PECORA VI
APRIL 13-17

The theme for the 6th Annual Pecora Symposium is "Integration of Remote Sensing into the Exploration Process." This year's symposium (which will be held in Sioux Falls, South Dakota, April 13-17) will focus on the world's dwindling energy and mineral resources and on developments in the utilization of remotely sensed data that have aided in the exploration for new reserves. The use of remotely sensed data has already been yielding impressive results and will become even more important to exploration activities in coming years.

The symposium is being sponsored by the Society of Exploration Geophysicists in cooperation with the American Association of Petroleum Geologists, the U.S. Geological Survey, the National Aeronautics and Space Administration, and the Geosat Committee. An important objective of the meeting will be to inter-mix papers directed toward both hydrocarbon exploration and mineral exploration to encourage an exchange of ideas between all exploration disciplines.

The uniquely conceived program offers geophysicists, geologists, and other explorationists an opportunity to learn more about a sophisticated method of exploration for oil and minerals. Coupled with the technical program will be a large exhibition of hardware, software, and services available to assist the explorationist.

The Pecora Symposium was established in 1975 to honor the work of the late Dr. William T. Pecora, a former director of the U.S. Geological Survey and later Undersecretary of the Interior. Dr. Pecora was the motivating force behind the establishment of the present program of earth resource sensing from space and had a deep appreciation for the use of satellites in the continual, effective monitoring of national resources.

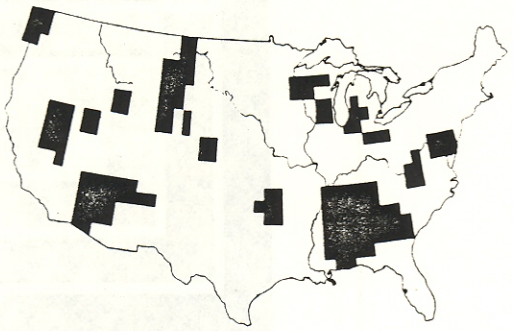
Interested readers are invited to contact the Society of Exploration Geophysicists, P.O. Box 3098, Tulsa, Oklahoma 74101, for further information. The telephone number is (918)743-1365.

Landsat Data Users NOTES

ISSUE NO. 11
MARCH, 1980

NASA

U.S. GEOLOGICAL SURVEY
EROS DATA CENTER
Sioux Falls, S. Dak. 57198



HIGH-ALTITUDE PHOTOGRAPHY PROGRAM

In December, Mark Hurd Aerial Surveys, Inc., of Minneapolis, Minnesota, was determined to be the low bidder on a program to acquire high-altitude photography for a nationwide aerial photo data base. Plans for this program were discussed in the May 1979 issue of the Landsat NOTES. Formal award of a contract was made in February, turning the plans into a reality.

Flights are scheduled to begin in March or April under the coordinating auspices of the Branch of Aerial Photography, U.S. Geological Survey Topographic Division. Approximately 600,000 square miles of coverage, as shown on the accompanying map, is scheduled for the first year. Seasonal factors and the priorities of funding agencies will dictate the pattern of coverage as the program continues. Some 88,300 flight line miles will have been covered by the completion of this contract.

The 9-inch black-and-white and color infrared photography will be acquired in north-south strips acquired along flight lines centered over USGS 7.5-minute quadrangles. The first and fourth exposure of the color infrared camera will coincide with the first and third exposure of the black-and-white camera to simplify the production of orthophotoquads and facilitate indexing. All coverage will be geographically retrievable and will be maintained "on the shelf" for any user wanting to purchase reproductions.

The EROS Data Center and the Agricultural Stabilization and Conservation Service (ASCS) in Salt Lake City, Utah, will be distribution centers for the photography. It is proposed to maintain either a master or a first-generation duplicate of all film at both centers so that requests for coverage could be processed at either location.

