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# THE CANADIAN ADVISORY COMMITTEE ON REMOTE SENSING

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REPORT

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Dr. K. Whitham  
Chairman  
Interagency Committee on Remote Sensing  
Department of Energy, Mines and Resources  
Ottawa, Ontario  
K1A 0E4

Dear Dr. Whitham:

The theme of the 1984 Canadian Advisory Committee on Remote Sensing (CACRS) meeting was "The Economics of Remote Sensing in Canada".

Using a panel format, CACRS members were briefed on a number of economic studies which had been conducted during the year, as well as on the newly announced funding for the space program, and were given an opportunity to comment, both by questioning the panelists and during subsequent workshops. The presentations made were:

The Internal Review of CCRS Activities  
The Economic Studies of RADARSAT  
The Canadian Space Program  
Economic Studies in B.C.  
Québec  
Ontario

Philip Lapp  
Oliver Kent, Price Waterhouse  
W.M. Evans, MOSST  
Frank Hegyi  
Claude de Saint-Riquier  
L.W. Morley

Comments on the studies were generally favourable although the Québec delegation felt that the amount of money being devoted to marketing and technology transfer was too small if the forecast benefits were to be realized in reasonable time. Other recommendations related to areas such as crop monitoring and oceanography presently receiving insufficient support.

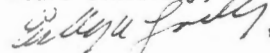
Following up on the Auditor General's recommendation, CCRS presented a proposal for a national goal setting exercise which received little support and the CACRS members suggested, as an alternative, that CCRS establish goals in its long term plan and allow the CACRS members to provide comment.

The after-dinner speaker for the meeting was Dr. Roberta Bondar, one of the six candidates for the flights aboard the NASA Shuttle. This provided an opportunity for CACRS members to learn about the Canadian Shuttle experiments and for Dr. Bondar to view the various displays and get an appreciation of the breadth of the Canadian Remote Sensing Program.

The displays presented by the federal and provincial agencies were much expanded over last year and provided an excellent means of showing the latest developments in remote sensing occurring all across the country. This has become a regular feature of the CACRS meeting.

The group made 41 recommendations of which 7 will be referred to IACRS.

Yours sincerely,



E.A. Godby  
Chairman, Canadian Advisory  
Committee on Remote Sensing

12 October 1984



EXECUTIVE SUMMARY

1983 ANNUAL REPORT

CANADA CENTRE FOR REMOTE SENSING

CANADIAN ADVISORY COMMITTEE ON REMOTE SENSING



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## 1.0 EXECUTIVE SUMMARY

The following is a summary of the discussions that occurred at the annual meeting of the Canadian Advisory Committee on Remote Sensing, which took place at Arnprior, Ontario, from April 16-19, 1984. The attendees at the meeting included the provincial representatives, chairmen of the various CACRS working groups, representatives of specialty groups, representatives of the provincial and national remote sensing societies, and invited speakers from Canadian industry specializing in economic studies.

### Objectives of the Meeting

The general topic of the meeting was "The Economics of Remote Sensing in Canada". Presentations were made in plenary session by members of an economic panel, chaired by Mr. Leslie Whitney, on the following topics:

- (a) the current status of remote sensing in Canada, based on a report prepared in 1983 by Philip A. Lapp and Associates Ltd;
- (b) several provincial economic studies recently carried out in Ontario, Québec, and British Columbia;
- (c) a methodology to predict the economic benefits of remote sensing to Canada in the 1990s, based on a report prepared for the RADARSAT program by Price Waterhouse Associates;
- (d) the Canadian Space Plan (1984-89), recently approved by the federal Cabinet;
- (e) a possible scenario for an approach to determining long-term goals and preparing a plan of action for the entire Canadian remote sensing program, consisting as it does, of agencies of the federal, provincial, and territorial governments, Canadian industry, universities, and the private sector.

The plenary group was then broken down into workshop groups, one focusing on oceans and ice, one dealing with crop monitoring, and four representing the various regions of Canada (Atlantic, Québec, Ontario, the West). These workshop groups were asked to address the following topics:

- (a) Do you support the level of economic benefits claimed in the Price Waterhouse report for the various user groups? If not, do you think additional economic studies are justifiable?

- (b) If you agree that the benefits claimed are realistic, what do you see as the critical gaps in our current programs and activities (e.g. lack of basic research, insufficient remote sensing infrastructure) that are impeding us from achieving the full range of benefits? Can you rank these gaps for the various user categories?
- (c) Do you agree that the proposed goal-setting process (item "e" above) is an appropriate activity for bridging these gaps?

The conclusions are summarized below.

### Results of the Discussions

The workshop group on **Oceans and Ice**, led by Dr. Jaan Kruus, examined the potential benefits described for the 1990s (e.g. \$12 million annually to East Coast oil and gas development and general shipping; \$20 million annually to Arctic oil and gas development; \$298 million capital cost saving in each half of the decade resulting from reduced disruption during construction of production facilities; a lessening in the number of tankers required; and an extension of the drilling season for exploration and development purposes). The group concluded that these forecast benefits seem reasonable, provided that the assumptions used in their preparation remain valid; the scenarios regarding Arctic and East Coast oil and gas development must be reviewed regularly and the potential benefits adjusted periodically if necessary. The group felt that additional studies would be useful in the following areas:

- (a) determining the benefits of scatterometer data, particularly for wind and wave forecasting;
- (b) evaluating in more detail the operational benefits of iceberg location and tracking;
- (c) studying chlorophyll and ocean colour.

