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REMOTE SENSING IN CANADA

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A NATIONAL PROGRAMME IN REMOTE SENSING IS COORDINATED BY THE DEPARTMENT OF ENERGY, MINES AND RESOURCES IN CO-OPERATION WITH OTHER AGENCIES OF THE GOVERNMENT OF CANADA, PROVINCIAL GOVERNMENTS, INDUSTRY AND CANADIAN UNIVERSITIES

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THE RADARSAT PROGRAM

Giant tankers plying the Arctic seas, winter and summer, carrying oil to southern refineries? Not so far-fetched according to two major industry proposals, the Arctic Pilot Project and Beaufort Sea Project, currently being considered for start-up during the period 1987-1990. The proposed tankers will displace 200,000 dead-weight-tonnes, be driven by 150,000 horsepower and will be specially strengthened to continuously break through ice thicknesses of up to ten feet.

In anticipation of a rapid expansion of Arctic development, an increasing level of R & D effort since 1976 has been concentrated on Synthetic Aperture Radar (SAR) as the primary sensor to provide information over the frozen and open oceans bordering Canada. Although SAR is also being studied for its uses in forestry, geology, hydrology and agriculture (see Convair 580 European Tour, page 11), it is especially suitable for northern applications because it provides reliable sensing day or night irrespective of cloud cover, and when used with a suitable processing and distribution system, delivers timely information for applications requiring near real-time response.

REMOTE SENSING IN CANADA DECEMBER 1981

Remote Sensing in Canada is the quarterly newsletter of the Canada Centre for Remote Sensing. It is principally intended to provide a vehicle for communication among the members of the Canadian remote sensing community.

"Quarterly", as we recently discovered, means that the newsletter should be published four times a year, and does not equate to eight bushels of corn, as we had always supposed - which is to say, that the editor hopes to increase productivity in 1982, and to gather four issues rather than two.

Brief submissions for the newsletter are most welcome, but due to space limitations, they will be subject to editing where necessary.

Material and comments may be sent to: The Editor, Applications Division, Canada Centre Centre for Remote Sensing, 717 Belfast Road, Ottawa, Ontario, K1A 0Y7.

During the period 1977 to 1979 through its SURSAT project, Canada participated in the NASA SEASAT program, acquired the ERIM multi-channel aircraft SAR, and started to develop a knowledgeable user community by conducting a series of applications experiments.

Since the completion of the SURSAT project, Canada has participated in the European Space Agency preparatory program for an earth resources satellite (ERS-1), principally by doing further work in SAR ground processing. Also CCRS has modified its aircraft SAR by adding a C-band (5.3GHz) channel and building a digital processing facility. In 1980 an agreement was signed with NASA to study the mission requirements in the U.S. and Canada for a radar satellite.

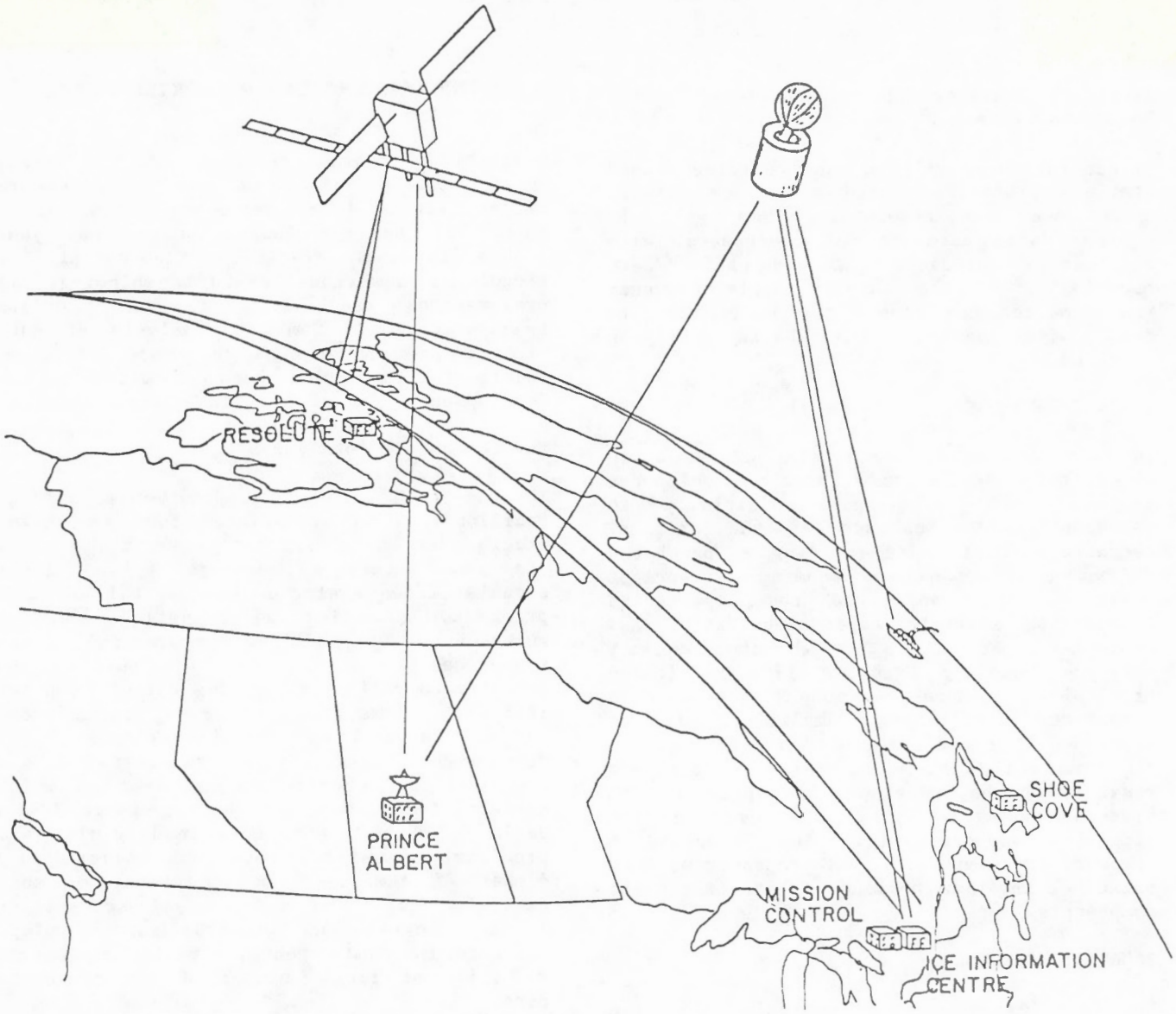
In 1981 approval was granted to conduct Phase A studies and to develop radar technology for a satellite program, whose primary purpose is to provide sea-ice information for Arctic marine transportation in the late 80's.

There are three elements to the current program: mission requirements definition supported by aircraft SAR experiments; a Phase A concept study which analyses spacecraft and ground system alternatives that respond to the user requirements; and research and development of radar technology.

MISSION REQUIREMENTS DEFINITION

While the principal motivation for the program is sea-ice reconnaissance, other applications will not be neglected. Drawing from the working groups of the Canadian Advisory Committee on Remote Sensing, teams have been established for ice, oceans, and renewable and non-renewable land resources. The U.S. has established similar teams. Both groups are working to define the applications that can utilize radar satellite data and to recommend complementary sensors for the mission, based on knowledge gained from previous microwave satellite and aircraft experiments. The complementary sensors are an optical scanner, radiometer, scatterometer and altimeter. The program will also include economic studies of the benefits obtainable from the data supplied from each of these sensors.