There is no doubt of the utility of high-altitude photography for a wide variety of mapping and interpretive applications. Sufficient experience has been gained to indicate that a *National* High-Altitude Photography Data Base will be of immediate and significant value to Federal, State, and local organizations involved in all aspects of land use, management, exploration, and conservation.

EDC DATA SALES

In recent months the EROS Data Center has responded to many inquiries about EDC sales and user groups. The following information is offered in an attempt to answer some of these questions:

- Total sales of both satellite and aircraft data during the period from 1972 to the end of FY 1979 amounted to $15,201,000 and of this total:
  - Landsat imagery accounted for 47%
  - Aircraft data accounted for 30%
  - Landsat CCT's accounted for 14%
  - "Other satellite" (Apollo, Gemini, Skylab) and miscellaneous data accounted for 9%.
- The product count during this same period broke down as follows:
  - 1,108,000 Landsat imagery frames
  - 1,137,000 aircraft imagery frames
  - 12,000 CCT scenes
  - 66,000 frames of other satellite and miscellaneous imagery.
- Data sales for FY 1979 paralleled these long-term trends. In FY 1979, receipts totaled $3,344,000, of which:
  - Landsat imagery accounted for 48%
  - Aircraft data accounted for 26%
  - Landsat CCT's accounted for 16%
  - Other satellite and miscellaneous data accounted for 10%.
- The product count for Landsat data during FY 1979 broke down as follows:
  - 134,000 Landsat imagery frames (83% black-and-white, 17% color)
  - 3,000 CCT scenes.
- Landsat imagery sales in FY 1979 totaled $1,588,000, and of this amount:
  - Users with non-U.S. addresses accounted for 36% — about the same as in FY 1978
  - Users from the Federal government accounted for 24% — a decrease of 6% from FY 1978
  - Users from industry accounted for 23% — up 2% from FY 1978
  - Academic institutions, individuals, and State and local governments accounted for the remaining 17% — all at levels relatively the same as in FY 1978.
- Landsat CCT sales in FY 1979 totaled $544,000. Of this amount:
  - Users with non-U.S. addresses accounted for 36% — up 12% from FY 1978
  - Users from the Federal government accounted for 21% — down 12% from FY 1978
  - Users from industry accounted for 26% — down 5% from FY 1978.
  - Academic institutions, individuals, and State and local governments accounted for the remaining 17% — some up slightly and others slightly down from FY 1978.

MSS AND RBV COMPOSITING WORK

A technique for combining MSS and RBV data into a single color-composite image has been developed at the EROS Data Center. Color fidelity is maintained by utilizing three spectral bands (4, 5, and 7) of MSS data and adding the RBV data as a brightness component. Since RBV data have a resolution of approximately 30 to 40 meters, versus 80 meters for MSS data, overall image sharpness is significantly better than if MSS data alone were used.

The technique is based on an ability to separate image hue and image brightness components in MSS data. Image brightness is represented by the sum of the digital values of the three bands. The original MSS data are thus separated into a single brightness component image and three hue component images. Reconstruction of the original image can be accomplished by multiplying each hue image by the brightness image. In the new technique, the MSS hue components are multiplied by the RBV brightness component rather than the MSS brightness component.

Because the MSS is a scanning device and the RBV is a camera, the geometry of the component images may not be identical. It is therefore essential that the MSS hue components be spatially registered to the RBV brightness component when the images are multiplied. This is done using a transformation technique which alters the MSS images to match the geometry of the RBV. A manual control-point matching technique can be used to accomplish this transformation, or an automated correlation algorithm can be used to accomplish it digitally.

The end result of the new MSS/RBV compositing technique is an image with a brightness component having over twice the resolution of a standard MSS composite.

Psychophysical studies of human vision have shown that the perception of sharpness in color images is heavily dependent on the sharpness of the brightness component, with the hue component being less important. This concept is used in standard U.S. color television systems in which the brightness signal is transmitted at much higher resolution than the color signals.

