SOUTH AFRICA SIGNS AGREEMENT

The National Aeronautics and Space Administration (NASA) and the South African Council for Scientific and Industrial Research recently signed a Memorandum of Understanding for the establishment of a Landsat ground station at Hartebeesthoek, near Johannesburg, South Africa.

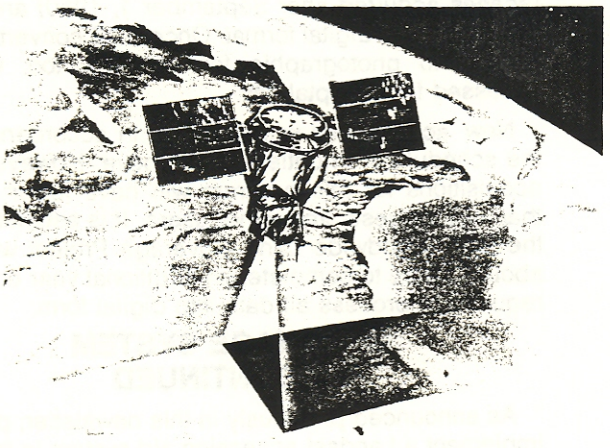
The agreement will make it possible for South Africa, an early user of Landsat data, to receive satellite transmissions in real time and to begin processing and disseminating the data to users in that region. The South African station is planned to be operational by early 1981.

HEAT CAPACITY MAPPING MISSION

Data from the Heat Capacity Mapping Mission (HCMM), an experimental project sponsored by NASA's Office of Space and Terrestrial Applications, are now available. The HCMM project was designed to evaluate experimentally the usefulness of remotely sensed surface temperature measurements for a wide variety of applications in geology, agronomy, ecology, hydrology, and climatology.

The HCMM satellite was launched April 26, 1978, and placed in a high-inclination (97.6°), near-circular orbit, at an altitude of 620 km. HCMM operations were terminated September 30, 1980. It carried a two-channel scanning radiometer which obtains broadband measurements of spectral radiance in the visible (0.5- to 1.1-micrometer) and thermal infrared (10.5- to 12.5-micrometers) portions of the electromagnetic spectrum. It thus sensed reflected solar radiation and emitted thermal radiation simultaneously.

The orbital characteristics of the HCMM satellite permitted repetitive observations of midlatitude regions over the course of the diurnal heating cycle. At midlatitudes, this coverage occurred at times of maximum and minimum surface temperature



Artist's concept of the Heat Capacity Mapping Mission satellite

Landsat Data Users NOTES

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NOVEMBER 1980

NASA

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

(about 1:30 p.m. and 2:30 a.m. local time), an optimal time for observing temporal and spatial thermal contrast within surficial materials. Thus, HCMM thermal-infrared measurements can be used on a regional basis to examine the amplitude of day and night variations in surface temperature. They can also be used to estimate the "apparent" thermal inertia of the surface and near surface materials.

The field of view of the radiometer was mechanically rotated through a scan angle of 60°, producing images with a swath width of 720 km. The ground resolution (at nadir) is 600 m in the thermal channel and 500 m in the visible channel. Data obtained in the two channels can be spatially cross-registered to an accuracy of 0.2 resolution elements or better.

Because HCMM was an experimental project, it was not designed to obtain global coverage of the Earth's surface. The satellite had no onboard tape recorders and had only been able to obtain useful scientific data within range of certain ground receiving stations. Even so, data have been acquired over extensive areas of North America, Europe, and Australia.

Some of the scientific investigations employing HCMM data are focusing on:

- Discrimination of rock and soil types.
- Monitoring stress in vegetation.
- Monitoring areal and temporal variations in soil moisture.
- Predicting water runoff from snow fields.
- Monitoring thermal effluents, currents, and eddies in large water bodies.
- Measuring the size and radiant thermal energy of urban heat islands.

Processing and reduction of HCMM data are still in progress, but current plans call for completion of HCMM-related data processing in the next several months. A HCMM Data Users Guide, associated catalogs, and data in both photographic and digital form are available from the National Space Science Data Center, Code 601.4, NASA Goddard Space Flight Center, Greenbelt, MD 20071.

