Trade Directory

OCEAN TECHNOLOGY TRAINING AND TRANSFER

Conference and Trade Show

22 - 26 August 1988

Halifax, Nova Scotia. CANADA

Sponsored by:

Dalhousie University, Halifax

International Ocean Institute, Malta

FOREWORD

Over a hundred coastal nations have now declared their Exclusive Economic Zones or equivalent Fishery Zones, following on the most exciting event in global ocean activities—the international agreement on the new Law of the Sea at the Third UN Convention in 1982. This innovative step in human exploitation and management of this world's ocean resources— fisheries, mining, energy, chemical, physical— represents a new age in man's presence that will place very new and unusual pressures and responsibilities on us all, new technologies, new skills, new developments, new artistry. It will require new assessment of our skills, new developments, and new ideas to match new demands into a world where today man is still very much a newcomer.

This directory to ocean technologists in Atlantic Canada was compiled for the convening of the 16th PACEM IN MARIBUS conference on Ocean Technology, in Halifax, Canada. Called by the International Ocean Institute (of Malta and Halifax, Canada), this is the sixteenth international conference on global ocean issues affecting mankind generally. In this 16th PIM, the conference addresses all the aspects of Ocean Technology in our new changing world and in the context of the North-South dialogue, and brings to Halifax international ocean technologists, ocean experts and opinion shapers to discuss and explore yet another aspect of man's role in the management of untold resources.

A unique component of the conference was an exhibit of new notions and ideas in ocean technology put on by some 24 leading ocean technology firms in Atlantic Canada. The Atlantic region of Canada plays a significant role in ocean technology developments—from principal design and construction of offshore oil and gas activities to environmental monitoring to the technology of genetics in mariculture. Technology firms in this directory were listed by general invitation, and include technology firms presently active and aggressive in the field of ocean technology innovation and development in a variety of disciplines—fisheries, engineering, surveying, geophysics, and communications.

We trust that the information in this directory will be of use and introduce you to the many ideas that are currently at the edge of a most exciting new development.

J.H. Vandermeulen, Coordinator
J. Somers, Exhibit Manager
H. Foster, Editor

acknowledgements

principal funding support from:

Atlantic Canada Opportunities Agency

additional support from:

Department of Fisheries and Oceans

International Institute for Transportation and Ocean Policy Studies

International Ocean Institute

Province of Nova Scotia

ABCO Industries Ltd.
81 Tannery Road
Lunenburg, N.S. BOJ 2CO

Contact: Alec Gingell

Tel. (902) 634-8821
FAX (902) 634-8583
Telex 019-21654

For over 40 years, ABCO Industries Limited has worked in close cooperation with the North American fishing industry, and has grown into the largest manufacturer of fish processing equipment in Canada.

Located in Lunenburg, Nova Scotia, in the heart of the Canadian East Coast fishing industry, ABCO Industries has its engineering and manufacturing facility, with over 1800 sq. meters of work shops and a work force of 75 persons.

Over the years, ABCO engineers have gained a thorough background knowledge of the day-to-day problems that affect both efficiency in the fish plant and quality of the product. ABCO equipment is based on designs which have proven to be acceptable for installation by nearly all major fish processing plants in Eastern Canada. While the basic concept for each item is based on standard proven designs, each is available in a wide variety of arrangements and sizes to suit customers needs. All equipment is built to conform with sanitary conditions established by the Canadian Federal Department of Fisheries. This ensures that the customer's processing line will operate smoothly and efficiently, while maintaining high quality and yields.

An example of this detailed understanding of day-to-day problems of processing plants can be seen in usage of ABCO Incentive Filleting Tables. These filleting tables enable the Production Supervisor to monitor abilities of each person filleting fish in terms of productivity and yield. This has two main advantages in that a bonus payment can be made to the best workers, thus encouraging high productivity, while one can identify and retrain those that are either very slow or waste fish by poor cutting. It can have a significant impact on the profitability of the plant.

As fish plants vary a great deal in size, sophistication, labour availability and labour costs, ABCO endeavours to recommend appropriate technology which will most benefit each individual plant.

ABCO also has the ability to undertake complete plant layouts, both for new construction, or where customers wish to modernize existing facilities.

ABCO maintains a Research and Development department that is constantly looking for better methods of fish processing and handling. We welcome enquiries on specific problems. Together with our client we can usually find a solution. The following examples are typical results of ABCO's close cooperation with the fishing industry.

The development of a wide range of Fish Unloading Systems has enabled ABCO Industries Limited to offer cost effective solutions to most unloading problems in various regions of the world. These unloading methods range from dry vacuum systems for operations where water usage is prohibited or where good clean water is unavailable, to wet pump unloading systems that can discharge fish from nets or flooded holds. For the smaller operation, we offer both a fixed and portable automatic tub dumper.

ABCO has also developed a series of energy efficient Continuous Cookers that give substantial yield improvements for lobster, crab and mussels. There is also a noticeable improvement in flavour and nutrient retention, as cooking time using the ABCO method is substantially reduced.

The ABCO automatic tub dumper

It is developments such as these that enable ABCO to offer a comprehensive range of equipment and engineering services to the fish processing industry.

This wide range of ABCO designed and built equipment is expanded even further by ABCO's association with manufacturers of specialized equipment in other countries. Examples of this equipment would be icemaking, fish smoking, fish meal plants, vacuum

Applied Microelectronics Institute
1127 Barrington Street
Halifax, N.S. B3H 2P8

Contact: V. Murray Vandewater

Tel. (902) 421-1250
Telex 019-21828

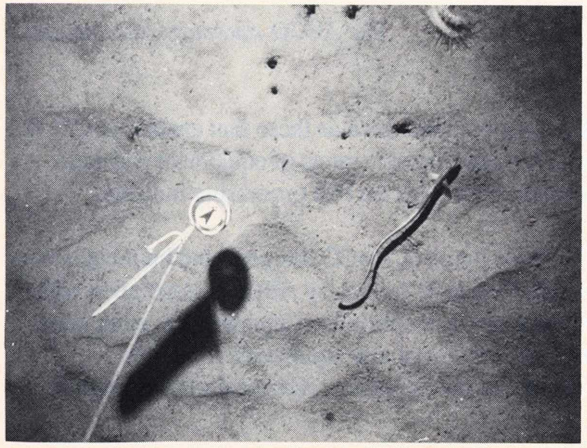
packaging, weigh scales, insulated boxes and forklift trucks.

ABCO Industries Limited endeavours to offer a total service to the fish unloading and processing industry, based on more than 40 years experience of good cooperation and understanding with their customers. ABCO also recognizes that local regulations on imports, local labour content and shipping charges make the purchase of ABCO equipment sometimes impossible, although the need is clearly established. Under those circumstances ABCO is prepared to discuss ways and means for local manufacture of non-critical components.

Whether your operation is large of small, modern or otherwise, ABCO's practical background in this industry could help solve your problems.

* * *

On the floor of the mid-Atlantic Ridge
photo credit BIO



Applied Microelectronics is one of the most successful resources for commercial applications of sophisticated electronic product design solutions. This activity (total value to date of over $3.5 million) includes prototype, production, manufacturing and testing. Typical applications involve microprocessors, higher level software and systems integration. Added to the resources of the company is the attention to the demands of quality control.

Advanced design tools include a high end integrated circuit design capability, electronic engineering design and prototype development and a variety of computer aided design programs. This has led to national and international expertise in analog/digital signal processing, high performance micropower miniature circuitry and systems, sensors and controllers, and telemetry that includes acoustic and radio frequencies. Particular capabilities are recognized in applications of real time multitasking software systems and RF applications.

The client base of Applied Microelectronics encompasses most of the advance technology applications in the area as well as national and international clients. This activity includes both complicated hardware design and development integrated with intricate higher level software development. These applications have been product oriented and form a diverse range of requirements and clients.

INDUSTRIAL SERVICES
- Contract product development in electronic systems
- Hardware prototype and manufacturing support
- Assistance in preparation of proposals and technical management
- CAD support for complex printed circuit board design and layout
- Remote access to computer-based design tools
- Access to laboratory space and specialized equipment

TECHNICAL CAPABILITIES
- Real time multitasking software design and development
- Integrated ASIC circuit design
- Software support and design for systems integration
- Realization of requirements for analog/digital signal processing
- High performance, micropower miniature circuitry
- Telemetry (acoustic, RF, etc.)
- Digital speech compression techniques
- Computer aided electronic engineering design tools

INDUSTRIAL DESIGN AND DEVELOPMENT PROJECTS
The industrial projects group provides an experienced electronic design and prototype capability with expertise in the application of microelectronic technology to industrial systems.

- Specialized product for the cable television market
- Ultrasonic Imaging System
- Remote Monitoring and Diagnostic System
- Electronics for a Programmable Underwater Camera
- Signal Conditioner
- Controller and RF Electronics for Ocean Buoy Systems

RESEARCH PROJECTS
One major application area is contractual research and

Arctic Sciences Ltd.
100 Ilsley Avenue, Unit AA
Dartmouth, N.S. B3B 1L3

Contact: Dave Fissel

Tel. (902) 465-3871
FAX (902) 464-003
Telex 019-31590

development performed for industrial clients. An active research program is carried out in collaboration with local universities and parallels industrial activities.

- Biotelemetry: development of technology for monitoring behaviour of aquatic animals and similar applications; development of sensors and monitoring devices for use during heart surgery
- Time Domain Beamforming: systolic/wavefront architectures for signal processing with long-term aim of a standard chip set to support digital signal processing techniques in VLSI.
- VLSI Design Software: Improved design automation aids at the symbolic layout level and investigations into algorithms for the generation of symbolic layout from a net-list style circuit description.
- Digital Speech Compression: A data compression technique based on the estimation of conditional probabilities of the input has been developed. This input is given a user-controlled portion of the past stored in memory of the coder and decoder 2.

Applied Microelectronics is a business with full marketing and administrative support. This assures prompt and efficient response on all areas of customer service ranging from product promotion to sales advice.

* * *

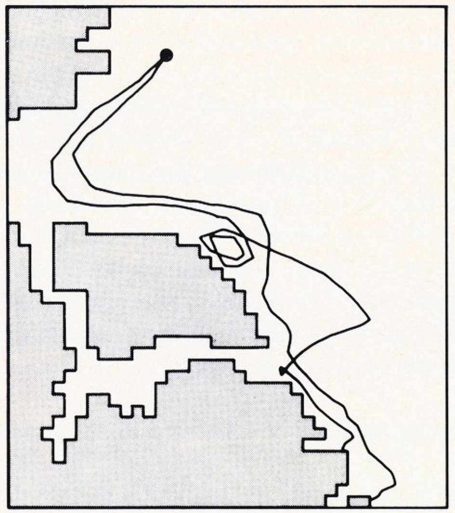
Arctic Sciences Ltd. is a scientific consulting company, specializing in physical oceanography, including waves and currents and water property distributions. Incorporated in 1977, Arctic Sciences consists of approximately 25 professional and support personnel operating from offices in Dartmouth, Nova Scotia and Sidney, British Columbia. The company has conducted more than 200 projects, ranging up to $500,000 in size, for its clients in the government, oil industry and private consulting business sectors.

SERVICES OFFERED BY ARCTIC SCIENCES.

- Physical Oceanography:
Measurements and analysis of ocean currents, waves, water levels, temperature, salinity and other water properties for scientific, engineering and environmental applications.
- Ocean Acoustics:
Research and development into active and passive acoustic techniques to measure oceanic properties (e.g. waves, currents, sea surface wind speeds, zooplankton distributions). A new line of commercial instrument products is being developed by an affiliated company, Oceanprobe Systems Manufacturing Inc.
- Sediment Transport:
Measurements and analyses of sediment transports in coastal and estuarine environments.
- Sea-Ice and Icebergs:
Studies of the concentration and distribution of sea-ice and icebergs, with application to scientific research and engineering requirements for fixed and mobile offshore platforms.
- Remote Sensing:
Digital processing and enhancement of satellite- and aircraft-based remote sensing data for: mapping oceanographic properties, including temperatures, water colour and sediment concentrations; and measurement of ice properties (concentration, lead/floe size statistics and velocities).
- Equipment Rental:
Over 40 types of oceanographic equipment and instruments are available for rental. Support services, including data processing and customized modifications, are offered for many of the instruments.
- Inter-Disciplinary Studies:
Since its inception, Arctic Sciences has participated in many interdisciplinary studies involving a wide range of applications: fisheries; marine mammals; biological oceanography; sediment distributions; and oil spill tracking and control.

* * *

Two oil parcel trajectories by Arctic Sciences



ASA Consulting Ltd.
PO Box 2025
Dartmouth East, N.S. B2W 3X8

Contact: Steve Hurlbut

Tel. (902) 465-5535
FAX (902) 464-9602

Bert van Leeuwen Industrial Design Ltd.
11 Princess Street
Amherst, Nova Scotia B4H 1W5

Contact: Bert van Leeuwen

ASA Consulting Ltd. is a Canadian company specializing in physical oceanography and ocean engineering as applied to estuarine, nearshore and continental shelf processes.

In particular, ASA specializes in the application of numerical techniques to the solution of problems ranging from applied fluid mechanics to continental shelf oceanography. Projects to date have included engineering applications, environmental impact assessments and basic scientific research. Study locations have ranged from the Bay of Fundy and the Northern Atlantic to the Canadian Arctic. Clients have included government agencies at the federal, provincial and municipal levels, power corporations, private industry and major oil companies. As well as expertise in numerical modelling, ASA's staff also offer considerable experience in project planning and management.

ASA Consulting Ltd. was established in Nova Scotia in 1983, and currently has a staff of six professionals. Our location in Dartmouth on the grounds of the Bedford Institute of Oceanography provides ready access to extensive ocean-related resources, both at the Institute itself and through Dalhousie University and the Technical University of Nova Scotia. In addition, a joint venture agreement with Applied Science Associates, Inc. of Wakefield, Rhode Island, USA, provides ASA Consulting Ltd. with access to internationally recognized expertise in the development and application of state-of-the-art numerical models.

The following are some of ASA's areas of expertise.

- Coastal Engineering: design studies for wave and current forces; extreme water levels; wave refraction, shoaling, reflection and diffraction; harbour seiching; harbour siltation/erosion; tidal power analysis; and nearshore and beach sediment dynamics
- Physical Oceanography: continental shelf, coastal estuarine and lacustrine circulation; ice and iceberg dynamics; boundary layer processes; mixing and stratification processes
- Offshore Engineering: analysis of extreme current and wave conditions; seabed stability; seabed/structure interactions; analysis of discharge plumes; and iceberg management analysis
- Environmental Impact Assessment: ecosystem modelling; oil spill fate and impact analysis; dredge spoil fate analysis; and water quality determination and pollutant transport
- Seabed Processes: continental shelf sediment transport; coastal sediment transport; and cohesive and non-cohesive sediments
- Fluid Mechanics: floating body dynamics; fluid/structure interactions; mooring dynamics; laminar, transitional and turbulent boundary layers; and non-Newtonian flow simulation.
- Numerical Modelling: one, two and three dimensions; cartesian and spherical coordinate systems; finite difference and finite element modelling; and boundary fitted coordinates
- Data Analysis: time series analysis; statistical analysis; and filtering techniques

* * *

Incorporated in 1974 to exploit the widely diversified experience of its Principal:
H. J. (Bert) van Leeuwen, P.Eng., A.C.I.D., MEIC.

This firm prefers non-routine, problem-solving assignments with considerable research and development content and has established excellent contacts and working relationships with experts in many areas of engineering, science and technology.

Association with VAN LEEUWEN ENGINEERING LTD. of Stittsville, Ontario, adds the expertise of young engineers in the area of EM1 and electronic packaging and robotics as well as production technology.

About 25% of the business is ocean oriented, and assignments carried out in the past include:

New design for a drill jar (drilling technology)
New design for a junk retriever (drilling technology)
Design research to reduce or prevent fatigue failures in drilling equipment
Design research to develop stable, passive, survival modules for cold oceans
Design research on engineering for aquaculture for the National Research Council Rationalization of fish processing equipment manufacturing
Research into the stability of small inflatables
Design of search and rescue balloons and balloon-kites
Design of improved fish transfer equipment
Design of modular fish boxes
Design and development of Saulnier Safety buoys and novel SCUBA buoys
Design of improved squid jigger
St. Lawrence Seaway shunter proposals

Tel. (902) 667-3464
FAX (902) 667-6008)

Design of mussel processing plant
Design for production of fish marking gun for aquaculture
Design of flipper propulsion device
Design of LCL containers
Improved, low cost composites for boat hulls
Industrial design of conventional marker buoys

Much of our regular work concerns reduction to practice, i.e., the development of an idea into something practical, which can be produced at reasonable cost. Because of the limited population in Eastern Canada, we have had to offer tool and machine design services for our clients in order to supply a more complete package. Our background in the electronics industry has given us the ability to design for mass-production. Our experience in the aircraft industry has enabled us to transfer much of the short run, quick change production technology to those clients who are committed to manufacturing in stainless steel and aluminum alloys and other advanced materials.

The following is a list of other assignments we have been associated with as designers or consultants.

Design of a powderpump for spectroanalysis of dry materials
Design of semi-automatic woodworking, glueing and nailing equipment
Design of a specialized scarf glueing machine using RF
Structural design for glue-laminated arch and beam manufacturer
Design of a new 108' x 200' production plant for same, using glulam trusses
Conveyors and systems for fish plants
Design and prototypes for fuel efficient blueberry burning machine
Design of blueberry processing, cooling, drying and sorting equipment
Marketing study for local manufacturing of non-ferrous products
Design of low pressure aluminum casting moulds for local manufacture
Design and development of "Solarsoft" roll-up solar water heater for the tropics
FRP Product development
Design of commercial building, including pre-fabricated modules
Design of high-speed progressive dies, plastic injection moulds, etc.
Design of domestic oil and gas furnaces
Call for specific answers to your inquiries

* * *

The CSS FCG Smith surveying
Lunenbury Harbour, Nova Scotia.
photo credit BIO

Bedford Institute of Oceanography (BIO)
PO Box 1006
Dartmouth, N.S. B2Y 4A2

Contact: Steve McPhee

Tel. (902) 426-3870
FAX (902) 426-7826
Telex 019-21891

The Bedford Institute of Oceanography (BIO) is the principal oceanographic institution in Canada. It is operated within the framework of several federal government departments. BIO facilities are operated by the Department of Fisheries and Oceans. The principal laboratories and departments located at BIO are:

- Department of Fisheries and Oceans: Canadian Hydrographic Service (Atlantic); Physical and Chemical Sciences Branch; Biological Sciences Branch.
- Department of Energy, Mines and Resources (DEMR): Atlantic Geoscience Centre
- Department of the Environment (DOE): Seabird Research Unit

DFO operates a fleet of research vessels, together with several smaller craft out of BIO. The two larger scientific ships, Hudson and Baffin, have global capability, extremely long endurance, and are Lloyds Ice Class I vessels able to work throughout the Canadian Arctic.

