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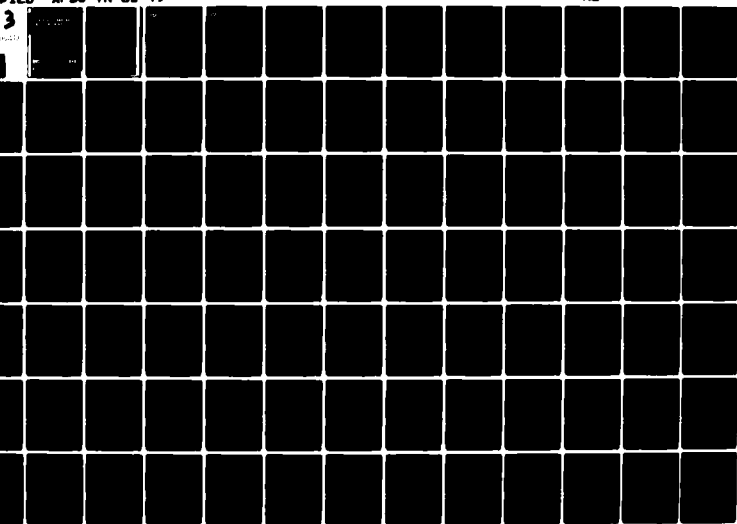
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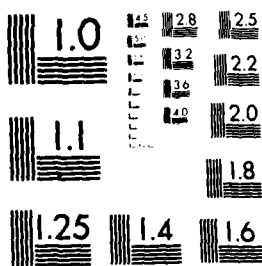
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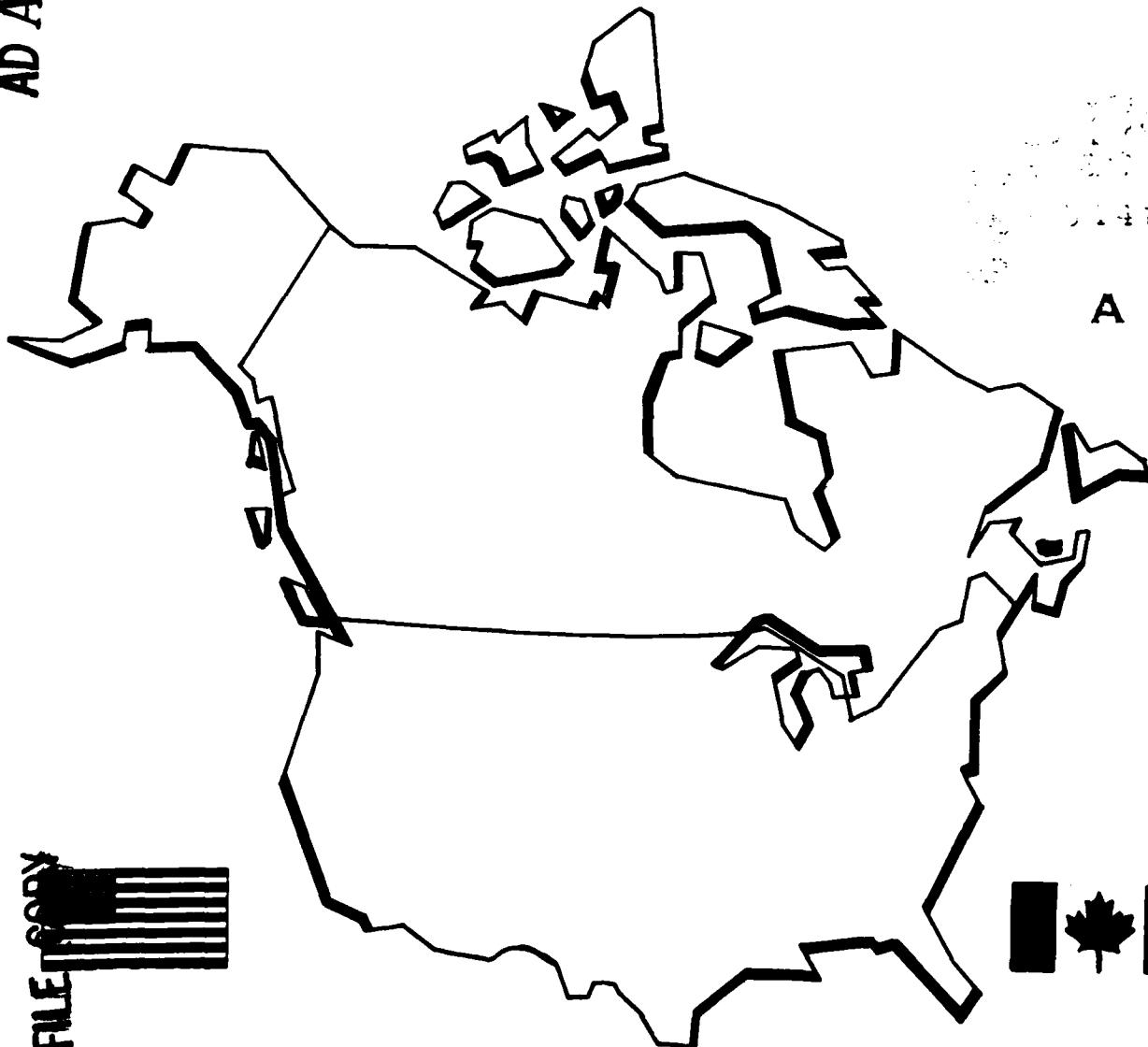
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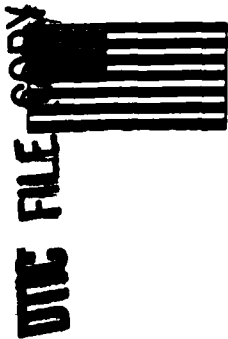
SEPTEMBER 1981

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CATALOG OF CANADIAN INDUSTRIAL CAPABILITIES



A



USAF SYSTEMS COMMAND LIAISON OFFICE
OTTAWA ONTARIO CANADA
K1P 5M9

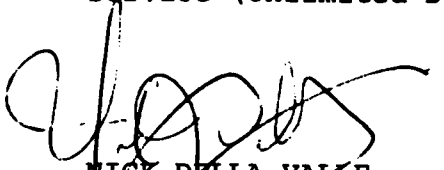
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This report has been reviewed by the USAF Systems Command Liaison Office (Ottawa) and is releasable to the National Technical Information Service (NTIS).

This report has been reviewed and is approved for publication.


JAMES G ESPEY III, Lt Col, USAF
Chief, USAF AFSC Liaison Office (Ottawa)

This report has been reviewed by the Canadian Government and is approved for release to the National Technical Information Service (Unlimited Distribution).


NICK DELLA VALLE
Chief, US Division
Defense Programs Branch
Department of Industry, Trade & Commerce

Qualified requestors may obtain additional copies from the Defense Technical Information Center. All others should apply to the National Technical Information Service.



DEPARTMENT OF THE AIR FORCE
AIR FORCE SYSTEMS COMMAND LIAISON OFFICE
EXPORT DEVELOPMENT BUILDING
110 O'CONNOR STREET—2ND FLOOR
OTTAWA, ONTARIO K1P 5M9

REPLY TO
ATTN OF USAF AFSC LO - Ottawa

SUBJECT AFSC-TR-81-49, "Catalog of Canadian Industrial Capabilities"

TO

1. We are pleased to forward for your information and use AFSC-TR-81-49, "Catalog of Canadian Industrial Capabilities". This report summarizes the technical capabilities of 113 Canadian companies. The purpose of the report is to enhance the awareness of AFSC project and procurement officers of the high technology capabilities of Canadian industry. Our goal for the application of this report is, of course, to increase the level of participation of Canadian industry in AFSC projects either through the normal procurement process or through the auspices of the United States-Canada Defense Production and Development Sharing Program.

2. In future issues of this catalog, we hope to expand on the number of Canadian companies presented and to improve on the keyword accession list for those companies. By June 1982, our office will have an on-line data processing capability to search for specific company capabilities in response to requests from your project and procurement officers.

3. Also enclosed is a copy of an Information Summary which briefly summarizes the activities of this office. We are here to help all AFSC project offices in their dealings with Canadian industry and Government agencies. Please feel free to call Dr Robert L McKenney or the undersigned at 676-6523, or for commercial calls (613) 593-7725.

Donald J Pearson

DONALD J PEARSON, Lt Col, USAF
Chief, USAF AFSC Liaison Office (Ottawa)

2 Atchs

1. AFSC-TR-81-49
2. AFSC LO (Ottawa)
Info Summary



DEPARTMENT OF THE AIR FORCE
AIR FORCE SYSTEMS COMMAND LIAISON OFFICE
EXPORT DEVELOPMENT BUILDING
110 O'CONNOR STREET—2ND FLOOR
OTTAWA, ONTARIO K1P 5M9

INFORMATION SUMMARY

USAF/AFSC LIAISON OFFICE - OTTAWA, ONTARIO, CANADA

1. This office represents the USAF and AFSC Headquarters in a program of research and development cooperation with Canada (Atch 1). Originally oriented toward jointly funded R&D programs, the emphasis of the office has shifted. Changes in the organization of the Government of Canada has elicited new interest in the full spectrum of R&D contracts - from basic research to full production contracts. This, coupled with USDRE and AFSC's interest in promulgating closer US/Canadian contractual relationships, has prompted this office to become more actively interested in all forms of USAF R&D efforts in Canada. These obviously include all forms of R&D, whether jointly funded programs, subcontracts, prime contracts or full production efforts. Our primary mission is R&D contracts; however, we would like to be kept aware of all other USAF production contracts with Canada.
2. While we cannot act as a representative of project and program offices, we can provide information on potential Canadian contractors, attempt to match USAF requirements with Canadian capabilities, arrange meetings, provide points of contact and provide advice based upon our knowledge of Canada. On the other side of the coin, we also provide points of contact for Canadian organizations who wish to compete for forthcoming USAF R&D contracts.
3. This office is the only Air Force R&D organization in Canada, and recognizing the scope and complexity of both the USAF requirements and Canadian capabilities, we can only provide assistance when it is requested. It is up to elements of the USAF and Canadian Government/industry/research community to seek our assistance to increase the benefits to both countries.
4. USAF personnel are sincerely requested to make use of our services and may do so by writing or calling Autovon 676-6523.

PERSONNEL ASSIGNED

DONALD J PEARSON, Lt Col, USAF
Chief Liaison Officer
USAF AFSC LO - Ottawa

ROBERT L MCKENNEY, Jr., PhD
Deputy Liaison Officer
USAF AFSC LO - Ottawa

MARY L SAFFOLD
Liaison Assistant
USAF AFSC LO - Ottawa

MISSION STATEMENT

USAF/AFSC LIAISON OFFICE - OTTAWA, ONTARIO, CANADA

1. The mission of the USAF/AFSC Liaison Office is to achieve improved utilization of industrial, scientific, and technical resources in Canada through increased cooperation with the USAF; and to enhance rationalization, standardization, and interoperability of military equipments in the interest of mutual defense. A partial list of agreements and regulations which affect this mission is given below. This list is not to be considered all inclusive since new agreements and regulations are from time to time being promulgated.

a. Basic Arrangement on Collaboration in R&D between the USAF and the Defense Research Board/RCAF (31 Dec 58).

b. Memorandum of Understanding in the field of Cooperative Development Between The United States Department of Defense and The Canadian Department of Defense Production (21 Nov 63).

c. United States/Canada Defense Production and Development Sharing, AFR 400-34 (28 May 74).

d. Cooperation with Other Countries in Research and Development of Defense Equipment, AFR 80-21 (27 Jan 64).

e. Standardization and Interoperability of Weapon Systems and Equipment in the North Atlantic Treaty Organization (NATO), AFR 73-3 (30 Aug 77).

2. Cooperation with Canada in R&D Universities.

a. Research grants to Canadian Universities.

b. Collaborative R&D with the Department of National Defense.

c. Cost-shared R&D with the Departments of National Defense or Industry, Trade and Commerce.

d. Direct R&D contracts with Canadian industry with no Canadian Government involvement.

3. This office also maintains cognizance of the Canadian R&D community including government, industrial and academic institutions to provide real time information to AFSC organizations on the state-of-the-art of R&D in Canada.

4. Major duties of the office include:

a. Maintain liaison with Canadian Government, industrial and academic communities to identify basic research, development, and production efforts of mutual interest. Make recommendations to USAF on those efforts which warrant USAF funding.

b. Acquaint Canadian industry with USAF procedures and future requirements of USAF.

c. Match USAF requirements with Canadian industrial capabilities.

d. Recommend to both USAF and Canadian agencies those areas where new initiative cooperative R&D may show potential.

e. Advise Canadian agencies on US points of contact.

f. Assist Canadian representatives in making travel arrangements to AFSC installations.

g. Make visit arrangements and provide technical assistance, sponsorship and contacts for Air Force visitors to the area as appropriate.

h. Advise USAF on Canadian R&D projects.

AFSC-TR-81-49, "Catalog of Canadian Industrial Capabilities"
September 1981

E R R A T A

Company: HiTech Canada Ltd

Address: HiTech Canada Building, 5th Floor
1390 Prince of Wales Drive
Ottawa, Ontario, Canada K2C 3N6

Contact: Mr. J E Saarinen, Manager
Market Development
System Sciences Division

Telephone Number: (613) 226-7800

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20. **ABSTRACT** (Continue on reverse side if necessary and identify by block number)

This catalog is a contracting source list of Canadian industries designed to be used by USAF procurement offices and project engineers/scientists. It provides profiles, a company/capability key word cross reference index and contact points for each company.

P R E F A C E

This catalog has been prepared with several objectives in mind:

- To encourage AFSC Project Officers to take advantage of the industrial capability of Canada to increase competition for R&D contracts and thereby decrease costs.

- To engender interest within AFSC for participating in the US/Canada Defense Production and Development Sharing Program (AFSC Sup 1 to AFR 400-34), and on an average, reduce R&D costs by 25 - 75%.

- To encourage Canadian aerospace industry to take a more active role in presenting their capabilities to the USAF for potential R&D efforts.

The data for the company profiles were gathered through personal and telephone interviews along with facility visits. Standard questionnaires were provided to each company and the profiles were based on their responses.

The companies profiled in this catalog represent only a partial cross-section of Canadian industry and research facilities with capabilities that may be of interest to the USAF R&D community, as well as to the logistics community. Being the first catalog of this scope and detail, it more than likely contains errors of omission, e.g., company capabilities that have been overlooked, and cross-referencing errors. Future editions will be more comprehensive and present a more complete picture of Canadian industrial capabilities.

Comments and/or suggestions concerning the format or content of this catalog are solicited. Questions concerning the US/Canada Defense Production and Development Sharing Program or the subject matter of this catalog should be directed to Lt Col Donald J Pearson or Dr Robert L McKenney, Jr., AFSC Liaison Office, Export Development Building, 2nd Floor, 110 O'Connor St, Ottawa, Ontario, Canada, K1P 5M9. Telephone contact can be made at 613-593-7725 (commercial) or Autovon 676-6523.

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Section I

I N T R O D U C T I O N

I N T R O D U C T I O N

One of the functions of the USAF Systems Command Liaison Office (Ottawa), is to stay current on Canadian industrial capabilities and trends. This is accomplished primarily through visits to the companies and personal and/or telephone interviews, followed by the completion of standard format company profile questionnaires. Additional information and leads to new companies are obtained through contacts with the Department of Industry, Trade and Commerce, Supply and Services, and the Canadian Commercial Corporation. This catalog represents the culmination of over one year's work involving extensive interviews and telephone contacts from the Maritimes to the most western provinces.

As would be expected for a modern, industrialized country, Canada's industrial base is very diversified. Their industries range from petroleum, fishing and energy, to chemical, environmental, ordnance, medical, metal working, communications, electronics, and aerospace. There is a very large commitment to the latter three industries which are, as one might expect, primarily concentrated in the Ontario corridor, leading from Windsor through Toronto and Ottawa, and terminating in Montreal, Quebec. There is activity in both the Ottawa and Winnipeg (Manitoba) areas to bring in more electronics oriented industries. These activities are being headed by the Commercial and Industrial Development Corporation of Ottawa-Carleton and the Winnipeg Business Development Corporation. Other areas, such as Vancouver, Calgary-Edmonton, Quebec City and Halifax also have a substantial contribution to the Canadian industrial base.

This first edition of the Catalog of Canadian Industrial Capabilities does not attempt to group the companies into specific categories such as aerospace or electronics. It simply places companies under sixteen major capability areas that include electronics, aircraft, space, software, etc. Neither does the catalog attempt to differentiate R&D capabilities from pure product lines. While most companies have product lines, some are very R&D oriented and seem eager to engage in R&D type contracts. Whether or not a company would consider contracting with the USAF for an R&D project not coupled to the production of an end item, was also not part of the first endeavor. For those companies that appear primarily product oriented, it is assumed that a company designing, developing and producing a product line has an R&D capability within its area of expertise.

Section II of this report presents Canadian industrial capabilities in a general format company profile that also includes history, credentials (gross sales, average work force, and plant size) and experience.

Section III relates company capabilities to a series of sixteen major capability areas. These areas are in turn broken down into more specific capability categories to aid the user in finding potential sources for his contemplated procurement. Companies are entered under appropriate categories in the form of two or three letter codes.

Section IV is simply a company-code cross index.

Section V provides a point of contact for each company along with job title and telephone number.

For the most part, Canadian industrial capability is on an even par with that of the US, but generally on a somewhat smaller scale. It can certainly be considered another source base for USAF R&D procurements as well as for commodity buys. It is hoped that this catalog will help provide the user with some insight into the Canadian system and encourage its use if deemed appropriate. Increased competition and "new blood" can only reduce USAF procurement costs and hopefully lead to better products.

Section II

C O M P A N Y P R O F I L E S

Company: A.E.I. TELECOMMUNICATIONS (Canada) Ltd

Address: 419 Notre Dame Ave
Winnipeg, Manitoba, Canada R3B 1R3

History:

A.E.I. is a Canadian company established over 55 years ago. They are a wholly owned subsidiary of the General Electric Company of England. There are no other Canadian locations.

Capability:

A.E.I. is involved in the engineering, manufacturing, distribution and installation of telecommunication switching systems. They have supplied major local and toll switching systems for Canadian metropolitan areas as well as smaller dial offices, PABX systems and peripheral equipment.

Credentials:

Gross Sales:
Per annum - \$7-8M

Average Work Force:
Eng - 10
Others - 122

Plant Size:
40,000 sq ft

Equipment:
The company has the following equipment available for use on projects:

- . Laboratory equipment: SWPT 6800 Computer Software System, Soroc Software Programming (Development) System, etc.
- . Machinery equipment: Ragen 750 Automatic Self Programmable PC Board Assembly System, Econopak 229 Automatic PC Board Soldering System, etc.
- . Test facilities: Environmental Chamber, adjustable from 0 to 70 celsius (32.0 - 158 fahrenheit) for burn-in testing of various integrated circuits (PC boards).

A.E.I. TELECOMMUNICATIONS (Canada) Ltd (Cont'd)

Experience:

A.E.I. is involved in the production of Automatic Number Identification (A.N.I.) systems and 911 Emergency Reporting Systems for world-wide markets. They have over 20 years of experience with A.N.I. system manufacture and have over 2 million lines of A.N.I. equipment installed in North America and other world-wide markets.

Company: AERO MACHINING Ltd

Address: 5411 Industrial Blvd
Montreal-North, Quebec, Canada H1G 3H7

History:

A small machining company incorporated in 1963 in the Province of Quebec. There are no other Canadian or US locations.

Capability:

Aero Machining provides services in tool design, production, maintenance, sub-assemblies, die and mold development and fabrication. They specialize in general machining, three axis profiling or four spindle profilers, high tensiles, titanium, and D-6-AC material. Their quality control is governed by the "Aero Machining Ltd" quality control manual in accordance with MIL-Q-9858A and MIL-C-45662A. The company is approved for the manufacture of aircraft hydraulic servos, landing gear components, missile and airframe machined parts. Accumulative quality control records are kept to provide necessary traceability of inspection data. Their quality control policy is said to be approved to meet the requirements of various US DOD QC specifications as well as the Canadian DND 1015 specification.

Credentials:

Gross Sales:
1980 - \$2.75M

Average Work Force:
Total - 120

Plant Size:
20,000 sq ft

Equipment:

Their equipment includes lathes, borers, milling machines, profilers, drills, honing machines, and grinders. They have a hydraulic assembly and test facility for all hydraulic assemblies and parts manufactured by the company. They are currently bringing their NC capability to up speed.

Expereince:

Aero principal customers include Air Canada, Canadair Ltd, Canadian Marconi, Douglas Aircraft, GE, United Aircraft, DeHavilland, Grumman Aircraft and Canadian Vickers Ltd.

Company: ALBERTA GOVERNMENT TELEPHONES (AGT)

Address: 10020-100 St
Edmonton, Alberta, Canada T5J 0N5

History:

AGT was created in 1908 to provide telephone service to the Province of Alberta and has since evolved to become the principal telecommunications carrier in the province. It is a crown corporation of the province. The Head Office is located in Edmonton, while regional offices and operating personnel are located in other major centers and throughout the province, respectively.

Capability:

AGT is the principal telecommunications common carrier in Alberta and the provider of shared switched public telecommunications related services and systems with related terminals. In carrying out these functions, AGT has developed extensive expertise in the provisioning of telecommunications. Specifically:

a) Public and Private communications systems carrying voice and/or data over land-lines, microwave radio systems and satellites circuits.

b) Public and Private two-way radio systems that are both stand-alone and connected to the telephone network.

c) Specialized Services - Closed Circuit Television; TV and Audio facilities for broadcasting purposes; Telemetry systems; Radio Paging; and Public Address Systems.

d) Common Carrier technology - Local distribution systems (paired cable, subscriber carrier); Local switching systems (Step-by-Step, Crossbar, Electronic Analog, Digital Electronic); Toll facilities (paired cable and co-axial cable using either Frequency or Time Division Multiplexing, analog and digital microwave radio systems, fibre optic systems); Toll switching systems (Mechanical Analog, Electronic Analog, Digital Electronic).

e) Support services required for the above activities - Purchasing, Material handling and distribution, Test Equipment and System Training.

f) AGT does not have equipment manufacturing capabilities, but has developed the necessary expertise to evaluate and select the best equipment for each application.

ALBERTA GOVERNMENT TELEPHONES (AGT) (Cont'd)

AGT's in-house capabilities can be summarized as follows:

a) A fully qualified Engineering group (535 personnel, including 183 Professional Engineers) involved with R&D for systems and networks, as well as planning and designing of upgrades to the existing plant and provisioning of new plant valued at over \$400 million in 1980.

b) A specification writing and equipment installation group of 784 people to support the Engineering group in re-arrangements and provisioning of equipment.

c) Over 4,000 technicians and craftsmen involved in the maintenance, re-arrangement and turn-up of service.

d) The provision of all auxillary services such as purchasing, stores, training, standardization of equipment, repair and calibration of test equipment, etc.

Telecommunication Facilities	12 Million Cct-km
AGT Local Telephone Service for	1.2 Million Telephones
AGT Long Distance Telephone Service for	1.7 Million Telephones

Credentials:

Statistical Data for AGT (1980 unaudited figures):

Gross Plant Investment	-	\$2.2B
Net Plant Investment	-	\$1.6B
Annual Revenues	-	\$637.0M
Annual Revenues Growth Rate	-	20%
Annual Capital Expenditures	-	\$381.0M
Annual Payroll	-	\$259.0M

Average Work Force:

PhDs	-	16
Masters	-	91
Engs	-	183
Bachs	-	434
Total	-	12,326 (professional & other as of Dec 80)

Plant Size:

N/A

ALBERTA GOVERNMENT TELEPHONES (AGT) (Cont'd)

Experience:

Some of the current projects currently being worked on by AGT are shown below:

a) Packet Switching System -

AGT, as part of the Trans Canada Telephone System, has provided subscribers with access to a packet switching system that is designed to allow communication between any computer and any intelligent or non-intelligent terminal using a high level protocol which makes the telecommunication network effectively transparent.

b) Automated Mobile Telephone System -

AGT is field trailing an automated two-way radio telephone system (AURORA) which is integrated into the existing long distance calling network. The Aurora System will allow two-way dial access between any Aurora mobile telephone and the public switched network.

c) Fibre Optic Telecommunication Facility -

AGT has installed and is operating a fibre-optic telecommunications facility between an outlying Microwave Radio System and the City of Calgary. The fibre-optic link, used to carry normal telephone traffic, is 50 km in length, operates at the T4 rate, and has a total capacity of over 20,000 two-way voice circuits.

d) Micro Computer Controlled Telemetry System -

AGT has several micro computer controlled telemetry systems in service. The system offers a broad flexibility in meeting specific telemetering needs of customers by the provision of standard hardware packages and custom designed software.

e) Wired City Concept -

AGT is field trialing the VIDON System in Calgary. This system is capable of providing a customer's residence with remote burglar, medical and fire alarm service, access to computerized data banks using an existing television set, remote utility metering, and remote control of utilities and other household functions.

ALBERTA GOVERNMENT TELEPHONES (AGT) (Cont'd)

Some of AGT's current R&D activities include:

a) Non-Conventional Power Systems -

AGT has been investigating a number of approaches for providing economic prime power at remote sites by optimizing designs for the generation and storage of electrical energy and through efficient energy utilization. The research program is concerned with investigating technical characteristics and collecting experimental data on the field performance of photo voltaic systems, vertical-axis and horizontal-axis wind generators, and cycled-diesel power systems. In addition, research is being carried out on associated hardware (e.g., batteries, controllers, passively-conditioned housings) in order to optimize the complete system.

b) Laser Communication System -

AGT is testing a free-space laser communications system on a 12.6 km hop in order to characterize the propagation effects and to evaluate system performance, reliability, and other operational aspects.

Company: ALBERTA RESEARCH COUNCIL

Address: 11315-87th Ave
Edmonton, Alberta, Canada T6G 2C2

History:

The ARC is a Crown Corporation founded in 1921 with a mandate to advise the Government on scientific matters and to promote responsible economic development through the use of science and technology.

Capability:

ARC's long Range Plan identified five major areas of research - oil sands, coal, natural resources, frontier sciences and industrial assistance. Oil sands research includes geology studies, heavy oil cracking, in-situ recovery, byproduct usage and bacterial degradation of bitumens. Coal research includes geology studies, liquifaction, pyrolysis, gasification and property definition. Natural resources projects include weather radar studies and weather modifications. Their Atmosphere Sciences Division has helped to develop a weather radar system extensively used in Alberta and sold to and installed in Brazil. The system uses a computer program interactive graphics, to produce displays of vertical cross sections from digital weather radar data archived on magnetic tape. The overall display allows the analyst to examine both the vertical and horizontal structure of the radar echoes. These data are used for storm analysis, hail description, flood prediction, aircraft-storm interaction or avoidance and spacecraft re-entry. Frontier science projects include searches for new catalysts, electroorganic reaction studies, low temperature bacteria studies and oil field origin and groundwater flow relationship. Industrial support efforts include the areas of conventional energy, solar and wind energy, agriculture, transportation, surfacewater engineering and ice engineering.

Credentials:

The ARC operates on a 16 million dollar budget of which about half comes from contracts.

Company: ANATEK ELECTRONICS Ltd

Address: 240 Brooksbank Ave
North Vancouver, British Columbia, Canada V7J 2C1

History:

Anatek is a Canadian owned company incorporated in 1969. It is active in both the Canadian and US electronics markets. The company operates with two divisions, power Supply and Microcircuit.

Capability:

Power Supply Division - Anatek has been building quality custom and laboratory power supplies since 1969. Their standard products include 50 and 120 watt linear laboratory power supplies and a series of 300 watt switching laboratory power supplies.

Microcircuit Division - In order to maintain a competitive stance in the power supply market, Anatek developed their own thick film microcircuit capability. The microcircuit facility, established in 1976 has recently been renovated to include clean-room facilities to improve printing and wire-bonding yields and reliability.

Anatek's future R&D efforts will be directed at the RF device and military market.

Credentials:

Gross Sales:

Power Supplies - \$2M annually

Microcircuits - \$1.5M (projected for 1982)

Average Work Force:

Power Supply Div - 32

Microcircuit Div - 14

Plant Size:

10,000 sq ft

Experience:

Major customers for power supplies have been NCR, Burroughs Business Machines Ltd, Farinon Canada Ltd and Plessey Canada Ltd. Custom microcircuits have been supplied to GTE Lenkurt Electric (Canada) Ltd, NCR and a host of telecommunications and computer peripheral manufacturers.

Company: THE ARMSTRONG MONITORING CORP

Address: 215 Colonnade Road South
Nepean, Ontario, Canada K2E 7K3

History:

A Canadian owned company incorporated in 1970. Formerly called Leak "X" Detection Devices Ltd, and is still affiliated with said company. There are no other divisions, although distributors are located in the US and several other Western countries.

Capability:

This company's original objective was to develop, manufacture and market electronic sensing systems for liquids. Successful additions to the original concept are hazardous gas, geophysical and structural monitoring. They are primarily concerned with the design of custom systems and equipment, although various products are available. At present, their primary interests lie in the detection and monitoring of hazardous gases and liquids, whereas their Leak "X" partner is primarily concerned with the manufacture and installation of linear detection systems for petroleum products. Their standard hazardous gas detectors use an "N" type semiconductor sensor that generally detect in the 1-5000ppm range. Example gases detectable are hydrocarbons, halogenated hydrocarbons, alcohols, ethers, ketones, nitrogen compounds, carbon dioxide, sulfur dioxide, chlorine, hydrogen sulfide and carbon monoxide. Applications for their systems include detection of hazardous gases at petroleum facilities, aircraft hangars, degreasing areas, chemical storage areas and sewage plants. Their liquid sensing and detection systems are designed primarily for storage facilities and pipelines. The system utilizes a special monitor in conjunction with linear or individual sensors. The linear sensor cable can be armored or un-armored and works on the principal of dielectric degradation which affects the electrical properties of the cable and indicates a leak on the monitor. The system works with petroleum and other liquids in a variety of environments. The latter detection device is the subject of a technical report published by Environment Canada entitled, "Evaluation of the Hydrocarbon Leak Detection Device Leak 'X'", (EPS4-EC-78-10), December 1978.

Credentials:

Gross Sales:
Not available

Average Work Force:
Not available

Plant Size:
Not available

THE ARMSTRONG MONITORING CORP (Cont'd)

Experience:

The company works with various departments of the Canadian Government as well as with other governments and private industry. For example, The Leak "X" concept is used in New York City and at Narita Airport in Japan (Japanese MOT). The company is doing business in the US and will do business with the USAF, should the opportunity arise.

Company: ATHABASCA RESEARCH CORPORATION Ltd

Address: 11210-143 St
Edmonton, Alberta, Canada T5M 1V5

History:

A Canadian owned high technology company with one subsidiary in Canada - Tanknology Canada Ltd, and one currently being formed in the US. The company was incorporated in early 1976 primarily to provide specialized services in the design of instruments and systems for air quality monitoring, meteorological measurements, and data acquisition and control systems for the petroleum industry and government agencies.

Capability:

Athabasca Research is actively engaged in the provision of multi-disciplined scientific and engineering systems and services. Their background experience includes the manufacture of geophones and recording seismographs for oil exploration purposes. A significant portion of their present activities are environment oriented, including research, data collection and interpretation, and the development and manufacture of associated instrumentation. They are active in the area of environmental monitoring program management and take responsibility for all aspects including hardware specification, procurement, operation and maintenance and data reduction. They provide turnkey operation of complete environmental and meteorological monitoring systems.

Athabasca's products include 1) weather radar data processing systems, 2) ambient air quality monitoring and meteorological systems, 3) ultraviolet spectrometers, 4) meteorological instruments, 5) Pibal Tracking Systems, 6) automated suspended sediment samplers, 7) geophones and seismographs, 8) a dedicated microprocessor based digital data acquisition system, 9) leak detection system for underground petroleum products storage tanks and 10) laser related devices.

Their weather radar system correlates radar reflections from storms with antenna azimuth and elevation positions and reflections intensities to derive a comprehensive picture of the storm and its characteristics. The system includes a conventional S or C band radar, the interfacing electronics hardware package and a PDP 11/34 computer. It features a strong interactive graphics capability.

Their ambient air quality monitoring systems generally include monitoring trailers equipped with instrument towers, data acquisition and computing terminals along with gas analyzers, meteorological sensors and peripheral devices. These systems are currently designed to detect SO₂, NO₂, NO, NO_x, NH₃, O₃, H₂S, CO and CO₂ to less than

10 ppb levels. The basis for detection is chemiluminescence, fluorescence, UV and IR absorption. Athabasca's meteorological instruments include a Windflo anemometer, Comprop anemometer (composite pitch propeller) for turbulence measurements, atmospheric flux monitor and differential air temperature system. The automated suspended sediment sampler is designed to take water samples for later analysis. The device can either sample continuously (at preselected intervals) or in a "rain gauge" mode. In the latter mode, it remains dormant, consuming almost no power until it is activated by a tipping bucket type of rain gauge.

Their Pibal tracking system is used for the determination of wind speed and direction and/or temperature, at incrementally increasing altitudes. It basically consists of two theodolites on a 1000 ft base line tracking a balloon, each instrument being equipped with shaft encoders that measure azimuth and elevation angles. These data are conveyed to a data acquisition system (Athabasca designed) which is programmed to calculate and print out the altitude, wind speed and direction, downwind position and temperature.

The Athabasca leak detection system utilizes the principle of vacuum induction of air bubbles to detect wall perforations in underground/ enclosed storage tanks for petroleum products. The system consists of a monitoring van equipped with appropriate instrumentation and vacuum equipment and hydrophone probe that identifies the distinctive bubble signature induced by the reduced pressure and simultaneously detects the presence of water. The test method is fast, economically acceptable and is initially evaluated by industry as being superior to other methods currently in use. The system detects pinhole size leaks as well as larger ones and is not subject to most of the drawbacks of the other leak test procedures.

They have conceived, designed and are currently negotiating a contract with the Canadian Department of National Defense to develop a Tactical Target Scoring System. The system can accurately measure the impact position of air delivered ordnance, e.g., bombs, rockets, missiles, etc., on tactical test ranges. It utilizes a unique sensing and data acquisition system that can interpret and transmit objective impact information to the range control facility. The system is independent of visibility restrictions, lighting conditions and can detect the munition's impact with or without an accompanying blast or marking charge. It is self-contained, requiring no external power sources, can be remotely activated or deactivated and conveys information by either conventional RF link or via a data collection platform.

ATHABASCA RESEARCH CORPORATION Ltd (Cont'd)

Finally they have demonstrated expertise in laser technology. Their Lasalign (or Lasaline) product expands a laser beam in one direction by an optical method to form a line that can be used as a reference line. They have also developed and manufactured a laser extinction-type particulate monitor. This device detects particulate matter in air and can give an accurate concentration. It is particularly useful in pollution monitoring, e.g., particulates in stack emissions.

Credentials:

Gross Sales:
1980 - \$1M

Average Work Force:
Total - 20

Plant Size:
7,000 sq ft (enlarged to 16,000 sq ft by 1 Sep 81).

Experience:

Athabasca Research has experience with both the Alberta and Canadian Governments, universities and Canadian industry. Industrial clients include Petro Canada, Imperial Oil Company, Shell Canada Ltd, Amoco Canada Ltd, Texaco Canada Ltd, Gulf Oil Company, Dow Chemical, Sherritt Gordon Mines, Bell and Howell Canada Ltd and Alberta Government Telephones. They have no experience with the USAF, but are interested in working with the USAF in the future.

Company: ATLANTIS FLIGHT RESEARCH Inc

Address: 2450 Derry Rd E., Hangar 5
Mississauga, Ontario, Canada L5S 1B2

History:

A wholly owned Canadian company incorporated in 1978. There are no other Canadian divisions or US subsidiaries.

Capability:

Atlantis is involved in the design, development and manufacture of test equipment primarily in support of avionics systems found on civil aircraft. In addition to test equipment, they have developed a number of custom electronic training aids which are applicable but not limited to the aerospace industry.

The avionics test equipment product line is comprised of a number of self-contained bench test units for various series of avionics systems. Test equipment for radio/radar altimeters, VHF navigation systems, VHF and HF transceivers, audio and passenger address amplifiers, cockpit voice recorders, flight data recorders and other systems have been developed to date and are now in service. In addition to the line of bench testers, Atlantis has produced units to suit customer requirements for testing on-aircraft equipment. For example, Engine Component Simulator and Parameter Readout units have been built to provide a fast and reliable check of engine-related wiring integrity and indicator accuracies for the Canadair Challenger aircraft.

Their Animated System Trainers are independent microprocessor controlled displays which provide a real-time simulation of various aircraft subsystems. For example, AST boards have been delivered to Canadair for their Challenger aircrafts ignition/start, electrical, hydraulic and bleed air systems. ASTs may be configured to suit individual training requirements.

Credentials:

Gross Sales:

1978 - \$45K
1979 - \$180K
1980 - \$400K
1981 - \$750K

Average Work Force:

PhDs - 1
MS - 2
Mfg - 5
Others - 7

Plant Size:

2,000 sq ft

ATLANTIS FLIGHT RESEARCH Inc (Con't)

Experience:

Atlantis has supplied equipment to the Canadian Government, original equipment manufacturers (e.g., Canadair - Challenger wide-bodied business jet, DeHavilland), the corporate aviation sector and major avionics facilities (mainly in support of airlines). Current US sales have been mainly commercial with no sales to the USAF. They are interested in expanding their business to include the US military.

Company: AVIATION ELECTRIC Ltd

Address: 200 Laurentien Blvd
Montreal, Quebec, Canada H4M 2L5

History:

Bendix Aviation Electric Ltd (AEL), a wholly owned subsidiary of the Bendix Corporation, was incorporated in 1931. It has two subsidiary companies, Rousseau Controls Division of Pointe Claire, Quebec and Pacific Division in Vancouver, British Columbia. These firms specialize in industrial hydraulic and pneumatic equipment and aircraft marine products, respectively. AEL is one of the 18 operating divisions forming the Bendix Aerospace-Electronics Group.

Capability:

AEL is one of two divisions within the above mentioned group that has the responsibility for the engine controls and accessories segment of the gas turbine engine market for Canada, and specifically Pratt & Whitney Aircraft of Canada Ltd. These controls and accessories are for power plants of 300 shp, for light single engine turboprops and for the very high thrust (to 50,000 lbs) engines in today's military, civil and transport aircraft. They have actually been involved in the manufacture of small gas turbine engine fuel control systems for over 30 years. They supply engine controls and accessories for the Pratt & Whitney Aircraft of Canada PT6, PT6T and JT15D engines. Their products now span the entire spectrum of powerplant installation with applications on turboprop, turboshaft and turbofan engines. They recently have been assigned the mandate to develop, produce and market the Digital Technology Small Gas Turbine Engine Control Systems worldwide. This system is the result of more than five years of intensive R&D within their Advanced Concepts Program. The technology involved is based on digital electronic computation with simple hydromechanical design. The first generation system has accumulated more than 100 hours of engine running time and more than 500 hours on real time simulators. The second generation system has accumulated 300 hours of real time simulation and has demonstrated accurate and rapid control characteristics when interfaced with two different gas turbine designs.

AEL has over 20 years experience in the land navigation area. Their navigation systems, both magnetic and directional, have been used by the US and Canadian Armed Forces as well as those of some other countries. They are also involved in the development of automatic weather reporting stations and gun alignment and control systems.

AEL is recognized for its repair and overhaul services for such items as aircraft accessories, radar and navigational aids, engine and flight instruments, hydraulic components, turbine engine fuel controls, electric generating equipment, wheels and brakes, airborne computers, and small gas turbine engines. They advertise fast turn-around time and an off-the-shelf exchange program.

AVIATION ELECTRIC Ltd (Cont'd)

AEL works to DND 1015 specification and MIL-Q-9858.

Credentials:

Gross Sales:

1980 - \$51M
1981 - \$58M (projected)
1982 - \$64M (projected)

Average Work Force:

Engineering - 63 (PhDs - 2)
Manufacturing - 940
Sales and Marketing - 86
Admin and Management - 89

Plant Size:

222,000 sq ft (3-building complex)

Experience:

AEL has considerable experience with both the US and Canadian Armed Forces as well as the private sector (worldwide).

Company: AVTECH ELECTROSYSTEMS Ltd

Address: (Mailing)

P. O. Box 5611, Station F
Ottawa, Ontario, Canada K2C 3M1

(Location)

Suite 205, 15 Grenfell Crescent
Nepean, Ontario, Canada K2G 0G3

History:

A small, private Canadian high technology company incorporated in 1975. There are no other branches or affiliates in Canada or the US. The company is represented in the US, France, W Germany, Japan, Switzerland, Austria and the UK.

Capability:

Avtech was established for the purpose of designing and marketing nanosecond waveform instrumentation. Since its start, it has become recognized as a leading supplier of nanosecond waveform generators and accessories with over 75 models. Their product line includes pulse generators, impulse generators, monocyte generators, pulse amplifiers, transformers, power splitters, bias insertion units and scope probes.

Their waveform generators are triggered, miniature and all solid-state. The amplitude and the voltage rate of rise for some of their units are at least an order of magnitude higher than those provided by standard tunnel diode pulse generators. The combination of some aspects of microwave integrated circuit technology with ultra-fast semiconductor device switching technology (including SRD, hot carrier diodes, avalanche, VMOS and bipolar switches) has yielded 199psec rise and fall times, PRF beyond 250 MHz, amplitude to 350 volts, peak currents to 100 amperes and single cycles of RF to 1500 MHz. They can design, develop and build to customer requirements.

Their linear pulse amplifiers are designed to be used to increase the peak output level of laboratory pulse generators to levels as high as 40 volts by providing voltage gains of approximately 2. The Avtech inverting and impedance transformers are designed to be used with general purpose laboratory pulse generators, with subnanosecond risetime pulse generators and circuits and other units. They provide inverted output pulse with a magnitude equal to the input signal magnitude and can match to other impedance levels or can obtain higher output currents.

AVTECH ELECTROSYSTEMS Ltd (Cont'd)

Their power splitters provide two outputs which are either both in phase (non-inverted) with the input signal or with one output non-inverted and with one inverted. They are designed for use with nanosecond speed laboratory pulse generators, with CW signals or with other units to frequencies as high as 1.0 GHz. Their bias insertion unit is designed for both CW and subnanosecond risetime baseband pulse applications. The scope probe was designed to be used with a 50ohm sampling oscilloscope to allow probing of test points in microstrip structures and in discrete RF circuits and subnanosecond pulse circuits operating at frequencies as high as 5 GHz and with risetimes as low as 100psec.

Credentials:

Gross Sales:

1980 - \$160K
1981 - \$350K

Average Work Force:

Total - 5

Plant Size:

3,000 sq ft

Experience:

Approximately 80% of Avtech sales are for export. Their products have been supplied worldwide to companies, universities and government agencies such as, USAF, Harry Diamond Laboratories, Los Alamos Scientific Laboratories, Hewlett Packard, Honeywell, Hughes Aircraft, Lawrence Livermore Laboratories, Martin Marietta, Bell Northern Research, etc.

Company: BAKER ENGINEERING ENTERPRISES Ltd

Address: 9620-27 Ave
Edmonton, Alberta T6N 1B2

History:

A Canadian owned company incorporated in 1973 with a US subsidiary (BEE Agra Corp) located in Denver, Colorado. The company's original aims were research, design and manufacture of electronic instrumentation, specifically for use in the agricultural industry.

Capability:

Engineering expertise at Baker centers is in the areas of mechanical/ electrical transducer design, analog & digital monitoring & control circuitry, microprocessor applications to monitoring control problems and electro-mechanical servo component design. Baker product line includes a combine efficiency monitor, liquid sprayer application rate monitor. Many other agriculturally-oriented monitors are in the Baker product line. A second general area of product development was toward an electric fence controller that operates on existing fences with wood posts without the requirements for wire insulators and grass/ brush free status. Particular attention is paid to production engineering and testing and quality control with appropriate documentation.

Credentials:

Gross Sales (past few years) - \$1 - 1.5M

Average Work Force:
Engineers - 7

Plant Size:
12,600 sq ft

Manufacturing Capability:

In-house equipment to insure quality productivity includes computer controlled printed circuit board drilling, transformer and coil winding, printed circuit wave soldering facility, sheet metal shearing punching and forming and a thermoplastic injection molding facility.

Experience:

During the past two years about 10 to 15% of sales have been to the US, primarily through their US affiliate. They have no experience with the US DOD.

Company: BARRINGER RESEARCH Ltd

Address: 304 Carlingview Drive
Rexdale, Ontario, Canada M9W 5G2

History:

The company was founded in 1961 to develop geophysical and geochemical techniques and instrument systems relating to mineral exploration.

Barringer Resources Inc (formerly Barringer Research Inc) was incorporated under the laws of the state of Delaware on 7 Sep 67 for the purpose of acquiring all of the issued and outstanding voting stock of Barringer Research Ltd, an Ontario (Canada) corporation.

Capability:

Barringer has undertaken research projects primarily in the earth sciences in the disciplines of geology, geochemistry, electro-optics electromagnetics, magnetism and atmospheric physics. As a result of such projects, they have developed instrument systems and techniques in the fields of airborne and ground mineral exploration and environmental and process monitoring. They have recently devoted a substantial portion of their efforts toward adapting for oil and gas exploration the instrument systems and technology that they initially developed for mineral exploration, as well as toward developing new oil and gas exploration instrument systems and technology.

Research and Development - INPUT[®] (INDuced Pulse Transient) system was the original development of Barringer and is the only commercial airborne electromagnetic prospecting system to use a pulsed field principle. The system has been successful in its application in the search for mineral deposits. The success of the system was recently recognized by the Society of Exploration Geophysicists which awarded Dr Anthony R Barringer the Kauffman Gold Medal of the Society for his contributions to the science and practice of geophysics via the INPUT system. According to the Society's statistical returns, 70% of all the world's commercial airborne electromagnetic surveys are carried out with the INPUT system.