In terms of work needed to fill the observable gaps in the program, the group felt: that further development of an Ice Forecast Centre with integrated data from many sources was essential; that further work should be done on handling iceberg data (e.g. developing models to integrate data on ocean currents); that models should be developed to enhance use of scatterometer data; and that ocean biological resource management is an area still requiring study and coordination, both nationally and internationally. Finally, the group concluded



that the goal-setting exercise suggested seemed acceptable although clearer instructions were required; the danger, it seemed to them, lay in the apparent separation of remote sensing technology from other equally important components of the integrated applications process.

The workshop group on **Crop Monitoring**, led by Ms. Diane Thompson, agreed that the forecast benefits seemed of a reasonable order of magnitude (approximately \$50 million annually for wheat forecasting, and \$10 million annually for other crops, if radiometer data were available, 10% less if not). In general, however, more detailed investigation is required into the value of remotely sensed information of all types to the decision-makers and planners in the agribusiness community; such an investigation should also take into account complementary sources of information available for domestic and international crop monitoring. Economic studies undertaken in the future should be more fully supported by relevant demonstration projects; for example, the group felt that the likelihood of Phases C and D of the RADARSAT program receiving approval will be enhanced by successful demonstration projects in the 1984 and 1985 growing seasons. Since Canada does not at present have the capability to monitor crop conditions regularly or to respond rapidly to unusual crop conditions in Canada and abroad, and since to date no pilot crop monitoring project has yet been performed, the group perceived an immediate need for interested groups in Canada (Dept. of Agriculture, Canadian Wheat Board, Statistics Canada, and CCRS) to initiate such a project, using available resources. It was noted that the CACRS Working Group on Agriculture has just been reorganized to incorporate a subgroup on Crop Information Systems. The group also saw an organizational weakness in the shortage of initial capital needed to finance the heavy front-end costs of implementing operational remote sensing programs in user agencies. Additionally, members of the group felt that there has been insufficient co-operation between government and industry in developing foreign markets for remote sensing hardware and services. Finally, the group agreed with the objectives of the goal-setting exercise but advised that the process should not in any way interfere with ongoing federal and provincial initiatives.

The **Atlantic Region** workshop group, led by Mr. Lawrence Peters, supported the level of benefits forecast for the 1990s in the Price Waterhouse report, though believing that the potential benefits would be increased, if updated, in the fields of coastal region moni-

toring, forestry and hydrology. They also saw a need for a changed approach to the concept of benefit forecasting, to include a more stable ongoing economic model and to incorporate a multi-level approach to regional benefits. The greatest gap in the success of the remote sensing program in the Atlantic region at present is the uncertainty about availability of LANDSAT data; a more guaranteed data source on an ongoing basis is required. To build on the success of the Technology Enhancement Program, provincial economic studies should be carried out, and follow-on projects should be co-ordinated with provincial resource management agencies to provide a catalyst to give greater visibility to the program. A wider range of standard products such as quicklook 9" x 9" and a greater consistency in the quality of computer-compatible tapes would also be of assistance.

The **Québec** workshop group, led by M. Hervé Audet, agreed that the forecast benefits for the 1990s seem realistic in principle, but pointed out that some previously forecast benefits have not yet been rendered into real benefits. They did not, however, consider it necessary to carry out further economic studies at this time; rather, they maintained, efforts should be made to provide the financial support necessary to produce the products and services necessary for the realization of the forecast benefits. Increased support of marketing and technology transfer are essential if full benefits are to be achieved. In normally recognized business circumstances, approximately 40% of a budget should be spent on product availability, quality assurance, marketing, applications development, and transfer to users; this budget ratio should be worked towards in the national remote sensing program, according to the Québec group. The group, many of whom had taken part in a similar workshop at the 1983 CACRS meeting, felt that the recommendations made at that time have not yet been fully implemented, and that to do so would help solve present problems. There have been many activities within Québec in the last year funded by the province in the realm of technology transfer, and the group recommended that Québec not be penalized for having undertaken such activities but rather that CCRS budget funds for Québec in the coming year through the Technology Enhancement Program, and that CCRS support and encourage the remote sensing applications industry now developing in Québec. The workshop group did not feel they had sufficient information to comment on the goal-setting exercise.