The final MSS/RBV color composite will not be identical in color response to a normal MSS composite because of differences in the spectral responses of the two sensors. However, it will still have the same hues that a standard MSS composite has, although it will have different relative brightnesses.

To date, this technique has been tried on only a few scenes, primarily because of the limited amount of digital RBV test data available. Simultaneous spacecraft acquisition of the MSS and RBV data is essential whenever changing features such as water silting patterns or vegetative growth are present.

LANDSAT TURNAROUND TIMES

One of the primary concerns of the EROS Data Center is to provide high quality Landsat photographic and digital data products to the user community in a timely manner.

Since February 1979, Landsat MSS data have been received at EDC in digital form via the Domsat link; these data are currently arriving about 12 days after acquisition by the satellite sensor. Once received, the data are further processed by the EROS Digital Image Processing System (EDIPS) in order to produce master reproducible film, a process that takes an additional 3 days.

Assuming that these steps have taken place, i.e., that EDC has received the data and archived a master reproducible in its storage facilities, a customer can expect an order for imagery to be shipped within 10 days of receipt of the order by EDC. This applies principally to orders for standard black-and-white imagery and assumes that no special handling has been requested. Should the order be for a computer-compatible tape (CCT), again assuming a master exists and standard processing is requested, the receipt-to-shipment turnaround time can be expected to average 7 days.

These response times represent an improvement over those experienced throughout most of FY 1979. Orders for standard photographic products were averaging a little over 14 days during that time.

Even today, occasional large orders for imagery can slow the system temporarily, adding a few days to the 10-day cycle now being experienced. And, as has always been the case, orders requiring a color composite to be made or orders requiring special handling will take 3 to 4 days longer than other orders.

The data must be available in the EDC archives before any of these turnaround times can be achieved. In cases where data must be requested from NASA/Goddard prior to reproduction, the turnaround time can increase by 75 to 100 days. Modifications to the processing systems at NASA/Goddard are planned which should reduce this time significantly. If part of your order does involve retrospective data, you have the option of requesting partial shipment on the order. This will ensure that you will receive any archived data immediately, with the retrospective portion of the order to follow later.

LANDSAT APPLICATIONS IN THE PACIFIC NORTHWEST

In 1974, the Pacific Northwest Regional Commission (PNRC) expressed the need for more accurate and current natural resource and land cover information upon which to base planning and management decisions. In response to that need, a Technology Transfer Task Force was formed to manage the Land Resources Inventory Demonstration Project (LRIDP) and the subsequent Landsat Application Program (LAP). NASA/Ames and the U.S. Geological Survey's EROS Data Center were invited to assist in the project.

The LRIDP involved 45 State and Federal agencies and 23 demonstration projects in the areas of forestry, agriculture, range lands, urban areas, coastal zone, noxious weeds, and surface mining. From 1975 to 1978, the projects provided those agencies with experience in extracting and using information from Landsat, working alone and in cooperation with each other as needed.

The Landsat Application Program followed the successful demonstrations. LAP, scheduled for completion in 1981, is designed to establish, in the northwest region, the operational capabilities needed to extract information from Landsat data and to use it in ongoing application projects. At project completion, Landsat technology will have been transferred to the point that each of the three States in the region will be in a position to support the analysis systems involved unassisted.

The entire PNRC project demonstrates that the transfer of technology is a task which requires unique and often innovative approaches. In this project, the Technology Transfer Task Force allowed users to concentrate on evaluating and using the technology and enabled the federal agencies, who are proprietors of the technology, to interact effectively with the States through an organized communication mechanism.

A substantial number of discipline-specific reports have emerged from the work done to date. These or any further information desired can be obtained from Mr. Dennis Hood, Applications Branch, U.S. Geological Survey, EROS Data Center, Sioux Falls, South Dakota 57198.