In most cases further experiments are necessary to determine seasonal variations, to obtain multi-temporal data sets, and to examine the importance of different radar parameters and digital image analysis. A series of aircraft flights over the period



July 1981 to July 1982 will gather data for a small number of intensive experiments. A critical experiment to determine the ice features that can be discriminated at C and L-band frequencies was completed over the Beaufort Sea in November 1981.

PHASE A MISSION CONCEPT STUDY

The overall concept for the Canadian radar satellite (RADARSAT) program is shown in the accompanying diagram. It is an end-to-end system that starts with a wide swath SAR on a polar orbiting satellite transmitting signals to ground receiving stations, where the data is converted into digital images. The image data is relayed via communications satellite to an ice-information centre, where other data such as aircraft SAR or weather satellite is incorporated to provide a forecast of ice conditions. The forecast is again relayed by communications satellite to the tankers in the form of annotated images.

Applications that do not require near real-time distribution will be serviced directly from the ground stations using air-mail or land communications networks.

The spacecraft will consist of a 3-axis stabilized platform with sufficient power and weight capacity to carry a C-band or L-band SAR and a complementary microwave or optical sensor. In addition, the transponder for search and rescue missions might be carried.

Both C-band and L-band radars will be considered during the early design trade-offs. The baseline parameters for these radars are a swath of 150 km. or greater, with a resolution of 25 to 30 metres at 4 looks and an incidence angle of 30° to 45°.

Preliminary orbit studies have shown that with this swath width it is possible to obtain twice-daily coverage over the primary

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Arctic transportation corridor, the North-West Passage.

Direct telemetry will be sent to three ground stations probably located at Prince Albert, Shoe Cove and Resolute. They will be equipped with hardware SAR processors, with sufficient throughput to maintain zero back-log for the area requiring near real-time response plus a reserve capacity to deal with back-up load-sharing between stations.

RADAR TECHNOLOGY

In order to develop industrial expertise in spaceborne SAR a substantial development program has just begun. Initially an assessment will be made of the critical technology involved in building a spaceborne SAR at both C-band and L-band frequencies. Based on this work and the application results of aircraft experiments at C and L-band frequencies, a choice of frequency will be made by December 1981. Selected critical SAR components, such as the antenna structure or high power amplifier, will be developed to establish confidence in building the complete flight SAR. Also an aircraft radar will be developed to provide SAR systems expertise, and for use in the satellite support role. And, finally, a hardware prototype of a SAR processor will be built using high-speed state-of-the-art components.

RADARSAT SCHEDULE

The earliest possible schedule for the RADARSAT program is for a launch by 1988. The Phase A studies are to be completed by August 1982 and will include any futher updates to mission requirements resulting from the aircraft experiments. The technology development schedule extends until 1984.

There is a strong need and desire for Canada to mount a domestic radar satellite program in order to serve the Arctic marine traffic that will increase in the 1990's. This satellite will be capable of carrying additional sensors to the SAR, and cooperative ventures with other nations and agencies will be considered to share the cost of the program. Canada will also be seriously considering joining satellite programs, such as ERS-1 and MOS-3, that carry SAR sensors. This participation could include radar related work in the space segment, but would almost certainly involve ground reception over Canada.

THROUGH THE LASER LOOKING-GLASS

Now you see it; now you don't. In the statistical characterization of the size, nature and frequency of sea ice pressure ridges, recent developments emphasize not so much what you are looking at as how your looking is done. Precision is essential, for ridges are a serious hazard to shipping, oil exploration and drilling, and on-ice transporatation. Computer analysis of data -- the promise of faster, more efficient interpretation -- has been expedited by the development of a digital interface, which is part of a current project by Intera Environmental Consultants Ltd.

The project is aimed at improvements in laser profilometry, a technique for generating precise ice ridge statistics in the Arctic. The new interface converts pulsed laser signals from analogue to digital format, prior to recording on magnetic tape. A subsequent, post-flight processing step reproduces each laser pulse on computer-compatible tape, for direct computer analysis. Data from the tapes are analysed on an interactive graphics display, for development of statistical measures of ice roughness. The criteria according to which certain ice parameters (e.g., height) are defined can be varied more readily than was previously possible, thus accommodating any number of theories. Establishment of this digital acquisition and analysis capability is an important step towards more complete automation, and hence, rapid, accurate reduction of large volumes of ice roughness data.

The system, which includes a pulsed laser, infrared linescanner, camera, and the interface, was flown off the coast of Alaska in the early spring of this year. During this exercise, approximately 4000 line kilometres of ice data were collected, and are now undergoing analysis. For this project, the system was housed in a Cessna 441 Conquest. The long-range capabilities of this turbo-prop aircraft allowed collection of data in very remote, and hitherto inaccessible areas.

Further improvements and system tests are being completed, in preparation for proposed flights next winter. In the near future, the system will be made available to interested groups; steps are also being taken to install computer analysis packages for terrain and oceans applications. More information may be obtained through Michael Kirby of Intera, at 785 Carling Avenue in Ottawa.

Colloquium on the Applications of the Next Generation of Earth Resource Satellites, Montréal, March 24-25, 1981

The objective of the Colloquium was to bring together a small group of resource managers and technical people, and with them explore in detail the implications of the next generation of earth resource satellites. The size of the group was limited to approximately fifty participants who were already familiar with the uses of satellite data. This avoided overcrowding the Workshops and provided a forum which ensured the full participation of all attendees.

The general reaction from the Workshop and discussions was that significant advances in operational applications could be expected with the new satellite data. In the majority of cases the increased spatial resolution and frequency of data coverage appeared to be of more interest than the increased spectral resolution. However, the spectral bands of both SPOT and Landsat-D were of particular interest in applications such as agriculture and forestry. The stereo capability of the SPOT system generated considerable interest and high expectation for its use in many applications areas. Many participants felt that with the next generation data there would be a significant increase in visual analysis using photointerpretation techniques.

The idea of presenting results from simulation experiments was well received. These experiments helped focus on the type of data products that will be available. In addition, the experiments gave the researchers an opportunity to become familiar with the data and start the development of analysis techniques specific to SPOT and Landsat-D. A number of problem areas were identified which, if taken into account, should lead to improvements in future simulation experiments. There was a good agreement on the need for more simulation experiments.

As a result of the Workshop discussions several important concerns were identified. Perhaps the most significant was the expected increase in data volume. Most resource managers were concerned about delays in obtaining data products and the increased complexity of analysis techniques. There was a significant demand for geometrically corrected data and data that could be overlayed with other geo-coded data bases. The availability of digital analysis systems for the user community was also an area of concern. These topics pointed out the need for a strong research and development effort in the analysis of multichannel satellite data and geo-coded data base integration. The development of analysis facilities available to a large number of users across Canada also had a high priority. There was general agreement that the above concerns must be resolved in whole or in part before the full potential of the next generation of earth resource satellites can be realized.

Publication of the Colloquium Report is expected early in 1982.