The **Ontario** workshop group, led by Dr. Peter Kourtz, recognized the validity of

the Price Waterhouse economic study, but felt that it would be useful to see benefit figures broken down into hard, uncertain, and potential high-yield dollars. Whereas benefits are often intangible and difficult to assess in the remote sensing field, any kind of funding provided for Canadian activities will have a ripple effect through the economy. In general, the cost to the taxpayer is balanced by the benefit to Canadian industry, to the employment situation, and to engineering expertise in Canada. Benefit studies might have more credibility if they were reassessed after the fact. The group felt that to bridge the critical gaps currently observed, the following actions are required, particularly by CCRS: funding of experiments to prove or disprove benefits, to be conducted by all components of the national program; description of future competitive data sources; provision of a more detailed technical description of the proposed design of RADARSAT and its proposed priorities of use; involvement of universities, with government funding, in analysis of radar data; funding of further development of methodologies for certain applications such as change detection; reassessment of the source of supply of the proposed optical sensor for RADARSAT.

The Western Region workshop group, led by Mr. Bill Best, supported the existing forecast of benefits and thought it unlikely that further studies would reach different conclusions. The difficulties they saw in reaching real success lay mainly in information gaps: up-to-date information is not always available, and announcements of opportunity are insufficiently advertised. Some members also felt that the proposed publication, "Remote Sensing: The Canadian View", might not fully represent the national remote sensing program and all its activities across Canada. They regretted the lack of a CCRS software catalogue and the difficulty in obtaining some products such as 70 mm positives, 9 x 9 negatives, and density-matched products. They also felt that the policy regarding ferry charges for airborne projects is unclear, and that it is difficult to differentiate between operational and research-oriented airborne projects. With regard to the goal-setting process, they felt that CCRS should allow its own goals to be examined and commented on by regional users, revising its goals if necessary, but they saw little need for goals for other components of the national program.

#### **IPTASC Recommendations**

The Interprovincial/Territorial Advisory Subcommittee, representing all the provincial and

territorial governments in Canada, made the following recommendations:

- (a) that CCRS reopen talks with NOAA to gain reception rights to LANDSAT data obtained over eastern Canada and received at the new SPOT ground station.
- (b) IPTASC reassures CCRS of its support for inclusion of a VIR sensor in the RADARSAT system. Regarding spectral and spatial resolution of the sensor, IPTASC will submit a recommendation to the RADARSAT office by May 31, 1984.
- (c) that CCRS fund a contest aimed at designing "video games" based on satellite imagery. The contest should have a prize, say, a total amount of \$10,000. It is hoped that such an action would publicize remote sensing among the general public.
- (d) that Dr. Lawrence W. Morley be appointed as an honorary member of CACRS in recognition of his services to remote sensing.



## 2.0 THE CANADIAN ADVISORY COMMITTEE ON REMOTE SENSING (CACRS)

### Introduction

The Canadian Advisory Committee on Remote Sensing (CACRS) was established in January 1972 to effect the development of a national program of remote sensing. Membership in the committee comprises representatives of provincial and federal organizations, industry and universities. Most members represent a government agency or national working group and thus ensure a broad representation of users, scientists and technologists. Annual meetings are held each calendar year to review programs and make recommendations.

### Terms of Reference of CACRS

The Canadian Advisory Committee on Remote Sensing has the following purposes:

1. Advising and assisting the Government of Canada, through the Minister of Energy, Mines and Resources, in meeting the objectives of the national program of remote sensing, by assessing national needs and capabilities and making recommendations regarding existing and proposed programs funded by EMR.
2. Advising and assisting all participants in the national program of remote sensing in the application of remote sensing techniques to the nation's resource management systems by:
  - studying the need for technology transfer to the end-user and industry;
  - promoting the active participation of interested parties in the execution of such transfer, and facilitating the coordination of their efforts;
  - evaluating the results.
3. Promoting the development and diffusion of remote sensing methods and applications by:
  - promoting research and development activity;
  - exchanging scientific and technical information;
  - organizing conferences, seminars, and training courses.

### Structure of CACRS

The Canadian Advisory Committee on Remote Sensing is structured as follows:

- Chairman: Director General, CCRS
- Executive: An executive committee was established in 1981 with terms of reference and structure described immediately below.
- IPTASC: The Interprovincial/-Territorial Advisory Subcommittee of CACRS is a body of representatives appointed to CACRS on the recommendation of the provinces and territories.
- Working Groups: CACRS established such working groups as it deems necessary to carry out its work.
- Some of the groups may operate on an ongoing basis, while others may be ad hoc groups appointed to carry out a specific task and then disbanded upon completion of the task.
- Secretariat: Provided by CCRS.

### Terms of Reference of the CACRS Executive

The Canadian Advisory Committee on Remote Sensing has an Executive with the following functions:

1. To analyze and rank, in order of priority, the recommendations of CACRS.
2. To decide on realistic methods of implementing these recommendations.
3. To review and approve the work plans of the working groups and to provide guidance to improve effectiveness.
4. To approve the establishment and terms of reference of limited-life working groups to meet specific needs.
5. To oversee special studies.
6. To prepare plans for and to oversee the reorganization or evolution of CACRS.
7. To plan and coordinate the organization of the annual CACRS meeting.

8. To approve a summary of the results and recommendations of the annual CACRS meeting for transmittal to a higher authority (i.e. IACRS in the case of the federal government).
9. To review the above-listed Terms of Reference at the CACRS annual meeting.