EDIPS ACCURACY CLARIFIED

The article on EDIPS Image Accuracy in issue No. 9 (refer to p. 4) made the claim that, taken "as is," Landsat imagery is well within National Map Accuracy standards for 1:1,000,000 scale coverage. This is true, as long as "as is" is taken to mean system-corrected imagery and not raw data. One reader expressed doubt, so we felt we should clarify the point. *(-Editors)*

THE HOTINE OBLIQUE MERCATOR PROJECTION

The following is a continuation of the remarks on map projections carried in our last issue.

Martin Hotine of the British Overseas Survey published the equations for approximating an oblique Mercator projection of the spheroid in 1946. This was a projection in which the axis did not follow a meridian, but was oriented obliquely.

In 1977, John Rowland of the U.S. Geological Survey adapted Hotine's equations to the problem of mapping Landsat imagery. An oblique projection lends itself to Landsat data because Landsat images are acquired along a swath which is inclined at an angle to true north (10° to 15° at the middle latitudes). He obtained a projection that corresponded roughly to the ground coverage along a single Landsat path and referred to it as the Hotine Oblique Mercator (HOM) projection. To limit scale distortions resulting from the curvature of a Landsat path, he defined five zones of latitude. Thus, for each Landsat path, a different projection is defined in each zone. The zones are as follows:

ZONE	LATITUDE
1	81°N. - 48°N.
2	48°N. - 23°N.
3	23°N. - 23°S.
4	23°S. - 48°S.
5	48°S. - 81°S.

The axis of each projection is determined by a center latitude and longitude coordinate (ϕ,λ) and an angle α chosen to minimize the distances of scene centers from the projection axis. This relationship between the projection axis and the scene centers is shown in Figure 1. Because the ground track of the scene centers projects as a curve (see Figure 2), it can be seen that angle α will vary from zone to zone. Each orbital path includes the same five zones but with different defined longitudes.

The HOM projection is accurate along the projection axis within 3 parts in 100,000 through a latitude range of 46 degrees. Perpendicular to the projection axis, the error increases proportionately to the square of the distance from the axis, giving a maximum position error of 3 meters within the path and zone

A rectangular coordinate system has been defined for HOM-projected images which identifies a U-axis coinciding with the projection axis and a V-axis perpendicular to the projection axis (refer to Figure 1 again). Values of U and V are expressed in meters and can be used to locate tick marks around the edge of a Landsat image. To keep all values positive, the (U,V) origin of this coordinate system is located some distance away from the (ϕ,λ) projection center: an offset of 5,000,000 meters is added to the U coordinate as a constant, and

500,000 meters is added to the V coordinate. Thus, the (U,V) coordinates of the projection center are (5,000,000; 500,000).

The HOM projection has been standard for Landsat image products since commencement of digital image processing operations on EDIPS last year. The (U,V) tick marks surrounding each image are labeled in units of 10^4 meters. Because the (U,V) coordinate system is rectangular, straight lines connecting corresponding U tick marks on the left and right sides of the image will be lines of constant U value; the same holds true for V tick marks top and bottom. Thus, unlike latitude and longitude coordinates, the U and V values can be interpolated anywhere in the image.

Computer programs have been developed at the EROS Data Center that can convert (U,V) coordinates to latitude/longitude coordinates, or vice versa. A program is also available that will compute the latitude and longitude of any pixel on an HOM-projected CCT. The latter program operates on UTM-projected digital images also. Documentation on the algorithms can be obtained by writing to the User Services Section, EROS Data Center, U.S. Geological Survey, Sioux Falls, South Dakota 57198.

