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for Photogrammetry
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NATIONAL REPORT

CANADA

Prepared for the

CANADIAN INSTITUTE OF SURVEYING

by
Jean R. R. Gauthier
Chairman, Photogrammetry Committee

DR. S.G. GAMBLE: IN MEMORIAM

Dr. Samuel Gill Gamble, soon after his retirement from the position of Assistant Deputy Minister, Department of Energy, Mines and Resources, Ottawa, Canada, died in July, 1977, in his 66th year. Following service overseas in the Canadian Army during the Second World War, mainly in survey units, achieving the rank of Assistant Director of Surveys, he was appointed Chief Topographical Engineer in the federal public service. From 1958 to 1972 he served as Director of the Surveys and Mapping Branch, Ottawa.

Early in his departmental career Sam Gamble invented the Gamble Stereoplotter. During the course of his outstanding leadership in the realm of federal surveying and mapping activities he received the highest recognition granted a Canadian in the photogrammetric world. He was elected President of the International Society of Photogrammetry, following the highly successful Congress of the organization held in Ottawa in 1972, a triumph to which his organizing and administrative genius contributed in very large measure. He served as President of the I.S.P. until 1976.

His special devotion to the advancement of all aspects of surveying, including the uses of photogrammetry, was also recognized in Canada by the award of two honorary degrees of science; namely, Doctor of Science from the University of New Brunswick in 1970 and Doctor of Geodetic Science from Laval University in 1972.

Engineer, land surveyor, soldier, administrator, photogrammetrist, educator and leader of men, Sam Gamble was widely known, liked and respected for his tireless, dedicated efforts in advancing the causes most valued by his fellow professionals in Canada and abroad.

The Canadian photogrammetric fraternity has lost, in the passing of Dr. Gamble, a gifted and much loved friend and colleague.

Don W. Thomson

1. INTRODUCTION

In Canada the period between 1976 and 1980 has been characterized by an increased involvement of the provinces in mapping, a quickening pace of federal topographic mapping at medium scale, and steady progress in digital mapping. These developments led to a concern about the lack of suitable standards for the exchange of digital data. This in turn led to the creation of three national committees which were charged with the preparation of the required standards.

Increasing activity in mapping by all levels of governments is having beneficial effects on the aerial survey industry since much of the work is done by commercial contracts. A healthy Canadian photogrammetric and remote sensing industry, working in a competitive environment at home, has been highly successful abroad. The names, addresses and capabilities of thirty-seven photogrammetric companies and twenty-two firms offering services in remote sensing are given in this report.

Taking advantage of a strong electronic industry and supported by the National Research Council, Canada is embarking in an ambitious program of photogrammetric instrument manufacturing.

Finally research and development in photogrammetry and remote sensing has been ably carried out by many outstanding scientists in government laboratories and at universities. It is worth noting the retirement of two world-known and respected photogrammetrists.

Dr. Theodor J. Blachut, founder of the Photogrammetric Research Section in the Division of Physics of the National Research Council of Canada, retired in December 1979 after 28 years of service in the main Canadian institution. The group headed by Dr. Blachut is internationally known as a pioneer of many novel ideas, new instruments and advanced mathematical methods, notably in the field of analytical photogrammetry. He has received various international distinctions and medals, and has written over 100 professional papers in five languages on a variety of topics on surveys and mapping. In 1962/63 Dr. Blachut was president of the Canadian Institute of Surveying. He was elected a fellow of the Royal Sociey of Canada in 1970.

Gerry H. Shut also retired from the National Research Council at the end of 1979. He received his education in geodesy and photogrammetry at the Technical University of Delft and worked for a time under A.J. van der Weele. Since 1952 he has been employed by the National Research Council of Canada specializing in the development and programming of methods in analytical photogrammetry. He received the Fairchild Photogrammetry Award in 1967 and contributed to the third edition of the Manual of Photogrammetry. He has been Associate Editor for photogrammetry of the Canadian Surveyor from 1967 to 1980 and he has been a member of the Editorial Board of Photogrammetria from 1967 to 1980.

2. MAPPING ACTIVITIES

In Canada, production of basic, multipurpose topographic mapping is shared by the three levels of government: federal, provincial and municipal.

2.1. Federal Activities in Mapping

At the federal level, topographic mapping at scales of 1:50 000 and 1:250 000 is largely the responsibility of the Topographical Survey, Department of Energy, Mines and Resources with some assistance from the Mapping and Charting Establishment, Department of National Defence.

As of April 1, 1980, 7977 maps at the scale of 1:50 000 have been published out of a total of 13 150 to cover all of Canada. It is expected that, with present technology and present level of resources, the 1:50 000 coverage of Canada will be completed in 1995. As a result of recent government policy the percentage of new 1:50 000 maps produced by commercial contract is increasing every year (61% in 1980).

In order to respond quickly to requests for new maps at 1:50 000, an Aerial Survey Data Base (ASDB) is being put in place in as yet unmapped areas. The ASDB consists of:

- the aerial photography,
- the necessary survey control, both horizontal and vertical,
- the result of the aerotriangulation in the form of marked diapositives and a list of coordinates.

Consequently, all the ingredients necessary to produce a map are in place before that map is needed. In a country such as Canada, where summer conditions last from 2 to 4 months for many areas and where cultural changes in the North are limited, the ASDB has greatly increased Topographical Survey's ability to respond to unexpected and urgent requests for base maps.

Revision of the two map series - 1:250 000 and 1:50 000 - is done on a cyclical basis as shown on the table below:

Revision Cycle (Years)	Zone	Number of Maps in the Series 1:50 000	1:250 000
5	urban	198	(not applicable)
10	rurax	1450	123
15	wilderness	2601	111
30	arctic and subarctic	8901	648

However, due to insufficient resources, Topographical Survey has not been able to keep its maps up-to-date according to the above cycle. It is hoped that the use of Landsat images and digital methods will

help overcome this problem in the years to come. In contrast to new mapping, increasingly done by commercial contract, revision is done exclusively in-house.

2.2 Provincial Activities in Mapping

During the last four years, mapping activities in the provinces have been on the increase. In general, provincial governments are concentrating their efforts on the production of topographic maps at scales of 1:20 000 and larger. Naturally, depending on the level of resources available, some provinces are more active than others. Whenever possible, the work is done in close cooperation with the federal government to avoid duplication and to achieve economies.

2.2.1 Newfoundland

Newfoundland is involved in a mapping program which will take about 10 years to complete. This consists of:

- 1:12 500 planimetric orthophotomaps for resource mapping. Approximately 500 sheets out of a total of 2200 have already been completed.

- 1:1250 and 1:2500 topographic line maps of urban areas. Approximately 3400 maps are required to complete this series of which 1400 have been produced.

2.2.2 Maritime Provinces (Nova Scotia, New Brunswick, and Prince Edward Island)

The Land Registration and Information Service of the Maritime Provinces has compiled about 3400 orthophotomaps at the scale of 1:10 000 with 5 m contours and about 5400 line maps of municipalities at scales of 1:1000 and 1:2000 with 1 or 2 m contours. When completed the map coverage of the Maritime Provinces will total 4700 orthophotomaps and 6400 line maps.

2.2.3 Quebec

Quebec is one of the most active of the Canadian provinces in surveying and mapping; it began production of topographic maps in 1965. The Province aims at establishing approximately 1500 maps at the scale of 1:20 000 with 10 m contours of the southern regions. So far 1100 of those have already been published. Although provision is made for colour separation, most maps of that series are published in black and white. Some of the topographic maps are gradually replacing old planimetric maps at the same scale.

A second goal of the Province is to establish monochrome maps of 700 urban centres with scales ranging from 1:1000 with spot heights or 1:2000 with 1 m contours.

Most of this work is done by commercial contract under strict standards of presentation and quality.

2.2.4 Ontario

In July 1977, the Ontario Government began a program to complete the base map coverage of the province in 13 years. Three prime scales were selected for basic topographic mapping:

- 1:20 000 with 10 m contours in Northern Ontario,
- 1:20 000 with 5 m contours in Southern Ontario, and
- 1:2000 with 1 m contours for urban areas.

Except in extreme northern areas, where photomaps will be produced, the design is traditional line mapping. Provision is made for colour separation but reproduction generally is in black and white.

All production is by commercial contract. Government involvement is restricted to program development, specifications, contract monitoring, and the safeguarding of records and production materials.

2.2.5 Manitoba

Manitoba has begun a program to map selected areas of the Province. It will produce photo and line maps at the scale of 1:20 000 with 5 m contours. In addition, 240 photomaps with 1 m contours have been produced for 68 northern communities of the province in the past 4 years.

2.2.6 Saskatchewan

The recently created Central Survey and Mapping Agency of the Province of Saskatchewan does not yet have a mapping program. In 1980, the Agency expects to produce 2,400 Township Photomaps at the scale of 1:20 000.

2.2.7 Alberta

Alberta has just begun producing its own 1:250 000 map series based partially on the federal maps at the same scale. The province has also produced orthophotomaps of 32 municipalities at the scale of 1:5000 with 1 m contours. In addition, 1:15 000 resources maps are produced by Alberta for forest inventory purposes.

2.2.8 British Columbia

British Columbia has a large and active Survey and Mapping Organization which has been producing a wide variety of maps. The province produces a full colour topographic map at the scale of 1:100 000. In the near future major emphasis will be placed mainly on the production of maps at 1:20 000 for resource inventory and 1:5000 and 1:2000 for areas of intense cultural and resource development activity. The majority of this work will be done by commercial contract.

2.3 Other Mapping Activities

Considerable mapping activities are taking place at the municipal level. Many large Canadian cities have their own survey department, some with photogrammetric capabilities. Finally, single purpose topographic maps are produced by or for provincial hydro-electric utilities.

2.4 Principal Map Producing Agencies

The following is a list of the principal agencies that produce maps either in-house or through commercial contract, often through a combination of both.