COTRAN[®] (CORrelation of TRANsients) - The system uses a new approach to signal processing that can only be achieved by digital techniques. The airborne computer analysis of the data is believed to give the system substantial advantages in terms of sensitivity and interpretability. Only one COTRAN system exists at the present time, and this is currently undergoing evaluation in surveys that are part testing and part operational.

BARRINGER RESEARCH Ltd (Cont'd)

TIVAC - The system is aimed at detection of hydrocarbon leakage over oil deposits by geophysical remote sensing methods. Metal detection systems have also been developed by Barringer as a spin-off from its airborne geophysical equipment. A modification of the original design was used for traffic counting and tramp metal detection on conveyor belts. Subsequently, this patent has been used as a metal detector in walk-through systems installed in airports. It has also been used on conveyor belts to protect ore crushers from damage caused by ingesting pieces of metal that accidentally get mixed in with the ore. A new prototype system has functioned well and has demonstrated a significant advantage in that it can be programmed to ignore pieces of metal, such as the clips on conveyor belt seams, which give a signal that will usually trigger a false alarm. It is anticipated that there will be further development of the COTRAN principle, possibly using new microcomputer technology, allowing production costs to be reduced so that the system can be supplied to a number of new applications. This system may also be used for military range clearance.

A new product, known as a Ratioing Radiometer is an optical device for measuring the reflectance ratios of pairs of wavelengths in the visible and infrared region. The instrument has application in identifying clay minerals for mapping purposes when exploring for mineralization and in the follow-up of targets of interest selected from satellite imagery and aerial photography, particularly with regard to the forthcoming US Landsat-D satellite and the French SPOT (Système Probatoire pour Observation Terrestre) satellite. Both these satellites use infrared channels that generate new kinds of information that can be checked on the surface with the Radiometer. The first production run is in progress.

Instrument Manufacture - Barringer has for many years been involved in the manufacturing of certain exploration instrumentation and monitoring equipment. An increase in their product line is planned. Towards this end, 13,000 sq ft of space have been added to their Toronto facility.

Another product of the company is its range of on-stream heavy water monitors for use in the monitoring of the heavy water content of flow streams in nuclear reactors. Barringer is a supplier for the CANDU, Canadian heavy water reactor, which has seen expanded use in Canada and other countries.

COSPEC[®] (CORrelation SPECtrometers) are the only commercially available remote sensing devices for the monitoring of atmospheric concentrations of sulphur dioxide and nitrogen dioxide. They perform a unique function in the monitoring of air pollution. The joint use of networks of ground sensors and remote sensing equipment is used as a tool for modeling air pollution episodes and various research investigations of air pollution problems.

BARRINGER RESEARCH Ltd (Cont'd)

Additional specialized optical systems for monitoring gases are manufactured by the company, including the GASPEC® infrared system for remote detection of gases, and its Correlation Interferometer that is used in related areas. These instruments are generally manufactured on special order for governmental agencies such as NASA.

SURTRACE® system is a helicopter-mounted airborne geochemical technique which uses a long flexible probe mounted beneath a helicopter to vacuum surface microlayer samples of material off the ground. Special tape sampling equipment is carried in the helicopter to store the samples sequentially, and a technique known as LASERTRACE® has been developed for providing 25 element analyses of the minute traces of material collected from the ground surface. The analytical technique is fully automated and computerized and is capable of high volume production. The system has already been used successfully in operational programs. Experience to date with the equipment has been restricted to mineral-type surveys, however, potential applications in the hydrocarbon field have been established by the use of related ground equipment over oil fields. A ground version back-pack model has also been successfully used.

AIRTRACE® system that extracts and analyzes aerosol in the atmosphere is a forerunner of the SURTRACE system. Although the AIRTRACE equipment is operational, its usage is limited to specific meteorological conditions. This limitation results in high costs of surveys and hence is a restriction on more general use of the AIRTRACE method.

AIRBORNE LASER FLUOROSENSOR - A successful airborne laser fluorosensor has been constructed for a Canadian government organization and has functioned very effectively in tests and surveys designed to detect and classify oil slicks.

GASPEC - the company has developed a remote sensing gas filter cell spectrometer-GASPEC® - which NASA Langley Research Center has used in flight tests and which has proven satisfactory in monitoring atmospheric carbon monoxide. This equipment has been incorporated as one of the five experiments selected for the first United States Space Shuttle to carry on-board, which is currently scheduled for Sep 81. The experiment is based on Barringer's design, and the space flight hardware was constructed by TRW Systems Group. The aim of the test is to monitor the global distribution of carbon monoxide.

The GASPEC concept is also to be used in the ERBS (Earth Radiation Budget Satellite) wherein it will detect HF, HCl, CH₄ and NO by looking at the rising and setting sun from the satellite (the HALOE or HALogen Occultation Experiment).

BARRINGER RESEARCH Ltd (Cont'd)

Credentials:

Gross Sales:

1978 - \$3.9M

1979 - \$5.0M

1980 - \$5.9M

Above total sales includes geographic areas of US, Canada, Europe and others.

Average Work Force:

Eng & Scientists - 34

Technical Support - 30

Barringer Research retains on staff a diverse group of scientists and engineers in the physical sciences. Barringer Magenta retains expertise in analytical chemistry, geochemistry and microbiology. The professional and supporting technical staffs shown above are for the metropolitan Toronto location only. The total US and Canadian professional strength, for example, is 52 scientists and 13 engineers.

Plant Size:

Barringer Resources Inc., Barringer Research Ltd and Barringer Magenta Ltd lease office and laboratory space as follows:

<u>Location</u>	<u>Sq Ft</u>	<u>Type</u>
1626 Cole Blvd Golden, Colorado	15,200	Office and Laboratory
304 Carlingview Dr Rexdale, Ontario	28,000	Office, Laboratory & Manufacturing
1455 Deming Way Sparks, Nevada	7,200	Laboratory
5161 Ward Road Wheat Ridge, Colorado	3,000	Laboratory
3750 19th St, NE Calgary, Alberta	2,900	Laboratory
1156 First Ave Whitehorse, Yukon	1,500	Laboratory

BARRINGER RESEARCH Ltd (Cont'd)

Experience:

Barringer experience is worldwide. Recent R&D clients include:

- Petro-Canada Explorations Inc
- TRW Systems Group (USA)
- National Research Council of Canada
- Canada Center for Remote Sensing
- US Air Force
- Department of Supply & Services (Canada)
- Rexnord Inc (USA)
- Atomic Energy of Canada Ltd
- NASA Langley Research Center (USA)
- Atmospheric Environment Services (Canada)

Previous contracts for the USAF include one for WPAFB, "Remote Detection of Chemical Vapors using Correlation Interferometric Techniques", in 1969 and one for Brooks AFB, "Development of a Hydrazine/Carbon Monoxide GASPEC", in 1976-1979.

Company: BELL-NORTHERN RESEARCH

Address: P. O. Box 3511 Station C
Ottawa, Ontario, Canada K1Y 4H7

History:

A Canadian corporation since 1971 owned jointly by Northern Telecom Ltd and Bell Canada (70/30). The company was founded in 1957 as the R&D arm of Northern Electric (original name of Northern Telecom). Bell-Northern Research Inc is a wholly owned subsidiary located in Palo Alto, CA. BNR's headquarters and three main laboratories are located in Ottawa with other laboratories in Montreal, Quebec City and Toronto. Most of BNR's research and development is carried out for its owners, however, some is done for Government agencies, other telephone companies and industries in related fields. There is no relationship between BNR nor its parent companies and the Bell System of companies in the US.

Capability:

BNR is experienced in all aspects of telecommunications research with established technology in large scale integrated (LSI) circuits, fiber optics transmission systems, transmission lines and software. New technologies will include VLSI circuits, charge couple device imaging and robotics (small volume manufacturing application). Their laboratory R&D is carried out in four operational divisions - Systems, Transmission & Data, Digital Switching Systems Development, and Technology. The prime thrusts of the Systems Division are the design of intelligent networks for future office and residential services; the definition of new fiber optic trunk and distribution systems; speech and image processing research; and planning studies to improve data networks and toll, local and subscriber loop operations. The transmission and Data Division staff works on system development in areas such as analog and digital radio transmission, outside plant, business communications and data, and fiber optics. The division contains a group which provides all of BNR with computer and engineering design services plus two other groups that provide support in the standardization of designs and materials, and the documentation of both hardware and software. The Digital Switching Systems Development Division is engaged in all aspects of computer technology. The Technology Division is charged with exploiting new technological opportunities for Northern Telecom and supporting current technologies and products. The division is composed of the Silicon Technology, Product Integrity, Manufacturing Engineering and Subscribers Equipment and Terminal Groups. BNR also maintains a large industrial library holding more than 26000 publications and about 450 periodicals in 40 languages.

BELL-NORTHERN RESEARCH (Cont'd)

Credentials:

Gross Sales:

1980 - Approx \$140M
1981 - Approx \$150M
1985 - Est \$200M

Average Work Force:

PhDs - 176
BS, MS - 974
Other - 1550

Plant Size:

79733 sq meters (3 sites in Ottawa)

Equipment/Facilities:

The company has a new IBM 3033 time-sharing general purpose computer plus a number of mid-range and minicomputers. Their total equipment investment is in excess of \$45M. Included in their equipment is an electron probe microanalyzer, scanning Auger spectrometer and scanning electron microscope. Their many facilities include (1) custom integrated circuit design facility and prototype fabrication line, (2) computer graphics mask pattern design capability, (3) automated testing system for integrated circuits, (4) thick film hybrid pilot line, (5) modern physical analysis laboratory, (6) audio frequency anechoic chamber, (7) optoelectronic materials and device laboratory, (9) optical fiber and cable research facility, (10) advanced systems research laboratory, (11) DMS and SP-1 captive offices and (12) electromagnetic anechoic shielded enclosure.

Experience:

BNR carries out some R&D for groups other than their owners. They estimate their business with the US Military at 0.25% split evenly between the Army and USAF. They are interested in continuing and expanding their business with the USAF.

Company: F. G. BERCHA AND ASSOCIATES Ltd

Address: 640-11th Ave, S.W.
Calgary, Alberta, Canada T2R 0E2

History:

The company was incorporated in 1975 and is Canadian owned. There are branch offices in Cochrane, Alberta, and Ottawa, Ontario, and affiliate corporation, F.G. Bercha and Associates Inc., located in Texas and Arizona. The US offices are wholly owned by Canadian principals.

Capability:

The company specializes in research and development, engineering and environmental consulting, with particular expertise in the areas of ice mechanics, remote sensing, Arctic engineering, special structures development, system simulation and risk analysis. The company provides a totally integrated capability due to its multidisciplinary workforce consisting of engineers, environmental scientists and systems professionals.

Credentials:

Gross Sales:

1980 - \$1.0M
1981 - \$2.0M (projected)
1982 - \$3.0M (projected)

Average Work Force:

Professionals - 15
Support - 5

Facility Size:

8,000 sq ft (Head Office)

Equipment:

Computer terminals and specialized graphic terminals.

Experience:

The company is perhaps best known for its capability to generate strategic information in relation to Arctic operations. From remote sensing data, the company is able to generate environmental information on ice and ocean systems applicable to the engineering design of structures. On the basis of this information, company engineers are able to turn the information into specific structural design parameters, and carry out preliminary as well as detailed engineering designs of structures for service in the Arctic frontier regions. In the area of Arctic and ice engineering and consulting, the company has been employed by most of the major US companies, including,

F. G. BERCHA AND ASSOCIATES Ltd (Cont'd)

Exxon, Amoco, ARCO, Sohio, Phillips, Mobil, and Chevron. In addition, principal Canadian clients in the Arctic include Dome, Petro-Canada, and Gulf Resources. Finally, the company is well known for its ability to develop novel structures for service in frontier conditions. Such structures have included portable aircraft shelters, made of aerospace materials to military specifications. To date, such aircraft shelters have been developed for the Canadian Department of National Defense for military service in support of Arctic airborne operations.

Company: BOEING OF CANADA Ltd
(Winnipeg Division)

Address: 99 Murray Park Road
Winnipeg, Manitoba, Canada R3C 3M6

History:

The Boeing Winnipeg plant was established in 1971 and is a wholly owned subsidiary of The Boeing Company of Seattle. There are no other Canadian locations.

Capability:

Boeing of Canada is a Canadian leader in high strength/weight ratio fiber composite plastic components of aircraft, space and other advanced technology applications. The company has the engineering, manufacturing and development expertise to design and build solid laminate, or sandwich panel components. Glass, high-modulus graphite and organic fibers and thermosetting resin systems, including epoxies, polyesters, phenolics or polyimides, are used with state-of-the-art capability. They currently produce both structural and nonstructural glass fiber and advanced fiber composite components for a diversified range of products covering a technological spectrum from aircraft and satellite components to thermoformed acrylic bathtubs, to light rail vehicles, to farm machinery components.

A stated objective of the company's management team is to establish Boeing of Canada as a center of excellence for composites manufacture within The Boeing Company, and as the Canadian leader in the composite industry. To achieve this objective, they have structured an intensive research and development program and increased tool design and fabrication capability. Significant involvement in the manufacture of advanced composite components for the new Boeing 757/767 aircraft is anticipated.

The Winnipeg Division's Quality Assurance Program operates to one standard of quality in conformance with the requirements of the Ministry of Transport Engineering and Inspection Manual (FAR Part 21, Subpart G), the Department of National Defense Specification DND 1015 and with the Boeing Company Corporate Policy 5H1. Quality is maintained throughout the manufacturing process by inspectors appointed by the Manager of Quality Assurance who in turn is approved by the Ministry of Transport. Complete laboratory tests are carried out on process test panels as required by customers and/or pertinent authorities. All raw materials are purchased from qualified suppliers and incoming shipments are subject to Quality Control receiving inspection to ensure that all requirements are met.

Credentials:

Gross Sales:
1979 - \$13M
1980 - \$23M

BOEING OF CANADA Ltd (Cont'd)

Average Work Force:

Eng	-	21
QC	-	41
Production	-	550+
Admin	-	71

Plant Size:

128,000 sq ft	(Manufacturing space)
30,000 sq ft	(Office space)
48,000 sq ft	(Manufacturing space leased nearby)

Equipment:

Major equipment includes:

- . An autoclave 15 ft in diameter, 30 ft long capable of 95 psi pressure and 625 degrees F ambient temperature.
- . An autoclave 10 ft in diameter, 30 ft long capable of 95 psi and 625 degrees ambient temperature.
- . An autoclave 4 ft in diameter, 10 ft long capable of 95 psi pressure and 625 degrees F ambient temperature.
- . Air-heated oven with two compartments 8 ft wide, 13 ft long and 8 ft high, with a maximum ambient temperature of 800 degrees F.
- . An air-heated oven with compartments 7 ft wide, 9 ft long, 7 ft high and capable of a maximum ambient temperature of 800 degrees F.
- . 44 inch vertical core cutting bandsaw.
- . Traverse saw capable of cutting up to 16 ft wide material with variable cutting speed.
- . Core milling machine capable of handling core sheets 10 ft long, 6 ft wide and up to 6 inches thick and capable of milling from 0 to 15 degrees $\pm$ a tenth of a degree.
- . Special taper core milling machine capable of handling sheets 6 ft long, 1 $\frac{1}{4}$ ft wide and 2 inches thick and capable of milling from 0 to 15 degrees.
- . Hydraulic core forming press with 4 ft x 4 ft platen.
- . One 8 ft x 22 ft and one 8 ft x 15 ft waterfall spray painting booths.
- . An 8 ft x 20 ft flame spray booth and apparatus capable of hard and soft, ferrous and non-ferrous metal spraying.

BOEING OF CANADA Ltd (Cont'd)

- . Assorted saws, routers' drills, punches, shears, finishing equipment, etc. equipped with tungsten carbide and diamond cutters.
- . Automated through transmission, water jet scanning ultrasonic system with C-scan data acquisition.
- . Assorted ultrasonic bond, thickness and flaw detection equipment.
- . A McLean Anderson, Explorer Model D, Filament Winding Machine, capable of producing a part approximately 150 inches long and nine (9) inches in diameter.

Experience:

Boeing-Winnipeg assumed production responsibility for the majority of all Boeing commercial aircraft. Significant contracts for graphite composites for Satcom and Anik D satellite programs were secured. A technology Transfer Program including establishment of a tool design group and upgrading of tooling and part fabrication capability was initiated in preparation for increased graphite and hybrid work on the new Boeing 757/767 aircraft programs.

Some of Boeing-Winnipeg customers include:

CANADAIR - CHALLENGER

- . fairing flap hinge
- . assembly wing tips
- . leading edge flap
- . access panels
- . smoke sensor
- . side console
- . cover assembly
- . inboard fairing
- . latch housing
- . aft wing-to-body fairing
- . horizontal stabilizer tips

DEHAVILLAND

- . panels
- . fairings
- . DHC 7 kevlar trough
- . nose avionics bay

HUGHES

- . satellite components

SPAR AEROSPACE

- . graphite epoxy plates
- . waveguides and satellite components

BOEING VERTOL

- . rain gutters
- . CH47 inlet screens

BOEING OF CANADA Ltd (Cont'd)

BOEING

. 707, 727, 737, & 747

GEONICS

. magnetometer booms

GEOPHYSICS

. magnetometer booms

AERODAT

. magnetometer booms

Company: BRISTOL AEROSPACE Ltd

Address: 660 Berry St
P. O. Box 874
Winnipeg International Airport
Winnipeg, Manitoba, Canada R3C 2S4

History:

Bristol was founded in 1930 and incorporated in Canada in early 1947. It is a wholly owned subsidiary of Rolls Royce Holding North America Ltd. Bristol owns and operates the Rockwood Propellant Plant (not a separate division) at Stoney Mountain, Manitoba. There are no other subsidiaries operated by the company.

Capability:

Since their inception in 1930, they have moved from manufacturing and repairing seaplane floats (1930-1943) to a company with five distinct product areas:

- . They manufacture "hot end" gas turbine components under contract to GE, Pratt & Whitney and Rolls Royce and remanufacture afterburner assemblies.
- . Bristol manufactures light alloy aircraft structures for three major aircraft; the DHC-7, the L1011 and the P3/CP140. They also manufacture small structures including their new Wire Strike Protection System.
- . They offer repair and overhaul of military and commercial fixed wing aircraft and military helicopters.
- . CANDU nuclear in-core reactor components are produced at Bristol.
- . Engineered products manufactured by Bristol include rocket engines and propellants, vertical axis wind turbines, electronic data instrumentation for payloads and satellites, electronic data instrumentation for remote site applications, and remote automatic inspection systems for steam generators. They also provide services in mechanical, electrical, aeronautical and propulsion design and development engineering. Other services include precision weldments of high temperature stainless steel alloys, titanium and corrosion resistant materials and a helicopter component test all for transmissions and gear boxes.

BRISTOL AEROSPACE Ltd (Cont'd)

Bristol's proprietary products include:

- . Black Brant - sounding rocket
- . CRV7 - air to surface rocket
- . WSPS - wire strike protection system for helicopters
- . LICUS - vertical axis wind powered turbine
- . CANSCAN - remote, automatic inspection system for steam generators
- . DCP - electronic data collection for remote site application
- . READAC - automatic weather station designed for unattended use in airport application.

Credentials:

Gross Sales:

1980 - \$42.8M
1981 - \$74.0M (est'd)
1982 - \$88.0M (est'd)

Average Work Force:

Salaried - 403
Hourly - 847
Technical - 92

Plant Size:

Production - 424,000 sq ft
Warehouse - 6,000 sq ft
Office - 30,000 sq ft

Equipment/Facilities:

They have complete facilities and equipment for metal forming, welding, machining and metal treating. They have a Numerical Control Machining Center with equipment such as the Sunstrand S-80, S-60 and OM-2A, a Raycon NC EDM, Mazak V5 NC machine center and a Giddings & Lewis 48" NC VTL. Also included is a PDP 11/70 computer with M.D.S.I. "Action Central" McAuto CAD/CAM System. Special facilities include a helicopter transmission test cell, non-destructive test laboratory, and an electronic test laboratory.

Experience:

In 1980, approximately 45% of Bristol's sales were to the US, with over 85% of these sales to the US military. USAF business includes combustion and exhaust components for the J85, J79, T64, T58 and TF39 engines, the TF30 afterburner and general repair and overhaul.

BRISTOL AEROSPACE Ltd (Cont'd)

Other customers in the US include the Navy, NASA, Pratt & Whitney Aircraft Corp, Lockheed Aircraft Corp, Grumman Aircraft Corp, General Electric Co, Bell Helicopter Co, Bendix Corp and Fairchild Hiller Corp.

Canadian business includes DND, National Research Council, Pratt & Whitney of Canada Ltd, Atomic Energy of Canada, Boeing Canada Ltd, Canadair Ltd, the de Havilland Aircraft of Canada Ltd, and others. International clients include Dornier GmbH, Germany; Royal Netherlands Air Force and the Swedish Space Corporation.

Bristol has been approved by the Canadian Ministry of Transport for Canadian Aircraft maintenance and the Canadian Forces for manufacturing testing and overhaul. The quality requirements of M.O.T. and FAA and the Canadian DND 1014 or MIL-Q-9858A are met for manufacturing, repair and overhaul.

Company: CAD/CAM GRAPHIC SYSTEMS Ltd

Address: 700 Industrial Avenue
Ottawa, Ontario, Canada K1G 0Y9

History:

A small Canadian owned high technology company incorporated in May 1979. There is a branch in Toronto and the company is incorporated in the US as CAD/CAM Graphic Systems Inc.

Capability:

CAD/CAM is an engineering design group specializing in computer aided graphics design and artwork generation for printed circuit boards and/or hybrid microcircuits. They also offer consulting services to assist clients in the development of design standards/criteria to suit their special needs. Their product services include, 1) design from schematic to color-coded layout, 2) digitizing of color-coded layouts for single, double or multilayered boards (prepared by either the customer or CAD/CAM), 3) photoplotting of the following artwork masters - component and solderside, drill graphics, solder resist mask, silk screen and assembly, 4) numerical control drill tapes to suit either Excellon or Digital Systems format, 5) documentation packages and 6) prototype and production quantities of printed circuit boards. The equipment presently in use at CAD/CAM is a CALMA GDS I Interactive Graphics System that consists of a) Data General Eclipse CPU, b) 48x60 inch digitizing tables (2) with dual 19x11 inch CRTs, c) design/edit stations (2) with tablet and CRT, d) CALCOMP 960 pen plotter (on-line) and e) GERBER 6240 Photoplotter (off-line).

Credentials:

Gross Sales:
1979 - \$0.16M
1980 - \$0.5M

Average Work Force:
Total - 15

Plant Size:
5300 sq ft

Experience:

CAD/CAM has contract experience with various departments of the Canadian Government, including the Departments of National Defense and Transportation. Canadian industrial experience includes such companies as Northern Telecom, Bell Northern Research, Litton Systems and AES Data Ltd. US industrial experience includes ITT Aerospace and IBM.

Company: CAE INDUSTRIES Ltd

Address: Corporate Offices
Suite #3060
P. O. Box 30
Royal Bank Plaza
Toronto, Ontario, Canada M5J 2J1

CAE ELECTRONICS Ltd
8585 Cote de Liesse
P. O. Box 1800
St Laurent, Quebec, Canada H4L 4X4

History:

The company was incorporated in 1947 as Canadian Aviation Electric Ltd to engage principally in the repair and overhaul of electronic and electro-mechanical equipment and devices. The name was changed to CAE Industries Ltd in 1963 to more accurately reflect its expanding interests in many diverse fields of industry. Diversification and acquisition began in 1961 with the formation of CAE Electronics GmbH in West Germany. Other subsidiaries include CAE Electronics Ltd, Northwest Industries Ltd, CAE Fiberglass Products Div, CAE Aircraft Ltd, CAE Metals Ltd, Canadian Bronze Company Ltd, Union Screen Plate Co Ltd, Welmet Industries Ltd, CAE Machinery Ltd, Webster Mfg (London) Ltd, Accurcast Die Casting Ltd, CAE-Montupet Diecast Ltd, CAE Morse Ltd, CAE Lubricators Div, and Cleveland-CAE Metal Abrasive Ltd. All are Canadian-based except the one subsidiary located in West Germany. This profile will concentrate on CAE Electronics Ltd.

Capability:

CAE Electronics Ltd designs and manufactures sophisticated commercial and military aircraft flight simulators and airborne magnetic anomaly detection equipment. They have also become a major producer of computer-based systems in the areas of electrical power generation and transmission, oil production, gas transmission, air traffic control and space.

In the simulator area, they are a leading designer and producer of flight simulators. Their simulators include state-of-the-art technology such as hydrostatic six-degree of freedom motion, general purpose computers and CRT-based instructor's facilities. They reproduce aircraft performance in all flight regimes and, in particular, the critical landing phase. Digital flight simulators have been developed for the A-300, B727, B737, B747, DC-8, DC-9, DC-10, L-1011, F-28, CL-600 and the new generation A-310, B757 and B-767. A wide range of simulators has also been supplied to different countries for various types of military aircraft, including tactical jet fighters, jet trainers, antisubmarine patrol aircraft and transports.

CAE INDUSTRIES Ltd (Cont'd)

They do not pursue the US military flight simulator market. CAE also designs and produces simulators for helicopters such as the Agusta AB-205 and AB-212, Bell UH-1D, Boeing-Vertol CH-47, Sikorsky CH-53 and Westland Sea King MK41. In addition to flight simulators, CAE Electronics produces training simulators for nuclear power plants. They are used to train operators to develop experience in responding to all normal, abnormal and emergency conditions as well as to learn required operating procedures and techniques.

In the avionics area, CAE Electronics develops and manufactures magnetic anomaly detection (MAD) systems used in antisubmarine warfare and geophysical exploration. Their cesium magnetometer system, usually mounted in a stinger at the rear of the aircraft, can measure changes in the earth's magnetic field as small as one part in 5 million.

They have developed a "JETS" joint enroute/terminal data processing and display system for air traffic control. The system is modular and the displayed information tailorable to user requirements. They are active in the space area as they are part of a Canadian consortium responsible for developing and manufacturing the complete Manipulator Arm system for the NASA Space Shuttle. They have designed and are manufacturing the display and control panel plus the rotational and translation hand controls that operate the manipulator itself. They have also designed and developed the simulation subsystem which is used as a design tool to test hardware and software modules of the system.

Credentials:

Gross Sales:

CAE Industries - \$300M

Average Work Force:

Total (CAE Electronics) - 1700

Plant Size:

300,000 sq ft

Experience:

CAE Electronics customers include United Airlines, Air Canada, British Airways, KLM, Swissair, TWA, the Canadian Forces, NASA, US Navy and other departments of the Canadian Government. They are currently working with the USAF (AFHRL) on a joint program - Design Study for a Wide Field, Helmet Mounted, Infinity Display System Slaved to the Eye.

Company: CTF SYSTEMS Inc

Address: 15-1750 McLean Ave
Port Coquitlam, British Columbia, Canada V3C 1M9

History:

CTF Systems Inc is a Canadian high technology company created in 1970 under the name Canadian Thin Films Ltd. The original objective of the company was the development and manufacture of instrumentation and systems allied to the field of electronics and applied physics. The name was changed in 1976 to reflect an extended range of capabilities. There are no other Canadian division or US subsidiaries.

Capability:

The technical operations of CTF Systems are divided into the research and development and production categories. Their primary R&D expertise lies in the areas of - 1) cryogenic and SQUID (Superconducting Quantum Interference Device) technology, 2) non-destructive ultrasonic evaluation and, 3) dive support instrumentation.

Cryogenic and SQUID Technology - CTF has developed and in certain cases, advanced the technology in the areas of cryogenic containers (dewars); construction and operation of SQUID sensors and associated substrates for sense coils; analog/digital electronics required for SQUID operation; and processing SQUID signals.

. Horizontal Dewars - a mobile, random orientation liquid helium cryostat. The dewar will be suitable for airborne tests and compatible with a 9-component gradiometer substrate.

. Large Diameter Vertical Dewar - a non-magnetic and non-metallic 12-inch diameter dewar for ground testing a SQUID gradiometer/magnetometer system.

. 3-Axis Magnetometer - a high-resolution, 3-axis SQUID magnetometer (10^{-5} γ) compatible with the above large diameter vertical dewar.

. SQUID Sensor - the SQUID operation is based on the Josephson Effect and utilizes the superconducting and quantum properties of matter. It is particularly sensitive to magnetic fields which makes it suitable for the construction of instruments for magnetic field detection. Present commercial SQUID's achieve resolution of 10^{-4} γ , and experimental systems achieve resolutions of 10^{-5} γ . The sensitivity of the sensor can be enhanced by a factor of 100 by means of superconducting flux transformer. This consists of coil(s) exposed to a measured environment and coil(s) coupled to the SQUID. The flux transformer provides noiseless amplification because it is superconducting. This flux transformer may be configured as a vector magnetometer, tensor gradiometer or second order gradiometer.

. Airborne Gradiometer - a 9-component system (6 gradiometers and 3 magnetometers), suitable for mobile applications was designed and developed. The design was guided by computer simulation in order to minimize interference between various elements of the system and balancing vanes. The housing of the system and all interconnections between cryogenic temperature and room temperature were devised for possible mounting in a horizontal dewar. A new generation of digital SQUID electronics was developed which increased slew and reset rates by nearly a factor of 4. The signal is sampled at a 100 kHz frequency, the digitized and recombined analog and reset signals have a dynamic range of 32 bits and the signal is digitally filtered and resampled for digital storage. Resampling rate and filter frequency (together with other parameters of the system) can be remotely controlled by a computer.

Non-Destructive Ultrasonic Evaluation (NDE) - work in this area was initiated in an effort to solve some NDE problems experienced by the Canadian Department of National Defense. The specific problem areas were NDE of corrosion in naval boilers and NDE of cracks in gun barrels.

. Naval Boilers - a 3-mode system (manual, semi-automatic and automatic) using an ultrasonic transducer suitable for operation in small diameter tubes which yields clear non-ambiguous signals. The mechanical probe for transducer motion is automated using microprocessor-based electronics.

. Gun Barrel Crack Detection - a dual ultrasonic transducer longitudinal probe giving good signal to noise ratio that can be moved easily along the gun barrel surface.

Dive Support Instrumentation - the objective of this work was to develop electronic dive support instrumentation for the Defense and Civil Institute of Environmental Medicine (DCIEM).

. XDC-1 - a portable calculator, based on microprocessor technology, which holds in PROM memory the DCIEM decompression model. With this device one can plan dive schedules (through accelerated time) or monitor dives in real time. In either mode, the operator is able to display ongoing values for a number of dive parameters at any time. These are: actual depth, total time of dive, safe depth, ascent time (on the minimum decompression curve), stage time or any of the internal model parameters.

Natural extension of the above technology led to the development of several other instruments.

CTF SYSTEMS Inc (Cont'd)

Credentials:

Gross Sales:
No Data

Average Work Force:
Total - 17

Plant Size:
9,600 sq ft

Equipment/Facilities:

The company has a variety of general and specialized equipment and facilities necessary for electronic, cryogenic/NDT R&D. Some of the equipment/facilities are listed below:

Computer Facility:

- . PDP 11-34; Dual 5Mb hard disks; 9" tape drive, RSX-11 software
- . PDP-8 E Intersil μ 6100 microprocessor development system

Electronic Equipment:

- . Signal Generators (Audio, R.F.)
- . Amplifiers (D.C., Audio, R.F.)
- . Digital Multimeters
- . Digital Counter/Timer
- . Digital Logic Analyzer
- . 10'x10'x8' RF Shielded Room
- . Spectrum Analyzer
- . Lock-in Amplifiers
- . Microvoltmeters
- . Oscilloscopes
- . Power Suppliers
- . Filters, Mixers, Attenuators
- . PCB Assembly
- . Wire Wrap Assembly

Cryogenic Equipment:

- . Helium Leak Detector
- . 100 liter LHe Storage Dewar (2 units)
- . 60 liter LHe Storage Dewar
- . LHe transfer line
- . Non-Metallic LHe Dewar Fabrication Facility
- . Non-Metallic LHe Test Dewars

NDT Ultrasonic Facility:

- . Multiple Frequency Ultrasonic Generator/Signal Conditioner/Receiver
- . NDT Transducer Sensor Construction Facility
- . Test Standards

CTF SYSTEMS Inc (Cont'd)

Mechanical Equipment:

- . Equipment necessary for inhouse fabrication of most required items.

General Equipment:

- . Three Axis Helmholtz Coil (2 m dia)
- . Vacuum Deposition System (Fore-Pump, Diffusion Pump, Vacuum gauge to 10^{-9} torr, High Current Heater Supply, High Voltage D.C. Sputtering Supply)
- . Three-Axis Micropositioners
- . Shielded Room Facility

Special Test Facilities:

- . A low magnetic gradient, low magnetic noise field test facility with associated instrumentation building.

Expierience:

CTF defense related experience has been primarily with the Canadian Department of National Defense. They have fulfilled 21 contracts with them since 1971, 16 in the past three years. They also enjoy an active technical relationship with two local universities.

Company: CADEIS INTERNATIONAL Ltd

Address: 39 Highway 7, Suite 202
Bell Mews Plaza, Nepean
Ottawa, Ontario, Canada K2H 8R2

History:

This Canadian owned company was incorporated in May 1980 to provide computer aided design of PC boards.

Capability:

The company's existing facility provide a capability of producing, from hand drawn schematics, finished schematic plots through interactive processing (CAD). They are capable of providing schematics, check plots, layout phototools, silk screen or dot matrix masks, NC drill tape data, as well as data on XY hole and lands, automatic component insections, and stocklists. Also provided are analog and digital board designs up to 16 board layers and 600 gates and 2000 signals with variable resolution (50, 25 & 20 mils). Interactive processing can provide resolution to 1 mil. All data are securely archived to permit quick and inexpensive modifications.

Credentials:

Average Work Force:

PhDs - 2
Eng - 6
Others - 6

Plant Size:

4,700 sq ft

Plant Capability:

In-house computer capability to permit up to 16 simultaneous PCB designs. Normal turn-around is approximately 2 weeks.

Experience:

Only having been in business 9 months, they are still getting basic experience, however, 40% of their business has been with the US. They have expressed a desire to contract with the USAF or its primes.

Company: CANADA SYSTEMS GROUP
ADVANCED TECHNOLOGY SYSTEMS DIVISION
(formerly Digital Methods Ltd)

Address: 1736 Courtwood Crescent
Ottawa, Ontario, Canada K2C 2B5

History:

A Canadian owned high technology company originally incorporated as Digital Methods Ltd in 1967. Their technical experience is in the field of computer systems and programming. CSG was established in 1971 to provide computer based information services to industry and government. The large parent company has its head office in Mississauga, Ontario, with branches in nine Canadian and four US cities.

Capabilities:

The company's main areas of expertise lie in the areas of; (1) analysis, design, and specification of real time control systems, (2) analysis, design and specification and implementation of information retrieval and database systems, (3) analysis and organization of associated manual systems, (4) project management, (5) technical support, and (6) training. The activities of the Division are mostly concerned with micro/mini-computers. The machines currently used are Hewlett Packard 2114, 2116, 21MX, Series 3000, Digital Equipment Corp (LSI-11, PDP-10, PDP-11), Data General NOVA and ECLIPSE series, Motorola 6800 and Intel 8080.

Credentials:

Gross Sales:
1980 - \$3.5M
1981 - \$5.5M Est

Average Work Force:
PhDs - 1
Engineers - 65
Others - 34

Plant Size:
12,000 sq ft

Experience:

The company has extensive experience with a large number of federal and provincial government agencies and with various business and industrial organizations. Private sector contracts include some in the US and UK. Typically less than 5% of sales to the US. Typical projects handled by the Division are studies, simulator systems, systems software design and implementation and computer graphics for air traffic control, satellite ground control systems (software design and program and implementation), VTOL/STOL data handling system design and implementation, computer aided graphics, telex switching systems (software development). The company has no past contracts with the USAF or other DOD agencies. They are interested in expanding into the US market and doing business with the USAF.

Company: CANADA WIRE & CABLE Ltd

Address: (Corporate Office)
147 Laird Drive
Toronto, Ontario, Canada M4G 3W1

History:

Canada Wire and Cable is a Canadian owned manufacturer operating business across Canada and participating with foreign partners in affiliated companies throughout the world. The company is a subsidiary of Noranda Mines Ltd. It was incorporated in 1911. They operate nine plants across Canada.

Capability:

Canada Wire and Cable is a manufacturing company and is involved either directly or through its subsidiaries or associates, in the manufacture of wire and cable, plastic products, fiber optic systems, medical instruments, transformers, lighting and other products. Their wire and cable product list is extensive and specific interest should be directed to the company. Their subsidiaries/affiliates, Grandview Industries Ltd, Canwirco Inc and Radionics Ltd, manufacture plastic conduit and fittings, magnetic wire, and high technology instruments for medical applications, respectively. Their Canstar Communications Division designs and installs fiber optic communications systems. They currently have a \$3.8 million project underway to build a fiber optic facility for research and production in Winnipeg, Manitoba.

Credentials:

Gross Sales:
No Data

Average Work Force:
Total - 3000

Plant Size:
No Data

Experience:

Some of the US customers of Canada Wire and Cable are US Government, Houston Wire, American Cordset Co, American Cable Corp, T.W. Comcorp, Phelps Dodge and Anixter.

Company: CANADAIR Ltd

Address: 1800 Laurentian Blvd
St Laurent, Quebec, Canada H4R 1K2

(Mailing Address)
P. O. Box 6087
Station "A"
Montreal, Quebec, Canada H3C 3G9

History:

Canadair was incorporated in late 1944 and is owned by the Canadian Government. Other Canadian locations are the Government Liaison Office in Ottawa and a Challenger Sales Office in Calgary. US offices include Canadair Services Ltd with representatives at Lockheed California Co (Burbank) and Boeing Commercial Airplane Co (Seattle and Pasadena); Challenger sales offices in Westport, Conn., Atlanta, Houston and San Francisco; and other Challenger related offices located throughout the US.

Capability:

Canadair has a high technology R&D capability specializing in aerodynamics, flutter analysis, composite materials, remotely piloted vehicles, fracture analysis, computational design techniques. Their product line includes the:

- . Challenger business jet aircraft
- . CL-215 multi-purpose amphibious aircraft
- . CL-89, CL-227 and CL-289 unmanned airborne surveillance systems

They have active subcontract work on the Boeing 747SP, 767; Lockheed CP-140, P3C; McDonnell Douglas F-18A, F-15 and Grumman EF-11A. They specialize in machining to close tolerances (0.001 inch) with a high degree of repeatability. They have an integrated heat treating and stretch forming system capable of treating and forming aluminum alloy sheets 40 ft x 8 ft x 0.375 in.

Their CL-89 Airborne Surveillance Drone (unmanned) is to be used at the division level. It is fitted with either a photographic or infrared line scanning sensor and is reusable. It is launched from a mobile zero-length launcher and recovered on a two-stage parachute system employing inflatable air bags to absorb land shocks. This drone is stocked in the arsenals of the Canadian Forces, the UK, West Germany, France and Italy.

The CL-289 is a longer updated version being developed jointly with Dornier GmbH of West Germany. This new vehicle will carry both photographic sensor and an infrared line scan sensor and will cover

CANADAIR Ltd (Cont'd)

a 150 kilometer range at speeds in excess of 700 kph. A real-time data transmission link is associated with the IRLS system. Onboard computers carry the flight instructions for both the CL-89 and CL-289.

The third model - CL-227, is an hourglass-shaped remotely piloted vehicle still in the development stage. It is designed as a highly survivable surveillance and target acquisition system for use at medium range. It has VTOL capability and is launched and recovered from a mobile two meter diameter platform. It can transmit real-time data.

Credentials:

Gross Sales:

1979 - \$115.6M
1980 - \$116.2M

Average Work Force:

Eng - 266
PhD - 11
Machinists - 650
Others - 5974

Plant Size:

2,700,000 sq ft (under cover)

Equipment:

Their special equipment includes:

- . Two Cincinnati profilers, numerically-controlled:
5-axis: Each bed 212 ft long, 13 ft, 4 in wide.
Each bed has 3 gantries with 3 spindles each.
- . One Ingersoll profiler; numerically-controlled:
3 axis: Bed 96 ft long, 17 ft, 5 in wide.
Single gantry with 3 spindles.
- . Nine Wilson profilers: Tracer-controlled: 3 axis:
some 6 spindle, some 4 spindle
- . Several Kearney and Trecker 3 and 5 axis profilers,
numerically-controlled.
- . Two Autoclaves: One 15 ft diam., one 12 ft diam. for
metal-to-metal, honeycomb and composite bonding.
- . Heat-treat, stretch forming system.

CANADAIR Ltd (Cont'd)

Experience:

The Canadair experience over the past two years includes subcontracts for vertical stabilizers for the F-11A, components for the Lockheed P3C and CP-140, rear fuselage sections for the Boeing 767, components for the McDonnell Douglas F-15, shipsets of components for the Lockheed C-5A and ball valves for the Electric Boat Corp. Products include 240 CF-5 Freedom Fighters under license from Northrop, Challenger business jet, CL-215 multipurpose amphibians and the surveillance drones.

Company: CANADIAN AIRCRAFT PRODUCTS Ltd

Address: 2611 Viscount Way
Richmond, British Columbia, Canada V6V 1M9

History:

Canadian Aircraft Products was founded in 1955 to design and produce aircraft floats. The company is Canadian owned and has no other Canadian locations or US subsidiaries.

Capability:

The company designs, engineers and fabricates aircraft components and other allied and support items for the aerospace industry. They maintain a design and engineering office capable of producing products to stated performance specifications and military specifications. They specialize in the design and manufacture of:

- . Aircraft Structures
- . Tools and jigs
- . Support equipment-ground
- . Ancillary equipment-air
- . Cargo handling equipment
- . Aircraft modifications
- . Aircraft systems

Modifications to aircraft include the design and installation of additional fuel systems, seats, engine replacement and structure changes. They have also conducted analyses relative to aircraft/airport compatibility.

Credentials:

Gross Sales:
1980 - \$6M

Average Work Force:
Total - 150

Plant Size:
75,000 sq ft

Equipment:
Forming capability (3000 ton rubber bed press), heat treating capability (3x4x18 ft gas-fired oven with water quench) and supporting services.

CANADIAN AIRCRAFT PRODUCTS Ltd (Cont'd)

Experience:

Canadian Aircraft Products has a long background of capability and expertise in repair, overhaul, manufacture and fabrication, as well as design and test of aircraft structures and components. They have designed, manufactured and repaired structures and components of a similar nature such as large aluminum boats, air cushion vehicles, etc. They have produced sheet metal fabricated parts for civil and military application. One such contract was for ammunition boxes for Kaiser Aluminum. They produce wing floats for the Canadair CL-215 water bomber and the floats for the de Havilland Twin Otter aircraft. The company has built and structurally tested the complete airframe of the Trident Aircraft Ltd Trigull aircraft. Other contracts include the horizontal stablizer for the Canadair CL-600 aircraft, control surfaces and airstair door for the de Havilland Dash 7 STOL airliner, the horn assembly for the McDonnell Douglas DC-9 and saberliner detail parts for N.A. Rockwell.

Company: CANADIAN ASTRONAUTICS Ltd

Address: 1024 Morrison Dr, Suite 201
Ottawa, Ontario, Canada K2H 8K7

History:

A rapidly growing wholly owned Canadian company incorporated in 1974. There are no Canadian divisions and no US subsidiaries. Company interest is on systems engineering and is concentrated in five principal business areas; satellite, electrical, computer, mechanical and microwave. Their initial business was in the area of space system design.

Capability:

As previously mentioned, the company is divided into five principal business areas. CAL has conducted numerous studies on satellite system design for space missions in the areas of communications, remote sensing, search and rescue, position location/navigation, data collection and science. The studies breakdown included concept and program definitions, trade-off analyses, baseline design, specification preparation and cost estimations. Their electronic system design includes RF, analog and digital technology. Recent projects have included studies of an airborne synthetic aperture radar, an experimental tracking radar test facility and a microwave radar simulation test facility. CAL designs and develops computer systems and microprocessors, both real and non-real time, for scientific and engineering applications. Their success in this area is facilitated by inhouse minicomputer and microprocessor systems for simulation work, interface checkout and software development. Their mechanical design team, using computer aided stress, structural dynamics and thermal analysis techniques, has applied its design talents in the areas of mechanical fixtures, test rigs, electromechanical design and environmental testing. They also provide structural design, finite element stress and dynamics analysis and thermal design and analysis. Areas of particular interest to the USAF may be command and control, signal processing, radar, sonar, data communications, electronic warfare, satellite system studies and antenna work.

Credentials:

Gross Sales:

1980 - \$1.6M

1981 - \$6M (projected)

Average Work Force:

S & E - 55

Others - 25

Plant Size:

19,000 sq ft

CANADIAN ASTRONAUTICS Ltd (Cont'd)

Experience:

CAL has participated in over 200 contracts and has never experienced an over-run. Their contracts have been divided between the Canadian Government (25%), NASA (30%) and others (45%). Canadian Government departments include Communications, National Defense, Environment, and Energy, Mines and Resources, National Research Council and the Ministry of Transport. Private sources include Atomic Energy of Canada Ltd, Telesat Canada, European Space Agency, Intelsat, Ontario Hydro, plus others. They have no direct contracts with the USAF, but are directly involved through the SARSAT program. One of the four satellite ground stations being built under the program will be located at Scott AFB. CAL can perform to military specifications.

Company: CANADIAN GENERAL ELECTRIC COMPANY Ltd

Address: Aerospace Operations
Industrial Benefits Program - Defense Programs
396 Attwell Drive
Rexdale, Ontario, Canada M9W 5C3

History:

Canadian General Electric Co was incorporated in 1892. It is ninety-two percent owned by the General Electric Co.

Capability:

Cobourg (Ontario) Plant - one of the largest Canadian custom molders, they specialize in thermoplastic injection molding and thermoset injection and compression molding. Their entire operation, from design (CAD/CAM) to finishing, is under one roof. They manufacture all types of composite molding for military purposes (e.g., rocket nozzles) and work to MIL SPEC 105.

St Andrews (Quebec) Plant - this plant specializes in fiberglass wound tubes for underground duct and high pressure pipe. They accept custom orders for military projects such as launch tubes (pod and hand-held) and rocket motor casings, etc., for the US Army.