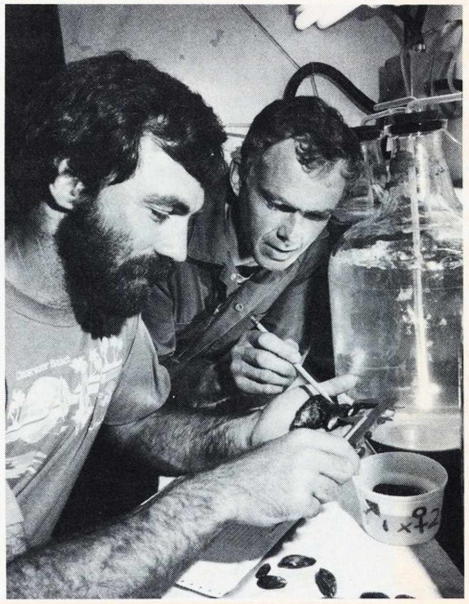
BIO has four objectives:
- To perform applied research leading to the provision of advice on the management of our marine environment including its fisheries and offshore hydrocarbon resources.
- To perform fundamental long-term research in accordance with the mandates of the resident departments.
- To perform necessary surveys and cartographic work to ensure a supply of suitable navigational charts for the region from George's Bank to the Northwest Passage in the Canadian Arctic.
- To respond with all relevant expertise and assistance to any major marine emergency within the same region.

BIO was established in 1962 by the Government of Canada to respond to the high probability that many sectors of the Canadian economy would, in the years to come, require research and services from all disciplines of marine science.

BIO was endowed from the start with splendid seagoing ships whose operational capability has seldom been matched even today, and the newly recruited scientific teams were quickly able to go to sea wherever and whenever their research required. An ability to work in the high Arctic under moderately severe ice conditions, and to continue precision scientific work in the North Atlantic under winter conditions that would be impossible for most ocean-going scientific vessels, has characterized BIO research through the years.

BIO has also been different from most other marine science institutes in a rather special way. The range of disciplines included in a single corporate institution has been extraordinarily wide, which has provided unusual opportunities for cross-fertilization and collaboration. The physical, chemical, and biological oceanography research groups have worked alongside teams of marine geologists, metrologists, fishery biologists, ornithologists, and hydrographers and cartographers. Many research projects, and more voyages than not, have involved collaboration between several of these groups, irrespective of their funding and affiliation.

Aquaculture mussel research at BIO



There is no doubt that the period since the establishment of BIO has been one of extremely rapid development of new understanding in all the marine sciences and the application of the new findings to the needs of society.

There is no question that the most revolutionary changes have occurred in the earth sciences, at least comparable to the Darwinian revolution in biology, and at least as important economically. When BIO was founded, the concepts of sea-floor spreading and continental drift were just beginning to be talked about on the basis of the first hard data to support them. In the intervening years the whole science of global plate tectonics has become established as the corner stone, not only of marine but of all geological sciences.

The contributions of BIO to global plate tectonics, ocean circulation, biological production, management of commercial sea fisheries, and techniques of charting the sea for navigation have been novel and significant.

There have been deep economic changes in the fishing, shipping, and offshore energy industries. In the same period, BIO has carried the mandate of several federal departments in the application of scientific solutions to the economic revolution that has occurred at sea, for

Brooke Ocean Technology Ltd.
24 Flamingo Drive
Halifax, N.S. B3M 1S7

Tel. (902) 443-2932

Contact: Arnold Furlong

the benefit or survival of several sectors of the Canadian economy.
There has been an ever-increasing demand for new surveys, new information, and new services that could have been satisfied in no other way. In the last quarter-century, the fishing industry and fishery managers have weathered the crisis in fuel prices, the establishment of a 200-mile fishing zone, the economic restructuring of the industry, and rapidly changing international markets. The energy industry has undertaken major offshore exploration in Atlantic and Arctic Canada, and found engineering solutions to deep water and unstable sediments, bergs and pack-ice, and extreme wind and sea conditions -- all in waters more exposed than any other offshore exploration area. The highest tidal regime in the world required extensive evaluation of the consequences of its utilization as a regional energy source. The shipping industry continually uses fewer, larger, deeper-draft, and faster ships on new routes and to new ports and demands a more rapid evolution of navigation charts and aids than ever before. This period has also brought unexpected new knowledge of how dramatically year-to-year weather patterns can be disrupted by changes in ocean circulation, and of the importance of the ocean in mediating longer-time-scale climate changes: the agriculture, transport and energy sectors of the Canadian economy are now known to have been seriously affected by such processes.

To all of these, and other practical matters, scientific solutions, services, or data have been required from the scientific community at BIO by several federal and provincial departments and by many Canadian industrial enterprises.

* * *

Brooke Ocean Technology Ltd. was formed in January 1983 to offer firstly, but not exclusively, mechanical research and development, and where necessary, the conceptual design and industrial reproduction of unique oceanographic equipment and methods, particularly mechanisms to suit various environments. Due to recent expansion, the Company can also offer electrical/electronic design services. Feasibility studies and other advisory services in ocean engineering, including the selection and use of related equipment and management of large projects is also within the scope of the Company's expertise.

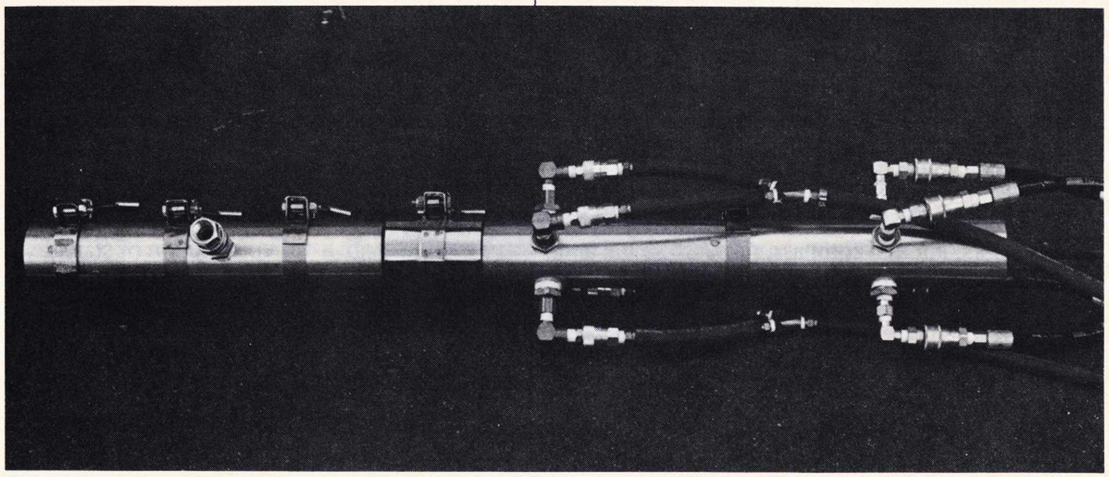
The principal has many year's experience associated with the fields of civil, aeronautical and nuclear engineering and spent 18 years at an oceanographic institute carrying out a variety of projects, from the development of new and unique oceanographic tools to the management of large development plans for industry.

The emphasis is on the application of practical mechanical design and engineering to the research, development and testing of new oceanographic equipment and instrumentation.

Brooke Ocean Technology Ltd., located in the Halifax-Dartmouth area, is 100% Canadian owned. The present administrative office is in Halifax with the engineering office located in the commercial area of the Bedford Institute of Oceanography.

PRODUCTS
- Cable Maintenance System: Brooke Ocean Technology Ltd. has developed the Cable Maintenance System for the Atlantic Geoscience Centre of BIO. The unit employs a unique brush sealing system, which conforms to the shape of stranded wire rope or E-M cable, allowing liquid or grease lubricants to be applied under pressure.

photo credit Brooke Ocean



Canadian Seabed Research Ltd.
PO Box 2508, Station M
Halifax, N.S. B3J 3N5

Contact: Glen Gilbert **Tel. (902) 422-2840**

-C-Mosquito Intelligent Single Board Computer: The C-Mosquito is a small, cost effective SBC intended for use in remote battery powered applications, requiring operation for extended time periods without servicing. It is useful in any application where an inexpensive programmable controller or data recorder is required.
- Browser: Browser is an underwater photomosaic system which has applications where 100% photographic coverage of an area of the ocean floor is required. It does not require the necessity of elaborate acoustic array markers and can be deployed, perform its survey, and be recovered in several hours.
- Launch and Recovery Mechanism for Support Vessels: Brooke Ocean Technology has developed a simple, low cost mechanism which eliminates the necessity of crew handling in the deployment or recovery of a support vessel from a mother ship, thereby avoiding the possibility of crew injury.
- System for Towing through Ice (Under development): This system will allow instrumented bodies to be towed astern through broken ice. The system will offer a method that is adaptable to most ships involved in towing instrumentation.
- Underwater Current Meter (Under development): The Underwater Current Meter is a low cost vector measuring current meter expected to be ready for the market place by 1989. The instrument has two orthogonal propeller sensors, internal compass, pressure gauge and 1 M Byte of solid state memory.

* * *

Canadian Seabed Research Limited is a 100% Canadian owned marine geophysical consulting company that offers professional services to engineering groups, petroleum companies and government agencies working in Canada's offshore environments. Emphasis within the company is placed on the interpretation of high resolution marine geophysical data.

OCEAN TECHNOLOGY PRODUCT LINE
- Marine Geophysics and Geology
- Side scan sonar applications
- Digital bathymetry system (SQS)
- Database applications
- Geographic information system
- Geophysical surveying and interpretation
- Acoustic/Geotechnical corelations
- Engineering CAD work stations
- HP Plotting Facilities

Typical projects include:
- site survey investigations
- localized marine geological research
- sediment core analyses
- computerized interpretation of marine geological data such as the East Coast and Beaufort Sea ice scour databases.

Digital interpretation of the marine data is accomplished through a varied selection of statistical, graphical and electronic mapping software utilities that can analyze and spatially display the data in optimal formats. A recent development is the planned acquisition of a Geographic Information Systems (GIS) digital mapping work station.

The company principals are Glen R. Gilbert and Steve d'Apollonia who have over 12 years working experience in the Canadian offshore industry with unique working experience in ice-infested environments. Canadian Seabed Research Ltd. presently employs four geophysical research technicians and operates from its offices at 1541 Barrington Street in Halifax, Nova Scotia.

SEAFLOOR QUANTIFICATION SYSTEM
Echo sounders used in marine surveying applications transmit and receive high frequency acoustic energy via a transducer. The acoustic signals, received from the seafloor are translated into an electrical analogue signal which burns a mark into electro-sensitive paper. The location of this mark records bathymetry while the intensity and duration of the pulse is dependant on the physical and morphological attributes of the reflecting medium.

The marine engineering community working in ice-infested waters has recognized the importance of analyzing great quantities of this echo sounder data such that statistical data can be derived concerning safe engineering design in areas of potential seafloor production. Cdn. Seabed Research has been intimately involved in such work, particularly relating to problems of ice scour in the Canadian Beaufort Sea.

Until now, data derived from an ice scour survey must be returned to the office, digitized and processed trough a series of intricate steps in order to yield high resolution information concerning the sea floor; namely ice scour statistics. In recognition of the present day digital technology, CSR offers an automated processing capability through the new sea floor Quanti-

fication System (SQS) whereby acoustic signals received from the sea floor are digitized, filtered and numerically processed to yield precise scour depth data previously unavailable for the offshore industry.

This information can be translated into a number of databases or CSRs, GIS mapping utilities and retains the ability to be digitally reprocessed in the future as new information becomes available. One immediate application is the identification and storage of scour depth information utilized in deriving information for pipeline burial depths in Arctic environments.

SCOUR DETECTION APPLICATIONS

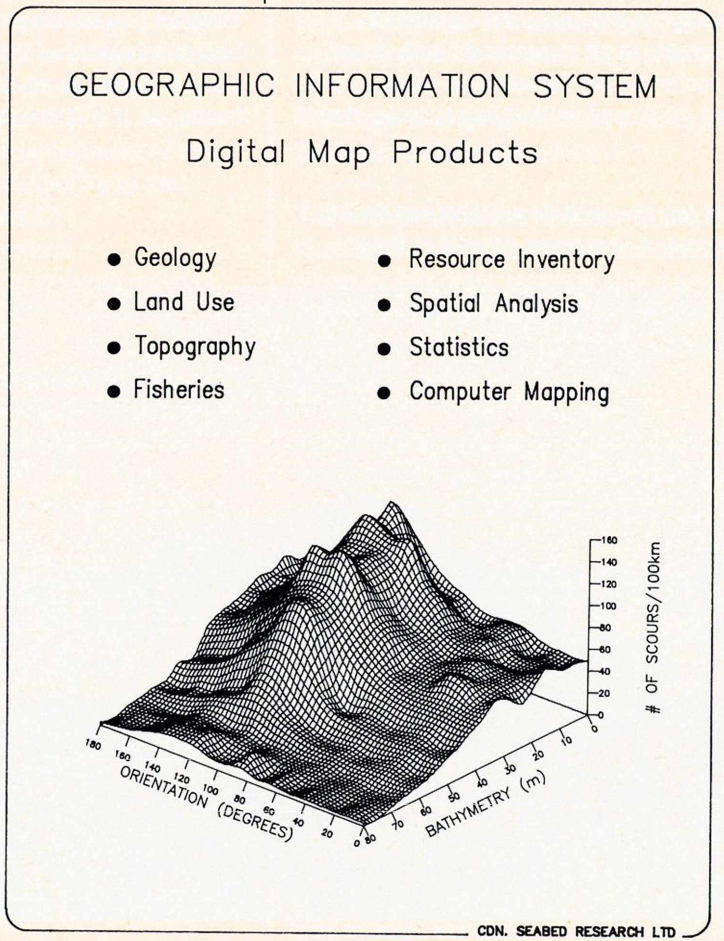
Scour depth values from echo sounder data are perhaps the most important scour parameters that can be recorded in ice-infested environments. From this data, scour depth distributions and extreme value analyses can be derived which will aid design engineers develop safe and yet economical pipeline burial strategies.

The SQS system digitizes the analogue sounder output and transmits the data serially to a high capacity micro-computer. The digital sampling rates of the digitizer are high enough to reproduce faithfully the detailed sea floor morphology. Once the data is stored correctly, a number of software utilities are run to remove spurious data points and screen the data for further analyses.

The scour detection software works by first digitally filtering the data such that a representative "smooth unscoured" sea floor profile is generated. Any negative divergence below this "smoothed profiled" will be detected as an ice scour feature by the software. At this stage the routine will detect the maximum depth of this incursion, record the ship's lat/long equivalent and download all this information to a pre-structured data-base format for further analysis.

Additional routines may include geological feature detection including: sand ridges, pingos, steep slopes and potential sediment ransport bedforms, including sand waves, sand ridges, etc.

* * *



Cherubini Metal Works Ltd.
50 Joseph Zatzman Drive
Dartmouth, N.S. B3B 1N8

Contact: Jeff Kay

Tel. (902) 469-5630
FAX (902) 466-3742

Cherubini Metal Works Ltd. is a Nova Scotia owned company, experienced, versatile and innovative in metal fabrication and manufacturing.

From modest beginnings Cherubini Metal Works has expanded to a 20,000 square foot production plant with 60 full-time employees, available and capable of producing fabrications to all recognized North American standards, including the Canadian Institute of Steel Construction and the Canadian Welding Bureau, class 2 certification.

Our construction services include erection and demolition of a wide range of structures, as well as their maintenance and repair. Our shop does made-to-measure fabrication, and includes skills in stainless steel, aluminum, brass and copper. Our field skills include: mobile on-site welding, burning and fitting on a 24 hour basis.

Whether you need a structural steel building, tanks, bins or a ladder, we can design, build and install it for you. Big jobs or small, if it is made of metal, it's our business. If it is not embedded, we will install it.

* * *

CSS Hudson passing a 325 ft. high iceberg in northern Baffin Bay

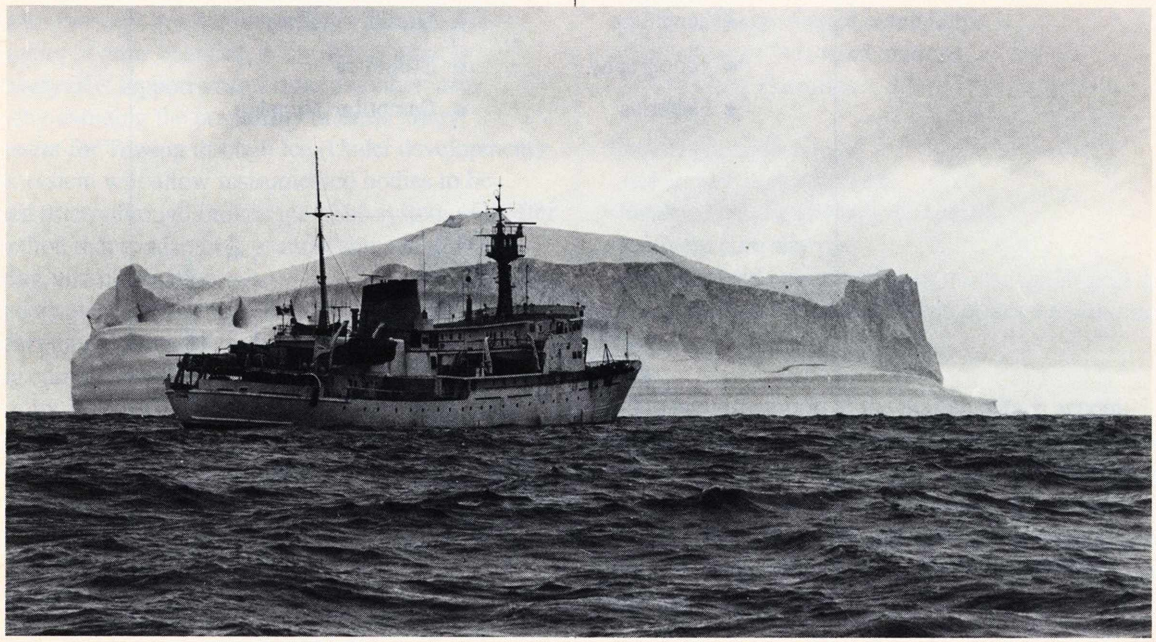


photo credit BIO

The CORD Group Ltd.
70 Neptune Crescent, Suite 215
Dartmouth, N.S. B2Y 4M9

Contact: Bob Wilson

The CORD Group Limited was formed in 1983 to provide marine safety related consulting and equipment evaluation services. Since inception, CORD has provided these services on a continuing basis to:
- Offshore oil and gas industry
- Canadian Department of National Defence
- Canadian Department of Energy
- Immersion suit manufactures
- Other commercial enterprises

The company activities are focused in the following general areas:
- Evaluation of safety and emergency equipment
- Development of manuals, procedures and contingency plans related to safety and handling of emergencies
- Preparation of industrial safety training plans
- Coordinate the aquisition, installation, trails, certification and training of marine safety/life saving systems
- Conceptualization and conduct of emergency simulation exercises.

CORD has acquired the expertise and resources to conduct comprehensive performance testing of immersion clothing ensembles. The equipment available in the company's test laboratory includes:
- Thermal Instrumented Manikin
- Test tank with computer controlled wave generating capability
- Wind tunnel for conducting manikin tests in controlled air flow

The Thermal Instrumented Manikin is a means for evaluating the thermal insulation of protective clothing. The system consists of a hollow aluminum manikin equipped with temperature sensors and electric heaters connected to a computer system. In operation,

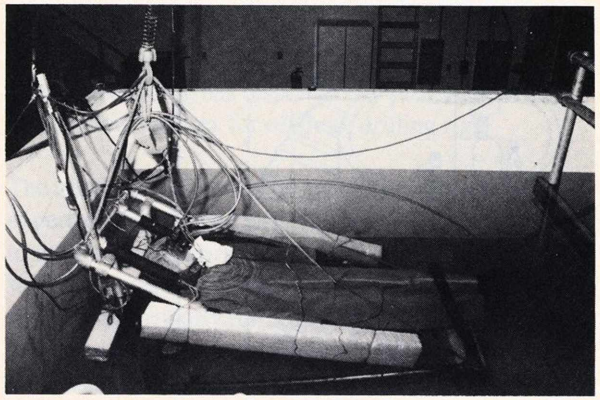
Tel. (902) 468-2116
FAX (902) 468-2636

Dalhousie University
The Technology Transfer Office
6093 South Street
Halifax, N.S. B3H 1T2

Contact: Gordon Owen

Tel. (902) 424-1648
FAX (902) 424-2319
Telex 019-21863 DALUNIV HFX

the manikin is dressed in the human-use apparel to be tested and immersed in a suitable environment. The computing equipment then controls the heaters to maintain the skin of the manikin at a set temperature and measures the electrical power required to do so. This power is equivalent to the heat that escaped through the suit due to the temperature differential. The power and temperature differences are then used, along with the known surface area of the manikin to calculate the thermal resistance offered by the apparel.