#### Structure of the CACRS Executive

The representation on the CACRS Executive is as follows:

Chairman:	Director General, CCRS.
Provinces:	Chairman, Vice-Chairman, and Past Chairman, IPTASC (Inter-provincial/Territorial Advisory Subcommittee of CACRS).
Working Groups:	Two representatives elected by the working group chairmen, to be appointed for a two-year term.
Industry:	A representative of Canadian industry may be invited on an as-required basis to address a particular agenda item at an Executive meeting.
Universities:	The Chairman, Education Working Group.

### 3.0 RECOMMENDATIONS OF CACRS

These recommendations have been extracted from the reports of the provinces, the specialty working groups, and the provincial remote sensing associations (which may be found in full in the minutes of the 1984 CACRS meeting) and from the reports of the workshop groups which met during the annual meeting of CACRS. These recommendations have been considered by the CACRS Executive, and the comments of the Executive have in some cases been expanded upon by CCRS.

#### 3.1 Continuity of Data

- 3.1.1 IPTASC strongly recommends that CCRS reopen talks with NOAA to gain reception rights to LANDSAT data obtained over eastern Canada and received at the new SPOT ground station.

##### - IPTASC

CCRS is not optimistic about achieving immediate success in this matter, but will continue discussions with NOAA. It is probable that the financial situation will become clearer after commercialization has developed further in the United States. In the meantime, the situation remains that Canada cannot afford to pay full station fees for two LANDSAT receiving stations.

- 3.1.2 Whereas the Agriculture Working Group recognizes the importance of early availability of foreign LANDSAT data to Canadian grain marketing agencies involved in crop information studies, and whereas the Canadian government through the International Affairs Subcommittee on Space Policy (IASP) and the Interdepartmental Committee on Space (ICS) are involved in negotiations with other countries in the development and availability of hardware/software systems for remotely sensing data systems, it is recommended that:

IASP and ICS, through the Canada Centre for Remote Sensing, be aware of the Canadian requirements relevant to agriculture for timely foreign LANDSAT MSS and similar data and include the provision for such requirements in these negotiations when feasible.

##### - Agriculture Working Group

This recommendation will be forwarded to IACRS. In the meantime, the CACRS Executive note that Agriculture Canada is represented on the RADARSAT Review Board, which aids in maintaining awareness at senior levels of the need for agricultural data, both nationally and internationally.

- 3.1.3 Whereas applications of remote sensing have not yet reached an advanced stage, and whereas the Québec organizational structure is fragile with respect to remote sensing applications, we recommend the following:

that CCRS provide continuity and improvements in satellite data distribution.

In the event that distribution is transferred to private industry, that CCRS maintain careful control over the prices of essential data.

This recommendation aims to avoid the repercussions on some applications of a sudden and substantial increase in the costs of distribution and the risk of collapse of the organizational structure now developing in Québec around remote sensing applications.

We congratulate CCRS for all the measures it has taken to provide adequate continuity and to improve its satellite data acquisition; we hope that these include access to SPOT data and the addition of an optical sensor to RADARSAT.

##### - Québec

CCRS certainly agrees to pursue its efforts to provide continuity and improvements in user services.

It is certain that conditions of transferring data production and distribution to industry, if such a transfer takes place, will include the setting of a reasonable rate structure, probably of the same order of such rates applied elsewhere in the world.

#### 3.2 Continuity of Data - East Coast Concerns

- 3.2.1 The Nova Scotia user community has grave concerns regarding the availability of satellite data for ongoing

monitoring programs. Cloud-cover conditions in this area necessitate repeat cycles that are as frequent as possible, in order to provide cloud-free coverage equivalent to that of other areas in Canada. It is therefore recommended that CCRS ensure that Nova Scotia receive at least as much SPOT and LANDSAT-4 and 5, TM and MSS coverage as other provinces.

- Nova Scotia

- 3.2.2 It is expected that when LANDSAT-4 and LANDSAT-5 are operational at the same time, coverage in Nova Scotia will not be the same as in the other provinces of Canada closer to PASS. If this is the case, it is recommended that efforts be made to minimize the disparity in coverage.

- Nova Scotia

CCRS has written to NOAA to request clarification of whether they can supply 8-day coverage of Canada's Atlantic Provinces. Users will be informed when a response to this letter is received. In the meantime, this letter has been circulated to the members of IPTASC in the Atlantic Provinces.

- 3.2.3 Physiographic and land-use patterns in the Maritime region require access to higher resolution satellite data (20 to 30 metres) to obtain for most applications the same level of operational functionality enjoyed in other regions of Canada. It is therefore recommended that data acquisition and applications development projects for these data (TM, SPOT) be given the highest priority using Maritime data.

- Nova Scotia

CCRS appreciates the need in the Atlantic Provinces for higher resolution data and has already made a commitment (see the 1982 CACRS Report) to provide data to all Canadian users on an equitable basis. To accomplish this, CCRS is receiving and processing HDDT's of Canadian TM data from Goddard. In addition, when the second SPOT receiving station is built in eastern Canada, SPOT data over the Atlantic region will be automatically received and archived.