Scarborough (Ontario) Plant - this plant is dedicated to precision machining and fabrication. They specialize in very large items.

Credentials:

Gross Sales:
1980 - \$1.5M

Average Work Force:
Total - 20,549

Plant Size:
Cobough Plant - 125,782 sq ft
St Andrews Plant - 50,000 sq ft
Scarborough Plant - 330,000 sq ft

Experience:

Canadian General Electric works with the Canadian Government, US military and many of the US and Canadian prime industries (e.g., General Motors, Xerox, etc).

Company: CANADIAN MARCONI COMPANY

Address: Headquarters and Manufacturing Plant
2442 Trenton Ave
Montreal, Quebec, Canada H3P 1Y9

Avionics Division
2442 Trenton Ave
Montreal, Quebec, Canada H3P 1Y9

Avionics Division
1150 Morrison Drive
Ottawa, Ontario, Canada K2H 8S9

Radar Division
1150 Morison Drive, Suite #400
Ottawa, Ontario, Canada K2H 8S9

Telecommunications Division
2442 Trenton Ave
Montreal, Quebec, Canada H3P 1Y9

History:

Canadian Marconi Company was founded in 1902 as the Marconi Wireless Telegraph Company of Canada, primarily for the purpose of operating a trans-atlantic communications link and a ship-to-shore communications service. The original location was at Glace Bay, Nova Scotia, but was later moved to Montreal where the corporate headquarters remain today. It was during the 1950's that the company lost its communications operations flavor, mainly because the Canadian Government took over responsibility for all communications operations, and the company became a developer and manufacturer of sophisticated electronic systems. The company is 51% owned by the General Electric Company Ltd of London, England.

Capability:

The major product areas of Canadian Marconi are:

Aircraft Navigation Systems

Doppler Sensors - use ground back-scattered microwave transmissions to calculate aircraft drift and ground speed by detecting the Doppler frequency shift of the ground back-scattered radiation. By suitable circuitry, the three velocity components of the aircraft may be accurately measured. By feeding this information to a navigation computer to be combined with other information, the aircraft position is computed and may be displayed. The

CANADIAN MARCONI COMPANY (Cont'd)

system uses moving or fixed antennas and operates at 8800 or 13300 MHz to provide a completely self-contained navigation means for aircraft of all types over a broad range of performance envelopes.

Omega Receivers - accept coded Very Low Frequency signals from eight ground stations and by measuring phase differences in signals from three stations, simultaneously produce a hyperbolic grid pattern from which an aircraft position anywhere on the earth's surface may be determined. Several models of the receiver/computer provide a complete range of systems suitable for use in military, general aviation, and commercial airline aircraft. Options for additional use of VLF communication stations are available as are several versions of the basic Omega system for different operating modes and user requirements. Extensions of Omega to very low cost vehicles such as Drones are under investigation.

Navstar Global Positioning System - receives signals from earth-orbiting satellites which continuously transmit information on their own position and orbital parameters as well as time. When completed in the late 1980s, the total constellation will comprise 6 satellites in each of three planes mutually inclined at 120 degrees. The aircraft system processes the received signals and provides position accuracy to within 50 meters in three dimensions.

Transit Satellite Navigation and Positioning System - accepts signals from orbiting US Navy Transit satellites and by measuring the Doppler shift of the two transmitter frequencies determine the position on the earth's surface with extreme precision. This capability makes it very useful to scientific and geodetic survey groups, offshore oil exploration companies, and all ship navigators. For mobile navigation, Transit receivers are often combined with other sensors, such as ship's logs, sonar systems, gyro devices etc., in order to provide continuous position information of high accuracy in view of the slow data rate obtainable from the Transit system.

Aircraft Monitoring and Display Systems

Engine Instruments - use sub-miniature lamps and fiber optics to present the information, have eliminated all dependence upon mechanical devices. In addition to the main feature of saving space in overcrowded cockpits, these instruments are extremely flexible in that sections of the parameter range can be emphasized at will, and they can be color coded to alert the pilot to dangerous situations, and to provide easy reliability thus improving safety and reducing pilot work load. Digital read-outs of parameters for very high accuracy can be incorporated. A broad spectrum of applications with a variety of individual designs is a feature of this product.

Intelligent Instruments - combine normal sensors and displays with micro-processors under software control to provide the aircrew performance and analytical information. Typical examples would include the Center of Gravity Indicator which monitors fuel burn-off and displays the changing C of G and aircraft gross weight; the digital Horizontal Situation Indicator which constantly receives information from a variety of sensors via the multiplex bus and provides a current situation display; and Fuel Management Systems to which is entrusted all concerns about the aircraft fuel supply and the most effective use. Systems of this kind improve safety and reduce pilot work load while providing the opportunity for operational cost saving.

Photogrammetry - a new product line including the (computer based) Analytical Stereoplotter which enables an operator to determine the position and size in three dimensions of an object or an area from pairs of stereoscopic photographs. The information can then be stored in a computer data bank from which it can be recalled for use in constructing maps and charts, updating existing maps, comparing changes from previous photographs etc. Many tasks can be automated providing an order of magnitude enhancement in capability for the photogrammetric community.

Specialized Components

Printed Wiring Boards - built to customer specifications with emphasis being placed on very complex designs in multilayer boards of up to 24 layers. No attempt is made to compete in the single-layer board market. Boards are made to military and commercial specifications with a high level of quality control.

Microcircuits - designed and produced at CMC include thin film and thick film, hybrid configurations, and microwave integrated circuits usable in applications up to 24 GHz. The products include amplifiers, oscillators, mixers, filters, resistor arrays, multipliers, matching networks as well as many versions of digital circuits, all of which can be tested to full military specification in the DND 1015/MIL-0-9858 approved facility. Most circuits are custom designed to user requirements for specialized, mainly military equipment.

Magnetic Devices - designed and built to customer specifications. They include various types of transformers, filters, delay lines, and power supplies.

Microwave Radio

Radio and Ancillaries - the AN/GRC-103 Radio Set operates in the 220 to 1850 MHz frequency range in four frequency bands. The Radio Set will accommodate frequency division multiplex (FDM) or time division multiplex (TDM) equipment. The TDM equipment may be pulse code modulation (PCM) or delta modulation (DM) multiplexers. Associated with the Radio Set is a test facility, the AN/GRM-95 used as a depot maintenance facility. The test facility is now available to test all four frequency bands of the radio. The AN/GRC-103 in conjunction with multiplexer equipment is configured into standard US Army and Marine Corps systems e.g., AN/TRC-113, AN/TRC-145.

Multiplexers - the MTD-24 Combiner is used with PCM multiplex equipment to increase the traffic carrying capacity of the AN/GRC-103 from 12 channels to 24 channels. The MTD-212 performs a similar function to the MTD-24 with reduced capabilities. The MTD-1010 is a 15 channel delta modulation multiplexer, replacing PCM equipment in new TDM systems. The MTD-1010 is capable of being stacked so that 4 units will provide a system capability of 63 traffic channels.

Switching Products - SA-12C Switchboard is a microprocessor controlled 12 line semi-automatic cordless field telephone switchboard. A facility exists to enable two SA-12Cs to be connected together to provide a 24 line capability. Similarly for larger installations, the SB-3082 is a 50 line switchboard capable of being stacked to provide 100 lines.

The Radio Wire Integrator C-6709 provides a capability to enable single channel net radios to be connected to the switched telephone network.

Mobile Radio

VHF/FM - transmitter-receivers in a frequency range of 138-174 MHz are produced in 4, 6, 8-channel vehicle mounted models with power output of 15 to 30 watts. Base stations have 4, 6, or 8 channels with power output of 2.5, 15, 30, or 70 watts.

UHF/FM - transmitter-receivers are manufactured in two frequency bands, 406-420 MHz and 450-482 MHz. The 4-channel vehicle-mounted models are available with power output of 10 or 30 watts and the 4 channel base stations have 10, 30 or 60 watts output.

CANADIAN MARCONI COMPANY (Cont'd)

HF/SSB - transmitter, receivers, and transmitter-receivers cover the frequency range 1.6-25 MHz in configurations including manpack portable, vehicle-mounted, and fixed station. Output power varies from 10 watts to 1000 watts and available channels vary from 1 to 16,000 (in the synthesized portable set).

Small Ship Radar - consists only of the LN-66 Marine Radar, originally produced for small coastal fishing vessels, has recently found several new roles in the US Navy. In its normal 10 KW configuration, it is used on surface patrol craft; with some modification, it is used as a fire control system; and in the 75 KW version, it is used as a helicopter surveillance radar.

Naval Surveillance Radar - consists of the CMR 1820, which is a light-weight, S-band surveillance radar for use in ships over 300 tons. It has a double curvature parabolic antenna enclosed in a radome, an MTI signal processor, and a frequency agile transmitter.

The Divisional functional areas are outlined below:

Avionics Division

Avionics Division - established in 1969 but in existence as part of the former Commercial Products Division since about 1950, was substantially based on one major product line, Doppler Navigation Systems. The program of diversification which commenced in 1970 has resulted in a range of new product lines and this trend is expected to continue. Products of this division can be conveniently divided into six main areas:

Aircraft Navigation Systems

"Transit" Satellite Navigation/Position Fixing Systems

Aircraft Monitoring and Display Systems

Photogrammetry

Data Communications Systems

Specialized Components

Radar Division

Radar Division is still in a growth phase and has been working on product development for 2½ years. Development of its first product, the radar Type CMR 1820 is nearing completion. This product is scheduled to be ready for start of deliveries to world markets by late 1982. Other products in the definition phase are outlined below:

CANDAIAN MARCONI COMPANY (Cont'd)

Surveillance Radar CMR 1819 - the result of a collaboration exercise with Marconi Radar UK. A demonstration system has been assembled. This radar will become an exclusive product of the CMC Radar Division, and will be engineered to North American standards should the market potential materialize.

Squinting Antenna - currently the subject of a system study being funded by CRC. It will enable the performance of the CMR 1820 to be enhanced and will allow fitment to small ships in the 100 to 200 ton range.

New Products - new products for related use with the CMR 1820 currently include high power amplifiers and plot extractor.

Telecommunications Division

Telecommunications Division was established in 1969 to manufacture military and commercial communications systems in the UHF and higher frequency ranges. Products of this division are classified in three product groups:

Radio and Ancillaries

Multiplexers

Switching Products

In the three Product Groups, the following programs of development will continue or start during the next five years:

Radio and Ancillaries Product Group

- a. ECCM Radio (previously known as Data Radio) - to develop the next generation of tactical radio relay equipment capable of surviving in an electronic warfare environment - is planned as a seven year program. Feasibility hardware will be made at the end of the second year, followed by full scale development.
- b. DOW-103 - the Digital Order Wire for the AN/GRC-103 Radio will give the system a capability to be NATO interoperable in accordance with the ~~STANAGS~~ now being finalized.
- c. DC/AC Inverter Power Supply - a requirement of the US Marine Corps, this power supply enables the AN/GRC-103 to be driven from a DC supply. The power supply is to be developed as part of a Canada/US cost shared development program.

CANADIAN MARCONI COMPANY (Cont'd)

- d. Radio Ancillaries - the Eurocom Adapter will enable the radio to interface to existing European multiplex equipment. A Transmission Quality Monitor, TOM-103, will be used to measure radio system performance.

Multiplexer Product Group

- a. Conditioned Diphas Adapter - part of the US Marine Corps program. This unit enables multiplexer, crypto and secure order wire units to connect together and to the AN/GRC-103 radio to form a Digital Wideband Transmission System.
- b. LTU-1010 Line Terminating Unit - this is an external Deltaplex option and enables separation of the radio and multiplex equipment by a distance of up to 2 Km. Fibre optic technology will be applied in this product as an interface option.
- c. Deltaplex (Internal Options) - several Deltaplex options are to be developed to enhance the flexibility and marketability of the basic product.

Switching Product Group

A family of switchboards is to be developed to be used in many identified tactical situations. This includes on-going development of the SA-12C, a twelve line semi-automatic switchboard and the MSB-1224 switchboard which has many more features and fits into an identified market slot.

Credentials:

Gross Sales:

1978 - \$57.3M
1979 - \$84.2M
1980 - 112.8M

Average Work Force:

Corporate (includes support & commercial divisions)	- 1320
Avionics	- 592
Radar (R&D only at present)	- 23
Telecommunications	- 559

Plant Size:

Montreal Plant - 486,000 sq ft (only 410,000 sq ft currently being utilized)
Ottawa Plant - 100,000 sq ft

CANADIAN MARCONI COMPANY (Cont'd)

Equipment:

The company machine shop contains a variety of metal working machines which perform functions such as drilling, milling, boring, honing, grinding, engraving, welding, brazing, sawing and rivetting. These are supplemented by two numerical control machines for metal processing and an injection moulding machine for plastics. In each of the printed wiring board, the microelectronics and the specialized electronic component departments, there are production and processing machines which allow the company to offer for sale products built to meet stringent military specifications at competitive prices.

Experience:

Canadian Marconi clientele include the Canadian Government, including the Department of National Defense, the US Military and private industry.

Company: CANADIAN THERMOSTATS AND CONTROL DEVICES Ltd

Address: 8415 Mountain Sights Ave
Montreal, Quebec, Canada H4P 2B8

History:

Cantherm was founded in late 1977 to continue the manufacturing and research program previously carried out by the defunct Multi-State Devices Ltd. They are closely associated with Microtherm GmbH of Pforzheim, West Germany, the leading European manufacturer of bimetallic temperature control devices.

Capability:

With its acquisition of MSD, Cantherm inherited an active R&D department which has continued to expand in many areas of microelectronics and thermal control. Their first order of priority was to finalize the Moxie from a laboratory prototype to a reproduceable chip. They have expertise in the fields of metallurgy, vacuum system depositions (sputtering) and semi-conductor production techniques as a result of their initial projects. Early on, they were awarded a two year development grant from the Canadian National Research Council to develop a thin film thermistor with tolerances $\pm 1\%$ at 25°C . Other specifications included maximum interchangeability and volume producibility at a market acceptable cost. The project was successfully completed within two years and the product is in the North American and European markets.

Credentials:

Gross Sales:
No information available

Average Work Force:
Total - 12

Plant Size:
5,000 sq ft (manufacturing)

Experience:

Cantherms product market is worldwide. On the North American continent, they work with the Canadian Government, industry and have an on-going contract with the USAF.

Company: CANTEL ENGINEERING ASSOCIATES Ltd

Address: 402 West Pender St
Vancouver, British Columbia, Canada V6B 1T6

History:

Cantel was incorporated in 1974 and is Canadian owned. It represents the merger of N.M. Lopianowski & Associates Ltd and Teleconsult Ltd, both founded in 1972.

Capability:

The scope of work performed by Cantel includes - Feasibility Studies, Advisory Services, System Engineering & Design, Cost Estimating, Specifications, Project Management, Acceptance Testing, Instructional Services, and Maintenance Philosophies & Planning.

Their areas of technology included:

- Long & Short Haul Transmission System
 - Terrestrial point to point (microwave, UHF & VHF)
- Communication Satellite Networks
- Multiplex (FDM & TDM)
- Broadcasting (AM, FM, Television, CATV)
- Supervisory & Control Systems
- Cable Carrier
- Telegraphy
- Telephony (switching, outside plant)
- Vehicular Mobile Systems
- Data Transmission System
- Interface with Communication Systems

Credentials:

Gross Sales:
1980 - \$0.6M

Average Work Force:
Professionals - 4
Administrative - 2

Plant Size:
2,500 sq ft

Experience:

Typical clients of Cantel are the Canadian and Provincial Governments, telephone utilities, pipeline and petroleum operating companies, transportation authorities, broadcast stations, CATV operators and data users. Some typical projects include; 1) technology and cost

CANTEL ENGINEERING ASSOCIATES Ltd (Cont'd)

projections for small earth stations in the 2.6 GHz bands for use with direct broadcasting satellites; 2) feasibility study, design and project management of a large VHF communications network; 3) a study of effective system configuration and error correcting strategies to establish digital mobile communications systems; and 4) specification and design of a 2400 mile pipeline satellite communications system.

Company: CASEY COPTER ACCESSORIES Ltd

Address: P. O. Box 121
Montreal Airport
Dorval, Quebec, Canada H4Y 1A5

History:

The small Canadian owned company was founded in 1975 with no other Canadian divisions. There is a US subsidiary that is currently inactive.

Capability:

The sole product of this small Canadian company is the Casey Shroud Heater System. The system is designed for maximum reliability with minimal moving parts and positive mechanical linkages for all controls. This passive heater system is based on the air-to-air heat exchanger principal requiring minimal maintenance. Use of the heater system does not reduce range, restrict airspeed nor reduce rate of climb because it does not require bleed air or fuel. The heater system offers cabin temperatures in the -40°C to 15°C range, 30 pound weight saving over combustion heaters, and high output (over 50,000 BTU/hr). It has proven reliability in Artic conditions. The Casey Shroud Heater fits all Allison C20 series engines in fixed or rotary wing aircraft. It is Supplemental Type Certified by the US DOT/FAA.

Crednetials:

Gross Sales:
Historical - \$0.8M
Current/Projected - \$0.9M

Average Work Force:
Eng - 2 (consulting)
Others - 4

Plant Size:
1700 sq ft

Experience:

The Casey heater system is currently being used by various departments of the Canadian Federal and Provincial Governments, governments of other countries, US State Governments and the Alaska and Minnesota National Guards. It is estimated that 75-80% of the total sales are to the US (10% to the National Guards). There are currently and never have been any sales to the USAF. They are interested in doing business with the USAF.

Company: CHEMBIOMED Ltd

Address: W5-56 Chemistry Bldg
University of Alberta
Edmonton, Alberta, Canada T6G 2G2

History:

Chembiomed was incorporated by the University of Alberta and has access to the intellectual resources of the university.

Capability:

Specializes in advanced carbohydrate synthesis, both at research and commercial levels. Their main field of endeavor is in the blood group and tumor antigenic determinants, but its synthetic capabilities extend to other carbohydrate antigens. Their access to synthetic determinants gives them the unique ability to manufacture antigens to raise and/or purify specific antibodies.

Credentials:

No company data provided prior to the time of this writing.

Experience:

Chembiomed Ltd has no experience with the USAF.

Company: COLLINS & MOON Ltd

Address: 435 Stone Rd W
Suite 215
Guelph, Ontario, Canada N1G 2X6

History:

The company was incorporated in Ontario in mid-1978.

Capability:

Collins & Moon Ltd is a computer systems development and sales organization with emphasis on:

- Data Base Management Systems
- Software Development
- Spatial Information Systems
- Numerical and Statistical Analysis
- Digital Terrain Analysis and Mapping
- Computer Graphics
- Hydrologic Analysis and Mapping
- Geographic Information Systems
- Thematic Analysis, Mapping and Display

They have built a library of software on some fundamental ideas about the management and analysis of terrain-related data. For example, a paper by Collins appearing in a 1975 Canadian Surveyor describes an algorithm that provides a complete analysis of a watershed, including the areas and volumes of all potential water storage basins and the boundaries between them. It remains unique in the field of digital elevation model analysis, and several practical simplified methods of watershed analysis have been derived from it. One notable derivative of this algorithm is an extremely fast method of contour drawing that can be applied to dense grid models of nearly one million points.

Prior to incorporation, successive versions of THEMAPS were developed. THEMAPS is a program system that derives thematic maps from a variety of input sources, using logical or arithmetic algebra. The capabilities of THEMAPS are such that thematic mapping can be supported by simplified data structures. The THEMAPS system, for example, has been applied to mapping the speeds of traverse of army vehicles over varied terrain.

The company has completed some unique programs for terrain analysis. An example is a program that finds the intersections of linear features stored in a string format. This was a problem of long standing in computer cartography and has been solved in an extremely simple and competent way. Other programs determine adjacencies of terrain features.

COLLINS & MOOD Ltd (Cont'd)

Another program which was developed ab initio by the company, is one that maps the depth-below-line-of-sight for a radar installation. It handles large terrain models in reasonable computer times.

Credentials:

Gross Sales:

1979 - 1980: \$0.127M
1980 - 1981: \$0.163M
1981 - 1982: \$0.20M (projected)

Average Work Force:

Eng - 2
Agrologist - 1
Comp Sci - 2
Others - 3 (plus others available on a part-time basis)

Facility Size:

800 sq ft

Equipment:

For software development connections to: Ahmdahl V5 computer.
DEC VAX 11/780 computer, VMS operating system.
DEC PDP 11 series computers with RSX 11 and UNIX operating Systems.
Honeywell 66
Digitizers
Plotters; Applicon, Versatec, Calcomp, jet-ink
Monochromatic and Color CRTs; currently supporting Tektronix 4050 series and the 4027, Ramtek 6,000 series, Norpak VDP and RDS display systems.

Experience:

In the areas of data base management - spatial analysis - geographic information systems, the company is presently involved in a multi-year contract that calls for the design of a complete spatial analysis system that will include a geographic information system and will use as major components existing relational and other data base management systems. The system being designed will be called upon to provide interactive input of spatial information, compact and convenient storage of every type of multi-dimensional spatial data, very fast retrieval of some types of data for simulation of strategic and tactical situations, and a full range of graphical and CRT display systems. This work is being carried out for the Canadian Defense and Civil Institute of Environmental Medicine.

They have developed a highly competent system of data entry, storage, retrieval and display that contains a powerful query and analysis system that is especially suitable for cartography and thematic mapping. The principal applications to date have been to Vehicle Mobility mapping for the Canadian Forces, and the system is now being applied to environmental mapping for the US Geological Survey. The system is highly interactive

and thus can be used by untrained personnel. On the other hand, it provides the framework of data input, management and display that may be effectively used by experienced scientists in carrying out extensive and complicated terrain analyses. This system accepts data in polygon or raster form, stores it in well-designed file structures, applies a powerful querying system in logical or arithmetic algebra, provides output data in polygon or raster form (independent of the input format), and creates plot files and display data for computer-driven plotters, raster plotters and raster (CRT) display systems of common types.

In the area of hydrology, Collins & Moon has completed work for the Ontario Department of Natural Resources. During the course of their work in the hydrographic analysis area, the company analyzed digital elevation models in dense grid format and the work was supportive of hydrological terrain assessment. The analysis of dense-grid digital elevation models, the methods of creating such models, are particular fields of expertise of the company. Software has been developed that carries out a complete watershed analysis from such a model, providing watershed boundaries, saddle points, runoff contributing areas, volumes and areas of water storages, flow quantities and drainage patterns, and other parameters.

Digital Elevation Model techniques have been developed and exploited for drawing contours, slope maps, maps of obstructions to vehicles, and Radar Masking (hidden ground and air space) maps. Programs have been developed for creating Digital Elevation Models from Contours and characteristic lines, and a number of new algorithms for this purpose are now the subject of research. Programs have been delivered to the Canada Center for Remote Sensing that attach elevations to each of the pixels of Landsat imagery.

The company has created and implemented programs for attaching thematic information, derived from line-drawn maps, to the pixels of Landsat images; and for the converse process, converting the pixels of a processed Landsat image into polygonal format for hard-copy cartography and for CRT display. Together with their thematic mapping programs, these programs effectively unite Landsat imagery directly with classical cartography, allowing the same methods of basic data management for both.

They have carried out projects for the Air Operations Research Branch of the Canadian Department of National Defense and for the Defense Research Establishment-Suffield. These projects involved the development of a program to produce maps of terrain visible from a long range radar, data base systems for terrain data computation and map production and a study for the creation and implementation of software for terrain analysis and display.

Company: COMPUTING DEVICES COMPANY

Address: P. O. Box 8508
Ottawa, Ontario, Canada K1G 3M9

History:

This high technology company has been a division of Control Data Canada Ltd since 1969. The company was established in 1948 and has a UK subsidiary, Computing Devices Company Ltd. It is also involved in the manufacture of supply of advanced electronic systems. The company maintains sales representatives in over twenty-three countries.

Capability:

Technology areas include signal processing systems for airborne, shore and undersea vehicles, digital ballistic computer systems for vehicle and portable installations, air navigation display systems, stores management systems for aircraft, electronic intrusion detection systems, command and control display systems for ships, jet engine thrust measurement systems and air defense systems. Specifically the company developed and is manufacturing an acoustic data processor (Preselectable Mainband Processor, PMP-8). This ASW system is designed for monitoring omnidirectional passive sonobouys from aircraft. Another system, the Standard Multi-sensor Digital Display, is designed for Canadian Navy use under the concept of Shipboard Integrated Processing and Display System. They have also developed a Microprocessor Digital Computer System according to a Chrysler specification for the fire control system of the XM-1 main battle tank. They have produced approximately 500 systems at this time. Their Projected Map Display is for use in a variety of aircraft from tactical fighters and helicopters to supersonic transports. This system has been used on the US Navy A-7 aircraft for over 8 years and has been accepted for the USAF Pave Low III rescue helicopter program. The S67 Blackhawk helicopter is also equipped with this system. The company is now working on small projected map display for evaluation by the US Army and for the German Army. They are currently involved in the shared development Ported Coaxial Cable Sensor program with the BISS SPO at Electronics System Division. The program goal is to develop and test buried cable detection system for outside security application. The program start date was mid 1976 and is currently in the FSED phase. Initial production deliveries for DOD requirements are scheduled for the 1983-89 time frame. The program has had many spinoffs. GUIDAR is their commercial product. They also developed a system (Thrust Computing System) to compute (from measured pressures) the gross thrust of the F100 turbofan engine. This was also a shared development program between the USAF and the Canadian Government completed in late 1978. Their design, development and production capabilities have been effectively demonstrated. They perform to military specifications. Contract manufacturing (offset business accounts for 25% of their business. This is accomplished for Hughes Aircraft Company for the Joint Surveillance System.

COMPUTING DEVICES COMPANY (Cont'd)

Credentials:

Gross Sales:

Historically - \$44M

Current - \$48M

Projected - \$80M

Average Work Force:

Professionals - 225

Total - 850

Plant Size:

295,000 sq ft in three buildings

Stittsville research facility totals 400 acres

Experience:

As seen under Capability section, they have experience with the US Military (approx 50% of their total sales). They have considerable production capability.

Company: CRYSTAL RESEARCH/YIELD SYSTEMS Corp

Address: 5 Sherbourne St
Toronto, Ontario, Canada

Mailing Address: P. O. Box 296, Stn "O"
Toronto, Ontario, Canada M4B 2B0

History:

The Canadian owned company was incorporated in early 1980 with no subsidiaries in the US. It was formed for the purpose of researching and manufacturing in the area of single crystal growth and equipment systems, as well as developing and researching new single crystal forms and growth methods.

Capability:

The newly formed company is touted as being the only firm in Canada in the field of crystal growth, crystal growth research, and crystal growth systems. Due to initial financial problems, the company did no business in 1980. They plan to set up shop in 1981 and carry out R&D in CAD/CAM yield systems relative to the crystal growth field and spin off manufacturing both in hardware and software.

Credentials:

Gross Sales:
Current - None
Projected 1981 - \$250 - \$275K

Average Work Force:
PhD - 1
Engineers - 1
Technicians - 4

Plant Size:
Attempting to locate in a 3-5000 sq ft facility.

Equipment:
The company is in the process of building and computerizing two venuil furnaces for laboratory and production use.

Experience:

At present, the company has no experience in Canada or the US. They are interested in doing business with the USAF once established in the very near future.

Company: DG Instruments Ltd

Address: 308 Leggett Dr
Kanata, Ontario, Canada K2K 1Y6

History:

A Canadian owned high technology company incorporated in January 1974. The company was founded by four former employees of the Ottawa-based Leigh Instruments Ltd. The company has no subsidiaries in the US.

Capability:

DGI specializes in navigational systems, wind & speed measurement, and remote sensing. The DGI designed, developed, tested and manufactured systems are for aircrafts, ships, air traffic control and meteorology. Systems include those for electronic ice measurement, submersible tide gauges, training displays for air traffic controllers, RPM indicating, VOR ground check and helicopter air data systems. They have just recently landed a \$2.5M contract from the Canadian Government to supply the DND with 27 air control indicators which allows for shipboard air traffic monitoring during naval maneuvers. The displays will be produced over the next two years.

Credentials:

Average Work Force:

Engineers - 16
Others - 24

New Contract:

Means about 15 new jobs.

Plant:

A new facility is anticipated by late spring of 1981.

Experience:

Their major customer is the Canadian Government - namely the Department of National Defense, Transport, Fisheries and Oceans, Energy, Mines and Resources Communications and Environment.

Company: DATALINE SYSTEMS Ltd

Address: 175 Bedford Road
Toronto, Ontario, Canada M5R 2L2

History:

A Canadian owned company incorporated in late 1968. The corporate headquarters is in Toronto with branch offices located in Ottawa, Montreal, Calgary and Vancouver. Agents are located in Winnipeg, St John's and Windsor. There are currently no US subsidiaries.

Capability:

Dataline is a computer services company with software products oriented towards business and finance operations. They are a computer time sharing (E.D.P. computer service) company with a computer center touted to be the optimum in information processing facilities. Their proprietary Computer Communications System can communicate with clients worldwide and provide each with individual treatment according to specialized requirements. The user has access to more than 100 application modules from the various program libraries and to several data bases. The center is equipped with multiple computers to provide ready backup for down equipment and is a secure operation with computers located in a lead screened room and no dependence on outside service organizations. Interactive processing is standard technique. Their system is linked to the Telenet system in the US.

Their primary produce areas include a) business data processing on-line, b) data base activities, c) energy related systems (primarily oil and gas), d) socio-econometric applications for Government use, e) financial services to banks and trust companies, f) educational services and technical documentation, g) communication network activities, h) corporate planning and financial modeling, i) data base maintenance and dissemination, j) project control systems and k) cash management activities. They are adept at problem solving operations, have developed engineering packages and have full plotting capabilities.

Credentials:

Gross Sales:

1979 - \$ 7M

1980 - \$8.2M

Average Work Force:

Total - 146

DATALINE SYSTEMS Ltd (Cont'd)

Experience:

Dataline clients include the Canadian Government, private industry and the US Government. They have worked with the US military in the R&D field and with the Army Corps of Engineers. They are interested in doing business with the USAF.

Company: The De HAVILLAND AIRCRAFT OF CANADA Ltd

Address: Garratt Blvd
Downsview, Ontario, Canada M3K 1Y5

History:

De Havilland Aircraft of Canada was established in 1928 as a sales outlet, assembly plant, and maintenance facility for aircraft of the British parent company's design and manufacture. The company is owned by the Canadian Government. Its main plant is located in Downsview with other offices located in Ottawa, Washington, DC., and Rosemont, Illinois.

Capability:

The de Havilland Aircraft of Canada is a designer and manufacturer of both civilian and military aircraft. It is a leader in short takeoff and landing (STOL) aircraft technology and is actively engaged in the design and manufacture of these aircraft. During the time period 1939-1945, the company built over 3000 Mosquito bombers and Tiger Moth and Anson trainers. Following this time, they designed and built the Fox Moth and later the DHC-2 Beaver. More than 1600 of these latter aircraft were built for use in Canada, the US and worldwide locations. Their work on the Beaver pioneered the concept of STOL. This aircraft was followed by the DHC-3 Otter and the twin-engined DHC-4 Caribou.

In the early 1960s, they combined turbine power technology with their STOL technology and began to turn out the Buffalo, Twin Otter and Dash 7 aircraft. Today engineering development is well underway on the DHC-8. This is a 32-36 passenger/cargo aircraft demonstrating STOL capabilities, fuel efficiency and rapid conversions between passenger/cargo configurations.

In the R&D area, they have designed and tested many two and three dimensional (airfoil section) wind tunnel models in various low speed wind tunnels. The tunnels mainly used are those operated by the National Aeronautical Establishment in Ottawa. This type of work has led to the development of an advanced powered lift system known as the Augmentor-Wing. A large Augmentor-Wing model incorporating a unique self-contained load compressor to provide large quantities of relatively cool air for test purposes was designed, built, and has been successfully tested in the 40 ft x 80 ft wind tunnel at NASA/Ames. At this time, a converted Buffalo incorporating the de Havilland Augmentor-Wing concept has completed over 700 hours of flight test research covering all aspects of STOL technology, airworthiness, handling and control, instrumentation, avionics, navigation, etc. They also designed and manufactured the complete powerplant nacelle package that was incorporated into the Augmentor-Wing Flight Test Vehicle.

The De HAVILLAND AIRCRAFT OF CANADA Ltd (Cont'd)

Credentials:

Gross Sales: (to 30 May 80)

Domestic - \$50M

Export - \$200M

Average Work Force:

Engineers - 112

Machinists - 103

Tool and Die Makers - 172

Technicians - 250

Support Staff - 133

Others - 4630

Plant Size:

Manufacturing Floor Space - 1,300,000 sq ft

Offices - 93,000 sq ft

Expansion Project - 236,000 sq ft

Manufacturing Facilities/Equipment:

For many years the de Havilland plants have been engaged in the production of stressed skin aluminum alloy airframes, and in so doing, utilize equipment normally found in a well-equipped aircraft manufacturing complex. Their present shop equipment includes milling machines; engine, turret, and pre-programmed automatic lathes; drill presses; drop hammers; punch, hydro and stretch presses; magneform; shapers, rolls; jogglers; tube bending and swaging machines; precision grinders; planers; multi-spindle routers; spot and heli-arc welders; vertical and jig borers; broaches and shears. In addition, heat treat, foundry, plating, painting, sandblasting, and other treatment equipment is available. Hydraulic, instrument, radio, plastic and upholstery shops also form part of the complete facility. The wood working shop specializes in the manufacture of wind tunnel models, patterns and mock-ups. Numerically controlled equipment includes a drafting and digitizing machine and several multi-spindle profile mills, one of which has a machine table measuring and marking machine. Many of the elements of a CAD/CAM system are presently in existence at de Havviland. Interactive graphics are currently used for detailed layouts of sheet metal and machined items. They are also preparing for the receipt of a pair of Dual Gantry 3-Spindle, 5-Axis Vertical Profilers.

They also maintain an Engineering Library, Metallurgical Laboratory, an Aerodynamics Laboratory, a Structural Testing Department, a Materials Research Laboratory, Environmental Chambers and an Engineering Computer Center. In addition, an Engineering Development Shop, housed in a separate 11,000 sq ft building, consists of 100 skilled tradesmen experienced in

THE De HAVILLAND AIRCRAFT OF CANADA Ltd (Cont'd)

working directly with the Engineering staff. Their Data Center contains an IBM System 3031/AP model digital computer with 8 mega bytes capacity. This will be exchanged for an IBM 4342/2 model in the near future. Finally, their Engineering Department has recently acquired a VAX II computer which will be fully operational by the fall of 1981.

Experience:

Contracts for both aircraft purchases and research and development programs have been negotiated with the US Air Force, NASA, US Department of the Interior, US Air Force Academy, Alaska National Guard, Canadian Forces, Canadian National Research Council and the Canadian Department of Transport. In addition to the above, the de Havilland product line is presently being operated in over 70 countries world-wide and on all seven continents.

Previous DOD contracts include:

- . 981 L20 DHC-2 Mk1 Beaver aircraft to the USAF/US Army.
- . 165 DHC-4 Caribou aircraft to the US Army.
- . CV7A Buffalo aircraft development
- . SC8A Air Cushion Landing System

Company: DIFFRACTO Ltd

Address: 6360 Hawthorne Drive
Windsor, Ontario, Canada N81 1J9

History:

DiffRACTO Ltd was incorporated in 1973 as an off-shoot of work done at the University of Windsor. The company is Canadian controlled with a 20% interest owned by Otto Wolff AG of Cologne Germany. An Otto Wolff subsidiary, Hommelwerke, is also the distributor of DiffRACTO products in Europe. They also have a US subsidiary, DiffRACTO Ltd, located at 19640 Harper, Grosse Point Woods, Michigan 48236. Most of the business of the company is conducted in the US through the US subsidiary which largely acts as a sales and service operation.

Capability:

DiffRACTO has been a pioneer in the provision of electro-optical inspection equipment to the manufacturing industry, primarily automotive, but also including nuclear, turbine engine, bearings and the like. These electro-optical units were originally developed on a custom basis but are increasingly becoming more and more standardized. Many are finding their way into robotic applications and a separate subsidiary is being formed to handle these applications including both inspection and robot guidance with visual sensing capabilities.

They currently produce a variety of standard sensor products. In addition are certain special machines, the most predominant example is the Airfoil Contouring System (ACS) for turbine blade inspection. The ACS was originally developed as a joint Canadian/US Defense Production Sharing project with the USAF (AFWAL/MLTM), General Electric, and DiffRACTO. This particular project has led to the sales of several such machines to manufacturers of blades in the US and is the subject of intense current interest relative to both the inspection of new and rework blades (where additional DiffRACTO flaw detection equipment can be combined into such machines). An off-shoot of the ACS is the Laser Gear inspection machine. It is touted as offering a revolutionary way of quantifying gear dimensions in minimal time.

DiffRACTO has devoted considerable effort to R&D activities and has received considerable support in this area from the National Research Council of Canada and the Department of Industry, Trade and Commerce. Current projects exist in the following areas:

- . Electro-optical flaw detection
- . E/O sorting machine development
- . High resolution sensor development (profile image and triangulation)
- . Robot guidance sensor development
- . Fiber optic dimensional and CMM probe development
- . Electro-optical sensors for machine tool feedback

DIFFRACTO Ltd (Cont'd)

In addition to these, there are numerous customer sponsored projects and smaller internal projects. It should also be noted that a large percentage of their custom inspection machines delivered have substantial sensor R&D components. The company currently performs over one million dollars of R&D per year directly aimed at laser and electro-optical sensor development for measure, inspection and robot guidance.

Major applications for this type equipment within private industry and possibly within the USAF are as follows:

- . Inspection and automatic adaptive control of turbine blade manufacture and rework.
- . Inspection of Turbine Assemblies and components. For example, they have projects underway with General Electric for inspection of rotor shaft internal defects. Previous projects were concerned with tip clearance on rotors and for the automatic ultrasonic inspection of disks (laser/optical sensor control portion).
- . Air Frames and Components.
- . Diffracto has participated to a small degree with Boeing in the ICAM sheet metal center development program. Much of the hardware needed to actually implement such a center from the inspection and robot control point of view, already exists at Diffracto. They are currently in discussions with Lockheed Georgia on this same subject.
- . Structural Integrity. Diffracto has completed laser based miniaturized strain gage for aircraft fatigue strain history monitoring for the Canadian Department of National Defense. This gage can be used for highly stressed air frames and gives real time as well as stored data directly in digital form. It can exist in a fiber optic based version having very low weight and freedom from electrical noise.
- . Manufacturing Technology. Applications include the inspection of parts on flexible machining centers and the inspection of tools in the changers.
- . Ordnance. The Diffracto inspection systems can be used for the inspection of ordnance. These normally high volume, high tolerance items require both dimensional and defect inspection and are therefore ideally suited for electro-optical inspection. Some Diffracto sensing systems operate with fiber optics and can be utilized in remote areas, e.g., loaded munitions areas, etc.

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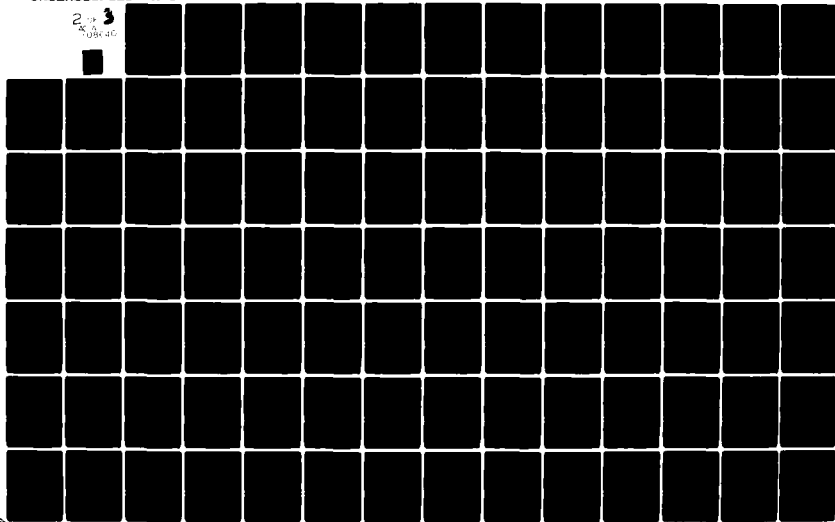
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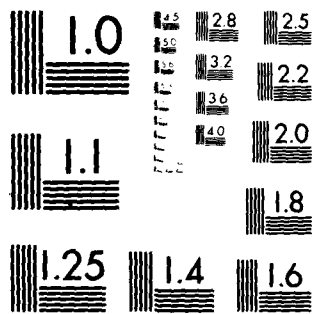
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NATIONAL BUREAU OF STANDARDS 1963-A

DIFFRACTO Ltd (Cont'd)

- . Inspection of Rivet and Fastener Holes in Aircraft Skins. They have a bore probe system that can contour holes optically without requirement for all the channels of information needed in a capacitance probe.

DiffRACTO standard products include:

- . Standard Laser/Electro-Optical Sensors
 - . 'MAXAN' Matrix Array Computer Vision Units
 - . Series S and D High Resolution Outer Diameter Sensors
 - . 'LaserProbe' High Resolution Laser Triangulation Sensors
 - . LaserSurf In-line Microfinish Sensors
 - . Model SF and BF Surface and Bore Flaw Detection Equipment
 - . K-series Microcomputer Based Controller for Optical Sensors and Machines
 - . Contact Optical Digital Bore Size Probes
- . Standard Machines
 - . 'ACS' Laser Airfoil Contour Systems
 - . Laser Gear Inspection Machine
 - . 'OptoSorter' Computer Vision Bolt Sorting Machine
- . Computer Controlled Marking Units
 - . Model 400 Laser Marker for Part Identification
 - . 'TurboJet' Ink Printer

Credentials

Gross Sales:

Fiscal Year 81 - \$5.5M
Fiscal Year 82 - \$6.5M (projected)

Average Work Force:

Total - 100 (5 PhDs)

Plant Size:

66,000 sq ft

Experience:

DiffRACTO has performed one contract with the USAF (AFWAL - Materials Laboratory) through the Defense Production and Development Sharing Program. They have worked with the US Army (Picatinny Arsenal) as well as with US industry, e.g., General Electric Co., Boeing Aircraft Co., Union Carbide, Uniroyal, Westinghouse, Bunker-Ramo, Battelle and others. They also work with the Canadian Department of National Defense and National Research Council of Canada.

Company: DMR and Associates

Address: 112 Kent St, Suite 2218
Ottawa, Ontario, Canada K1P 5P2

History:

A Canadian owned company incorporated in 1973 with no US subsidiaries. They also have offices in Vancouver, Edmonton, Calgary, Toronto, Montreal, Quebec City and Saint John.

Capability:

DMR provides consulting services exclusively in the field of information and data processing systems. They provide three primary categories of services - management consulting, project management and development, and technical. The first category includes such services as strategic planning, organizational and feasibility studies, reviews and audits, and analysis of data processing requirements. The second category includes management of hardware and software installations, planning/management of development and implementation projects, project estimating, scheduling and control, project reviews, training of personnel, and development and implementation of entire application systems with emphasis on structured techniques. Technical services include design of data centers, physical planning and installation of computer equipment, contingency planning, capacity planning, communications network management planning, analysis and simulation of telecommunications networks, and data base requirements planning, package selection, generation and optimization.

Credentials:

Gross Sales:

Historically - \$1M

1980 - \$16M

1981 - \$18M

Average Work Force:

Professionals - over 300

Office Space - 50,000 sq ft (across country)

Unique Feature:

They avoid association with service bureaus, and suppliers of software and hardware products. This helps to ensure a position of total objectivity. The personnel are engineering inclined.

Experience:

They have had no experience with the US military, but are interested in doing business with the USAF should a requirement exist. They have had experience with Government agencies, banking and insurance institutions, manufacturing and distribution companies, utilities and educational institutions.

Company: EBCO INDUSTRIES Ltd

Address: P. O. Box 94200
7851 Alderbridge Way
Richmond, British Columbia, Canada V6X 2A4

History:

Ebco Industries Ltd is a Canadian owned company and was formed in 1956 as a small tool and die shop in Vancouver. The company has had a compounded growth rate of 50% per year since that date and now it is a multimillion dollar concern comprising sixteen companies. This highly diversified organization, including all subsidiaries and affiliates, has a wide range of expertise that includes all aspects of machining and fabricating, electronic data entry and processing equipment, electronic R&D, data processing, furniture, general and specialty construction, custom wheels and automotive accessories, real estate, upholstery, and stoves. This profile will concentrate only on their machining capability which can vary from a 10 minute grinding or polishing job to an 18 month multimillion dollar custom 50 foot diameter atomic cyclotron.

Capability:

Ebco Industries is a multifaceted corporation with a major investment in the machining and fabrication business. Their skills and facilities include:

- . Machining of all kinds - milling, grinding, planing, turning, boring, sawing, etc. They also have CNC capability (planer mills and machining center).
- . Fabrication and medium and heavy plate work.
- . Welding - manual, semi-automatic and automatic in steel, stainless steel, aluminum, T-1, nickel-chrome, titanium, copper, low-temperature steels, etc.
- . Thermal stress relieving and heat treating.
- . Sand blasting and painting.
- . Tool and die work, engraving in metals and plastics.
- . Mechanical and hydraulic assembly.
- . Metal stamping.
- . Tube bending and welding
- . Electro-plating - decorative chrome, brass, copper, zinc, bronze.
 - Industrial hard chrome, cadmium, zinc, iron-manganese and zinc phosphating.
- . Galvanizing Plant - hot dip galvanizing.
 - Centrifugal system for small hardware.

EBCO INDUSTRIES Ltd (Cont'd)

They specialize in close tolerance machining utilizing Brunson optical transit squares and 3-axis digital readouts. Their quality assurance procedures meet SCA standards Z299.2, Z299.3, Z299.4 and ASME Section VIII. Their fabrication facility has the capability to shear, cut, burn, bend, shape and roll plate.