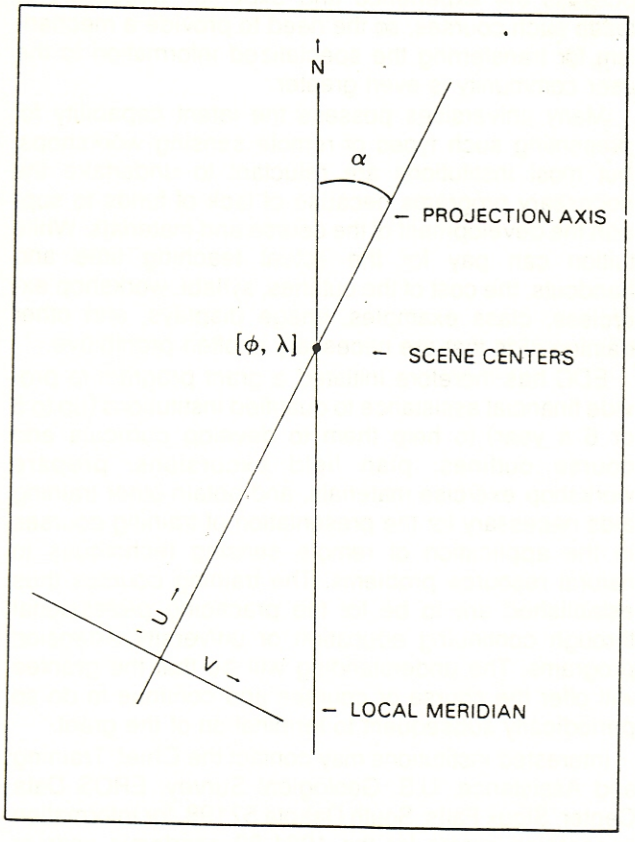


Figure 1. HOM projection axis and (U,V) coordinates

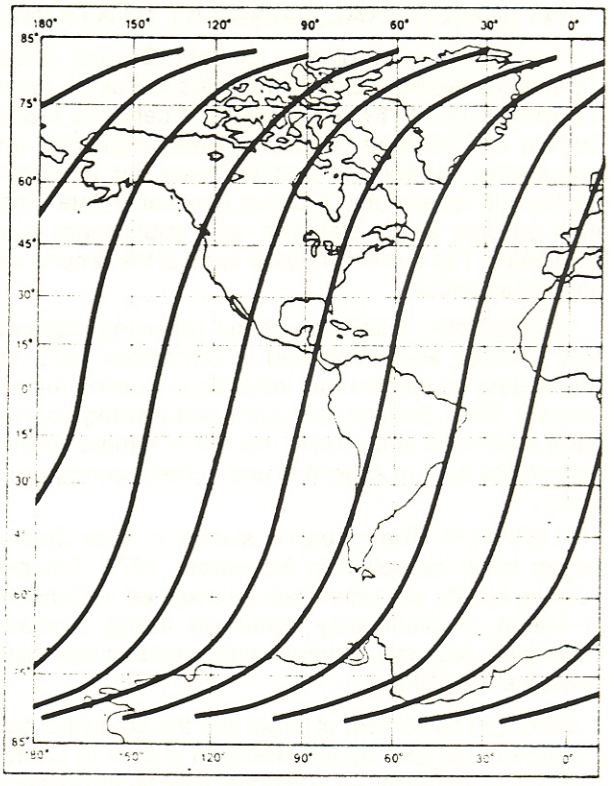


Figure 2 Ground tracks of the satellite as they appear on a figure of the earth.

SYMPOSIA

The 6th Canadian Symposium on Remote Sensing will be held May 21-23, 1980, in Halifax, Nova Scotia. Sponsored by the Canadian Remote Sensing Society, the symposium should be of value to anyone interested in the technical advances and *practical* utilization of remote sensing. Interested persons should contact Mr. Graham Doyle, CBCL Ltd., 61 Young Street, Halifax, Nova Scotia B3K 2A4, phone: (902)455-7241, for further information.