Co-Chairmen: K.P.B. Thomson, Canada Centre for Remote Sensing, and, H. Audet, Ministère de l'Energie et des Ressources du Québec

8th CANADIAN SYMPOSIUM ON REMOTE SENSING

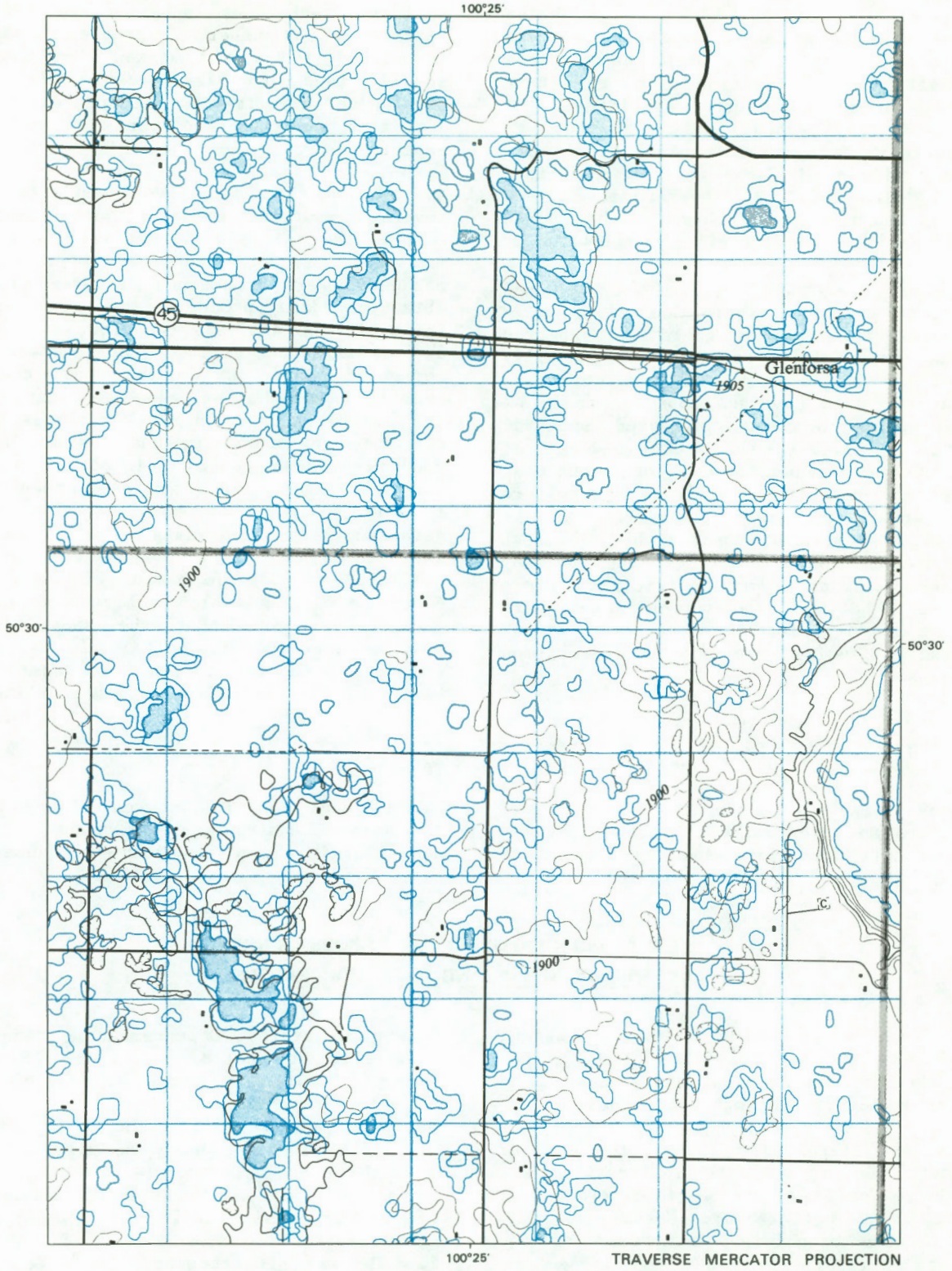
1st ANNOUNCEMENT AND CALL FOR PAPERS

The 8th Canadian Symposium on Remote Sensing, coupled with the 4th Congress of the Quebec Remote Sensing Association, will be held in Montreal on May 3rd through 6th., 1983.

All persons interested in submitting a paper on Remote Sensing and its applications are invited to send a 600 word abstract, in English or French, before November 15th., 1982, to the organizing committee, at the following address:

Robert Desjardins, Département de Géographie, Université du Québec à Montréal, B.P. 8888 Succ. A, MONTREAL (Québec) Canada. H3C 3P8

All questions concerning topics and scientific aspects should be directed to one of the co-chairmen of the technical committee: Dr. K.P.B. Thomson, Canada Centre for Remote Sensing, 717 Belfast Road, Ottawa (Ontario) Canada. K1A 0Y7, or, Dr. Ferdinand J. Bonn, Département de Géographie, Université de Sherbrooke, Sherbrooke (Québec) Canada. J1K 2R1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TRAVERSE MERCATOR PROJECTION

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Experimental Water Bodies Map for a Wetland Environment in the Canadian Prairies

The accompanying map demonstrates a simple but effective use of a geographic information system in which Landsat image data have been combined with cartographic data to survey wetland environments.

The water bodies information on this National Topographic System (NTS) map has been replaced by data from four Landsat images acquired on June 21, 1973, June 16, 1974, May 15, 1975 and August 7, 1976. The procedure adopted to prepare this product was as follows. First each original LANDSAT image was rectified, interpreted, and classified by a semi-automated multi-pass digital classification method called 'GEOTHEME'. The 'GEOTHEME' classifier allows for delineating the boundaries of water bodies up to one hectare in size with an accuracy in ground location of 20 meters. Then the classified data were combined to produce a blue overlay, by comparing the presence or absence of water in each image element through a computer-based technique.

The presence of water in all four images was interpreted as permanent water (medium blue), the presence of water on two or three of the four was interpreted as semi-permanent water (light blue), and the presence of water on only one of the four was interpreted as ephemeral water (screened blue).

As can be noticed on the map, by this methodology it was possible to establish an accurate record of the dynamic fluctuations of water in the common pothole depressions of the prairies, known as sloughs. A map of this type could be used for water resources management (e.g. irrigation planning), wildlife management (e.g. protection of drought-sensitive areas) and for general agricultural development.

For more information contact:

Dr. R. Steffensen,
Geostudio Consultants Limited,
522 St. Laurent, Suite 24,
Ottawa - Tel. 746-2950

TENTH ALBERTA REMOTE SENSING COURSE
University of Alberta, Edmonton, 22-26 February 1982

Conducted by the Alberta Remote Sensing Center in cooperation with the Faculty of Extension, University of Alberta.

The purpose of the course is to develop practical expertise in the use of remote sensing in earth resources surveys and management.

It instructs multidisciplinary users in the application, acquisition and interpretation of earth resources satellite (LANDSAT) and aircraft multiband data - both photographic and non-photographic. It emphasizes practical uses of remote sensing, and utilizes imagery interpretation exercises based upon actual research projects under the guidance of the researchers involved.

Excellent instruction will be provided by Canadian scientists from many agencies across Canada actively engaged in remote sensing, and by Professor R.N. (Bob) Colwell of the University of California, one of the world's leading scientists in the field of remote sensing.

The course will include: an introduction to remote sensing; historical development; basic matter and energy relationships; data acquisition - photographic and non-photographic sensors; the Canadian satellite and airborne remote sensing programs; techniques of manual and instrument aided image interpretation; use of digital satellite data; land use studies and classification; agricultural applications; geosciences; and much more.

Registration will be open to anyone, in order of receipt. The planned registration fee of $160 includes syllabus and course materials.

Past courses have been oversubscribed, so persons should plan early to attend. Those interested should call the Alberta Remote Sensing Center at (403) 427-2381.

1031502

AIR POLLUTION MEASUREMENTS FROM SPACE

Although Canadians have heard much about Space Shuttle and "The Arm", SPAR's remote manipulator, few are aware that one of the first experiments on Space Shuttle is a Canadian invention and development.

One of the five experiments being carried on the Space Shuttle flight, scheduled for early November 1981, is part of the MAPS (Measurement of Air Pollution from Satellites) program of the National Aeronautics and Space Administration, Langley Research Center.