Ebco builds large and small assemblies and machines and boasts the largest repair capability in western Canada. This latter capability is especially applied to the repair and rebuilding of sawmill and pulpmill machinery and logging equipment.

The company is developing a new Aerospace Division that will contain the largest and most sophisticated machining capability available. The main machines comprise two bed tables, each 90 feet long by 160 inches wide, having two gantries per table each with three spindles capable of five axis machining, that operate simultaneously by CNC control. They will also have available anodizing and ultra-sonic immersion inspection systems.

Credentials:

Gross Sales:

Forecast for Year Ending 30 Sep 81 - \$26.8M (Ebco Industries Ltd)
- \$47.0M (Ebco Industries Ltd,
plus 9 subsidiaries)

Average Work Force:

Total - 500

Plant Size:

Total facilities - 211,022 sq ft on 13 acres (an additional
52 acres to be developed in 1981)

Equipment/Facilities:

Crane capacity - maximum lift 150 tons, 40 ft under hook (in shops)
- maximum lift 70 tons, 36 ft under hook (in yard)
Door size - maximum 24x24 ft
Shipping Facilities - road, rail and water loading capacity.

Ebco's equipment list is too voluminous to itemize in this profile, however, a brief summary is presented:

Punch presses - ranging from 15 to 250 tons
Overhead cranes - ranging from 5 to 80 tons
Mobile cranes - up to 7.5 tons
Cutting equipment - Linde 4 & 8 head with tracers
- plasma arc machine
- ironworker

Stress Relief Furnace - 50 ft, 20 ft W, 16 ft H, max temp 1000°C
and max load 100 tons

EBCO INDUSTRIES Ltd (Cont'd)

Other equipment includes grinders, welding manipulators, boring mills, planers, lathes, milling machines, drills, forming presses, plate rollers, welding equipment, planer mills, CNC machines with software preparation and programming system and various inspection and quality control equipment.

Experience:

Clients include - The Boeing Company (MX transporter trailer for USAF and CNC-machined components for hydrofoil vessel for USN), Hooker Chemical Co (electrolytic cathode cells for chlorine plants), The de Havilland Aircraft Company of Canada (CNC-machined aluminum components for STOL aircraft), University of British Columbia (56 ft vacuum tank and resonators for the Meson Facility - TRIUMF Project), the Robbins Co (underground tunnel boring machines to 32 ft diameter), Lockheed Petroleum Services Ltd (wellhead cellars for sub-sea oil well drilling and exploration), plus many other companies and a variety of manufactured items.

Company: ELINCA COMMUNICATIONS Ltd

Address: 100 Bronson Ave, Suite 802
Ottawa, Ontario, Canada K1R 6G8

History:

Elinca Communications operates under a Federal Charter issued in December 1973. It is a wholly-owned Canadian company which groups into one integrated and coordinated whole, the combined resources in engineering, manufacturing and project management of several leading Canadian companies in the telecommunications, electronics and civil engineering fields, and offers these capabilities on a TURNKEY basis.

Capability:

Elinca Communications is a consortium of Canadian companies from the electronics sector. The capabilities of the member companies provide for telecommunications systems and vehicular control systems, and together with other suppliers, for any type of electronic system. The consortium members consist of - Alberta Government Telephones (AGT), Andrew Antenna Company Ltd, Mitel Corporation, Raytheon Canada Ltd, SNC Enterprises Ltd, and Spar Aerospace Ltd. These members invariably utilize various other commercial enterprises. This grouping of companies provides Elinca with a full telecommunications capability, i.e., consulting engineering (terrestrial and space), traffic studies and requirements (fixed and mobile), specifications, manufacture, implementation (electrical, electronic and civil), commissioning, maintenance, operation, billing systems, and training.

Major accomplishments have included involvement in more than 40,000 route kilometers of installed microwave systems in Canada and more than 25,000 route kilometers overseas. More than 100,000 kilometers of buried cable has been laid by AGT in Alberta. Furthermore, complete TURNKEY projects have been carried out in many varied industrial disciplines including telecommunication systems, hydro-electric dams and power generation and distribution, and the optical telescope project in Hawaii and more than 30 other foreign countries around the world.

Space Communication: Spar Aerospace is the prime contractor for Canada's Anik C and D telecommunications satellite, and with SNC provided the satellite earth station at Weir, Quebec. Both Spar and Raytheon Canada have provided satellite earth stations of all sizes and capacities around the world. See separate profile for Spar Aerospace Ltd in this catalog.

ELINCA COMMUNICATIONS Ltd (Cont'd)

Terrestrial Communications: Alberta Government Telephone systems owns and operates a modern, high density terrestrial telephone system in the Province of Alberta, Canada, providing some 1,200,000 telephones to about 2,000,000 people. Furthermore, it also provides some 18,000 mobile telephones operating through 90 control sites throughout Alberta. AGT uses equipment supplied by Spar, Raytheon, Andrew, and Mitel, as well as other national and international suppliers. Mitel and Andrew Antenna are international suppliers of telecommunications equipment.

Management of Capital Projects: SNC is a major consulting, engineering and project management organization. Its engineering disciplines include telecommunications and broadcast, but also cover energy, buildings, industrial plants, transport, and the resource disciplines.

Credentials:

Not applicable for this profile.

Experience:

<u>Project</u>	<u>Customer</u>	<u>Application</u>	<u>Company</u>
Pan Aftel Telecommunications	Senegal, Mali, Haute Volta, Niger, Benin PTT's	Pan African Network	Andrew/Raytheon/Spar/SNC
6 GHz Microwave	PT&T India	Trans-India Network	Raytheon/Andrew
2 GHz Microwave	India PTT	Dehra Dun to New Delhi	Spar/Andrew
6 GHz Microwave	CN-CP Canada	Vancouver to Montreal	Raytheon/Andrew
2 GHz Microwave	Manitoba Tel	Dauphin to Thompson	Spar/Andrew
2 GHz Microwave	Nicaragua	National Network	Spar/Andrew
Satellite earth stations (58)	Telesat Canada	Remote areas radio & TV	Raytheon/Andrew

ELINCA COMMUNICATIONS Ltd (Cont'd)

<u>Project</u>	<u>Customer</u>	<u>Application</u>	<u>Company</u>
Project Manage- ment	Cinko-Kursun Metal Sanayii Kayseri, Turkey	Zinc Process- Plant	SNC Enterprises
Hydro Electric Power Development 780 MW	Kerala State Electricity Board, India	3 Hydro Electric Dams & Plant	SNC Enterprises
Satellite earth stations	Teleglobe, Canada	International gateway, Weir, Quebec	Spar/SNC Enterprises

Company: EPIC DATA SALES Ltd

Address: 7280 River Road
Richmond, British Columbia, Canada V6X 1X5

History:

Epic Data Sales Ltd is a member of the Ebco group of companies (See Ebco Industries Ltd). They are a Canadian owned company incorporated in mid-1974. The large diversification of capability and products associated with Ebco Industries caused many problems in labor and material tracking. They looked for an automated system that would solve these problems and discovered there was no system available that would perform these functions at a reasonable price. They developed their own data collection system and Epic Data Sales Ltd was formed.

Capability:

Epic Data Sales Ltd develops and manufactures data collection systems based on microprocessor technology. Their terminals and controllers are designed to use as many common parts and subassemblies as possible. This philosophy, coupled with the use of solid state components wherever possible, enables them to keep down cost while maintaining reliability. The user terminals on the factory floor, the office or other environments are simple and straight-forward to use.

Each multifunction terminal model may be upgraded to provide new input devices (e.g., magnetic strip reader), special interfaces (e.g., weigh scale) or peripherals (e.g., CRTs or printers). In almost every case, adding capabilities to a system does not obsolete equipment already purchased. In addition to their "do anything" terminals, they are developing single function terminals. Their first units collect data solely via a barcode wand and they are planning a single function barcode slot reader and a single function keyboard terminal. Epic is developing a system control unit that will be able to perform validation via table lookups, a mini/micro computer and turnkey software packages (e.g., time and attendance, job costing and library application programs).

Their products include:

- . Time and attendance terminals
- . Standalone units
- . Cassette storage units
- . System control units
- . Single function barcode terminals
- . Single function barcode terminals expanded
- . Single function terminal concentrator

EPIC DATA SALES Ltd (Cont'd)

Credentials:

Gross Sales:

1980 - \$3.9M

1981 - \$1.8M (at time of data submission)

Average Work Force:

Total - 70 (will expand to approximately 115 in 1981)

Plant Size:

4,500 sq ft (to be expanded to 14,500 sq ft in 1981)

Equipment:

Epic Data has GenRad Automatic Testing Equipment which is used to test all assemblies as they come off the production line. They also utilize an Everett Charles Printed Circuit Board Shorts Detection system primarily on incoming inspection to detect hairline shorts which are not visible to the naked eye.

Experience:

Epic Data is touted to be a world leader in the manufacture and design of data collection equipment. They have major clients throughout the world and their equipment is frequently recommended for use by such major computer companies as Xerox, Tandem, Digital Equipment Corp and Sperry Univac. Epic Data customers include General Electric Co, Monsanto, General Motors Corp, Motorola Corp, Mexican Government, FX Leipold (West Germany), Pleassey France S.A. (France), City and County of San Francisco, Canadian Government and others.

Company: EPITEK ELECTRONICS Ltd

Address: 100 Schneider Rd
Kanata, Ontario, Canada K2K 1Y2

History:

The Canadian owned company was incorporated in 1969 with a US subsidiary (Epitek Electronics Inc) located in Odgensburg, NY. The latter is a distribution center only. The company specializes in the design, development and production of thick film hybrid circuits and networks for the electronics industry.

Capability:

The Epitek custom design expertise is directed primarily towards the following market areas - (1) computer communications (terminator networks, modem hybrids, tone squelch hybrids), (2) telecommunications (line matching networks, RF hybrids), (3) instrumentation (ladder networks, input alternators, voltage dividers), and (4) military devices (oscillator hybrids, trimmable resistor networks, Codec hybrids). Their standard product line includes audio amplifiers, active filters, telephony hybrids and SIP and DIP resistor and resistor-capacitor networks. They strive for quality control and can design to meet MIL-M-38510, MIL-STD-883 and MIL-R-83401. They are now beginning to carry out R&D in the thin film area and intend to develop expertise in solar cell and chip resistor line technology in the near future. Approximately 5% of their budget is directed towards internal R&D. The company holds a security clearance.

Credentials:

Gross Sales:

Current - \$3M
Projected - \$5M

Average Work Force:

PhDs - 4
Engineers - 5
Others - 100

Plant Size:

12,000 sq ft (plan to expand to 26,000 sq ft in 1981)

Manufacturing Capability:

Their manufacturing facility is equipped with all the standard production and test equipment to insure quality production. Special equipment includes two YAG laser trimmers and CO₂ ceramic laser scribe.

Experience:

Epitek sales are divided 60% to the US and 40% to Canada. They have no direct sales to the US military, but about \$3M to the DOD through US primes. The indirect DOD sales are in the areas of mines and sonobouys. They are interested in doing business with the USAF.

Company: EXCO ENGINEERING

Address: 220 Torbay Road
Markham, Ontario, Canada L3R 2P3

History:

Exco Engineering is a division of Extrusion Machine Company Ltd, a private, wholly owned Canadian company incorporated in 1951. Exco was formed in 1970 as the result of a company reorganization and operates as a custom machining and engineering division.

Capability:

Exco Engineering is a custom machining and engineering facility that is equipped to work to MIL-45208, DND-1016 and CSA-Z-299-3. The company specializes in the design of special machines, die cast tooling and extrusion tooling. It can supply aircraft components, precision machine parts, die cast dies, shot sleeves, and extrusion tools (dies, mandrels, mandrel holders, liner, containers and stems). Exco services include heat treating and stress relieving (H-13 only), (NC machine work, Blanchard grinding, EDM machining, 3-D copy milling, general machining, machine repair and retro-fitting and hard facing and rebuilding of screw conveyors.

Credentials:

Gross Sales:

1980 - \$6.0M
1981 - \$7.5M
1982 - \$8.0M

Average Work Force:

Machinists/Toolmakers - 80
Eng/Admin - 20

Plant Size:

Markham Plant - 26,000 sq ft x 22 ft
Markham Plant - 10,000 sq ft x 24 ft 6 in
Scarborough Plant - 14,000 sq ft x 5 ft
New expansion - 12,000 sq ft high bay

Equipment:

Their new expansion is equipped with 2 bridge cranes, one double hook of 30-ton and 10-ton capacity and another single hook of 10-ton capacity. It is also equipped with three 5-inch spindle CNC horizontal boring mills. Their Scarborough plant concentrates exclusively on aluminum extrusion dies. The Markham plants are equipped with those items typical of an industrial service center, e.g., various types of cranes, mills, lathes, CNC equipment, electrical discharge machinery, grinding machinery, honing machinery, cutting equipment and various other equipments.

EXCO ENGINEERING (Cont'd)

Experience:

Have supplied components and parts to such organizationa as DeHavilland Aircraft, McDonnel Douglas, Canadair and Sperry Gyroscope.

Company: EXPLOSAFE DIVISION
Vulcan Industrial Packaging Ltd

Address: 414 Attwell Drive
Rexdale, Ontario, Canada M9W 5C3

History:

Vulcan was incorporated in 1958 and is a Canadian owned company. The parent company manufactures metal and plastic containers for industrial uses. They have a total of sixteen plants.

Capability: The objective of the Explosafe Division is to supply engineered Explosafe explosion suppression systems for military, commercial and consumer use and to replace reticulated foam as the explosion suppressant in military applications.

The Explosafe system is an expanded metallic foil mesh fabricated into a cellular matrix structure which occupies the interior of a volatile liquid container, e.g., a fuel tank. Displacement is approximately 1 percent of fluid volume. Explosion suppression is based on (1) curtailing combustion reaction and (2) absorption of heat release during reaction. The advantages of the system are lightweight, low displacement, non-reactive, permanent and readily installed. It is a passive system requiring no controls or logistic support. The system does not deteriorate, does not introduce contamination into the tank and can withstand a high operational temperature. Explosafe can be welded insitu and eliminates slosh. It offers low retention and dissipates static electricity.

Credentials:

Gross Sales:
No Data

Average Work Force:
Total - 25

Plant Size:
24,000 sq ft

Experience:

The Explosafe Division participated in the Canadian Government/USAF evaluation of the aircraft fuel tank ullage explosion suppression performance of Explosafe. The 3 year effort resulted in technical report AFWAL-TR-80-2043, dated July 1980. As a result of this program, a military specification is being drafted. The material is being considered for use by the US military and private industry.

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Vulcan Industrial Packaging Ltd

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EXPLOSAFE DIVISION (Cont'd)
Vulcan Industrial Packaging Ltd

Aircraft being considered include the C-130, A-10, A-7 and F-111 and the 500-MD and AH-1 helicopters. USAF "Peacekeeper" security vehicles are being equipped with Explosafe. Prototype or production status exist for the M113-A1 and -A2 APCs, the VLTP7 Assault APC, M110 Self Propelled Howitzer, M578 Recovery Vehicle and the High Mobility Multi-Purpose Wheeled Vehicle. It is also a candidate for the MLV(W), Military 2½ ton truck being produced by Bombardier Ltd (Canada) and an Escort Vehicle (armored) for the US DOE. Potential sea use includes a patrol boat (Harbor Patrol Rescue Boat) for the Orange County, CA, Sheriff's Dept and for a shipboard fuel storage tank being manufactured by Kellett Corporation, Willow Grove, PA.

Company: FITTINGS (1980) Inc

Address: 135 Bruce St
Oshawa, Ontario, Canada L1H 1R1

History:

Fittings Ltd was formed in 1901 to provide a variety of quality castings. The company changed its' name to Fittings (1980) Inc to reflect a change in management.

Capability:

The Company furnishes complete support for total casting projects from functional concept to designing, material selection and final finishing. Providing both malleable and pearlitic iron castings, from ounces to pounds, their main production runs are for castings from 1 to 10 pounds. Working to ATSM standards and using a tool and gauge calibration system traceable to the National Bureau of Standards, they emphasize complete quality control procedures for all phases of their operation. They have the capability to coin victaulic style iron fittings for pipe-ends to +.010, thus eliminating the formerly used expensive machining processes.

Credential:

Gross Sales:
1980 - \$10M

Average Work Force:
Production - 211
Engineering - 2
Quality Control - 10

Plant Size:
200,000 sq ft (165,000 sq ft devoted to Mfg)

Equipment:
Molding equipment - 8 automated matchplate machines, 3 turntables, and 3 roto-lift machines with conveyor lines. Sand facilities - 3 automatic batch sand mixers and automatic moisture control. Melting facilities - 3 coreless induction furnaces with 13.5 ton capacity each. Annealing facilities - 3 continuous, 30-hour cycle protective atmosphere ovens. Space straightening facilities - 5, 300 & 500 ton hydraulic presses.

Experience:

Fittings (1980) Inc has had wide experience dealing with US firms which include - Rockwell International, Massey-Ferguson, Chrysler, Dresser Industries, Cast Metal Industries and others.

Company: FOUNDATION ELECTRONIC INSTRUMENTS Inc

Address: 1794 Courtwood Crescent
Ottawa, Ontario, Canada K2C 2B5

History:

A wholly owned Canadian corporation specializing in research, development and manufacturing for the communications industry, primarily in the area of fiber optics. The company began as a part-time operation in late 1974 and became a full-time corporation in November 1977. There are no other divisions of the company in Canada and no US subsidiaries, although a US sales office is planned for the near future.

Capability:

Foundation Instruments is a small, but dynamic company, active in research, development and manufacturing of fiber optics components, systems and associated products. Their capabilities are herein described by reviewing their established product line which includes portable microphone mixers for broadcast use; sub-miniature time-date-generators for broadcast and security application; programmable controllers for industrial and broadcasting use; video/audio routing switchers for telecommunications, broadcasting and industrial use; military switchboards; data multiplexers and de-multiplexers; low noise UHF amplifiers; telemetry systems and fiber optic systems. Their research capabilities with respect to these latter systems are best related by referring to systems that have been or are being designed by their principal scientific personnel. Foundation personnel have designed Fiber Optic Transmission System, 20MHZ baseband analog systems, 10MB/S digital systems, a special fiber optic section for a shipboard communication simulator, fiber optic transmitters, receivers, security circuits, alarm flags and video amplifiers associated with a secure communication link, and subscriber and central office terminals for telephone systems. This latter capability allows the subscribers to receive their choice of several television programs, as well as telephone and additional information over a fiber optic cable. This capability is bi-directional.

Foundation capabilities will be expanded in the short term to include multichannel fiber optic communications systems, high reliability shipboard communications systems, tactical fiber optic communications systems and data acquisition systems for use with fiber optics. In the long term, they plan to incorporate into their system an LED, laser production facility and a fiber production facility.

FOUNDATION ELECTRONIC INSTRUMENTS Inc (Cont'd)

Credentials:

Gross Sales:

1971 - \$365K

1980 - \$1M

1981 - \$3M (projected)

Average Work Force:

Part-time & Consultants - 5

Engineers - 27

Plant Size:

5,300 sq ft (anticipate expansion in 1981 to 10,000 sq ft)

Experience:

Foundation has experience with several departments of the Canadian Government - e.g., National Defense and Atomic Energy Commission. They also have experience with other organizations - Northern Telecom, IBM, Hewlett-Packard of Canada, and some private companies in the US. About 15% of their sales are to the US with about 8% to the US Army. Their current contract with the US Army will result in an instrument that will determine the load bearing capacity of soils. They have no experience with the USAF, but are interested in gaining USAF business.

Company: GANDALF DATA COMMUNICATIONS Ltd

Address: Gandalf Plaza
9 Slack Rd
Ottawa, Ontario, Canada K2G 0B7

History:

A privately owned Canadian high technology company since 1970 with affiliates in the US and the UK. They are Canada's largest manufacturer and supplier of digital data communications equipment, linking computer terminals to telephone lines that access mainframe computers. Gandalf Data Inc., located in Wheeling, Illinois, was started in 1975 and is a major industrial force in volume production and distribution of digital data transmission devices. Gandalf Digital Communication Ltd, located in Warrington, Cheshire, England, began operations in 1978. The data transmission equipment needs of the computer industries of the US and UK are supplied by the affiliates. The Canadian office supplies Canada's needs as well as the remainder of the international market.

Capability:

The Gandalf Group of Companies is a multimillion dollar enterprise serving the international market in the computer communications field, supplying state-of-the-art expertise in the design, development and manufacture of data transmission hardware and related products. Over the years Gandalf has invested 5-12% of its sales dollars in R&D. They have advanced the art with their medium and long distance data modems, 50 mile 4800 bps and 9600 bps, respectively, and their current Private Intelligent Networkers (PIN) Series of data communications equipment. They plan to continue to develop innovative techniques for transmitting data for users of computer technology. The 1980 R&D expenditure exceeded \$1M.

Credentials:

Gross Sales:

1979 - \$13M (group), \$4.2M (Canada)
1980 - \$26M (group), \$8.1M (Canada)
1981 - \$40M (group) est

Average Work Force:

Total - 600 (group), 300 (Canada), 350 (US)
Engineers - 60 (Canada)

Plant Size:

Current - 65000 sq ft (Ottawa), 22000 sq ft (Hull, Quebec)
95000 sq ft (US)

GANDALF DATA COMMUNICATIONS Ltd (Cont'd)

Manufacturing Capability:

This capability exists in Ottawa primarily for specialty items. The main manufacturing takes place in the plant located in Hull, Quebec. Sales and field service offices/departments are spread across the country.

Experience:

Gandalf sales distribution for the year ending July 31, 1980, is 49.0% US, 31.0% Canada, 11.8% UK and 8.2% other. Gandalf Data Communications Ltd does not compete with Gandalf Data Inc (Wheeling, Ill) for business in the US. The information provided in this product, however, applies equally to the US company.

Company: GARRETT MANUFACTURING Ltd

Address: 255 Attwell Drive
Rexdale, Ontario, Canada M9W 5B8

History:

Garrett Manufacturing Ltd (GML) is a wholly owned subsidiary for the US based Garrett Corporation. The Garrett Corporation, Mack Truck, United Oil Products and Ampex are the major components of the Signal Companies, one of the 100 largest US corporations with 1980 sales of \$4.3 billion.

A Garrett office was established in Canada in 1952 to provide sales and service support for Garrett products in Canada. One year later, the company established a repair and overhaul facility near Toronto International Airport and added an engineering department to support this endeavor.

Throughout the 1950s, Garrett expanded its engineering department, added a production department and began the design and manufacture of ground equipment for the Canadian aircraft industry. In 1961, Garrett Manufacturing Ltd assumed a world product mandate for design, development and production of electronic temperature controls. These controls are a major subsystem of the Garrett environmental control systems that fly on more than 70% of the commercial and military aircraft in the western world.

Garrett Manufacturing Ltd now supplies a broad mix of products and services to the world aerospace industry. Garrett's aerospace products include aircraft cabin, cockpit and compartment temperature controls; windshield heat controls; airflow sensing and control systems; engine speed sensors; radio communication equipment for personnel and air traffic control applications; ground test equipment for aircraft air data systems; and custom thick and thin film hybrid microcircuits. GML is the Canadian repair and overhaul base for all Garrett products. In addition, GML assembles and tests electronic equipment on a "build to print" basis.

Capability:

The company is actively engaged in research and development in control systems, RF communications and analog and digital circuit design to support existing products and create new opportunities. Environmental and EMI testing to military/aerospace standards is performed in Garrett's approved test facilities.

A single standard quality control system conforming to DND 1015 and meeting the requirements of MIL-Q-9858 and NATO AQAP.1 is employed by the company. DND maintains a resident detachment in the plant which will on request, provide reciprocal inspection services for the US DOD and other NATO governments.

GARRETT MANUFACTURING Ltd (Cont'd)

All of the major airframe manufacturers in the US have surveyed and approved GML's facility and control systems as being acceptable for the manufacture of both military and commercial aircraft equipment.

Garrett products include:

Microcircuits - GML's microelectronic products are produced in a fully integrated facility with dedicated engineering, sales and production staff. This facility produces thick and thin film hybrid microcircuits. GML's microcircuit installation is equipped with \$5 million dollars worth of specialized manufacturing equipment including automatic laser trimming, computer controlled testing and an electron beam scanning microscope. This facility is producing microelectronic devices to military specification for the military and aerospace industries.

Temperature Control Systems - GML's temperature control systems usually consist of electronic control boxes; temperature and/or airflow sensors; and temperature selectors. The most recent designs, featuring microprocessor-based digital electronics for improved performance and increased reliability are in production for Boeing's 757/767 programs. Garrett temperature controls are used in cabin, cockpit and compartment airconditioning systems; wing anti-ice temperature control systems; window heat control systems, and some liquid coolant systems. In the addition to the Boeing 757/767, Garrett systems are in use on A300, A310, DC-9, DC-10, 727, 737, 747, F-14, F-15, F-18, Viggen, EF111A, Gulfstream II/III, Challenger, HS-125, IAI 1124/1125, Sabreliner, Learjet 54/55, HU-25A Guardian, SRR, and Hughes AAH. Most of the major commercial, military and business aircrafts in the western world use Garrett temperature control systems.

Communications Systems - Emergency Locator Beacons developed by GML are used throughout the world in military, commercial and general aviation applications. These low power transmitters automatically provide an emergency homing signal to assist search aircraft to locate an aircraft in distress. Personal Locator Beacons and Survival Radio Sets are recent product developments which permit two-way voice communication with search aircraft as well as providing an emergency homing signal. VHF/AM Single Channel Transmitters and Receivers are produced for civil aviation air traffic control communications. Installed at air radio facilities, this ground station equipment offers many performance and maintenance features not previously available.

GARRETT MANUFACTURING Ltd (Cont'd)

Major Systems and Subcontract Manufacturing - Major Systems and Subcontract Manufacturing is GML's "build-to-print" product line. This service is administered by the Manufacturing Operations group. The facilities represent an investment of millions of dollars in electronics, electromechanical and sheet metal assembly equipment and are available for assembly and test to customer drawings and specifications, of complete electronic systems, black boxes and complex printed wiring boards. GML is successful in this specialized high technology industry because their experienced personnel, aerospace-standard quality assurance and modern automatic test equipment enable them to offer timely delivery, competitive prices and consistent high quality.

Repair and Overhaul/Customer Support - GML's customer support/repair and overhaul facility is unique in Canada. It is the only facility outside of Air Canada's Montreal base and CP Air's Vancouver facility that has the capability to simulate conditions for testing airborne air conditioning rotating machines and high temperature valves. These facilities are also equipped to repair and overhaul gas turbine auxiliary power units, actuators, starters, central air data computers, other aircraft systems, and turbochargers for tractor, truck and automotive applications.

Credentials:

Gross Sales:

1980 - \$51M

Forecast growth pattern - 10 to 12%

Average Work Force:

Eng - 150

Production - 600

Qual Ins/Customer Support - 100

Other - 150

Plant Size:

Main Plant/Head Office - 75,000 sq ft

Product Support Facility - 34,000 sq ft

Taber Road Facility - 12,000 sq ft

GML Microcircuit Facility - 21,000 sq ft

Engineering Facility - 33,000 sq ft

Experience:

GML customers are worldwide and include both the commercial and military sectors.

Company: GENERAL MOTORS OF CANADA Ltd
(Diesel Division)

Address: P. O. Box 5160
1991 Oxford St East
London, Ontario, Canada N6A 4N5

History:

Diesel Division, General Motors of Canada Ltd was established in 1941 for the manufacture of diesel-electric locomotives. The Diesel Division is a wholly owned subsidiary of General Motors of Canada Ltd, which in turn is wholly owned by General Motors Corporation.

Capability:

The Diesel Division is primarily involved in the engineering and manufacture of locomotives, General Motors coaches and Terex off-highway vehicles. They also design and manufacture armored vehicles, general purpose, for the Canadian Forces. This latter vehicle, designated AVGP, is a six wheeled amphibious unit and is being supplied in three models, a personnel carrier, a fire support vehicle and a maintenance recovery unit.

Credentials:

Gross Sales:
1980/81 - \$608M (projected)

Average Work Force:
Eng - 40
Others - 2838

Plant Size:
Main Plant - 866,000 sq ft
Highbury Ave Plant - 267,000 sq ft
St Eustache Plant - 138,000 sq ft

Experience:

The Diesel Division has been awarded a contract by the US Navy for a design study for a Hybrid Mobile Protected Weapon System and has entered a bid on the Light Armored Vehicle program for the US Marine Corps (administered by the US Army). They have also participated in the MX missile carrier program through Delco Electronics and bid on the US Army Infantry Fighting Vehicle Second Source program. Since their beginning, they have supplied more than 3000 locomotives to 29 domestic customers and have exported more than 500 units for 15 railways in 12 countries. They are currently under contract to supply \$155M worth of locomotives to Egypt. Since they began building coaches in 1961, they have supplied 7200 units across Canada.

Company: GLENAYRE ELECTRONICS Ltd

Address: 1551 Columbia Street
North Vancouver, British Columbia, Canada V7J 1A3

History:

A Canadian owned company incorporated in 1963. There are no other Canadian locations. The company has a US subsidiary, Glenayre Electronics Inc., located in Blaine, Washington. The US corporation is a sales and service outlet for products designed and manufactured by the Canadian parent.

Capability:

The products and projects of Glenayre are organized into four groups; communications, transportation systems, power conversion, and instrumentation and control panel assembly. Standard products are offered as well as custom products and systems based on customer requirements. A heavy commitment to R&D is maintained to insure the company remains abreast of current technology. Heavy emphasis is placed in the telecommunications area. They have developed and now manufacture an advanced Mobile Telephone Control Head (GL 2000), a microprocessor-based unit featuring automatic call initiation. Also developed and manufactured are the scanning control head, tone products, a subaudible encoder/decoder and central office control equipment such as a radiotelephone terminal incorporating microprocessor control and fully solid state audio switching. They are also developing microprocessor control heads and communications management hardware for larger fleet operators.

In the area of transportation systems, they design and manufacture automatic vehicle monitoring systems. These systems generally involve buses, trains, trucks and subway cars. New product development includes a proximity beacon for locating non-tracked equipment and a low priced transponder suitable for electronic identification of anything from freight cars to personnel in a security sensitive area.

Their power converters (DC/DC) are designed for fixed or mobile operation, are of compact design and have a broad range of input and output voltages. They also produce power supply packages for data processing, communications and other industries. Included in the Glenayre plant is a fabrication and assembly facility for industrial control and switchboard application.

Credentials:

Gross Sales:
1979 - \$ 5M
1980 - 8M
1981 - 11M

GLENAYRE ELECTRONICS Ltd (Cont'd)

Average Work Force:

Eng	- 50
Production	- 75
Others	- 25

Plant Size:

33,000 sq ft

Manufacturing Capability:

Of the above total floor space, 10,000 sq ft is devoted to manufacturing. They maintain a metal fabrication shop, paint shop, assembly area and fully equipped test, service and quality control departments.

Experience:

They have worked with several foreign countries including the US, as well as with private industry and Provincial Governments across Canada. There has been no direct work with the USAF, although they are interested in selling to the USAF.

Company: GLOBAL THERMOELECTRIC POWER SYSTEMS Ltd

Address: P. O. Box 90
Bassano, Alberta, Canada T0J 0B0

History:

Global is a privately held Canadian company incorporated in 1975. The Global operation, originating employees, equipment and thermoelectric science and technology, was originally a major part of the Thermoelectric Division, 3M Company, St Paul, Minnesota. All facilities are at the above location.

Capabilities:

The Global corporate mission is the commercial application of mature, field-proven remote power technology, coupled with an on-going commitment to research and development of promising remote power technologies. They are regarded as a complete manufacturing and marketing organization and, as a result of the above mission, are engaged in extensive R&D of thermoelectrics, combustion and electronics. Their Bassano headquarters accommodates both administrative and production facilities as well as an engineering department and research and development laboratories.

The company's product is a line of high reliability thermoelectric power systems for remote unattended stations requiring 10 to 1000 watts continuously. They have provided the Sandia Laboratories with power systems for SALT-type monitoring in the USSR-systems that not only provide the required power, but cannot be undetectably tampered with. This latter property results from the fact that the Global power systems have no moving parts and generally do not malfunction. Their production capacity is about 16 generators per week. Manufacturing of the thermoelectric generators is accomplished through various stages of mechanical and electronic assembly, backfilling, leak checking and basic machining. Their shop capabilities can easily hold tolerances to the required ± 0.001 inch. The high technology semiconductor thermoelectric materials and hermetically-sealed thermopile power units are manufactured entirely on site. This is predominately for reasons of quality control and due to the highly specialized skills and equipment required. They are apparently the world's sole commercial source for sintered, doped lead-telluride thermoelectric elements meeting the US Government's standard for 3M-type ES1101 characteristics. It is interesting to note that Global thermoelectric generators have powered telemetric transmissions back to earth during Apollo moon missions. Their systems are performing today in some 40 countries, accumulating a total of well beyond 15,000 years of reliable operation.

GLOBAL THERMOELECTRIC POWER SYSTEMS Ltd (Cont'd)

Recognize that, while thermoelectrics is a relatively mature technology, the development of remote power in general is still in its infancy. The company is therefore striving for the development of lower cost, more widely applicable power sources incorporating proven thermoelectric technology with newly developing manufacturing techniques. Their applied research is directed towards the fields of solid state physics, heat transfer and storage, and gas and fluid dynamics while development is actively underway in combustion technology, thermoelectric metallurgy, piezoelectric ultrasonic atomization, electronic and electrical engineering and new burner systems. On-going experiments were witnessed in the areas of fuel atomization and increasing the combustion characteristics of diesel fuel.

Credentials:

Gross Sales:

Historical - \$2M
Current (1980) - \$2.4M
Projected (1981) - \$2.1M

Average Work Force:

PhDs - 1
Eng - 21

Plant Size:

24,000 sq ft

Manufacturing/Equipment:

Because of the special requirements associated with the manufacturing of long life, hermetically sealed, semi-conductor thermopiles, they have special equipment/instruments such as a helium mass spectrometer, TIG and MIG welding equipment, induction heater (for preparation of special alloys) and vacuum and back filling equipment.

Experience:

Global's power systems markets are in the areas of telecommunications (radio repeater sites); cathodic protection; telemetry, supervisory control and signals; and navigation and positioning. Customers include US EPA, US Army, Exxon Corporation (US), Mountain Bell (Boise, Idaho), Continental Telephone of the West (Phoenix, Arizona), Texas Instruments, Teledyne Geotech, Amoco Pipeline Company (New Mexico), Nippon Electric Company, ARAMCO/PETROMIN (Saudi Arabia), Algeria Post and Telegraph (Algeria), Abu Dhabi National Oil Co., Shell Canada, Marinav Corporation (Canada), Offshore Navigation Canada Ltd, NNPC (Nigeria) and Dome Petroleum (Canada). As can be

GLOBAL THERMOELECTRIC POWER SYSTEMS Ltd (Cont'd)

seen, they have world-wide experience with major organizations. They are currently working with the US Army and indirectly with the USAF (ASD) through the USA. They are interested in working directly with the USAF and appear to have considerable technology/experience to offer. They are very R&D oriented in addition to offering a reliable product line.

Company: GOODWOOD DATA SYSTEMS Ltd

Address: 150 Rosamond St
P. O. Box 210
Carleton Place, Ontario, Canada K7C 3P4

History:

A Canadian owned high technology company founded in 1976. It was originally owned by I. P. Sharp Associates Ltd, a Toronto based computer hardware and software consulting company. The company has a US subsidiary, Goodwood Data Systems Inc., located in Ogdensburg, N.Y.

Capability:

Goodwood is primarily involved in the design and manufacture of aviation data handling systems, weather processing systems, and computer aided learning systems. They also design and manufacture video display systems, data acquisition systems, communication monitors, flight strip printing systems plus other electronic equipment. Their airport information processing systems, designed for air traffic control, weather forecasting and passenger movement, are in use at the International airports serving Toronto, Ottawa, Montreal, Winnipeg, Edmonton and Vancouver. Their human resources allows them to cover the broad areas of engineering (including system logic and design), software design and development, systems management, product assurance (including reliability and maintainability analysis), production (including O&R), quality assurance, documentation, and training. Their computer aided learning system, known as AVCAT (Audio Visual Computer Aided Trainer), provides individualized audio/visual based instruction with record keeping, student management and full lesson authoring and editing capability,

Credentials:

Gross Sales:
1980 - \$1.3M
1981 - \$2.5M forecast

Average Work Force:
PhD - 2
Eng - 14
Others - 29

Plant Size:
19532 sq ft - main building
4910 sq ft - storage & boardroom & boiler buildings

Experience:

Present customers include various departments in the Canadian Government and industries in both Canada and the US. They are interested in doing business with the USAF.

Company: GREAT LAKES FORGINGS Corp

Address: 1590 Matthew Brady
Windsor, Ontario, Canada N8S 3K6

History:

Great Lakes Forgings was incorporated in 1950. They are Canadian owned with no other locations in Canada or in the US.

Capability:

Great Lakes Forgings is a closed die forge shop and produces low carbon and alloy steel forgings. Their product line, forged rivetless conveyor chains, are used in material handling systems and account for fifty percent of their current business.

Credentials:

Gross Sales:

1981 - \$10M

1982 - \$12M (projected)

Average Work Force:

Total - 120

Plant Size:

Forging Plant - 18,000 sq ft

Heat Treat Plant - 12,000 sq ft

Equipment:

They are equipped with eight air and hydraulic forging hammers.

Experience:

A prime customer is American Chain and Cable (US, Canadian and Italian Divisions) as well as the automotive industry (Chrysler, Ford). Unikey Corp (US) is a major customer in the materials handling area. They are also supplying two US firms with forged hooks for military end use.

Company: HAMMOND MANUFACTURING COMPANY Ltd

Address: Corporate Office
394 Edinburgh Road
Guelph, Ontario, Canada N1H 1E5

Electronic Transformer Divisions
95 Curtis Drive
Guelph, Ontario, Canada N1K 1E1

History:

The company was formed in 1927. There are presently three divisions - Electronic Transformer Division, Electrical Transformer Division, Cabinetry Division - and sales and technical services offices in Montreal, Toronto, Winnipeg, Calgary and Vancouver (Canada). There are also sales and technical service offices located in Buffalo, NY and Dallas, TX. Hammond Manufacturing is a privately owned Canadian company.

Capability:

The company is involved in the manufacture of a wide range of magnetic devices for the electrical/electronic industry. Specific areas are outlined below:

- . High Voltage design and fabrication
High voltage transformers are designed, wound assembled and tested at the Electronic Transformer Division, Guelph. Fabrication of sheet metal cases and special mechanical mountings are manufactured by the Cabinetry Division, Guelph. The company has been manufacturing custom designed high voltage transformers since 1940 for functions such as radar, dielectric testing, H.V. power supplies, medical electronics, modulation transformers, electrostatic speakers and electronic air cleaners. They have design and manufacturing capability for single and three phase units.
- . High Voltage Testing
The Electronic Transformer Division has in-house test capabilities up to 50 KV RMS 60 Hz dielectric testing, Corona testing at 60 Hz to 400 Hz per MIL-T-27 specification. Specification: Available for testing at the Electrical Transformer Division - dielectric up to 80 KV RMS, up to 200 KV DC (high impedance loading), and up to 175 KV impulse. Test equipment is of commercial and custom manufacture.
- . Case design for containing special transformers and fabrication is available to withstand pressure due to liquid expansion. Includes water cooling.
- . Leak detection per MIL-T-27.

HAMMOND MANUFACTURING COMPANY Ltd (Cont'd)

- . Vacuum processing is available for silicone and mineral transformer oils as well as mineral and epoxy varnishes and potting epoxy, or compounds.
- . Oil filling available. At present there is no gas filling of high voltage transformers.
- . Low voltage transformers - power, trigger, Audio High Frequency, pulse, and reactors are designed and fabricated at Electric Transformer Division. Capabilities range from microwatt devices up to kilowatt level in single, two and three phase configurations at frequencies ranging from 10 Hz to 150 KHz. Physical characteristics range from standard EI laminations through "C" core, wound core, toroidal, pot core, etc., in materials of silicone steel, nickel alloy, mu metal, ferrite, powdered iron and air core transformers and reactors.
- . Current and Pulse capabilities
 - Electronic Transformer Division - current to 10A
- pulse to 10KV
 - Electrical Transformer Division - current up to 50,000A
- . Military requirements - designed to meet MIL-T-27 available with certificate of conformance. The company inspection system is established to Department of National Defense specification DND 1016, (equivalent to MIL-I-45208). They are presently in the second stage of applying for recognition of a Quality Program to DND 1015 (equivalent to AQAP-1 NATO Quality Control Systems Requirement for Industry and Military Specification MIL-Q-9858A Quality Program Requirements).
- . Source surveillance and government source inspection available by DND Canadian Forces Technical Service Depot 302, Guelph.

Credentials:

Gross Sales:

	1979	1980	1981 (forecast)
Corporate -	\$28.3M	\$33.7M	\$44M
Electronic Div -	\$ 2.9M	\$ 3.1M	\$ 4.3M

Average Work Force:

Corporate (Total) -	1100
Electronic Div -	130

HAMMOND MANUFACTURING COMPANY Ltd (Cont'd)

Plant Size:

Electronic Div	- 20,000 sq ft
Electrical/Cabinetry Div	- 175,000 sq ft
Other Mfg Plants	- 50,000 sq ft
Warehouse Facilities	- 100,000 sq ft

Equipment:

- Electronic Transformer Division
 - . Winding - multiple/gang coil winders
 - unit coil winders
 - toroidal coil winders
 - bobbin coil winders
 - R.F. choke winders
- . Automatic Stacking/laminating machines
- . Vacuum impregnating/potting encapsulating/casting tanks
- . Ovens - Baking and curing ovens
- . Environmental - Heat, altitude, cold (plans for 1982 include a complete environmental lab including shock, vibration, salt spray, humidity, etc.)

Experience:

Hammond Manufacturing has been involved with military projects since 1939. They are presently supplying magnetics to Canadian and US manufacturers of the power supply for the gun turret fire control computer for the M-1 Main Battle Tank. Hammond Mfg also supplies magnetics for/to:

- . Canadair Challenger Aircraft
- . Atomic Energy of Canada Ltd "THERAC" Series of Linear Accelerators.
- . Satcomm ground communications stations for NATO
- . Garrett Mfg
- . Collins Radio
- . Varian Canada
- . Bell Canada
- . Canadair
- . De Havilland Aircraft
- . Canadian General Electric
- . ITT
- . Computing Devices Company
- . National Research Council of Canada
- . Department of National Defense
- . Department of Supply & Services
- . Sperry Univac
- . Raytheon Canada
- . Atomic Energy of Canada
- . Ward Beck Systems
- . McCurdy Radio
- . McCurdy Communications
- . Litton Systems
- . Universities and research groups

Company: HAND CHEMICAL INDUSTRIES

Address: 221 Nipissing Road
Milton, Ontario, Canada L9T 1R3

History:

The company was established in 1873 for the purpose of making dramatic display fireworks. During WWII and up to the present day, military pyrotechnic items form a major part of their business. Hand Chemical Industries has been an operating division of LORCON Inc since 1977. The latter company was incorporated in 1962 and is 100% Canadian owned. LORCON is a specialty chemical company employing approximately 250 people in its four divisions and two subsidiary companies.

Capability:

Hand Chemical Industries operates from plants at Milton, Ontario, and Papineauville, Quebec, and a research laboratory at Thurso, Quebec. They are involved in the design and manufacture of military pyrotechnics and commercial fireworks (the only commercial fireworks manufacturer in Canada). Their military pyrotechnic products include:

- . Smoke ammunition
- . Chemical dispersers (air & ground burst)
- . Flares
- . Signalling devices
- . Practice munitions
- . Training charges
- . Spotting charges
- . Simulation charges
- . Impact markers

Many of their products utilize smoke producing chemicals while others utilize what can be classified as bacteriological or chemical warfare simulation materials. The red phosphorus used in many of their smoke compositions has been desensitized to minimize processing and storage problems. They are now in the process of developing a new orange smoke pot.

The plant can meet ASTM or military specifications as required. The supervisory staff has extensive experience and training in the safe and efficient operation of pyrotechnics plants. These supervisory personnel have an average of more than 25 years experience in the safe handling of sensitive pyrotechnic compositions, analysis, and hardware design. Plant personnel maintain a security clearance of confidential, while supervisory personnel maintain secret level clearances.

HAND CHEMICAL INDUSTRIES (Cont'd)

Credentials:

Gross Sales:

1981 - \$4.3M

Average Work Force:

Professional - 8

Others - 105 (total usually varies between 103 & 173)

Plant Size:

Total - 80,000 sq ft (encompasses 100 acres at 3 locations
and includes numerous buildings)

Experience:

They have completed nine contracts for the Canadian Forces over the past three years. The items supplied under these contracts were chemical air burst dispersers, smoke pots, practice bombs, aircraft marine markers, smoke grenades and signal cartridges. The aircraft-launched marine marker is very similar to MK 25 marker designed by the US Navy at Crane, Indiana. Hand Chemical has also supplied more than two million Practice Bombs, MK4 Mod 3 to the US. Their smoke pot, SC 390, which delivers 11 to 18 minutes of white smoke (HC), is currently being evaluated by the US. Recently, upon request of the Canadian Forces, they developed a chemical warfare attack simulator. They produced over 5000 units for field training use by NATO forces.

Company: HERMES ELECTRONICS Ltd

Address: 40 Atlantic St
P. O. Box 1005
Dartmouth, Nova Scotia, Canada B2Y 4A1

History:

Hermes is the successor of the Canadian branch of EMI Electronics of the UK. It was established in 1949 and has specialized in anti-submarine warfare products, certain areas of HF communications, and oceans/environmental data systems products.

Capability:

The company's product include -

1) Sonobuoys and bathythermograph buoys - production types include AN/SSQ-41A, AN/SSQ-41B and NA/SSQ-36. The AN/SSQ-53B and others are under development.

2) Ionospheric sounding equipment - vertical and oblique sounding equipment is manufactured and is in service on a worldwide basis. The AN/FPT-11 transmitters, AN/UPR-2 receivers and their commercial counterparts represent the last generation of these equipments.