"Remote Sensing for Resource Management" will be the theme of a national conference, October 28-30, 1980, in Kansas City, Missouri. The purpose of the conference is to bring together leaders in remote sensing and natural resource management to discuss the practical applications of remote sensing to land and water resource management. The program will feature numerous case histories and examples of how information collected by remote sensing can be used to solve resource related problems. Only minor emphasis will be given to the actual technology of remote sensing. The call for papers requests that abstracts be submitted by June 1. Further information can be obtained from the Soil Conservation Society of America, 7515 Northeast Ankeny Road, Ankeny, Iowa 50021.

INTERNATIONAL LANDSAT STATIONS

The 9th meeting of the Landsat Ground Station Operations Working Group was held in Tokyo, Japan, November 12-14, 1979. Discussions centered around current and planned Landsat 3 data acquisition and processing capabilities and on plans for upgrading facilities to receive and process Landsat D data. Briefings on data sales, statistics, and applications were also given. The current status of each of the ground stations is as follows:

ARGENTINA: Installation of the receiving station at Mar Chiquita was completed in December 1979; the processing equipment was installed in Buenos Aires in January 1980. Several symposia and training courses have been held to stimulate interest in remote sensing techniques both in Argentina and in neighboring countries.

AUSTRALIA: The receiving station in Alice Springs began initial reception in November 1979. The processing facility equipment will be installed in Canberra in March. A preliminary document listing products, cataloging, and data distribution procedures was made available in February.

BRAZIL: The number of users and the amount of data produced and sold by the Brazilian station in Cuiaba continue to increase. An additional user facility is being established in Brasilia.

CANADA: The Canada Centre for Remote Sensing has recently helped to develop a low cost data analysis system and a CCT-to-film color imagery recorder system. It is hoped that the recorder system can be used to produce color products beginning in early 1980.

EUROPEAN SPACE AGENCY: The Kiruna and Fucino ground stations continue to receive data regularly. The processing facility at Kiruna, Sweden, is processing "quick-look" data as well as MSS images and CCT's. The processing facility in Fucino, Italy, returned to operation in November 1979 after installation and integration of a new imagery recorder and other hardware.

INDIA: The receiving station in Hyderabad began taking test data from Landsat in August 1979. The station should be operational in early 1980. A large number of applications projects are currently in progress in India including a natural resources survey, a water resources survey, and various soil studies.

JAPAN: The Japanese ground station in Ohashi became fully operational in July 1979. Radio frequency interference has limited the acquisition of some RBV data to a hexagonal-shaped coverage area, which is less than the potential full coverage zone of the antenna. It is hoped that the problem can be resolved soon.

THAILAND: The National Research Council of Thailand hopes to begin construction of the Thai receiving station in early 1980. In other developments, a remote sensing workshop was held in Bangkok for 51 Thai government and local agencies. Thailand is working to establish an Asian remote sensing training center to utilize data from the Thai ground station to train resource managers in image and digital Landsat data analysis techniques.

EDC UNIVERSITY GRANT PROGRAM

Despite the training courses in remote sensing offered by the EROS Data Center, NASA, and a few academic institutions, the demand for certain types of training in remote sensing, as applied to natural resource inventory, management, and development, currently exceeds capabilities. This is particularly true for those resource scientists and managers employed by State and local agencies, and the private sector, who cannot avail themselves of the training programs established within many of the larger Federal resource-oriented agencies.

There is thus a need for training courses for the practicing professional. The need at present is not so much for basic introductory courses (which are easily taught by many institutions), but rather for more advanced, discipline-specific, applications-oriented courses in which the actual techniques of performing a job are stressed (as well as limitations, costs, and necessary personnel resources). In many cases only a few institutions possess the experience and expertise necessary to teach such courses, so the need to provide a mechanism for transferring the specialized information to the user community is even greater.

Many universities possess the latent capability for presenting such types of remote sensing workshops, but most institutions are reluctant to undertake the necessary programs because of lack of funds to support the development of the course and materials. While tuition can pay for the actual teaching time and handouts, the cost of the outlines, syllabi, workshop exercises, class examples, image displays, and other training aids that are necessary is often prohibitive.