RBV WORLDWIDE LAND COVERAGE PROJECT

The NASA Office of Space and Terrestrial Applications recently announced a project to systematically acquire Landsat 3 return beam vidicon (RBV) imagery of the land masses of the world. The one-time coverage is to be acquired while the capability still exists to use one of the onboard tape recorders for this purpose. Upon completion, the data will be archived in digital form at the Earth Resources Observation Systems (EROS) Data Center.

Only scenes which have 30 percent or less cloud cover, and which meet overall quality standards, will be selected. A schedule of priorities for new acquisitions will also be observed. In general, in the Northern Hemisphere, coverage from April to October will be selected to ensure the highest sun angles; in the Southern Hemisphere, coverage from November through March will be selected for the same reason. These general guidelines will be modified where climate conditions dictate. The priorities for this project are listed below:

Priority	Country/Area	Path	Row
1	United States and North America	001-090	006-047
2	U.S.S.R.	090-200	001-035
3	Japan/China	110-160	020-047
4	Middle East/East Africa	170-190	035-070
5	Eastern South America	230-245	055-090
6	Western Australia/ Indonesia	105-140	055-075
7	Central America/Caribbean	014-045	043-052
8	Southeast Asia/India	135-165	035-055
9	Europe/North and West Africa	195-225	010-060
10	Western South America	245-010	055-100
11	Eastern Australia	095-105	070-090
12	Southern Africa	175-195	060-085
13	Greenland	245-045	001-020
14	Antarctica	001-251	105-120
15	Arctic Islands	045-070	001-005
16	Remaining Land Masses of the World		

The effort began with an assessment of the Landsat 3 RBV data (in photographic form) already in the EDC archives. Those scenes found acceptable are being earmarked for retrospective digital processing at the NASA Goddard Space Flight Center. Also, as the digital RBV production line becomes fully operational, the current backlog of data acquired before September 1, 1980, will be worked off at the Goddard Space Flight Center and shipped to EDC in photographic format. These scenes will also be assessed and acceptable ones will be flagged for retrospective digital processing.

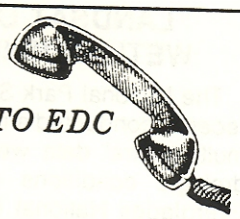
Now that NASA's capability to process RBV data in digital format is operational, all new acquisitions (scenes acquired after September 1, 1980) are being sent to EDC in digital format. Once EDC converts these scenes to photographic format, they, too, will be assessed for acceptability.

New acquisitions will be made in accordance with the schedule of priorities given above. However, data acquisitions for this program will have lower priority than will requests from other users. It is estimated that the RBV Worldwide Land Coverage Project will take about 2 years to complete; an additional year could be required to process all data into digital form.

MicroIMAGE SYSTEM DISCONTINUED

As announced previously in this newsletter, plans to implement a Landsat accession aid system in the form of band 5 reference images on microfiche have been postponed several times. Delays in delivery of

TELEPHONE CALLS TO EDC



The EROS Data Center has recently installed a direct-dial telephone system so that users will not have to ask for an extension number when they call the Center. The User Services Section can now be dialed directly at (605)594-6151. If you desire to reach another part of the Center, and you know the 3-digit extension number, simply dial (605)594-6_____, inserting the 3-digit number in the blank space. The operator, of course, can always be reached at (605)594-6511.

multispectral scanner (MSS) data to EDC and lack of any RBV data have made it impossible to proceed with production of the fiche. Since this situation has not improved, plans for a microIMAGE reference system have been discontinued. The current procedure of providing MSS reference images on 16-mm roll microfilm will continue to be the only method of providing microform reference images in the future. If data delivery schedules change at some point and appear to justify reconsideration of the microIMAGE system, this will be done.

All customers who have purchased a subscription for microIMAGE fiche will be contacted by the EDC User Services Section to make alternative arrangements.

Any user wishing to order reference images on 16-mm microfilm should contact the User Services Section, U.S. Geological Survey, EROS Data Center, Sioux Falls, SD 57198, phone (605) 594-6151. The price is $15 per roll. Indexing materials in the form of microCATALOG fiche are available to facilitate use of the microfilm rolls.