- 3.2.4 Gregory Geoscience Ltd. recommends that CCRS maintain a listing of imagery of Newfoundland acquired by NASA, including information on image quality and cloud cover. The company also finds the 4 to 6-week period between ordering and receiving imagery too long, especially for small, urgent projects.

- Ontario

Sioux Falls provides a listing of all data that have been processed; some data, however, will not be listed because, although received, they are not yet processed. CCRS has access to the on-line Sioux Falls database to obtain immediate information about what data are available. CCRS further suggests that users contact CCRS to find out if data are available and then check the NOAA data on the same date to observe cloud cover before ordering. As far as speed of delivery is concerned, CCRS suggests that users request use of courier service or of Post Office Special Delivery, rather than trust the regular mail.

- 3.2.5 As useful LANDSAT-4 data were not collected in large amounts over New Brunswick, it is recommended that efforts be made to continue to support the LIDQA project until adequate assessments can be made by provincial users.

- New Brunswick

The purpose of LIDQA was to evaluate the TM sensor. Although very few useful scenes were obtained with LANDSAT-4, it has been possible (using mostly U.S. scenes) to evaluate TM performance. Now that a limited production capability is operational, LANDSAT-5 TM scenes will be sold at prices to be approved. As of April 1, 1984, CCRS ceased distribution of data for LIDQA.

3.3 Technology Enhancement Program

- 3.3.1 It is recommended that CACRS and IPTASC place top priority on strategies for promoting the introduction of remote sensing technology into operational programs of the provinces and territories in forestry, agriculture, land-use monitoring, crop inventory, studies of water resource quality and quantity, and wildlife ecology, with

particular emphasis on ongoing monitoring as opposed to one-time mapping.

- Ontario

This recommendation will be brought in particular to the attention of IPTASC. The Ontario Centre for Remote Sensing comments that it for one is already carrying out this recommendation, but no doubt the members of IPTASC can assist in this process in other less advanced provinces. The Technology Enhancement Program is a definite step in the process, and CCRS is now providing greater financial resources to applications development in general than in the past. In addition, some CCRS staff are now being moved into a renewed User Assistance and Marketing Unit.

- 3.3.2 Whereas there is a widening gap between the front line of new developments in remote sensing and the practical application of remote sensing at the user/resource management level, and whereas there is a definite need for new developments to be included in the list of remote sensing tools available, and for "old" knowledge to be reinforced, it is recommended that:

CACRS urge CCRS to sponsor a series of regional workshops emphasizing remote sensing technology in resource management. Such workshops should include all forms of remote sensing and include visual as well as digital techniques; and

whereas there are limited budget (3% for application development) and personnel available at CCRS to involve in technology transfer workshops, it is recommended that:

CACRS urge CCRS to find some method to avail itself of expertise outside the CCRS organization to augment the technology transfer program; and

whereas the technology transfer program is directed at the grass roots resource management user, and whereas there are growing efforts in the application of digital image analysis, and whereas there has been a dramatic impact of the personal computer (PC) on the average person, and whereas developments have proceeded in the

United States of America in the use of the PC in LANDSAT image analysis, it is recommended that:

CACRS urge CCRS to foster the use of the personal computer in remote sensing applications and strive to make LANDSAT (and/or other satellite) subscenes available in some chosen format(s) on diskettes or floppy disks for use in the personal computer.

- Forestry Working Group

CCRS wishes to point out that funds to support regional workshops are available through the Canadian Remote Sensing Society, to which CCRS gives an annual grant for just such purposes.

CCRS is studying the whole subject of microcomputers and new data formats, and this will also be a topic specifically addressed to the attention of Peter Kourtz's new working group for users of image analysis systems. CCRS notes that one of the Technology Enhancement Program projects, snow monitoring in New Brunswick, has now become operational and has been transferred to an industry possessing a microcomputer.

- 3.3.3 Professor R. Protz of the University of Guelph calls for a thorough review by the federal government of how the data and information presently available can be transferred to many more users within smaller political units (e.g., counties and townships).

- Ontario

See answer to 3.3.1. This recommendation will be referred to the User Assistance and Marketing Unit when it is staffed.

3.4 SPOT

- 3.4.1 It is recommended that agreement with SPOT-IMAGE be finalized as soon as possible so that Canada will play a major role in this program.

- Ontario

Canada will very shortly sign a Memorandum of Understanding with SPOT IMAGE, concerning reception of SPOT data in Canada.



3.4.2 It is recommended that measures be taken to provide reception and distribution of SPOT data in Canada as soon as possible.

- Forestry Subgroup

See answer to 3.4.1.

3.5 **Applications Development**

3.5.1 It is recommended that the Radar Subcommittee meet in February or March 1984 to resolve the following items.

(a) What portion of the 1983 SAR Melfort data set will be analyzed at CCRS and what analysis projects will be available to other agencies?

(b) What is the need and rationale for collecting additional data from other prairie test sites and other parts of Canada in the 1984 growing season?