3) HF antennas - a unique active broadband aperiodic loop array is produced. Various configurations of this system are in service in twenty-three countries and fifty-four agencies of various governments.

4) Moored and drifting data buoy systems - buoy vehicles for the collection, recording and retransmission of oceanographic, meteorological and environmental data have been developed and systems engineered for government, institutional and industrial users. They developed the Canadian Ocean Data Systems Buoys for the Canadian Government in 1975.

5) Environmental data systems - ice stations and automatic weather stations have been developed and manufactured for industrial and government users.

Credentials:

Gross Sales:
No Data

Average Work Force:
Total - 500 (including 75 engineers, technicians, draftsmen and engineering support staff)

Plant Size:
137,600 sq ft

HERMES ELECTRONICS Ltd (Cont'd)

Equipment:

They have a fully equipped environmental testing laboratory as well as a comprehensive manufacturing facility. Their environmental laboratory is one of the largest in Eastern Canada and contains vibration equipment, humidity and temperature chambers, shock and tensile testers and high pressure testing tanks. The equipment meets the requirements of MIL-STD-810 for Environmental Test Methods. This is the prime military standard which establishes uniform environmental test methods for determining the resistance of equipment to the effects of natural or induced environments peculiar to military operations. Hermes cannot conduct testing for fungus and sand & dust, but arrangements can be made to have these carried out at other approved laboratories.

The manufacturing facility has a chemical process capability and the capability to manufacture printed circuit boards, plate, paint, weld, stamp, magnetically form and machine. The plant is equipped to manufacture electronic and mechanical components and equipment as prototypes or in quantity production.

The company's quality control and inspection department has developed and implemented a complete quality assurance program, which ensures quality and compliance to customers specifications, often to military standard. A calibration and standards room is maintained and supervised by quality control and inspection. This facility checks all company instruments to ensure their accuracy by using standards with certified values. These are traced to N.R.C. and N.B.S. and are checked at regular intervals to ensure their accuracy. A quality assurance manual in accordance with DND 1015 and with MIL-G-9858A defines the QA operation of the company.

Experience:

Hermes is a large scale producer of sonobuoys for the Canadian and US Governments as well as other governments. They are presently completing a major order of AN/FPT-11 transmitters for the US Navy.

Company: HEROUX Inc

Address: 755 Thurber
Longueuil, Quebec, Canada J4H 3N1

History:

Heroux Inc was founded in 1942 and is a wholly owned division of Bombardier Inc.

Capability:

Heroux is a fully integrated company involved in the manufacture, assembly and test of aircraft landing gears and hydraulic systems for the military and commercial markets. They also operate a landing gear and hydraulic repair and overhaul facility in St Jean, Quebec. This latter R&O facility handles such aircraft as the 707, 727, 737, DC8, DC9, DC10, L-1011, C-130, KC135, P3 and the DHC-5 & DHC-6. They have complete onsite electroplating facilities.

Credentials:

Gross Sales:
\$20M/Year

Average Work Force:
Total - 450

Plant Size:
250,000 sq ft

Equipment:
All necessary equipment for the manufacture, repair and testing of landing gear and hydraulic systems.

Experience:

The company is involved in all major markets in North America, England, Europe and South America on both military and commercial basis. Major customers include the US Air Force, Canadian Forces, Air Canada, Canadair de Havilland, McDonnell Douglas, Boeing, Lockheed, Grumman and other airlines (British Coledonian, Britannia, Avianca and Aero Peru).

Company: HITECH CANADA Ltd

Address: 68 Highway 7, Suite 103
Ottawa, Ontario, Canada K2H 8P5

History:

HiTech is a private Canadian owned business incorporated in 1973 with no Canadian divisions or US subsidiaries.

Capability:

Since their formation, HiTech has gained experience in the areas of space communications, air traffic control, radar and electronic warfare, electronic mail, network planning, project and facilities management, data compression, production and process control systems, supervisory and monitoring systems, business accounting, and reliability and quality assurance engineering. Staff skills cover the spectrum from applied mathematics, engineering, computer sciences to management. HiTech's major thrust areas are: Custom Computer Systems; Data Entry and Communication Products; and Radar Systems Engineering and Signal Processing.

Hardware and software support for micro, mini and medium scale computer systems are provided in the disciplines of real time and scientific systems, manufacturing/business accounting systems and data base management systems. The former discipline, being most relevant to USAF R&D needs, can be applied to supervisory and monitoring systems, process and production control, data archival, graphic display security and entry control, testing systems, simulations, data acquisition and analysis, laboratory systems, and results interpretation and reporting. All computer systems development work can be accomplished in HiTech's own computer room and laboratory.

HiTech's data entry and communications products have evolved from internally funded Research and Development of image processing software. Text and/or graphic information on hard copy paper is digitized by a facsimile transmitter, video camera or digital scanner. The software driven microprocessor controller then translates recognizable characters to an ASCII computer code and compresses graphic information. This can now be output to a variety of networks. Present products include: OCR Page Readers; Work Counters; Automated Message Handling System (OCR Telex/TWX); and Alpha/numeric recognition processor for production control. Future products will include multifunctional, hard copy input/output terminals offering OCR and graphics capabilities, programmable Mark Sense Readers, and advanced capabilities, font learning OCR systems.

HITECH CANADA Ltd (Cont'd)

HiTech's radar engineering group has the capabilities to develop radar and tracking simulations, provide operational requirements analyses, perform systems engineering and evaluation and write related technical manuals. Their research and development work has been in support of various aspects of radar systems, electronic warfare and signal processing.

HiTech also provides both technical and professional consulting services in the following fields - terrestrial and space communication systems, graphics, programming services, system evaluation, communications (VHF/UHF) engineering studies, management and operations research and air traffic control studies. Their expertise in space communication systems arises mainly from their employees' background in space programs both in Canada and the US. Program experience ranges from vehicle project management (Scout, Delta, Thor-Agena), to spacecraft (US military communications satellites, RCA, SATCOM, VELA, GEOS, ATS), to communication and telemetry links (Voyager, Pioneer and ATS), to program planning and ground support (Hermes, SARSAT, GEOS and US military comsats).

Credentials:

Gross Sales:

1980 - 1981 - \$2M

Average Work Force:

Professional/Technical ~ 37

Others ~ 3

Plant Size:

7,000 sq ft (15,000 sq ft - Dec 81)

All company personnel have been cleared to Secret by the Canadian Government, and their company premises are also cleared for storage of classified documents.

Experience:

The company has undertaken a wide range of contracts with various industries and many departments of the Canadian Government including the Department of National Defense. They currently have no sales to the US. Past work involving US systems was indirect in nature. They are interested in establishing contact with and doing business with the USAF in the future.

Company: I. M. P. GROUP Ltd

Address: Head Office
7037 Mumford Rd
Halifax, Nova Scotia, Canada B3L 2J1

History:

The company, Industrial Marine Products, was formed in 1967 to purchase the assets of a group of Nova Scotia companies which had been manufacturing foundry and steel fabricated products since 1865. During the next few years they expanded into the commercial fishing gear and marine equipment areas and expanded operations into other locations in eastern Canada and the US. In the early 1970s, the company acquired the facilities, equipment, operational management and workforce of a major aircraft company in the Halifax area and thus expanded into aircraft overhaul and repair and aerospace manufacturing areas. The current operating divisions of the I. M. P. Group are:

- Aerospace Manufacturing
- Aerospace Engineering Services
- Aircraft Repair and Overhaul
- General Aviation Services
- Foundry
- Steel Fabrication and Machine Shop
- Tool and Plastics
- Marine
- Offshore Services
- Hotel
- Properties and Investments
- Research and Development

Capability:

Aerospace Manufacturing Division - manufactures electronic wiring assemblies for various aircraft and electronics industries. Aerospace metal components are also manufactured.

Aerospace Engineering Services Division - offers integrated services for the other aerospace divisions that include repair schemes, corrosion control, weight and balance, modification development, systems installation design, aeronautical engineering, aircraft maintenance, stress analyses, fatigue studies, structural design, electrical and avionics engineering, systems interface design, electromagnetic compatibility testing, systems ground and flight testing, configuration and modification program control, maintenance and technical publications for military aircraft.

Aircraft Repair and Overhaul Division - as the major fixed and rotary wing maintenance facility in eastern Canada, it offers repair

I. M. P. GROUP Ltd (Cont'd)

and overhaul programs for military and commercial aircraft as well as a full range of equipment modifications.

General Aviation Services Division - offers aircraft servicing maintenance, hangarage, crew and passenger lounges for large and small commercial aircraft.

Foundry Division - equipped to produce cast iron, steel and steel alloy castings up to two tons with both cupola and electric induction furnaces.

Steel Fabrication and Machine Shop Division - essentially a custom shop, it is serviced by four 5 ton overhead cranes. Typical products include components for fishing trawlers from steel, stainless steel and aluminum and a whole range of products, repairs and modifications for the offshore oil industry.

Tool and Plastics Division - manufactures molded plastic parts using the injection molding technique.

Research and Development Division - primary function is to identify and develop new products and processes related to the continued expansion of the I. M. P. Group and the technical excellence of its products.

The other divisions of I. M. P. have no apparent relevance to USAF requirements and are therefore not further defined in this section.

Credentials:

Gross Sales:

I.M.P. Group Ltd - \$50M
Aerospace Mfg Div - \$2.5M
Aerospace R&O Div - \$3.0M

Average Work Force:

No Data

Plant Size:

Aircraft R&O Div - 60,000 sq ft (2 hangars)
Steel Fabrication & Machine Shop - 14,000 sq ft
No data on other facilities

Experience:

I. M. P. Group aerospace clients include the US Navy (P3 aircraft), Canadian Department of National Defense, Canadair, USAF, and McDonnell Douglas Canada. They are hopeful of participating in the CF-18 program.

Company: ITT CANNON ELECTRIC CANADA
(A Division of ITT Industries of Canada Ltd)

Address: 4 Cannon Court
Whilby, Ontario, Canada L1N 5V8

History:

The company commenced operation in Canada in 1942 as Cannon Electric Company Ltd. The parent company, Cannon Electric Company, Los Angeles, was eventually purchased by ITT Corporation and the Canadian company became a wholly owned ITT subsidiary. In 1956, the company name was changed to present and in 1967, the company began operation as a Division of ITT Canada Ltd. The company maintains Sales Offices in Montreal and Vancouver.

Capability:

ITT Cannon Electric Canada is engaged in the R&D, manufacture and sales of electrical and electric connectors, cable harnesses, and interconnect devices for the hostile environment market. Cannon connectors are in virtually every passenger jet aircraft in the free world, deep in the earth and ocean, in space, in nuclear reactors and in oil and gas drilling rigs - in other words, in the hostile environment.

Their manufacturing capability features both manufacturing and industrial engineering, tool design (plastic and metallic components), machining fabrication and assembly operations, machine and model shops, molding facilities and electroplating. They have worldwide market responsibility and engineering design cognizance over, a) battery power connectors, b) firewall connectors, c) waterproof connectors, d) high temperature connectors, e) buffet series, f) aircraft firewall connectors, g) circular nuclear series, h) weatherproof series, i) Canadian design specials, j) environmental rack and panel DRA series, k) Cable TV-CATV connectors, l) geophysical-seismic, m) cryogenic connector series and n) sonar-underwater tow connectors.

Product development has led to a variety of new and/or improved connectors. These include, a) a new series with proven results at elevated temperatures for nuclear applications, b) a connector to meet MIL-C28840 (submitted for QPL) for seaboard application, c) a connector, MS5015/3400D series, being used by the US Navy on new equipment as well as for retrofit, replacement and all power applications, d) the MIL-C-83723 Series III connector is designed for high performance aero applications, e) the "Downhole" connector is designed for high pressure usage and is hermetically sealed, f) the MR series connector, rugged, heavy duty and waterproof and is designed to withstand severe environmental condition, g) geophysical hermaphroditic connector is designed for the seismic exploration industry and h) a connector to meet MIL-C-38999.

ITT CANNON ELECTRIC CANADA (Cont'd)

Credentials:

Gross Sales:
1980 - \$18M

Average Work Force:
Not specified

Plant Size:
Production - 55,000 sq ft
Office - 15,000 sq ft

Experience:

It suffices to say that Cannon connectors are designed to the specification of the electronic industry and meet the requirements of the Canadian Department of National Defense, the US DOD, Canadian Ministry of Transport, and the Canadian Standards Association. Cannon plugs are used worldwide.

Company: IMAPRO Inc

Address: Head Office
308-1750 Courtwood Crescent
Ottawa, Ontario, Canada K2C 2B5

West Royalty Industrial Part
Charlottetown, Prince Edward Island, Canada C1E 1B0

History:

The company was incorporated in 1976 in Prince Edward Island and is Canadian owned. The head office was established in Ottawa in mid-1981. A branch will open in Toronto in September 1981 and a US branch will open in late 1981.

Capability:

Imapro Inc is a small high technology company that has its objective to produce hard copy output on film from digital electronic information. They have developed a Color Image Recorder that takes satellite generated imagery data, e.g., Landsat data, and simultaneously records the three primary colors, in proper proportion, with one pass of the data. In fact, it can create color pictures from any suitably formatted digital data. The photographs are of extremely high resolution and the time involved to produce a single photograph is nominally one-third that required by other available image recorders. The photographs are produced on 240 mm-wide roll film which makes the technique suitable for production line operation. The system uses fiber optic technology and a new mechanical method for moving the film.

Another image recording product developed by Imapro is a Quick Color Recorder which is a relatively inexpensive system that requires three passes to produce a photograph. They have designed and installed in their plant a distributed microcomputer system interconnected by fiber optics (one kilometer fiber runs). By their own choice, their fiber optic expertise is applied in the total system sense as opposed to individual components. Imapro also is involved in graphics development and the development of general purpose data acquisition systems primarily for solar heating application. As can be gleaned from the above, they prefer to undertake special projects that involve electro-optics and electromechanics.

Credentials:

Gross Sales:

1980 - 1981 - \$0.5M
1981 - 1982 - \$1.2M (projected)

Average Work Force:

Engineers - 6
Others - 6

IMAPRO Inc (Cont'd)

Plant Size:

Charlottetown - 2,700 sq ft
Ottawa - 1,000 sq ft

Equipment:

Their special equipment includes a one megabyte main memory
32 bit computer installation with photo imaging capability
and offline storage. It has disc and magnetic tape capability.
They also have high precision measuring equipment.

Experience:

Imapro clients include the Canada Center for Remote Sensing, Canadian
Department of Communication, Defense Research Establishment - Ottawa
and the Institute of Man and Resources (Government of Prince Edward
Island).

Company: INDUSTRIAL RESEARCH & DEVELOPMENT Ltd

Address: 345 Higgins Ave
Winnipeg, Manitoba, Canada R3A 0V4

History:

INRAD is a wholly owned Canadian company incorporated in 1975.
There are no other Canadian locations.

Capability:

The INRAD group is interested in new product development, particularly in the plastics, petroleum, chemical engineering, agricultural and energy spheres. They are also in the commercial packaging business. Some of their products include - 1) a study of rare earth magnetostrictive materials for underwater transducers, 2) photocatalytic conversion of water to hydrogen, 3) the development of a high voltage fluorescent light switch, 4) a farm fertilizer generator and, 5) work on a high temperature solar collector suitable for a national grid system and for central heating.

They are actively engaged in developing a method of forming hydrogen from water by use of a monolithic titania glass catalyst and sunlight. It is hoped the efficiency of this method can be improved in the 1981-1982 time frame. Based on the above technology, they have developed an economical hydrogen detector. This sensitive detector gives a visual and audio signal, increasing in frequency with hydrogen concentration, in the 1 to 5% range.

Other capabilities include plastic fabrication (vacuum forming), custom packaging, skin and blister packaging, precision machining and engraving.

Credentials:

Gross Sales:
Annual - \$0.5M

Average Work Force:
PhDs - 2
Eng - 1
Phys - 1
Chem - 1
Others - 7 - 15

Plant Size:
18,000 sq ft

INDUSTRIAL RESEARCH & DEVELOPMENT Ltd (Cont'd)

Experience:

The company has worked with the Canadian Department of National Defense and with private industry. They currently have no sales to the US. They have been in contact with the USAF primarily in the area of rare earth magnets.

Company: IRVIN INDUSTRIES CANADA Ltd

Address: 479 Central Ave
Fort Erie, Ontario, Canada L2A 3T9

History:

The company was incorporated in Canada in 1925 and is a subsidiary of Irvin Industries Inc of New York. The parent company not only operates many facilities in the US and one in Canada, but also in the UK, Italy, Sweden, Holland and Spain.

Capability:

The Canadian firm produces personnel parachutes; back and seat-type for ejection seats, military search and rescue units, paratroopers and military freefall; precision opening release systems; air cargo ground-handling equipment; aerial delivery systems; inflatable life support systems; and aircraft, automobile and industrial restraint systems. Irvin has also designed and manufactured special purpose parachutes including sophisticated recovery systems for supersonic jet transports; and multi-use high-reliability and patented deceleration systems for fighter aircraft.

Their Production Department is equipped with more than 300 sewing machines, capable of efficiently stitching the latest natural and man-made fabrics, tapes and webbings. Added to this are quality-control test machines, cloth laying and cutting tables, grommet and eyelet machines and jigs and fixtures to enable the company to produce highly-dependable and durable life support equipment. A new facility, completed in 1976, accommodates the assembly, inspection and customer servicing of the FF-2 "Hitefinder" Automatic Parachute Opening Device. This is an environmentally-controlled facility and is equipped with modern environmental test chambers, jigs, fixtures and inspection equipment to ensure the necessary accuracy, quality and reliability required by this very sensitive life-saving instrument.

Irvin's Quality Control Program has been designed to conform with the requirements of the Canadian Armed Forces standards as defined in DND Spec 1015 - whose equivalent US Department of Defense standards are MIL-Q-9858 and MIL-I-45208. The quality audits, conducted by independently-assigned specialists; as well as full-time in-house quality assurance representatives assigned by the Department of National Defense; provides for the surveillance of Irvin's quality control program. Irvin Industries Canada Ltd has been listed by the military as an "approved" company since Dec 1938.

Irvin's Engineering Department is responsible for all projects from the proposal stage to production. This encompasses design, development, static testing, aerial and dynamic testing, drawing approval, preparation of procedures and specifications and approval of the first-off specimen. Preliminary design work is facilitated by an in-house computer

IRVIN INDUSTRIES CANADA Ltd (Cont'd)

which is capable of simulating tests, thereby avoiding extensive trial-and-error testing. They also maintain Drafting and Customer Service/Product Support Departments.

Irvin products include space vehicle recovery, drone recovery, missile recovery, deceleration (for high performance aircraft) systems; and personnel parachute systems; special purpose parachutes; precision opening, release systems; air cargo delivery systems; and other miscellaneous items such as harnesses, belts, protective clothing, special suits/clothing, life rafts and survival kits.

Credentials:

Gross Sales:

1979 - \$5.62M
1980 - \$5.13M

Average Work Force:

Total - 140

Plant Size:

36,000 sq ft

Experience:

Irvin customers include the USAF (AIM Parachute Program - joint program and the deceleration parachute for the F-105), the Canadian DND, Canadair, DeHavilland and many other off-shore customers (primarily military).

Company: JMR INSTRUMENTS CANADA Ltd

Address: No 8, 6320 11 Street S. E.
Calgary, Alberta, Canada T2H 2L7

History:

JMR was incorporated in the fall of 1978 and is totally owned by JMR Instruments, Inc., Chatsworth, CA. The latter company in turn is a subsidiary of Bowmar Instruments Corp, Newberry Park, CA.

Capability:

JMR Instruments Canada is a high technology electronics designer and manufacturer of satellite doppler survey receivers and integrated marine data acquisition systems. These integrated systems use distributed microprocessor technology, KALMAN filtering and "fail-soft" hardware. Equipment is designed and field proven to meet rigid commercial field and marine conditions.

Credentials:

Gross Sales:
1980 - \$1.1M

Average Work Force:
Eng - 3
Computer Specs - 2
Others - 11

Plant Size:
R&D Area - 1,000 sq ft
Mfg Area - 1,800 sq ft
Admin Area - 1,500 sq ft

Equipment:
Specialized microprocessor design and development systems including PDP11-34 with RSX11M operating system. They also have a full range temperature and environmental chamber.

Experience:

JMR satellite doppler receivers manufactured in Canada are in use throughout the world. Users include the Canadian Military (Mapping and Charting Establishment), the Canadian Hydrographic Service and many commercial users.

Company: KOSS MACHINE & TOOL Co

Address: 1765 Shawson Dr, Unit 15
Mississauga, Ontario, Canada L4W 1N8

History:

Koss Machine & Tool Co was started in 1975 as a general machine shop and incorporated in 1976. The company ventured into defense and aircraft industry associated work in 1978, which today comprises 80% of their work. The company is a division of 333 111 Ontario Ltd.

Capability:

The company is involved in milling and lathe operations primarily involved with defense and aerospace related work. The CNC milling operation has a working travel of up to 20x40 inches and a vertical space up to 29.75 inches. Tolerances can be held to 0.0003 inch. A new machine center will be delivered in early 1982 that will exhibit X, Y, Z- axis lengths of 75.5, 27.5 and 23.6 inches, respectively.

Lathe operations are carried out with both CNC and conventional machines with maximum swing of 24 inches, maximum cross travel of 9.75 inches and a maximum machining length of 21.5 inches.

A quality assurance manual (quality level to DND 1016/MIL-I-45208) is being prepared and will be completed by the end of August 1981.

Credentials:

Gross Sales:

1979 - \$0.12M
1980 - \$0.27M
1981 - \$0.265M (first 6 months)
1982 - \$0.75M (projected)

Average Work Force:

Machinists	- 10
Quality Control	- 1
Production Control	- 1
Administrative	- 2

Plant Size:

6,000 sq ft

Equipment:

Includes CNC machines, vertical milling machines, engine lathes, turret lathes and other assorted equipment associated with machining operations.

Experience:

Contractor approvals have been afforded by Canadair Ltd, The de Havilland Aircraft of Canada Ltd and McDonnell Douglas.

Company: KRISTIANSEN CYCLE ENGINES Ltd

Address: 966 Waverly St
Winnipeg, Manitoba, Canada R3T 4M5

History:

The company was formed in Jul 74 by Mr. H. Kristiansen. Their objective was to conduct research and development on a novel new engine. The engine is an extended power stroke device designed to extract 50% more energy from one gallon of fuel.

Capability:

K-Cycle Engines is set up to research and develop internal combustion engine devices. They are capable of designing, developing, and testing complete engine prototypes on a one-off basis. The testing capability includes SAE engine performance testing with the exception of emission testing. Their test cells can measure horsepower, torque, RPM, air flow, coolant flow, fuel consumption, and various engine temperatures.

They have a Mark III Engine mounted in a Ford Fairmont. It develops twice the torque of the standard crankshaft engine it replaces. With this developmental K-Cycle engine, the automobile accelerates to 60 mph much faster than with the conventional powerplant. In the test stand, the Mark III with 140 cubic inch displacement, has developed 210 ft lbs of torque at 1400 RPM and 70 hp at 2000 RPM at the same fuel efficiency as the standard engine of same displacement delivering 105 ft lbs of torque and 70 ph at 4000 RPM. Their next stage of development involves computer aided combustion research, aimed at improving fuel efficiency to the expected K-Cycle level.

Credentials:

Gross Sales:

None to date, development proceeding.

Average Work Force:

Total - 20 to 30

Plant Size:

Development Laboratory - 5,000 sq ft

Head Office - 5,500 sq ft

Equipment:

One bay of their testing laboratory is equipped with a computerized data acquisition system, capable of sampling from a wide variety of sensors. The data can be rapidly processed, displayed and printed. In addition, the accuracy is that required by the SAE.

KRISTIANSEN CYCLE ENGINES Ltd (Cont'd)

Experience:

Although there is no marketing experience with the K-Cycle engine to date, there has been an active program in alternate fuels research and testing of conventional engines, in particular - fuel efficient devices. Extensive testing gasohol has also been carried out.

Company: LEIGH INSTRUMENTS Ltd
Engineering and Aerospace Division

Address: P. O. Box 82
Carleton Place, Ontario, Canada K7C 3P3

History:

A Canadian owned high technology company incorporated in 1961. Other Canadian Divisions are the Industrial Products Division, Waterloo, Ontario, and the Components Division, Toronto, Ontario. They have subsidiaries in Syracuse, New York, Ireland and the UK. The Industrial Products Division is a producer of commercial electromechanical devices that include teletypes, teleprinters, speakers, explosive detectors and automated postal systems. The Components Division designs and manufactures quartz crystals, filters and synthesizers for radio communication and navigational equipment. Leigh Systems Inc (Syracuse) manufactures industrial packaging equipment and process control instrumentation.

Capability:

The Engineering and Aerospace Division is committed to the design and development of avionics equipment for both commercial and military aircraft. Their specialized equipment, generally categorized as aircraft instrumentation and electronic data acquisition systems, include Crash Position Indicators, flight data recorders, altimeters, mechanical strain recorders, instrument panels and a variety of special sensors and signal processing equipment. Ground support equipment includes radar traffic management for both air and marine systems. The company also manufactures an ice detector that has application on rotary and fixed-wing aircraft, hovercraft, low speed ground vehicles and stationary gas turbines. The Leigh Ice Detector System is especially well suited for helicopter use in that it does not require a given amount of air flow around the fuselage to yield a signal on the detector. The system is designed to measure the liquid water content of the air and will automatically de-ice the probe at intervals, simultaneously activating an ice warning light.

Their Real-time Photogrammetry System, originally conceived by the Canadian National Research Council to assist tracking a moving object in 3-dimensional space, employs state-of-the-art photogrammetry techniques to continuously determine and display with high precision position and orientation of the tracked object. The system has just been successfully demonstrated to NASA at its Remote Manipulator Development Facility at the Johnson Space Center. NASA is studying the effectiveness of the system integrated with the Remote Manipulator System to assist Space Shuttle crew in space manipulations of payloads.

LEIGH INSTRUMENTS Ltd (Cont'd)
Engineering and Aerospace Division

Credentials:

Gross Sales:

1980 - \$15M
1981 - \$20M

Average Work Force:

Phds - 2
Eng - 50
Others - 278

Plant Size:

10,000 sq ft - Ottawa
120,000 sq ft - Carleton Place

Manufacturing:

Their plant at Carleton Place is a fully equipped engineering and manufacturing facility. The plant includes facilities for overhaul and repair, environmental testing, plastics fabrication, electronics buildup and quality control. They build to military specifications when required.

Experience:

Leigh avionics equipment is currently utilized by the Canadian Forces, USN and USAF. USAF aircraft include Air Force One, C-5A, KC-135, C-141 and B747. Their systems have been supplied to many countries including the UK and West Germany. It is estimated that 40 - 50% of their sales are to the US military with about 10% to the USAF. They are interested in increasing their USAF market.

Company: LITTON SYSTEMS CANADA Ltd

Address: 25 Cityview Drive
Rexdale, Ontario, Canada M9W 5A7

History:

A wholly owned subsidiary of Litton Industries Inc incorporated in 1960. Its initial task was the partial production of LN-3 systems for the CF-104.

Capability:

The company is organized into nine sections that include Engineering, Advance Programs, Operations, Contracts and Pricing, Program Management and Finance and Administration. The Litton Systems areas of expertise include, 1) inertial navigation systems, 2) C³ systems, 3) radar operation training simulators for ATC and GCI controllers, 4) airborne search radar, 5) automated test equipment, 6) flight inspection systems for enroute and terminal aircraft navigation aids, 7) flat panel displays, 8) integrated security systems, 9) large scale system integration, 10) special purpose computer-based systems and 11) weapons systems computer modeling. Current IRAD is devoted to ring laser gyro-based strapdown inertial technology.

They started as an inertial navigation systems house and have continued to expand and develop their INS related capabilities to cover a range of both military and civil systems. Their facility has a total capability in manufacturing, engineering and systems management, includes a critically controlled clean room and production meets the critical standards of military and civil aviation organizations. More than 5900 inertial navigation systems have been produced at Litton. Their systems are used in such military aircrafts as the F-104, F-4, F-111, CP-140, CF-104, and their LN-35 system is being produced for a US cruise missile on a second source basis. Litton produced the command and control system for the Canadian DDH-280 destroyers. This was initially a technology transfer area, however, later the company made significant design improvements in the displays indicating the success of the transfer of technology.

They have designed digital radar simulators for training civil air traffic controllers, ground control interception officers for the military, both air and sea. The radar simulators have been designed in modular form both in hardware and software resulting in several models and configurations in various training applications. Both single and dual radar simulators have been developed with realistic simulation of aircraft and surface vessels and with variable radar characteristics and video effects including clutter, moving weather and land mass.

LITTON SYSTEMS CANADA Ltd (Cont'd)

They have developed an automatic test capability in support of inertial navigation systems. These are now used worldwide by both commercial and military facilities. Their Inertial Referenced Flight Inspection System has been successfully tested and is capable of calibrating Category I, II and III instrument landing systems as well as enroute nav aids. The modular design approach, spare memory and computing time capability provide exceptional flexibility in system design, thereby permitting the systems to be modified to meet new or special requirements.

Litton Systems under the US/Canada Defense Production and Development Sharing Program, developed a solid state, flat panel display system using light emitting diode technology for use in military environments. The AFWAL Flight Dynamics Laboratory maintained design authority. The display system is comprised of a data bus interface, computer display generator and an LED flat panel display head. Their integrated security systems are computer based systems for perimeter detection, closed circuit TV monitoring, access control and communications. The systems are in place at three maximum security prisons, one nuclear power station and they are currently attempting to get NATO acceptance. Their large scale system integration capability is readily demonstrated by their Data Interpretation and Analysis Center. This Center was designed to provide the Canadian Forces Maritime Command with a computerized system for correlating current and historical data. It enhances mission planning, briefing, debriefing and post-flight reconstruction and analysis. The New Air Dev Center is considering the system for use aboard aircraft carriers. They have also provided scientific support services to National Defense by providing weapons systems computer modeling to simulate combat systems, tactical scenarios and associated physical phenomena.

Credentials:

Gross Sales:

1979 - \$74M
1980 - \$103M
1981 - 105M (forecast)

Average Work Force:

Eng - 300
Others - 1992

Plant Size:

6 plants - 377,945 sq ft

LITTON SYSTEMS CANADA Ltd (Cont'd)

Experience:

It is anticipated that 83% of Litton Systems' business this year will be for export. As can be seen from the Capabilities Section, their products are for both commercial and military use. They have done business with the USAF.

Company: LUMONICS Inc

Address: 105 Schneider Road
Kanata, Ontario, Canada K2K 1Y3

History:

A Canadian owned high technology company since 1970 with no subsidiaries in the US. The company was formed to manufacture and sell the pulsed CO₂ laser developed at the Defense Research Establishment Valcartier.

Capability:

Lumonics specializes in pulsed gas lasers and is the sixth largest North American Laser manufacturer serving both the scientific and industrial markets. They have twelve series of lasers available with various models within each series. A significant portion of their business is contract R&D, but it is carried out only when Lumonics anticipates and retains rights for commercial exploitation. Their scientific market includes university and government researchers. The two primary fields in which their customers are active are chemistry/isotope separation and controlled thermonuclear fusion. Lumonics has also been manufacturing a series of excimer lasers for scientific application since 1978 and has just received Government funding to develop an industrial series over the next 4.5 years.

Credentials:

Gross Sales: (1978-1979) - Approx \$4M/5.9M
Current - Approx \$7M

Average Work Force:
Scientists & Engineers - 40
Others - 70

Plant Size:
50,000 sq ft

Manufacturing Capability:

The key functions of material procurement and control, electrical and mechanical assembly and final performance testing are carried out in-house. Machined and sheet metal components are sub-contracted.

Experience:

Lumonics is interested in working with the USAF and has done so in the past in the form of providing standard lasers. They have not undertaken any USAF-sponsored R&D. They carry out extensive in-house R&D and for the Canadian Government.

Company: MACDONALD DETTWILER & ASSOCIATES Ltd

Address: 3751 Shell Road
Richmond, British Columbia, Canada V6X 2Z9

History:

MDA was formed in 1969 and is a privately owned Canadian company.

Capability:

MDA is a leading supplier of digital systems in the fields of remote sensing from air and space, of data handling from meteorological satellites and of airline flight operations. It is a high technology firm whose main areas of business are, 1) remote sensing satellite processing systems (especially for the NASA Landsat series), 2) meteorological satellite processing systems for all the major satellites (this area has recently been expanded to include full weather forecasting systems), 3) synthetic aperture radar (SAR) digital processors for airborne and spaceborne sensors, 4) aviation systems for flight operations support, 5) high speed film image recorders and 6) HF modems. The latter system is being flight tested by US airlines for use in long distance aircraft to ground communications.

They are a leading supplier of Earth Resource Satellite Stations. The company has played a role ranging from that of prime contractor providing a fully integrated receiving and processing facility to that of a sub-contractor supplying system design and subsystem components. The basic design of these satellite data systems is modular. Data can be processed at high speed from a variety of sources including the MSS and RBV sensors of the current Landsat satellite as well as spaceborne sensors planned for Landsat-D and Spot-A.

MDA supplies complete ground stations for the reception and processing of data from polar orbiting and geostationary meteorological satellites. Their Weather Image Processor processes, stores and images satellite data during reception. The user can play back stored data to produce enhanced images or video displays of specific areas of interest. They also produce an analysis system which permits extended interactive analysis of the meteorological satellite data, and provides for the overlay of conventional measured and forecast meteorological parameters on imagery to enhance its usefulness in forecasting.

They design and manufacture digital processors for both airborne and spaceborne SARs. Their developmental designs are based on computer software and on electronic hardware. This allows them to supply small fast units for aircraft use and larger ground based units for the processing of satellite generated radar data.

MACDONALD DETTWILER & ASSOCIATES Ltd (Cont'd)

Their flight operations digital equipment is used by the commercial aviation industry. Their major product is a Flight Operations Computer System (FOCUS) which automatically plans all scheduled and charter flights for an airline. FOCUS can minimize fuel consumption by calculating the optimal flight path and flying altitude based on the forecast weather conditions. FOCUS files the flight plan with the air traffic control authorities and inturn monitors the progress of the flight.

The MDA FIRE 240 laser film image recorder exhibits high resolution, high geometric accuracy and high throughput. It is rugged, light-weight and allows for unattended operation.

Credentials:

Gross Sales:
1981 - \$14M

Average Work Force:
Total - 205

Plant Size:
No data

Experience:

MDA customers include:

- . NASA
- . General Electric Company
- . Daedalus Enterprises Inc
- . Texas International Airlines Inc
- . Canada Center for Remote Sensing
- . Atmospheric Environment Service, Canada
- . Messerschmitt-Bolkow-Blohm GMBH, FRG
- . Swedish Space Corp
- . National Space Development Agency of Japan
- . Swissair Transport Company Ltd

Company: MPB TECHNOLOGIES Inc

Address: P. O. Box 160
21051 N Service Rd
Ste Anne de Bellevue, Quebec, Canada H9X 3L5

History:

This high technolog, ompany is Canadian owned and was incorporated in 1976. It is a spin-off from RCA Ltd. There are no other locations in Canada and no US subsidiaries.

Capbility:

The company is located in space previously occupied by the R&D laboratories of RCA Ltd. They acquired many of the assets of the former laboratories and are fully facilitated to conduct experimental, theoretical and developmental work in a variety of fields. These include lasers, electromagnetics and radars, digital electronics and instrumentation. Laser work includes the design and development of CO₂ continuous wave lasers (1-20 watt range, $\geq$ 10,000 hours lifetime, sealed off) and CO₂ waveguide lasers with wide band width and good tunability (sealed off, 10,000 hours lifetime). They have a capability with iodine lasers in conjunction with mode locking experiments and have conducted laser spectroscopic studies. They have also been involved with heterodyne detection techniques in conjunction with optical fiber hydrophones that can measure 1/500 of a fringe (phase shift: 360/500).

In the area of electromagnetics and radar technology, MPB has carried out research with synthetic pulse radar for airborne measurement of sea-ice thickness and in the area of radar/chaff interaction. They have been involved with communications analysis (cross polarization effects, earth and satellite communications), oil spill detection using electromagnetic techniques and antenna research (wide-band VLF antennas).

In the digital electronics area, MPB has gained expertise in electronic graphics, displays, training systems and graphic composition. They have also been involved with special purpose communication terminals (transcontinental telephones) and special purpose recorders (based on microprocessor technology). In the area of instrumentation, they are involved with a Space Shuttle experiment (wave injection facility), hazardous gas detection, and with the Canadian Varennes Tokamak (data acquisition, preionization, diagnostic instrumentation - probes, lasers, microwave interferometry), software development (controls and on-line data analysis).

MPB TECHNOLOGIES Inc (Cont'd)

MPB products include the VISTA 80 Graphics System, a versatile character generating system which utilizes a standard keyboard for message composition and a magnetic diskette system for bulk storage of messages. The system is based on microprocessor technology. Primary use is for presenting alphanumeric information in news, weather, sports and election programs and for titling and credits. Their Laser Communications System is capable of video, multiple voice channel or high bit rate digital transmission. The system has a video signal to noise ratio greater than 60 dB and is immune to RF interference. They also produce sealed-off CO₂ lasers that are long lived (greater than 38,000 hours) and have power ranges from 3 to 12 watts TEM₀₀ and 1 to 18 watts multimode. Suggested uses are optical communications, atmospheric research, spectroscopy, far infrared laser excitation, materials processing, surgery, etc. Their final product is a High Intensity Light Source. It is a long (450mm) self-starting vortex stabilized arc discharge. It has a continuous radiation spectrum, can be started instantaneously and can deliver a hundred times more light output than a high power mercury arc lamp light-head of comparable dimensions.

Credentials:

Gross Sales:

1979 - \$1.3M
1980 - \$1.5M
1981 - \$2.0M

Average Work Force:

PhDs - 12
Eng - 15
Others - 13

Plant Size:

12,000 sq ft

Experience:

Typical clients for MPB include the Canadian Government (Dept of National Defense, Communications Research Center, National Research Council), AFOSR, CBC, SPAR Aerospace Ltd, Telesat Corporation, RCA Ltd plus others. The company estimates that about 5% of their total sales are to the US.

Company: MAR-DEL COMPONENTS Ltd
(Subsidiary of Caulfield Creative Arts Ltd)

Address: Rural Route 2, Site 9, Box 20
Sherwood Park, Alberta, Canada T8A 3K2

History:

Caulfield Creative Arts Ltd was formed in 1975 and was created for the purpose of manufacturing advanced microprocessed based music processing systems for the music industry. Utilizing its founders and staff expertise in engineering, it has also founded the following subsidiaries and division:

- . Caulfield Engineering Division
 - Industrial Engineering Services
 - Custom Computer Products
 - Research and Development Services for process control, geophysics, acoustic and oceanography
 - Industrial Maintenance Services
- . Mar-Del Components Ltd
 - High Technology Engineering Sales in the oceanographic, scientific, industrial and telecommunications fields
- . Caulfield Creative Arts Corp
 - Subsidiary for carrying out the music and engineering services in the US

Mar-Del Components Ltd was formed in December 1980.

Capability:

Mar-Del Components Ltd was created to provide competent marketing and sales of high technology components and systems for the Oceanographics, Scientific, Industrial and Telecommunications fields. Services provided:

- . Marketing and Sales
 - full forecasting based on individual requirements
 - market surveys
 - competitive analysis
 - analysis of lost business
 - applications advice
 - regular call reports
- . Maintenance and Repair
 - depending upon product, full or partial service can be provided
 - sales people can be trained for field service or applications engineering

MAR-DEL COMPONENTS Ltd (Cont'd)
(Subsidiary of Caulfield Creative Arts Ltd)

Caulfield Engineering Division develops, manufactures, and services specialized remote sensing equipment, front end digital systems and controls. Only state-of-the-art microprocessor technology and software development are utilized, enabling the company to place systems in remote, harsh environments. Key areas of expertise are - Telemetry and Supervisory Control; and Remote Sensing and Signal Processing in Oceanography and Geophysics. Caulfield Engineering is licensed under the Association of Professional Engineers, Geologists and Geophysicists of Alberta.

Industrial services:

- . Caulfield Engineering Division has expertise in industrial systems in the fields of:
 - Motor Controllers
 - Remote Sensing
 - Supervisory Control
 - Process Alarms

Detailed experience in:

- Analog Systems
- Microprocessor Controlled
- Hybrid Systems
- Acoustics, radiation, telemetry

Services provided are:

- 24 hour maintenance and service Engineering studies, problem analysis & hardware design improvements, Technical consultants for management cost/effective decisions

Custom Computer Products:

Caulfield Engineering Division has developed a data terminal that can be customized to display almost any non-standard symbols or graphics not normally found in standard terminals. This unit, the CE-1000T, has the ability to be preprogrammed with up to 256 different custom symbols or graphics.

They have a standard line of small customized microcomputer systems based on the new high speed 8085. This system, the CE-7000 line, employs the new STD-Bux concept and can be customized in various configurations to provide the following:

- . Keyboard Terminal
- . CRT Customized Terminal
- . 16-Channel A-D
- . Multiple Channel D-A
- . Multiple I/O Status Ports
- . Up to 64 K Memory
- . Triac-Input and Output Ports
- . Relay Controls Ports
- . RS-232 I/O Communication

MAR-DEL COMPONENTS Ltd (Cont'd)
(Subsidiary of Caulfield Creative Arts Ltd)

Research and Development Services

- . Geotechnical Analysis of Marine Shallow Sub-Bottom Data
- . Side Scan Digital and Analysis Systems
- . Custom Microprocessor for Shallow Hammer Seismic
- . Ice Structure Research
- . Signal Processing for Ultrasonics and Magnetic Flux Inspection of Materials
- . Process Control Development with Customized Computers including all Software
- . Harsh Environmental Computer and Systems Design
- . Acoustics Research for Construction and Geotechnical Projects
- . Signal Processing System for Oceanography, Surveying and Geophysics
- . Industrial Computer Display Problems and I/O Computer Designs
- . Application of Electronic Measurements to Agriculture Research

Credentials:

Gross Sales:

Mar-Del Components Ltd
Present - \$0.4M
Forecast - \$1M (1 Jan 82)

Caulfield Creative Arts Ltd
Present - \$0.6M
Forecast - \$1M (30 Sep 81)

Average Work Force:

Total - 20

Plant Size:

3000 sq ft

Equipment:

Mar-Del Components Ltd - None
Caulfield Creative Arts Ltd

- . H.P. Tape Recorders
- . Oscilloscopes
- . Computers and related electronic equipment
- . 900 gallon Anechoic Test Tank - it is also available for testing acoustic systems

MAR-DEL COMPONENTS Ltd (Cont'd)
(Subsidiary of Caulfield Creative Arts Ltd)

Experience:

The following customers and experience are for the 1979 - 1980 time period:

- . Control Devices
 - Development of CMOS Computer Systems for remote industrial monitoring via communication lines.
- . Dome Petroleum
 - Installation and operation of special acoustic recording systems for at-sea use in the Beaufort Sea for oceanographic data processing.
 - Major research effort for applying shallow geophysics and microprocessors for polar ice thickness measurements.
 - Sub-bottom and sidescan acquisition in Beaufort Sea and signal processing via digital computers.
- . Imperial Oil, Building Products Division
 - Design and maintenance of production control equipment
- . Texaco
 - Design services and maintenance of production control equipment.
- . Gulf
 - Design of computer aided sub-bottom geophysical data playback system and the processing of the data.
- . Canadian Engineering Surveys
 - Navigation system digital construction
- . Syncrude Canada
 - Shallow geophysical surveying system application.
- . Petro Canada
 - Gilby Gas Plant, design services and maintenance of production control equipment.
 - Data reporting for Noise Measurement for Arctic Pilot Project
- . Department of Fisheries & Oceans, Institute of Ocean Sciences
 - Development, construction and testing of a modified Sonic Oriented Current Meter System (Mark II).

Company: MARS AERIAL REMOTE SENSING Ltd

Address: 640-11th Ave, S.W.
Calgary, Alberta, Canada T2R 0E2

History:

The company was incorporated in 1980 in Calgary, Alberta, and has currently a branch office in Ottawa, Ontario and Phoenix, Arizona. The company is 100% Canadian owned. It is affiliated with F. G. Bercha and Associates Ltd, a Canadian consulting company.

Capability:

The company specializes in providing an integrated remote sensing service. It owns and operates a Gulfstream G-1 aircraft equipped with a side-looking airborne radar, of the APS-94D type, as well as an assortment of other sensors, including RC-8 cameras, multi-spectral camera, thermal scanner, and magnetometer. The side-looking radar is of aerospace technology caliber, and includes both analog and digital output. It is capable of storing the digital output for subsequent digital interpretation. The hardware system is only one of its type in commercial use in the world; as such, MARS possesses a unique capability in terms of hardware. In addition, the MARS approach to integrated remote sensing, providing a useful information product, has made it well known for its capability in solving information related remote sensing problems through judicious design, execution, interpretation, and analysis of remote sensing program images.

Credentials:

Gross Sales:

1980 - \$3M (expect sales to increase substantially in 1981 and subsequent years)

Average Work Force:

Total - 20 (includes executive, engineering staff, aircrew, mechanics, radar engineers, sensor technicians and support staff)

Plant Size:

Office Space - 2,500 sq ft

Industrial Space - 3,000 sq ft

Additional space is leased for aircraft maintenance, electronic shops and general operations.

Equipment:

Grumman G-1 aircraft with APS/94D SLAR, RC-8, I²S, magnetometer, and TIR scanner constitute a unique commercial multi-sensor package.

MARS AERIAL REMOTE SENSING Ltd (Cont'd)

Experience:

The company in its first year of operation has carried out work for most of the major US oil companies, including Exxon, ARCO, Amoco, Mobil, Chevron, Sohio, and Phillips, as well as selected projects for Burlington Northern and a number of mining companies. Its principal clients in Canada constitute the federal Government, Dome Petroleum, Petro-Canada, and Gulf Canada Resources.

Company: MENASCO CANADA Ltd

Address: 3495 Cote Vertu Road
St Laurent
Montreal, Quebec, Canada H4R 1R3

History:

Menasco is a wholly owned subsidiary of Menasco Inc and was organized in 1971.