EDIPS UPGRADE IN PROGRESS

As a result of on-site work currently being completed by TRW, Inc., the EDC Digital Image Processing System (EDIPS) will soon be capable of resampling and applying geometric corrections to Landsat data. Currently, both radiometric and geometric corrections (including resampling) are made at the NASA Goddard Space Flight Center prior to transmission of the data to EDC. The upgrade now in progress will allow EDC to establish an archive of unresampled (that is, radiometrically corrected only) data, thereby allowing faster turnaround times in responses to customer requests for "raw" data. The standard procedure for obtaining uncorrected data in the past has been for EDC to place a retrospective order to the Goddard Space Flight Center.

Although a firm date to begin production processing with the upgraded EDIPS has not yet been set, the system could be operational as early as January 15.

LGSOWG TAPE FORMAT DOCUMENTATION

Documentation on the standard format for computer-compatible tapes, which was adopted last year by the Landsat Ground Station Operators Working Group (LGSOWG), is now available. The format will not formally go into effect until Landsat D is launched, but some stations plan to implement it before that time.

Users can request a copy of the documentation (which covers both MSS and RBV tape products) from the User Services Section, U.S. Geological Survey, EROS Data Center, Sioux Falls, SD 57198, phone: (605) 594-6151.

MAGSAT DATA AVAILABLE

Some data from a NASA magnetic-field sensing satellite, Magsat, are now available. About 70 days of data have been processed at the NASA Goddard Space Flight Center and sent to the National Space Science Data Center for distribution to investigators. The scalar and vector data are available in digital form at varying tape densities. Some software for magnetic-field analysis has also been developed.

Magsat reentered on June 11, 1980, after maintaining a near-polar orbit for 7 months. The data are the lowest-altitude satellite magnetic-field data ever acquired.

Inquiries about the Magsat data may be addressed to the National Space Science Data Center, Code 601, NASA Goddard Space Flight Center, Greenbelt, MD 20771, phone: (301) 344-6695.

1981 INTERNATIONAL REMOTE SENSING WORKSHOPS

Each May and September since 1973, the EROS Data Center has conducted an International Remote Sensing Workshop specifically intended for non-U.S. scientists. These workshops have been designed to familiarize the participants with the general characteristics of a variety of remote sensing systems and to present an opportunity for instruction and practice in the manual analysis of remotely sensed data with an emphasis on Landsat images. The workshops have been multidisciplinary and have not emphasized any particular applications.

Beginning with the 16th Workshop, scheduled for May 1981, the format and emphasis of the workshops will be changed. The spring workshop will concentrate on geologic and hydrologic exploration and planning, and the fall workshop will emphasize vegetation assessment and land-use planning. In addition, future workshops will be somewhat more advanced than

those in the past, although an optional fifth week of instruction has been added to the beginning of each course in which a review of fundamentals will be taught for participants with little prior experience.

These changes, which will make the workshops more advanced and discipline-specific, have been made in response to comments by participants in past courses. It is realized that as the science of remote sensing matures, and more people around the world acquire a basic introductory education in remote sensing, the need for training is changing also.

Applications are currently being accepted for both the May and September 1981 workshops. Brochures describing the courses in detail and containing all necessary application forms are available from:

Chief, Training and Assistance Section
U.S. Geological Survey
EROS Data Center
Sioux Falls, SD 57198
or
Chief, Office of International Geology
U.S. Geological Survey
National Center, Mail Stop 917
Reston, VA 22092

Students of the Fall 1980 International Workshop pause to examine some outcrops of gypsum during a field trip to the Black Hills of South Dakota. Field verification of interpretations made in the classroom is an integral part of the International Workshops.

LANDSAT CLASSIFICATION OF WETLANDS IN THE EVERGLADES

The National Park Service, in cooperation with EDC, recently conducted a research project in which Landsat multispectral data were used to monitor various hydrologic conditions of the Shark River slough in Everglades National Park. The ecological balance of Shark slough is dependent on management policies affecting surface-water origins north and east of the boundaries of Everglades National Park. The water enters the park through four control structures maintained by the U.S. Army Corps of Engineers.