EDC has therefore initiated a grant program to provide financial assistance to qualified institutions (up to 5 or 6 a year) to help them to develop curricula and course outlines, plan field excursions, prepare workshop exercise materials, and obtain other training aids necessary for the presentation of training courses in the application of remote sensing techniques to natural resource problems. The training courses thus established are to be for the practicing professional through continuing education or university extension programs. The understanding will be that the grantee will offer the course or courses and continue to do so periodically subsequent to termination of the grant.

Interested institutions may contact the Chief, Training and Assistance, U.S. Geological Survey, EROS Data Center, Sioux Falls, South Dakota 57198, for information concerning grants for the 1981-82 academic year or later.

LANDSAT PRODUCTION STATUS

Data Availability

7/72 thru 1/80

EDC Film Archive	
MSS and RBV	377,621 scenes
Color Composites	13,871 scenes
EDC Tape Archive	
CCT's	9,031 scenes
HDT's	22,575 scenes

Cumulative Sales

7/72 thru 1/80

Frames of imagery	1,151,708
Scenes of digital data	13,210

Scenes Processed/Received

November 1979 thru January 1980

	RBV	MSS
Scenes processed by NASA/Goddard	1,666	4,988
Scenes received at EDC	1,574*	8,160**

Average rate of receipt of scenes at EDC: 80 per day

* 70-mm film only

** MSS scenes received are more than scenes processed due mainly to Goddard reducing backlog.

Turnaround Times

January and February 1980

Acquisition by satellite to receipt at EDC	12 days
EDC digital image processing time	3 days
Receipt of standard film order to shipment	under 10 days
Receipt of standard digital order to shipment	7 days
Retrospective CCT orders from Goddard	75-100 days

EDC TRAINING SCHEDULE

The EROS Data Center's Applications Branch staff will conduct or participate in several training courses and workshops in the coming months.

Apr 12 - Apr 13 *Association of American Geographers Remote Sensing Workshop* (Louisville, Kentucky). Precedes AAG Annual Meeting. Open enrollment. Contact: Floyd Henderson, Dept. of Geography, State University of New York at Albany, 1400 Washington Ave., Albany, New York 12222, phone: (518)457-8683.

May 5 - May 30 *International Remote Sensing Workshop* (Sioux Falls, South Dakota). Open to non-U.S. scientists. Contact: Office of International Geology, U.S. Geological Survey, National Center (917), Reston, Virginia 22092.

May 12 - May 16 *Remote Sensing for Wetlands Analysis* (NSTL, Bay St. Louis, Mississippi). Open to U.S. Fish and Wildlife Service personnel only. Contact: Dr. Allan Marmelstein, Office of Biological Services, U.S. Fish and Wildlife Service, Washington, D.C.

Jun 9 - Jun 13 *Remote Sensing Applications Training Course* (Sioux Falls, South Dakota). Open to U.S. Fish and Wildlife Service personnel only. Contact: Dr. Allan Marmelstein, Office of Biological Services, U.S. Fish and Wildlife Service, Washington, D.C.

Jun 15 - Jun 20 *Third Annual Vegetation Remote Sensing Workshop* (Glen Arbor, Michigan). Open enrollment. Contact: Prof. Charles Olson, School of Natural Resources, University of Michigan, Ann Arbor, Michigan 48109, phone: (313)764-1413.

Jun 16 - Jun 20 *Forest and Rangeland Inventory Methods* (Berkeley, California). Contact: S. Arce, Letters and Sciences, U.C. Extension, 2223 Fulton St., Berkeley, California 94720, phone (415)642-1061.

Jun 23 - Jun 27 *Terrain Analysis: Interpretation of Aerial Photographs and Images* (Sioux Falls, South Dakota). Contact: Lisa Underkoffler, Graduate School of Design, Gund Hall L-37, Harvard University, Cambridge, Massachusetts 02138, phone: (617) 495-2578.