One of the scientific mysteries at present is the disappearance of the large volumes of carbon monoxide (CO) generated by industrial and other processes, the so called "Carbon Monoxide Sink". The generation of CO can be calculated and, if it continued to build-up in concentration, it would in a relatively short time span poison mankind and all oxygen breathing life on earth. What happens to the CO? Various theories have been advanced but nobody knows for sure.

The experiment is to measure the global distribution of carbon monoxide by looking downwards from the satellite towards the earth. The observation is made with a remote sensor which measures the carbon monoxide infrared absorption in the upwelling radiation from the earth, the atmosphere, and the reflected sunlight.

The detection of trace polluting atmospheric gases is extremely difficult. Nevertheless, a method of detecting a specific pollutant, all the while rendering the instrument insensitive to other interferences, was invented and patented in Canada by Dr. Barringer in the early 1970's. Barringer Research, an Ontario Company, constructed a prototype GASPEC^{R} instrument (gasfilter correlation spectrometer) for NASA. Extensive and successful airborne tests have been conducted by NASA with a highflying aircraft circumnavigating the earth near the equator.

The Space Shuttle instrument is a space-hardened version of this Barringer Research development, and was constructed in Los Angeles.

There are from 100 to 200 parts per billion carbon monoxide, depending on the degree of pollution, in the atmosphere of the Northern hemisphere which is more than twice as much as is usually found in the Southern hemisphere. The Canadian developed instrument on Space Shuttle is capable of detecting changes in the carbon monoxide abundance of a few parts per billion, and is expected to be able to quantitatively measure the carbon monoxide pollution plume from industrial and metropolitan areas and where and when it disappears.

Barringer Research Ltd.
Press Release, October 1981

(Dr. Cameron Cumming of Barringer informs us that the GASPEC was turned on, as programmed, on the abbreviated Shuttle flight, and the experiment appears to have been successful. Ed.)

1031503

TECHNOLOGY TRANSFER PROGRAM

A new interdepartmental remote sensing technology transfer program has recently been approved by the Federal Government. The goal of the program is to bring about a widespread, regular use of remote sensing data and methods for the inventory, monitoring and management of Canada's land and water resources. The program will be executed through agreements with interested resource management agencies in the Provinces and Territories. Emphasis will be placed upon recently developed, but proven applications which can be incorporated into operational programs, particularly those involving the use of satellite data and digital image analysis.

To plan and oversee the execution of the program, a Technology Transfer Office (TTO) has been established at the Applications Division of the Canada Centre for Remote Sensing. In the planning stage, TTO will seek inputs from federal departments and from the provinces concerning potential involvement in the program. For more information, please contact:

Josef Cihlar
Head, Application Development Section
CCRS
2464 Sheffield Road
Ottawa, Ontario
K1A 0Y7
Telephone: (613) 995-1210

1031504

TOPOGRAPHIC MAP REVISION WITH SATELLITE DATA

The national topographic map series (NTS) is an essential source of information on the features of the Canadian landmass. At present only the 1:250 000 scale series is completed. The 1:50 000 scale series is approximately 66% completed and it is expected to take until 1990 before it is finished. Considering both series there are approximately 9500 topographic maps of Canada published at the present time.

The revision of these 9500 maps is the concern of the Topographical Survey Division of the Surveys and Mapping Branch, Department of Energy, Mines and Resources. As the number of maps grows, more and more resources are needed to revise these maps.

In May 1979 Gregory Geoscience Limited, under contract to the Topographical Survey Division, began research into the possibility of using Landsat data in the revision process for topographic maps. The research proved the satellite data useful in two ways. A comparison of Landsat interpretation and standard airphoto interpretation indicated that the satellite data could be used to map all relevant changes at the 1:250 000 scale. This conclusion was conditional on the type of surface cover within the map area. The second observation was that all major changes on the 1:50 000 maps could be detected in wilderness areas using the satellite data. With the knowledge of where the changes were on the map, revision airphotography could be better planned.

The next step was to define the needs of an operational program. A proto-operational program was started in 1980 to be completed by the end of March 1982. This program includes the mapping of changes on 62 1:250 000 map sheets and change detection on over 1000 1:50 000 map sheets (with most being done in the summer of 1981).

To date, the techniques and instrumentation developed for detection, mapping and airborne verification of change information have proven to be successful. The potential cost savings is indicated by change detection mapping on 491 maps which resulted in the diversion in 1980-81 of approximately $300 000 from airphotography for 1:50 000 map revision to other productive work.

It appears that the dedicated use of Landsat imagery in the revision of topographic maps will mean more up-to-date topographic map series and a more efficient use of the air surveying dollar.

Harold D. Moore
Gregory Geoscience Limited

FGBAL AND MARS OPEN OTTAWA BRANCHES

F.G. BERCHA and Associates Limited (FGBAL) has recently opened a branch office in Ottawa, providing consulting services in remote sensing, arctic engineering, simulation, environmental analysis, ice mechanics and risk analysis. FGBAL also has offices in Calgary (Head office), Phoenix and Houston. Dr. P. Chagarlamudi, the Chief Scientist for FGBAL, is stationed at the Ottawa Office.

FGBAL will be sharing office accommodation with MARS Aerial Remote Sensing Limited (MARS), a Canadian owned and controlled company providing a comprehensive range of remote sensing services, including program design and optimization, imagery acquisition, interpretation and analysis.

MARS owns and operates a Grumman G-1 aircraft which is dedicated to the acquisition of remotely sensed data. Sensors available on the aircraft include Side Looking Airborne Radar (SLAR), Dual RC-8 Cameras, I^2S Multi-spectral Camera, a Magnetometer, a 35 mm Strip Camera, and a Thermal IR Line Scanner.

MARS operates both nationally and internationally with head offices in Calgary and regional offices in Ottawa and Phoenix.

The Ottawa offices of FGBAL and MARS are managed by Mr. Ernie McLaren, and are located at Suite 2208, 112 Kent St., Ottawa K1P 5P2. Tel. (613) 563-0555.

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CCRS C-Band SAR Image, Stonehaven, Kincardine, Scotland.

This HH-polarization image was optically processed at the Environmental Research Institute of Michigan to a nominal 3 m resolution.

CONVAIR 580 EUROPEAN TOUR

Just like the average tourist visiting Europe, the CCRS Convair 580 aircraft spent the months of June and July taking pictures. Unlike the average tourist, however, the Convair 580 is equipped with a multi-frequency Synthetic Aperture Radar (SAR).

Under the management of Intera Environmental Consultants Ltd., of Ottawa, the SAR-580 captured radar imagery over the United Kingdom, Germany, Switzerland, Italy, Holland, Spain, Austria, France and Greenland.

Of principal interest to many investigators has been the results from the newly-installed, C-band frequency channel on the radar, since this frequency is a likely choice for future satellite SAR systems, particularly the European Earth Resources Satellite to be launched in 1987. The C-band radar transmitter and interface were developed by Canadian Astronautics Ltd., of Ottawa, under a contract to CCRS.

The accompanying image is an example of C-band imagery acquired off the coast of Scotland on June 6, near the town of Stonehaven, which is seen clearly in the image. In the foreground, at the near edge of the radar swath, the coastline and waters of the North Sea are visible, as well as the fingerprint-like banding characteristic of ocean waves. The radar discriminated several land uses in the non-urban regions, including forestry and different agricultural field crops, although no detailed analysis is yet available. Field boundaries, roads, railway tracks and power lines are sometimes accentuated by radar shadow effects.

Preliminary analysis of the results shows that this band has potential both in land and sea applications, and the CCRS instrument will provide a unique and valuable tool to science and industry in Canada and abroad.