Capability:

Menasco Ltd specializes in the design and manufacture of landing gear systems, flight control systems and a variety of actuation systems for many types of aircrafts. Their capability includes the development, design, and fabrication of landing gear (DC-10, 737, CL-41, SDS 3-30, etc), landing gear steer-by-wire (DHC-7), and various actuation systems (rudder, aileron stabilizer, flap drive, speed brakes, etc - F-28, SL-84, DHC-5, F-111, C-141, C-5A, etc). Applicable standards (FAA, DOT, MIL-Q-9858 A) are applied. Physical and environmental testing is accomplished with, among other facilities, three drop test towers which can also measure landing gear shimmy and steering characteristics.

Credentials:

Gross Sales:
No Data

Average Work Force:
Eng - 35
Mfg - 448
Others - 175

Plant Size:
208,000 sq ft

Equipment:

Complete physical and environmental testing laboratory for landing gear, flight controls and actuating devices, including facilities for vibration, structural, stress survey, fatigue testing, and full complement of NC equipment and a computerized production control system.

Experience:

Menasco Ltd has produced equipment for the following manufacturers and aircraft - Boeing (727, 737, 757, CH-47); Bell (YAH-63, V-15); Canadair (CL-41, CL-84); DeHavilland (DHC-5, DHC-7); Fairchild Republic (A-10); Fokker VFW (F-28); General Dynamics (F-111); Lockheed (C-141, C-5A); McDonnell Douglas (DC-10); and Short Bros (SD3-30).

Company: MILLER COMMUNICATIONS SYSTEMS Ltd

Address: 300 Legget Drive
Kanata, Ontario, Canada K2K 1Y5

History:

A Canadian owned high technology company founded in 1974 with no US subsidiary. It was originally formed as a systems engineering company specializing in the planning, design and implementation of a wide range of communications systems.

Capability:

The current direction of the Miller research efforts is towards military systems, automatic test and monitoring systems, digital communication terminals and systems upgrading and life extension. Their expertise and areas of interest are outlined as follows:

Communications:

Satellite - SCPC and DAMA, TDMA, SSMA
HF - Syncompex, Spread Spectrum, Maximum Likelihood Receiver,
Voice Privacy

Electronic Warfare:

ESM - ESM Receiver, Noise Monitoring, Spectrum Monitoring
ECM - Jamming
ECCM - Spread Spectrum, Interference Cancellation, Null
Steering Antenna

Navigation and DF:

Navigation - GPD Navstar, Sarsat
DF - VHF DF, HF DF, Null Steering

Radar:

Studies
High Speed Digital Processing

The 1981 objectives of Miller are to; (1) substantially increase non-government sales, (2) increase sales in the US (to 20% level), (3) shift technology base to defense systems, (4) develop TDMA and SCPC as a product line, (5) develop related products (primary devices, syncompex, monitoring equipment) and (6) develop a qualified, cost effective manufacturing capability (design and build, build to print).

Credentials:

Gross Sales:

1979 - \$1M
1980 - \$1.3M
1981 (current) - \$2.0M (50/50 Gov't vs Comm)
Projected - \$5 - 10M (50/50 Gov't vs Comm)

MILLER COMMUNICATIONS SYSTEMS Ltd (Cont'd)

Average Work Force:

Engineers - 38

Others - 12 (total employees projected to be 200 by 1985)

Plant Size:

8000 sq ft

(additional 5000 sq ft - 1983)

(additional 10000 sq ft - 1985)

(Room for expansion to 40000 sq ft on present site)

Manufacturing Capability:

The company's manufacturing division is equipped with tooling and staff to permit competitive execution and quick turnaround of complex, moderate quantity jobs. It is primarily responsible for building Miller systems and products. Upgrading and overhaul and repair is also undertaken.

Experience:

Present customers include various departments of the Canadian Government and various industries in the private sector of Canada, the US and Europe. They are interested in doing business with the DOD in general and with the USAF in particular.

Company: NORPAK Ltd

Address: P. O. Box 70
Pakenham, Ontario, Canada K0A 2X0

History:

Incorporated in 1975, NORPAK Ltd is a privately owned Canadian company located outside of Ottawa in Pakenham, Ontario.

Capability:

Since incorporation, NORPAK Ltd has been dedicated to the design, engineering and manufacture of computer driven display systems. The scope of NORPAK's product line ranges from low cost, low resolution raster graphic displays to sophisticated, high resolution image processing systems. The common element in these products has been systems which provide varying degrees of picture presentation capabilities. Whether the application requires simple colored graphs or a complete air traffic controller training system, the goal in NORPAK's product development has been to satisfy all user requirements in the most efficient and cost effective manner.

During the course of establishing a comprehensive base of operations, NORPAK has become involved in numerous extremely diverse application markets. Although there are certain areas which are common, the present line is segmented into three rather distinct hardware groupings:

Graphics Display Terminals (MK3, MVP, VDP2)

Stand-Alone Graphics Creation Systems (IPS2)

Image Display Devices (VDP2)

With the addition of supporting software, some overlap is provided between the functional groupings.

Being a product oriented company with capabilities of supplying complete systems, NORPAK has had its products utilized in diverse marketplaces including - remote sensing, medical imagery processing, process control, education, military command, control and communications and business applications.

All product development and R&D Engineering projects related to computer graphic display technology is handled by the in-house R&D staff. Currently, several R&D programs for the development of the next generation of NORPAK computer graphic display production are in progress.

NORPAK Ltd (Cont'd)

Credentials:

Gross Sales:

1978/79 - \$3.3M
1979/80 - \$5M
1980/81 - > \$7M

Average Work Force:

Total - 140 (projected over 200 by end of 1981)

Plant Size:

6,800 sq ft
12,000 sq ft additional space effective Sep 81

Facilities:

Technical facilities at NORPAK's plant in Pakenham, Ontario, include production equipment and assembly space, a full complement of electronic test equipment, several digital computers, environmental test chamber, and comprehensive in-house stock of electronic components. Other aspects of technical support include draftsmen, electronic technologists, hardware and software engineers, and administrative staff who are available for assisting in the execution of project activities.

Experience:

NORPAK has had experience in applying its computer graphics product line to interactive computer graphic and image processing systems, electronic subsystems, process control and computer-aided design systems for both commercial and industrial use. Specific development work undertaken by NORPAK in previous years includes - an air traffic control simulator system, tactical display system and videotex display systems. They manufacture much of the hardware associated with Telidon, Canada's sophisticated, two-way communications system.

NORPAK Ltd (Cont'd)

Credentials:

Gross Sales:

1978/79 - \$3.3M
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Company: NORTHWEST INDUSTRIES Ltd

Address: P. O. Box 517
Hangar #14, Municipal Airport
Edmonton, Alberta, Canada T5J 2K5

History:

Established in 1943 as an aircraft maintenance base during WW II, it was purchased in 1962 by CAE Industries Ltd of Montreal.

Capability:

Northwest Industries Ltd (NWI) have the capability and capacity at the Edmonton International and Municipal Airports, to accommodate complete overhaul and repair of military and civil operator's aircraft. Their inventory of ground handling and testing equipment supported by an up-to-date technical publications library insures a turn-around with minimum of ground time.

NWI's Mobile Repair Parties are equipped to service operator's fleets of aircraft off-site at any location with full technical support. They are equipped to service the latest in the State-of-the-Art Radar, Avionics and Aircraft electronic equipment, using up-to-date testing equipment and personnel who have many years of experience. NWI manufactures wiring harness assemblies, aircraft control cable assemblies and aircraft tubing assemblies to Canadian Government and FAA Specifications. The manufacturing facility is capable of producing aluminum alloy machined parts, sheet metal fabrications, sub-assemblies and major component assemblies to close tolerance requirements for the aircraft industry.

Modern technology is used in the manufacture of fabric reinforced plastic components such as air conditioning ducts for use in aircraft. NWI's objectives are in the field of aircraft repair and overhaul and manufacture of aircraft airframe components. The company holds the following approvals:

- 1) Canadian Department of National Defense Approval #686-1/44.
- 2) Canadian Ministry of Transport Approval #3/57.
- 3) US Federal Mfg Code #35598.
- 4) Prime Contractor Approvals (current & past):
 - a Lockheed California Company
 - b Boeing Commercial Airplane Company
 - c Hughes Aircraft Company
 - d Scottish Aviation Limited (UK)
 - e Spar Aerospace

NORTHWEST INDUSTRIES Ltd (Cont'd)

Credentials:

Gross Sales:

<u>Year</u>	<u>Manufacturing</u>	<u>Repair & Overhaul Ops</u>	<u>Total</u>
FY 78/79	7,410,000	11,115,000	18,525,000
FY 79/80	5,497,000	8,244,000	13,741,000
FY 80/81	6,633,000	9,948,000	16,581,000
FY 81/82 proj	6,740,000	10,110,000	16,850,000

Average Work Force:

Engineering Dept	- Professional Engineers	2
	Senior Engineers	2
	Tech Support Staff	3
Tech Publications-	Tech Illustrators	4
	Tech Writers	2
Quality Control	- Senior Laboratory Techs	1
	Tech Writers	2
	NDT Techs	7
	Avionics/Aircraft Access Techs	2
	Aircraft Techs	10
	Process, Receiving & Shipping	3
Aircraft Repair & Overhaul Dept	- Engine Run-up Mechanics	4
	Radio/Radar/Instrument Techs	15
	Sheet Metal Techs	34
	Airframe Mechanics	57
	Aircraft Electricians	23
	Electronic Assemblers	27
	Aircraft Instrument Mechanics	13
	Aircraft Painters	9
	Miscellaneous Trades	20
Manufacturing Department	- Jig and Tool Makers	4
	Machinists	12
	Assembly Mechanics	12
	FRP Production Workers	9
	Sheet Metal Mechanics	7
	Miscellaneous Trades	5

The direct work force is supported by a full compliment of indirect staff, supervision and executive personnel, to give an average annual work force of 500 personnel.

NORTHWEST INDUSTRIES Ltd (Cont'd)

Plant Size:

Edmonton Municipal Airport Facility	311,000 sq ft
Edmonton International Airport Facility	51,000 sq ft

Equipment:

Ekstrom Carlson No. 110 Numerical Control Gantry, 3 Spindle Profile Mill Autoclave, Devine, working area 6' x 18', 150 PSIG, 450°F Max., etc. A complete listing of their equipment is shown in their 60 page Capability Report which was too voluminous to include in this profile.

Experience:

Customers who have awarded Northwest Industries Ltd major contracts include:

- Lockheed California Company
- Boeing Aircraft Corporation
- Scottish Aviation Ltd
- Hughes Aircraft Company
- United States Air Force
- United States Navy
- United States Department of Interior
- Government of Canada
- Department of National Defense
- Ministry of Transport
- Department of Supply and Services
- Republic of Bolivia
- Pacific Western Airlines
- Quebecair
- Wardair Canada Ltd
- Alaska International Airways Inc

Company: OPTO-ELECTRONICS Ltd

Address: 2538 Speers Rd, Units 9 & 10
Oakville, Ontario, Canada L6L 5K9

History:

A Canadian owned high technology company incorporated in late 1976 with no subsidiaries in the US. The company was formed with the primary goal of carrying out research, development, manufacturing and marketing of high technology electronic components, devices and instruments.

Capability:

The company's fields of expertise lie in the areas of industrial control instrumentation, fiber optic systems, optical communications, electro-optics and instrumentation, fast optical sources and detectors, high voltage pulse techniques, solid state electronics, laser devices and sensors and transducers. Past year activities include new product development and manufacturing as well as contract research for industry and government. Manufactured products include a line of special ultrahigh speed photodetectors, ultrahigh speed diode laser light sources and a line of industrial electro-optical process monitors and controllers. The company introduces an average of four new products per year. Current research projects include ultra-fast photodetectors, ultra-fast laser diode sources, industrial monitors and controllers, a fiber optic data link, high voltage pulse measurements, a surface spark gap laser switch and an electronic streak camera.

Credentials:

Gross Sales:

1980 - 0.5M
1981 - 0.9M (projected)
1982 - 1.5M (projected)

Average Work Force:

Scientists, engineers & technicians - 16
Others - 2
Total staff by end of 1981 (projected) - 25

Plant Size:

8,000 sq ft

Manufacturing/Research Capability:

Their capability consists of a machine shop, assembly room, dark room and circuit etching, electronics test and optics test areas, stock room and shipping and receiving rooms. Five persons are currently

OPTO-ELECTRONICS Ltd (Cont'd)

assigned to manufacturing. Their R&D facility consists of laser, optics, electronics and optics design and electronics assembly areas, a chemistry laboratory, materials processing room, areas for microscope and spectral analysis, vacuum work and measurement and a high voltage shielded room. Also included are special rooms for furnace work, machining and modeling and a library. The research staff consists of 7 PhDs, 3 M. Eng., 1 MSc., 2 B. Sc. and 1 B. Eng.

Equipment:

Major equipment includes high vacuum evaporator, electron microscope, cryogenic, electrical and optical facilities, spectrophotometer, ellipsometer, diffusion furnace, vacuum furnace, optical microscopes, multiple beam interferometer, electrometers, oscilloscopes and other associated instruments.

Experience:

Their experience has for the most part been with the Canadian Government. Most products are exported. They have expressed interest in doing business with the USAF.

Company: OPTOTEK Ltd

Address: 1283 Algoma Road
Ottawa, Ontario, Canada K1B 3W7

History:

A Canadian owned high technology company with no other divisions in Canada or the US. Incorporated in October 77, a spin-off from Bowmar Canada Ltd (a Canadian subsidiary of Bowmar Instrument Corporation).

Capability:

Active - 1) Development and manufacture of LED materials and devices based on Group III-V and II-VI compounds, 2) design and manufacture of custom LED arrays for military and industrial application, 3) design and manufacture of display-related electronic sub-systems and test equipment.

Latent - 1) Alternate (non-LED) applications of III-V compound semiconductors, e.g., FET's, 2) alternate display technologies, e.g., liquid crystals, electrochromic technology.

Future R&D - Currently LED displays, both monochromatic and multicolor, range in resolution from 25 to 1000 lines-per-inch. Future expansion will encompass gallium arsenide field effect transistor and high-speed integrated circuit technology, as well as infrared photodetector technology based on cadmium mercury telluride.

Credentials:

Gross Sales:

Historical - Approx \$1M
Current - Approx \$1.25M
Projected - \$5M by 1983
% to US Military - 15

Average Work Force:

PhDs - 2
Eng - 6
Others - 18

Plant Size:

20,000 sq ft with expansion capability to 30,000 sq ft

Equipment:

Full complement of semiconductor processing equipment

OPTOTEK Ltd (Cont'd)

Experience:

Optotek has experience with the USAF, USA and NASA and is interested in continuing its business with the DOD and NASA. Past contracts have been in the LED materials, devices and displays areas. Principal programs with the USAF have been the Multimode Matrix Display and the Video Flat-Panel Display. The USN programs include manufacturing technology for advanced solid state data annotation displays and a planned production involving the update of an F-4 reconnaissance system.

Company: PHALO/OSD

Address: 3530 Pharmacy Ave
Scarborough, Ontario, Canada M1W 2T9

History:

This is a new Canadian company incorporated in Jan 81. This company is a division of Phalo Electron Inc., a Canadian based corporation, and is a subsidiary of Phalo Corporation of Shrewsbury, Massachusetts.

Capability:

The company is a marketing, manufacturing and systems engineering business providing fiber optic communication links, products and services for the industrial process control and data processing markets. Their products will consist of fiber optic links and couplers, associated equipment such as fiber splicers and test equipment, fiber optic modems and services that will include system design, installation, maintenance and test. Anticipated R&D work will consist of the development of data modems which will interface with business computers and peripherals and of couplers which will interconnect up to 40 fibers.

Credentials:

Gross Sales:
None (new company)

Average Work Force:
Total - 6 (estimated 8-10 by Dec 81)

Plant Size:
5,000 sq ft

Experience:

Although a new company, the personnel on hand are experienced in the fiber optics area through past employment with companies well known for fiber optic expertise. The company is gearing for 50% of their product sales to be in the US.

Company: PHILIPS ELECTRONICS Ltd

Address: 601 Milner Ave
Scarborough, Ontario, Canada M1B 1M8

History:

Philips Electronics Ltd was incorporated in 1941 and is a wholly owned subsidiary of Philips Canada Ltd. The parent company is a wholly owned subsidiary of N. V. Philips' Gloeilampenfabrieken of The Netherlands. Philips Electronics is organized into three regions with seven branches located across Canada and a Government Liaison Office in Ottawa. The head office is located in Scarborough, Ontario.

Capabilities:

Philips Electronics Ltd is a diverse organization with activities in almost every aspect of electronics and many electrical products. Their products include advanced electronic equipment for the aeronautical industry, quartz crystals, video display units and ballast transformers for fluorescent and gas discharge lighting. The primary capability of the Nav aids Division is design, development production and testing of ground based aircraft navigation systems. This includes instrument landing systems (ILS), VHF omni-range systems (VOR) and distance measuring equipment (DME). A secondary capability is in air traffic control and related communications equipment. Their system, LORADS, will control air traffic within a radius of 250 nautical miles at altitudes up to 80,000 ft.

Other divisions with capabilities of possible interest to the USAF are the Video Display Monitor Division and the Crystal Division. The former designs, develops and produces high resolution video display units. These units are not currently designed to military specifications, but the company is considering incorporating MIL SPEC criteria in the future. The latter division produces piezo-electric quartz crystals for the military and electronics industry. One of their specialties is very high quality glass-encapsulated crystals of the type used in satellites. These crystals are produced to military specifications.

The Philips Department for Standards and Tests is a Canadian Government certified test laboratory. This department not only tests Philips manufactured items, but also equipment from outside sources such as the Canadian Forces and the US military. Philips Electronics is also carrying out research in fiber optics technology. Their current efforts are in conjunction with their parent organization in The Netherlands and is not product oriented.

PHILIPS ELECTRONICS Ltd (Cont'd)

Credentials:

Gross Sales:

\$4 - 8M/Year - Navaid Division

Average Work Force:

Total - 1750
Navaid Division - 25 (Eng)
42 (Prod/Mgmt)
16 (Others)

Plant Size:

40,000 sq ft (Scarborough Plant)

Experience:

Philips Electronics customers include the Canadian Government, US military, Hughes Aircraft Co, G.E., Xerox Corp, IBM Corp, DEC and many more throughout the US, Canada and the world.

Company: PHOTOCHEMICAL RESEARCH ASSOCIATES Inc

Address: 45 Meg Drive
London, Ontario, Canada N6E 2V2

History:

Photochemical Research was incorporated in mid-1976. It is a Canadian owned high technology company with a US sales office located in Oak Ridge, Tennessee.

Capability:

PRA is involved in the design, development and manufacture of electro-optical instrumentation systems, specifically in light generation, detection and analysis. Their present product lines consist of luminescence decay systems for the reliable measurement of short lived fluorescence life times; pulsed light sources with pulse widths from picoseconds to seconds and spectral ranges from the VUV to the IR; CW light sources and a line of optical building blocks; and Photon Counting Systems for low light level detection.

In addition to manufacturing standard products, they operate research and laboratory facilities for custom manufacturing, contract research and consulting. PRA operates on an international basis through offices in Canada and the US, as well as through distributor networks in Europe and the Far East.

Credentials:

Gross Sales:
No Data

Average Work Force:
Scientists/Eng - 20
Others - 50

Plant Size:
22,500 sq ft

Experience:

PRA has sold their off-the-shelf products to a variety of academic, industrial, and government research facilities including - Lawrence Livermore Laboratories, Oak Ridge National Laboratories, Los Alamos Scientific Laboratories, Solar Energy Research Institute, Exxon Research, Bell Laboratories, Western Electric, and Eastman Kodak.

Company: PRATT & WHITNEY AIRCRAFT COMPANY Ltd

Address: P. O. Box 10
Longueuil, Quebec, Canada J4K 4X9

History:

Established in 1928 as a Canadian center for the overhaul of Pratt & Whitney Aircraft radial piston engines, the company eventually took over full responsibility for this function, as the parent company began developing and manufacturing gas turbine engines. P&WC is a wholly owned subsidiary of the Pratt & Whitney Aircraft Group, a division of United Technologies Corporation.

Capability:

P&WC has the mandate to develop and produce all small gas turbine engines typically for general aviation, commuter and paramilitary use. Their primary business areas are:

- . Small gas turbine engine development
- . Small gas turbine engine production
- . Small gas turbine engine oriented research

The development of gas turbine engines at P&WC started in the late 1950s with the early PT6. This turboprop engine was introduced to the commercial market in 1963. By 1973, the 5000th PT6 engine had been delivered and ten different versions had been certified. The military designation for this engine is the T74-CP-701. In 1979, they introduced the PT7 turboprop engine. This fuel efficient engine is used primarily in commuter and short-haul aircraft.

Their JT15D turbofan engine was introduced in 1967. It is the power-plant of the Cessna Citation corporate jet as well as the Aerospatiale Corvette and the Mitsubishi Diamond 1 aircrafts. P&WC has also developed a twin turboshaft engine for helicopter use. These are designated the PT6T-3 and -6 series (military designation is T400-CP-400, -WV-402).

Credentials:

Gross Sales:

1979 - \$463M
1980 - \$605M

Average Work Force:

Eng - 612
Others - 991

Plant Size:

All Plants - 1,809,640 sq ft

PRATT & WHITNEY AIRCRAFT COMPANY Ltd (Cont'd)

Experience:

USAF (AFWAL):

- . Research on High DN Value Roller Bearings - a program to demonstrate the antifriction properties of small high DN value roller bearing. Carried out as a shared development program.
- . Alternate Fuels Combustion Research - experimental study of the effects of alternate jet fuels on small gas turbines. Carried out as a shared development program.

US ARMY (AVRADCOM)

- . Subcontractor in Cooled Radial Turbine Program to Pratt & Whitney Aircraft - Government Products Division (1969-1971). Pratt & Whitney Aircraft of Canada Ltd (P&WC) was responsible for the Aerodynamic design and participated in the structural analysis and mechanical design of the rig.
- . Consultant to Pratt & Whitney Aircraft (P&WC) - Government Products Division (GPD) on ST9 1500 HP demonstrator program for new US Army helicopter engine (1966-69). In the 2 stage centrifugal compressor, the first stage was a scaled P&WC research.
- . Consultant to P&WC - GPD for demonstration of 10:1 Pressure Ratio in a single centrifugal compressor (1970-1972). P&WC provided data from previous in-house demonstrations of 10:1 Pressure Ratio in 1967 and 1970 supported by Canadian Defense Research Board.
- . P&WC is currently negotiating a research program with the US Army at Fort Eustis for an advanced 15:1 Pressure Ratio Single Centrifugal Compressor.

US NAVY

- . P&WC was a subcontractor to P&WA - Commercial Products Division (CPD) in 1964-1966 on a demonstration of a regenerative, small turboprop engine based on the PT6. P&WA designed the regenerator, while P&WC designed the ducting, organized hardware fabrication and demonstrated the concept.
- . P&WC won a contract in 1969 to provide a twinned helicopter engine (T400/402-Twin Pac R) to the US Navy for Bell Aerospace helicopters. To date, 1032 units have been supplied. In addition, the engine is also supplied in a civil version (PT6T3/6) with 2218 units produced to date. Development of the engine is a continuous process and an engineering improvement by the US Navy.

PRATT & WHITNEY AIRCRAFT COMPANY Ltd (Cont'd)

- . P&WC is currently a subcontractor to P&WA - CPD on a demonstration of single crystal turbine blades for sulfidation resistance in marine operation.

ENVIRONMENTAL PROTECTION AGENCY

- . In 1973-1974, P&WC carried out a combustion research program for small, single can, highly loaded combustors for automotive application. Good performance with low emissions was demonstrated.
- . In the early 1970s, P&WC was subcontractor to UTRC on a study of the automotive application of gas turbines. In this capacity, P&WC carried out a series of cycle studies and supported experimental work on combustion.
- . P&WC also supported Environment Protection Agency (EPA) (Triangle Park) on studies of the carcinogenic effect of small gas turbine emissions in 1977-1978.

NATIONAL AERONAUTICAL SPACE ADMINISTRATION (NASA)

- . In 1977, P&WC was subcontractor to P&WA - CDP on a turbofan core noise program at Ames carried out on a NASA purchased P&WC JT15D engine. In this capacity, P&WC designed and fabricated an alternate fan core stator to increase the axial spacing between rotor and stator and the number of stator vanes.
- . In 1978-1980, P&WC was subcontractor to P&WA - CPD on a program of nose cone telemetry for Lewis as applied to a NASA JT15D turbofan. In this program, P&WC designed a transmitter to operate within the nose of a JT15D during engine ground operation to study the difference between ground and flight noise measurements.
- . P&WC was also subcontractor to P&WA - CPD in 1979-1980 on a program to supply Langley with copies of the telemetry units from item #2 for flight use with stringent manufacturing requirements.
- . P&WC is currently subcontractor to United Technologies Research Center on a Combustor soot program. All combustor hardware is being designed and fabricated by P&WC, while United Technologies Research Center will assemble the rig and carry out all testing (1980-1981).

Company: PRESENTEY ENGINEERING PRODUCTS Ltd

Address: 2784 Fenton Road
Ottawa, Ontario, Canada K1G 3N3

History:

A Canadian company incorporated in 1958 with no other Canadian branches or US subsidiaries.

Capability:

Presentey engages as a prime contractor in a wide variety of activities including research, development, production and consulting for both the military and private sectors. Over the years, the company has designed and produced an assortment of hardware items that include airborne voice recorders and ground based reproducers for the CF-104 aircraft, transmitter teletypewriter controls for shipboard use, low drift DC amplifiers, multichannel memory/loop tape recorders for high performance jet aircraft, 14 channel FM/AM data recorder for high altitude research, magnetometers, proton magnetometers, dust monitoring systems, rocket subcommutator, an AWS sonobuoy antenna, plus other items. They designed and produced the first Canadian air pollution monitor which is installed at various locations in the Ottawa, Toronto and Montreal areas. The company was awarded all the contracts of a bankrupt electronics firm by the Canadian Government. All those contracts were successfully completed. At least two USAF contracts, transistorized missile checkout cards and radar target simulators, were part of that deal. Recent projects include the design and development of the signal patch panel systems for the latest Canadian destroyers and a 64-channel A/D converter/recorder system. They have also been active in the fields of airborne photogrammetry, navigation aids and airborne photography film annotation systems. Another inhouse product is a brushless DC motor. It is a low cost, high quality, long life, selfcontained, compact unit to be used in new equipment designs as well as a replacement for brush type motors in existing equipment. Applications include magnetic tape recorders, reels and capstan drives, film transports in cameras, airborne instruments, chart recorders, printers, blowers and various operations in hostile environments. The company is reasonably self-sufficient. They are equipped to carry out electronics work as well as to design and machine parts, tools, jigs and dies for production of parts, stamping and molds. Production equipment is available for electronics and mechanical operations. They also have the capability to design silicone elastomer molds and have made considerable progress in epoxies processing.

PRESENTY ENGINEERING PRODUCTS Ltd (Cont'd)

Credentials:

Gross Sales:

1980 - \$1M

1981 - \$1.5M (projected)

Average Work Force:

Total - 16

Plant Size:

10,000 sq ft

Manufacturing Capability:

The company maintains a manufacturing capability in the electronics and mechanical areas. They are equipped with a machine shop for normal operations. They can carry out heat treating, stamping, tool and die cutting, oxy-acetylene and electrical welding and sheet metal operations. Limited environmental and vibration testing can be carried out.

Experience:

They are experienced in working with the Canadian military and have had some contracts with the USAF (AFLC). They are interested in working with the USAF R&D community.

Company: PRIOR DATA SCIENCES Ltd

Address: 16 Credit Union Way, Ste 301
Ottawa, Ontario, Canada K2H 8R6

History:

PRIOR Data Sciences Ltd was founded in early 1977 and has steadily grown to its current level of 36 employees (January 1981). The company is Canadian owned and is located in both Ottawa (Headquarters) and Toronto. There are no US subsidiaries.

Capability:

PRIOR Data Sciences has capabilities in "turnkey" computer systems development, software engineering consultation and contract support services. Experience in a wide spectrum of application areas has been embodied in the company and brought to bear on the solution of real-time, engineering oriented problems.

Computer system development may range from microprocessors to mainframes (the company has significant experience in the mid-range minicomputers such as the DEC PDP-11 series). They have assumed responsibilities as a software subcontractor and as a turnkey system developer.

Consulting services have been provided for authorship of proposals, systems analysis prior to hardware procurement, proposal evaluation, acceptance test plan preparation, and writing of specifications or standards.

Contract support services are available for all phases of development projects from system analysis to programming.

Application experience is covered by the areas of - Operating Systems, Data Communications, Command and Control, Graphics Display Systems, and Process Management Information Systems. Specific examples in these areas are as follows:

Operating Systems -

Minicomputers

- . Real-time operating system design
- . FORTRAN compiler design and implementation
- . Overlay loader design and implementation
- . RSX operating system software development
- . UNIX operating system software development
- . Block-structured macro-assembler development
- . Compiler validation and acceptance
- . Hot-standby system switchover software

PRIOR DATA SCIENCES Ltd (Cont'd)

Microcomputers

- . Macro-assembler development
- . Bootstrap loaders
- . Protocol emulations

General

- . Device controller software
- . Hardware diagnostics and fault isolation
- . Microprocessor emulation
- . Database design and implementation
- . Utility software development
- . Cross-assembler development
- . File maintenance software
- . Crash and auto-restart handling

Data Communications

- . Minicomputer based Automatic Data Test System for remote testing of communications equipment
- . Self-maintenance software for telephone test equipment
- . Packet Switching Network software development
- . Development of minicomputer concentrator for emulation of IBM 3270 display stations, utilizing non-intelligent terminals

Command and Control

- . Supervisory control and data acquisition for the power industry
- . Applications software development for collision avoidance in air traffic control
- . Minicomputer command control of automated plant processing

Graphics Display Systems

- . Design and development of interactive graphics display system on XDS Sigma-6
- . Color graphics display software for power distribution system
- . Digital satellite image telemetry correction
- . Graphics software for electronic warfare simulation

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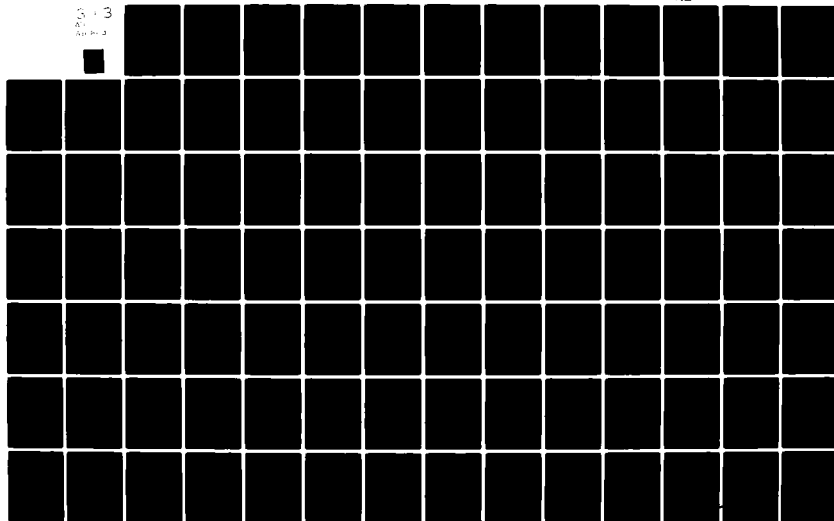
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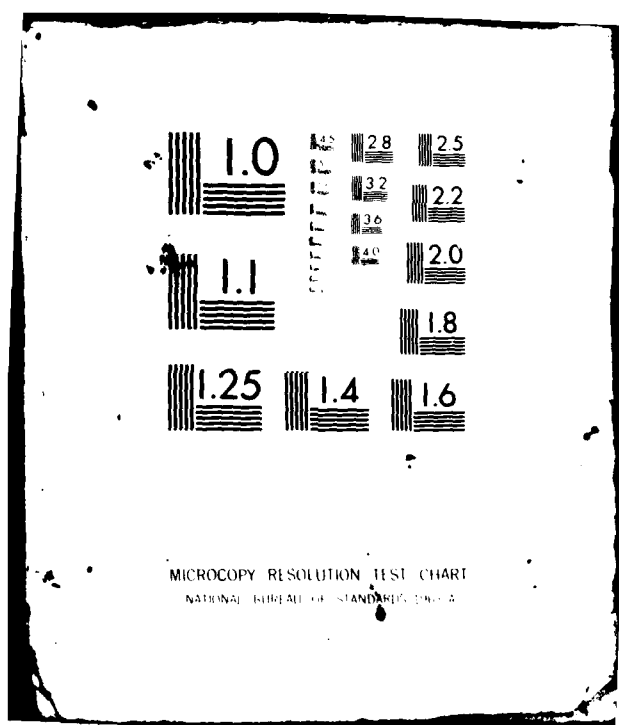
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PRIOR DATA SCIENCES Ltd (Cont'd)

Process Management Information Systems

- . System and applications software design for plant operation management
- . On-line information retrieval systems development
- . Software development for vessel traffic management
- . Automobile engine test system development
- . Data collection for telephone call processing applications

Credentials:

Gross Sales:

1979 - \$0.9M

1980 - \$1.8M

Average Work Force:

Professionals - 32

Others - 4

Plant Size:

1,500 sq ft (Ottawa)

2,000 sq ft (Toronto)

Equipment:

PDP 11 computer each location

Experiences:

Sixty percent of the company's work is military-related. They have had no direct contracts with the US military, but have been sub-contractor on military-related contracts. They have experience with the Canadian Government, both on the provincial and federal levels, including the Department of National Defense. They also have extensive industrial experience with such companies as Leigh Instruments Ltd (Avionics Div), Motorola Canada Ltd, Litton Systems Canada Ltd, and AES Data Ltd.

Company: PYLON ELECTRONIC DEVELOPMENT COMPANY Ltd
INSTRUMENT DIVISION

Address: 20H Enterprise Ave
Ottawa, Ontario, Canada K2G 0A6

History:

The company is Canadian owned with no active subsidiaries in the US. It was incorporated under Federal Charter in 1955 in Lachine, Quebec. The Ottawa division opened in 1977 and a Toronto division opened in the fall of 1979. The Lachine division manufactures telephone central office power plants, some switching equipment, ringing generators, ring talk signal supplies and custom equipment such as facsimile broadcast consoles, Dutch Auctions (teletype) and data monitoring test bays for telco use. The Toronto division manufactures cables, harnesses, and special telecom equipment including custom board assembly.

Capability:

The Instrument Division is involved with high technology R&D in the area of calibration and/or instrumentation for measurement of radioactive hazards. Their primary thrust has been in the development of radioactive gas generators, standards and detection equipment for commercial use. Typical commercially available equipment includes calibrated radon and thoron gas sources, radon calibration standard, vacuum soil probe, portable radon detector, radon monitor-counter, ventilation efficiency monitor, and vacuum water degassing units. Also included in their product line is a time code generator system. This equipment was researched, developed and manufactured at the Instrument Division.

Credentials:

Gross Sales - \$2M (average sales for 3 preceeding final years,
all divisions)

Average Work Force:

Scientists/Engineers - 16
Others 7

Plant Size:

Current - 3500 sq ft
Planned - 15000 sq ft (construction to begin 4-81)
Future - 10000 sq ft additional

Equipment:

At present, prototype facilities for metal work are available but must rely on outside suppliers for much of hardware production.

PYLON ENTERPRISES DEVELOPMENT COMPANY Ltd (Cont'd)

Experience:

The Instrument Division is interested in working with the USAF. They have had no past contracts with the USAF. Their experience has been primarily with various departments of the Canadian Governments, such as National Defense, Environment, Energy, Mines and Resources, National Research Council and the Atomic Energy Control Board.

Company: QUESTOR SURVEYS Ltd

Address: 6380 Viscount Road
Mississauga, Ontario, Canada L4V 1H3

History:

Originally a one aircraft survey operations section of a mining company, the company split in 1961 and formed a survey service for any mining organization. During this period, the company operated one owned aircraft and three leased aircraft. In 1970, they began expanding operations and in 1979, acquired the geophysics division of Northway Survey Corporation. During this period, they specialized in the use and development of the Barringer INPUT electromagnetic system. They are Canadian owned and have no subsidiaries.

Capability:

Questor specializes in all state-of-the art airborne sensing for base metal, uranium and oil. In addition to the Barringer INPUT system (VLF electromagnetics), they also are capable of acquiring and analyzing data from airborne standard and high sensitivity magnetics and standard and multi-channel spectrometry. They also design and build very high sensitivity magnetometers along with their associated data acquisition systems. Their aircraft fleet includes - two Skyvans, three trislanders, three DC-3s and an Aero Commander. The INPUT systems generate a pulsed signal from a vertical dipole. Existing conductive ores induce eddy currents in the primary field which form secondary fields. These secondary fields are then sensed. Through analysis of these secondary field anomalies, sulphide and graphite conducting pockets have been identified to a depth of 300 meters. Standard and high-sensitivity magnetometry provide detailed magnetic contour maps. Corrections for aircraft attitudes and maneuvers and the use of precision clocks etc., enable Questor to improve the normal high standard government contour maps by a factor of four in geologic resolution.

Gamma ray spectrometers are used to identify potential uranium deposits as well as for geologic mapping and identification of man-made radioactive wastes. Data reduction for all types of sensors/missions is provided by the company's specially developed algorithms and provides a variety of outputs depending on the users' needs.

Questor has recently organized an internal Research Division. They are presently working to improve the various sensors used by Questor to increase penetration, sensitivity and flexibility. Some consideration has been given to becoming involved in remote infrared detection and side looking radar for mapping purposes.

QUESTOR SURVEYS Ltd (Cont'd)

Credentials:

Gross Sales:

1980 - \$6M

1981 - \$8M (projected)

Average Work Force:

PhD - 1

Prof Eng - 3

BsE - 10

Technicians - 15

Others - 91

Plant Size:

22,000 sq ft (plus rental hangar space)

Experience:

Questor's clients include 49 different countries around the world for one or more of their surveys. Their surveys have led to the discovery of fourteen base metal, precious metal or uranium deposits in a variety of geologic environments. In Canada, customers have included - Noranda Mines, Falconbridge Mines, Inco, Imperial Oil, Shell Oil, and Gulf Oil. They are interested in conducting research for the USAF.

Company: RAYLO CHEMICALS Ltd

Address: 8045 Argyll Road
Edmonton, Alberta, Canada T6C 4A9

History:

Raylo Chemicals is a wholly owned Canadian company. It is a subsidiary of Connlab Holdings Ltd which is a subsidiary of Canada Development Corporation. No US subsidiaries. The company was incorporated in 1963 and purchased by CDC in 1973.

Capability:

Raylo Chemicals specializes in custom synthesis, contract research and stock sales. Areas of expertise include synthetic chemistry (natural products, pharmaceuticals, hydrocarbon chemistry, dye-stuffs and monomers), physical chemistry (highly strained molecules, polymers, fluorination of hydrocarbons, and high pressure and high temperature reactions), petroleum chemistry (petrochemical process development and air oxidations) and polymer chemistry (specialty polymers, chemical postmodification, novel functionalized polymers, microstructure investigation by pmr and cmr, wiring, vulcanization). Principal areas of contract research include synthesis of new compounds for pharmaceutical purposes, development of chemical processes, research to develop physical and physio-chemical data in support of commercial industrial processes, and post polymerization modification of linear polymers. They produce and sell fine chemicals. Their current stock includes over 100 compounds. In addition, they offer custom manufacturing of fine chemical from project conception through laboratory quantities to semi-works production of several hundred kilogram quantities.

Credentials:

Gross Sales:

1979 - \$0.9M
1980 - 1.2M
1981 - 1.5M

Average Work Force:

PhDs - 12
Eng - 1
Others - 14

Plant Size: 6,000 sq ft, Lab Size: 6,000 sq ft

Equipment: Typical chemistry laboratory equipment plus 60 MHZ NMR spectrometer and UV, visible and IR spectrophotometers, various capacity reactors and a variety of separation equipment. Plant equipment consists of glass lined and stainless steel reactors, centrifuges and driers.

Experience:

The company has produced 77 patents and 35 publications. Their clients are Government, Universities and industry, in both US and Canada. They have not carried out research projects under USAF contract.

Company: SED SYSTEMS Inc

Address: P. O. Box 1464
Saskatoon, Saskatchewan, Canada S7K 3P7

History:

SED evolved from the Space Engineering Division of the University of Saskatchewan. SED was incorporated in 1972, and is a privately owned Canadian company. In addition to its Saskatoon Head Office, the company maintains the following offices:

SED Systems Inc
710-350 Sparks St
Ottawa, Ontario
Canada K1R 7S8

SED Electronics Inc
P. O. Box 171413
Memphis, Tennessee
USA 38117
(Wholly owned Subsidiary)

SED Systems Inc
Prince Albert Satellite Sta
(SED Operates Canada's
Landsat Station)
P. O. Box 2500
Prince Albert, Saskatchewan
Canada S6V 7G3

Capability:

SED supplies a diverse range of products and services to the following three markets - Aerospace, Communications and Instrumentation & Control. A summary of the major products and services offered by SED is listed below:

Specialized instrumentation for sounding rocket, high altitude balloon, shuttle-borne satellite and ground based complementary equipment.

Spacecraft systems engineering and program planning services.

Systems engineering for satellite support; planning, operation and control, software, ground control equipment, systems test equipment.

Systems engineering for communications; network design, information data bases.

Systems engineering for simulations.

Systems engineering for industrial process control

Design, manufacturing and installation of complete earth stations, and earth station sub-systems (including microwave components), for data, message and television transmission and reception.

SED SYSTEMS Inc (Cont'd)

Commercial products are listed below:

Pulse and touch-tone automatic telephone dialers.

Agricultural instrumentation.

Industrial monitoring and control.

Rural telecommunications.

New home services.

Satellite communications are listed below:

Complete design, manufacture and installation of stations for message, telephone and TV reception by satellite.

Subsystems for satellite earth stations.

Microwave components.

Their specific areas of interest in space and defense are in ground based satellite related systems. These systems are categorized as follows:

Test Equipment -

System design, production and integration (hardware & software)

Hardware unit design and production.

Control Equipment for Operational Ground Stations -

System design, production, integration and installation (hardware & software).

Hardware unit design and production.

Custom Software -

Design, production and integration.

Customized Communications and Control Earth Terminals -

Simulations -

SED SYSTEMS Inc (Cont'd)

Credentials:

Gross Sales:

1980-81 - \$11M
1981-82 \$16M (projected)

Average Work Force:

Engs, Phys, Comp Sci - 70 (5 - PhDs)
Others - 210

Plant Size:

76,000 sq ft (expand to 120,000 sq ft in 1982)

Equipment:

SED has a variety of specialized facilities including, Precision machine shop and chassis fabrication facility; Metal finishing and painting shop; Computer systems, payload and earth stations integration facilities; and Microwave clean room.

Experience:

SED served as both the systems integrator and test contractor, as well as the designer on the following space/defense related work unless otherwise noted:

Payloads

Sounding rocket and balloon payloads
produced over 60
Canadian National Research Council (NRC)

Firewheel sub-satellite
for 1980 launch on Ariane
NRC (Max, Planck Institute - Germany)

Mission Planning and Support

Communications Technology Satellite (CTS or Hermes)
planned attitude acquisition phase
designed ground control station and developed software
Canadian Department of Communications (DOC)

Satellite Telemetry, Tracking and Command Stations

ANIK A
TAC station for A2
Telesat Canada

ANIK C
transportable tracking station (Guam)
Hughes Aircraft Company

SED SYSTEMS Inc (Cont'd)

LANDSAT/GOES

Canadian tracking station (Prince Albert)
SED has operated for 8 years
Canadian Center for Remote Sensing (CCRS)

SARSAT Canadian Mission Control Center

to be installed at Trenton, Ontario as part of Canada's
contribution to the International SARSAT program
Canadian Department of National Defense

Ground Control Equipment

ANIK C, SBS and INTELSAT V
variety of equipments including
command generators and upconverters
telemetry displays
quantity 50
Hughes Aircraft Company

Communications Earth Terminals

Terminals
wide variety including
low-cost 4 and 12 GHz TV receive only
2 way fixed and transportable terminals
(4/6 and 12/14 GHz)
quantity over 150

Satellite System Test Sets

ANIK C/SBS (12/14 GHz)
computerized payload test and integration support unit
Hughes Aircraft Company (quantity 4)
DOC (quantity 1)
ANIK D 4/6 GHz)
as for ANIK C
SPAR Aerospace and DOC (quantity 1)

Computer Systems

LANDSAT, GOES
data collection platform processor (DCP)
visible and infrared spin scan radiometer processor (VISSR)
Canadian Atmospheric Environment Services and CCRS

NORAD Joint Surveillance System

Digital Switches at Regional Control Centers to handle up to
84 channels of radar data (quantity 8 switches)
Hughes Aircraft Company

Company: SCIEX Inc

Address: 55 Glencameron Road
#202
Thornhill, Ontario, Canada L3T 1P2

History:

SCIEX Inc was incorporated in 1970 and is Canadian owned. The original name was Sciex Ltd, but was changed to the present name in 1977. The company has a US subsidiary, SCIEX (USA) Inc, located in Delaware and an inactive Canadian subsidiary, SCIEX ANALYTICS Inc.

Capability:

The original purpose of the company was to market specialized laboratory equipment, such as molecular beam systems. A major reorganization was initiated in 1975 in order to exploit the field of trace chemical analysis and other related disciplines. Initially, they focused their thrust on trace chemical analysis based on ionization and ion separation techniques. They also exploited their know-how in fluid dynamics and vacuum technology. SCIEX has developed a Trace Chemical Analysis System (TAGA® 3000) that can be fully mobile and is touted to be 1000 times more sensitive and 1000 times faster than other available systems. The TAGA® 3000 is for targeted compound analysis. They are currently developing the TAGA® 6000 MS/MS for mixture analysis and structural elucidation work.