- Agriculture Working Group

This recommendation was referred to the Working Group for action. A meeting of the Radar Subcommittee is being held in May 1984, now that Phase B of the RADARSAT program has been approved.

3.6 **Data Acquisition and Image Processing**

3.6.1 It is recommended that CCRS support be given to help initiate a study to review the capabilities of the available technology in ice reconnaissance. In this way a clearer picture will emerge of current capabilities, gaps in available technology and other areas requiring work and support. It is envisaged that an independent source (such as a university engineering group) could evaluate the ice remote sensing status, problems and needs, and recommend the systems, analysis and/or data integration packages which could be supported.

- Working Group on Ice

Budgetary constraints permitting, CCRS does intend to conduct such a review, notably in the context of RADARSAT Phase B studies dealing with user requirements in the ice reconnaissance area. J.C. Henein will consult with

the Chairman of the Working Group on Ice concerning this matter.

3.6.2 It is recommended that CCRS continue to work towards making the end products of a remote sensor consistent in their representations of the same, or like, objects. This is seen to involve development of calibrated responses throughout systems, so that, in particular, multirate imagery and image greytone can be compared in terms of environmental variables and not sensor adjustment, function, or alignment.

- Working Group on Ice

CCRS acknowledges the need expressed in this recommendation, and views it as an ongoing problem. Several approaches to the problem are being made, including Dr. F.J. Ahern's work on atmospheric correction. Also, a COSPAR group entitled "The International Climatology Land Surface Project" are working in this field.

3.6.3 CCRS should involve itself more in oceanographic remote sensing studies. There are a number of projects and potential commercial products that could usefully be encouraged in Canada through CCRS involvement. One example of such a project would be the extension of validity of CZCS processing algorithms to higher latitudes. A potential product could result from the development of portable APT receiving stations with some image processing capabilities.

- Oceanography Working Group

Budgetary constraints permitting, CCRS does wish to involve itself more in oceanographic remote sensing applications of direct value to operational users. CCRS will report on its success in securing the resources to do so.

3.6.4. CCRS should evaluate the capabilities of the Miami image processing software now available at IOS and being implemented in improved form at BIO.

- Oceanography Working Group

If possible, CCRS will reevaluate the capabilities of the improved Miami image processing software being implemented at BIO.

3.6.5. It is recommended that the speed of the distribution of received data be improved.

- Forestry Subgroup

CCRS will continue to take all possible measures.

3.7 **RADARSAT**

3.7.1 IPTASC reassures CCRS of its support for inclusion of a VIR sensor on the RADARSAT system. Regarding spectral and spatial resolution of the sensor, IPTASC will submit a recommendation to the RADARSAT office by May 31, 1984.

- IPTASC

CCRS appreciates this recommendation, and looks forward to receiving the detailed specifications of the resolution requirements.

3.7.2 CCRS should take steps to ensure archiving of the data due to be collected from RADARSAT and ERS-1. The primary justification of these satellites (particularly RADARSAT) is for real-time applications, but the data will be extremely valuable in research applications over a longer term.

- Oceanography Working Group

It is presently planned that all data from RADARSAT and ERS-1 will be archived.

3.7.3 It is recommended that RADARSAT be equipped with an optical sensor.

- Forestry Working Group

CCRS and the RADARSAT project team agree wholeheartedly with this recommendation and will look into means of implementing it, if it is possible within the project budget.

3.8 **NOAA Data**

3.8.1. The Water Resources Working Group is concerned about the current status/-policy on the archiving of NOAA imagery. This question has been considered previously by CACRS, but the availability of archived NOAA data in Canada is not clear at this time. It would be of great benefit to users if a status report on the prospects of

archiving these data could be provided to working group chairmen for distribution to their members.

- Water Resources Working Group

This question is being carefully considered by CCRS in conjunction with AES and a status report will be provided to CACRS members.

3.8.2 CCRS should arrange for a full archive of NOAA AVHRR imagery of Canadian coastal waters and neighbouring off-shore waters as covered by Canadian ground stations. The present system provides only an 8-bit archive of selected scenes at AES ground stations, though CCRS is to be commended for beginning the archiving task for the area covered from Prince Albert.

- Oceanography Working Group

See response to 3.8.1.

3.9 **Organization and Communications**

3.9.1 The Agriculture Working Group recommends the formation of a subcommittee to review and provide direction for rangeland research in remote sensing. It is also recommended that the first meeting of the committee be held as early as possible in 1984.

- Agriculture Working Group

It has been agreed by the CACRS Executive and the Chairman of CACRS that the Agriculture Working Group will now have three subgroups: (1) Agriculture-Radar, particularly in support of the RADARSAT program, (2) Rangeland; (3) Crop Information Systems.

3.9.2. Whereas there is a perceived need for subgroups of user-oriented CACRS working groups in order that a) local representation in the activities of CACRS may be increased, b) regional challenges with national implications may be met when they arise, and c) another avenue for technology transfer in addition to regularly sponsored symposia, workshops etc. may be provided, it is recommended that:

the Chairman of CACRS, after consultation with the Executive Committee of CACRS and the Chairman of the working group in question, be empowered to

select and appoint regional vice-chairmen of a working group when and where it is deemed necessary to further the goals, mandate, or effective communication of CACRS.