Laurence Gray

RANGELAND WORKSHOP

In 1980, the Canada Centre for Remote Sensing, Public Lands Division, Alberta Energy and Natural Resources and the Alberta Remote Sensing Centre embarked upon a joint project to assess whether LANDSAT multi-spectral scanner data could be used to assess range condition in Southern Alberta. An enhanced color composite data product was developed which could be reliably used to determine range condition in the Mixed Grass Prairie region of Alberta which covers an area of approximately 2.5 million hectares.

The next important step which must be made is the transfer of this developed technology to those persons who can make use of it to manage one of Canada's important resources - namely its rangeland areas. As an example of how arduous a task this can be, remember that it took twenty years from the time that xerography was discovered until Xerox put out its first copier.

Public Lands Division, Alberta Energy and Natural Resources, who are deeply involved in this work, are using the LANDSAT products in carrying out their operational mandate to manage the public rangeland in Southern Alberta, but there are many others who could benefit from this technological development. As a first step in the transfer of this technology to these groups, a workshop was held in Lethbridge, Alberta on April 9, 1981 on the use of remotely sensed data for rangeland management. This was held in conjunction with a more general workshop on rangeland management. The thrust of this remote sensing workshop was to present, generally, what remote sensing can do, how the data is collected and processed, and, in particular, what LANDSAT multi-spectral scanner imagery can tell the range manager about his area of interest. This was done through a series of slides of ground features taken by field parties, by relating them to the satellite imagery.

This workshop was attended by approximately forty persons, most of whom were from Alberta government departments. This is just a start. To reach other groups throughout Western Canada that are responsible for rangeland management, plans are underway for a workshop, in Lethbridge, February 16,17, 1982. More details will be available from Mr. C.D. Bricker, Alberta Remote Sensing Center, 11th Floor, Oxbridge Place, 9820-106 Street, Edmonton, Alberta, Canada, T5K 2J6.

INTERNATIONAL SOCIETY FOR PHOTOGRAMMETRY AND REMOTE SENSING COMMISSION II SYMPOSIUM

OTTAWA, Canada
August 30 - September 2, 1982

THEME

The technology used for machine analysis of photogrammetric and remote sensing data has advanced considerably since the last Commission II Symposium held in Paris in 1978. This symposium will give the experts in analysis and processing systems the opportunity to exchange information and ideas on the latest developments.

TECHNICAL SESSIONS

Meetings for the five Commission II Working Groups will be scheduled for Monday, August 30 and Friday, September 3 at the Symposium Headquarters. Technical Sessions will be scheduled at 0830 - 1200 and 1330 - 1700, August 31 and Sepetember 1, 2. Papers to be presented will cover advances in the following areas:

- o Analytical and Hybrid Photogrammetric Instruments
- o Automated Photogrammetric Instruments and Systems
- o Instruments for Analysis of Remotely Sensed Data
- o Instruments for Pre-processing, Storage and Dissemination of Remotely Sensed Data
- o Equipment for Processing Synthetic Aperature Radar Data

In addition, one session, the "Manufacturers' Forum" will be devoted to presentations by industry on the latest advances in commercial equipment and services.

DISPLAYS

An exhibits committee is planning a comprehensive set of displays to be provided by industry. It is expected that all relevant segments of the industry will be represented.

PROCEEDINGS

The proceedings will be published prior to the Symposium and will be distributed to participants at registration.

Call for Papers
International Society of Photogrammetry and Remote Sensing Commission II Symposium

Abstracts of papers should be submitted to the Technical Program Committee by January 15, 1982. A one page abstract of less than 250 words should include the title of the paper, author's name, affiliation and address. Emphasis should be on advances and new developments.

Authors of papers accepted for presentation will be notified by March 15, 1982. Camera-ready copies of the accepted papers must be received by June 1, 1982, to appear in the proceedings which will be available at the symposium.

Please send abstracts to:
Z. Jaksic, President,
Commission II of ISPRS,
Division of Physics,
National Research Council of Canada,
Bldg. M-36, Montreal Road,
Ottawa, Canada K1A 0R6

LOCATION

The Symposium will take place at the Chateau Laurier Hotel in Ottawa, which is located at the heart of the city near the Parliament Buildings, National Art Gallery, National Arts Centre and several shopping areas.

In addition to the technical sessions, the social events will include a complementary wine and cheese reception on Monday, August 30th and a Banquet at the Royal Ottawa Club on Thursday, September 2nd. Tickets for the Banquet will be in limited number, and will be sold on a "first-come-first-served" basis. There will also be an Accompanying Persons Programme which will include tours and other activities. Tickets to musical events at the National Arts Centre will also be available to pre-registered attendees.

SECOND CIRCULAR

A second circular containing more details on accommodation, registration, technical and social programs will be mailed in early 1982 to everyone who has returned the attached preliminary application form (see page 21).

DIGITAL IMAGE ANALYSIS TRAINING

The number of digital image analysis systems used to study remotely sensed data is rapidly increasing. A 1981 Canadian survey showed eleven systems in operation and another nine planned for installation by the spring of 1983. With improved accessibility to systems, interest in learning how to use them is growing rapidly. However only a few training programs have been established to date, at Laval University, the University of British Columbia, and the Ontario Centre for Remote Sensing. Other programs are still in the planning stages.

In May 1981 CCRS sponsored a workshop for provincial agencies, universities and companies interested or involved in digital image analysis training. Information about training aids and material available from CCRS was distributed. Copies may be obtained from:

Canada Centre for Remote Sensing
Technical Information Service
717 Belfast Road
Ottawa, K1A 0Y7
Attention: Lidia Taylor
Tel. (613) 995-1210

In 1981-82 CCRS will be providing technical support to six workshops offered across Canada. The outline of each workshop will be different, but topics such as sources of digital remote sensing data, image corrections, enhancement and classification techniques, and output products will be covered, and applications specific to each region will be discussed. For further details, contact the coordinator of the workshop of interest to you.

Provincial workshops

1. Sponsors: Nova Scotia Land Survey Institute and Nova Scotia Remote Sensing Committee
   Coordinator: Mr. J. Wightman,
   Date: November 23-25, 1981
   Location: Lawrencetown, N.S.

2. Sponsors: New Brunswick Remote Sensing Committee and Department of Surveying Engineering, University of New Brunswick
   Coordinators: Dr. E. Derenyi,
   Department of Surveying Engineering,
   University of New Brunswick,
   P.O. Box 4400,
   Fredericton, N.B. E3B 5A3
   and
   Mr. W.R Trenholm,
   N.B. Remote Sensing Committee,
   C/o Agricultural and Land Planning Section,
   Department of Agriculture and Rural Development,
   Box 6000,
   Fredericton, N.B. E3B 5H1
   Proposed date: Feb. 22-24, 1982
   Location: Fredericton, N.B.

3. Sponsor: L'Association Québecoise de Télédétection
   Coordinator: Dr. Ferdinand Bonn,
   Laboratoire de Télédétection,
   Dépt. de Géographie
   Université de Sherbrooke
   Sherbrooke, P.Q. J1K 2R1
   Proposed date: March 22-24, 1982
   Location: Québec, P.Q.

4. Sponsor: Ministry of Forests, British Columbia
   Coordinator: Dr. R.V. Quenet or Mr. J. Nemeth
   Inventory Branch
   Ministry of Forests
   1450 Government St.
   Victoria, B.C. V8W 3E7
   Proposed date: Spring 1982
   Location: Victoria, B.C.