The current activities of SCIEX include:

- . Marketing of TAGA® 6000 MS/MS Systems for structural elucidation and compound analysis.
- . Marketing of TAGA® 3000 Systems for targeted compound analysis.
- . Marketing of integrated TAGA® -based mobile systems.
- . Development of special inlets for TAGA® Systems.
- . Development of special computer programs for TAGA® systems.
- . Development of special chemical methodology for TAGA® systems.
- . Research and development involving mobile and laboratory based analytical services and related environmental or occupational health programs.
- . Special consulting studies including those dealing with pre-collected sampling systems in the field or in the workspace.

SCIEX Inc (Cont'd)

Their research and development services include:

- . Leasing of time and scientific personnel on TAGA ® s within SCIEX premises, when available.
- . Leasing of time and scientific personnel on the mobile TAGA ® laboratory, when available.
- . Provision of mobile and laboratory based analytical services and related environmental or occupational health program, when available.
- . Special consulting studies, including those dealing with pre-collected sampling systems in the field or in the workspace.

Credentials:

Gross Sales:
No data

Average Work Force:
PhDs - 12
Others - 58

Plant Size:
15,000 sq ft

Facilities:

Their Trace Analysis Applications Laboratory is an ultra trace organic, inorganic and elemental analysis laboratory centered around TAGA ® technology. This laboratory has the unique capability to identify and to quantify in real time trace organic compounds in air, gas, water and fluid samples at concentrations down to the parts per trillion level. SCIEX research and development facilities activities include 2 computerized atmospheric pressure ionization mass spectrometer TAGA ® 3000s, one of them mounted in a mobile lab, with a series of versatile inlet systems; two analog TAGA ® 2000 versions, one of them mounted in a mobile lab and one TAGA ® 6000 mass spectrometer/mass spectrometer system. These systems are operated by a series of DEC11/03 and 11/23 computers with appropriate peripheral terminal, graphic and hard copy capabilities.

SCIEX Inc (Contd)

A variety of sample handling techniques have been developed to facilitate the introduction of a wide assortment of samples to the TAGA®. Facilities are available for the safe handling of hazardous and toxic (carcinogenic) compounds.

The laboratory facilities also include a separate Hewlett Packard computerized gas chromatograph. Their in-house expertise in the field of gas chromatographic column technology enables the preparation of both packed and open tubular capillary columns.

They also possess a small microprocessor, software, data acquisition and electronic circuitry development laboratory. The hardware consists of PDP8/M dual disc system, Tektronix CRT terminal and hard copy unit, multiwriter and graphics terminals, and all the minor equipment necessary to enable the rapid development and demonstration of advanced microprocessor interfaces and data acquisition, data processing and pattern recognition systems, for a variety of field and laboratory applications of SCIEX's instrumental systems.

SCIEX has the in-house capability of developing and testing advanced vacuum systems, and is equipped with the latest leak testing and other test equipment for specialized vacuum systems, especially those involving cryogenics and ultra high vacuum. They also have an effective working arrangement with the Aerospace Institute Laboratory of the University of Toronto. Work is carried out in this laboratory on fundamental questions pertinent to TAGA® developments.

Experience:

SCIEX customers include - Xerox Corporation, US Customs, National Research Council of Canada, Health and Welfare Canada, Ministry of Environment (Saskatchewan), Ministry of Defense (UK), Canadian Department of National Defense, Environment Canada, and Ministry of Environment (Ontario).

The contracts primarily involve the TAGA® 3000 system. Some were direct purchases, others evaluation studies/purchases and some involved modification studies and research studies.

Company: SEAGOLD WATER SYSTEMS Inc

Address: 4008 Myrtle St
Burnaby, British Columbia, Canada V5C 4G2

History:

Seagold was formed in 1978 to carry out research related to reverse osmosis desalination. TDC Technology Development Corporation, a jointly owned company of Teck Research Inc and CDC Ventures Inc, acquired controlling interest in 1979. The company began commercial production in the fall of 1980.

Capability:

Seagold manufactures a full line of reverse osmosis desalinators from a hand operated unit (WaterLever) for emergency use in liferafts to motorized desalination systems for making 50,000 gallons of fresh water per day from sea water.

Credentials:

Gross Sales:

1980/81 - \$0.3M
1981/82 - \$1.0M (projected)

Average Work Force:

PhD - 1
Eng - 5
Others - 13

Plant Size:

6,000 sq ft

Equipment:

Precision machine shop
Central seawater system
Analytical laboratory

Experience:

They have contracted with the US Army (M I C O M) for the development of an energy efficient pump and with the David W Taylor Research Center (Bethesda, MD) for hand operated liferaft desalinators. They also provided the desalinator for the Eureka Weather Station on Ellesmere Island.

Company: SHARP SPECIAL SYSTEMS (Ottawa)
I.P. SHARP ASSOCIATES Ltd

Address: 265 Carling Ave, Suite 600
Ottawa, Ontario, Canada K1S 2E1

History:

I.P. Sharp Associates Ltd is a Canadian owned company incorporated in 1964. The corporate headquarters is located in Toronto. Sharp Special Systems is a division of I.P. Sharp that began operation in 1973. All of the company's minicomputer-related activities are amalgamated in the division. Wholly owned subsidiaries of this Canadian company are located in Australia, Austria, Belgium, Denmark, France, Far East, Germany, Italy, Mexico, Netherlands, Norway, Sweden, Switzerland, UK and US. The company has twelve Canadian locations in six provinces. There are nineteen US locations in twelve states and Washington, DC.

Capability:

I.P. Sharp is a computer software company specializing in:

- . Provision of timesharing service called SHARP APL.
- . Development of software to handle projects ranging from large database applications to small real-time monitor and control systems.
- . Research and development of software tools to aid in the production of secure systems.

SHARP APL is offered in both interactive and batch modes and can be used at your own premises, using a variety of terminals, via a telephone connection. Each user has a 256 kilobyte workspace that may contain both functions and data. Any number of workspaces may be stored on disk for later retrieval. The file system is based on the principles of shared direct access and total security.

Development of turnkey computer systems now represents the major portion of the Special Systems activities. However, they continue to offer a wide range of services, including:

- . project management
- . facilities management
- . feasibility studies
- . system specification and design
- . hardware evaluation, selection and acquisition
- . design and selection of communications facilities
- . system operational audits
- . contract programming
- . complete turnkey systems

SHARP SPECIAL SYSTEM (Ottawa)
I.P. SHARP ASSOCIATES Ltd

(Cont'd)

Credentials:

Gross Sales:

1979 - \$24M
1980 - \$35M
1981 - \$50M (Projected)

Average Work Force:

Approximately 400 professionals with degrees from BSC through PhD, predominately Mathematicians, Engineers or Physicists, plus support staff.

Office Space:

Approximately 10,000 sq ft (Special Systems - all locations)

Equipment:

2 x Amdahl 480/V8
1 x VAX 11/780
n x PDP 11/34

Experience:

Timesharing

Using SHARP APL, many multinational companies and governments access private and public data bases in the following areas:

Socio/Economic
Financial
Commodities
Airline Schedules
Natural Resources

Process Monitoring and Control

- . Mail Handling Systems for Canada Post Office
- . Plant Monitoring System for General Electric Company
- . Process Monitoring Systems for Atomic Energy of Canada
- . Radar Control for Canadian Department of National Defense
- . Command and Control System for DDH280 for Canadian Department of National Defense

SHARP SPECIAL SYSTEM (Ottawa)
I.P. SHARP ASSOCIATES Ltd

(Cont'd)

Real-Time Information Display

- . Operational Information Display System for airports administered by Canadian Ministry of Transport
- . MAX-PAK, a micro film information system developed for Illinois State Police
- . Aviation Communication Measurement System, an airborne communication monitor for Canadian Ministry of Transport
- . Schiphol Airport Information System for the Amsterdam airport

Communications

- . The SHARPnet, designed and built by I.P. Sharp Associates Ltd to facilitate access to SHARP APL
- . X.25 compatible front-end processors and Network Interface Machines for Canadian Department of National Defense

Research & Development

- . Specification of secure Database Management System for USAF project Guardian
- . Implementation of Euclid compiler jointly funded by the US Defense Advanced Research Projects Agency (DARPA) and Canadian Department of National Defense
- . Front End Security Monitor for Canadian Department of National Defense
- . Formal Verification Methodology for Canadian Department of National Defense
- . Integrated Verification System for US Navy

Company: SHERRITT GORDON MINES Ltd

Address: Fort Saskatchewan, Alberta, Canada T8L 2P2

History:

A Canadian owned highly diversified company with a US subsidiary located in Portland, Oregon (Sherritt Fertilizers Inc). Sherritt was incorporated in 1927 as a mining company. In 1954, their processing plant at Fort Saskatchewan was opened. Located at this latter site is the Sherritt Research Center which is their R&D arm.

Capability:

Besides mining copper, zinc and precious metals and refining nickel and cobalt, Sherritt Gordon carries out R&D at their Research Center in the area of powder metallurgy. They are active in developing dispersion strength alloys and abradable seals for turbine engines. They are currently expanding their research activities to include cobalt rare earth magnets, wear resistant materials and continuous casting.

Credentials:

Gross Sales: (R&D Only)
Historical (1975-1978) - Approx \$1.9M average
(1979) - Approx \$2.0M

Projected: ---

Average Work Force - Research:

PhDs	- 13
MSs	- 3
BSS	- 21
Other	- 54

Equipment:

The Research Center is well equipped for process research in Hydrometallurgy and product research. This includes autoclaves, solvent extraction and ion exchange equipment, standard chemical laboratory equipment and an analytical laboratory. Also included are powder presses, smelting furnaces, rolling mills, vacuum induction melting equipment, flame and plasma spray guns. Physical testing equipment includes tensile testing, stress rupture, wear resistance, metallography, transmission and scanning electron microscopes, electron microprobe and x-ray diffraction.

SHERRITT GORDON MINES Ltd (Cont'd)

Experience:

A large portion of their total metal sales go to the US which includes fabricated metal products such as dispersion strengthened nickel and composite powders for turbine engines. The products, which may be used in military aircrafts, are sold to engine manufacturers. Sherritt is interested in doing business with the USAF when the research area is consistent with their research objectives. Research and development projects have been carried out under USAF contracts in the late 1960s and early 1970s. These contracts were in the area of dispersion strengthened nickel-chromium alloys. The research specifically dealt with improved oxidation resistance and mechanical properties.

Company: SIMTRON Ltd

Address: 494 Queensway, Unit 1
Peterborough, Ontario, Canada K9J 7L9

History:

Simtron, a Canadian owned high technology company, was incorporated in 1976. It is engaged in the design, manufacture and servicing of products for the communications, air, maritime and ground transportation markets. There are no other offices in Canada and no subsidiaries in the US.

Capability:

Simtron is basically an electrical/electronic design and manufacturing company that is divided into four principal operational groups - Research and Development, Electronic, Engineering and Manufacturing. The company also manufactures electronic equipment to customers specifications. Since its inception, Simtron has developed expertise in the areas of - 1) flight-rated and MIL standard equipment consisting of printed circuit board assembly, wiring and mechanical assembly to MIL standard quality levels, and the manufacture of flight-rated controls flown on commercial aircraft, 2) nuclear controls and test equipment consisting of circuit board artwork, board stuffing, inspection, testing and assembly of units into operating equipment, along with the assembly of associated hardware, and 3) control panels which include the specialty subdivisions of aviation test equipment, marine application motor controls and industrial motor control equipment. For the aforementioned areas, customers are offered engineering services (covering artwork design, drafting, equipment and component recommendations and design review, material list preparation and documentation, purchasing, expediting, and scheduling services), manufacturing and assembly of electrical/electronic and mechanical equipment, testing services (including design and manufacturing of jig equipment) and quality control.

The Electronics Group is primarily concerned with designing and supplying communications systems and equipment to the avionics and telecommunications industries and Government agencies. Specialties include multiplex integrated data transmission and acquisition systems, defense related electronics systems, transponder and receiver systems, ground-based avionics test simulators and control systems and equipment for the nuclear power generation industry.

The Engineering Group is composed of several subgroups that are responsible for the control support of all high technology projects. These subgroups are responsible for system performance, equipment design, mechanical design, manufacturing drawings and documentation.

SIMTRON Ltd (Cont'd)

The Manufacturing Group is staffed by approximately 100 people and equipped with modern manufacturing machines and computer aided production systems. The production facility is divided into a High Speed Labor Intensive PCB Assembly Area, High Quality Production and Assembly Area (MIL SPEC), Dedicated Quality Control Area, and an Engineering Support Area.

The Research and Development Group is currently dedicated to completing the development of an Integrated Multiplex Data Acquisition System.

Credentials:

Gross Sales:

1980 - \$1.6M
1981 - 2.4M (projected)

Average Work Force:

R&D	-	4
Eng	-	6
Technicians	-	11
Production	-	100
Others	-	9

Plant Size:

10,000 sq ft (capability to expand to 25,000 sq ft)

Experience:

Present customers include Northern Telecom Ltd, Canadian General Electric Ltd, Canadair Ltd, Menasco (Aerospace), National Research Council, CAE Electronics Ltd, Bell Helicopter (US) and Rockwell International (US). They are making strides towards expanding their marketplace into the US and are interested in doing business with the USAF.

Company: SLACAN
Division of Slater Steel Industries Ltd

Address: 681 King St W
Hamilton, Ontario, Canada L8N 3E7

History:

Slacan was incorporated in the Province of Ontario in 1962.

Capability:

Slacan is an operating division of Slater Steel Industries Ltd with its head office and manufacturing facilities located in Hamilton, Ontario. They are the largest Pole Line Hardware manufacturer in Canada, providing more than 2,000 different items for the electrical, transmission and communication markets. The divisions product lines are engineering orientated. They claim a reputation for excellence of design, high quality of manufacture and long service in the field. Their business areas of interest are - aluminum castings, steel forgings, and steel stampings. They operate under quality control levels outlined in CSA Z299.3 and under Military Specifications MIL-C-6021, Class 2A, 2B Grade B and D for castings.

Specific capabilities are outlined below:

Aluminum Castings - permanent mold up to 50 pounds; sand mold up to 150 pounds; Feron, CO₂ and shell cores; and material poured - 125, 135, 234, 432, 6377, Almag 35, B226, A357, etc. Reference - all aluminum castings for the ballistic fire control computer developed by Computing Devices for the US Army main battle tank XM-1.

Stampings - Steel - a total of 85 units comprising of open back inclines to 135 ton capacity, straight sided single action presses to 200 ton capacity, double acting deep draw to 300 ton punch and 200 ton blank holder capacity, hydraulic brakes to 400 ton capacity with 14 ft bed including 2 ft horn. The above equipped with air clutches, brakes and cushions.

Credentials:

Gross Sales:
No Data

Average Work Force:
Total - 250

Plant Size:
190,000 sq ft (manufacturing area)

SLACAN (Cont'd)

Equipment:

Forging Equipment - board hammers up to 2000 pounds capacity (4); electro-hydraulic hammer 4000 pounds capacity (1); forging press 700 tons capacity (1); hot headers 2" capacity (3); hot header 1½" capacity (1); and various trim presses and furnaces.

Finishing Equipment - Machining limited, however, includes milling, turning, drilling, threading and tapping. Other facilities include welding, cleaning, painting, hot dip galvanizing, heat-treating - steel and aluminum, and Tool Engineering.

Experience:

No specific information was given on experience except for their work with Computing Devices Co (Aluminum castings for the ballistic fire control computer for the XM-1 main battle tank).

Company: SPAR AEROSPACE Ltd

Address: Corporate Headquarters
Suite #3690, South Tower
Royal Bank Plaza
P. O. Box 83
Toronto, Ontario M5J 2J2

Space & Electronics Gp,
Remote Manipulator Systems Div
1700 Ormont Drive
Weston, Ontario M9L 2W7

Satellite Systems Div
Aerospace & Communications Systems Div
21025 Trans-Canada Highway
Ste-Anne-de-Bellevue, Quebec H9X 3R2

Defense Systems Div
P. O. Box 13050
Kanata, Ontario K2K 1X3

Mechanical & Electrical Gp
Gears & Transmissions Div
Repair & Overhaul Div
825 Caledonia Road
Toronto, Ontario M6B 3X8

The Copter Shop
1190 McTavish Road North East
Calgary, Alberta T2K 7G6

Northway-Gestalt Corporation
1450 O'Connor Drive
Toronto, Ontario M4B 2V2

History:

Spar Aerospace Ltd, a Canadian owned company, commenced operations as a public company in Jan 1968, following the acquisition of the Special Products & Applied Research (SPAR) Division of The de Havilland Aircraft Company of Canada Ltd.

In 1960, they bought the assets of York Gears Ltd, and in 1972 acquired Astro Research Corporation of California. In 1977, the Government and Commercial Systems Division of RCA Ltd was acquired, and in the same year Spar purchased certain assets of the space electronics manufacturing unit of Northern Telecom Ltd. In 1978, the Copter Shop of Calgary, Alberta was acquired.

SPAR AEROSPACE Ltd (Cont'd)

In 1980, the company acquired Northway-Gestalt Corporation which was founded in 1946 and is the largest mapping company in Canada. Northway-Gestalt acquired Aerial Graphics of Colorado Inc of Denver in July 1980 in order to establish an operating base in the US.

Capability:

The company is engaged in the design, development, manufacture and servicing of systems and products for the aerospace, communications, remote sensing, aviation and mapping markets.

Aerospace - Spar's largest single project to date is the development of the Remote Manipulator System (RMS) for the US Space Transportation System. The first RMS is being produced in Canada under an agreement between the National Research Council of Canada (NRCC) and the National Aeronautics & Space Administration (NASA). Spar was the prime contractor to NRCC for the design, development and manufacture of this flight system under contracts valued at about \$95 million. In 1979, NASA placed a contract with the Canadian Commercial Corporation for Spar to build three additional systems at a cost of some \$60 million. Delivery of these systems to NASA is scheduled for 1982, 1983 and 1984. The RMS comprises a 15 metre (50 ft) long mechanical arm with joints similar to a human shoulder, elbow and wrist. It is operated by an astronaut to deploy satellites and other space payloads from the Space Shuttle's cargo bay, and to retrieve them for on-board servicing or return to earth. The RMS is capable of handling payloads weighing up to 30,000 kilograms (65,000 pounds).

The company is also working on several non-space applications of the advanced manipulator system. In 1980, Ontario Hydro awarded Spar a contract to perform design studies on the use of remote manipulator systems in the maintenance of nuclear reactors. Programs to test manipulators for under-water applications and to adapt them to medical use for handicapped people have also been undertaken.

Through Astro Research Corporation, Spar designs and develops light weight portable structures for space and ground applications. These include the patented STEM product line and the Astromast deployable structures which support large solar-cell arrays on satellites. Astro is currently supplying support structures and systems for the Large Space Telescope, a joint project of NASA and the European Space Agency (ESA).

Communications - Spar is the principle supplier in Canada of satellite communications systems which include satellites and satellite subsystems and land-based earth stations. The design and fabrication of structures and payloads for the following Canadian satellites which are now in orbit was done by Spar - the Alouette I and II, the ISIS I and II, the Anik A series, and the Hermes satellite. For the Anik B, Spar produced the payload.

SPAR AEROSPACE Ltd (Cont'd)

Hughes Aircraft Company of Los Angeles in 1978 awarded Spar \$20 million sub-contracts for work on the Anik C satellite scheduled to be launched in 1982. The project comprises certain design functions and the manufacture and testing of communications payload systems - transponders and antennas - power, attitude and stability controls, spacecraft structures and thermal controls.

In 1979, Spar was awarded a \$78.6 million prime contract by Telesat Canada Ltd, to supply two 24-channel Anik D communications satellites - the first such prime contract to be won by a Canadian company. For this program, the Federal Government has enlarged the facilities at the David Florida Laboratory near Ottawa, providing a capability for the integration and testing of large satellites which up to now has not been available in this country. RCA Astro Electronics Division in 1980 granted the company a \$2.2 million contract to supply the antenna system for the Satcom E commercial satellite which is expected to be launched in 1981.

The company manufactures satellite earth stations and equipment and microwave components for markets in Canada and abroad. Major current projects consist of a \$17 million contract from Ghana for an earth station and related components, and a \$3.6 million contract from Embratel of Brazil to supply communications equipment for earth stations. To date, Spar has supplied 82 earth stations to 14 different countries.

Remote Sensing - the company is a leader in the field of remote heat sensing technology, having worked for more than 15 years to develop a unique passive infrared surveillance system which detects ships, missiles and aircraft for defense and navigation purposes. In 1977, a Spar-developed system was tested by the Canadian Navy on a destroyer and a similar system was evaluated on land and sea by the US Navy in 1979. Following the success of these trials, the Canadian and US Governments have been engaged in negotiations to facilitate, on a joint basis, the final pre-production development phase of the program.

Aviation Services - the manufacture of gears and transmissions has been a basic part of the operations since 1969. Spar designs, manufactures, assembles and services gear boxes and transmissions for engines in jet aircraft and helicopters. It also manufactures gears for the RMS, the joints of which comprise large and intricate gearboxes.

The company produces accessory gearboxes for General Electric's J85-21 (F-5E/F aircraft) and the T700 (Black Hawk, Sea Hawk, AAH and Bell 214ST helicopters) engines, manufactures tail rotor and intermediate gear boxes and main rotor shafts for the Sikorsky S.76 helicopter.

SPAR AEROSPACE Ltd (Cont'd)

Spar fabricated the transmission and other components for the Boeing-Vertol CH-46 Chinook helicopter, and also produced the transmissions and gears for the Westland Lynx helicopters (UK) and the gearbox components for the Puma helicopter made by Aerospatiale of France.

In 1980, General Electric's aircraft engine group awarded contracts to Spar for more than \$10 million to produce gearboxes and components for several aircraft and helicopter engines, including the new J79-17X engine development program.

The company provides repair and overhaul services (R&O) for a wide range of military and commercial aircraft instruments and mechanical components, servicing such customers as Nordair, Pacific Western Airlines, Aeromexico and Quebecair. Through the Copter Shop, Spar performs full maintenance services on helicopters. R&O services cover electrical, oxygen, navigational, auto pilot, hydraulic, and air conditioning systems, constant speed drives, accessory gearboxes and components of electrical, flight control and heating systems.

A large part of the business is derived from agreements with 17 aircraft equipment manufacturers which have appointed Spar a Canadian "service station" for their products.

In 1980, Spar and Sperry Inc., a subsidiary of Sperry Corporation of New York agreed to establish "a continuing business relationship" to pursue contracts for "the life-cycle support military and commercial aircraft and ships". This business combination has the technology and skills to service the new generation of computerized aircraft instruments and systems.

Mapping Services - Northway-Gestalt acquires, analyzes and displays information of the earth's terrain on conventional graphic maps and converts these maps to computer language - digital mapping. The company's major technological asset is the Gestalt automated mapping system of which the unique Gestalt Photo Mapper (GPM) is the major component.

The GPM using electronics and optics scans aerial photographs, collects up to 700,000 height elevations per orthophoto, analyzes and correlates this data in a computer, and produces Gestalt Orthophotos - highly accurate photographs in which the distortions in the terrain caused by aerial photography have been mathematically corrected; and Digital Elevation Models (DEMs) - computer-produced maps on mechanical tape which contain precise elevation data essential to the accurate plotting of contours, slopes and horizontal and vertical measurements.

Northway-Gestalt sells about one-half of its services to clients in the private sector including forestry, surveying, natural resource, utility and engineering companies. The balance is sold to governments and the

SPAR AEROSPACE Ltd (Cont'd)

agencies for use in resource evaluation, setting environmental standards, and for land use studies.

Research and Development - R&D has been an important activity since the company's inception and has contributed greatly to the success of Spar. In the past five years, more than \$13 million has been invested in R&D, including grants and contributions from governments. About 20% of the time of Spar's engineering staff is spent on R&D projects. The company maintains its own specialized engineering laboratories which have direct access to large-capacity scientific computers.

Credentials:

Gross Sales:

1979 - \$108.8M

1980 - \$127.7M

Average Work Force:

S&E and Technologists - 600

Others - 1400

Plant Size:

Spar maintains facilities at Toronto (2); Ste-Anne-de-Bellevue, Quebec; Kanata, Ontario; Calgary (The Copter Shop); and Carpinteria, California, USA (Astro Research). Northway-Gestalt has facilities in Toronto; Dartmouth, Nova Scotia; Vancouver, BC; and Denver, Colorado, USA. In total, these facilities occupy about 630,000 sq ft.

Experience:

Spar's services, systems and products are marketed to governments and their agencies, commercial airlines, manufacturers of aircraft, aircraft engines and parts, and engineering and industrial companies. Some of these contracts are outlined in detail in the Capability Section. Countries include Canada, US, Western Europe, Asia, Australia and Africa. Most work is performed under a design, development or production contract, or a combination of the three. Development contracts cover design work, including production of a prototype, while production contracts include all forms of manufacturing.

Spar's sales to the US total about 20% of which about 8% are to the US military (less than 1% to the USAF). Most US military sales are indirect through subcontract to US contractors for aircraft equipment in the electro-mechanical field.

Company: SPARTON OF CANADA, Ltd

Address: P. O. Box 5125, Terminal A
100 Elm St
London, Ontario, Canada N6A 4N2

History:

Incorporated under Federal charter in 1930, Sparton of Canada Ltd is a wholly owned subsidiary of Sparton Corporation, Jackson, Michigan.

Capability:

Development, engineering, and manufacture of specialized electric products for the military, industrial and Original Equipment Manufacture (OEM) markets.

R&D activities include development of a directional command active sonobuoy, new improved low noise passive sonobuoy, and a low noise hydrophone; switched and ferro-resonant power supplies.

Engineering Department staff covers professional disciplines of Electrical/electronic engineering, mechanical engineering, physics, flow dynamics, and hydroacoustics. Experienced in the preparation and management of engineering projects from proposal through to implementation (development, specifications, testing, production).

Sparton of Canada Ltd is a qualified producer meeting the requirements of DND 1015 and US MIL-9858A Quality Assurance Programs. There is a resident military QC detachment on the premises. Cleared by DSS Industrial Security for projects up to SECRET classification.

Current product lines are active and passive sonobuoys for military customers; heavy duty low voltage regulated power supplies for large computer systems.

Credentials:

Gross Sales:

1979 - \$8.0M
1980 - \$7.3M
1981 - 16.0M (Est)

Average Work Force:

Production:	250 - 300
Engineering Dept:	PhD - 1
	MSc - 1
	Phys - 1
	Eng - 7
	Techs - 19
	Others - 10

SPARTON OF CANADA Ltd (Cont'd)

Plant Size:
170,000 sq ft

Equipment:

Complete facilities for the forming, milling, and treatment of sheet metal and aircraft alloy type 7075. Engineering facilities include fully equipped laboratories, hydrodynamic test tank, access to CAD programs; computer terminal access to CDC CYBER 73/16, DEC System 10, GE MK3 System (IBM 3033).

Experience:

Since 1954, supplier of passive sonobuoys to the Canadian Government. Since 1970, supplier of omni-directional Range Only (RO) active sonobuoy to the Canadian Government and to other overseas users. Since 1979, sole source supplier of RO active sonobuoy (AN/SSQ-47B) to USN and to other overseas users. In 1976-1978, completed development of Canadian Command Active Sonobuoy System for Canadian Government. OEM supplier of two types of regulated power supplies to NCR, Waterloo, Ontario.

Company: SPERRY UNIVAC DEFENSE SYSTEMS
A Division of Sperry Canada Inc

Address: 311 Saulteaux Crescent
Winnipeg, Manitoba, Canada R3J 3C7

History:

Sperry Univac's Winnipeg Manufacturing Plant was established in 1977 as the first facility of the Defense Systems Division of Sperry Univac to be located outside of the continental US. The establishment of this plant was a direct result of the Procurement Policy of the Canadian Department of National Defense as it related to the CP-140 Aurora Patrol Aircraft. The company operates exclusively at the Tier 3 level of the industry. The initial plant charter was to assemble components for the Univac CP-140 Computer which is the heart of the sophisticated computer technology developed for submarine detection. This computer is also deployed on the US Navy P3C and S3A Aircraft.

A Systems Engineering and Marketing facility was established in Ottawa in December 1980 to assist in the integration of the Engineering Systems requirements for the Canadian Patrol Frigate Program with hardware design, manufacturing and system integration efforts in Winnipeg.

Capability:

The charter of the Winnipeg Plant has expanded from assembly to complete design, development, testing and system integration of its own product line. Presently, the Winnipeg plant is engaged in assembly and test of coil wound products, power supplies, magnetic tape transports, maintenance consoles, switches, printed circuit assemblies, harnesses and the start up of a product mandated Micro-computer.

The rapid expansion of their areas of endeavor required a new facility which started operation in April 1981. The new plant has the latest in high technology manufacturing, test and office facilities, and is certified by the Department of National Defense as a manufacturer and repair facility of electronic equipment. The final test area contains environmental chambers that meet the complete range of military specifications and are large enough to accommodate entire computer and avionics systems. Random vibration capabilities will be installed to meet the workmanship screen required on all new Canadian and International Avionics Military Procurements. Sperry Univac recently started development of the AN/UYC-501 (V) SHINPADS (Shipboard Integrated Processing and Display System), a product conceived by the Canadian Forces for use on the new Canadian Patrol Frigates.

SPERRY UNIVAC DEFENSE SYSTEMS (Cont'd)

Credentials:

Gross Sales:

1980 - \$1.5M
1981 - \$5M (projected)
1982 - \$10M (projected)

Average Work Force:

Engineers - 15
Manufacturing -105
Admin - 23

Plant Size:

40,000 sq ft (Winnipeg Facility)
5,000 sq ft (Ottawa Facility)

Equipment:

Environmental Test Chamber
Random Vibration
Automated Card and Final Test Systems
Flow Solder
Component Lead Formers
Semi-Auto Dip Insertion
Static Controlled Work Stations

Experience:

Major supplier of high technology, reliable and ruggedized information handling products and systems. Customers include the US military, US industry, and International military procurements.

Company: SPILSBURY COMMUNICATION SYSTEMS

Address: 120 East Cordova Street
Vancouver, British Columbia, Canada V5A 1L1

History:

A Canadian owned company incorporated in 1941. They maintain a branch office in Halifax, Nova Scotia, and have no US subsidiaries.

Capability:

The company specializes in radiotelephone equipment, antennas and navigational aids. Their solid state equipment is designed for long range frontier and costal marine communications. They developed and now manufacture HF single sideband radio communication equipment for land and marine use, fixed and mobile. They are also concerned with the overall concept of providing a system of communications rather than with the manufacture of specific units. One of the major areas of innovation in this field has been the design of unique series of antennas which increases the effective communicating power of a radio by ten to fifteen times over a conventional installation. These Spilsbury center-loaded, variable tuned HF whip antennas are used in portable, mobile and fixed service on land, sea and air. In addition to the above, Spilsbury manufactures full range, VHF FM radiotelephone equipment for mobile and fixed station land or marine use. Other specilized equipment includes a non-directional low frequency beacon system to be used for medium range aeronautical or marine navigation and locator beacon installation. The beacon transmitter is equipped with a unique top-loaded variable tuned antenna system.

Credentials:

Gross Sales:
1980 - \$3.5M
1981 - \$5M
1982 - \$6M forecast

Average Work Force:
Professional (Technical) - 16
General Assembly - 20
Other - 29

Plant Size:
18,000 sq ft

Experience:

Spilsbury equipment is used in over 50 countries including Canada and the US. Although there has been no direct sales to the USAF, they are interested in increasing their US sales.

Company: SYSTEMHOUSE Ltd

Address: 99 Bank St, 3rd Floor
Ottawa, Ontario, Canada K1P 6B9

History:

A privately owned Canadian company incorporated in mid 1974. The head office is located in downtown Ottawa while branch offices are located across Canada (Vancouver, Edmonton, Calgary, Winnipeg, Toronto, London, Montreal & Halifax). A US subsidiary is located in Washington, DC and a Project Office in Ft Lauderdale, FL.

Capability:

The business areas committed to by Systemhouse are business systems, health care systems and mapping and photogrammetry. They have successfully completed assignments in a variety of disciplines that include systems requirements studies, development and implementation of computer systems, computer systems audits and evaluation, education, project management and the complete provision of turnkey computer information systems. They offer expertise in the areas of consulting services, systems development services, technical development services, application management services, and minicomputer services.

Specific expertise in consulting services includes management science, information requirements analysis, management control systems, organization planning, EDP administration and policy analysis. In systems development, special areas of expertise include project management, computer technology, systems design and computer programming. Technical development services provide and develop expertise in the area of data base and communication systems and designs and provides educational offerings relating to data base and computer communications. After-sale service is provided. Mini-computer service develops and provides expertise in the area of minicomputer and microcomputer solutions from the traditional business-oriented applications or order-entry, accounts payable, accounts receivable and payroll to the leading-edge integration of hardware/software systems.

Research and development in the area of data communications centers around network architectures and standards for videotex, office communications, process control networks and open system inter-connection. Research projects in these areas include the definition of a Videotex Network Architecture (Telidon) and the design and specification of an Information Provider System to Videotex host protocol. R&D in the communications systems software development include inter-network communications, packet network interfaces, communications drivers and network control and management software. They also have expertise in communications applications software such as specialized intelligent terminal firmware and in advanced protocol converters/emulators. In the area of photogrammetry, they have developed an analytical stereoplotter that makes use of current computer hardware and software technology. Their cartographic systems include Automap for map production and Autochart for nautical chart production.

SYSTEMHOUSE Ltd (Cont'd)

Credentials:

Gross Sales:
1981 - \$35M

Average Work Force:
Total - 700 (80% professional)

Plant Size:
23,000 sq ft (R&D)
30,000 sq ft (other in Ottawa)

Experience:

Systemhouse clientele includes Canadian Federal and Provincial Governments, the Australian Government and private industry. Approximately 15% of their sales are to the US. They have no sales to the US military, but are interested in doing business with the USAF.

Company: TECHNIMECA Ltd

Address: 380 Montee de Liesse
St Laurent
Montreal, Quebec, Canada H4T 1N8

History:

A Canadian owned company incorporated in 1972. There are no other Canadian divisions and no US subsidiaries.

Capability:

The company specializes in precision machining. They primarily manufacture parts for aerospace, electronics and commercial industries. Small and medium size parts are manufactured and assembled from solid bar, forgings and castings to military specifications or specific customer requirements. They have the facilities to work with aluminum, magnesium, brass, plastics, steels, stainless steels, copper, beryllium copper, nickel and titanium. Other materials have been machined utilizing various special techniques. Their inspection facility includes equipment such as a coordinate measuring machine, optical comparator, hardness tester, checkers for surface roughness and gears and various types of gages and measuring devices. Because of the innovative manufacturing techniques required in the precision parts industry, selected employees undergo a comprehensive and ongoing training program.

Credentials:

Gross Sales:
1980 - \$1M (striving for 50% export)

Average Work Force:
Total - 36

Plant Size:
20,000 sq ft

Manufacturing Capability:

The Technimeca manufacturing capability is supported by equipment for turning, machining (numerical control), jig boring, gear cutting, milling, duplicating, grinding, drilling and bending. Other miscellaneous equipment common to machining facilities are present.

Experience:

Technimeca is interested in bringing in work from the US and appear to be capable of carrying out work for the USAF. Past and present customers include Pratt & Whitney, Rolls Royce Canada, General Electric (US), plus other companies from the US and Canada.

Company: TRACKER INDUSTRIES Ltd

Address: 246 Jane St
Toronto, Ontario, Canada M6S 3Z1

(Mailing Address)
P. O. Box 1094, Station A
Toronto, Ont, Canada M5W 1G6

History:

Tracker Industries was incorporated in 1974. It is a wholly owned Canadian company with no other Canadian locations.

Capability:

They are engaged in custom design and prototyping (R&D) of analog and digital electronic circuits. Specifically, the company R&D areas include microprocessor applications engineering (hardware and software) and programming. Microprocessors generally used in the past include the 6800, 6809, 8080 and 8085. They have experience with the following computer languages - Assembly, Basic, Pascal, Forth, Fortran and Ada (1982 activity). Their programming applications have been in the areas of environmental, biomedical, avionics, data communications, data acquisition and monitor/control systems, and their design and prototype work has been primarily directed to handheld, portable equipment. The 68000 microprocessor will be used in 1982. In the area of network systems (X.25, HDLC, SDLC and local data communications), the company is generally involved in the consulting or interfacing areas.

Credentials:

Gross Sales:
\$0.1M/year

Average Work Force:
Eng - 2-3
Others - 2

Plant Size:
1,000 sq ft (expandable to 3,000 sq ft)

Experience:

Tracker Industries clients include General Motors of Canada, Bell Canada, other corporations and universities and the federal and provincial governments. Products include data communication networks, data terminals and public telecommunications equipment.

Company: UDT INDUSTRIES Inc

Address: 2125 East, St-Catherine
Montreal, Quebec, Canada H2K 2H9

History:

Incorporated in 1942 under the name of Universal Die & Tool. Changed name to UDT Industries Inc in 1975 to reflect more accurately machine shop business. Company is Canadian owned. There are no other Canadian or US subsidiaries.

Capability:

UDT's major product is machined parts ranging from light-medium to hard core items, such as; fittings, splice plated, hinges, bulkheads, slat-tracks, spars, dog leg, spar caps, leg assemblies, etc., made from plate stock, forgings, extrusions, aluminum alloys, steels, titanium, etc. CNC and conventional equipment are utilized.

Alluminum alloys heat treating electrical air furnace is part of UDT's capability, 5 ft diameter by 18 ft high, it is continuously performing quench & age hardening of major structural parts for McDonnell Douglas & Lockheed Aircraft from AL-AL 7075 T 411 & 2014 T 411 condition F to T6 or T73 condition.

UDT work to MIL Q9858 A and DND 1016. Tolerances are maintained as per customer's requirements.

Credentials:

Gross Sales:

1979 - \$3.6M
1980 - \$4.4M

Average Work Force:

Engineer - 1
Inspectors - 5
Machinists - 40
Others - 24

Plant Size:

60,000 sq ft
15,000 sq ft (Additional July/1981)
6,000 sq ft (Additional Oct/1981)
14,000 sq ft (Renewed Oct/1982)

Equipment:

NC equipment includes vertical machining centers, horizontal machining center, vertical profiling milling machines, vertical profiler bed type (3 & 4 axis).

UDT INDUSTRIES INC (Cont'd)

Experience:

Customers include - McDonnell Douglas Canada Ltd (DC 9, DC 10), Canadair (from T33 to Challenger), Enheat, DeHavilland Aircraft, Fleet Industries (Lockheed Product), NATO, USAF, CCC, DND, Rohr, Research & Development Canada (Propulsion Pod) and ITT Gilfillan (Antenna Radar).

Company: ULTRA LASERTECH Inc

Address: 6415-2 Viscount Road
Mississauga, Ontario, Canada L4V 1K8

History:

A small Canadian high technology company incorporated in 1979 with a laser technology base and licensing derived from RCA. There are no other Canadian divisions and no US subsidiaries.

Capability:

They are engaged in the design and manufacture of custom CO₂ lasers and wave guide lasers. They are involved in R&D associated with laser photoacoustics, laser spectroscopy and laser communications and radar. Other areas of expertise include remote sensing, pollution detection, ultra high power laser modeling and design and laser applications. Their product line includes sealed, continuous wave, isotopic CO₂ lasers; tuneable CO₂ lasers; a CO₂ laser optoacoustic detector; industrial type sealed CO₂ lasers; laser power supplies and mirror mounts.

Credentials:

Gross Sales:

1979 - \$313K
1980 - \$300K
1981 - \$422K

Average Work Force:

Total - 6 full-time
3 part-time

Plant Size:

3000 sq ft - R&D laboratories
800 sq ft - Production Facility

Experience:

Since their start in 1979, Ultra Lasertech has been engaged in the development of a laser optoacoustic trace gas analyzer, a commercial laser cavity enclosure and an industrial CO₂ laser. Other projects have included determining the laser optoacoustic signatures of PCBs, developing a tuneable sealed ¹³CO₂ laser system, a sealed ¹⁴CO₂ laser tube and a balanced dual spectrophone chamber and measuring water vapor absorption at isotopic CO₂ laser wavelengths. Their optoacoustic trace gas analyzer is being designed specifically to measure nitric acid vapor although it is applicable to a large number of contaminants of environmental concern. The analyzer is being designed to detect the acidic vapor down to the lower limit of less than 1 ppb for field operational use. The present status is detection at 10 ppb. Other gases studied during development include several freons, sulfur hexafluoride, ethylene, ammonia, butane, some explosives, PCBs, Jet A fuel and several other hydrocarbons. It is anticipated this technique will be suitable for detection of hydrazine.

Company: UNIROYAL Ltd
Government Products & Development Div

Address: 120 Huron St
P. O. Box 1120
Guelph, Ontario, Canada N1H 6N3

History:

Uniroyal Ltd is a wholly owned subsidiary of Uniroyal Inc of Middlebury, Connecticut, a world-wide organization which employs about 48,000 people in 94 plants and 175 branches around the globe. It was established in 1854. Today Uniroyal Ltd has approximately 3,700 employees in 11 plants and 11 branches and warehouses across Canada. Directly under the cognizance of the Government Products & Development Division are the Guelph R&D Laboratories, Kitchener Machinery Shops, Kitchener Textile Plant and the Lindsay Textile Plant. Other plants not directly under the cognizance of the division are the Kitchener Tire Plant, Lindsay Tire Cord Plant, Bracebridge Belting Plant, Papineau Hose Plant, and the Elmira and Clover Bar (Alberta) Chemical Plants. The division however, can call upon the services and expertise of these other organizations.

Capability:

Uniroyal has embarked on an increasing R&D program aimed at developing new high technology products and manufacturing processes. Significant R&D growth has occurred during the past fifteen months in the areas of polymer chemistry, Arctic material development, chemical warfare protection, advanced composite processing, tank track design and lightweight composite armor. The research center (R&D Laboratories) has, for example, developed many new and improved plastic and elastomer products, discovered many new chemical products (fungicides, herbicides, insecticides, rubber chemicals and pharmaceuticals) and is involved in a major research effort in the area of pollution control.

The diversified activities of the division are clearly shown by the following description of some of the ongoing projects:

a. Production projects include the development and production of landing bags for the Canadair CL-89 Airborne Surveillance Drone. This drone is in service in Europe with the armed forces of the UK and West Germany (probably France and Italy by this writing). Also included in this category are air mattresses for the Canadian Forces, air mattress stoppers and felt for commercial ammunition.

b. The research and development projects carried out at the division are extremely diversified and are outlined below:

. Cairbed for burn victims. The victims literally float on a bed of air. This project is in the prototype phase.

UNIROYAL Ltd (Cont'd)

- . New polymer for an NBC face mask.
- . Drone propeller made from carbon fiber composite.
- . Tank track components for potential use by the US Army (XM-1) and the Canadian Forces.
- . Composite armor primarily for helicopter use.
- . Collapsible containers for liquids.
- . Elastic trunk material for an air cushion vehicle.
- . Air inflatable skids for APCs and tanks.
- . Run flat military tire.
- . Microwave curing of tank track elastomers.
- . Pentose fermenting yeast for alternative fuel (Alcohol) production.
- . Epoxy fortifier (potential for the National Research Council of Canada).
- . C130 fuel delivery system consisting of 1000 gallon collapsible containers.
- . Lightweight recoilless gun.
- . NBC protective clothing.

The product line of the Kitchener Textile Plant is landing bags for the Canadair CL-89 Airborne Surveillance Drone, NBC warfare protective clothing for the Canadian Department of National Defense and other NATO nations, military air mattresses, felt boat liners for the military and ammunition felt. Their Lindsay Textile Plant is in the process of re-equipping for NBC warfare protective clothing manufacture.

The Kitchener Machinery Shops is equipped with machinery for the automotive assembly line, tire molds, calendars, banbury mixers, pulp and paper processing and various other equipment and machines for a wide variety of industrial processes.

Credentials:

Gross Sales: (Uniroyal Ltd)
1979 - \$310M
1980 - \$341M
1981 - \$358M (projected)

UNIROYAL Ltd (Cont'd)

Average Work Force:

Total - 3,735

Research Center - 100 (PhDs - 18; Eng - 57)

Plant Size:

Guelph R&D Laboratory - 141,000 sq ft

Kitchener Machinery Shops - 60,000 sq ft

Kitchener Textile Plant - 111,000 sq ft

Lindsay Textile Plant - 55,000 sq ft

Experience:

Uniroyal Ltd has extensive experience with the Canadian Government and in particular with the Department of National Defense. Their total sales to the US in 1980 was around \$63M. They have essentially no sales to the US military, but are actively seeking business with both the USAF and the US Army. Their USAF interests lie in the air cushion vehicle area and their USA interests in the tank track component area.

Company: URBAN TRANSPORTATION DEVELOPMENT CORPORATION Ltd

Address: 2 St Clair Ave W
Toronto, Ontario, Canada M4V 1L7

History:

The Urban Transportation Development Corporation Ltd (UTDC) was established in 1973 to design, develop and market new transit equipment and systems. Other Canadian locations include Project Offices in Hamilton, Ontario; and Vancouver, British Columbia; the Transit Development Center in Kingston, Ontario; and another office in Wychwood (Toronto), Ontario. The company maintains an office in the US - Arlington, VA, UTDC (USA) Inc. UTDC is Canadian owned.

Capability:

As mentioned above UTDC's main objective is to develop new, rail-based transit systems. Some of their vehicles/systems are described below:

Intermediate Capacity Transit System - a automated system that has the capability of transporting in excess of 25,000 people per hour.

Canadian Light Rail Vehicle - a single ended, 4 axle rigid vehicle capable of operating singly or in trains of up to six units. Propulsion by two, 220-HP motors, each driving two axles (440 HP per car). Solid state chopper control with blended, regenerative braking.

Articulated Light Rail Vehicle - a single-ended (double-ended optional), i.e., axle vehicle, capable of operating singly or in trains of up to three units. Propulsion by two 245-HP motors, each driving two axles (490 HP per car). Solid State chopper control with blended, regenerative braking.