An ability to monitor the spatial and temporal components of the overland waterflow in the Everglades National Park is required in order to understand relationships between water delivery and its impact on the park ecosystem. Prior to this Landsat study, the relationship between the quantity of water discharged through the water-control structures and the spatial impact on various regions in the park had not been determined.

The purpose of the research was to monitor various hydrologic conditions of the Shark River slough using Landsat multispectral data. Five Landsat scenes, representing a wide range of hydrologic conditions within the slough, were selected. These images were analyzed, using an interactive digital image processing system (a General Electric Image 100), and the areal extent of various hydrobiological zones, the spatial and temporal aspects of water inundation, and the variations in volume of water stored within the slough were determined.

Image processing procedures for this project required the extraction of geographically identical subscenes from each of the five selected Landsat computer compatible tapes. These 51- by 51-km subscenes were geometrically registered to a map base for correlation with water-depth measurements at the 75 monitoring stations within the slough, and they were contrast-enhanced to facilitate image interpretation.

The locations of all hydrologic monitoring stations were superimposed on each subscene to aid in image analysis. For each of the five selected Landsat subscenes, band 7 data were used to define the area of inundation within Shark River slough. A density-slicing technique was used to classify the data, and interactive attempts were made with this simple classification procedure until the results came closest to agreeing with ground-based water and land separation. During low-water level periods, however, the band 7 density-slicing approach was only partially successful. The vegetation canopy present at times of low-water levels made definition of the land and water interface difficult. For these subscenes, a parallelepiped classification technique was used to supplement the band 7 density-slicing results. Landsat inundation classification results were then combined with water depth data from the hy-

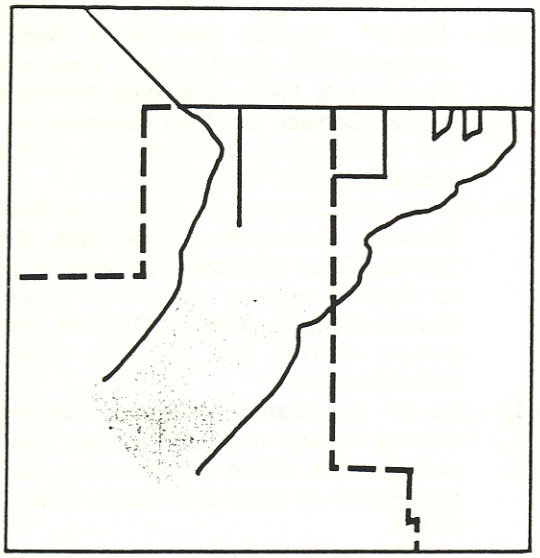
drologic monitoring stations to estimate total water volume on each date of Landsat coverage.

This investigation showed that Landsat digital data can be used to accurately monitor hydrologic conditions in a freshwater marsh ecosystem. An insight also was obtained into the relationships between water deliveries to Everglades National Park and surface water movement throughout the slough. The study found that Landsat data: (1) can be applied to delineate the extent of Shark slough's hydrobiological zones and the expansion or contraction of the slough's margins throughout wet and dry seasons; and (2) when combined with ground-station data, can be used to estimate the volume of water stored in the slough.

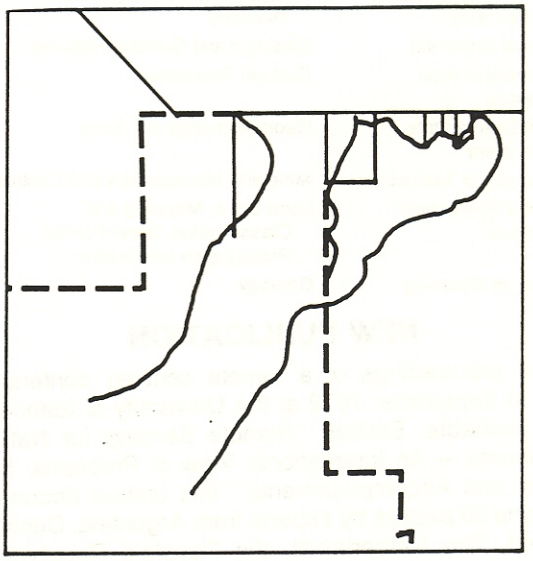
The information obtained through this analysis and interpretation of Landsat data is being used to formulate a water resources management program for Everglades National Park which will enhance the maintenance and preservation of the park's ecosystem.