Federal Government

Topographical Survey Surveys and Mapping Branch	615 Booth Street Ottawa, K1A 0E9
Mapping and Charting Establishment Department of National Defence	Ottawa, Canada K1A 0K2
National Capital Commission Surveys and Mapping Division	48 Rideau Street Ottawa, K1N 8K5

Provincial Agencies

Newfoundland and Labrador

Lands Branch, Department of Forestry and Agriculture	Howley Blg., Higgins Line St.John's, Newfoundland, A1C 5J2

Nova Scotia, New Brunswick and Prince Edward Island

Land Registration and Information Service	College Hill Road Fredericton, New Brunswick, E3B 5H1

Québec

Direction des relevés techniques Ministère de l'énergie et des ressources	1995, boul. Charest, ouest Ste-Foy, Québec, G1N 4H9
Ville de Montréal Travaux publics-Arpentage	700 est, rue Craig Montréal, Québec, H2Y 1A6
Hydro Québec Service des relevés techniques	855 est, rue Sainte-Catherine Montréal, Québec, H2L 4M4

Ontario

Ministry of Natural Resources	Whitney Block, Queen's Park Toronto, Ontario, M7A 1W3
Ontario Ministry of Transportation and Communication	1201 Wilson Avenue, East Bldg. Downsview, Ontario, M3M 1J8
Ontario Hydro Surveys and Mapping Department	700 University Avenue Toronto, Ontario, M5G 1X6
Municipality of Metropolitan Toronto, Central Mapping Agency	3284 Yonge Street Toronto, Ontario, M4N 3M7
Regional Municipality of Sudbury Planning Department	Sudbury, Ontario P3E 4P2

Manitoba

Surveys and Mapping Branch Department of Natural Resources and Environment	1007 Century Street Winnipeg, Manitoba R3H 0W4
Manitoba Hydro	1140 Waverley Street Winnipeg, Manitoba, R3T 0P4

Saskatchewan

Central Surveys and Mapping Agency	1855 Victoria Avenue Regina, Saskatchewan, S4P 3V5

Alberta

Surveys and Mapping Branch Alberta Transportation	College Plaza, 8215-112 Street, Edmonton, Alberta, T6G 2M2
Resource Evaluation and Planning Department of Energy and Natural Resources	North Tower, Petroleum Plaza 9945-108 Street, Edmonton, Alberta, T5K 2G8

British Columbia

Surveys and Mapping Branch Ministry of Environment	Parliament Building Victoria, B.C., V8V 1X4
B.C. Hydro Photogrammetric Engineering	970 Burrard Street Vancouver, V6Z 1Y3

3. SIGNIFICANT PHOTOGRAMMETRIC AND REMOTE SENSING DEVELOPMENTS

3.1 Aerial Photography

Standardization techniques for aerial colour infrared film were prepared by J.M. Fleming and published by the Interdepartmental Committee on Air Surveys. Factors that influence the quality of colour infrared photographs are examined and those that can be controlled by the aerial photographer to produce a more reliable product are identified.

3.2 Instruments and Methods

3.2.1 National Research Council - Photogrammetric Research Section

Development of new digital and hybrid correlation techniques and devices. The Array Image Correlator and the Charge-Coupled Device Heterodyne Image Correlator are two devices that are presently under development.

Further development of analytical instruments including the new methods of precision length measurements and electronic image transfer that will have far reaching consequences on the future design of analytical stereoplotters.

Further development of the Position Verifier and add-on component to analytical plotters for on-line real-time editing.

Further development of Stereocompilers for the exploitation of stereoorthophotos with facilities for digital recording or generation of line drawn maps, and the related development of the Steering Device which is an add-on component allowing for direct scribing at the time of stereo-compilation.

3.2.2 Department of Energy, Mines and Resources - Topographical Survey

Methods and procedures for the linkage of interactive graphic systems with conventional photogrammetric plotters were developed (see also paragraph 3.4.1).

Development of methods and software for the production of contours from dense Digital Elevation Models (DEM's) produced with the Gestalt Photomapper II.

3.2.3 University of New Brunswick

Investigation of a new concept for map revision, Digital map data is transformed to correspond to the geometry of the photograph to be used for the updating. Changes are detected, digitized and transformed back into the map coordinate system.

Development of a method for the positioning, rectification and mapping using linear entities such as road or railway segments as a substitute to conventional ground control points. The method can be applied to

conventional aerial photography as well as other types of imagery.

3.3 Mathematical Analysis of Data

3.3.1 National Research Council

With the development of the analytical plotters and the increase in usage of mini-computers in mapping organizations, it was necessary to modify the existing photogrammetric data processing software from batch to on-line environment.

Programs for on-line analytical aerial triangulation and block adjustment were developed for mini-computers. (Schut, Kratky).

The earlier version of the program for bundle adjustment has been reprogrammed to simplify the input requirements and to enable its use on minicomputers. In addition, a subroutine for the use of additional parameters and a method of using special terrain height constraints has been incorporated in the program (Schut).

3.3.2 Topographical Survey Division, E.M.R.

With the integration of the Gestalt Photomapper (GPM-II) system in the digital topographic mapping program, a computer system was developed for the post-processing of DEM's produced by the GPM-II. The system includes the following main tasks:

- Standardization of DEM structure using various interpolation algorithms.

- Verification and filtering of the generated map elevation grid.

- Linear interpolation of contours on a per-map-sheet basis.

3.3.3 University of Guelph

Work involving dense DTM's has been completed which allows a variety of analysis such as

- Investigation of a watershed including location of watershed boundaries, runoff, storage volumes and areas, and surface flow patterns;

- Thematic extractions, spatial relationships, intervisibility and creation of DEM's from contours.

The programs combine the advantages in processing speed of the dense grid structure, and the economy of storage inherent in outline or string structures.

3.4 Topographic and Cartographic Applications

3.4.1 Digital Mapping

An increasing number of mapping organizations and aerial survey companies are becoming actively interested in digital mapping. At the federal level, Topographical Survey, Surveys and Mapping Branch, produced an experimental map at 1:50 000 in 1978. The Digital Mapping Unit of the Division began full production of 1:50 000 standard maps in 1979. The mapping and Charting Establishment, Department of National Defence, has begun a modernization program to increase the automation of its facilities.

Several provincial and municipal agencies have purchased and installed new digital mapping systems (Quebec, Alberta, B.C. Forest Service, Communication and Transportation Ontario, Montreal, Burnaby) while others are actively investigating digital mapping methods (Ontario, the Maritime Provinces). For instance, the Province of Ontario is investigating or is currently utilizing several automated or semi-automated digital cartographic systems. Parts of its present thrust is towards the utilization of these systems to improve the storage and retrieval of many types of land-related data held on government files.

3.4.2 National Standards for Digital Mapping

Under the auspices of the Canadian Council on Surveying and Mapping, three Technical Committees were established in 1978 to prepare national standards for the exchange of digital map data.

Committee 1 will develop a national and uniform classification syster for topographic features. This is to include a Dictionary of Terms describing all topographic features as well as a coding system.

Committee 2 will develop standards for resolution and accuracy of digital topographic data and recommend standards for rating the up-to-dateness and completeness of the data.

Committee 3 is preparing standards for the transfer of digital topographic data on various media (magnetic tapes, disks and punch cards) as well as conventions for the logical definition and organization of all topographic data elements.

The committees expect to complete the standards in 1981.

3.4.3 Use of Landsat Images for Map Revision

The use of Landsat images for revision of the 1:250 000 national map series is being investigated. Inital results are very promising and a proto-operational program is being developed.

3.4.4 Littoral Mapping

The Canadian Hydrographic Service, in conjunction with the Canada Centre for Remote Sensing, has undertaken to produce an operational system to use aircraft collected data for shallow water bathymetry. The primary sensor is an aerial camera using colour film. The secondary sensor is a pulsed profiling laser bathymeter.

The stereo photos are used to produce photogrammetric models in an analytical stereoplotter equipped with an on-line refraction correction. Exterior orientation parameters are supplied by an inertial navigation system hard-mounted to the camera. The output from the inertial system is recorded during the flight and is recovered using a post-mission track recovery system which is built around a Kalman filter-optimal smoother. When the stereo models have been set up it is possible to measure depths to 10 m .

The laser bathymeter which operates simultaneously with the camera provides spot depths every 8 m along the aircraft track to a depth of 25 m . The laser depth data is merged with the photo depth data during the photogrammetric processing.

At the present time the aerial hydrography system is evolving from the research and development stage into the operational environment.

3.5 Non-Topographic Photogrammetry

Non-topographic photogrammetry is increasingly used on a routine basis by federal and provincial government organizations and by private industry in fields such as architectural recording, forestry, mining and medicine. Research projects, often involving new and inventive applications, are being carried out at the National Research Council and at universities with post-graduate programs in photogrammetry.

Recent instrumental and technical developments such as the analytical plotter are widening the range of application and increasing the accuracy and the versatility of photogrammetry (Kratky, 1979). Examples of recent projects on the NRC Anaplot include the use of four simultaneously oriented small format photographs, offering the possibility of full stereoscopic coverage of a three-dimensional object. The Anaplot is also used for a precise archeological survey of a shipwreck, using underwater photogrammetry.

Analytical processing of data allows the use of non-conventional data acquisition systems. At Laval University the geometry of imagery obtained by scanning and transmission electron microscopes has been analyzed and successfully modeled for practical use.

On-line photogrammetric techniques have been developed in a joint NRC-NASA project to control the manipulator system for retrieval or replacement of satellite payloads by remote control from the space shuttle. It has been demonstrated that photogrammetric resection can provide reliable feedback parameters for a smooth control operation with a frequency of 30 times per second (Kratky, 1979).