Industrial workshops

5. Sponsor: Control Data Canada Ltd.
   Coordinator: Ms. L. Shergold or Mr. J. Carr
   Control Data Canada Ltd.
   130 Albert St.
   Suite 1105
   Ottawa, Ont. K1P 5G4
   Proposed date: May 1982
   Location: Toronto, Ont.

6. Sponsors: Pegasus Earth Sensing Corporation and MacDonald Dettwiler & Associates (MDA)
   Coordinator: Mr. T.H.F. Reimchen,
   Pegasus Earth Sensing Corp.,
   4381 Gallant Ave.,
   North Vancouver, B.C.
   V7G 1L1
   Proposed date: Spring 1982
   Location: Vancouver, B.C.

REPORT ON THE SEVENTH CANADIAN SYMPOSIUM ON REMOTE SENSING

The Seventh Canadian Symposium on Remote Sensing was held from September 9 to 11, in Winnipeg, Manitoba. It was organized by the Manitoba Branch of the Canadian Institute of Surveying, and sponsored by the Canadian Remote Sensing Society of the Canadian Aeronautics and Space Institute.

The theme of the Symposium being "Down to Earth Management", most of the papers dealt with actual applications of remote sensing (aerial photography, Landsat, radar) in the management of Canadian resources. The sessions were organized under four sub-themes: Land Use Applications, Earth Science Applications, Ecological Applications, and Data Management and Acquisition. Approximately one-quarter of the papers were related to research being carried out in the Western provinces, which allowed the many Eastern Canadian participants to get a better grasp of the implications of remote sensing for Western Canada.

In parallel with the scientific activities, the organizing committee prepared a lively program of social activities reflecting the culture of Manitoba, including a cruise on the Red river, and a banquet of roast bison, followed by Eastern European folk dancing.

PURDUE '82

Papers are being solicited for the 8th International Symposium on Machine Processing of Remotely Sensed Data, which will be held on the campus of Purdue University in West Lafayette, July 7-9, 1982. January 15, 1982 is the deadline for submission of paper summaries on research and/or applications in either the general area of computer-aided digital data analysis, or the specific area of Crop Inventory and Monitoring. Summaries should be sent to Mr. D.B. Morrison, Purdue/LARS, 1220 Potter Dr., West Lafayette, IN 47906-1399.

CCRS REPORT PUBLICATIONS

Copies of the following reports are available, free-of-charge, from the CCRS Technical Information Service at 717 Belfast Road, Ottawa K1A 0Y7.

RESULTS OF A BENEFIT-COST ANALYSIS OF THE CCRS AIRBORNE PROGRAM
Users' Manual 81-1, Robert A. Ryerson

This report provides a detailed analysis of the benefits, costs and nature of the application for a sample of the CCRS airborne remote sensing projects flown up to and including 1978. Tangible benefits verified by users, and reported here, total $9 million to $15 million (1978 $) and $3.7 million continuing benefits. Although not all projects resulted in benefits, most did at least return their costs. Through careful study of the reports presented here, it is hoped that other potential users of airborne remote sensing will be able to better assess the potential applicability of remote sensing to their own data collection problems.

BASIC GUIDE TO SMALL-FORMAT HAND-HELD OBLIQUE AERIAL PHOTOGRAPHY
Users' Manual 81-2, Jack Fleming, Grant Dixon

The content of this manual is appropriate for the use of farmers, foresters, environmentalists, civil engineers and others who wish to make use of low-cost aerial photography to monitor local environments or to acquire permanent historical records. It provides a general overview of small-format oblique aerial photography, including pilot selection, flight planning, aircraft, cameras, films, filters and photo scale calculations. Appendices supply additional data on spectral curves of selected filters, and recommendations on film exposure and weather considerations. An annotated bibliography directs readers to sources of more detailed technical information.

SMOKE PLUME DEFINITION BY SATELLITE REMOTE SENSING
Users' Manual 81-3,
Thomas T. Alföldi, Julia M. Harvie

Landsat digital data is employed on the CCRS image analysis system to define the maximum extent and lateral distribution of a smoke plume. Two quantitative methods are detailed, in which either a single satellite image or two images of differing dates are used. Detailed instructions are given for the procedures to be followed, and accompanying figures provide an illustrated example.

1031506

REMOTE SENSING SATELLITES UPDATE

The Landsat-D satellite is still scheduled for launch at the end of July 1982. The Landsat-D system will still have the familiar 4 band multispectral scanner and a new advanced sensor, the Thematic Mapper (TM), that is designed to provide spatial, spectral and radiometric capabilities significantly more advanced than those of the present MSS. NASA has stated that the major objectives of the Landsat-D project are to:

- Assess the capability of the TM and associated systems to provide improved information for Earth resources management
- Provide, for both domestic and foreign users, a transition from MSS data to the higher resolution and data rate of the TM
- Provide for system level feasibility demonstrations together with NOAA and other user agencies to define the characteristics of an operational system including transfer of Landsat D/D[1] management from NASA to NOAA
- Provide for continued availability of MSS data
- Permit continued foreign data reception.

The spacecraft will be launched into a near polar orbit having a 98.22 degree inclination to the equatoral plane. The nominal altitude will be 705.3 kilometres and the orbital period about 98.8 minutes. At this planned orbit the satellite will have a repeat cycle of 16 days. Unlike Landsat 1, 2 and 3, Landsat-D will not provide adjacent track coverage on the next day but seven days later (i.e., each day the coverage advances seven orbital paths to the west). This is anticipated to provide better coverage for agricultural crop monitoring.

The swath width will be 185 kilometers with a 7% overlap on adjacent scenes. The pixel size will be 57 by 82 meters for the MSS and 30 by 30 meters for the TM.

The TM sensor will have seven spectral bands in the solar reflected region as follows:

Band 1	0.45	to	0.52 micrometers
Band 2	0.52	to	0.60 micrometers
Band 3	0.63	to	0.69 micrometers
Band 4	0.76	to	0.90 micrometers
Band 5	1.55	to	1.75 micrometers
Band 6	10.40	to	12.50 micrometers
Band 7	2.08	to	2.35 micrometers

Due to the lower orbit and modified coverage pattern, the present World Reference System (also known as the Fleming System after Betty Fleming of Canada's Surveys and Mapping Branch) will no longer be applicable. A system similar to the Fleming System has been set forth by NASA and is being studied by CCRS for inclusion into our processing systems. New orbit coverage maps will be generated and distributed to Canadian users when completed.

In January 1983, NOAA will become the operator and manager of the operational Landsat-D program, responsible for spacecraft control, the preprocessing of Landsat-D MSS-D data, and for archived and real time Landsat data services. NOAA, NASA and EROS Data Centre have programmed their individual and joint Landsat activities to meet this schedule.

Canada received Cabinet approval in March of this year to proceed with a program to receive, record, archive and preprocess Landsat-D data. The Prince Albert and Shoe Cove satellite stations are to be upgraded to receive the data from both the MSS-D and TM scanners. Prince Albert will also be upgraded to process the MSS-D and thematic mapper data to produce system corrected or bulk products for Canadian users. The Shoe Cove station will receive and record Landsat-D data and forward the recorded data, high density digital tapes, to Prince Albert for processing into images and computer compatible tapes.

It is planned to have both stations ready for reception, recording and archiving of data at the time of launch in 1982. MSS data will be processed for distribution from Prince Albert shortly after launch in October or November 1982. The TM data will be available in the summer of 1983. The distribution of TM data will be constrained by two factors. First, the TM processing system, which will not be available before the summer of 1983, and more importantly, the thematic mapper evaluation program being conducted by NASA following launch. The program is called Landsat-D image data quality analysis program, LIDQA. This program is scheduled to last a year. During the LIDQA program, TM data in very limited quantities is to be transmitted to receiving stations for operational tests and evaluation of both the processing system and the data. Canada intends to participate in this program and will have selected sites covered for this evaluation. The TM data

collected will be small and for evaluation only. Following the evaluation program, late in 1983, the TM is planned to become routinely operational but due to satellite system constraints coverage will be scheduled by NASA or NOAA providing Canada with some 7-10 scenes per day out of a total allotment of 250 scenes per day.