The CORD Group has recently developed a Breathing Simulator to test respiratory systems. These systems can be either human or mechanical systems. The machine simulates a programmed output performance and measures the internal characteristics of a breathing system. The parameters describing output performance are: respiratory minute volume, tidal volume, frequency and wave form. The parameters describing internal characteristics are compliance and resistance. The assembly of hardware under computer control provides a flexible system that can be programmed for specific requirements.

* * *

Dalhousie University is a major research and educational center in Halifax, Nova Scotia, the largest metropolis on the East Coast of Canada. In 1987-1988, the University conducted over $24 million in sponsored research through grants and contracts.

Dalhousie University's Office of Technology Transfer was established in December, 1987 to bring university-based science and technology into closer partnership with the business community. The Office is responsible for linking research to the establishment of new spin-off businesses as well as contributing to the expansion of already existing ones.

The Technology Transfer Office works with industry to:

- transfer new technologies and inventions from University researchers to industry
- help with the research and development needs of industry
- meet the specialized technical and analytical needs of industry by providing access to Dalhousie's knowledge, resources and expertise
- fulfill occasional consulting needs

DEPARTMENT OF OCEANOGRAPHY

Dalhousie University's Dept. of Oceanography is made up of four major groups of research: Biological, Chemical, Geological and Physical Oceanography. Each group continues a tradition of excellence in oceanographic science. Research activities in the past two years were carried out in the Atlantic, Pacific, Indian, Antarctic and Arctic oceans as well as in offices and shore-based laboratories.

Strong collaborative efforts have resulted in many successful ventures with Dalhousie's Biology and Geology Departments, the National Research Council of Canada's Atlantic Regional Laboratory, the Federal Department of Fisheries and Oceans, the Technical University of Nova Scotia, and in particular, with the Bedford Institute of Oceanography, as well as other universities in the Atlantic Region and beyond.

The Department maintains its own supercomputing facilities, including graphics.

The Groups are active on many fronts, from understanding the biological consequences of variability in air-sea interactions, to developing a new understanding of the deep-sea benthos. Research activities are diverse, and include short term practical problems as well as pure research.

The projects range from mass culture of phytoplankton to trace metal adsorption kinetics; from instrument development to a study of Niagara Falls.

Work to date has focused on geodynamic problems concerning deformation of the lithosphere, formation of sedimentary basins, and evolution of mountain belts. Other work has focused on the Ocean Drilling Projects, work on ice in the Arctic Ocean, and participation on site surveys.

THE AQUATRON LABORATORY

The Aquatron Laboratory is a specialized marine and freshwater research facility designed to provide scientists and engineers with control of environmental variables of large volumes of water, but within the tractable confines of the laboratory. Fully integrated within the

Life Sciences Centre, the system couples large research tanks and controlled-environment aquarium rooms with an array of standard laboratory facilities in the departments of Oceanography, Biology and Psychology.

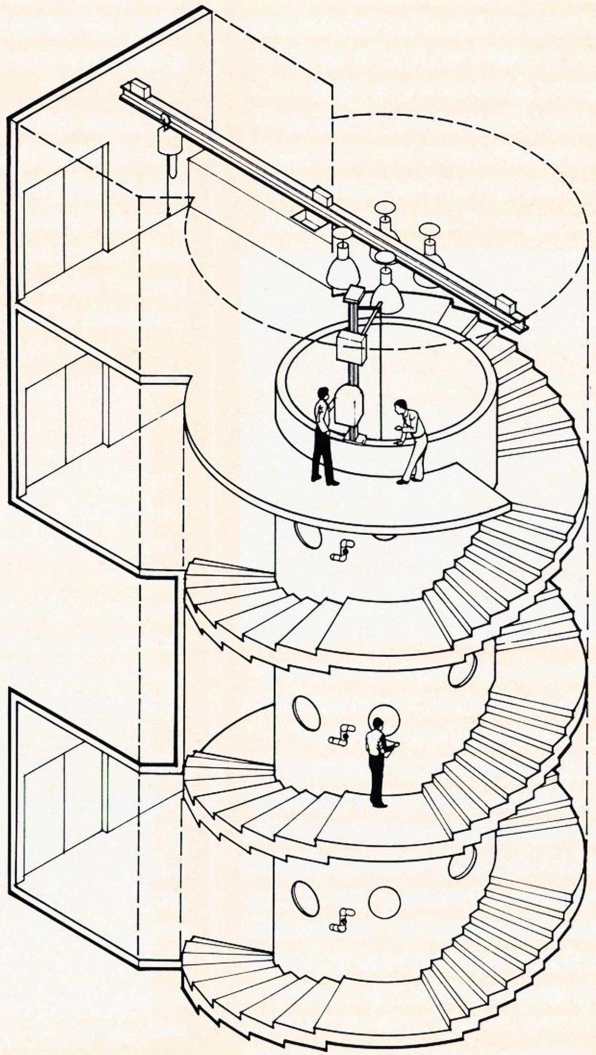
The Aquatron Laboratory is maintained and operated by Dalhousie University, with assistance of the National Sciences and Engineering Research Council of Canada. Its facilities are available for use by marine scientists from academic institutions, government laboratories and commercial establishments, both within Canada and abroad.

Research activities in the Aquatron facilities have focused on a number of important aspects in fisheries-related research. These include:

- Salmon aquaculture and physiology
- Cephalopod spawning and larval ecology
- Equipment development and testing
- Seal behaviour and parasitology
- Benthic boundary-layer processes
- Lobster culture
- Cold water crab physiology
- Aquaculture genetics
- Phytoplankton mass culturing
- Zooplankton feeding and behaviour.

* * *

AQUATRON LABORATORY
DALHOUSIE UNIVERSITY



Dominion Diving Ltd.
PO Box 862
Dartmouth, N.S. B2Y 3Z5

Contact: Barry Lohnes

Tel. (902) 434-5120
FAX (902) 463-7966
Telex 019-23562

The concentration and diversity of ocean-related activity on the Canadian east coast has created a need for a wide range of diving services and support equipment. Dominion Diving has responded by providing salvage, inspection, repair and maintenance services, support equipment and shore based services. During the past 20 years, Dominion Diving has constantly expanded its operations to meet the growing demands of their customers.

This has necessitated a continual update of equipment, diving techniques and related services.

Dominion Diving has responded by providing diving and support services for offshore drilling rigs.

The trend toward the use of remotely operated vehicles to perform specialized tasks has added a new dimension to the diving industry. Dominion Diving realizes the safety and cost benefits offered by diver alternative systems, particularly for deep water work, and has expanded its capability in this area through the purchase of Scorpio 49 and a Canadian Hysub.

Dominion Diving provides underwater contract services, support vessels and a full range of equipment for all phases of the offshore oil and gas industry.

DIVING SERVICES
Diving teams with air and mixed gas capability available for short and long term contracts. Complete diving systems with surface support vessels are available on a 24 hour basis.

CONSTRUCTION
Diving support for platform and pipeline projects including riser installations on production platforms, pipeline surveys, burials and tie-ins, and setting of offshore tanker moorings.

DRILL RIG SUPPORT
Complete diving support for all phases of drill rig operations including pre-site surveys, hull inspections, and other surface and subsurface work for water depths to 750 feet.

SALVAGE
Inshore and offshore recovery of ships, barges, cargo, sub-sea structures and other objects.

MAINTENANCE AND REPAIR
Underwater welding and cutting, subsurface structure maintenance, platform and buoy maintenance, pipeline repairs, anode replacement, hull cleaning, and propellor, rudder and nozzle replacements for supply/support vessels.

SURVEY SUPPORT
Bottom and sub bottom profiling, coring, sand migration studies, rig positioning, tower components and equipment, and shore support including materials, supplies and small transportation vehicles.

INSPECTION
Manned and unmanned inspection vehicles, magnetometer equipment, side scan sonar, non-destructive testing (NDT), magnetic particle inspection and ultrasonic testing.

DIVING SUPPORT
Subsidiary companies of Dominion Diving Limited provide equipment repair and maintenance, custom machining, metal fabrication services, project management, and operational support.

Biomedical, diving and electronic systems engineering support, and civil engineering and marine survey expertise is available through association with local firms.

- 3 Diving Chambers rated to 250 FSW
- Open diving bell rated to 200 FSW
- Observation bell rated to 675 FSW
- Diving bell with lock out capability
- Complete range of manned and unmanned vehicles for observation and specialized work tasks
- 3 portable welding machines for underwater use
- 3 large and 6 small mobile offshore compressor units, hot water units, and diving bell handling system for diving support vessel
- Bounce dive system, rated to 750 FSW, with satura tion capability
- 35 sets of diving gear
- 8 HEO_2 helmets for deep sea diving
- Hull cleaning equipment for all size vessels
- Full range of underwater tools to support all diving operations

SUPPORT VESSELS
- 80 foot survey/diving support vessel
- 60 foot work boat for salvage, survey and scientific use
- 46 foot steel tug for towing and pilotage services
- 40 foot harbour diving tender complete with diving bell handling system
- 80 foot crane barge with 10 ton lift capacity
- flat deck barges

* * *

Earth and Ocean Research Ltd.
22 Waddell Avenue
Dartmouth, N.S. B3B 1K3

Contact: Dan Plasse

Tel. (902) 465-3974
FAX (902) 466-5745

The primary activity of the company is sea bed mapping. Typical projects include:

1) Geophysical/engineering projects—route surveys for pipelines, power cables and telecommunications cables, oil and gas drilling hazard surveys, and harbour development surveys;

2) Marine seismic exploration—field surveys with our fully rigged seismic ship M/V Probe Researcher (234 ft length, see below) plus on-board client representation and quality control for oil companies; and

3) Scientific projects—field investigations and office studies for the Government of Canada in support of continuing resource management activities. A typical resource management project includes the mapping of high resolution seismic data and seafloor sediment data to determine the potential for near shore mineral deposits, or, alternatively, to investigate a specific sea floor process such as sediment transport or ice scouring.

In total, Earth and Ocean personnel have participated in or conducted well over 100 sea bed mapping projects for various clients. A short list of recent and continuing projects includes:

- a fibre optic route survey in offshore Taiwan
- a resource evaluation project to indicate the potential of near shore gold and heavy mineral deposits in Atlantic Canada
- a harbour development study in Madagascar
- a preliminary pipeline route investigation for Gulf Canada in the Canadian Beaufort Sea
- a multi-channel seismic survey off southern Nova Scotia.

The company maintains a strong thrust in research and development. Over the past two years we have developed a sea bed mapping system that runs on the IBM PC compatible family of microcomputers. This system, called Super-Tech, enables the geologist to create digital databases from geological as well as geophysical information.

In addition, Super-Tech interfaces to a wide variety of computerized drafting packages such as Autocad and Verascad, which allows for the creation of digital drawings and for computerized draughting. Super-Tech is sufficiently compact to be used for mapping in real time at sea, or in a confined office space.

Our clients include major oil companies such as Mobil, Gulf, Husky, and Shell, as well as geophysical contractors such as McElhanney Services, Jacques/McClelland, McGregor Geosciences, and Geomarine Associates.

We also perform contracts on behalf of the Geological Survey of Canada, the Atlantic Geoscience Centre at the Bedford Institute of Oceanography, the Department of Indian and Northern Affairs, the National Research Council of Canada, the Department of External Affairs, the Canadian Oil and Gas Lands Administration, the Environmental Studies Revolving Fund, and the Nova Scotia Department of Mines and Energy.

We work closely on various R & D projects with Canadian universities such as the Technical University of Nova Scotia, Dalhousie University and the College of Geographic Sciences.

In 1986, Earth and Ocean formed a joint venture company with Duke University called Probe Research Canada Ltd. (PRC). PRC's mandate is to conduct large-scale seismic surveys in frontier areas of oil and gas exploration using our seismic ship M/V Probe Researcher. The ship is outfitted with advanced technical equipment worth several million dollars, including a complete seismic data processing system.

Planned projects for 1988 and 1989 include surveys along the Red Sea, Gulf of Aden and the Mediterranean. Much of the work will be conducted along the coastlines of some of the world's poorest nations. The results of these scientific projects could form the basis of long range exploration programs for oil companies working in these areas.

The combined billings of Earth and Ocean and Probe Research Canada Ltd. are expected to be about $6 million in the fiscal year 1988-1989.

* * *

The Eastcan Group of Survey Consultants Ltd.
5251 Duke Street, Suite 408
Halifax, N.S. B3J 1P3

Tel. (902) 420-8338
FAX (902) 423 0385

Contact: David Robert

The Eastcan Group was formed in recognition of a need for a large, multi-disciplinary survey organization to service the expanding and increasingly complex survey requirements of Maritime, Canadian and overseas markets. It is corporately owned by and unites the professional and technical expertise of the following four Maritime survey companies:

- Servant Dunbrack McKenzie and MacDonald Ltd.
- Wallace MacDonald and Lively Surveying Ltd.
- Rayworth and Roberts Ltd.
- Key Surveys Ltd.

Providing a complete range of surveying and mapping services, and operating independently from the corporate companies, The Eastcan Group operates three divisions: Photogrammetric Division (Dartmouth); Marine Division (Dartmouth/Halifax); and G.I.S. Division (Halifax).

The Eastcan Group and its owner companies provide full-time employment for 112 people including professional surveyors, engineers, photogrammetrists, system analysts and programmers, and support technologists.

LAND INFORMATION SYSTEMS

Land information systems technologies apply to such areas as municipal management and planning, resource industries (forestry/agriculture), engineering companies, and hydrographic chart production. The Eastcan Group provides professional assistance in the design and development of this highly effective technology within your company or agency. Totally integrated packages are available for digitizing new or existing information and the provision of this data in a compatible and workable format. Plotting facilities are available for hard copy output. True compatibility between graphic presentation and our digital database is accomplished by utilizing integrated industry-proven software. We can operate and maintain your database, which will further assist you in minimizing capital costs and expenses, while continuing to take advantage of this new and efficient technology.

CONVENTIONAL AND DIGITAL MAPPING

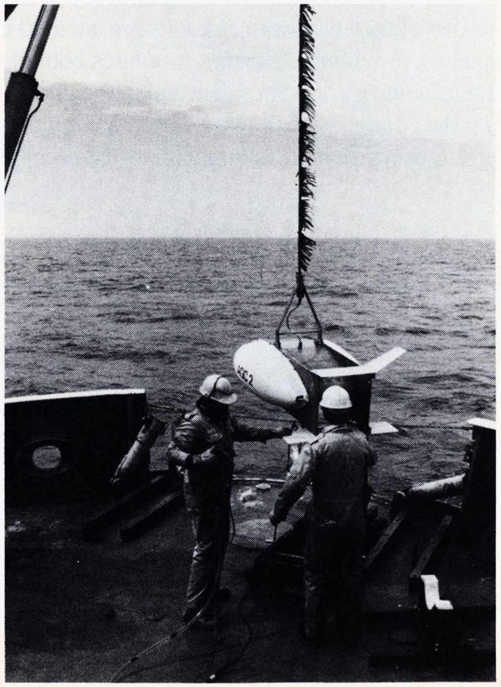
The production of maps has always been a fundamental part of many technical projects including government support programs, engineering design and scientific studies. The Eastcan Group, through its Atlantic Air Survey Division, provides a full range of mapping services using both conventional or digital techniques —depending on user requirements and specifications. Basic line maps can be provided showing all topographic features such as buildings, roads and contours. This can be further enhanced with the production of an othophoto base. The entire process can be performed digitally, which allows greater flexibility in the collection and usage of the information. Other specialized services are provided such as the compilation of stockpiles for forestry and mining companies and the subsequent volume calculations or the mapping of biological information on the seabed using underwater photogrammetry.

Cartographic services including drafting and scribing are provided as part of the mapping process or as standalone projects.

MARINE AND GEODETIC SURVEYS

The Eastcan Group offers a full range of offshore surveying and navigation services including positioning, support for seismic surveys, control of dredging surveys, berm construction, offshore rig positioning, placement of caissons and other offshore structures. The collection of sounding data and subsequent production of field sheets required for hydrographic surveys is also provided. These services are supported by a comprehensive software package for both on-line work and post-processing of data and by an equipment pool consisting of $1.4 M worth of navigation and sounding hardware.

Preparing to launch a High Resolution Deep Travel Seismic Vehicle on board CSS Hudson
photo credit BIO



Eastern Marine Services Ltd.
230 Wyse Road
Dartmouth, N.S. B3A 1M9

Contact: Dan Wellwood

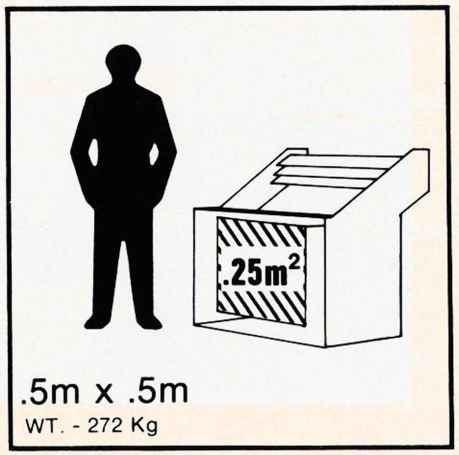
Tel. (902) 465-4779
FAX (902) 463-7246
Telex 019 235501

Expertise can be provided for the planning and execution of major geodetic surveys projects using Doppler Satellite, Inertial Surveying systems and the new Global Positioning Systems.

LEGAL AND ENGINEERING SURVEYS

Through its four corporate companies, The Eastcan Group provides a complete package of legal and engineering surveying services. The corporate partners have been providing these services in the Maritimes since 1875 and have established a solid and professional reputation throughout the area. A tremendous wealth of historical records is available which results in a very cost effective approach to the client's survey needs. Up-to-date survey hardware and software are used by all companies, providing efficient procedures both in the field during the gathering of data and in the office during the computational phase. High quality plans are generated using accurate computer-assisted drum plotters.

* * *



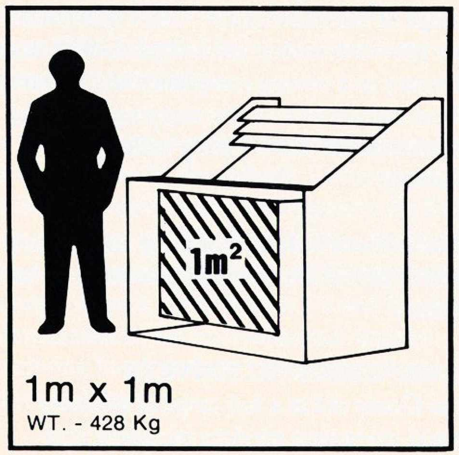
Eastern Marine Services was founded in 1976 and operates in a number of fields including ship repair, equipment manufacturing and specialty fabrication.