Digital Terrain Modeling techniques are becoming established in non-topographic applications. At Laval University forms of animals (body size and shape) and microscopic objects are being analyzed by digital modeling. Techniques for plotting perspective diagrams from the Digital Terrain Models have been developed. Computation programs for urban and architectural applications are also being developed. These programs depend, among other factors, on procedures to eliminate "hidden lines."

Non-topograpic photogrammetry often includes the acquisition of very precise data. Calibration of cameras and photogrammetric systems by means of three-dimensional test fields is carried out at NRC, Laval University and the University of New Brunswick. At Laval University a calibration procedure for a helicopter mounted stereometric camera system is being developed. The photographs are used to determine, by simple photogrammetric means, the tree peripheries and heights which are needed for timber quantity inventory measurements.

High precision deformation measurements and determination of milling dimensions for spherical tank components for tankers have been carried out by analytical methods at the University of New Brunswick (Faig, 1978). A combined use of photogrammetric observations and survey data is often necessary to obtain the required accuracy. This method was used for checking the sphericity of aluminum plates (El Hakim, 1979). Other precision engineering applications include photogrammetric determination of the shapes of boat hulls (Murdy et al, 1979) and pile movements (Bozozuk et al, 1978).

Photogrammetry is becoming an important tool in medical applications. Equipment for scoliosis screening based on moiré topography has been developed at NRC (van Wijk, 1980). It is presently being evaluated in pilot screening projects by universities and hospitals in North America (Adair et al, 1977).

3.6 Economic, Professional and Educational Aspects of Photogrammetry

During the last Congress, Dr. T.J. Blachut was invited to form a group of authors willing to write a history of photogrammetry. Dr. Blachut was joined by a number of leading scholars as co-authors and the group proceeded with the preparatory work. The text will consist of nine chapters each written by a different author. Some chapters have already been written, at least in part. There is good reason to believe that the book will be published commercially by one of the scientific publishing houses. According to a tentative plan, the initial English text will be translated into Spanish and published as a separate edition in this language at no cost to the ISP. Due to many difficulties and delays the book will not be published until after the international congress of 1980.

3.7 Interpretation of Data

During the reporting period, applications of various types of remote sensing data were actively pursued and reported at the Annual Canadian Symposiums on Remote Sensing (1977-Québec, 1978-Victoria, 1980-Halifax).

In July 1977, a second receiving station for the reception of Landsat and Seasat data was opened at Shoe Cove, Newfoundland, to provide coverage of eastern Canada and the Atlantic ocean.

During 1978-79 a comprehensive study project on the applications of synthetic aperture radars was carried out (SURSAT PROJECT). This study was directed towards the determination of the sea and land surveillance capabilities of satellite SAR as demonstrated by SEASAT. In addition 27 000 km of airborne SAR using ERIM 4-band SAR was supplied to investigators working in oceans management, agriculture, forestry, ice studies, human activities and geology to determine the role of SAR as a remote sensing tool. This project saw the development of digital image restitution equipment for SAR data by MacDonald Dettwiler and Associates, Vancouver and the Canadian Communication Research Centre, Dept. of Communications.

In the same period, geometric and radiometric correction of multi-spectral scanner data became available from the Canada Centre for Remote Sensing as a result of their development of the Digital Image Correction System (DICS). Digital image analysis techniques are widely used in the interpretation of data and several systems have been developed in Canada (ARIES, OVAC-8, MDA.)

4. THE AERIAL SURVEY AND REMOTE SENSING INDUSTRY

4.1 The vastness of Canada, the need to gain knowledge and to develop its resources are some of the factors contributing to the growth and strength of the Aerial Survey and Remote Sensing industry. The industry has performed well since it is capable of providing all services required by government and the private sector, without the need to import any foreign services with the exception of sophisticated electronic equipment. The Canadian industry has earned an enviable reputation world wide for its technical competence, integrity and innovative capability. It has provided aerial surveying and remote sensing services in over 100 foreign countries.

4.2 The Aerial Survey Industry

The 37 Canadian Aerial Survey companies with their postal and cable address, telephone number and capabilities are listed on the following pages.

Code Used for Capabilities of Aerial Survey Companies

A = Aerial Photography
C = Control Survey
T = Aerotriangulation and Numerical Adjustment
L = Large Scale Photogrammetric Mapping
M = Medium Scale Photogrammetric Mapping
P = Photomapping
R = Colour Reproduction

Aero Photo (1961) Inc.
1975 Boul. Charest Ouest
Ste-Foy, Québec, G1N 2E6
Telephone: (418) 683-2231
Telex: 051-31523
Cable: -
Capability: A,C,T,L,M,P,R

Airmap Limited
4534 South Clark Place
P.O. Box 918, R.R. #5
Ottawa, Ontario K1G 3N3
Telephone: (613) 822-0253
Telex: -
Cable: -
Capability: L,M

Airquest Surveys Ltd.
1540 Gamble Place
Winnipeg, Manitoba, R3T 1N6
Telephone: (204) 284-3101
Telex: 07-587517
Cable: -
Capability: C,L,M

Anaphoto Services
3281 Monica Drive
Malton, Ontario, L4T 3E6
Telephone: (416) 677-5825
Telex: -
Cable: -
Capability: T

Atlantic Air Survey Ltd.
P.O. Box 187, 650 Windmill Rd.
Dartmouth, Nova Scotia, B2Y 3Y3
Telephone: (902) 469-7901
Telex: 019-31562
Cable: Atlantair
Capability: A,C.L,M,P.R

J.D. Barnes, Ltd., Surveyors
4632 Yonge Street,
Willowdale, Ontario, M2N 5M1
Telephone: (416) 223-6010
Telex: 06-966730
Cable: -
Capability: A,C,T,L,M

Beliveau-Couture
Arpenteurs-Geometres, Conseils
780 Avenue de Brabant
Ste-Foy, Québec, G1X 3V9
Telephone: (418) 656-1572
Telex: 051-31576
Cable: -
Capability: A,C,T,L,M

Burnett Resources Surveys Ltd.
Lake City Industrial Park
2973 Lake City Way
Burnaby, B.C., V5A 3A1
Telephone: (604) 420-2600
Telex: 04-354648
Cable: -
Capability: C,T,L,M,R

Capital Air Surveys Ltd.
Pembroke and Area Municipal Airport
R.R. #6, Pembroke, Ontario, K8A 6W7
Telephone: (613) 687-5586
Telex: 053-34541
Cable: Capitalair
Capability: A

Foto Flight Ltd.
214 Whitman Place N.E.
Calgary, Alberta, T1Y 4H9
Telephone: (403) 275-9334
Telex: -
Cable: -
Capability: A

Garx Air Surveys
Suite 200, 1 Place Laval
Laval, Québec, H7N 1A1
Telephone: (514) 384-1260
Telex: 05-25469
Cable: -
Capability: A,C,T,L,M,P

Geographic Air Survey Ltd.
12851-148th Street
Edmonton, Alberta, T5L 2H9
Telephone: (403) 451-1406
Telex: -
Cable: -
Capability: A

Geonumerigraphe Inc.
1796 Boul. Laurier
Sillery, Québec, G1S 1M4
Telephone: (418) 681-3583
Telex: -
Cable: -
Capability: A,C,M

Global Remote Sensing Inc.
P.O. Box 191
Breslau, Ontario, N0B 1M0
Telephone: (519) 648-2770
Telex: 069-55317
Cable: -
Capability: A

Hugh Hamilton Ltd.
Suite 120-116 East 3rd Street
North Vancouver, B.C., V7L 1E6
Telephone: (604) 980-5061
Telex: -
Cable: -
Capability: M

Industrial Forestry Service Ltd.
Suite 101-1595-5th Avenue
Prince George, B.C., V2L 3L9
Telephone: (604) 564-4115
Telex: -
Cable: -
Capability: C,T,L,M,R

Integrated Resources Photography
P.O. Box 2278,
Vancouver, B.C. V6B 3W5
Telephone: (604) 681-3505
Telex: -
Cable: -
Capability: A,C,T,L,M

Kenting Earth Sciences Ltd.
380 Hunt Club Road
Ottawa, Ontario, K1G 3N3
Telephone: (613) 521-1630
Telex: 053-4173
Cable: -
Capability: A,C,T,L,M,P,R

Marshall, Macklin, Monaghan Ltd.
275 Duncan Mill Road
Don, Mills, Ontario, M3B 2Y9
Telephone: (416) 449-2500
Telex: 06-966695
Cable: -
Capability: A,C,T,L,M,R

McElhanney Surveying & Eng. Ltd.
14 Bentley Avenue,
Nepean, Ontario, K2E 6T8
Telephone: (613) 225-9710
Telex: 053-3174
Cable: -
Capability: A,C,T,L,M,P,R

McElhanney Surveying & Eng. Ltd.
1200 W. Pender Street
Vancouver, B.C., V6E 2T3
Telephone: (604) 683-8521
Telex: 04-51474
Cable: SURVENG
Capability: A,C,T,L,M

Monaghan & Associates
825 St. Jean Baptiste
Québec City, Québec, G2E 5B7
Telephone: (418) 871-2828
Telex: 051-31706
Cable: -
Capability: C,T,L,M,R

Nfld. & Labrador Surveys Ltd.
P.O. Box 4264, K-Mart Plaza
Torbay Road, St. John's,
Newfoundland, A1C 5Z7,
Telephone: (709) 753-9080
Telex: -
Cable: -
Capability: A,C,T,L,M,P

North West Survey Corp.
International Ltd.
17203-103rd Avenue,
Edmonton, Alberta, T5S 1J4
Telephone: (403) 483-8033
Telex: 037-3039
Cable: SURVEYOR EDM
Capability: A,C,T,L,M,P,R

Northway-Gestalt Corporation
1450 O'Connor Drive
Toronto, Ontario, M4B 2V9
Telephone: (416) 755-1141
Telex: 06-963518
Cable: NORTHWAY TORONTO
Capability: A,C,T,L,M,P,R