Further information on this study, including the final technical report, can be obtained from the User Services Section, U.S. Geological Survey, EROS Data Center, Sioux Falls, SD 57198.

Representative Spatial and Temporal Margins of Shark River Slough.



MARCH 23,1978



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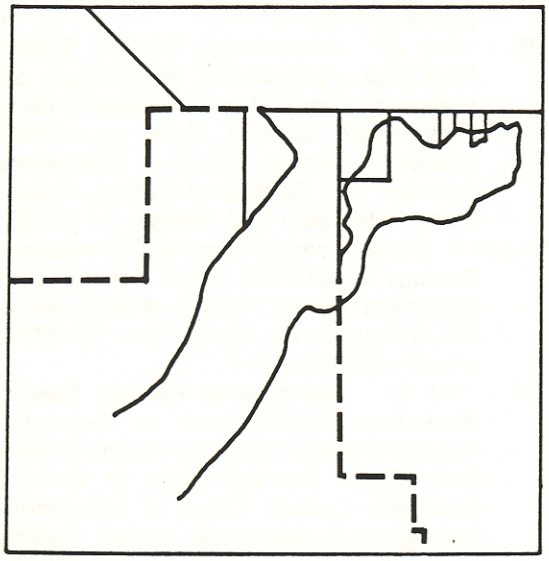
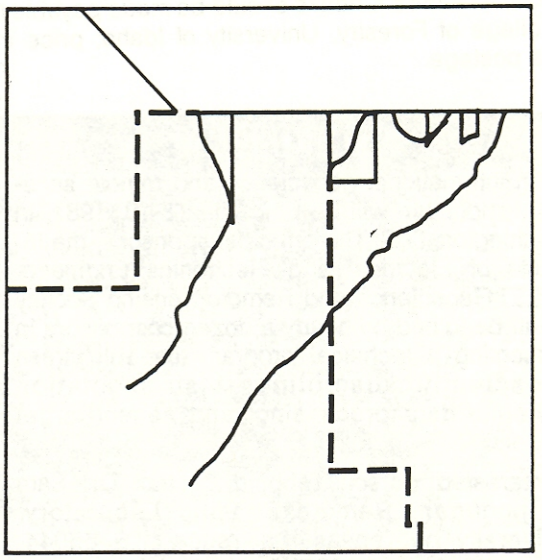


MAY 16, 1978



MARCH 9, 1979

EDUCATIONAL GRANTS

In August of 1980, the EROS Program awarded grants totaling over $250,000 to eight universities, after evaluating 26 proposals. The grant program is part of an effort to help qualified institutions develop curricula for remote sensing training courses.

The money will be used to prepare exercise materials, course outlines, field excursions, and training aids directed at the practicing professional. The universities receiving the grants, and the subject areas of the curricula to be developed, are as follows:

Institution	Type of Training
University of Arizona	Arid Land Management and Advanced Remote Sensing Techniques
University of California at Berkeley	Forest, Range, and Agriculture Inventory
Harvard University	Geologic and Surficial Features
University of New Mexico	Cultural Resources
South Dakota State University	Geomorphology and Soils
University of Tennessee	Mineland Management and Control
Virginia Polytechnic Institute	Land Cover Mapping and Classification, Small-Format Photography for Forestry
Univer. of Wyoming	Geology

NEW PUBLICATION

The proceedings of a remote sensing conference held in September 1979 at the University of Idaho are now available. Entitled "Remote Sensing for Natural Resources – An International View of Problems, Promises, and Accomplishments," this unique document contains 39 papers by experts from Argentina, Canada, Finland, The Netherlands, the People's Republic of China, Sweden, and the United States. To obtain a copy, send $10 to Susan Hieb, College of Forestry, Wildlife, and Range Sciences, University of Idaho, Moscow, ID 83843. Checks should be made payable to the College of Forestry, University of Idaho; price includes postage.