This equipment was developed by Eastern Marine in cooperation and with the assistance of BIO, which operates the system under the name "BIONESS" and "MINI-NESS."

In addition to the systems in use in Canada, the EZ NET is also used in France, Italy and Australia.

Eastern Marine has built an enviable reputation for quality, customer responsiveness, and for standing behind its products. These have translated into a dependable easily used and maintained piece of equipment.

Eastern Marine Easy-Zooplankton Net Frontal sampling areas. Two Models.



EZ NET

The Easy-Zooplankton Net Sampling System is a 10 sample, 1000 metre depth headframe, complete with sensors and data processing electronics, available in two models: mouth size of 1 sq. metre or .25 sq. metres. It is complete with sensors, including conductivity, temperature, depth and water flows. Operating at a depth of up to 1,000 metres, it has speeds of up to five knots. EZ NET is battery powered with rechargeable NICADs. Nets can be opened and closed in real-time, or preprogrammed between each tow to drop on time interval, or to trigger on either ascending or descending depths.

The self-contained data processor is built so that user specified sensors can be accommodated. Optional features are programmed when the system is assembled. The deck software runs on any IBM PC or compatible. Converts sensor data to real engineering units, monitors swept volumes, net clogging and sensor readings, and saves either raw or converted data to disk for later printing or analysis. Also saves average readings for each net opened.

The system is shipped complete, ready to use after batteries are charged, together with standard spares.

EZ NET is used principally by marine biologists engaged in research in the areas of plankton, zooplankton and immature species.

Where a direct correlation between physical samples collected and environmental parameters are required, this is the instrument of choice.

* * *

E.Y.E. Marine Consultants
33 Alderney Drive, Suite 350
Dartmouth, N.S. B2Y 2N4

Contact: Debra Hidvary

Tel. (902) 463-8940
FAX (902) 463-6319
Telex 019-22632

E.Y.E. Marine Consultants is the operating name of Evans, Yeatman and Endal (associates) Limited. The company dates back to 1965 when M. Yeatman and M.R. Evans separately formed marine consulting companies, which were merged in 1972.

The company offers a full range of design, inspection, survey and advisory services, mainly in the workboat and offshore field.

DESIGN CAPABILITIES
Offshore support vessels, survey and research vessels for fisheries, oceanographical, hydrographic, and seismic research, trawlers, purse seiners, and other types of fishing vessels, ferries, tugs, scows, crane barges

CONVERSIONS AND MODIFICATIONS
In addition to the above mentioned types of vessel, E.Y.E. has engineered conversion and modifications of other and larger types such as tankers and dry cargo vessels.

SURVEYS
E.Y.E. is the Canadian Atlantic coast agent for Detnorske Veritas and Panama Bureau of Shipping and carries out Classification and foreign government safety inspections on vessels and semi-submersible drilling rigs. In addition, damage, deadweight, condition and appraisal surveys are carried out for government agencies, shipowners, and underwriting groups.

SPECIAL SERVICES
Special services include expert witness advice in marine disputes and litigation, marine transport and fisheries feasibility studies, stability and propulsion investigation, and conducting speed and bollard pull trials and inclining experiments.

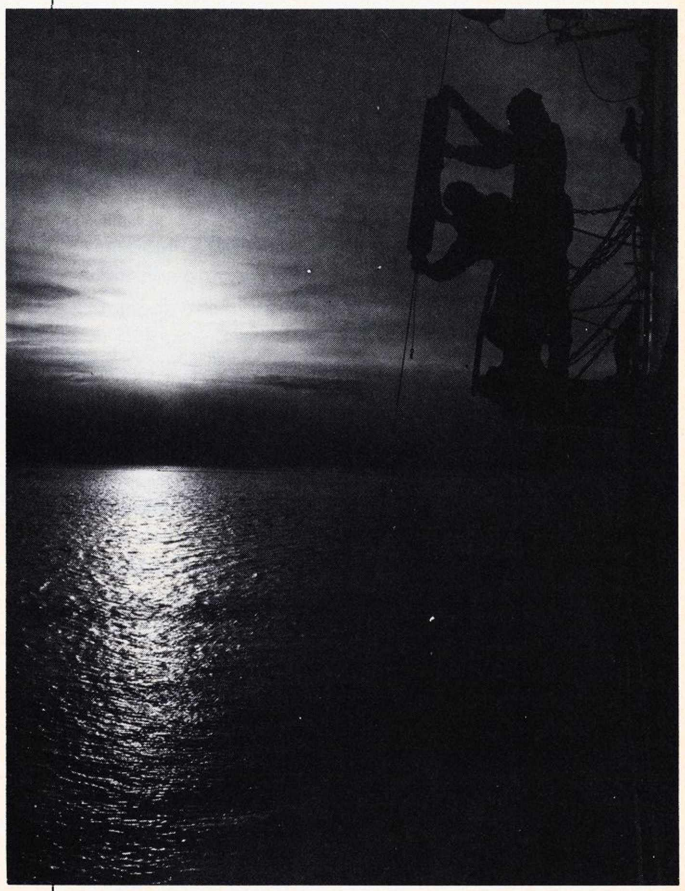
OWNER'S INSPECTION
Acting as owners' technical representatives during new construction, repairs and modifications.

E.Y.E. has offices in Dartmouth, Nova Scotia and St. John's, Newfoundland, and is in the process of setting up a U.S. office. Currently a staff of 12 professional and 4 administrative personnel is employed in the two offices. The company is owned by senior staff, and having no ownership connection with shipbuilding or shipping groups, is totally objective in its judgements.

E.Y.E. staff speak several languages and have carried out assignments for clients in England, U.S.A., Japan, Iran, Spain, Central and South America.

* * *

Taking a water sample on board CSS Hudson
photo credit BIO



Eyretechnics Ltd.
11 Morris Drive, Suite 207
Dartmouth, N.S. B3B 1M2

Contact: Tim Edwards

Tel. (902) 469-3372
FAX (902) 464-0003
Telex 019-31733

Eyretechnics Limited is a 100% Canadian-owned marine consultancy, in operation since 1971. The company's head office is located in Ottawa, with regional offices on the Atlantic and Pacific coasts.

The company offers technical and engineering services for a wide variety of ocean-related requirements including: engineering design, naval architecture, vessel construction supervision and inspection, transportation studies, vessel conversion, refit or modernization specifications and overseeing, technology innovation, research and development.

Eyretechnics' staff comprise a mix of 150 engineers, naval architects, technicians, draftspersons and administration. Many of our technical personnel have spent a considerable number of years at sea, operating and maintaining ships and their systems. We well appreciate marine and ocean-related engineering problems and requirements.

The company's technical expertise is supported by current computer-aided design and drafting facilities to enable fast, efficient and accurate turnaround of work.

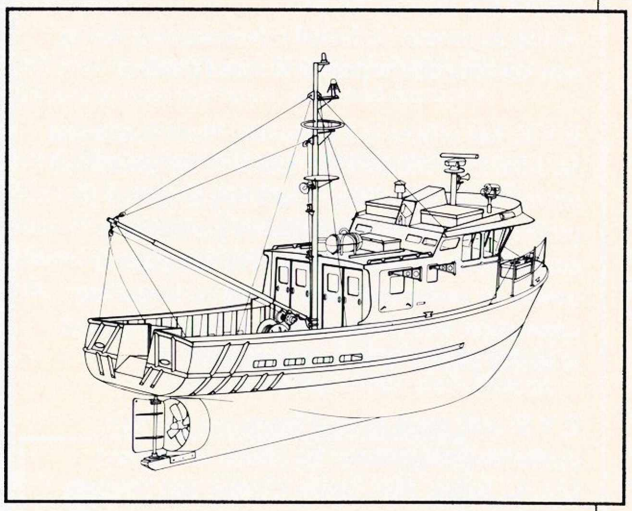
FISHING INDUSTRY SUPPORT

Fishing industry support addresses all areas that enhance the quality of fish caught and processed and includes: fishing vessel design, conversion, refit, modernization; fishing gear and deck machinery selection and arrangement; on-board fish handling, processing and storage systems; and fishing vessel performance and stability analysis.

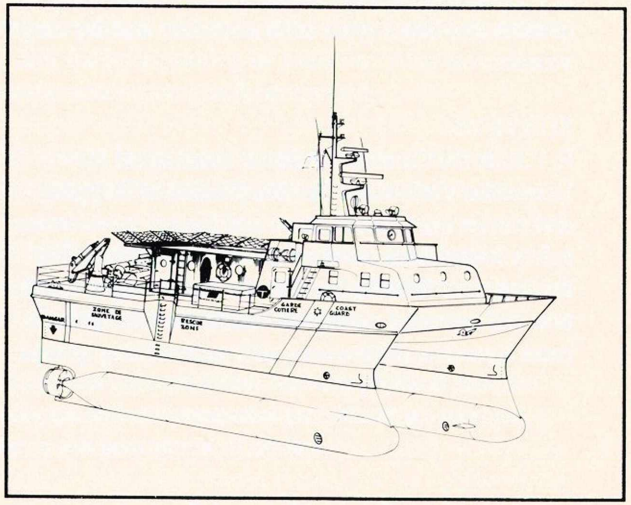
SWATH COASTAL PATROL VESSEL

SWATH (small waterplane area twin hull) vessels, by their unique hull design and configuration, provide a steady and stable platform in rough coastal waters, when running at speed or when on station. These characteristics are particularly advantageous for Coastal Patrol/Search and Rescue work, where long periods of time may be spent patrolling coastal waters. Out designs are suitable for Coast Guard, Fisheries, Police, Pilotage, and Defence work. This technology is attracting considerable interest, worldwide.

* * *



Eyretechnics fishing industry support



SWATH (small waterplane area twin hull) designed by Eyretechnics

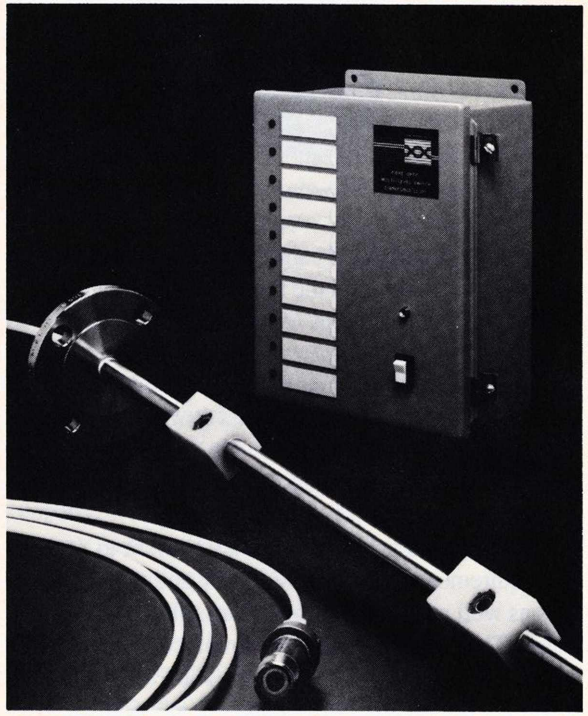
FOCAL Technologies Inc.
40 Thornhill Drive, Unit 7
Dartmouth, N.S. B3B 1S1

Contact: Contact: Graham Smith

Tel. (902) 468-2263
FAX (902) 468-2249

FOCAL Technologies Inc. is a marine-oriented fibre optic company with five years experience in serving the needs of the oceanographic community nationally and internationally. Our specialty has been the application of fibre optic technology to severe environments such as undersea, turbines, and shipboard.

FOCAL's projects have resulted in a growing number of manufactured products such as those described in the following paragraphs.



The Fibre Optic Remote Head (RH-2) for a standard laboratory fluorometer allows in-situ measurements of biomass and dye tracing without risking loss of the costly part of instrumentation.

→

The OS-1 spectrometer is a submersible, passive solid state irradiance spectrometer for measuring the spectral quality of ambient light in the water column and under snow and ice in the Arctic. With no moving part, the instrument is inherently very reliable.

←

FOCAL's Fibre Optic Multi-level Switch (LL 310) can be used in a wide variety of liquids and applications ranging from offshore structures to laboratory measurements. A continuous fibre optic level sensor is under development.

FOCAL supplies a family of marine rotary products. Fibre optic rotary joints allow fibre optic data to be carried through a rotating interface such as a winch or an underwater swivel. A licensing agreement with the Nova Scotia Research Foundation Corporation has added electrical sliprings and fluid rotary unions to the line.

FOCAL Technologies developed a fibre optic telemetry system for use with underwater towed sensor arrays. The telemetry system was successfully tested at sea in June 1987, in a collaborative project with the Canadian Department of National Defence.

The Fibre Optic Steamflow Meter system (SF-1) is a conversion of the standard Price type AA current meter. The major advantages of the SF-1 are its ability to operate in conducting fluids such as salt or polluted water, which makes the standard electrical version very noisy, and a sixteen-fold increase in resolution.

Geomarine Associates Ltd.
5112 Prince Street
Halifax, N.S. B3J 2L4

Contact: Alan Ruffman

Tel. (902) 422-6482
FAX (902) 425-6559

FOCAL's Fibre Optic Local Area Network is a versatile network featuring full duplex communication between any two nodes on the fibre data highway; a video channel is carried on the same fibre. In a shipboard installation, the network served as a pilot system to assist in the drafting of standards for shipboard use of fibre optics.

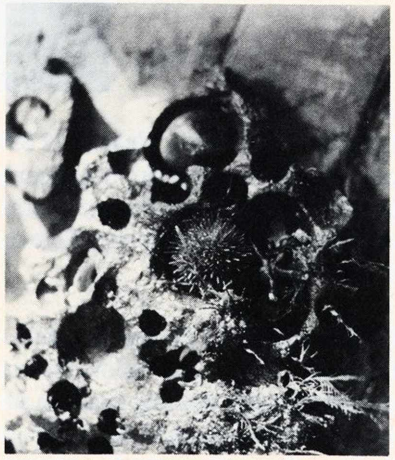
FOCAL Technologies Inc. has a well qualified research and development team and is equipped with extensive test equipment (OTDR, BERTS, environmental, versaCAD, lasers and other optical sources, etc.). FOCAL provides a range of professional services geared to support the application of custom products in the field. As a logical extension to the engineering and manufacture of specialized devices, FOCAL provides calibration, testing, programming and installation services. These services are available at the customer's site, at sea, or at our facilities in Dartmouth, Nova Scotia.

The facility and staff are security cleared. The company has recently established a manufacturing facility to accommodate the licenced products and those developed in-house. An MIL-certified Quality Assurance program is being implemented as part of this expansion.

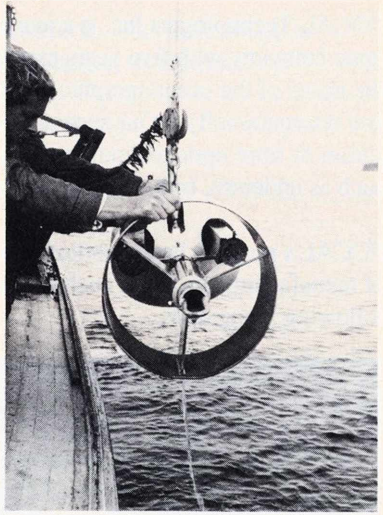
* * *

Geomarine Associates was formed in 1973 and is one of Canada's original ocean-related firms. It has provided seafloor mapping and interpretative services from Canada's Arctic to the American border in all areas of active hydrocarbon and resource exploration. International projects have involved work in Europe, Greenland, off Senegal and The Gambia, in Uruguay, Guatamala and off mainland China.

The firm is fully familiar with all aspects of ocean mapping and related equipment. It has operated surveys from government vessels, naval vessels and chartered ships through to small local fishing craft. Projects have been for government, university and private agencies in support of resource evaluation, mapping benthic and fish habitat, sand and gravel searches, the mineral industry (gold and chromate placers) and for the oil and gas industry.



Bedrock and bottom fauna ecovered from rock dredge



Sidescan sonar on bottom survey of Grand Banks

Geomarine has selected cable, pipeline and safe navigation routes, measured the thickness and types of overburden, bedrock types and mapped gravity and magnetic fields, as well as using sidescan sonar in mapping wrecks. Other work has involved determining the limit of the continental margin as defined by Article 76 of the Law of the Sea Convention and research into seismicity and marine geology.

The Company is prepared to assist a client to design the requirements for a marine survey and to evaluate bids as well as seeing a project through to the report stage. The Company has been involved in ocean policy assessment and definition. The President, Alan Ruffman, is a member of Canada's newly-formed National Marine Council.

* * *

GeoTech Surveys Ltd.
50 Johnson Crescent
Lower Sackville, N.S. B4C 3A4

Contact: Warren B. Ervine **Tel. (902) 865-2932**

Global Marine Products Ltd.
13 Acadia Street
Dartmouth, N.S. B2Y 2N1

Contact: Keith Colwell

GeoTech Surveys Limited was incorporated in 1980 as a private Canadian company based in Nova Scotia. We provide professional engineering and scientific consulting services to industrial and governmental organizations where expertise is required for projects involving geological engineering or research including those in the offshore of eastern Canada.

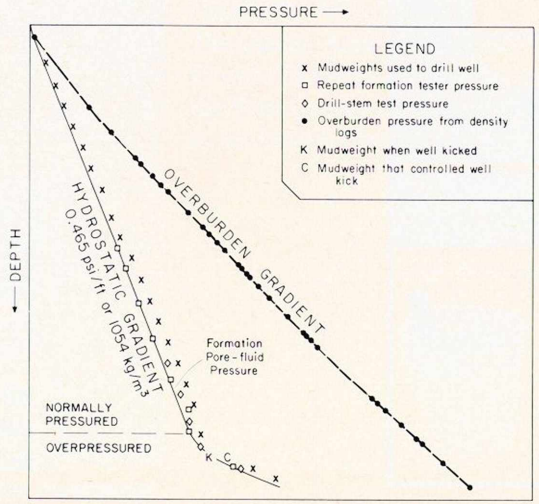
Dr. Warren B. Ervine, President of GeoTech, is a geological engineer with more than 30 years experience in the resource industries and has served numerous corporate, academic and governmental organizations in Canada and the United States. He received his education at the University of Toronto (B.A.Sc, M.A.Sc), and at Stanford University, California (Ph.D. 1973). He is certified as a Professional Engineer in Ontario and in Nova Scotia. For eight years prior to forming GeoTech, Dr. Ervine was a professor geology at universities in the United States and Canada.

Most of the projects we have undertaken in the offshore of eastern Canada have required the resolution of a specific problem or task within a broad understanding of geological and engineering principles. Because we are a small company, we maintain good working relations with specialists and experts in a wide variety of related fields and have drawn on these resources when necessary. GeoTech has in-house computer capabilities for technical problem solving, statistical evaluations and data analyses, and we have access to several research libraries.

Some recent projects include:
- Study of organic material in east coast offshore oil and gas wells
- Determination of subsurface temperatures in East Newfoundland Basin (Hibernia Field) using hydrocarbon maturation data
- Development of a technique for using pressure tests from oil-well drilling to establish deep subsurface stress magnitudes in the Scotian Shelf (Venture Field) (Paper published CJES, v.24, 1987)
- Compilation of an environmental impact statement for laying a submarine gas pipeline from Sable Island (Venture Gas Field) to the Nova Scotia mainland
- Geological interpretation of deep-seismic records on Georges Bank and Scotian Shelf

* * *

Illustration of a typical suite of pore-fluid and over-burden pressure measurements from an exploration well.



Global Marine Products Limited is a designer and manufacturer of quality fishing equipment, including custom fabricating, welding and precision machining, using the most up-to-date machinery, in its modern Dartmouth, Nova Scotia Plant.