Orhan's Reproductions &
Photomapping Ltd.
907-9th Avenue S.W.
Calgary, Alberta, T2P 1L3
Telephone: (403) 265-7514
Telex: 03-822617
Cable: -
Capability: C,T,L,M,P,R

Pacific Survey Corporation
1409 West Pender Street
Vancouver, B.C., V6G 2S4,
Telephone: (604) 683-6501
Telex: 04-507804
Cable: -
Capability: A,C,L,M,P

Photo-Compilation P.M.S. Inc.
2405 Chemin Ste-Foy
Ste-Foy, Québec, G1V 1T1
Telephone: (418) 651-5436
Telex: -
Cable: -
Capability: A,C,L,M

Photocan Surveys Limited
4632 Yonge Street
Willowdale, Ontario, M2N 5M1
Telephone: (416) 223-6010
Telex: 06-966730
Cable: -
Capability: A,C,T,L,M,P,R

Photomap Air Surveys Ltd.
83 Galaxy Blvd. Unit #1
Rexdale, Ontario, M9W 5X6
Telephone: (416) 675-2660
Telex: -
Cable: -
Capability: A,C,L,M

Photosur Inc.
1320 Sherbrooke Street W.
Montreal, Québec, H3A 2R5
Telephone: (514) 288-1370
Telex: 055-61257
Cable: PHOTOSUR
Capability: A,C,T,L,M,P

Prairie Surveys Ltd.
1170 Winnipeg Street
Regina, Saskatchewan, S4R 1J6
Telephone: (306) 525-6200
Telex: -
Cable: -
Capability: A,C,T,L,M,R

Resource Mapping Services Ltd.
300 Steelcase Road West, Units 4&5
Markham, Ontario, L3R 1B3
Telephone: (416) 495-0428
Telex: -
Cable: -
Capability: A,C,L,M

Routhier, Grenier & Assoc.
1987 du Sanctuaire
Beauport, Québec, G1E 4E2
Telephone: (418) 667-1913
Telex: -
Cable: -
Capability: C,L,M

T&S Topographic Services Ltd.
10543-123rd Street
Edmonton, Alberta, T5N 1N9
Telephone: (403) 482-7508
Telex: -
Cable: -
Capability: A,C,L,M,P,R

Terra Surveys Limited
2060 Walkley Road
Ottawa, Ontario, K1G 3P5
Telephone: (613) 731-9571
Telex: 053-3502
Cable: GEOTERRA
Capability: A,C,T,L,M,P,R

Western Photogrammetry
17007-107th Avenue
Edmonton, Alberta, T5S 1G3
Telephone: (403) 483-7722
Telex: 037-2537
Cable: -
Capability: A,C,T,L,M,R

4.3 THE REMOTE SENSING INDUSTRY

The names and addresses of 22 companies offering a variety of remote sensing services are listed on the following pages.

Code Used for Capabilities
of Remote Sensing Companies

C = Consulting Services
S = Data Systems and Services
E = Equipment

Barringer Research Ltd.
304 Carlingview Drive
Rexdale, Ontario, M9W 5G2
Telephone: (416) 675-3870
Capability: C,E

Dames and Moore Limited
11618-75th Avenue
Edmonton, Alberta, T6G 0J2
Telephone: (403) 436-9460
Capability: C

Dendron Resource Surveys Ltd.
P.O. Box 6493, Station "J"
Ottawa, Ontario, K2A 3Y6
Telephone: (613) 225-6903
Capability: C

Dipix Systems Limited
1785 Woodward Drive
Ottawa, Ontario, K2C 0P9
Telephone: (613) 224-5175
Capability: E

Dobrocky Seatech Limited
130 Kingston Street
Victoria, B.C., V8V 1V4
Telephone: (604) 388-9131
Capability: C

Geostudio Consultants
525 St. Laurent Blvd. - Ste. 24
Ottawa, Ontario, K2H 8K7
Telephone: (613) 746-2950
Capability: C

Geoterrex Limited
2060 Walkley Road
Ottawa, Ontario, K1G 3P5
Telephone: (613) 731-9571
Capability: C,S

Gregory Geoscience Ltd.
1750 Courtwood Crescent
Ottawa, Ontario, K2C 2B5
Telephone: (613) 224-9565
Capability: C

Intera Environmental
Consultants Ltd., Centre 70,
7015 MacLeod Trail, S.W.
Calgary, Alberta, T2H 2K6
Telephone: (403) 253-8895
Capability: C,S

ISIS Limited
P.O. Box 1630, Prince Albert
Saskatchewan, S6V 5T2
Telephone: (306) 764-3602
Capability: S

J.D. Mollard & Associates
815 McCallum - Hill Building
Regina, Sask. S4P 2G6
Telephone: (306) 352-8811
Capability: C

Kenting Exploration Services Ltd.
5636 Burbank Crescent
Calgary, Alberta, T2H 1Z6
Telephone: (403) 253-6633
Capability: C,S

Lockwood Survey Corporation Ltd.
1409 West Pender Street
Vancouver, B.C., B6G 2S4
Telephone: (604) 683-6501
Capability: C,S

MacDonald Dettwiler & Assoc. Ltd.
Nootka Building
10280 Shellbridge Way
Richmond, B.C., V6X 2Z9
Telephone: (604) 278-3411
Capability: E

Nordco Limited
P.O. Box-8833
St. John's, Nfld., A1B 3T2
Telephone: (709) 754-2401
Capability: C

Norpak Limited
P.O. Box-70
Pakenham, Ontario, K0A 2X0
Telephone: (613) 624-5555
Capability: E

PHD Associates
107 Fordwich Crescent
Rexdale, Ontario, M9W 2T6
Telephone: (416) 742-6425
Capability: C

Philip A. Lapp Ltd.
56 Sparks Street - Suite 100
Ottawa, Ontario, K1P 5A9
Telephone: (613) 238-2452
Capability: C

Remotec Applications Inc.
P.O. Box 5547
St. John's, Nfld.,
Telephone: (709) 364-1779
Capability: C

SED Systems Limited
710 - 350 Sparks Street
Ottawa, Ontario, K1R 7S8
Telephone: (613) 238-8241
Capability: S

Shawinigan Engineering Co. Ltd.
620 Dorchester Boulevard West
Montreal, Quebec, H3B 3L7
Telephone: (514) 878-9311
Capability: C

Sibbald Group
2300 Bow Valley Square 3
255-5th Ave. S.W.
Calgary, Alberta T2P 3G9
Telephone: (403) 263-5760
Capability: C

5. INSTRUMENT DEVELOPMENT

Endowed with a strong and thriving electronic industry, Canada is taking full advantage of the latest instrumental developments to launch an ambitious construction program of photogrammetric instruments.

5.1 The CANADIAN MARCONI COMPANY is developing photogrammetric products based upon the technology developed by the National Research Council of Canada. The first result of this development is the ANAPLOT II system of photogrammetry.

The ANAPLOT II is based upon the modular approach to measurement systems which has become almost standard to the field of high-order instrumentation, and provides the means of satisfying the needs of conventional mapping, the automatic production of orthophotographs, the automatic production of digital terrain maps, the semi-automatic production of elevation contour maps, and on-line aerial triangulation.

The modules are so designed that the relevant characteristics of assembled instruments are sufficiently better than the best resolution expected in the photographs to be analyzed, so that the instrument does not intrude upon the accuracy of the measurements. In manual operation, the relevant characteristics of the instrument are sufficiently superior to the visual acuity and manual dexterity of the observer to ensure no degradation in the pointing accuracy or speed of response of the observer. Emphasis is also put upon making full use of the operator's capabilities by providing adequate field of view and controls of such size, shape and position so as to provide the traditional handwheels and footwheel, while at the same time conforming to the latest trends in human engineering.

The system stresses high resolution viewing systems and high precision measurement. Demonstrated root mean square accuracies over a 9" x 9" grid are within 1.5 micrometres.

5.2 The Graphics Division of SYSTEMHOUSE LTD. designs cartographic and photogrammetric systems. AUTOMAP/AUTOCHART, a cartographic system for the production of topographic maps and nautical charts, is in use in Australia and Canada and will shortly be delivered to India. Recently SHL has completed the development of AUTOPLOT, a universal analytical stereoplotter based on NRC technology. The AUTOPLOT system provides all of the precision photogrammetric facilities required by commercial, government and research agencies.

SHL and its Graphics Division have a proven record of professional development services for cartographic and photogrammetric systems. AUTOPLOT, the analytical stereoplotter integrated with AUTOMAP, the map production system, provides a complete and cost effective turnkey system for commercial and government aerial survey and mapping agencies.

5.3 Over the past three years GESTALT INTERNATIONAL LTD. has moved from Vancouver, B.C. to Stittsville, Ontario and finally to Toronto, Ontario. GESTALT has amalgamated with a long established air survey company and is now known as NORTHWAY-GESTALT CORPORATION.

Three series II GESTALT PHOTO MAPPERS have been installed during this period:

- A system was delivered to the Surveys and Mapping Branch of the Department of Energy, Mines and Resources in Ottawa during 1977. This instrument is primarily used in support of the 1:50 000 national topographic series.

- Late in 1978, a GPM II with stereomate capabilities was installed at the Instituto Geografico "Agustin Codazzi" in Bogota, Columbia, including four digitized stereomate plotters, and a computerized drafting system. Orthophotos and stereomates are being used for a cadastral mapping program.

- A second GPM II was delivered to the United States Geological Survey in Reston, Virginia early in 1979 for use in their national orthophoto mapping program.

NORTHWAY-GESTALT presently operates two GESTALT PHOTO MAPPERS in Canada, both of which will have DEM capability by mid 1980. A series V GPM is presently being developed with high precision transports which will significantly improve the accuracy of digital elevation models.

BIBLIOGRAPHY
1976-1980

This bibliography includes papers and technical reports published by Canadians in the period 1976-1980.