SYMPOSIUM

An international geoscience and remote sensing symposium will be held June 8-10, 1981, in Washington, D.C. The principal sponsor – the Institute of Electrical and Electronics Engineers (IEEE) Geoscience and Remote Sensing Society – will be joined by nearly a dozen cosponsors in presenting a technical program that will stress geoscientific disciplines, instrumentation systems, data processing, and sensor-target models.

Interested persons should contact Dr. Sam Shanonugan, Remote Sensing Laboratory, University of Kansas, Lawrence, KS 66044, phone: (913) 864-4836, for further information. Papers are due before January 16, 1981.

EDC TRAINING SCHEDULE

The EDC Applications Branch staff will conduct or participate in several training courses and workshops in the coming months.

Dec 8 - Dec 11, 1980 *Concepts and Operational Use of IDIMS* (Anchorage, Alaska). Open to Bureau of Land Management personnel. Contact: Chief, USGS/EROS Field Office, 218 'E' Street, Anchorage, AK 99501.

Jan 19 - Jan 23, 1981 *Introduction to Computer Analysis of Remote Sensing Data* (Anchorage, Alaska). Open to Bureau of Land Management personnel. Contact: Chief, USGS/EROS Field Office, 218 'E' Street, Anchorage, AK 99501.

Feb 23 - Feb 27 *Remote Sensing for Wetlands Analysis* (NSTL, Bay St. Louis, Mississippi). Open to U.S. Fish and Wildlife Service personnel. Contact: Dr. Allan Marmelstein, Office of Biological Services, U.S. Fish and Wildlife Service, Washington, D.C.

Mar 16 - Mar 20 *Basic Course in Geological Remote Sensing Techniques* (Sioux Falls, South Dakota). Open enrollment, preference given to Federal agency personnel. Contact: Branch of Applications, EROS Data Center, Sioux Falls, SD 57198, phone: (605)594-6114.

Mar 17 - Mar 20 *Application of Remote Sensing to Wildlife Habitat Inventory* (Arcata, California). Contact: Office of Continuing Education, Humboldt State University, Arcata, CA 95521.

Mar 23 - Mar 27 *Water Resources Remote Sensing Workshop* (Sioux Falls, South Dakota). Open enrollment, Contact: Branch of Applications, EROS Data Center, Sioux Falls, SD 57198, phone: (605)594-6114.

Apr 28 - May 29 *International Remote Sensing Workshop: Applications in Geologic and Hydrologic Exploration and Planning* (Sioux Falls, South Dakota). Open to non-U.S. scientists. Contact: Office of International Geology, U.S. Geological Survey, National Center, Mail Stop 917, Reston, VA 22092.

Jun 1 - Jun 5 *Digital Remote Sensing Techniques in Geology* (Sioux Falls, South Dakota). Open enrollment. Contact: Branch of Applications, EROS Data Center, Sioux Falls, SD 57198, phone: (605)594-6114.

Aug 31 - Oct 21 *International Remote Sensing Workshop: Applications in Vegetation Assessment and Land-Use Planning* (Sioux Falls, South Dakota). Open to non-U.S. scientists. Contact: Office of International Geology, U.S. Geological Survey, National Center, Mail Stop 917, Reston, VA 22092.

ADDITIONAL TRAINING IN REMOTE SENSING

Feb 9 - Mar 6, 1981 *Digital Image Processing* (Flagstaff, Arizona). Open to non-U.S. scientists. Contact: Office of International Geology, U.S. Geological Survey, National Center, Mail Stop 917, Reston, VA 22092.

Feb 9 - Feb 13 *Aerial Photography/Aerial Photo Interpretation* (Moscow, Idaho). Contact: Dr. Joseph J. Ulliman, College of Forestry, Wildlife and Range Sciences, University of Idaho, Moscow, ID 83843, phone: (208)885-7016.