Global is the world's largest producer of semi-automated longlining equipment with over 300 systems in use throughout the world.

The Global Longline System is known world-wide for its simple operation, easy maintenance and its high quality at low cost combination. The System has superior engineering features which are evident at first glance. All Global Longline components are manufactured to exacting standards from field tested materials and carry the Global 90 Day limited guarantee on all materials and labour. The System comes in a variety of models to suit any requirements. The system can start either with a Global Baiter, Hauler, Hook Rack System, Hook and Bait Cleaner and Roller Assembly or any combination of these.

The Global Baiter II is probably the most efficient random baiter on the market today. It works well with Squid, Mackerel, or good fresh Herring, having baiting efficiencies second to none with very little bait loss.

The combination of Global Longline Systems available from the Tub Rack System through to a completely automated Hook Rack Storage System gives the Global Longline System distinct advantages over other systems. It is simple to operate, with minimum maintenance and carries a one year limited warranty. Unskilled labour can be easily trained to operate the system. The complete fishing system

Hermes Electronics Ltd.
40 Atlantic Street
Dartmouth, N.S. B2Y 4A1

Contact: Paul S. Cugno

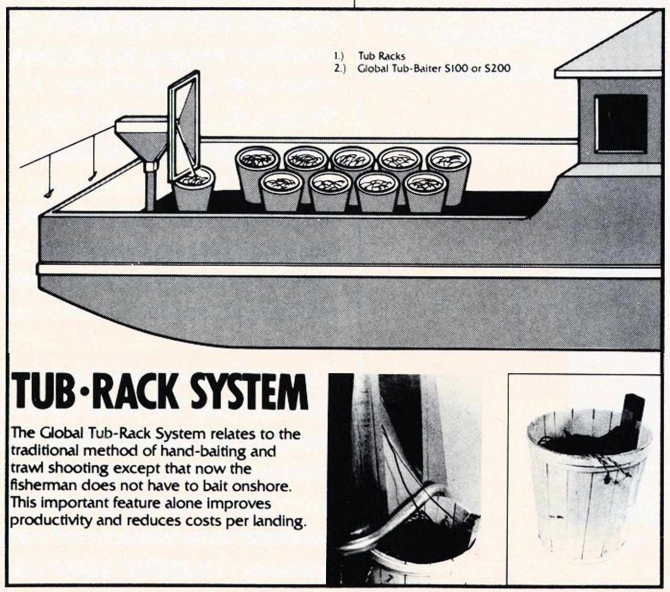
Tel. (902) 463-0060
FAX (902) 464 9753

Tel. (902) 466-7491
FAX (902) 463-6098
Telex 019-21744

includes not only all the necessary deck gear but also trawl lines, gangions, hooks, buoys, radar reflectors, swivels, monofilament, balloons, trawl tubs, anodes, swivels, crimping tools, stops, silicones, gangion holders, maintenance hook racks, etc. The gear can be easily installed and removed to blend in nicely with other types of fishing or it can be used when other types of fishing are in a slump to help supplement income. It has been operating very successfully on boats from 18 feet to over 75 feet, under a wide variety of conditions for an extended period, providing reliable service in all areas.

The Global Longline System is the low cost, simple, effective way of longlining. Contact us for details.

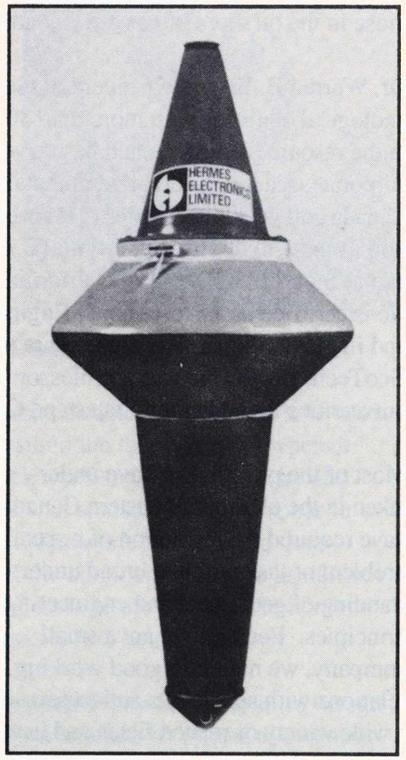
* * *



Hermes is a leader in the design and manufacture of data acquisition platforms that service hostile environments. Hermes' Ocean Data Systems products include a variety of ocean and land-based instrument platforms used to accumulate, process and transmit data from remote locations to central data-collection stations. Examples of Hermes products: Drifting Data Buoys, Ice Beacons and a 400 MHz Satellite Transmitter, which serves as the beacon for the location system and also transmits the sensor data.

OCEAN DATA SYSTEMS (ODS)
Hermes' ODS products include a variety of ocean and land-based instrument platforms used to accumulate, process and transmit data from remote locations to central data-collection stations.

-Drifting buoys
-Moored buoys
-Ice Beacons
-Shipboard Data Platform (SDP)
-Hermes Argos Satellite Transmitter



The Hermes Conical Drifting Buoy

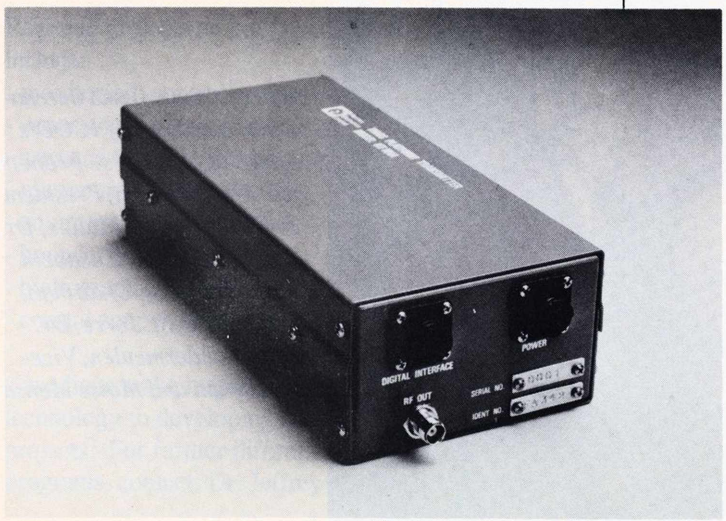
HF COMMUNICATION SYSTEMS
Hermes has extensive experience and technology for designing and producing communications equipment.

- active HF Receiving Loops
- Antenna Arrays
- High Frequency (HF) Oblique/Ionospheric Sounders.

DESIGN AND ENGINEERING

Hermes Engineering and Design Department is a team of over 50 engineers, specialists, technicians, draftsmen and illustrators, who investigate the use of new technologies in current and future products, develop concepts and designs for new products, introduce them to production and provide engineering support for production.

Recent product developments include the latest version of the DIFAR sonobuoy, miniature sonobuoys and towed arrays. These designs incorporate the latest in Large Scale Integration (LSI), thick/thin film and Surface Mount technology.



Hermes Argos Satellite transmitter

MANUFACTURING AND ASSEMBLY

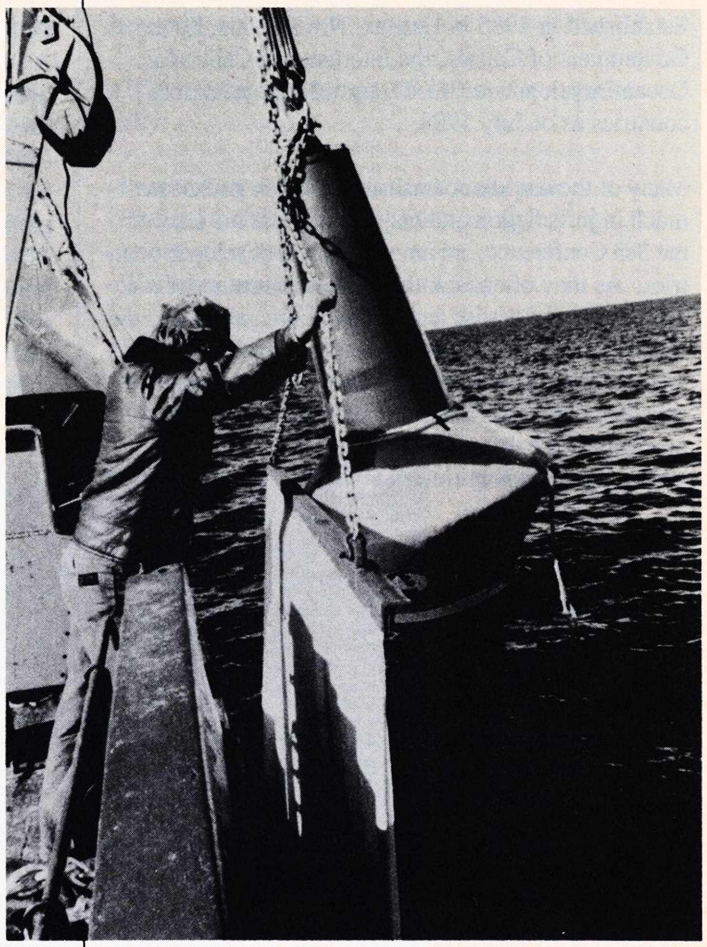
Hermes has a modern, 150,000 square foot manufacturing facility, designed specifically for the manufacture of medium and high volume production of hydro-acoustic sensor systems. Additional facilities are used to manufacture lower-volume communications and oceanic and meterological data systems.

- Chemical Processing
- Sonic and RF Welding techniques
- Encapsulation
- Machining capabilities
- Plating technology
- Toolmaking operations
- Machining capability
- Test Facilities
- Custom Assembly
- General Assembly

QUALITY ASSURANCE

The Quality Assurance Program of Hermes Electronics Limited is part of the Total Quality Assurance Program of the Devtek Corporation.

* * *



Lowering a Hermes drifting buoy over the side.

International Centre for Ocean Development
5670 Spring Garden Road
Halifax, N.S. B3J 1H6

Contact: Jeffrey Watson

Tel. (902) 426-1512
Telex 019-21670 ICOD HFX

Established in 1985 in Halifax, Nova Scotia, by the Government of Canada, the International Centre for Ocean Development (ICOD) has 131 projects in 62 countries as of July 1988.

Many of the world's coastal states, which gained so much in jurisdiction and responsibility at the Law of the Sea Conference, are among the less developed countries. As they often lack the most rudimentary ocean management expertise and infrastructure, as well as the financial resources to exploit their new resource base, many of these LDCs are precluded from realizing any substantial benefit from their potential gains, or, in most cases, are they capable of fulfilling their accompanying management responsibilities.

Created to help developing countries receive the most benefit from their newly acquired ocean space, ICOD is a unique agency in the Canadian official development assistance program because it focuses exclusively on the marine sector.

Large capital intensive projects, common to many donor agencies, are avoided. ICOD concentrates on the transfer of skills and on institution building to enable developing countries make the most of their own ocean resources and to manage their expanded jurisdictional zones.

To do this ICOD contracts Canadian expertise from the private, academic and public sectors. To date, over 33 firms or individual consultants have been contracted to advise and transfer skills.

POLICY AND MANDATE

A 14 member Board of Directors, (four from developing countries) makes up ICOD's policy making executive. The ICOD mandate includes:

- Initiate and support programs in developing countries for improved management and use of ocean resources, particularly for food production.
- Help countries develop their own expertise and institutions for integrated ocean-use management.
- Enlist the expertise of people and institutions in Canada and in the developing world.
- Develop and support the collection and dissemination of information on ocean development.
- Develop and sponsor training programs, technical assistance projects, and advisory services for ocean resource development and management.
- Support certain research programs in ocean resource development.

To accomplish this, ICOD has a projected budget of $58 million over the next five years (1988-1992). This will be supplemented by additional funds managed by ICOD as a broker on behalf of other agencies. ICOD is the executing agency for a $10 million Canadian International Development Agency (CIDA) program over the next five years in the South Pacific. A number of similar programs are expected in the near future.

Officers (seated) and international members of ICOD's Board of Directors. From the left: Gary Vernon, President & CEO, Phillip Muller, Dr. Vaughan Lewis, Elisabeth Mann Borgese, Chairman, Danielle de St. Jorre, Dr. John Vandermeulen, Vice-Chairman and Moise Mensah

IITOPS
Dalhousie University
1236 Henry Street
Halifax, N.S. B3H 3J5

Tel. (902) 424-3879
FAX (902) 424-1334
Telex *UKB 7491

Contact: Edgar Gold

OPERATIONS

ICOD consists of three operational divisions: Technical Assistance; Information; and Training. Each division gives priority attention to four regions: the Caribbean Basin; West Africa; the South and West Indian Ocean; and the South Pacific. The intent is to allow maximum impact for ICOD's limited budget and to focus on states where the ocean areas have a high potential for contribution to national development. Many of these recipients are small island states.

Examples of global projects are:
- marine educational materials (world fisheries map)
- a manual and training course on research vessel operation and management
- courses on non-fuel minerals, sea use planning, marine affairs, fish stock assessment, and vessel maintenance, repair and safety.

Regional projects on integrated ocean management include:
- monitoring, control and surveillance
- economic analysis and marketing
- artisanal fisheries development
- marine mineral assessment
- environmental assessment
- boundary delimitation
- hydrographic charting
- coastal zone management

Canadians make major contributions to the transfer of technology to developing countries through ICOD's projects. For further information on ICOD and its programs, contact: Dr. Jeffrey Watson.

* * *

The International Institute for Transportation and Ocean Policy Studies (IITOPS) is a federally incorporated organization, resulting from the amalgamation of the Dalhousie Ocean Studies Programme and the Canadian Marine Transportation Centre in 1986. IITOPS was established to maintain the position of Dalhousie University as a pre-eminent national and international centre for marine transportation, environmental and ocean law, policy and management studies.

IITOPS represents a new approach to the supply of research, training and related services for ocean industry as well as ocean-related agencies in Canada and around the world.

IITOPS services encompass four areas of responsibility:

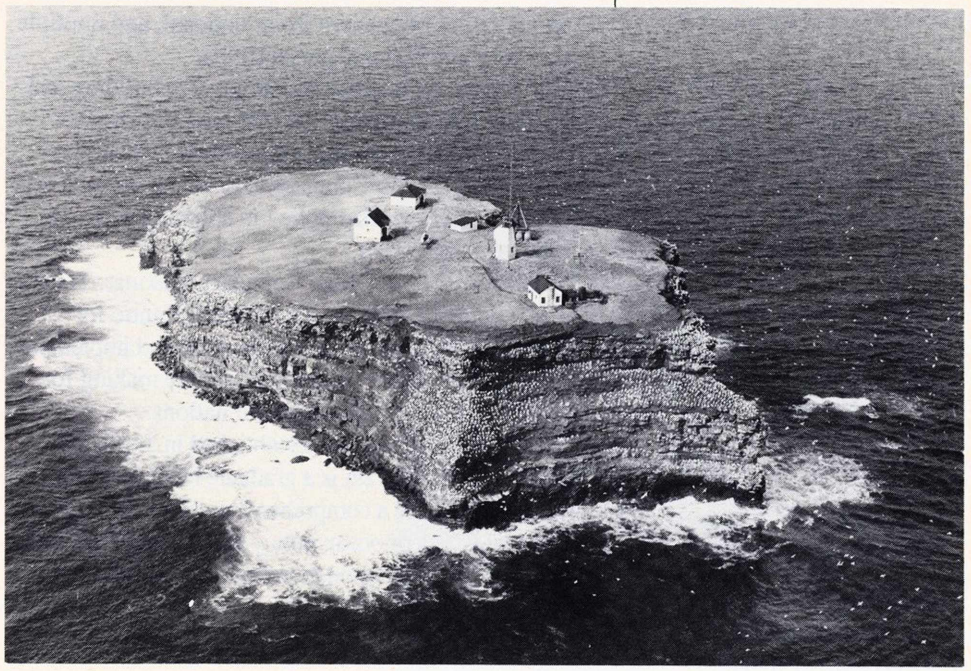
- Research in transportation and ocean policy
- Professional development and training
- Information and publications
- Workshop and conference activities

RESEARCH

The four main categories of IITOPS research programmes and projects are: problem assessment, policy evaluation, regulatory analysis and development, and management strategy and operations. IITOPS research is focused in three areas of expertise: transportation, ocean resources and industries, and ocean development and strategy.

PROFESSIONAL DEVELOPMENT AND TRAINING

The Institute organizes special training and educational programmes for a variety of user



Bird Rock, Magdalen Islands. photo credit BIO

groups including government and industry personnel, academics and special interest groups. To date, workshops and training programmes have been arranged for groups interested in transportation studies, marine law and law of the sea problems, marine environmental concerns and ocean resource development and management issues in the Arctic, Atlantic, Caribbean and Southeast Asian regions.

INFORMATION AND PUBLICATIONS

IITOPS provides communication and information services to support its research programmes and projects and its professional development and training activities. The Institute coordinates editorial, graphic arts, publishing and distribution services for all areas.

WORKSHOP AND CONFERENCE ACTIVITIES

IITOPS can coordinate and run conferences of all sizes. Complete conference services are available, including accommodation, catering, and recording, transcribing and publishing of conference proceedings.

CONTRACT SERVICES

IITOPS will conduct research for governments, funding agencies, universities and institutes on a contract basis. The Institute has arrangements with several consulting companies so that it can act as a subcontractor to them for the provision of specific parts of a major study, or to provide special expertise.

PROJECTS

- Technology Impact Study: Supported by Labour Canada's Technology Impact Research Fund, IITOPS associates conducted a study to identify the nature and effects of technological change on Canadian marine workers. Research examined the techniques which would allow a smooth transition during the adoption and implementation of technology in four sectors: commercial shipping, offshore fishing, offshore oil and gas, and government support services. Preliminary analysis pointed to the need to develop new innovative approaches to policy and legislation, organizational design and labour/management relations, and training.
- Ocean Development and Management in Davis Strait/ Baffin Bay: Two IITOPS associates with research funding assistance from the Social Sciences and Humanities Research Council of Canada, have undertaken a study of ocean development and management issues of the Baffin Bay and Davis Strait region. This unique project was designed to gather information and examine issues of concern from national, and multiple community and regional perspectives.
- CLC Study of Canadian Shipping, Shipbuilding and Ship Repairing Industries: IITOPS and Dalhousie's Henson College conducted a joint study on behalf of the Canadian Labour Congress to examine labour's role in Developing Canadian policy in shipping and ship construction and repair.
- Training Course in Ocean Boundary Making: IITOPS signed a contract with the International Centre for Ocean Development (ICOD) to develop and implement a training programme on ocean boundary making for participants from Southeast Asian nations.
- Marine Affairs Program: Established in 1986, the Marine Affairs Program is a graduate level program intended to provide a comprehensive overview of the theoretical issues of ocean policy and management and their practical application to policy, law and marine resource development.

* * *

IMP Group Ltd. (Marine Divison)
120 Thornhill Drive
Dartmouth. N.S. B3B 1S3

Contact: Richard Frail

IMP Group Limited was formed in 1967 when it purchased the assets of a group of Nova Scotian companies which had manufactured foundry and steel fabricated products since 1865. IMP's interests diversified to include the merchandising and manufacturing of commercial fishing gear and related industrial marine products. In the early 1970s IMP acquired a major aircraft repair and overhaul company located in Halifax, Nova Scotia, and has diversified its Aerospace facilities and capabilities to include the following operating divisions:

- Aerospace Repair and Overhaul
- Aerospace Engineering
- Aerospace Manufacturing
- General Aviation Services and FBO Network
- Machine Shop
- Plastics
- Marine
- Foundry
- Genco
- Hotel Properties

MARINE DIVISION

IMP Group, Marine Division, is the largest marine supplier of its type in Canada with a network of manufacturing facilities and branches in Canada, United States and England. This division supplies the fishing industry with gear for both inshore and deep sea fishing. It continually searches worldwide for top quality equipment at economical prices, however, where appropriate, the IMP Group manufactures its own products often using the facilities of the other divisions. IMP together with its associated companies in the Group, is one of the leading international suppliers in the fishing industry.