COMMISSION I
PRIMARY DATA ACQUISITION

Carman, P.D., "Aerial Camera Vibration", Proceedings of ISP Commission I Symposium, Tokyo, May 1978.

Carman, P.D., Brown, H., "N.R.C. Camera Calibrator". Photogrammetria, Vol. 34, 1978, pp. 147-165.

Carman, P.D., Johnston, S.F., "Effects of Ambient Conditions on Film Sensitivity", Proceedings of ISP Commission I Symposium, Tokyo, May 1978.

Fleming, E.A., "Aerial Cameras and Aerial Photogrpahy", presented at the Seminar for Potential Users of Photogrammetry, sponsored by the Photogrammetry Committee of CIS, Ottawa, October 25-26, 1979.

Fleming, J., "Exploiting the Variability of Aerochrome Infrared Film". Photogrammetric Engineering and Remote Sensing. Vol. 44, No. 5, May 1978, pp. 601-605.

Fleming, J., "Standardization Techniques for Aerial Colour Infrared Film", ICAS Technical Publication SMP 1253B, Canada Map Office.

Ziemann, H., "Report of the Working Group on Image Geometry", Proccedings of the XIII Congress of the International Society of Photogrammetry, Helsinki, 1976.

Ziemann, H., "Repeated Photographic Laboratory Calibrations of Two Reseau Cameras", Photogrammetria, Vol. 34, p.167, 1978.

Ziemann, H., "A Coordinate System for Aerial Frame Photography", Photogrammetric Engineering and Remote Sensing, Vol. 44, p. 597, 1978.

Ziemann, H., "Progress Report of the Working Group on Image Geometry", Proceedings ISP Commission I Symposium, Tokyo 1978.

Ziemann, H., "Visual Calibration of Reseau Cameras", Photogrammetria, Vol. 34, p. 119, 1978.

Ziemann, H., "Organisationsformen fur ein Liegenschaftskataster", Nachrichten aus dem Offentichen Vermessungsdienst des Landes Nordrhein-Westfalen, 11 (1978), 4, 140-153.

Ziemann, H.,"Die Definition Kammer-bezogener Photogrammetrischer Grundbegriffe und Bestimung Flachenhafter Verzeichnungswerte", German Geodetic Commission, Seires B, No. 216 (Festschrift Gotthardt), pp. 164-187.

COMMISSION II

INSTRUMENTATION FOR DATA REDUCTION

Allam, M.M., "Interfacing Analog Photogrammetric Instruments with Digital Information Systems", Proceedings of 45 ASP Annual Convention, Washington D.C., March 1979, Volume I, pp. 92-110.

Blachut, T.J.," A Brief History of the ANAPLOT", The Canadian Surveyor, Volume 33, p. 90, 1979.

Blachut, T.J., Basic Features, Design Configurations and Performance of the ANAPLOT", The Canadian Surveyor, Volume 33, p. 107, 1979.

Jaksic, Z, " The Significance of Analytical Instruments in the Development of Methods and Techniques in Photogrammetric Data Precessing", Proceedings of the XIII Congress of the International Society of Photogrammetry, Helsinki, 1976.

Jaksic, Z., "Interfacing Analytical Photogrammetric Instruments with Digital Cartographic Systems", Archives of the XVth Congress of FIG, Stockholm, 1977, pp. 365-372.

Jaksic, Z., "Notes on the Evaluation Criteria and Performance Tests for Analytical Plotters", Proceedings of the International Symposium on Equipment for Analytic Photogrammetry and Remote Sensing, Paris, 1978.

Jaksic, Z., "Conceptual Principles and Architecture of the ANAPLOT System", The Canadian SUrvyeor, Vol. 33, p. 95, 1979.

Jaksic, Z., "Software Design and Basic Application Software of the ANAPLOT", The Canadian Surveyor, Vol. 33, p. 131, 1979.

Kratky, V., "Real-Time Photogrammetric Support of Dynamic Three-Dimensional Control, Photogrammetric Engineering and Remote Sensing, Vol. 45, p. 1231, 1979.

Pekelsky, J.R., "Simple, Stable Kinematic Mirror Mount", Rev. Sci. Instrum. 50, 25 (1979).

Pekelsky, J.R., "The Optical System of the NRC ANAPLOT". The Canadian Syrveyor 33, 125 (1979),

Real, R.R. "Graphic Data Compressor for Plotting Instruments", IEEE Trans. Industrial Electronics and Control Instrumentation IECI-22, 555(1975).

Real, R.R., "Reversible Binary Rate Scalers for Positional Control", IEEE Trans. Industrial Electronics and Control Instrumentation IECI-22, 569 (1975).

Real, R.R., "Digital Profile to Contour Converter and Display", Appl. Opt. 15, 2855 (1976).

Real, R.R., "Special Purpose Incremental and Parallel Computing Applied to Photogrammetric Instrumentation", IEEE Trans. Industrial Electronics and Control Instrumentation IECI-23, 354 (November 1976).

Real, R.R., and K.K. Lau., "Control System for the Analytical Processing of Stereo-Images", Rev. Sci. Instrum. 48, 1021-1027 (1977).

Real, R.R., "Proposed Instrumentation for Analytical Video Stereoscopy of Extended Images", IEEE Trans. on Instrumentation and Measurement IM-27, 243 (1978).

Real, R.R., "Proposed Analytical Stereo System for Diagnostic Radiology", J. Appl. Photographic Engg. 5, 226 (1979).

Real, R.R., "Control System for the NRC ANAPLOT", The Canadian Surveyor 33, 153 (1979).

COMMISSION III
MATHEMATICAL ANALYSIS OF DATA

Allam, M.M., C.K. Chaly and C. Wong., "Geometrical Distribution of Vertical Control and the Simultaneous Adjustment of Auxiliary Data in Independent Model Triangulation", Paper presented at ISP, July 1976. 9p.

Allam, M.M., "Photogrammetric Deformation of Lake Surfaces Caused by Air Temperature Differential Over Water Bodies", Paper presented at ISP, July 1976. 13p.

Allam, M.M., "Aerial Triangulation", Proceedings of the A.C.S.T.T.O. Symposium", Ottawa, November 1976, pp. 31-33.

Allam, M.M., "Manitoba Retracement Survey", Proceedings of the A.C.S.T.T.O. Symposium, Ottawa, November 1976, pp. 42-47.

Allam, M.M., "Software Package for Topographic Mapping Using Digital Terrain Models", Proceedings of the International Users Conference on Computer Mapping Software and Data Bases, Harvard University Laboratory for Computer Graphics and Spatial Analysis, Cambridge, Massachusets, U.S.A., July 1978.

Allam, M.M., "A Photogrammetric Retracement Survey", The Ontario Land Surveyor Journal, Volume 21, No. 1, Winter 1978, pp. 30-32.

Allam, M.M., "DTM's Application in Topographic Mapping", Proceedings of the ASP DTM's Symposium, St. Louis, Missouri, May 7-9, 1978, pp. 1-15. Published in Photogrammetric Engineering and Remote Sensing Journal, Volume 44, No. 12, December 1978, pp. 1513-1520.

Blais, J.A.R., "Space-M Spatial Photogrammetric Adjustment for Control Extensions Using Independence Models". Paper presented at ISP, July 1976.

Brandenberger, A.J., "Combined SKYLAB and High Altitude Aircraft Photography Space Triangulation", Co-author: M.E.O. Ali, Proceedings, International Symposium, Commission IV, ISP, VOl. XXII-4 "New Technology for Mapping", October 2-6, 1978, Ottawa, Canada, pp. 354-373

Bujakiewicz, A., "The Correction of Lens Distortion with Polynomials", Canadian Surveyor 30, No. 2, 67 (1976).

Derenyi, E.E., "Horizontal Control Extension with SKYLAB/EREP Imagery", The 42nd Annual Meeting of the American Society of Photogrammetry, Washington, D.C., February, 1976, pp. 118-128.

Derenyi, E. and J.E. Drummond, "Map Quality COntrol Using Extra Aerotriangulation Points", 45th Annual Meeting of the American Society of Photogrammery, Washington, D.C., March 1979, pp. 591-598.

Faig, W., "Aerotriangulation", Lecture Notes No. 40, Department of Surveying Engineering, U.N.B., 1976.

Faig, W., and S.F. El Hakim, "The Utilization of Auxiliary Vertical Control in Aerotriangulation with PAT-M", U.N.B. Technical Report No. 36, 1976.

Faig, W., S.F. El Hakim, and T. Mathew, "Vertical Control for Independent Model Triangulation", Journal of the Surveying and Mapping Division, American Society of Civil Engineers, 1977, pp. 37-46.

Faig, W., and S.F. El Hakim, "Compensation of Systematic Image Errors Using Spherical Harmonics", Proceedings of the ASP/ACSM Fall Convention, Little Rock, Arkansas, 1977, pp. 492-498.

Faig, W., and S.F. El Hakim, "Comined Geodetic and Photogrammetric Adjustment for Densification of Control Networks", Proceedings, 45th Annual Meeting of the American Society of Photogrammetry, Washington, D.C., 1979, pp. 582-590.

Faig, W., "Canadian Experiences in the Adjustment of Large Photogrammetric Blocks with Auxiliary Vertical Control", Invited Paper, Aerial Triangulation Symposium, University of Queensland, Brisbane, Australia, 1979.

Kratky, V., "Grid-Modified Polynomial Transformation of Satellite Imagery", Remote Sensing of Environment 5, No. 1, 67 (1976).

Kratky, V., "Use of Analytical Photogrammetry in Cadastre", Revista Cartografica, No. 28, 119, 1975, published in 1977.

Kratky, V., "Grid-Structured Reflexive Prediction and Digital Terrain Modeling", Technical Papers from the 1977 ASP Fall Convention, Little Rock, 1977.

Kratky, V., "Reflexive Prediction and Digital Terrain Modeling", Photogrammetric Engineering and Remote Sensing, 44, 5 (1978).