CCRS is planning to continue the same product lines for the MSS data. It is planned to provide TM data in an image format and a digital format on computer compatible tapes as either raw data or system corrected data.

Landsat II and III Status

At present, CCRS is routinely recording MSS data from Landsat II at Prince Albert and Shoe Cove, and RBV data from Landsat III at Prince Albert only. CCRS will record MSS data from Landsat III upon demand, however the scanner on Landsat III continues to have the line start problem which causes about 28% of the left side of the image to be missing or useless. Prince Albert has developed the capability to correct the data within the remaining 72% of the scene. Should Landsat II fail prior to Landsat-D launch, CCRS will switch to Landsat III for MSS data.

Reception and product generation of RBV data from Landsat III was to have begun at Shoe Cove next summer. This project has been terminated due to system problems at Shoe Cove, and the impending launch of Landsat-D, which will be followed by a planned shut down of Landsats II and III. RBV data will continue to be received and available from Prince Albert until the shut down of Landsat III.

Ordering Data Products

Please take note of the fact that ISIS Limited is no longer involved in the provision of satellite data products. Users are requested to contact the Canada Centre for Remote Sensing directly, at either the Prince Albert or Shoe Cove satellite Stations, or the User Assistance and Marketing Unit at 717 Belfast Road, Ottawa K1A 0Y7. Tel. 613-995-1210.

NOAA Status

AVHRR (Advanced Very High Resolution Radiometer) data from the NOAA and TIROS-N satellites has been routinely recorded and archived at the Shoe Cove station since 1976. AVHRR data products, imagery and computer compatible tapes, are available from Shoe Cove. Prince Albert routinely records NOAA AVHRR data on film and is implementing a capability to archive on magnetic tape and offer computer compatible tapes to Canadian users in 1982.

At present only the NOAA 6 and NOAA 7 satellites are active. TIROS-N was shut down in 1981 due to instrument and satellite problems.

LANDSAT COST INCREASES

Although no specific figures are yet available, CCRS has been informed that when LANDSAT-D is launched, the charges being levied by NOAA for the reception of LANDSAT MSS data at Prince Albert and Shoe Cove will be substantally increased, starting in 1983. If the station charges were to increase by a factor of four or five, as has been suggested, it will be necessary to build substantial increases into product prices over a period of years. More information will be provided when details of actual increased station charges become known.

OCRS SEMINARS

The Ontario Centre for Remote Sensing wishes to notify those who received its schedule of remote sensing seminars that the following courses are booked up until March, 1981:

General Remote Sensing Seminar for Mangers
Specialty Remote Sensing Seminar on Land Use Applications
Specialty Remote Sensing Seminar on Geological Applications
Photo Interpretation Course for Great Lakes - St. Lawrence Forest Conditions
Photo Interpretation Course for Boreal Forest Conditions

These courses will be repeated in 1982/83. Anyone wishing information on any of these courses is invited to contact:

Ontario Centre for Remote Sensing
Ministry of Natural Resources
880 Bay Street, 3rd Floor
Toronto, Ontario M5S 1Z8
Telephone 416-965-8411

Attention: Dr. Simsek Pala
Chief Scientist

Energy, Mines and Resources Canada | Énergie, Mines et Ressources Canada
Canada Centre for Remote Sensing

SATELLITE IMAGERY PRICE LIST (LANDSAT/NOAA/SEASAT SERIES)

Effective June 1, 1981

IMAGE SIZE	TYPE	SCALE	FORMAT	B&W	COLOR
185mm	MSS	1:1,000,000	Paper	$10.50	$20.00 (CIR) $17.50 (CIBACHROME)
185mm	RBV	1:500,000	Paper	$10.50	
185mm	NOAA/TIROS	Any	Paper	$10.50	
185mm	NOAA/TIROS	Any	Film Pos.	$12.80	
371mm	NOAA/TIROS	Any	Paper	$25.75	
742mm	NOAA/TIROS	Any	Paper	$45.00	
371mm	MSS	1:500,000	Paper	$25.75	$48.00
371mm	RBV	1:125,000	Paper	$25.75	
742mm	MSS	1:250,000	Paper	$45.00	$90.00
742mm	RBV	1:125,000	Paper	$45.00	
70mm	MSS	1:3,369,000	Film Pos.	$41.00/4 band strip	
70mm	MSS	1:3,369,000	Film Neg.	$84.00/4 band strip	
185mm	MSS	1:1,000,000	Film Pos.	$12.80	$22.00
185mm	RBV	1:500,000	Film Pos.	$12.80	
371mm	MSS	1:500,000	Film Pos.	$32.00	
371mm	RBV	1:250,000	Film Pos.	$32.00	

COMPUTER COMPATIBLE TAPES

TYPE	TRACKS	BPI	FORMAT	PRICE
4 Band MSS	9	1,600	Tape Set	$230.00 (including tape reel and Band 5 print)
DICS	9	1,600	Tape	$200.00 (per sub-scene with colour print) †
NOAA (5 Bands)	9	1,600	Tape Set	$100.00 (tape reel and Band 5 print)
SEASAT	9	6250/1600	Tape Set	$250.00 (magnetic tape only)

	Microfiche		Fax*
$220.00/month	$2,200.00/year	(ORBITS 7 to 90)	$ 27.00/image
$ 41.67/month	$ 500.00/year	(ORBITS 1 to 9)	$ 100.00/day (limit of 4 images/day)
$ 91.67/month	$1,100.00/year	(ORBITS 1 to 30)	$ 2,900.00/month (up to 130 images) $33,000.000/year (up to 1500 images)

SPECIAL SERVICES CHARGES

Handling Charges: $5.00 per order

RUSH ORDERS:
1. To the carrier within 24 hours of reception of the order: Unit price X 3
2. For rush orders which cannot be handled under normal production conditions: Unit price X 2

DELIVERY AND HANDLING

1. Postage extra to customers outside Canada.
2. Registered mail and special delivery charged directly to customer.
3. Courier services charged directly to customer.

† The price of $200.00 for a DICS sub-scene as stated on the current price list applies to images for which the Geometric Correction Transformation has not been derived. For second or subsequent sub-scene from the same image, or for the first sub-scene from an image for which the Geometric Transformation has already been determined, a price of $110.00 applies.

*Orders in excess of 1500 images are to be referred for pricing.

Please note: Prices are subject to change annually on 1 April.

CONFERENCES

A list of meetings, conferences, courses, etc. in the areas of remote sensing, pattern recognition, computers and computer applications, space surveying and mapping and other related topics.

December 1981 - March 1982

20th Conference on Radar Meteorology
November 30 - December 3, 1981
Boston, Mass.

Infrared and Millimeter Waves Conference
December 7-11, 1981
Miami Beach, Florida

Soils Workshop
December 7-11, 1981
LARS/Purdue University
West Lafayette, In.

AGU Fall Meeting
December 7-11, 1981
San Francisco, Calif.

Matching Remote Sensing Technologies & Their Applications: international conference
December 16-18 1981
Remote Sensing Society
London, Eng.