- Forestry Working Group

The Chairman of CACRS, in consultation with the CACRS Executive and the Chairman of the Forestry Working Group, has already established a subgroup of the Forestry Working Group, intended to operate largely in French. There will be cross-representation between the working group and its subgroup, and measures will be taken to ensure that the two groups are continually informed of each other's work.

- 3.9.3 It is recommended that the subgroup using French as its working language be recognized as an integral part of the Forestry, Wildlife and Wildlands Working Group of the Canadian Advisory Committee on Remote Sensing (CACRS) and that it be designated by the name:

- Forestry Subgroup

See the answer to 3.9.2.

- 3.9.4 It is recommended that the person in charge of this subgroup be considered co-chairman of the plenary group.

- Forestry Subgroup

CCRS will be pleased to invite the person in charge of the Forestry Subgroup to the annual meeting of CACRS.

- 3.9.5 It is recommended that CCRS support working groups or regional associations wishing to distribute information on remote sensing. In other words, all advertising in the provinces of already-completed work should be welcomed and receive from CCRS the subsidies required for publication.

- Forestry Subgroup

CCRS would be pleased to receive a mock-up (with good-quality illustrations) of any project describing work and results of significant operational value for a sufficiently large segment of the potential user community. If these criteria apply, CCRS will look

into appropriate means (consistent with budgetary constraints) of publishing these results as part of its authorized publications. Proper credit will obviously be given to the group or individual responsible for completing the project.

3.10 Training and Education

- 3.10.1 It is recommended that CCRS organize a "show-and-tell" group of at least two applications scientists and one cost/benefit expert to travel across Canada making presentations to university deans and professors in the environmental sciences to make them aware of the importance of teaching and conducting research in remote sensing.

- Ontario

Such a project is being considered by the RADARSAT office, though with a larger audience in view than simply universities. At the same time, CCRS notes that a number of universities are regrouping to ensure specialty remote sensing laboratories only at certain centres.

- 3.10.2 Professor I. Hale of Ryerson Polytechnical Institute recommends that a Speaker's Bureau document be published listing speakers and topics available to universities and colleges. He also recommends that a data package be put together for use in introductory remote sensing courses.

- Ontario

This would be an excellent project for the Education Working Group to undertake.

- 3.10.3 Professor B. Boucek of Sir Sandford Fleming College recommends the preparation of packages of materials demonstrating remote sensing technology and techniques.

- Ontario

See response to 3.10.2. Additionally, such packages of information are now available from both the Ontario Centre for Remote Sensing and from American sources.

- 3.10.4 J.F. Touborg Consultants Inc. recommends that a greater number of courses

be arranged specifically for small companies using remote sensing.

- Ontario

The CACRS Executive feel that a sufficient number of short courses are now available but that it is possible that they are not well enough advertised. The CCRS newsletter is a good means of discovering what courses are available.

**3.11 Resource/Geographic Information Systems**

- 3.11.1 The operational use of remotely sensed digital data can be greatly enhanced by incorporating the data to update digital map data stored in an Geographic Information System (GIS). It is recommended that CCRS actively facilitate linkages to existing GIS Operations and agencies through demonstration and pilot projects.

- Nova Scotia

This kind of activity is being carried out through the developing LDIAS project. CCRS also notes that the Québec company DIGIM has been active in this field.

**3.12 Economic Studies**

- 3.12.1 Whereas there is a need for more complete documentation of the economics of remote sensing, and a need for economists to consult with user-groups in the evaluation of new or past remote sensing projects, it is recommended that:

the user-oriented working groups be consulted more fully in the development of goals and be asked to participate more completely in economic studies of remote sensing projects.

- Forestry Working Group

The consultative process will be heavily utilized in the next year by CCRS as it develops its economic studies.

**3.13 New Standard Products**

- 3.13.1 To transfer technology to users and to facilitate the use of microcomputers, it is recommended that CACRS urge

CCRS and other agencies providing remote sensing data, to make available remote sensing data on a medium compatible with microcomputers (e.g. floppy disks or diskettes) as a standard product.

- Water Resources Working Group

CCRS does make data available to microcomputer users via Data-Pac or telephone; users can then record the data on their own floppy diskettes in their own format. New floppy drives are now available for the IBM PC: a 5 $\frac{1}{4}$ " drive which can store over 2 MBytes of data on a single diskette and an 8" drive with a 10 MByte capacity per diskette. In addition, a low-cost, write-once optical disk system will be available this summer. The unit will permit storage of 1 GByte per 12" disk. CCRS is investigating these options, and will seek the advice of the Working Group for Users of Image Analysis Systems.

- 3.13.2 Professor J. Vlcek of the University of Toronto recommends that LANDSAT and other digital data be made available on 8" double-sided, double-density diskettes, such as those used by the EROS Data Center. He also proposes that CCRS consider creating a videotape library from high-resolution monitor displays of LANDSAT and other imagery.