Apr 18 - Apr 19 *Remote Sensing Workshop* (Los Angeles, California). Held in conjunction with 71st Annual Meeting of Association of American Geographers. Contact: Ronald A. Weinkauf, Department of Geography and Earth Science, University of Wisconsin, LaCrosse, WI 54601, phone: (608)785-8340.

Jun 2 - Jul 3 *Advanced Training in Geologic Interpretation* (Flagstaff, Arizona). Open to non-U.S. scientists, Contact: Office of International Geology, U.S. Geological Survey, National Center, Mail Stop 917, Reston, VA 22092.

Aug 25 *Postgraduate Diploma Programme in Remote Sensing* (Tamil Nadu, India). Duration: 1 year. Contact: Prof. R. Palanivelu, Head, Division of Photogrammetry and Remote Sensing, Pararignar Anna University of Technology, Madras - 600 025, Tamil Nadu, India.

Oct 5 - Nov 6 *Advanced Training in Land Use Planning and Environmental Applications* (Flagstaff, Arizona). Open to non-U.S. scientists. Contact: Office of International Geology, U.S. Geological Survey, National Center, Mail Stop 917, Reston, VA 22092.

Oct 13 - Oct 24 *International Geologic Correlation Programme (IGCP) Workshop on Remote Sensing and Mineral Exploration* (Nairobi, Kenya). Contact: W. D. Carter of L. C. Rowan, U.S. Geological Survey, National Center, Mail Stop 730, Reston, VA 22092.

Monthly: *Short Course on Numerical Analysis of Remote Sensing Data* (West Lafayette, Indiana). Contact: Douglas B. Morrison, Purdue/LARS, 1220 Potter Drive, West Lafayette, IN 47906, phone: (317)749-2052.

Continuing: *Training in Remote Sensing* (Brookings, South Dakota). Long-term (3-12 months) detailed training in technical and administrative techniques of remote sensing technology. Contact: Dr. Donald G. Moore, Remote Sensing Institute, South Dakota State University, Brookings, SD 57007.

NOTE:
If you are planning a training course in remote sensing, please let us know well in advance so that we can list it in this newsletter. Contact the Chief, Training and Assistance, U.S. Geological Survey, EROS Data Center, Sioux Falls, South Dakota 57198, phone: (605)594-6114. concerning all training-related activities.

HISTORICAL LANDSAT STATISTICS (FY 73-FY 80)*

	FY 73	FY 74	FY 75	FY 76	FY 77	FY 78	FY 79	FY 80
Landsat 1MSS scenes received at EDC	46,354	11,764	55,284	14,109	12,286	4,964	51	—
Landsat 2 MSS scenes received at EDC	—	—	10,962	53,704	25,282	44,715	12,886	8,325
Landsat 3 MSS scenes received at EDC	—	—	—	—	—	12,350	22,452	18,032
TOTAL LANDSAT MSS SCENES RECEIVED AT EDC	46,354	11,764	66,246	67,813	37,568	62,029	35,389	26,357
Landsat photographic frames sold (from EDC)	81,071	157,178	197,654	297,253	130,100	110,723	134,482	128,433
Landsat digital scenes sold (from EDC)	10	228	729	3,299	1,887	2,853	2,982	4,139
Dollar volume of total Landsat sales (EDC)	$229,642	$564,994	$909,009	$2,093,664	$1,453,837	$1,976,068	$2,131,813	$2,388,567
Customer Profile of total Landsat data (by dollar volume):								
Federal government	27%	16%	21%	34%	26%	31%	23%	16%
State/Local government	5%	2%	2%	1%	1%	1%	1%	3%
Academic	13%	12%	16%	11%	10%	8%	11%	9%
Industrial	30%	22%	24%	21%	28%	24%	24%	26%
Individual	7%	13%	11%	8%	5%	4%	5%	4%
Non-U.S.	12%	23%	19%	25%	30%	32%	36%	42%
Non-Identified	6%	12%	7%	0%	0%	0%	0%	0%

*Fiscal years 73-75 lasted from July to June; FY 76 lasted from July 75 to September 76; FY 77-80 lasted from October to September.

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)594-6151.

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

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