Tel. (902) 468-2111
FAX (902) 468-3077
Telex 019-31462

Instrumar Ltd.
PO Box 13246, Station A
St. John's, Newfoundland A1B 4A5

Contact: Alastair Allan

OFFSHORE SERVICES DIVISION
The IMP Group has become a major supplier of goods and services to the offshore hydrocarbon industry working in Canadian East Coast waters.

The Steel Fabrication, Machine Shop, Foundry and Plastics Manufacturing facilities are providing a whole variety of products and services for the offshore oil and gas industry. IMP's network of marine supply warehouses stock a complete range of products used in this industry. The Aerospace Engineering are applying their skills by doing an assortment of engineering tasks for offshore structures and the Aviation Services Division are providing services and hangar space for the offshore support helicopters. IMP specially equipped aircraft are assisting on crew changes and services to Sable Island.

STEEL FABRICATION & MACHINE SHOP DIVISION
This facility is housed in a modern well-equipped custom steel fabrication and machine shop. The 14,000 square feet floor space is serviced by four 5 ton overhead cranes. Component for fishing trawlers manufactured out of steel, aluminum and stainless, and a whole range of products, repairs and modifications for the offshore oil industry are typical of its products.

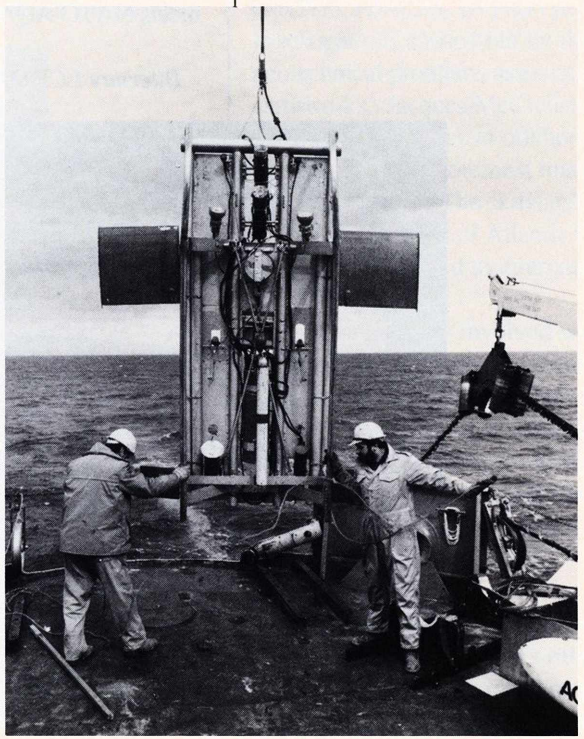
TOOL AND PLASTICS DIVISION
The Tool & Plastics Division manufactures moulded plastic parts using injection moulding machines. With technical support from the Research and Development Division, the design, development and manufacture of high precision moulds are performed in the tool and die department. The plastic division is constantly developing new product lines, some of which are being marketed worldwide including medical devices, pipe thread protectors for the oil industry, and components used in the fishing industry.

RESEARCH AND DEVELOPMENT DIVISION
Associated with its commercial activities, the IMP Group maintains a Research and Development Department. Its primary function is the identification and development of new products and processes related to the continued expansion of the Group and the technical excellence of its products.

* * *

Instrumar Limited is a research and development company specializing in the design of custom instrumentation and the development of new electronic products. Manufacturing is carried out in its subsidiary company, Instrumar Engineering Limited.

The company serves the offshore petroleum, fishing and marine transportation industries and offers complete project management from concept to production. In-house services include full hardware and software capability with specialities in optoelectronics, power supply and package design.



BRUTIV

Bottom Referencing Underwater Towed Vehicle

Photo credit BIO

Internav Ltd.
PO Box 1261, Sydport Industrial Park
Sydney, N.S. B1P 6J9

Tel. (709) 726-8460
FAX (709) 726-8613

Contact: Alex Libbus

Tel. (902) 564-2043
FAX (902) 564-0390

Among Instrumar's products are a portable hand-held spectrophotometer, developed in conjunction with Westinghouse Canada Inc.; tactile sensory devices and trawl net monitoring equipment for the fishing industry; a non-acoustic underwater-through-ice data transmission system; and various ice-measuring instruments produced for the offshore petroleum industry.

* * *

Established in 1977 as a marine navigation company, Internav has grown over the last decade into a multi-faceted electronics organization. Its team of young, dynamic engineers and designers are capable of working with all aspects of modern electronic technology.

Internav's flexibility and problem solving capability means rapid response and turnaround on virtually any electronics design or manufacturing problem.

The company's manufacturing resources include a dedicated and highly trained production staff, extensive testing facilities, and a Quality Assurance program that meets NATO AQAP-4 standards.

Internav LC 300 Loran Navigation System

Internav's location on Cape Breton Island makes it a prime candidate for Industrial Benefit related work.

A multi-capability electronic company, Internav is positioned to solve a wide variety of engineering and manufacturing problems.

Internav began as a designer and manufacturer of Loran-C navigation receivers. Internav's Loran receivers are now used world-wide and are known for their accuracy, reliability and high performance.

During the 1980s, Internav has built on its existing strengths by moving into military and civil contract engineering and manufacturing.

Today, Internav's revenues come from a healthy mix of Loran-C sales and contract manufacturing. These areas offer strong growth potential for the future.

LORAN-C
Loran-C is a radio navigation system used to determine position. Internav's Loran-C receivers are microprocessor-based, with software developed in-house. Originally built for commercial shipping and fishing, Internav's receivers have a reputation for quality, reliability and performance under demanding operating conditions. Today, over 10,000 are used world-wide on craft ranging from fishing boats and hydrographic vessels to airplanes.

Internav is ready to work with companies that have requirements beyond their own capacity or wish to increase the Canadian or Atlantic regional content of their product.

Jacques, Whitford and Associates Ltd.
1046 Barrington Street
Halifax, N.S. B3H 2R1

Contact: H. James Simmons

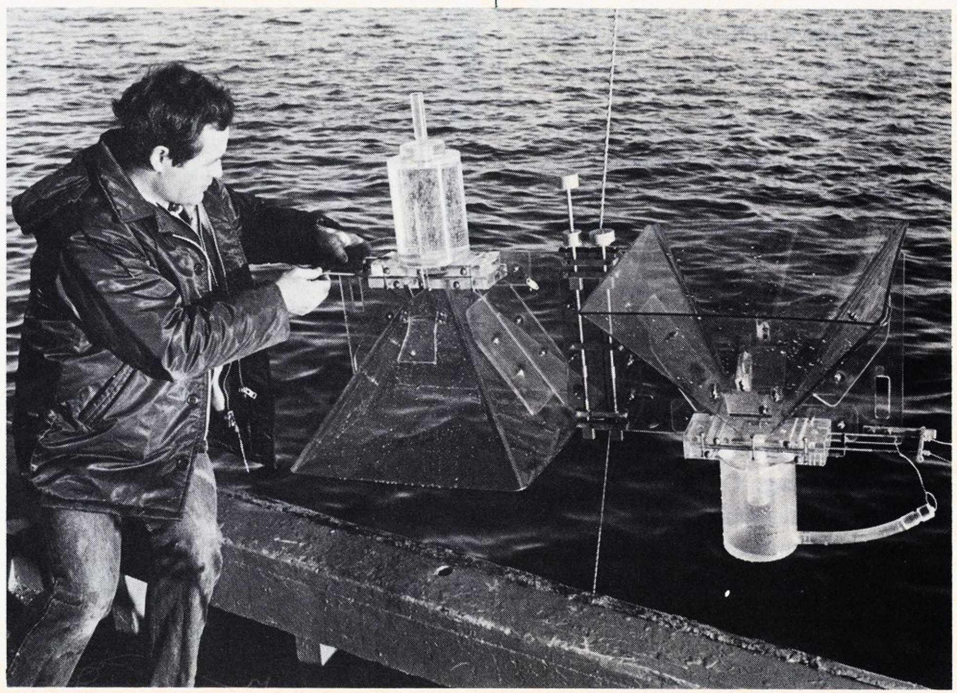
Tel. (902) 423-6325
Telex 019 21745

In addition to its military approved production facility and Quality Assurance system, Internav's ability to keep manufacturing costs down and to respond rapidly to customer's needs make it a good choice for a project partner.

Internav engineers have new designs ready for the next generation Loran-C, as well as for future satellite based systems such as the U.S. Global Positioning System.

* * *

Plankton Trap
photo credit BIO



The Jacques, Whitford Group of Companies is an Atlantic Canada-based engineering group offering a comprehensive range of geotechnical, materials and mining engineering and other related geoscience consulting services to clients in industry and government.

The principal operating company, Jacques, Whitford and Associates Ltd., offers geotechnical site investigations and design for industrial, commercial and residential projects, earth dams, mining projects, bridges, tunnels and port facilities; blast monitoring, analysis of blast vibrations and design and planning of blasting operations; underpinning and rock bolting; inspection and instrumentation during construction.

The Group operates several subsidiary companies: W.S. Langley and Associates Ltd. (materials testing for aggregates, concrete and asphalt inspection and technology); Water Management Services Ltd. (hydrogeological and environmental engineering); Newfoundland Geosciences Ltd. (geotechnical and materials engineering); and Jacques/McClelland Geosciences Inc. (geotechnical and geophysical services to onshore and offshore petroleum exploration and development industries).

GEOTECHNICAL INVESTIGATIONS
Investigations carried out by the firm encompass all geotechnical problems associated with foundations and earthworks. Jacques/McClelland Geosciences Inc. has extensive experience in offshore related projects, and is recognized as the foremost marine geotechnical firm in Atlantic Canada. The skills gained under the harsh and difficult conditions of Atlantic Canada have been successfully applied to international projects.

JMGI is intimately involved with all geotechnical aspects of hydrocarbon exploration and development on the east coast of Canada. They have conducted major offshore geotechnical investigations to gather information on soil conditions for analysis of foundations for production and transmission facilities, on both the Hibernia Field (Newfoundland) and the Venture Field (Nova Scotia).

JMGI, heading a project team or working in close association with its client's other consultants, is able to provide a complete range of geological and geotechnical services for marine pipeline projects. Some of

these services include:

- geophysical and geotechnical data collection
- pipeline route location
- geological mapping and interpretation of seismic records
- definition of seabed soil properties
- development of geotechnical design criteria
- pipe burial and trench design
- prediction of pipeline scour
- development of heat transfer coefficients
- development of slope stability criteria
- siting studies and foundation design for associated pipeline facilities
- provision of on site expertise during the execution of the project

DESIGN OF FOUNDATION AND EARTHWORKS
The firm provides consulting services through reports to clients and direct consultation with engineers and architects.

CONSTRUCTION CONTROL AND SUPERVISION
Ensuring that geotechnical design recommendations are implemented is a vital aspect of project development. Field testing and instrumentation of sub-surface structures and materials play an important role in this regard. Staff are available on a continuous or an as-required basis for site inspection and quality control.

HYDROGEOLOGY AND AGRICULTURAL SERVICES
The Groundwater Division of Jacques, Whitford and Associates provides professional consulting services in the fields of hydrogeology and agricultural engineering. The division works closely with the environmental, mining and geotechnical divisions of the company.

MATERIALS TESTING
W.S. Langley and Associates, the Construction Materials Division, provides a complete range of professional services, testing, and construction inspection of concrete, structural steel, asphalt, and other construction materials.

VIBRATION ANALYSIS AND CONTROL
At present, we have 15 of the latest model seismographs. Eight of these instruments give a direct read-out of the particle velocity in each of three orthogonal planes (vertical, longitudinal, and transverse), and are equipped with a fourth channel, which provides a direct reading of the noise level and air pressure set up from the blasts.

MINING ENGINEERING SERVICES
The Mining Division provides professional mining engineering and geological services as well as field and laboratory testing for the mineral resource development industry. The work performed incorporates all aspects of the mineral sector including exploration, development and mining.

ENVIRONMENTAL SERVICES
The Environmental Division have a proven record in industry, government and academic endeavours in the field of environmental consulting. Our expertise centres on the development and application of environmental impact assessment techniques, environmental monitoring, risk and ecological modelling, and field-laboratory experimentation.

In the last two years, over 40 projects have been completed on a wide variety of environmental subjects, for example:

- role of major highway projects on salt marshes and coastal marine environments
- coastal impacts of sea level rise and climate change
- marine and freshwater water quality analyses
- ecosystem modelling
- ecotoxicology
- stock assessment for an offshore clam fishery

The Company has pioneered new methodologies in ecological risk assessment, ecological modelling and cumulative effects assessment.

* * *

photo credit BIO

CSS Hudson lifiting the deep sea geological survey vehicle Seabed II

KB Electronics Ltd.
150 Bluewater Road
Bedford, N.S. B4B 1G9

Contact: Richard Poole

Tel. (902) 835-7268
FAX (902) 835-6026
Telex 019-21779

KB Electronics has been manufacturing electronic power conversion equipment for the commercial, marine, and defence industry since 1979. The Company is an established designer and manufacturer of 400-Hz frequency changers, UPS systems, helicopter starting supplies, battery chargers, and converters.

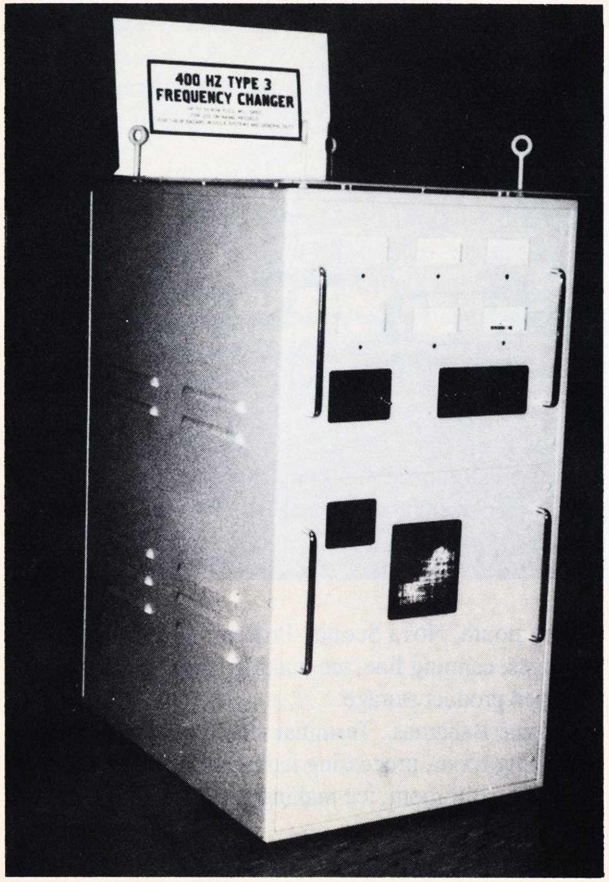


photo credit
KB Electronics

Direct participation in major Canadian and U.S. defence programs and as subcontractor to American, European and Canadian original equipment manufacturers has established the Company as a world leader in power conversion. Naval vessels, military aircraft, weapon and missile systems rely on KB power systems for top performance and reliability.

Modern well-equipped research and development facilities with computerized environmental testing, vibration, audio noise, electro-magnetic interference, CAD systems and scientific computers contribute to the manufacture of an efficient, reliable finished product.

Manufacturing is self-contained in a 9300 square metre plant that contains metal shop, plating, painting, assembly and sophisticated testing equipment.

KB electronics in NATO certified (code 38370) with a quality assurance system complying to AQAP-1 and MIL-Q9858A and its military certification laboratory meets AQAP-6 requirements.

* * *

Kenneth Lee Research Ltd.
30 Forest Road
Dartmouth, N.S. B3A 2M3

Contact: Ken Lee

Kenneth Lee Research Limited, is a Canadian owned consulting and research organization in the environmental sciences based in Dartmouth, Nova Scotia. Formed in 1985, the organization currently has a staff of five professionals. The company is unique in that it centers its expertise in aspects of microbial ecology which are required for multidisciplinary studies of environmental processes, aquatic toxicology and contaminant monitoring. Clients have included government agencies, major oil companies and universities.

REPRESENTATIVE CORPORATE PROJECTS (1988)

Development and assessment of field procedures based on nutrient enhancement, which can be used to clean up oil (VENTURE condensate/HIBERNIA crude) stranded on or buried in intertidal environments, including beaches and salt marshes.
Department of Fisheries and Oceans.

Field and laboratory studies to evaluate the significance of bacteria to the nutrition of offshore scallops. As a result of an unsolicited proposal (UP), Kenneth Lee Research Limited was funded to investigate a novel concept which suggests that low molecular weight hydrocarbons, through bacterial processes, contribute to the carbon and energy requirements of benthic organisms such as offshore scallops.
Department of Fisheries and Oceans.

Development of rapid low cost sediment bioassay procedures based on the activity of indigenous bacterial populations.
Environmental Protection, Environment Canada.

J.D. Koppernaes Engineering Ltd.
1248 Bedford Highway
Bedford, N.S. B4A 1C6

Contact: Glenn Ross or Peter Mitchell

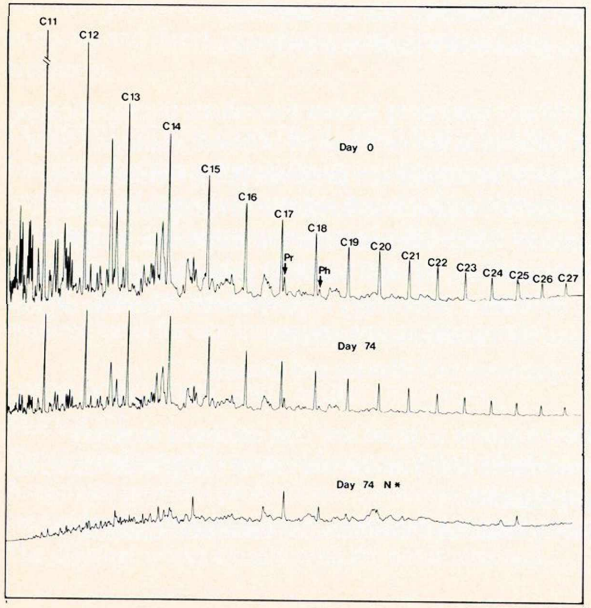
Tel. (902) 835-8348
FAX (902) 835-0134

Tel. (902) 469-0072

Assessment of the toxicity of the dredged spoils from Dalhousie Harbour, New Brunswick and the recovery of the Heron Island Dump site using microbiological test procedures.
Environmental Protection, Environment Canada.

Enumeration of viable bacteria in samples of sediment and water collected from Sydney Harbour, Nova Scotia.
P.A. Lane and Associates.

Preparation of a data report for the Regional Ocean Dumping Advisory Committee outlining the concentration of petroleum residues in harbour sediments of the Atlantic Provinces.
Department of Fisheries and Oceans/Environmental Protection, Environment Canada.



J.D. Koppernaes Engineering Ltd. is a multi-disciplinary engineering firm located in Bedford, Nova Scotia, Canada. Established in 1957, the company provides engineering design and consulting services to an international clientele.