Jul 14 - Jul 18 *Applications of Digitally Processed Remote Sensing Data* (Sioux Falls, South Dakota). Open to U.S. Dept. of Interior personnel only. Contact: Branch of Applications, EROS Data Center, Sioux Falls, South Dakota 57198, phone: (605)594-6511, ext. 114.

ADDITIONAL TRAINING IN REMOTE SENSING

Apr 7 - Apr 25 *Introduction to Remote Sensing* (Panama). Also to be held Sept 8-26. Instruction in Spanish. Sponsored by the Defense Mapping Agency, Inter-American Geodetic Survey, and EROS Program. Contact: Chief, DMA-IAGS Cartographic School, APO Miami, Florida 34004.

Apr 14 - Apr 16 *Mapping from Space - Techniques and Applications* (Washington, D.C.). Contact: Continuing Engineering Education, George Washington University, Washington, D.C. 20052, phone: (202)676-6106.

Apr 28 - May 2 *Manipulation of Computer-Compatible Tapes* (Panama). Also to be held Sep 22-26. Instruction in Spanish. Sponsored by the Defense Mapping Agency, Inter-American Geodetic Survey, and EROS Program. Contact: Chief, DMA-IAGS Cartographic School, APO Miami, Florida 34004.

May 5 - Jun 6 *Satellite Map Skills for Elementary School Teachers* (Edmonton, Alberta). Held in conjunction with the Alberta Remote Sensing Center. Contact: Dr. Joe Kirman, Project Omega, 248 Education South, University of Alberta, Edmonton, Alberta T6G 2G5.

May 12 - May 16 *Advanced Topics in the Analysis of Remote Sensing Data* (West Lafayette, Indiana). Contact: Philip H. Swain, Pur-

due/LARS, 1220 Potter Drive, West Lafayette, Indiana 47906, phone: (317)749-2052.

Jun 9 - Jun 13 *Soil Applications of Digital Analysis of Multispectral Data* (West Lafayette, Indiana). Contact: Douglas B. Morrison, Purdue/LARS, West Lafayette, Indiana 47906, phone: (317)749-2052.

Jun 16 - Jun 20 *Remote Sensing Workshop in Digital Image Processing (VICAR-IBIS)* (Bellingham, Washington). Contact: Dr. Ken Langran, Department of Geography and Regional Planning, Western Washington University, Bellingham, Washington 98225, phone: (206)676-3277.

Jul 21 - Jul 25 *International Conference on Soil Conservation* (Bedford, England). Contact: Mrs. P. M. King, National College of Agricultural Engineering, Silsoe, Bedford, England MK45 4DT.

Sep 29 - Oct 17 *Landsat Mosaic Workshop* (Panama). Instruction in Spanish. Sponsored by the Defense Mapping Agency, Inter-American Geodetic Survey, and EROS Program. Contact: Chief, DMA-IAGS Cartographic School, APO Miami, Florida 34004.

IMAGE ANALYSIS EQUIPMENT AND SERVICES

The list of sources offering image analysis equipment and services that was printed in Issue No. 3 of the *Landsat Data Users Notes* is maintained at the EROS Data Center and is revised and expanded as new information is made available to EDC. Organizations requesting changes in their listings, or wishing to receive copies of the most current list, should direct their inquiries to:

User Services Section
U.S. Geological Survey
EROS Data Center
Sioux Falls, South Dakota 57198
(605)594-6511

* * *

The Landsat Data Users NOTES is published bi-monthly in order to present information of interest to the user community regarding Landsat products, systems, and related remote sensing developments. There is no subscription charge; individuals and organizations wishing to receive the NOTES should contact the User Services Section, U.S. Geological Survey, EROS Data Center, Sioux Falls, South Dakota 57198, U.S.A., telephone: (605)594-6511.

Comments, corrections, and other inquiries should be directed to:

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