Kratky, V., "DTM Interpolation with Gliding Vectors", Proceedings Digital Terrain Models (DTM) Symposium, ASP, St. Louis, May 1978.

Kratky, V., "Spectral Analysis of Some Interpolation Methods", Proceedings ISP Commission IV Symposium "New Technology for Mapping", ISP, Ottawa, October, 1978.

Kratky, V., "Effects of SEASAT Orbiting on Imaging Geometry of Synthetic Aperture Radar", Proceedings 3rd International Conference on Cartographic Processing and Analysis of Satellite Imagery, GDTA, Toulouse, 1979.

Kratky, V., "On-Line Analytical Triangulation", The Canadian Surveyor, 33, 162 (1979).

Kratky, V., "On-Line Analytical Solutions in Close Range Photogrammetry", The Canadian Surveyor 33, 177 (1979).

Leupin, M., "Optimization of Photogrammetric Point Determination", ISP Commission III, Presented Paper, Helsinki 1976.

Leupin, M., "Analytical Photogrammetry, an Alternative to Terrestrial Point Determination", The Australian Surveyor, 2/1976, Vol. 28.

Leupin, M., "Neue Aspekte der Photogrammetrie in der Grundbuchvermessung am Beispiel der NV Arisdorf", Vermessung, Photogrammetrie Kulturtechnik, 9/1976.

Leupin, M., "Une approche photogrammétrique au problème de la rénovation cadastrale", Canadian Surveyor, 3/1977, Vol. 31.

Leupin, M., "Is Optimization of Photogrammetric Point Determination Possible?" Photogrammetria, 6/1977, Vol 33.

Leupin, M., "Etude sur l'utilisation de la photogrammétrie dans la rénovation cadastrale, 1977", Rapport de recherche pp. 41-46 (1131), Service de la Cartographie, Ministère des Terres et Forêts, Québec.

Leupin, M., "La densification de réseaux trigonométriques par photogrammétrie", Rapport de recherche G-43, 1978, Service de la Géodésie, Ministère des Terres et Forêts, Québec.

Leupin, M., "Real-Time Aerotriangulation for Teaching Purposes", Presented Paper, Annual Convention ASP, Washington, 1979.

Leupin, M., "Grundsaetzliche Probleme bei der Anwendung der Photogrammetrie in der Netzverdichtung", Zeitschrift fuer Vermessungswesen, Heft, 1, 1980, Nr. 105.

Masry, S.E. and P. Vanicek, "Derivation of Camera Rotations from LTN-51 Inertial Navigation Systems", Department of Surveying Engineering Technical Report No. 34, March, pp. 26, 1977.

Masry, S.E.and S. MacRictchie, "Cän Film "Shrinkage" be Ignored?", Department of Surveying Engineering Technical Report, No. 51, February, 1978, pp. 18.

Schut, G.H., "Review of Interpolation Methods for Digital Terrain Models", Canadian Surveyor 30, No. 5 (1976).

Schut, G.H., "Methods and FORTRAN Programs for Self-Calibration of Position Measuring Devices", Revista Cartografica, No. 28, 81-110, 1975, published in 1977.

Schut, G.H. "Selection of Additional Parameters for Bundle Adjustment", Proceedings of Symposium of Commission III of ISP, Moscow, May 1978; Also Proceedings American Society of Photogrammetry, Fall Technical Meeting, Albuquerque, October 1978.

Shut, G.H., "Adjustment of Bundles, Part 2: Programs and Operating Instructions", NRC Report PPR - 48, 1978.

Schut, G.H., "Selection of Additional Parameters for the Bundle Adjustment", Photogrammetric Engineering and Remote Sensing 45, 1243 (1979)

Zarzycki, J.M. and M.M. Allam, "Block Triangulation by Bundles and Stereounits", Paper presented at the ISP, 1976, Joint Publication with G.W. Marks and E.M. Mikhail of Purdue Univeristy, U.S.A.

COMMISSION IV
TOPOGRAPHIC AND CARTOGRAPHIC APPLICATIONS

Allam, M.M., and C. Wong, "Gridding Topographical Surfaces", Paper Presented at ISP, July 1976, 9 p.

Allam, M.M., "New Mapping Systems at the Surveys and Mapping Branch", The Ontario Institute of Chartered Cartographers, Volume 78, No. 4, August 1978.

Allam, M.M. "The Role of the GPM-II/Interactive Mapping System in the Digital Topographic Mapping Program", Proceedings of the International Society for Photogrammetry Commission IV Symposium, Ottawa, Canada, October 1978, pp. 5-23.

Allam, M.M., "Digital Topographical Map Production", Invited Paper - DTM Symposium, Guelph University, Guelph, October 9-11, 1979.

Allam, M.M., "Multiple Station Interactive Map Compilation with Distributive Computer Network", Invited Paper- AUTO CART IV Symposium, Reston, Virginia, U.S.A., November 4-8, 1979.

Blachut, T.J., "Sistema de cartografia y fotointerpretacion basados en ortofotos estereo", Instituto Geografico Militar of Argentina, Technical Series, Vol 15, Buenos Aires, 1976.

Blachut, T.J., "Algunas reflexiones sobre las disciplinas geodesicas en el contexto de las necesidades y el desarrollo actual", Revista Cartografica, No. 26, Mexico 1974, published 1976.

Blachut, T.J., "Importancia de las tecnicas ortofotograficas", Revista cartografica, No. 27, Mexico, 1974, published 1976.

Blachut, T.J., "The Stereo-Orthophoto Technique in Cadastral and General Mapping", Photogrammetric Engineering and Remote Sensing XLII, No. 12 (1976).

Blachut, T.J., and M.C. Van Wijk, "Results of the International Orthophoto Experiment 1972-76", Photogrammetric Engineering and Remote Sensing XLII, No. 12 (1976).

Blachut, T.J., "Tecnica estereo-ortofotografica en el levantamiento de mapas catastrales y generales integrados a escale grande", El Catastro, Instituto Geografico Militar y de Catastro Nacional, La Paz, October 1977.

Blachut, T.J., and M.C. Van Wijk, "Resultados del experimento ortofotografico internacional de 1972-76", Revista Cartografica, No. 29, Mexico, 1976, published 1977.

Blachut, T.J., "Considérations fondamentales sur la stéréo-orthophotographie et son état présent", Commünications de la Journée Stéréo-orthophotographie, IGN, Paris 1978.

Byrne, J.M., "Utilization of Orthophoto Base for Forest Inventory Mapping", Proceedings, ISP Commission IV Symposium, Ottawa, Canada, October 1978, pp. 708-714.

Collins, S.H.,"Algorithms for Dense Digital Terrain Models", Proceedings, ISP Commission IV Symposium, Ottawa, Canada, Octobe 1978, pp. 715-725.

Daykin, S.E.,"Gestalt Service Centre Operations, Orthophoto Mapping Experience, and Future Gestalt Technology", Proceedings, ISP Commission IV Symposium, Ottawa, Canada, October 1978, pp. 516-523.

Derenyi, E., and S. MacRitchie, "Photogrammetric Application of SKYLAB - Photography", Canadian Surveyor, Vol. 34, No. 1.

Everett, M.J., "Interactive Digital Photogrammetry at B.C. Hydro", Proceedings, ISP Commission IV Symposium, Ottawa, Canada, October 1978, pp. 284-292.

Faig, W. and S.E. Masry, "Photogrammetric Flood Risk Mapping", Presented Paper at International Society for Photogrammetry, Commission IV, Inter Congress Symposium, Ottawa, 1978.

Fleming, E.A., "The Use of Satellite Photography in the National Topographic Mapping Program of Canada", Paper presented at ISP, July 1976, 13p.

Fleming, E.A., and D.D. Lelievre, "The Use of LANDSAT Imagery to Locate Uncharted Coastal Features", Paper presented at the 16th Canadian Hydrographic Conference, Burlington, March 1977.

Fleming, E.A., "Positioning Off-Shore Features with the Aid of LANDSAT Imagery, Photogramm. Eng. and Remote Sensing J., 43, 1, 53-59, 1977.

Fleming, E.A., "Photomapping in Review-Progress in Geometry, Reproduction and Enhancement", The American Cartographer, Vol. 5, No. 2, 1978.

Gibbons, G.J., "Experience with Digital Mapping of Topographical Survey", Presented paper, ISP Commission IV Symposium, Ottawa, Canada, October 1978.

Kratky, V., "Use of Analytical Photogrammetry in Cadastre", Proceedings of PAIGH Symposium on Role of Integrated Land Surveys in the Development of Countries, Bogota, Columbia, February 1976.

Linders, J.G., "Data Base Design for Cartographic Applications", Presented Paper, ISP Commission IV Symposium, Ottawa, Canada, October 1978.

Masry, S.E., and R. MacLaren, "Digital Techniques for Map Revision and Detecting Errors in Digitised Data", Department of Surveying Engineering Technical Report No. 40, January pp. 34.

Masry, S.E., "Coastal Mapping from a Stereomodel Established Using Inertial Plaform Data: Error Analysis", Department of Survyeing Engineering Technical Report No. 49, December 1977, pp. 38.

Masry, S.E., J. Gibson, A. D'Aoust, A. Reid, "Application of Inertial Navigation to Coastal Mapping", Proceedings of Coastal Mapping Symposium, Rockville, Maryland, August 14-15.

Masry, S.E., S. MacRitchie, J. Gibson, "Different Considerations of a Universal Coastal Mapping System", Proceedings of International Society of Photogrammetry Inter-Congress Symposium, Ottawa, October 2-6, 1978, pp. 681-701.

Masry, S.E., R.A. MacLaren, "Digital Map Revision", Photogrammetric Engineering, Vol. 45, No. 2, February 1979, pp. 193-200.

Masry, S.E., "Positioning, Mapping and Rectification Using Entities as Substitute to Conventional Control - A New Concept, U.N.B., Research Report #67, January 1980.