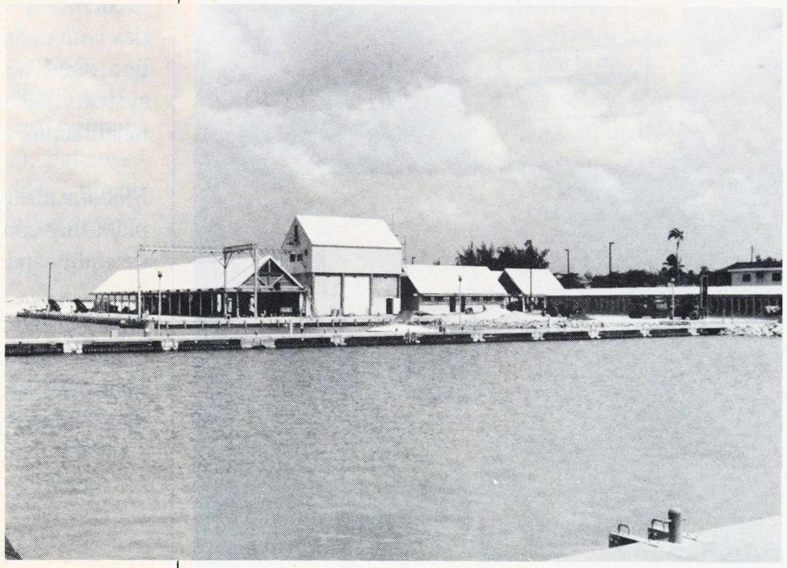
Koppernaes Engineering provides a wide range of services including:
- feasibility studies
- market analysis
- investment evaluations
- site development
- process design
- facilities design
- construction management
- quality enhancement studies
- research and development

Our background is varied, however, we specialize in work related to the fisheries and to marine structures. In general, we are involved in a project from conceptual design to plant startup.

As part of our services we conduct a thorough analysis of the project including market, investment and site evaluations and a feasibility analysis to determine the viability of the project. Based on the evaluations, the site and facilities would be designed to meet the requirements. We also offer construction management and contract administration services to bring the project to completion.

Some of the typical fisheries/marine projects we have completed or are presently working on include:
- Bridgetown, Barbados. Development of fishing harbour, vessel unloading and berthage, processing hall, cold storages, blast freezers, ice making facility and vendor stations.

Bridgetown fishing harbour, Barbados by Koppernaes



- Weymouth, Nova Scotia. Processing hall, cold storages, canning line, ice making facilities and finished product storage.
- Nassau, Bahamas. Terminal wharf, service berth, receiving room, processing hall, cold storages, blast freezers, chill room, ice making facilities and amenities buildings.

Lobsiger Associates Ltd.
1127 Barrington Street.
Halifax, N.S. B3J 3G6

Contact: Ulrich Lobsiger

Tel. (902) 429-0283
FAX (902) 420-0674

- Castries, St. Lucia. Wharf and canoe ramp, processing hall, chill room, cold storages, blast freezers, ice making facilities and amenities buildings.
- Louisbourg, Nova Scotia. Harbour protection, ice making facility, vessel unloading, bait house, cold storage, blast freezers and dry storage.
- Ramea, Newfoundland. Wharfage, receiving room, offal storage, fishmeal processing hall, chill room and dry storage.
- Jizan, Saudi Arabia. Modernization of fish processing facility.

Acting on our client's behalf, we have worked on presentations to Development Organizations such as the Caribbean Development Bank, Inter-American Development Bank, Canadian International Development Agency, Departments of Development and Departments of Economic Expansion to secure funding for various projects.

In addition to fisheries related projects, our staff have been involved in the design of marine structures, such as tanker terminals, ferry terminals and ship repair facilities.

* * *

Since its incorporation in April 1983, the Company has carried out an intense development effort in underwater imaging. Subsea still camera prototypes have been tested in many diverse oceanographic, fisheries and general marine technology applications in Canadian Arctic waters and in the Northwest Atlantic.

Production models that evolved from these developments have been sold to major oceanographic institutions in North America, and as far away as New Zealand. In addition to these sales, our ocean technology firm has participated in a consulting role during studies using photographic techniques in the Dutch North Sea, the Gulf of Mexico, and in the Black Sea.

Our sophisticated underwater still camera proves its value most convincingly in deep-sea oceanographic investigations where it is employed in its time-series and/or event sensing modes. Coupled to appropriate external sensors, such as a range finder, a transmissometer, or a current meter, the autonomous camera can decide on its own when to take pictures or picture sequences. As an example, fish schools can be sensed with an acoustic transducer, which in turn triggers the camera system according to preprogrammed criteria. Several major technical reports have been or are being published in science journals describing results of such investigations. The potential of "smart underwater eyes" is finally gaining widespread recognition.

To complement these complex oceanic imaging instruments, Lobsiger Associates is now performing contract research in applying low-light television cameras to visual surveys of fishing trawls, monitoring in aquaculture, and as a general environmental documentation tool. The goal is to develop a cost-effective ultra low-light camera system for wide applications.

The company also executes custom designs for underwater camera housings and for related instruments, and, through affiliated firms, it has access to elegant image database software packages. Additionally, Lobsiger holds a third year contract to operate the towed underwater vehicle RUCV Mermaid for the Department of Fisheries and Oceans, gaining practical experience in the assessment of fishing gear effectiveness.

* * *

Stero pair cameras for underwater photgrammetry

J.H. Lock & Sons Ltd.
19 Acadia Street
Dartmouth, N.S. B2Y 2N1

Contact: Norman Picton

Tel. (902) 469-6642
FAX (902) 465-5239
Telex 019-21704

J.H. Lock & Sons Limited is a multi-plant, multi-skilled Canadian company with more than 50 years of experience in the field of industrial refrigeration. We supply complete, custom-designed systems as well as refrigeration components, assemblies and specially fabricated products in a wide range of metals.

Our company began in 1931 as a quality producer of refrigeration systems and related products. Since then, we have grown in both size and capabilities. Today, our five plants across Canada design, engineer, manufacture and service some of the most diverse and sophisticated forms of refrigeration to be found anywhere in the world.

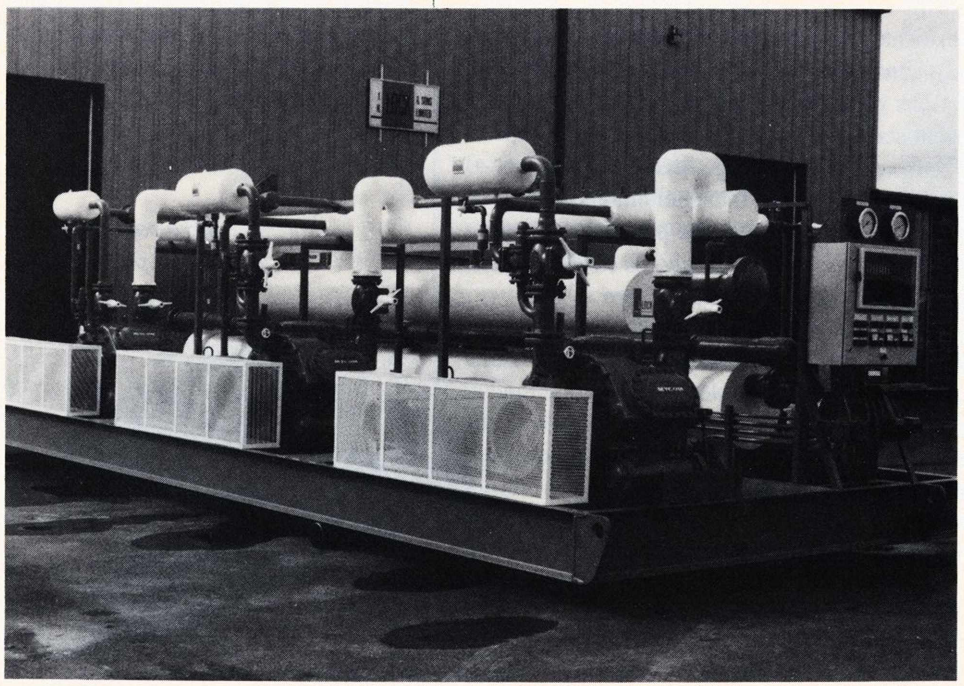
We supply advanced systems for cold storage rooms and warehouses. For breweries and packing houses. For freezing plants, fish plants, dairies and soft drink bottling plants.

Our company is also a leading manufacturer of specialized refrigeration systems and components for ice rinks, low temperature plastics processing plants, environmental test chambers, heat recovery systems, and many other recently developed applications.

In addition, we offer planning, engineering, and manufacturing services tailored to each stage of the refrigeration process.

Clients can call us at any time to perform any or all of the following tasks: preliminary configuration studies, detailed process design including complete budget, outline and detail drawings, flow diagrams, piping, arrangements, full system description and start-up operating manuals.

Our engineering department is second to none in Canada, with our engineers maintaining continuous client liaison, taking care in selecting equipment that optimizes both function and energy usage. We use the most advanced computer-aided design technology available anywhere. This enables us to simulate thermal flow, improve system designs and optimize equipment selection. It also provides us with several important drafting aids.



←
A sample project is the Seawater to Freshwater Heat Pump, designed for Clearwater Lobsters Limited, Clark's Harbour, Nova Scotia. The design features include: microprocessor control panel; choice of either heating or cooling mode with temperature control; automatic capacity control in eight steps with protection against short cycling; complete compressor safety controls; two steps of freeze protection; three steps of motor overcurrent protection; power supply phase imbalance or voltage dip protection; and telephone link to duty operator through Chubb System in the event of an alarm condition.

* * *

Lunenburg Foundry and Engineering Ltd.
53 Falkland Street
Lunenburg, N.S. B0J 2C0

Contact: Ray Buffett

Tel. (902) 634-8827
FAX (902) 634-8886
Telex 019-21509

Lunenburg Foundry and Engineering Limited, a company well known for its long history of involvement in the marine industry, is continually improving and expanding its marine product lines and service capabilities.

Initially established in 1891 to manufacture stoves, ranges, and fireplaces, the company soon began operation of a marine department to supply the mechanical requirements of Lunenburg's busy fishing fleet.

The company was an early pioneer in the development of a marine internal combustion engine and continues to manufacture their "Atlantic" 2-cycle engines first produced in 1909. In 1921 Lunenburg Foundry was the first in Canada to install a diesel engine in a fishing schooner.

During World War II, Lunenburg Foundry became heavily involved in naval refitting and was responsible for refits, conversions, and outfitting of over 180 vessels in addition to its normal peacetime activities.

Following this the company began constructing steel vessels and was the first to do so in Western Nova Scotia. Eight vessels were completed.

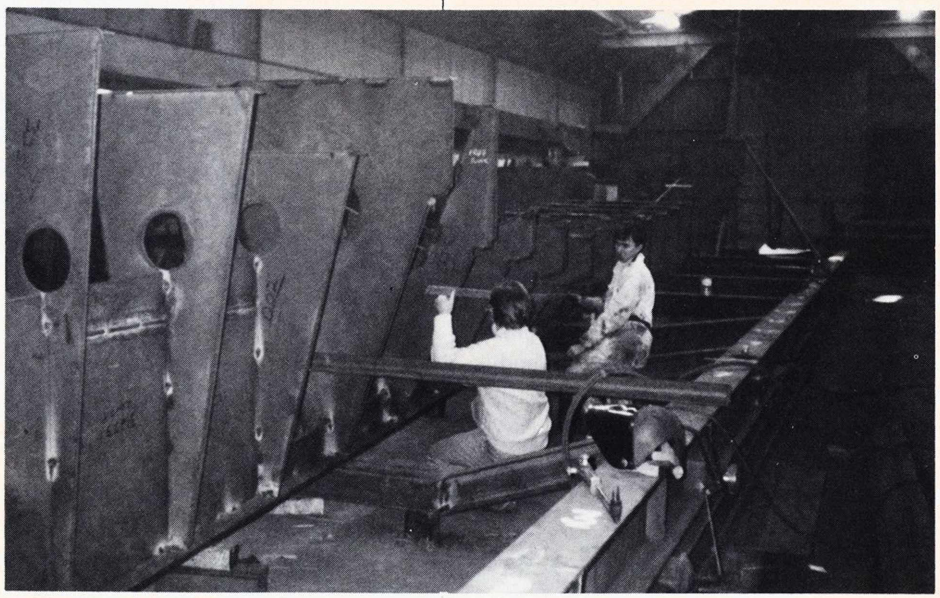
Today, Lunenburg Foundry and Engineering Limited designs and manufactures a full line of marine equipment for the fishing industry. Trade names such as "Atlantic," "Bluenose," and "Senator" are well known and respected by Atlantic Canadian fishermen and boatowners.

As the Ford Industrial Distributor for Nova Scotia, the company has been producing Ford Senator gasoline and diesel marine engines for over 25 years. A recent addition to this line is the "Senator 401TI," a 260 horsepower, turbocharged and intercooled diesel engine designed for the higher power needs of today's market. Soon to be introduced is a 325 horsepower model, which will give a power range suited to larger vessels and a wider variety of marine applications.

A full selection of Bluenose underwater gear is also manufactured, which allows the company to offer complete marine propulsion packages. These products include couplings, shafting, bearings, stuffing boxes, propellers, and rudders. Many other complimentary product lines are distributed including hydraulic steering systems, pumps, and engine controls.

Lunenburg Foundry and Engineering employs 80 people, including five design engineers and two naval architects. There are complete facilities for ship building, refit, and repair. Three marine railways with a maximum capacity of 1600 metric tonnes are fully integrated with all other departments and serviced by a well trained staff. A 75 ton mobile boat hoist is being installed in order to offer greater service to the inshore fishing fleet and to provide boatowners with self-service and storage facilities.

Presently under construction is a 65' steel wet fish dragger being built for West Side Fisheries of North West Cove. This vessel was designed by Peter Kinely,



Floors installation on 65' steel wet fish dragger

M & M Manufacturing Co. Ltd.
61 Estates Road, Ocean Industrial Park
Dartmouth, N.S. B2Y 4K3

Contact: David K. Hynes

Tel. (902) 465-7675
FAX (902) 465-4102
Telex 019-22712

Naval Architect and Vice President of R&D, and uses modern CAD/CAM technology. The plates for the vessel were cut by computer to ensure a higher quality finished product, more efficient construction, and to allow greater economies of production in this and subsequent contracts.

Currently under design is a new hydraulic trawl winch. This winch will be a compact, full featured model offering reduced weight and deck space requirements. Its features include innovative hydraulic engineering and ease of maintenance. This model will be installed on the vessel under construction and marketed competitively in Atlantic Canada. It will be the first hydraulic model in the company's line of winches and is expected to be quite successful owing to its modern design and sturdy construction.

Facilities at Lunenburg Foundry and Engineering include ferrous and non-ferrous foundries, a well equipped machine shop, engine department, propeller department, metal fabricating shop, heating department, and complete marine engineering services.

In addition to the standard product lines, the company designs and manufactures custom items to suit a wide range of applications.

Whether it is a new product design that requires manufacture or a unique piece of hardware that needs duplication, we can help. Our many years of experience and well equipped foundry and manufacturing facilities lend themselves readily to fulfilling your special requirements. We will be pleased to offer a quotation upon receipt of these requirements.

* * *

M & M Manufacturing Co. Ltd. was founded in 1980 in Monastery, Nova Scotia. The initial manufacturing base was quickly expanded to include steel fabrication, shutdown, repair and maintenance services for the refining, power generation, pulp and paper and other process industries.

The horizons of the Company extended to the offshore oil and gas industry in late 1982, when M & M was successful in obtaining contracts from several offshore operators, rig owners and production testing companies. From this work base the Company has continued to expand so that today it can provide manufacturing services to a wide range of industries.

M & M Manufacturing Limited Partnership was formed in 1985, when the MIL Group and M & M Manufacturing Co. Ltd. agreed to associate themselves to pursue opportunities in industrial and offshore developments on Canada's east coast.

The MIL Group, through its 39% interest in the partnership, enables M & M to take part in larger-scale

industrial and offshore projects. MIL's project management, engineering, planning and construction expertise provides the necessary support.

In eight short years, the reach of M & M has extended considerably to new markets, new products and new services.

Today, M & M Manufacturing Limited Partnership is one of Atlantic Canada's most successful industrial enterprises. M & M operates a fully-equipped fabrication plant in Nova Scotia. Also, large quantities of mobile and portable equipment are available for on-siye plant shutdowns and offshore rig work in the Maritimes and Newfoundland.

M & M regularly employs some 80 people, rising to over 200 during periods of peak demand.

M & M is currently active in the following sectors:
- Offshore exploration
- Refining
- Power generation
- Pulp and paper
- Shipbuilding
- Manufacturing
- General industrial

M & M's largest plant is located in the Ocean Industrial Park at Woodside, Dartmouth, Nova Scotia. The Company also maintains a base at Monastery, Nova Scotia to serve the eastern end of the province. M & M Manufacturing Newfoundland Ltd. serves the province of Newfoundland with the ability to undertake site and offshore operations for speciality fabrication and servicing projects.

M & M is organized into five departments: Technical; Operations; Quality Assurance; Commercial; and Finance and Administration.

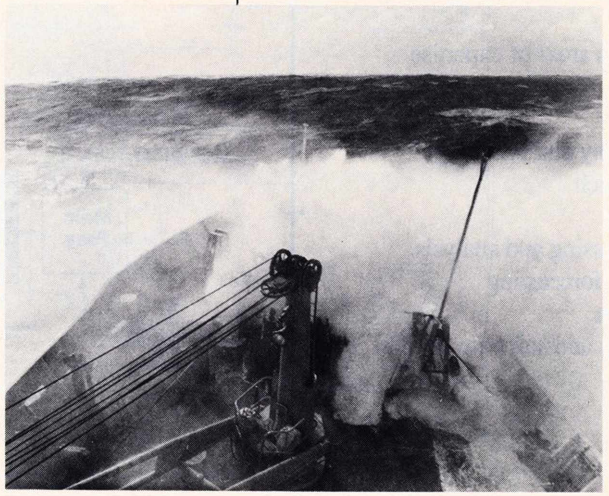
M & M places particular emphasis on Quality Assurance and Quality Control. This is borne out by the Company's excellent reputation for welded products. The Company has undertaken projects to a variety of codes and standards, developing Quality Control and Quality Assurance procedures to meet the most stringent requirements.

To expand its range of product lines and fabrication capabilities, M & M is actively involved in new technology and research and development. Examples of this approach are:
- Helicopter Refueling Units
- Offshore Construction
- Welding

* * *

The bow of the CSS Hudson in a North Atlantic sea

photo credit BIO



MacLaren Plansearch Ltd.
1959 Upper Water St., Suite 701
Halifax, N.S. B3J 3N2

Contact: S. G. P. Skey

MacLaren Plansearch Limited (owned by Lavalin Inc., Montreal, P.Q.) are leaders in meteorological, oceanographic and operational consulting services. They have been providing these services to industry and government since 1979. The combined skills of their meteorologists, oceanographers, engineers, scientists, programmers and field technicians provide a range of services including basic meteorological and oceanographic research field studies, data processing and interpretation, wind and wave hindcasting, numerical modelling, weather forecasting and offshore environmental support.