Opening New Cartographic Frontiers in Latin America: technology exchange week
January 25-29, 1982
American Society of Photogrammetry
Panama City, Panama

Alaska Surveying and Mapping Conference
January 25-29, 1982
Anchorage, Alaska

International Society for Optical Engineering Conference
January 25-29, 1982
Los Angeles, CA

Course on Principles of Data Processing for Earth Scientists
February 1-5, 1982
USGS
Reston, VA

Digital Image Processing
February 8 - March 5, 1982
USGS
Flagstaff, Arizona

Third International Geodetic Symposium on Satellite Doppler Positioning
February 8-12, 1982
New Mexico State University
Las Cruces, N.M.

12th International Congress of Soil Science: Managing Soil Resources to Meet Challenge of Mankind
February 8-16, 1982
New Dehli, India

ACM Annual Computer Science Conference
February 9-11, 1982
Indianapolis, Ind.

Tenth Alberta Remote Sensing Course
February 22-26, 1982
University of Alberta
Edmonton, Alberta

1982 ACSM-ASP Annual Convention
March 14-20, 1982
Denver, CO

April 1982 - June, 1982

Computer Network Performance Symposium
April 13-14, 1982
ACM
College Park, Maryland

International Symposium on Advances in Quality of Image Data
April 14-16, 1982
ISP
Canberra, Australia

Conference on Lasers and Electro-Optics (CLEO)
April 14-16, 1982
Phoenix, Arizona

Canadian Institute of Surveying Symposium and Annual Meeting
April 19-23, 1982
Ottawa, Ontario

Workshop on Applications in Geologic and Hydrologic Exploration and Planning
April 26 - May 28, 1982
EROS Data Center
Sioux Falls, SD.

Course on Management of
Large Space Projects
May 3-14, 1982
CNES
Toulouse, France

Geological Association of
Canada and Mineralogical
Association of Canada Joint
Annual Meeting
May 17-19, 1982
Winnipeg, Manitoba

Twenty-Fourth Plenary Meeting
of COSPAR
May 17 - June 3, 1982
Ottawa, Ontario

Second International Conference
on Geological Information
May 23-27, 1982
Colorado School of Mines
Golden, CO

International IEEE/AS-P
Symposium and USNC/URSI
Meeting
May 24-28, 1982
University of New Mexico
Albuquerque, NM

1982 International Geoscience and
Remote Sensing Symposium (IGARSS '82)
June 1-4, 1982
Munich, Germany

XXIV Plenary Meeting COSPAR,
including Symposium on Changes
in the Earth's Surface as
revealed by a Decade of
Observations from Space
June 1-2, 1982
Ottawa, Ontario

Sixteenth International
Symposium on Remote
Sensing of Environment
June 2-9, 1982
ERIM
Buenos Aires, Argentina

International Symposium on
Materials Used On-Board
Satellites and Space Probes
June 8-11, 1982
ESA/CNES/CERT
Toulouse, France

International Symposium on
Hydrometerology
June 13-17, 1982
Denver, CO.

Canadian Hydrology
Symposium - Hydrological
Processes of Forested Areas
June 14-15, 1982
University of New Brunswick
Fredericton, N.B.

11th International Laser
Radar Conference
June 21-25, 1982
AMS
Madison, Wis.

Thirteenth International
Symposium on Space Technology
and Science
June 28 - July 3, 1982
Tokyo, Japan

July 1982 - September

Eighth International Symposium
on Machine Processing of Remotely
Sensed Data
July 7-9, 1982
LARS
West Lafayette, IN

Symposium on Hydraulic Applications
of Remote Sensing and Remote Data
Transmission
July 19-30, 1982
Exeter, U.K.

Summer School on Remote Sensing
Applications in Marine Science
and Technology
July 25 - August 14, 1982
European Assoc. of Remote
Sensing Labs.
Dundee, Scotland

Joint Oceanographic Assembly
August 2-13, 1982
IOC-UNESCO
Halifax, N.S.

Advances in Photogrammetric and
Remote Sensing Instrumentation for
Processing and Analysis of Data
August 30 - September 3, 1982
ISP
Ottawa, Ontario

Workshop on Applications in
Vegetation Assessment and Land
Use Planning
August 30 - October 1, 1982
EROS Data Center
Sioux Falls, SD.

International Symposium on
Precision and Speed in Close
Range Photogrammetry
September 5-10, 1982
ISP
University of York
Heslington, York, England

International Society for
Photogrammetry and Remote
Sensing: Commission VII
data interpretation
September 13-17, 1982
GDTA
Toulouse, France

October 1982 -

Optical Society of America
Annual Meeting
October 18-22, 1982
Tucson, Arizona

Annual Technical Conference
on Remote Sensing and the
Atmosphere
December 15-17, 1982
Remote Sensing Society
Liverpool, England

If there are subject areas which you would like to see covered, conferences which have been missed or upcoming conferences which you are aware of or for further information contact:

Canada Centre for Remote Sensing,
TIS (Lidia Taylor),
717 Belfast Road,
Ottawa, Ontario. K1A 0Y7
tel. (613) 995-1210

BOOKSHELF

Infrared imaging systems technology, Jerrold Zimmerman and William L. Wolfe, eds., Bellingham, WA, Society of Photo-Optical Instrumentation Engineers, 1980.

Thermosense I: First National Conference on the capabilities and limitations of thermal infrared sensing technology in energy conservation programs, Chattanooga, Tennessee, September 20-21, 1978, Falls Church, VA, American Society of Photogrammetry, 1979.

Thermosense II: Second National Conference on thermal infrared sensing technology for energy conservation programs, Albuquerque, New Mexico, November 7-9, 1979, Falls Church, VA, American Society of Photogrammetry, 1980.

Ghosh, Sanjib K. Analytical photogrammetry, New York, Pergamon Press, 1979.

Remote sensing of atmospheres and oceans, Adarsh Deepak, ed., New York, Academic Press, 1980.

Terrain analysis and remote sensing, John R.G. Townshend, ed., London, George Allen and Unwin, 1981.

Satellite Hydrology, Fifth Annual W.T. Pecora Symposium, Proceedings, June 10-15, 1979, M. Deutsch, D.R. Wiesnet and A. Rango, eds. Available from American Water Resources Assn., Minneapolis, Minnesota, 55414.

Glossary of Technical Terms in Computer Assisted Cartography - Glossaire de Termes Techniques pour la Cartographie Assistée par Ordinateur, International Cartographic Assn. 1980. Available from: ACSM, 210 Little Falls St., Falls Church, VA 22046, U.S.A.

Kroek, Dick. Everyone's space handbook: a photoimagery source manual, Arcara, CA, Pilot Rock Inc., 1976.

Manual of photogrammetry, Chester C. Slama, ed., 4th. ed., Falls Church, VA, American Society of Photogrammetry, 1980.

Spaceborne synthetic aperture radar for oceanography, Robert C. Beal, ed., Baltimore, MD, Johns Hopkins University Press, 1981.

Wiesnet, D.R. Applications of remote sensing to hydrology, Geneva, Switzerland, World Meteorological Organization, 1979.

Practical applications of remote sensing to timber inventory, Edmonton, Alberta, September 26-28, 1979. Published by Northern Forest Research Centre, 1980.

Harvard Library of Computer Graphics. Mapping Collection. Cambridge, MA, 1979 11v.

INTERNATIONAL SOCIETY FOR PHOTOGRAMMETRY AND REMOTE SENSING

COMMISSION II SYMPOSIUM

PRELIMINARY APPLICATION FORM

Please address all correspondence to:

Canadian Institute for Surveying,
Box 5378, Station "F",
Ottawa, Ontario, CANADA. K2C 3J1

NAME:_____ ADDRESS:_____

_____

_____

Please assist our planning by checking the appropriate boxes:

I will attend
almost certainly
possibly
and be accompanied by _____ additional persons
(number)

I would like _____ tickets to the banquet
(number)