Strome, W.M. and E.A. Fleming, "Landsat Imagery - A Cartographic Reference System", Proceedings, ISP Commission IV Symposium, Ottawa, Canada, October 1978, pp. 484-485.

St. Riquier, C., de, "Large Scale Digital Mapping in the Province of Quebec", Proceedings, ISP Commission IV Symposium, Ottawa,Canada, October 1978, pp. 187-193.

Turner, J.B., "M.T.C. Digital Mapping System", Proceedings, ISP Commission IV Symposium, Ottawa, Canada, October 1978, pp. 323-327.

Van Wijk, M.C., "Estereo Ortofotos contra ortofotos tradicionales", Revista Cartografica, No. 27, Mexico, 1974, published 1976.

Van Wijk, M.C., "Geometrical Quality of Stereo-Orthophotos Produced from Automatic Image Correlation Data". Photogrammetric Engineering and Remote Sensing 45, 1363 (1979).

Van Wijk, M.C., et al., "La révision de la carte de base au 1:25 000 en France", Société Française de Photogrammétrie, Bulletin No.58, 1975, published in 1976.

Van Wijk, M.C., et al., "Production and Accuracy of Simultaneously Scanned Orthophotos", Photogrammetric Engineering and Remote Seinsing 42, No. 12 (1976).

Van Wijk, M.C., "Geometrical Quality of Stereo-Orthophotos Produced from Automatic Image Correlation Data", Proceedings, Symposium of Commission IV of ISP, Ottawa, 1978.

Zarzycki, J.M., "Experience with the Automated Contouring by Gestalt Photomapper GPM-2 for Production of 1:50,000 maps", Paper presented at ISP, July 1976, 8p.

Zarzycki, J.M., "An Integrated Digital Mapping System", The Canadian Surveyor, Vol 32, No. 4, 1978.

Zarzycki, J.M., "Digital Mapping and Computer Assisted Cartography", Presented Paper at the Sixth Conference of South African Surveyors, 1978.

Zarzycki, J.M., "The Impact of Computer Technology on the Relative Roles of Photogrammetric Engineers and Coartographers", a position paper for the Joint ISP/ICA/FIG Meeting, Zurich, Switzerland, Jly 9-13, 1979.

Zarzycki, J.M., "The Integration of Gestalt and Automated Cartography as a National Tool" presented at the Commonwealth Survey Officers' Conference, Cambridge, England, July 20, August 4, 1979.

Zarzycki, J.M., "Digital Photogrammetric Mapping and Digital Topographic Data Base", Volume in honour of Professor Solaini of Italy, October 9, 1979.

Zarzycki, J.M., "Opportunities and Perspectives in Digital Mapping and Automated Cartography", USGS International Centennial Symposium, Reston, Virginia, U.S.A., October 14-19, 1979.

Ziemann, H., "A Data Base for Geographic Referencing in a Land Data System", Proceedings of the 37th Annual Meeting of the American Congress on Surveying and Mapping, Washington, D.C. February 1977, p. 469-477.

Ziemann, H.,"Spatial Partitioning in Land Data Management (Cadastral) Systems", Proceedings of an Advanced Study Symposium on Topological Data Structures for Geographic Information Systems, Harvard University, Cambridge, Massachussets, October 1977, 44 p.

Ziemann, H., "Key-Note Address", Proceedings of Seminar on the Correlation Between Control and Cadastral Surveys, Toronto, 1978.

Ziemann, H., "Requirements of a Land Data Management System", Proceedings of Symposium on User Requirements for Land Records and Resource Information Systems, Univ. of Maine at Orono, Orono, Maine.

Ziemann, H., "Land Unit Identification - An Analysis", NRC 15736, PPR46, 213 p.

COMMISSION V
NON-TOPOGRAPHIC PHOTOGRAMMETRY

Allam, M.M., "The Estimation of Fractures and Slope Stability of Rock Faces Using Analytical Photogrammetry", Paper presented at ISP, July 1976, 13 p.

Allam, M.M., "The Estimation of Fractures and Slope Stability of Rock Faces Using Analytical Photogrammetry", Photogrammetria, Volume 34, No. 3, May 1978, pp. 89-99.

Faig, W., "Photogrammetric Surveys of Underwater Objects", Invited Paper for the ASP Coastal Mapping Symposium, Rockville, Md., 1978.

Faig, W., "The Utilization of Photogrammetry in the Determination of Deformation of Structural Parts in the Ship Building Industry", Invited Paper, 2nd International Symposium on Deformation Measurements, FIG, Bonn, 1978.

Ghosh, S., "Scanning Electron Microscope, Systems and Applications", Chapter 6 of Handbook of Non-topographic Photogrammetry, ASP, the same listed above under No. 62 (1976), 141-147 pp.

Ghosh, S., "Analytical Techniques in Photogrammetry -- Some Comments; Invited Paper at the International Conference on Computer Applications in Civil Engineering; Roorkee, India, 4 pp., October 1979.

Ghosh, S.,"Photogrammetry for Police Use: Experience in Japan", Photogrammetric Engineering and Remote Sensing, Vol 46, 4 pp., March 1980.

Kratky, V., "Analytical X-Ray Photogrammetry in Scoliosis", Photogrammetria 31, No. 6, 195 (1975).

Kratky, V., "Analytical On-Line Systems in Close-Range Photogrammetry", Photogrammetric Engineering and Remote Sensing 42, No. 1, 81 (1976).

Kratky, V., "On-Line Analytics for Close-Range Photogrammetry", Technical Papers from 1976 ASP Fall Convention, Seattle, 1976.

Kratky, V., "Analytical Study of a Photogrammetric Solution for Real-Time Three-Dimensional Control", Proceedings, ISP Commission V Symposium "Photogrammetry for Industry", Vol II, ISP, Stockholm, August 1978.

Masry, S.E., E. Derenyi and B.G. Crawley, "Photomaps from Non-Conventional Imagery", Photogrammetric Engineering, Vol. 42, No. 4, April, pp. 497-502, 1976.

Masry, S.E., W. Faig, "The Analytical Plotter in Close-Range Application", Photogrammetric Engineering, Vol 43, No. 1, January, pp. 89-94, 1977.

Van Wijk, M.C. and H. Ziemann, "The Use of Non-Metric Cameras in Monitoring High Speed Processes", Photogrammetric Engineering and Remote Sensing 42, No. 1, 91 (1976).

Van Wijk, M.C., Co-Author, "Moiré Topography in Scoliosis Screening", Clinical Orthopaedics and Related Research 129, November-December 1977).

Van Wijk, M.C., R. Bozozuk and B.H. Fellenius, "Terrestrial Photogrammetry for Measuring Pile Movements", Canadian Geotechnical journal 15, 596 (1976).

Van Wijk, M.C., D.C. Murdey, "The Measurement of Sailboat Hull Shape Using a Photogrammetric Method", Report LTR-SH-249 - National Research Council, 1979.

COMMISSION VI
ECONOMIC, PROFESSIONAL AND EDUCATIONAL ASPECTS OF PHOTOGRAMMETRY

Blachut, T.J., "Some Reflections on Survey Discipines in the Context of Present Development and Requirements of Society", Canadian Surveyor 30, No. 1, March 1976.

Blachut, T.J., A. Chrzanowski and J. Saastamoinen, "Urban Surveying and Mapping", Springer-Verlag, New York, 1979, 372 + ix pp., with 155 figures.

Brandenberger, A.J., "General Report of ISP Working Group VI-1; A World-Wide Analysis on Photogrammetric Education and Photogrammetric Research Policy & Organization", Invited Paper, XIII Congress of the International Society of Photogrammetry, Helsinki 1976, Commission VI, 1972-1976, Cracow, Poland; 9 pages.

Brandenberger, A.J., "Cadastral Surveying & Mapping in the Framework of World & National Surveying and Mapping (S & M) Activity". Proceeding of the Land Records Symposium, August 25-27, 1976, University of Maine at Orono, Orono, Maine, U.S.A., 12 pages.

Brandenberger, A.J., "Study on the Status of World Cartography", Department of Economic and Social Affairs; World Cartography, Volume XIV, ST/ESA/SER.L/14; United Nations, New York, U.S.A., 1976; Pages 71-96.

Brandenberger, A.J., "Das Vermessungs-und Kartenwesen in der Sowjetunion", Nachrichten aus dem Karten-und Vermessungswesen, Reihe I: Originalbeitrage, Heft Nr. 71, Institut fur Angewandte Geodasie, Frankfurt A.M. 1977, pp. 17-26.

Brandenberger, A.J., "Educational Trends in the Mapping Sciences", Proceedings of the International Symposium held October 6-8, 1976; Fawcett Centre fo Tomorrow, The Ohio State University, Columbus, Ohio, U.S.A., 1977, Pages 22-33.

Brandenberger, A.J., "A Survey of Mapping Capabilities and Achievements in the OAS-Member States", Natural Resources Forum, Volume 3, No. 1, October 1978, Published for the United Nations by D. Reidel Publishing Company, Boston, U.S.A., Pages 87-90.

Brandenberger, A.J., "Activity Report of ISP WG VI-1, Period 1976-78", Papers for the International Symposium Commission VI, ISP, Poland-Krakow, 8-9 August 1978, The Stanislaw Staszic University of Mining and Metallurgy, Pages 120-130.

Brandenberger, A.J., "Mapping and Air Photography Inventory Work Presented in the UN World Cartography Journal and Information Contained in the Surveying and Mapping Data Bank of the Department of Photogrammetry, Laval University", Proceedings of the Second W.I.S.I. Meeting, FAO, Rome Italy, December 4-6, 1979, 5 pages. (sous presse)

Brandenberger, A.J., "Study on the World's Surveying and Mapping Manpower and Training Facilities", World Cartography, United Nations, New York, U.S.A., 133 pages. (sous presse)

Brandenberger, A.J., L.M. Sebert, "Survey of the Status of National Mapping and of National Mapping Agencies of the Member States of the Pan-American Institute of Geography and History", Revista Cartografica, Mexico, D.F., 49 pages. (sous presse)

Brandenberger, A.J., "General Report ISP Working Group VI-1; A World-Wide Analysis on Photogrammetric Education & Research", Invited paper, XIV Congress of the International Society of Photogrammetry, Hamburg, 1980.