- Ontario

See response to 3.13.1. CCRS does not have the staff resources to select and record LANDSAT scenes. In addition, image analysis facilities are heavily used for higher priority work.

- 3.13.3 It is recommended that CCRS study the possibility of making band-5 images available in 70 mm or 9 x 9 format on a "rush" basis; this would permit better evaluation than band-6 microfiches.

- Québec

These images are presently available on request from PASS.

- 3.13.4 It is recommended that CCRS fund a contest aimed at designing "video games" based on satellite imagery. The contest should have a prize, say, a total amount of \$10,000. It is

further suggested that the winner be announced at the next CACRS meeting. It is hoped that such an action would publicize remote sensing among the general public.

- IPTASC

CCRS will certainly investigate the feasibility of this very creative idea.

**3.14 Sensor Research and Development**

3.14.1 It is recommended that CCRS should continue to evaluate particular sensors and/or topics of interest to the ice community. While it is recognized that CCRS cannot contribute in all areas, the Working Group is concerned with continuing R&D in the following areas, and with a continuing active involvement by CCRS in the many outstanding problems and issues in sea-ice reconnaissance.

- multifrequency airborne SAR,
- HF radars for long-range detection of ice and icebergs,
- improved surface-based marine radars for near-range detection,
- sonar sensors for beneath-ice applications,
- ice thickness sensors,
- target size detection versus sea state,
- target discrimination of sea ice, bergs, ships,
- target returns at low angles,
- ducting and fading of icebergs on marine radar screens.
- Working Group on Ice

CCRS will refer this recommendation to the Program Planning and Technology Assessment Unit at CCRS.

**3.15 Honorary Membership**

3.15.1 It is recommended that Dr. Larry Morley be named an honorary member of CACRS in recognition of his services to remote sensing in Canada and abroad. This recommendation was unanimously agreed to.

**Historical Highlights**

**1971**

**APRIL 1:** Canada Centre for Remote Sensing officially established, with Dr. L. W. Morley as Director-General.

**MAY:** Agreement signed between EMR and NASA.

**1972**

**FEB. 22-24:** First CACRS (third "Montebello") meeting at Montebello, Québec.

**JULY 23:** LANDSAT-1 launched.

**1973**

**FEBRUARY 7-9:** First Canadian Symposium on Remote Sensing (Ottawa, Ontario).

**FEBRUARY 19-22:** Second CACRS Meeting, Montebello, Québec.

**APRIL:** Manitoba Remote Sensing Centre established in Winnipeg.

**SEPTEMBER:** Ontario Remote Sensing Centre established in Toronto.

**1974**

**FEBRUARY 18-21:** Third CACRS Meeting, Montebello, Québec.

**APRIL 28-May 1:** Second Canadian Symposium on Remote Sensing (Guelph, Ontario).

**JUNE:** Alberta Remote Sensing Center established in Edmonton.

**1975**

**JANUARY 23:** Launch of LANDSAT-2.

**MARCH 31-APRIL 3:** Fourth CACRS Meeting, Montebello, Québec.

**SEPTEMBER 22-24:** Third Canadian Symposium on Remote Sensing (Edmonton, Alberta).

**1976**

**MARCH 29-APRIL 1:** Fifth CACRS Meeting, Arnprior, Ontario.

**1977**

**APRIL 4-7:** Sixth CACRS Meeting, Arnprior, Ontario.

**MAY 16-18:** Fourth Canadian Symposium on Remote Sensing (Québec, Québec).

**JULY:** Opening of the Shoe Cove Satellite Station in Newfoundland and subsequent reception of LANDSAT data.

**1978**

**JANUARY 7:** Closedown of LANDSAT-1 after 5½ successful years.

**MARCH 5:** Launch of LANDSAT-3.

**APRIL:** Launch of HCMM.

**APRIL 10-13:** Seventh CACRS Meeting, Arnprior, Ontario.

**JUNE 27:** Launch of SEASAT.

**AUGUST 28-31:** Fifth Canadian Symposium on Remote Sensing (Victoria, B.C.).

**OCTOBER 10:** Failure of SEASAT.

**DECEMBER:** Signing of the Cooperative Agreement between the European Space Agency and Canada, to take effect January 1, 1979.

**1979**

**APRIL 9-12:** Eighth CACRS Meeting, Arnprior, Ontario.

**1980**

**APRIL 8-11:** Ninth CACRS Meeting, Arnprior, Ontario.

**MAY 21-23:** Sixth Canadian Symposium on Remote Sensing (Halifax, N.S.).

**1981**

**APRIL 13-16:** Tenth CACRS Meeting, Arnprior, Ontario.

**SEPTEMBER 7-10:** Seventh Canadian Symposium on Remote Sensing (Winnipeg, Manitoba).

**1982**

**MARCH 29-APRIL 1:** Eleventh CACRS meeting, Arnprior, Ontario.

**JULY 16:** Launch of LANDSAT-4.