All UTDC research and development in the ground transportation area is carried out at their Kingston facility, UTDC Research and Development Ltd. All projects are product delivery programs and all exploitation of technology advances and designs already acquired are carried out by Metro Canada Ltd. This division, located in Kingston, manufactures and installs all transit systems and related hardware products. It includes the Transit Development Center. New R&D areas will be the development of hydrogen storage and fuel systems to be equipped on two demonstration transit buses.

Credentials:

Gross Sales:
No Data

URBAN TRANSPORTATION DEVELOPMENT CORPORATION Ltd (Cont'd)

Average Work Force:

Total number not provided, however, 45.4% are Engineers or have PhDs, and 45.5% have college/university degrees.

Plant Size:

None

Planned for 1981 - 40,000 sq ft

Equipment/Unusual Facilities:

Included in this category are - Training facilities, Propulsion development laboratories, Transit Test Track, SELTRAC-Vehicle command control and communication system, and Energy test lab.

Experience:

Major customers include - Toronto Transit Commission; San Francisco Municipal Railway; Transport Canada; Royal Commission on Electric Power Planning; Olaco Ltd; Ontario Northland Railroad; California Dept of Transportation; Dept of Transportation US; Santa Clara County, California; and MBTA-Massachusetts Bay Transportation Authority.

Some major projects include:

Steerable Truck Retrofit Design - develop a preliminary design to modify an existing heavy rail transit truck to make it steerable for the US DOT.

Transit Management Advisory Services - a Study (including recommendations) of San Francisco Municipal Railway Maintenance Procedures, and the implementation of improvements for the city of San Francisco.

LRT Training Program - develop an Operations training program for San Francisco's new underground light rail transit service for the city of San Francisco.

Transportation Advisory Services - evaluate and recommend ways and means to upgrade rail commuter services between San Francisco and San Jose for the California DOT.

Santa Clara County Life Cycle Costing Demonstration Project - develop, demonstration and validation of life cycle cost procurement methodology for the purchase of transit coaches for Santa Clara County, California.

Canadian Light Rail Vehicles - design, develop and delivery of 191 Light Rail Vehicles for the Toronto Transit Commission.

URBAN TRANSPORTATION DEVELOPMENT CORPORATION Ltd (Cont'd)

Hydrogen Powered Buses - develop hydrogen storage and fuel systems and equip two demonstration transit buses to use hydrogen for the Ministry of Energy, Province of Ontario.

Composite Flywheel Materials - prepare a development program for the design and testing of composite materials for flywheels for the National Research Council of Canada.

Rotary Powered Steerable Rail Truck - preliminary design of a steerable rail truck with AC rotary propulsion for Transport Canada.

Company: VALCARTIER INDUSTRIES Inc

Address: P. O. Box 790
Courcelette, Quebec, Canada G0A 1R0

History:

Valcartier Industries was incorporated in 1967. The initial business was started in 1880 and was called Dominion Arsenals. The original site was located in Quebec City, but in 1933 it was moved to a new 500 acre site at Val Rose, 15 miles outside Quebec City. A second plant, located within the city, produces heavy artillery cases. Valcartier Industries is Canadian owned and is a wholly owned subsidiary of the SNC Group.

Capability:

Valcartier Industries is a manufacturer of high quality, small and heavy arms ammunition, both military and commercial. It is the only Canadian small arms ammunition manufacturer and supplier to the Canadian Forces. They operate their own foundry and produce brass, lead and gilding metals required for the manufacture of ammunition. Valcartier ammunition conforms to NATO specifications. Their plant is equipped with its own water wells, water treatment plant and industrial waste treatment plant.

Valcartier manufactures various small arms ammunition such as the NATO 7.62mm round. All dies, punches, tool holders and other tools are produced in-house. The precision tooling is used for both sporting and military small arms ammunition, as well as for all artillery ammunition in the 40mm to 4-inch naval shell range. The casings for the various calibers, including 105mm tank gun cases and field artillery cases, are produced in their Louise Basin manufacturing facility in Quebec City.

Valcartier maintains high quality control standards through rigid and numerous destructive and non-destructive inspection checks following the various stages in the manufacturing process. For example, during the production of the 7.62mm round, there are fifteen separate inspections, beginning with a test for impurities in the base metals after melting, right on through to a final inspection before packaging the finished rounds. They have a functioning Proof House and ranges for proof firing of all products.

Valcartier has recently started an R&D department whose aim is to improve present products and techniques and to provide ammunition research facilities capable of responding to military requirements. The department is equipped with a manufacturing capability, testing facilities, measuring devices and indoor and outdoor ranges.

VARCARTIER INDUSTRIES Inc (Cont'd)

Credentials:

Gross Sales:

Annual - \$45M

Average Work Force:

Total - 1,000 +

Plant Size:

Manufacturing - 500,000 sq ft

Warehouse - 84,000 sq ft

Total acreage - 500 acres

Experience:

Valcartier is the sole supplier of small arms ammunition and large caliber brass cases to the Canadian Forces. They export small arms ammunition to more than 20 countries, including the US, Norway, Belgium, Kenya and Indonesia. They are currently participating in the Advance Attack Helicopter project (US Army). They are the main source of 30mm aluminum cartridge cases. These cartridge cases are supplied to the Defense Systems Division of Honeywell, who in turn subcontracts them to Hughes Helicopter.

Company: VALLEYFIELD CHEMICAL PRODUCTS Corp

Address: P. O. Box 5520
Valleyfield, Quebec, Canada J6S 4V9

History:

Valleyfield Chemical Products Corp was started in 1940 and has been operating continuously every since. The complex has undergone two multi-million dollar modernization programs, the first in 1950-1952 and the second in 1977-1978. It was incorporated under the present name in 1977.

Capability:

Valleyfield is a fully integrated commercial and military propellant and explosives complex. It has its own capability to produce nitric acid, nitroglycerine, nitrocellulose, propellants and RDX. Nitrocellulose is produced by the batch process utilizing wood pulp of high alpha cellulose content and nitric acid produced at the plant. It also has the capability to produce nitrocellulose from cotton linters. Present plant capacity for nitrocellulose production is 12 million pounds per year with the capability to expand to 40 million pounds annually should the need arise.

They use the in-house produced nitrocellulose in the manufacture of single-base, double-base and triple-base propellants. The former are primarily used in small arms munitions, military or sporting, in medium caliber military ammunition and large caliber weapons in multi-perforated form. The double-base product is used mainly for small caliber sporting ammunition. The latter is used principally in large caliber guns. The plant produces its own nitroglycerine, using the Biazzi Process, for the manufacture of the double and triple base propellants. Nitroguanidine for triple-base propellant manufacture is purchased.

Valleyfield produces RDX by the Bachmann Process. It is manufactured to military specifications in various granulations as required. The RDX is mixed with TNT to produce cyclotol. Other products include Composition B, Compositions A-3 and A-4, and Compositions C-4 and A-5. Demolition Block M5-A1 and M.12 is also manufacturec at Valleyfield.

Credentials:

Gross Sales:
No Data

Average Work Force:
Total - 650

Complex Size:
1800 acre site

VALLEYFIELD CHEMICAL PRODUCTS Corp (Cont'd)

Experience:

Though its prime client continues to be the Canadian Department of National Defense, Valleyfield is one of the two accredited suppliers of propellant for the US Air Force GAU-8/A weapon system. With respect to the GAU-8 system, they supply Honeywell with both propellant and high explosive (Comp A-4) and Aerojet with Comp A-4. Other major clients in the US include Olin Corp (nitrocellulose for ball propellant), Ford Aerospace and Communications Corp (40mm Bofors Program), and E. I. DuPont de Nemours (propellant). Their US distribution for HE is GOEX. Valleyfield has received orders for its propellants and explosives from The Netherlands, Belgium, Portugal, Italy, France, Greece and Turkey.

Company: VARIAN CANADA Inc

Address: 45 River Drive
Georgetown, Ontario, Canada L7G 2J4

History:

Varian Canada Inc was established in 1955. The company was formed primarily to supply microwave tubes to the Canadian Military. This limited market was not capable of supporting growth, so VCI set out to develop new products and new markets. Today VCI's sales of its manufactured products are 75% export, with products split evenly between electron tubes and equipment. Varian Canada Inc is a Canadian Corporation, a wholly-owned subsidiary of Varian Associates Inc of Palo Alto, California.

Capabilities:

The primary product of the Varian Canada Avionics Operation is the Peripheral Vision Horizon Device which is also referred to as the "Malcolm Horizon". It is a subliminal attitude change indicator for cockpit workload reduction and disorientation prevention. It operates on the principle that orientation information is sensed primarily by a person's peripheral vision system and processed subconsciously by dedicated areas of the brain.

Components manufactured by Varian Canada include klystrons, travelling wave tubes, magnetrons and magnetometers.

Credentials:

Gross Sales:
1980 - \$30M

Average Work Force:
Total (1981) - 500

Plant Size:
113,800 sq ft (76,000 sq ft wholly owned main plant and
37,800 sq ft leased property)

Experience:

The Malcolm Horizon has been under development at Varian Canada for three years, and extensive operational testing has been carried out with the cooperation of the Canadian Forces and the US Air Force, particularly at Edwards AFB, CA. First production models are scheduled to fly in USAF aircraft by the end of 1981 and quantity production is planned for mid-1982.

Company: VORTEK INDUSTRIES Ltd

Address: 1820 Pandora Street
Vancouver, British Columbia, Canada V5L 1M5

History:

A private Canadian company incorporated in 1975 in the Province of British Columbia with no other branches or US subsidiaries.

Capability:

Vortek specializes in the manufacture and development of ultra-powerful arc lamps and related optical systems. The lamps operate at input powers of up to 125,000 watts using a patented internal cooling method. Originally developed for outdoor flood-lighting, the lamps have proven to be an excellent light source for solar simulation and industrial processes. Vortek also operates a high-power plasma arc laboratory. New product designs are tested prior to production and radiation experiments are conducted for clients on a contract basis.

Credentials:

Gross Sales:
1980 - \$1M

Average Work Force:
PhDs - 3
Eng - 1
Others - 5

Plant Size:
4000 sq ft

Experience:

Most recent contract was installation of Large Area Solar Simulator in Canadian National Solar Testing Facility, Toronto, Ontario. No sales have been made in the US.

Company: WESTECH SYSTEMS Ltd

Address: 14605-134 Ave
Edmonton, Alberta, Canada T5L 4S9

History:

A Canadian owned high technology telecommunications company formed in late 1978 by AES Data Ltd and International Systcoms Ltd of Montreal and Alberta Government Telephone of Edmonton. Its original corporate mission was to enter the communications industry by designing, developing and marketing state-of-the-art communications systems to meet specific world market needs.

Capability:

Westech's primary product is the AURORA automatic mobile telecommunication system. It utilizes a cellular concept which allows for higher mobile handling capability within the available frequency spectrum. There is no need for an overlay network. The system makes possible instant contact and control over personnel and vehicles in the serving area. Expansion of future enhancements can be implemented with minimal effort due to the computer control and associated software. The system provides full duplex operation, call queing, full coverage roaming, automatic tracking, mobile number identification, centralized administration, remote mobile disable and 1+, 0+, 0 operation. AURORA, a medium capacity cellular system, is similar to a high capacity cellular system with the major exception being that when required, it can interface to the nearest central office rather than utilizing extensive trunking and overlay circuits in conjunction with large dedicated central switches.

Credentials:

Gross Sales:
Approx \$3.5M (1979-1980)

Average Work Force:
Engineers - 6
Others - 9

Plant Size:
6,000 sq ft R&D Space, expanding to 12,000 sq ft in near future.

Experience:

Westech has not worked under contract to the USAF in the past and has no current US roles. They are interested in doing work with the USAF in the future if their capabilities meet a specific USAF requirement. They were provided with our BML Application package and are expected to complete and submit the package in the near future.

Company: WHITESHELL NUCLEAR RESEARCH ESTABLISHMENT

Address: Pinawa, Manitoba, Canada R0E 1L0

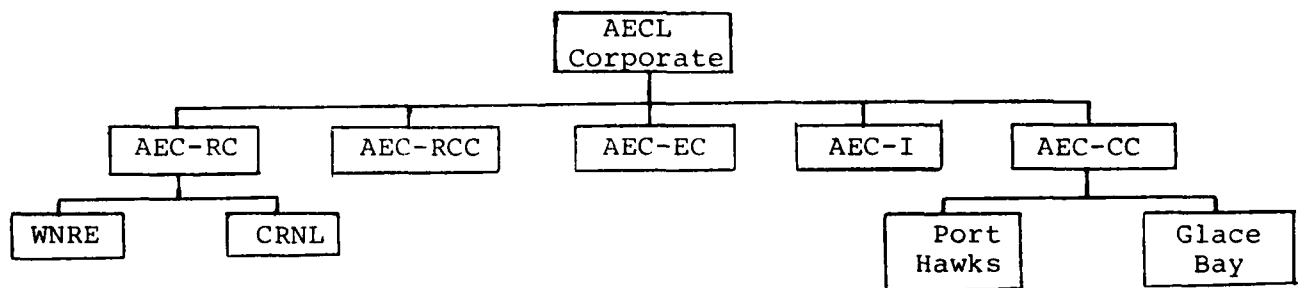
History:

The Whiteshell Nuclear Research Establishment (WNRE) came into being in 1963 for the purpose of developing the organic cooled nuclear power reactor concept. WNRE is part of the Atomic Energy of Canada Research Company (AEC-RC), which in turn is a part of Atomic Energy of Canada Ltd (AECL). The latter is a crown corporation of the Government of Canada.

Canada's nuclear program had its beginning during the Second World War when a team of Allied scientists was assembled in Montreal for work related to the development of atomic weapons. With the end of the war, the Canadian effort was redirected, and since then all work on atomic energy has been concerned with peaceful uses.

The program was initially administered by the National Research Council of Canada, but by 1952 it had expanded so much it was placed under a new, specialized organization (AECL). In the fall of 1979, a Commercial Operations Office was established at WNRE for the purpose of marketing site services, products and transferring technology.

The following is a breakdown of the AECL structure:



AEC-RC (AEC-Research Co) - Head office is in Ottawa with sites at Chalk River, Ontario and Pinawa, Manitoba.

AEC-RCC (AEC-Radiochemical Co) - Head office and manufacturing facilities in Ottawa, Ontario with scattered offices in foreign countries.

AEC-EC (AEC-Engineering Co) - Head office, engineering offices and labs at Toronto, Ontario with engineering offices in Montreal, Quebec.

WHITESHELL NUCLEAR RESEARCH ESTABLISHMENT (Cont'd)

AEC-I (AEC-International Co) - Head office in Toronto, Ontario with scattered offices in foreign countries.

AEC-CC (AEC-Chemical Co) - Head office and engineering offices at Ottawa, Ontario with plants at Glace Bay and Port Hawkesbury, Nova Scotia.

Capability:

WNRE is an R&D site. It performs fundamental and applied research, develops processes, products and components and has a large staff of experienced people in most disciplines and trades. Its strongest capability is touted as the ability to undertake the role of innovator, perform the necessary R&D work, build and prove the prototype or pilot plant and commercialize the concept.

Keywords that Describe their Capability

Research & Development (R&D)	Electrochemistry
Nuclear	Corrosion
Irradiations	Colloidal chemistry
Chemical Analysis	Surface Chemistry
Contract Research	Health physics
Neutron Activation	Medical biophysics
Metallurgical	Radiation
Reactors	Environment
Materials Testing	Pathways analysis
Reactor Facilities	Derived release limits
Isotopes	Biological environment
Radiation Shielding	Tailings
Physics	Metallography
Chemistry	Radioactive wastes
Thermal Analysis	Disposal
Hydraulics	Trace analysis
Nuclear Design	Vitrification
Mathematics	Chemical processes
Computer Code Development	Combustion
Materials Characterization	Detonation
Fluid Dynamics	Electronics, nuclear
Safeguards	Instruments, nuclear
Risk Analysis	Separation processes
Non-destructive testing	ASME codes
Professional services	Quality assurance

Credentials:

Gross Sales:

1980/81 Annual Budget-\$47M, Gov't Appropriation-\$42M,
Commercial Revenues-\$5M

1981/82 Annual Budget-\$50M, Gov't Appropriation-\$44M,
Commercial Revenues-\$6.5M

WHITESHELL NUCLEAR RESEARCH ESTABLISHMENT (Cont'd)

Average Work Force:

Professional	- 235
Technical	- 250
Clerical	- 180
Prevailing Rate	- 235

Plant Size:

Consists of approximately 10 major buildings which house R&D facilities, a research reactor (WR-1), engineering offices, machine, construction and maintenance work shops, administrative offices, protective services, fire department, stores and warehousing. Very rough area of all facilities in 150,000m².

Equipment:

Facilities are geared to nuclear R&D and have the following unique items:

1) Research reactor - (WR-1 organic cooled, the only operational organic reactor in the world).

2) Irradiation facilities, i.e., loops, neutron activation facilities, nuclear fuel, materials, corrosion and component test facilities.

3) Good design capability, CAD system available backed up by experienced staff and large library of relevant computer codes.

4) Analytical facilities - unique capability for surface characterization and trace element measurements.

5) Metallurgical and mechanical testing facilities - experience in testing ferrous and non-ferrous metals, ceramics, glasses, rocks and composites.

6) Hot cell facilities capable of handling 10⁶ Curies of radioactive material.

7) Fabrication capabilities.

8) Biophysical laboratories.

9) Environmental laboratories and field facilities.

10) The site consists of 40 Km² of land area.

11) Gamma irradiators, Van de Graaff and neutron generator facilities.

12) Combustion test facilities to study detonation characteristics on steam, air, hydrogen mixtures.

WHITESHELL NUCLEAR RESEARCH ESTABLISHMENT (Cont'd)

Experience:

AECL has been in existence for approximately 35 years. During this time, it has developed the CANDU-pressurized heavy water reactor system. It has helped to commercialize the radioisotope industry in the medical, pharmaceutical and industrial fields; developed and commercialized the heavy water industry and is currently the world's largest producer of this commodity. In addition, AECL has been instrumental in developing the Canadian nuclear fuel industry and has played a large part in developing the US nuclear fuel design for both the military and civilian reactors. It has also played a major role in developing and commercializing zirconium alloys for the nuclear industry. AECL's major assets are experienced staff and state-of-the-art facilities and equipment.

Section III

C O M P A N Y / C A P A B I L I T Y C R O S S I N D E X

A I R C R A F T

- . Aircraft Control
CMC MCL SPA
- . Air Delivery Systems
IIC
- . Airframe Components/Structures
BOE EXC SPA CAP
CDR DHC BAL IMP
- . Air Traffic Control Systems
CAE PEL LEI
- . Armor
UNI
- . Cargo Handling Equipment
IIC CAP
- . Cockpit Display
CMC CDC LIT
OPT SUD VAR
- . Composite/Fiberglass Components
BOE NWI CGE
UNI VTD CDR
- . Connectors
ITT
- . Crash Locator Beacons
GML LEI
- . Data Handling & Analysis
CDC GDS LEI
LIT MDA

A I R C R A F T (Cont'd)

- . Drones
CDR
- . Engine Components & Systems
AEL SGM SPA
PWA BAL
- . Engine Controls
CMC DGI AEL
CDC PWA
- . Environmental Controls
GML
- . Explosion Suppression Systems
EXP
- . Flight Data & Voice Recorders
CDC LEI PEP
- . Flight Data Systems
DGI GDS
- . Fuel Systems/Research
AEL PWA
- . Helicopters/Subsystems
CCA DGI LEI
SPA BAL CAP
- . Hydraulics
AER HER BAL
- . Instruments
AEL CMC CDC
LEI LIT VAR
DGI GML PEP

A I R C R A F T (Cont'd)

- . Landing Gear
MCL HER
- . Navigation
AEL CAL CMC
CDC LIT DGI
- . Performance Measuring Devices
CDC
- . Personnel Survival & Restraint
IIC
- . Repair & Operations/Overhaul
AEL CAE GML IMP NWI
PWA CAP SPA HER BAL
- . Simulators/Training
AEL CAE GDS
- . STOL Aircraft Manufacture
DHC
- . Wiring & Tubing
IMA ITT NWI
AEL IMP CWC

C H E M I S T R Y

- . Alternate Fuels Research
UNI PWA KCE
- . Chemical Synthesis/Catalyst/Photocatalyst
ARC RAY UNI INR
- . Custom Research
RAY WNR
- . General Chemistry
WNR
- . High Explosive Ingredients
VAL
- . Petroleum Chemistry
RAY
- . Pharmaceutical Chemistry
CB RAY
- . Physical Chemistry
RAY
- . Polymer Chemistry
RAY UNI
- . Rare Earth Magnets
INR
- . Rubber Chemistry
UNI

E L E C T R O N I C S

- . Acoustic Sensing
ATH CDC
HEL SOC
- . Antennas
CAL ECL MPB SPA
HEL SCS PEP
- . C³ Systems
CAL CDC
GML PEP
- . Cockpit Displays
CMC DCD
LIT OPT
- . Computers/Computer Parts
CAL CDC GDC GDS PDS
HIT MDC PEP SUD
- . Consulting
CAN DMR GDS PDS
HIT TI SYS
- . Crash Position Indicators
GML LEI
- . Cryogenics/Sensors
CTF
- . Crystal Growing/Manufacture
CRY PEL
- . Data Acquisition/Handling/Analysis
CDC GDS LEI LIT SIM
ATH CAE MPB MDA

E L E C T R O N I C S (Cont'd)

- . Digital To Photo Processing
IMA
- . Flight Data Recorders
CDC LEI PEP
- . Geophysics/Environmental Sensors
ATH CTC GEL SOC TAM
CTF SCI INR
- . Ground Stations
ECL HIT MDC MCS
PEP SED SPA MDA
- . Infrared Instrumentation
BRL OEL OPT
PHD SPA
- . Integrated High Density LED Displays
OPT
- . Laser/Fiber Optics/CCD
BNR FEI LUM MPB NOR CWC ULI
OEL OPT PHD MDA PEL DIF
- . LSI/VLSI
BNR
- . Measurement & Control Systems
(Sensors, Instrumentation, Analysis, Control)
BEE CAE ECL IPS MDC MPB
OEL SUD TAM DIF CSG PRA
- . Medical Electronics/Instrumentation
SYS CWC
- . Multi-Layered, Pre-Wired Board Assemblies
CMC SIM SUD

E L E C T R O N I C S (Cont'd)

. Navigation

AEL	CAL	CDC	DGI	SCS
LIT	PEP	PEL	MCS	

. PC Board Design & Fabrication

EEL	CML	SIM
SUD	ANA	GML

. Power Supplies

AVT	CMC	FEI	GML	PEP
SUD	SOC	ANA	GEL	GTP

. Radio Communications Gear, Fixed, Mobile

AGT	BNR	ECL	SCS	GML	CMC	HEL
FEI	MDC	MCS	SED	SPA	WSL	MCS
MDA	GDC	HIT	NOR	SIM	GDS	

. R&O

CDC	LEI	LIT	NWI	SUD
CAE	AEL	CMC	SPA	GML

. Solid State Devices

CTC	DGI	EEL	FEI	EDS	INR
GDC	GML	OEL	PED	OPT	
VAR	AVT	BAL	CAL	TI	

. Telephone Communications/Gear

AGT	BNR	ECL	GEL	AEI
SED	SIM	CMC	TI	

. Thick/Thin Film Hybrid Parts & Design

EEL	GML	ANA	CTC
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. Video Display Systems

CAE	GDS	CDC	MPB
PDS	NOR	PEL	SUD

. Voltage Transformers Regulators High/Low Voltage

AEL	CMC	CDC	GML	GEL	HMC
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E N E R G Y

- . Auxilliary Power Units
GTP KCE
- . Engine Research
KCE
- . Nuclear Reactors/Instrumentation/Simulators
BRL PED WNR
CAE SIM BAL
- . Solar/Simulators
ARC VOR INR
- . Thermoelectric
GTP
- . Wind
ARC BAL
- . Unattended Power Supplies
GTP

E N V I R O N M E N T A L E Q U I P M E N T

- . Meteorological Stations/Equipment
ATH DGI LEI BAL ARC GDS AEL

- . Water Desalinization
SEA

E N V I R O N M E N T A L / P O L L U T I O N

- . Airborne Surveys

BRL	QSL	SPA
MAR	PEP	

- . Environmental Analysis, Simulation, Forecasting

ATH	BRL	CDC	FGB	GDS	MDA
HEL	MAR	MPB	PEP	SCI	

- . GC/MS Equipment

SCI

- . Liquid Leak Detection

ATH SCI TAM

- . Mapping

CMC	CAM	FGB	LEI
MAR	QSL	SPA	SYS

- . Pollution Sensing/Analysis/Control

ATH	MPB	PEP	TAM	SCI
ULI	UNI	WNR	BRL	

- . Radar - WX

ARC ATH GDS SED

- . Remote Sensing

BRL	FGB	MDC
MAR	BAL	ULI

- . Trace Gas Detection

BRL MPB SCI TAM ATH ULI INR

- . Testing

CAL

L A S E R S

. Communications
BNR FEI MPB OEL
PHD ULI

. Gas Lasers
MPB ULI LUM PRA

. Laser Optics
ATH DIF

. Spectroscopy
ULI BRL

M A C H I N I N G , F O R G I N G , C A S T I N G

- . Automated Precision Measuring
DIF
- . Injection Molding
IMP CGE INR
- . Machining - Extended Length
CDR DHC
- . Metalworking, Heat Treating, Coating Specialized
EBC NWI UDT CDR BAL
- . Powder Metallurgy
SGM WNR
- . Precision Casting
FIT IMP SGM SLA
- . Precision Forging
SLA GLF
- . Precision Machining
EBC EXC KOS NWI CGE INR
TEC UDT UNI CDR BAL
- . Specialty Alloys
SGM
- . Stamping, Spin Forming
EBC NWI SLA BAL
- . Titanium
AER BAL
- . Tooling, Die Fabrication
AER EBC EXC
CAP BAL UNI

O R D N A N C E

- . Ammunition - Cases
VII
- . Ammunition - Live
VII
- . Ammunition Propellants
VAL
- . Ammunition - Smoke/Marking/Spotting
HCI
- . Ammunition - Training/Practice
HCI
- . Chemical Dispersers
HCI
- . Explosives - High Energy/Demolition
VAL
- . Flares
HCI
- . Fuses
HCI
- . Pyrotechnics
HCI
- . Rockets
BAL
- . Signal Charges
HCI
- . Simulation Charges
HCI

P R O T E C T I V E E Q U I P M E N T

- . Explosion Suppression Systems
EXP
- . Helicopter Wire Strike
BAL
- . Integrated Traffic Control
MPB
- . NBC Equipment
UNI
- . Parachutes Restraint Systems
IIC
- . Survival, Life Supports
IIC

R A D A R

- . Antenna Systems
MPB SUD
- . Simulators
PEP CAL HIT LIT
- . Space Based
HIT
- . Surveillance/Navigation
LIT MPB SUD MDA
CMC CDC MCS
- . Weather
ARC ATH GDS SED MDA

S E C U R I T Y & S A F E T Y

- . Computer Security
IPS
- . Crash Position Indicator
LEI
- . Emergency Locator Beacons
GML
- . Explosion Suppression Systems
EXP
- . Intrusion Detection
CDC HEL LIT VOR GEL
- . Magnetic Anomaly Detection
CAE CTF PEP

S O F T W A R E S E R V I C E S

- . CAD/CAM
CI CC
- . Circuit Layout
CI CC
- . Data Acquisition & Processing
IPS LEI MDC MPB MCS
NOR PDS SYS TI CAM
- . Design to Requirements - Business, R&D, other
CSG CAL EDS IPS PDS
SED SYS WNR TI GML
- . Environmental Programs (Large & Small)
ATH TI
- . General Processing/Interactive Processing
DSL DMR GDC SYS CAM
- . Geographic/Geologic Analysis
BRL FGB CAM
- . Graphics/Display
HIT IMA IPS CAM
MPB PDS PEL NOR
- . Mapping
LEI QSL SPA SYS CAM
- . Simulation Programs
CAE GDS SED FGB
- . Structural Analysis
CAL IMP LEI DIF
- . Structural Design
CAL
- . Training Programs
AFR GDS MPB
- . Transportation Control Systems
MPB TI

S P A C E

- . Communications
CAL ECL HIT MPB
MCS SED SPA
- . Data Reduction
CAL MDA
- . Digital to Photo Data Reduction
IMA MDA
- . Environmental Simulators
VOR
- . Extendable Structures
SPA
- . Ground Positioning
CMC JMR
- . Ground Stations
CAL SED SPA MDA
- . Instrumentation
SED
- . Mechanical Arms
SPA
- . Navigation
MCS JMR
- . Radar
CAL
- . Satellites
HIT
- . Satellite Electronics
CAL HIT PEL
- . Systems/Studies
CAL HIT SED SPA

T E S T I N G, T E S T E Q U I P M E N T

. General Testing

IMP WNR PEL

. Non-Destructive/System Testing

CTF IMP WNR
PEL BAL

. Precision Measuring

DIF

. Test Equipment & Instrumentation

AFR LIT PHD SIM AVT BAL
MCS PEP WNR CAP PEL GML

M I S C E L L A N E O U S

- . Aerial Surveys
MAR QSL SPA
- . Air Traffic Control Systems/Simulators
CAE DGI GML HEL
LEI LIT PEL NOR
- . Arc Lamps - High Intensity
VOR PRA MPB
- . Arctic R&D
FGB UNI
- . Armored Vehicles
GM
- . Combustion Engine Research/Manufacture
KCE
- . Container Design
UNI INR
- . Facility Management
HIT IPS
- . Ground Transportation
GM UTD
- . H₂/Fuel Storage Systems
UTD
- . Meteorological Stations/Instruments
ATH DGI LEI BAL ARC AEL
- . Specialized Structures
FGB SPA
- . Transporter Systems
GM UTD

Section IV

C O M P A N Y C O D E I N D E X

C O M P A N Y C O D E I N D E X

1	AEL	Aviation Electric Ltd
2	AER	Aero Machining Ltd
3	AFR	Atlantis Flight Research Ltd
4	AGT	Alberta Government Telephones
5	ANA	Anatek Electronics Ltd
6	ARC	Alberta Research Council
7	ATH	Athabasca Research Corp Ltd
8	AVT	Avtech Electrosystems Ltd
9	BAL	Bristol Aerospace Ltd
10	BEE	Baker Engineering Enterprises Ltd
11	BNR	Bell Northern Research
12	BOE	Boeing Canada Ltd
13	BRL	Barringer Research Ltd
14	CAE	CAE Electronics Ltd, CAE Industries Ltd
15	CAL	Canadian Astronautics Ltd
16	CAM	Collins & Moon Ltd
17	CAN	Cantel Engineering Associates Ltd
18	CAP	Canadian Aircraft Products Ltd
19	CB	Chembiomed Ltd
20	CC	CAD/CAM Graphic Systems Ltd
21	CCA	Casey Copter Accessories Ltd
22	CDC	Computing Devices Company
23	CDR	Canadair Ltd
24	CGE	Canadian General Electric Co Ltd
25	CI	Cadeis International Ltd
26	CMC	Canadian Marconi Company
27	CRY	Crystal Research/Yield Systems Corp
28	CSG	Canada Systems Group
29	CTC	Canadian Thermostats and Control Devices Ltd
30	CTF	CTF Systems Inc

31	CWC	Canada Wire and Cable Ltd
32	DGI	DG Instruments
33	DHC	The de Havilland Aircraft of Canada Ltd
34	DIF	Diffrauto Ltd
35	DMR	DMR and Associates
36	DSL	Dataline Systems Ltd
37	EBC	Ebco Industries Ltd
38	ECL	Elinca Communications Ltd
39	EDS	Epic Data Sales Ltd
40	EEL	Epitek Electronics Ltd
41	EXC	Exco Engineering
42	EXP	Explosafe Division, Vulcan Industrial Pkg Ltd
43	FEI	Foundation Electronic Instruments Inc
44	FGB	F. G. Bercha and Associates Ltd
45	FIT	Fittings (1980) Inc
46	GDC	Gandalf Data Communications Ltd
47	GDS	Goodwood Data Systems Ltd
48	GEL	Glenayre Electronics Ltd
49	GLF	Great Lakes Forgings Corp
50	GM	General Motors of Canada Ltd, Diesel Div
51	GML	Garrett Manufacturing Ltd
52	GTP	Global Thermoelectric Power Systems Ltd
53	HCI	Hand Chemical Industries
54	HEL	Hermes Electronics Ltd
55	HER	Heroux Inc
56	HIT	HiTech Canada Ltd
57	HMC	Hammond Manufacturing Co Ltd
58	IIC	Irvin Industries Canada Ltd
59	IMA	Imapro Inc
60	IMP	I. M. P. Group Ltd
61	IPS	I. P. Sharp Associates Ltd
62	ITT	ITT Cannon Electric Canada

63	JMR	JMR Instruments Canada Ltd
64	KCE	Kristiansen Cycle Engines Ltd
65	KOS	Koss Machine & Tool Co
66	LEI	Leigh Instruments Ltd
67	LIT	Litton Systems Canada Ltd
68	LUM	Lumonics Inc
69	MAR	MARS Aerial Remote Sensing Ltd
70	MCL	Menasco Canada Ltd
71	MCS	Miller Communications Systems Ltd
72	MDA	Macdonald Dettwiler & Associates Ltd
73	MDC	Mar-Del Components Ltd
74	MPB	MPB Technologies Inc
75	NOR	Norpak Ltd
76	NWI	Northwest Industries Ltd
77	OEL	Opto-Electronics Ltd
78	OPT	Optotek Ltd
79	PDS	Prior Data Sciences Ltd
80	PED	Pylon Electronic Development Co Ltd
81	PEL	Philips Electronics Ltd
82	PEP	Presentey Engineering Products Ltd
83	PHD	Phalo/OSD
84	PRA	Photochemical Research Associates Inc
85	PWA	Pratt & Whitney Aircraft Co Ltd
86	QSL	Questor Surveys Ltd
87	RAY	Raylo Chemicals Ltd
88	SCI	Sciex Inc
89	SCS	Spilsbury Communication Systems
90	SEA	Seagold Water Systems Inc
91	SED	SED Systems Inc
92	SGM	Sherritt Gordon Mines Ltd
93	SIM	Simtron Ltd
94	SLA	Slacan, Division of Slater Steel Industries

95	SOC	Sparton of Canada Ltd
96	SPA	SPAR Aerospace Ltd
97	SUD	Sperry Univac Defense Systems
98	SYS	Systemhouse Ltd
99	TAM	The Armstrong Monitoring Corp
100	TEC	Technimeca Ltd
101	TI	Tracker Industries Ltd
102	UDT	UDT Industries Inc
103	ULI	Ultra Lasertech Inc
104	UNI	Uniroyal Ltd
105	UTD	Urban Transportation Development Corp Ltd
106	VAL	Valleyfield Chemical Products Corp
107	VAR	Varian Canada Inc
108	VII	Valcartier Industries Inc
109	VOR	Vortek Industries Ltd
110	WNR	Whiteshell Nuclear Research Establishment
111	WSL	Westech Systems Ltd

Addendum

112	AEI	A.E.I. Telecommunications (Canada) Ltd
113	INR	Industrial Research & Development Ltd

Section V

P O I N T S O F C O N T A C T

P O I N T S O F C O N T A C T

Aero Machining Ltd Mr. Gerard Beausoleil	(514) 324-4260
Alberta Government Telephones (AGT) Mr. R J Taylor, Gen Network Planning & Design Manager	(403) 425-3600
Alberta Research Council Dr. Duncan Currie Dir, Frontier Science Div	(403) 432-8019
Anatek Electronics Ltd Dr. Doug Smeaton, President	(604) 980-7061
The Armstrong Monitoring Corp Mr. William L Armstrong	(613) 225-0120
Athabasca Research Corporation Ltd Mr. T E Adams, President	(403) 452-0924
Atlantis Flight Research Inc Mr. Fred Prins Vice President, Marketing	(416) 677-6956
Aviation Electric Ltd Mr. Gordon McWhaw Marketing Representative	(514) 744-2811
Avtech Electrosystems Ltd Dr. W J Chudobiak President	(613) 226-5772
Baker Engineering Enterprises Ltd Mr. Len Friedenberg President	(403) 463-0922

Barringer Research Ltd Mr. John Davies Vice President, Engineering	(416) 675-3870
Bell Northern Research Mr. David J Wiegand Marketing Liaison Manager	(613) 596-4493
Boeing of Canada Ltd Mr. L L Bryson Vice President	(204) 888-2300
Bristol Aerospace Ltd Mr. Keith Burrows Vice President, Marketing	(204) 775-8331
CAD/CAM Graphic Systems Ltd Mr. Chris Coates Marketing Representative	(613) 526-0620
CAE Electronics Ltd (CAE Industries Ltd) Mr. Bernie Swartz Industrial Relations	(514) 341-6780
CTF Systems Inc Dr. Max Burbank President	(604) 941-8561
Cadeis International Ltd Dr. Leslie Klein President	(613) 820-5210
Canada Systems Group Advanced Technology Systems Div Mr. R T C Cobbold, Marketing Mgr	(613) 225-1171
Canada Wire and Cable Ltd Mr. V S Carpenter Manager, Commercial Services	(416) 421-0440

Canadair Ltd Mr. Frederick R Kearns President	(514) 744-1511
Canadian Aircraft Products Ltd Mr. D C Cameron President	(604) 278-9821
Canadian Astronautics Ltd Mr. James D Taylor President	(613) 820-8280
Canadian General Electric Co Ltd Mr. Brian Noble Specialist Industrial Benefits Program	(416) 675-7500 X210
Canadian Marconi Company Mr. E Spinner Manager, Products & Markets	(514) 341-7630
Canadian Thermostats and Control Devices Ltd Mr. Richard Marquis General Manager	(514) 739-3274
Cantel Engineering Associates Ltd Mr. N Mark Lopianowski	(604) 684-1144
Casey Copter Accessories Ltd Mr. M J Casey Vice President	(514) 636-6155
Chembiomed Ltd Dr. A Daniel Vice President, Operations	(403) 432-2053
Collins & Moon Ltd Mr. Geo C Moon General Manager	(519) 836-3844
Computing Devices Company Mr. Jack G Warner Dir, International Marketing	(613) 596-2840

Crystal Research/Yield Systems Ltd Mr. Michael H Branson President	(416) 755-6670
Dataline Systems Ltd Mr. Gordon Brown Branch Manager	(613) 232-9616
The de Havilland Aircraft of Canada Ltd Mr. J W Sandford, President	(416) 633-7310
D. G. Instruments Ltd Mr. A Graham Craig President	(613) 592-3141
Diffracto Ltd Mr. T R Pryor President	(519) 945-6373
DMR and Associates Mr. Malcolm C Thurgur Senior Consultant	(613) 238-2697
Ebco Industries Ltd Mr. Helmut Eppich President	(604) 278-5578
Elinca Communications Ltd Mr. James R Williams Vice President	(613) 233-5671
Epic Data Sales Ltd Mr. Norman A Cafik General Manager	(604) 273-9146
Epitek Electronics Ltd Mr. John Cairney Vice President, Admin	(613) 592-2240

Exco Engineering Mr. Brian Robbins President	(416) 495-9440
Explosafe Division Vulcan Industrial Packaging Ltd Mr. A Solaroli Manager, R&D	(416) 675-6492
F. G. Bercha and Associates Ltd Dr. Frank G Bercha President	(403) 262-7764
Fittings (1980) Inc Mr. T A Santos President	(416) 723-3433
Foundation Electronic Instruments Inc Mr. Attila J Szanto President	(613) 226-4000
Gandalf Data Communications Ltd Mr. Peter Kawchak Vice President, Marketing	(613) 225-0565
Garrett Manufacturing Ltd Mr. B W Atkinson Manager, New Tech Sales	(416) 675-1411
General Motors of Canada Ltd Mr. W L Claggett Mgr, Tech Sys Def Production Sales	(519) 452-5245
Glenayre Electronics Ltd Mr. E K Deering President	(604) 980-6041
Global Thermoelectric Powers Systems Ltd Mr. Donald W Peterson President	(403) 472-3512

Goodwood Data Systems Ltd Mr. Joseph I Krebs Vice President	(613) 257-3610
Great Lakes Forgings Corp Mr. Al Simone Manager, Sales	(519) 945-1151
Hammond Manufacturing Company Ltd Mrs. Janice Husson Marketing Services Manager	(519) 836-3522
Hand Chemical Industries Mr. R A Brown General Manager	(416) 878-2831
Hermes Electronics Ltd Mr. Keith Hatchard Manager, Marketing Admin	(902) 466-7491
Heroux Inc Mr. M T Stringer President	(514) 679-5450
HiTech Canada Ltd Mr. J E Saarinen Director, Marketing	(613) 820-1200
Imapro Inc Mr. Goffredo (Fred) E Andreone President	(613) 226-4080
I. M. P. Group Ltd Mr. H I Conner Director, Marketing	(902) 861-3737
I. P. Sharp Associates Ltd Mr. W W Bradbury Manager, Spec Sys (Ottawa)	(613) 236-9942

ITT Cannon Electric Canada Mr. Mike Moore Sales Representative	(416) 668-8881
Irvin Industries Canada Ltd Mr. John Swanigan President	(416) 871-6510
JMR Instruments Canada Ltd Mr. G I McMillan Marketing Representative	(403) 255-6667
Koss Machine and Tool Co Mr. Drago Cajic President	(416) 678-7236
Kristiansen Cycle Engines Ltd Mr. R Shand Director, Marketing	(204) 284-1083
Leigh Instruments Ltd Mr. T A Spurston Director, Marketing	(613) 283-4400
Litton Systems Canada Ltd Mr. John L Smeaton Marketing Manager	(416) 249-1231
Lumonics Inc Mr. Roger Sandwell Sales Manager Research Prods	(613) 592-1460
MPB Technologies Inc Dr. M P Bachynski President	(514) 457-2035
Macdonald Dettwiler & Associates Ltd Mr. Marshall Prentice Sales Manager	(604) 278-3411

Mar-Del Components Ltd Mr. John A Say Sales Manager	(403) 467-9813
Mars Aerial Remote Sensing Ltd Dr. Frank G Bercha President	(403) 262-8482
Menasco Canada Ltd Mr. Paul A Rivard Manager, Marketing Ser	(514) 332-3330
Miller Communications Systems Ltd Mr. A H Jarvis Manager, Operations	(613) 592-3020
Norpak Ltd Mr. Mark Norton President	(613) 624-5711
Northwest Industries Ltd Mr. Floyd Maybee Vice President, Operations	(403) 455-3161
Opto-Electronics Ltd Dr. B K Garside President	(416) 827-6214
Optotek Ltd Dr. David I Kennedy President	(613) 746-3100
Phalo/O.S.D. Mr. Sam Amormino Manager, Systems & Components Sales	(416) 498-9680
Philips Electronics Ltd Mr. J Y Dror Director, Corp Engineering & Development	(416) 292-5161

Photochemical Research Associates Inc Dr. Roderick C Miller Director, Marketing	(519) 686-2950
Pratt & Whitney Aircraft Company Ltd Mr. S Monaghan Chief, R&D Support	(514) 677-9411
Presentey Engineering Products Ltd Mr. S Presentey President	(613) 822-1251
Prior Data Sciences Ltd Mr. David C Webster Manager	(613) 820-7235
Pylon Electronic Development Company Ltd Mr. Alex Itenson Manager, Branch Plant	(613) 226-1280
Questor Surveys Ltd Mr. P G Lazenby Chairman	(416) 676-9880
Raylo Chemicals Ltd Dr. Russell G Smith General Manager	(403) 469-7601
SED Systems Inc Mr. Donald H Kjosness Vice President, Adv Sys Eng Gp	(306) 244-0976
SPAR Aerospace Ltd Mr. B. R. Machum Director, Gov't Relations & Marketing Support	(613) 563-0230
Seagold Water Systems Inc Mr. Denis Walsh Sales Manager	(604) 437-4445

SCIEX Inc Dr. Neil M Reid Executive Vice President	(416) 881-4646
Sherritt Gordon Mines Ltd Mr. Herbert Veltman Dir, Sherritt Research Center	(403) 998-6432
Simtron Ltd Mr. L T Legris Director, Marketing	(705) 743-6937
Slacan, Division of Slater Steel Industries Mr. John H Taylor, Vice President	(416) 528-8888
Sparton of Canada Ltd Mr. L Staszak Vice President	(519) 455-6320
Sperry Univac Defense Systems Mr. G R Smith Dir, Canadian Operations	(204) 888-4222
Spilsbury Communications Systems Mr. Fred G Palidor General Manager	(604) 684-4131
Systemhouse Ltd Mr. Tony A Moretto Marketing Manager	(613) 526-0670
Technimeca Ltd Mr. Arthur Cormier Dir, Marketing & Sales	(514) 739-3193

Tracker Industries Ltd Mr. Lou Fedyna, President	(416) 762-8744
UDT Industries Inc Mr. Lucien Pinsart Vice President	(514) 526-9454
Ultra Lasertech Inc Dr. R A Crane Dir, Science & Technology	(416) 677-8091
Uniroyal Ltd Mr. W Doug Byam Mgr, Sales Development & Government Relations	(519) 822-3790
Urban Transportation Development Corp Ltd Mr. Ed Brezina Mgr, Government & Public Affairs	(416) 961-9569
Valcartier Industries Inc Mr. Michael Pick, President	(418) 844-3711
Valleyfield Chemical Products Corp Mr. R D Heddle Vice President, Marketing	(514) 371-5520
Varian Canada Inc Mr. A E Kennedy Marketing Mgr, Avionic Operations	(416) 877-0161
Vortek Industries Ltd Dr. G G Albach, President	(604) 251-2451
Westech Systems Ltd Mr. Gordon S Raitt President	(403) 452-8450
Whiteshell Nuclear Research Establishment Mr. Raymond O Sochaski Mgr, Commercial Operations Office	(204) 753-2311

Addendum

A.E.I. Telecommunications (Canada) Ltd
Mr. R E Day
Sales Manager

(204) 942-7221

Industrial Research & Development Ltd
Mr. Edward A Speers
President

(204) 947-1740

END