERVICE ORIENTATION SESSION: An orientation session was given at EDC December 6-7 to eleven representatives from the Northern Forest Laboratory in Missoula, Montana, and other Forest Service Units conducting development studies to map and inventory forest fire fuels, model fire behavior and reduce residual fire from logging activities. The session objective was to demonstrate state-of-the-art remote sensing technology potentially applicable to these developmental efforts. The session included an introduction to the EROS program, a review of demonstration projects, and demonstrations of digital image processing techniques and applications. Demonstrations in the Data Analysis Laboratory included session participants conducting an analysis on the Image 100 to classify forest cover types from Landsat data for an area near Missoula, Montana. Each participant received a compilation of selected readings discussing applications of small scale imagery and digital data to forest management.

DENVER MESA REMOTE SENSING SEMINAR: EDC personnel participated in a remote sensing seminar held at the Denver Federal Center December 7-8, 1977. The seminar, conducted by MESA's Denver Technical Support Center and USGS/EDC, covered the basic principles of remote sensing and its use in mini-ground stability problems. Approximately 70 participants from the mining industry and related fields attended the seminar. Considerable interest in remote sensing technology was expressed by the attendees and a few mining companies indicated they are using the data routinely.

CLAUNCH, NEW MEXICO PROJECT: EROS personnel spent four days in the Claunch, New Mexico area to field check Landsat image interpretations and aeromagnetic data anomalies. Lineaments exhibited on Landsat images correlated with faults, karst structures and dikes. Positive aeromagnetic anomalies occur over diabase dikes and sills and outcrops of Precambrian rocks. Other magnetic anomalies could not be explained by surface expressions and may correspond to topographic variations on the Precambrian rocks in the subsurface.

EROS DIGITAL IMAGE PROCESSING SYSTEM (EDIPS): EDC completed review of the MK II High Resolution Film Recording System (HRFRS) Acceptance Test Procedure and submitted a detailed report to Branch of Contracts. HRFRS provisional acceptance tests are scheduled to start at Goodyear Aerospace January 9, 1978, and the system is scheduled to be shipped to TRW January 18, 1978, for interface with the EDIPS system. The final EDIPS System Verification and test plan was received in mid-December. EDIPS testing is scheduled to begin in March at TRW and the system delivered to EDC in April.

VISITORS: The Data Center had over 600 visitors during December, including representatives from: local colleges and universities, the EROS Program, the Geologic Division, the Maine Geological Survey, the University of New Mexico, NASA/GSFC, and the Subcommittee on the Environment and Atmosphere of the House Science and Technology Committee.

II. EROS Applications Assistance Facilities (AAFs)

LAGS ACTIVITY: A five day conference was held on Satellite-Derived Sea Surface Temperatures jointly sponsored by IAGS, EROS and NOAA. Participants from Chile, Ecuador, Peru and NOAA were in attendance. The meetings took place at the DMA IAGS Cartographic School. A regional seminar on Remote Sensing of Natural Resources sponsored by the Guatemalan Government and the Canadian Government was held in Guatemala City, Guatemala. Presentations were made by individuals from DMA IAGS, Canada, Costa Rica and Guatemala. Attendance exceeded 100 people. A regional symposium of Remote Sensing in Natural Resources was held in Bolivia during the first week of December. The meetings were sponsored by the Geological Service of Bolivia.

ALASKA ACTIVITY: Participated in an interagency workshop on aerial photography in Alaska sponsored by the Bureau of Land Management and the National Aeronautics and Space Administration. Representatives from State, Local and Federal Government agencies attended and discussed the various ways and means of obtaining aerial photography of the state. They also discussed what was already available, where it was archived and maps were exchanged showing the extent of coverage held by the agencies involved. Participated in a workshop sponsored by the U.S. Forest Service and the Soil Conservation Service which was a generalized, inter-agency seminar to review the status of various projects within the state which involve typemapping and/or inventories. Also discussed the feasibility of conducting some of the studies jointly to more efficiently utilize the manpower and funds available for these activities. Seventy-three people visited the AAF in addition to Geophysical Institute personnel and fourteen B/W and ten color orders were placed through the EROS Data Center with total dollar value of \$3,183. In addition orders were placed with the National Ocean Survey for aircraft imagery totaling \$4,061.

III. Statistical Reports

Data Production and Data Base Summaries are attached.

