

CCRS EVALUATION

TERMS OF REFERENCE

LANDSAT PROGRAM ISSUES

- o Extent and Nature of Landsat Usage
- o Consequences of Terminating the CCRS LANDSAT Program
- o Alternatives to Providing LANDSAT Imagery
- o Achievement of Original Objectives and Benefits
- o Relevance of Current Objectives

TECHNOLOGY TRANSFER ISSUES

- o Extent and Impact of Technology Transfer
- o Problems and Suggestions for Improvement
- o Specific Technologies to be Reviewed
 - Landsat
 - Synthetic Aperture Radar (SAR)
 - Laser R&D
 - Image Analysis R&D
 - Solid State Scanner (MEIS)

METHOD OF APPROACH

MAILED QUESTIONNAIRE

- o 2400 Sent Out - Derived from CCRS Mail Lists
(Including Present and Former Landsat Users)
- o 431 Were Returned Unopened
(Incorrect or Out-of-Date Address)
- o 1135 Were Unanswered
(Would include Duplications and Consolidated Responses)
- o 834 Were Completed and Returned
(A Response Rate of 42% Out of 1969)

STRUCTURED INTERVIEWS

- o 84 Groups or Individuals Were Interviewed
- o Covered Canada's Five Geographic Regions
- o Included
 - Heavy Users of Remote Sensing
 - Former Users
 - Non-Users
 - Miscellaneous Users Chosen at Random

EXTENT AND NATURE OF LANDSAT USAGE

SIGNIFICANT FINDINGS

Sales of Landsat Canadian Products

| | <u>1973</u> | <u>1982</u> |
|-----------------|-------------|-------------|
| IMAGERY (Units) | 84,000 | 6,500 |
| CCT (Tapes) | 140 | 960 |

- o Application fields of Landsat cited most often were Geosciences, Forestry, Geography, Mineral Resources and Water Resources (covering two-thirds of the responses).
- o Least mentioned areas in the responses were Atmospheric Monitoring, Fisheries, Pollution Detection and Oceanography.
- o Half of Landsat Applications Reported were for Research, one-third for one-time operations and one-fifth for operational use.
- o A surprising 322 operational systems using Landsat were reported in the Questionnaire responses.
- o Continuity of Service was largest concern among operational users.
- o Cost escalation (after cessation of 6-5 program) also of concern to most users.
- o Comments on quality of service were, with few exceptions, most favourable.

EXTENT AND NATURE OF LANDSAT USAGE (CONT'D)

MAJOR CONCLUSIONS AND RECOMMENDATION

- o Satellite Remote Sensing in Canada is showing signs of maturing in some applications.
- o As the resulting market develops, private sector can be expected to move in, as in the U.S.
- o Markets would be in
 - Data Acquisition
 - Value-added services (e.g. Image Analysis, Interpretation)
- o Regulatory measures may be needed, depending on how data rights are granted
- o Recommended that private sector involvement be planned in the best national interest

CONSEQUENCES OF TERMINATING THE CCRS LANDSAT PROGRAM

- o Approximately 13% of Respondents, mainly researchers, had no alternatives and would fail to perform their work.
- o Most respondents would turn to alternative sources (Eros Data Center, Sioux Falls, S. Dakota)
- o For operational users - 30% would use archived data, 20% would resort to airborne imagery, 8% would fail to do their work and 42% would use alternative sources.
- o If CCRS image analysis facilities were terminated, users would seek alternatives in industry.
- o Termination of Applications Development Activities would be viewed with alarm
- o Concluded that there is not yet widespread dependency on Canadian Landsat Reception by operational users
- o Concluded that greater benefits would be achieved from the technology by stepping up Applications Development activities and recommended increased emphasis in CCRS future plans and priorities.

ALTERNATIVES TO PROVIDING LANDSAT IMAGERY

- o Reliance on EROS would increase costs and delays in obtaining imagery.
- o U.S. Receiving Stations do not cover N.E. Arctic important to Ice Forecasting in Canada.
- o Continuity and security of data supply uppermost in minds of operational users.
- o Privatization not feasible at present market levels.
- o Recommended that for security and continuity, a VIR Sensor be included on RADARSAT.

ACHIEVEMENT OF LANDSAT BENEFITS AND ORIGINAL OBJECTIVES

- o In general, the consensus among respondents and those interviewed was that the original CCRS objectives had been achieved for LANDSAT, except for some application areas.
- o Many noted too heavy an emphasis on new technology compared to applications development. The imbalance was stressed by the following application groups:
 - Mining and Geology
 - Hydrology
 - Agriculture
 - Ocean Applications
- o Progress through Research and Demonstration stages to operational use is best measure of benefits. The count of 322 operational systems speaks for itself.
- o Fully 70% of industrial respondents had Landsat involvement with related domestic and export sales
- o Concluded that of those application areas receiving least emphasis, pollution detection and monitoring ought to get more attention from CCRS and so recommended.