Faig,W., "Underwater Photogrammetry", ASP Handbook of Non-Topographic Photogrammetry, Chapter 4, 1978.

Ghosh, S., "Analytical Photogrammetry", Book published by Pergamon Press, June, 1979.

Ghosh, S., "Quantitative Methods Applied to Stereo Imaging", Chapters 11, 12 and 13 (Theory, Hardware and Methods, and Application to Single Specimens, respectively) of book: Methods and Prospectives in Cell Biology, Published by Academic Press, Inc., 1980.

Leupin, M., "Photogrammetry, a Surveyor's Tool", CIS Annual Convention, Presented Paper, Winnipeg, 1976.

Saastamoinen, J., "On the calculation of Refraction in Model Atmospheres", Refractional Influences in Astrometry and Geodesy, edited by E. Tengstrom and G. Teleki, 78, D. Reidel Publishing Company, Dordrecht, 1979, Proceedings of IAU Symposium No. 89.

Zarzycki, J.M., "Research and Development in Topographical Survey", Ottawa, R&D Seminar, April, 24-25, 1979.

Ziemann, H., Guest Editiorial, Photogrammetria 33, 4, 113 (1977).

Ziemann, H., Editorial, The Canadian Surveyor 32, No. 2, June 1978.

COMMISSION VII
INTERPRETATION OF DATA

Alfoldi, T.T., and J.C. Munday Jr., "Water Quality Analysis by Digital Chromaticity Mapping of Landsat Data", Canadian Journal of Remote Sensing 4, pp. 108-126.

Brach, E.J., R.W. Timker and G.T. St. Amour, "Improvements in Spectral Reflectance Measurements of Field Crops", Canadian Agriculture, Eng. 19, pp. 78-83.

Brandenberger, A.J., "La Photogrammétrie forestière au Canada", Volume en honneur du 70ième anniversaire du Professeur Solaini, Ecole Polytechnique de Milan, Milan, Italie, 9 pages.

Brisco, B., R. Protz, "Evaluation of High-Resolution Side-Looking Airborne Radar on the University of Guelph Test Strip", Fifth Canadian Symposium on Remote Sensing, Victoria, B.C.

Brown, R.J., "Canadian Experiences with the Use of Aerial Thermography", Proceedings of the First National Conference onthe Capabilities and Limitations of Thermal Infrared Sensing in Energy Conservation Programs, Chattanooga, Tennessee.

Brown, R.J., J. Cihlar, "Remote Sensing Reveals Heat Loss", GEOS, WInter Issue: 18-20.

Bunn, F.E., W. Langley, and F.W. Thirkettle, "Development of Digital Optical Procedures for Correction of Luminosity "Hot Spot" on Areal Photographs", Report prepared by Ph.D. Associates, Rexdale for Agriculture Canada, DSS COntract #07SZ .01525-7-0231, 1978.

Butlin, T.J., F.E. Guertin, S.S. Vishnubhatia, "The CCRS Digital Image Correction System", Proceedings of th 5th Canadian Symposium on Remote Sensing, Victoria, B.C. August 1978, pp. 271-283.

Derenyi, E., "A Small Area Crop Information System", Symposium on Remote Sensing for Natural Resources, Moscow, Idaho, September 1979.

Dey, B., H. Moore, and A.F. Gregory, "Applications of Satellite Imagery for Monitoring Snowline in the Yukon and N.W.T., Polar Record, vol. 21(121), 1979. (in press)

Godby, E.A., P. Bhavsar, W.D. Carter, J.N. de Villiers, J. Otterman, W.M. Strome and N. Vinnichenko, "Comparison of the Resolution of Photographic Cameras and Instantaneous Field of View of Linescan Instruments", COSPAR Report to the UN, November 1978.

Ghosh, S., "Quantitative Aspects of Remote Sensing -- A Tool for Agricultural Mapping", Invited Article/Contribution to Agricultural Geography, published by the Delhi School of Economics, Delhi, India, 15 pp.

Jackson, R.D., J. Cihlar, J.E. Estes, J.L. Heilman, A. Kahle, E.T. Kanemasu, J. Millard, J.C. Price and C.L. Wiegand, "Soil Moisture Estimation Using Reflected-Solar and Emitted Thermal-Infrared Radiation", Chapter 4 in Proceedings of a Soil Moisture Workshop, Greenbelt, Maryland, January 1978, NASA Conference Publication 2073.

Kasvand, T., A.R. Mack and C. Merritt, "Reduction of the Uneven Luminosity Associated with High-Altitude Wide Angle Aerial Colour Photographs", Proceedings, Fifth Canadian Symposium of Remote Sensing, Victoria, B.C. pp. 399-407, 1978.

Kerr, G.D., R.C. Rounds, and J.E. Welsted, "Use of Panchromatic and Colour Infrared AIr Photographs to Produce a Vegetation Map for Canadian Forces Base Shilo, Manitoba", Proceedings of Fifth Canadian Symposium on Remote Sensing, Victoria, B.C., pp. 408-414, 1978.

Kesik, A., "Application of Landsat Mosaics for the Compilation of Small-Scale Geomorphological Map of Yukon Territory", ISP and IUFRO Symposium, Freiburg, West Germany.

Lawrence, Garth R., J. Ellis Tracey, and Patricia B. Smith, "The Value of Qualitative Interpretation of Aerial Thermography in Residential Heat Loss Studies", Presented at Fifth Canadian Symposium on Remote Sensing, Victoria, B.C.

Lowry, R.T., S. Shlien and D.G. Goodenough, "A CCRS System for Synthetic Aperture Radar Imagery Analysis", Proceedings of the 5th Canadian Symposium on Remote Sensing, Victora, B.C. pp. 363-372.

Mack, A.R., E.J. Brach and V.R. Rao, "Investigation of Crop Spectra and Selection of Optimal Spectral Channels", Canadian Journal of Spectroscopy, 23:42-51, 1978.

Moore, H.D., J.H. Adams and A.F. Gregory, "Mapping Mine Waste with Landsat Images", 4th Canadian Symposium on Remote Sensing", 1977.

Mosher, P., R.A. Ryerson and W.M. Strome, "New Brunswick Potato Area Estimation from Landsat", Twelfth International Symposium on Remote Sensing of Environment, Manila, Phillipines, April 1978.

O'Neil, R.A., V. Thomson and A. Neville, "The Development of Techniques for the Detection and Tracking of Oil Spill in Ice Infested Waters", Arctic Marine Oilspill Program Seminar, Calgary, Alberta, March 1978.

Pala, Simsek, "Spaceborne Remotely-Sensed Data as Applied by the Ontario Centre for Remote Sensing: Present and Future", Presented at ISP and IUFRO Symposium, Freiburg, West Germany.

Prout, N.A., "Mapping of Ecological Land Units of Labrador Utilizing LANDSAT Imagery", Proceedings of 4th Canadian Symposium on Remote Sensing, Quebec, Que., May 16-18, 1977.

Prout, N.A., "Development of Automated Land Classification Methods for Atlantic Provinces Coastal Resources", Proceedings of the 5th Canadian Symposium on Remote Sensing, Victoria, B.C., 1978.

Rao, V.R., E.J. Brach and A.R. Mack, "Crop Discriminability in the Visible and Near Infrared Regions", Photogrammetric Engineering and Remote Sensing 44:1179-1184.

Rubec, C.D., and J. Thie, "Land Use Monitoring with LANDSAT Digital Data in Southwestern Manitoba", Proceedings of the the Fifth Canadian Symposium on Remote Sensing, Victoria, B.C., pp. 136-145, 1978.

Rubec, D.D.A., and G.M. Wickware, "Automated Land Classification in the Boreal Zone Using LANDSAT Digital Data", Proceedings of the Fifth Canadian Symposium on Remote Sensing, Victoria, B.C., 1978.

Russell, D., D. Mossop and C. Goodfellow, "Remote Sensing for Waterfowl Nesting and Nesting Habitat, Old Crow Flats, Yukon Territory, Canada", PECORA IV-Applications of Remote Sensing Data to Wildlife Management Conference, Sioux Falls, S. Dakota, October 10-12, 1978.

Ryerson, R.A., P. Mosher, V.R. Wallen and N.E. Stewart, "Three Tests of Agricultural Remote Sensing for Crop and Inventory in Eastern Canada: Results Problems and Aspects", Proceedings from the Fifth Canadian Symposium on Remote Sensing, Victoria, B.C., pp. 441-453, 1978.

Shubert, J.S., J. Thie and D. Gierman, "Computer Processing of LANDSAT Data as a Means of Mapping Land Use for the Canada Land Inventory", Proceedings from the Fourth Canadian Symposium on Remote Sensing, Quebec, May 16-18, 1977.

Strome, W.M., D.G. Goodenough, F.J. Ahern, L. Gray, S. Shlien and R.T. Lowry, "Digital Analysis of Remotely Sensed Data at CCRS", Proceedings of CIPS Session 1978, Canadian Computer Conference, CIPS, pp. 413-420.

Wallen, V.R., H.R. Jackson, P.K. Basu, H. Baenziger and R.G. Dixon, "Electronically Scanned Aerial Photographic Technique to Measure Winter Injury in Alfaifa", Canadian J. Plant Science 57:647-651, 1977.

Zailinszky, Pala, Victor and Simsek, "Digital Analysis of Landsat Data for Selective Forest Stand Typing - an Initial Feasibility Study", Presented at ISP and IUFRO Symposium Freiburg, West Germany.