RELEVANCE OF CURRENT OBJECTIVES

- o Current objectives have been criticized for their lack of specific targets, and levels of accomplishment, but these are spelled out in operational plans.
- o Ultimate success is whether users find the technology useful and cost-effective.
- o The 322 operational systems reported appeared to be a good source of economic data and represent an important component of CCRS's "HARD-CORE" clientele
- o While most would be represented or embodied in CACRS, we recommended contact be made by CCRS with this special group re service provided and benefits derived.

TECHNOLOGY TRANSFER

EXTENT AND IMPACT

a) LANDSAT

- o 56 of a total of 80 industrial respondents were involved with CCRS on Landsat; 15 made domestic sales arising from their Landsat work, 12 of these in image analysis equipment or services.
- o Extensive export sales by MDA and Dipix. MDA sold turnkey systems to Australia, Thailand, S. Africa, Indonesia, Sweden and USA (Alaska). Also subcontracted LANDSAT systems in eight other countries.

b) SYNTHETIC APERTURE RADAR

- o 17 companies claim satellite SAR involvement with CCRS.
- o Major contracts with MDA - SAR processor led to domestic and export business (SEASAT, RADARSAT, ERS-1).
- o MDA and CAL made domestic SAR sales (Intera's STAR-1, CCRS's C-Band SAR), and MDA now launched on export campaign)

TECHNOLOGY TRANSFER: EXTENT AND IMPACT (CONT'D)

c) LASER R&D

- o Laser Fluoresensor, Barringer Research Ltd. U.P. in 1975 too expensive to commercialize, but still active
- o Laser Bathymeter for airborne hydrographic surveys not initially chosen but now being developed in a scanning version by OPTTECH INC. for CHS.
- o Track Recovery Technology Used in Aerial Hydrography used by HUNTEC (1970) Ltd. in marine seismic systems.

d) IMAGE ANALYSIS R&D

- o Most users were very satisfied with CCRS's image analysis services.
- o Image analysis systems at CCRS developed in-house with outside support at times - CIAS is current system, LDIAS under development.
- o Some expressed view that image analysis services and R&D not adequately separated.
- o Canadian image analysis industry has been DIPIX, OVAAC-8 and MDA. DIPIX had sold 45 systems, 14 in Canada, 31 abroad.

TECHNOLOGY TRANSFER: EXTENT AND IMPACT (CONT'D)

- e) SOLID STATE SCANNER (MULTI-BAND ELECTRO-OPTICAL IMAGE SENSOR)
 - o MDA-developed, supported by CCRS through a U.P. Pushbroom Scanner. 5 Wavelength bands.
 - o In late development stages with a lead in the market that may be lost if program is not accelerated.

CONCLUSIONS AND RECOMMENDATIONS

- o Technology transfer has achieved levels which permit Canadian companies to compete in domestic and export markets.
- o Canada possesses a world-class industry in earth resource satellite ground stations, image analysis systems, SAR processors and airborne SAR systems.
- o The larger user community has yet to embrace digital technology.
- o Most effective technology transfer is when expertise is physically closest to the user (viz. Ontario, Alberta, Quebec and B.C.)
- o Recommended that technology transfer programs be established in Saskatchewan and Newfoundland once effectiveness shown in Manitoba and Maritimes.
- o Recommended improvements to CCRS's In-House CIAS System and acceleration of the MEIS program.

TECHNOLOGY TRANSFER PROBLEMS AND
SUGGESTIONS FOR IMPROVEMENT

- o Major problems are those associated with expanding the number and range of end users.
- o CCRS needs to expand its number of delivery agents and distributors (Seen as the Provincial and Specialist Centres).
- o Planned termination of technology enhancement programs in Manitoba and Maritimes in March, 1984 is premature and recommended they be extended to provide time to complete and evaluate them.

GENERAL ISSUES

1. IMPACT OF EROS ON CANADIAN DATA SALES

- o We concluded the question of Data Ownership of imagery of Canada sold by EROS Data Center Needs to be examined in the light of large user charges to Canada. Canada should receive royalties from EROS sales.

2. RESEARCH VS OPERATIONS

- o Earlier CCRS problems of mixing research and operational activities seem to have been sorted out mainly by re-organization.
- o There are Federal and Provincial gaps in applications of remote sensing - Federal gaps in application areas not fulfilled (Fisheries, pollution, etc.), provincial gaps such as Saskatchewan and Newfoundland.
- o Concluded that the substantial Federal investment in remote sensing will be far less effective than it could be if additional effort is not put into broadening the geographic base into provinces that have not adopted the technology.