OCEAN CLIMATOLOGY

MacLaren Plansearch has the expertise to define wave, wind and current climatology for any location world wide. Climatology relevant for both design criteria and extreme conditions can be determined by MacLaren Plansearch's experienced staff and in-house software. The company's experience in this field includes work

Tel. (902) 421-3200
FAX (902) 425-4464
Telex 019-22718

Martec Ltd.
5670 Spring Garden Road
Halifax, N.S. B3J 1H6

Contact: Allan McLean

Tel. (902) 425-5101
FAX (902) 421-1923

for the Government of Canada in the Beaufort Sea, the Great Lakes, and the Northwest Atlantic. Also MacLaren Plansearch has developed wave climatologies for Indonesia and the Indian Ocean.

MacLaren Plansearch operates a 24-hour weather forecasting office and Weather and Information Network Service (WINS) with an operational staff that includes international forecasters with world-wide experience in:

- aviation forecasting for private, public and military aircraft
- offshore marine forecasting for drilling and oil exploration operations along with ship routing
- temperature and precipitation forecasting for municipalities, transportation, utilities, and construction.

The WINS Service provides, via satellite link, a complete range of weather products including facsimile, weather radar, satellite imagery and alphanumeric circuits.

MacLaren Plansearch's areas of expertise include:

- physical oceanography and limnology
- meteorological research
- numerical modelling
- data collection processing and analysis
- site specific weather forecasting
- database management
- computer technology and software support

* * *

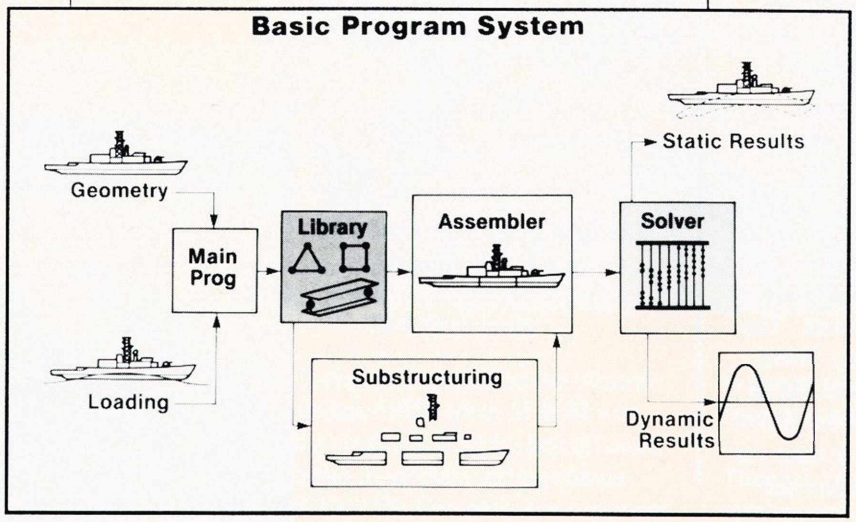
Martec Limited was established in 1973, in Halifax, to provide technical services in ocean science and engineering.

The marine environment is still the main area of interest and the Company has developed capabilities in structural analysis and design, ocean engineering, environmental services and software system development.

Qualifications of the professional staff cover chemical, civil, mechanical and ocean engineering, physical oceanography and marine biology and computer science.

STRUCTURES GROUP

Martec's Structures Group is the largest within the Company and has an extremely well developed expertise in the use of the finite element technique in structural analysis, particularly with regard to ship design.



Under contract to the Department of National Defence, Martec has developed an extremely powerful suite of programs called VAST for vibration and stress analysis of ships and ships' structures.

The VAST suite has been used to analyze large units, such as the CPF hull, and components such as propellers and warship masts. VAST is presently being extended to permit the analyses of submarine hulls.

A microcomputer version of VAST is presently being developed and will be available commercially by the end of 1988.

OCEAN ENGINEERING GROUP

The Ocean Engineering Group specializes in the prediction of environmental forces on offshore and coastal structures to aid in their design and safe operation.

Typical projects include:
- the estimation and measurement of forces on marine risers
- development of better methods of predicting the extent of wave forces on offshore structures
- the design of coastal protection systems

The Ocean Engineering Group has made a particular specialty of scour and erosion prediction, and has carried out major assignments for offshore resource companies involved in the design of offshore platforms and pipelines.

McElhanney Services Ltd.
101 Thornhill Drive, Suite 1
Dartmouth, N.S. B3B 1S2

Contact: Andrew Power

ENVIRONMENTAL SERVICES GROUP

The Environmental Services Group combines Martec's expertise in engineering, oceanography and marine biology to study the impact of activities on the marine environment.

The activities vary widely in scope and have included undersea pipelines, undersea cables, tidal power, marine terminals, ships' wastes, and various industrial and municipal discharges.

The Environmental Services Group are skilled in the interpretation of environmental regulatory requirements.

In recent years, Martec has been heavily involved in the environmental assessment of offshore oil and gas exploration and is presently completing a series of experiments on the extent of tainting of the flesh of various marine species, such as scallops, by hydrocarbons.

Martec's Environmental Group has recently developed a submersible computing and data acquisition system, SUB-C-DAS, for the collection and processing of information collected underwater.

SOFTWARE SYSTEMS GROUP

The Software Systems Group has been building up expertise in microcomputers and has carried out several projects in the conversion of large mainframe programs to run on microcomputers and personnel have given several courses in microcomputer use.

As one would expect from a high technology company, Martec is exceptionally well equipped with computer terminals, microcomputers, plotters, printers, etc., and maintains itself on the leading edge of this technology.

Martec, with its extensive corporate experience and the individual expertise of its staff, has developed a capability in ocean science and engineering which permits the Company to meet technical and administrative objectives with an unusually high degree of competence.

* * *

schematic by McElhanney Services

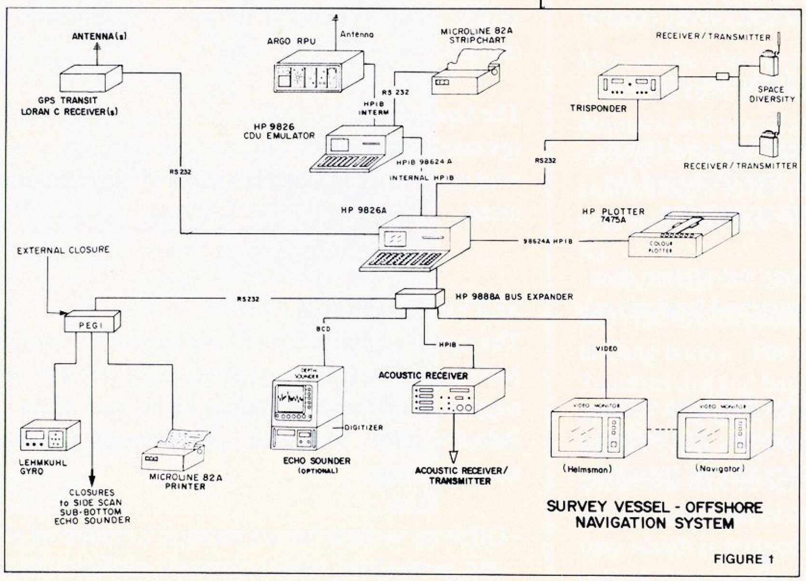


FIGURE 1

For over 75 years, McElhanney has provided excellence in the fields of marine and geodetic surveys; legal and petroleum land surveys; engineering; mapping, and data processing. To ensure further state-of-the-art integration, the activities of the company's geophysical, geodetic, marine, mapping and computer personnel are under the direction of the Geosurveys Group. This group includes employees with diverse experience and educational backgrounds who are capable of transferring technology and operational experience. Practical knowledge is thereby combined with academic knowledge of further software development and research.

In-house and external training programs ensure that the level of expertise is always maintained at peak efficiency.

McGregor Geoscience Ltd.
1959 Upper Water Street, Suite 507
Halifax, N.S. B3J 2Y3

Tel. (902) 463-0041
Telex 019-31670

Contact: John McG. Stewart

Tel. (902) 420-0313
FAX (902) 420-0589

The services provided by this group include:
- Geodetic and Control Surveys
- Digital and Conventional Mapping
- High Resolution Marine Geophysical Surveys
- Marine Navigation and Positioning Services
- Marine Hazard Surveys
- Data Post Processing and Presentation
- Hydrographic Surveys
- Oceanographic Studies
- Telecommunication Remote Surveys
- Research and Development

Quality control for positioning is a priority for projects conducted by the Geosurveys Group. McElhanney is constantly improving and updating software/hardware systems to ensure high accuracy in:

- Evaluating and rectifying mismatched survey control data for concession boundaries
- Transferring survey information from one datum to another
- Verifying survey control and equipment calibration
- Monitoring and enforcing survey specifications for geophysical and land seismic data acquisition programs
- Evaluating seismic and route survey navigation data
- Reproducing navigation and mismatched land seismic survey data

We have worked in over 60 countries and have extensive inventories of up-to-date equipment. For further information on any aspect of the services we provide, please contact Andrew Power.

* * *

McGregor GeoScience Limited is a Canadian company specializing in marine geological and geophysical surveys, interpretation and research.

McGregor GeoScience's worldwide experience ranges from studies in coastal waters to the abyssal plains and from scientific research to applied science and technology.

McGregor GeoScience was formed as a private, Nova Scotia-based company in 1973. The company has a staff of 15 employees dedicated to geoscience interpretation, marine surveys and engineering support.

The Interpretation Group consists of professional marine geologists and geophysicists with broad experience in their marine specialty. They are supported by a skilled group responsible for technical assistance and drafting.

The Operations Group is a cohesive team of marine operations specialists and electronics technicians with vital experience in Canada's harsh offshore environment.

SERVICE APPLICATIONS
Through the application of geophysical techniques McGregor GeoScience provides many services in support of offshore operations by the petroleum industry, utility companies, governments and engineering groups.

- Offshore wellsite hazard surveys; Location of shallow gas, permafrost, buried channels, seafloor obstacles, faults, sediment slumping, etc.
- Pre and post-lay pipeline surveys
- Production platform site surveys
- Pre and post-dredging surveys
- Underwater cable route studies
- Magnetometer location of pipelines and other submerged objects
- Iceberg scour and profiling studies
- Harbour and port development studies
- Marine aggregate searches
- Marine geotechnical studies
- Hydrographic surveys
- Placer mineral exploration
- Marine archaeological searches

FIELD OPERATIONS
McGregor GeoScience draws on an extensive complement of geophysical and support equipment in undertaking offshore and inshore surveys. This equipment provides data on the seafloor and to depths of 100 m or more beneath the seafloor, depending on geologic conditions. The equipment complement includes:

- Digital Seismic Recording Systems
- Hydrophone Arrays
- Acoustic Energy Sources
- Sidescan Sonar
- Bathymetric Systems
- Signal Processors
- Underwater Camera
- Sediment Sampling Equipment
- Navigation Systems
- Survey Vessels
- Oceanographic Instrumentation

METOCEAN Data Systems Ltd.
11 Morris Drive, #125
Dartmouth, N.S. B2W 4A5

Contact: Ralph Orton

INTERPRETATION SERVICES
Marine geologists and geophysicists of the Interpretation Group are skilled in the extraction of information from geophysical records, in the integration of this information to yield coherent interpretations and in the development of comprehensive reports, maps and illustrations which substantiate the interpretation. We strive to involve the interpreter from the survey planning stage, then in the survey phase, monitoring data quality and finally, in the post-survey phase, as project leader of the processing and report development task.

Our professional staff undertake major compilations of pre-existing geophysical data, integrate it and produce comprehensive interpretations. Such compilations have been undertaken for bathymetric, seismic, magnetic and gravity data from the continental margin of Senegal and for exploration seismic data from the continental margin of the northeastern United States.

The same process of compilation and integrated interpretation of existing data may be applied to inshore study areas or as the initial step in planning future field surveys.

Specific services offered by McGregor include:

- Wellsite survey interpretation
- Pipeline, platform and cable route studies
- Analysis and interpretation of all forms of geological and geophysical data, from exploration seismic data to sidescan sonar and bathymetry records
- Geological and geophysical compilations for inclusion in multi-disciplinary studies, such as environmental impact statements, project planning or regional studies
- Onboard interpretation during surveys
- Sediment analysis
- Sidescan sonar mosaic construction

CONSULTING SERVICES
- Consultation in geophysical survey planning
- Acoustic and electronic systems engineering
- Client representation: geophysical operations and navigation

* * *

Teamwork between scientists and ship's crew on board the CSS Hudson

photo credit BIO

METOCEAN Data Systems designs and manufactures state of the art data acquisitions and telemetry systems for severe environments. It its three years of operation the company has developed an international reputation for excellence and innovation in the fields of oceanography, meteorology, and defence.

METOCEAN's staff has over 100 years of directly related experience in product design, testing, manufacturing, deployment and international marketing of meteorological and oceanographic data acquisition equipment. Accomplishments include the development and manufacture of naval sonar systems, sonobuoy systems, towed array modules, automated test sets, drifting buoys, ARGOS transmitters, various moored buoys, ice beacons and icebased weather stations, and various study contracts.

Most of the company's products incorporate a common electronic data acquisition and telemetry system, designed and manufactured by METOCEAN. This package uses the ARGOS satellite system. ARGOS enables users to recover data from remote areas on a near real time basis complete with an accurate position fix.

METOCEAN's primary area of concentration is drifting buoys. The METOCEAN Data Systems' Standard drifting buoy is a spar type drifter of proven design. The buoy is modeled after the National Data Buoy Center's TOGA buoy. The drifter is a self contained unit designed for a minimum one year unattended collection of meteorological and oceanographic data which is relayed through the ARGOS satellite system on a regular basis.

Tel. (902) 465-3529
FAX (902) 464-9455
Telex 019-31564

METOCEAN, in addition to its Standard Drifting Buoy, has developed a state of the art Compact Meteorological and Oceanographic Drifter (CMOD). This buoy uses the ARGOS satellite system for positioning and data telemetry. This buoy enables the user significantly to reduce capital, transportation, deployment and premature failure costs.

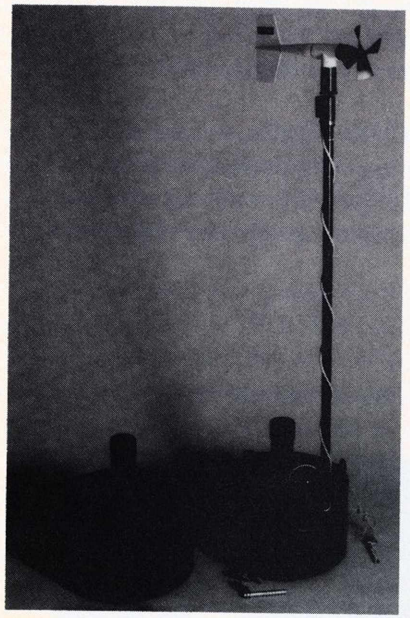
METOCEAN has also designed, developed and manufactured anemometer ice beacons, a sonobuoy size Compact Air Launched Ice Beacon (CALIB) for use in ice surveillance and an Ice Mass Monitoring Platform (IMP) used to determine ice accretion.

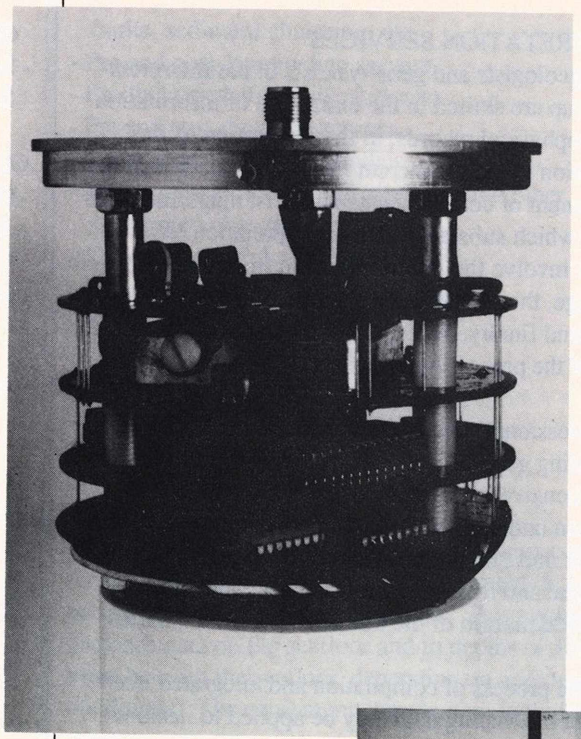
METOCEAN has developed an Ambient Noise Sensor designed to determine wind speed from underwater noise. An integral part of this development was the design of a low noise preamplifier, which has been described by customers as two orders of magnitude more sensitive than anything available in the world.

State of the art surface mount and product testing facilities coupled with a MIL Standard Quality Assurance program, enable METOCEAN to provide customers with reliable cost effective products. Products can also be designed, adapted or made to customer specifications. All products are backed by METOCEAN's product service and warranty program.

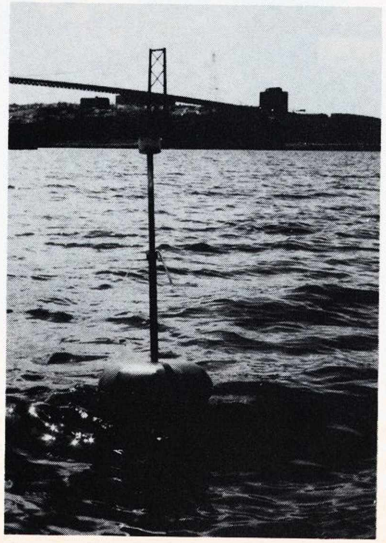
* * *

Ice beacons and anemometer

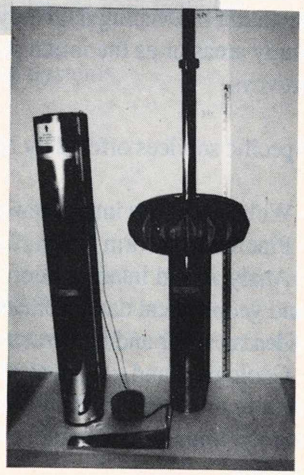




Argos Transmitter



Metocean drifting buoy



NAUTEL
RR1
Tantallon, N.S. B0J 3J0

Contact: Robert Perry

Tel. (902) 823-2233
FAX (902) 823-3183
Telex 019-22552

Twenty miles south of Halifax in Nova Scotia, lies the small fishing village of Hackett's Cove -- surely one of the most unlikely locations for one of the world's leading manufacturers of non-directional radio beacons.

The reason for selecting this location is largely a matter of history. In 1969, Dennis Covill, an engineering manager, decided to set up a small company for tendering on electronic research and development contracts.

Starting with two others and a capital of $35,000, their first workshop was in the basement of Dennis Covill's home in Hackett's Cove. Today, NAUTEL is still a private company. The big unexpected break came when the federal transport department called for tenders on a new type of solid state non-directional beacon transmitter. Transport Canada specified a target requirement for a Mean Time Between Failure (MTBF) of 3,500 hours, a figure then considered impossible by the electronics industry.

NAUTEL engineers examined the specifications and decided that they could equal or better the target. As they were the only bidder to make this claim, considerable skepticism had to be overcome before a contract could be signed.

The basis of the NAUTEL claim lay in the design of their newly developed network used to combine the output of the individual power amplifier modules before feeding to the aerial, together with a wholly solid state approach.

This technique gave the advantage that in the event of an individual module failure, only minimal power reduction resulted. Consequently, remedial work could wait until the next scheduled maintenance period instead of an emergency visit to the site. This aspect is particularly important when a facility is located in the Arctic or on a remote island. The concept resulted in a $100,000 development contract, which laid the foundations for the present success of the company.

Such projects could not be achieved in a basement workshop and a move was made to a purpose designed factory, surrounded by forest and located at the water side. The company now employs nearly 100 workers, many of them from Hackett's Cove, who have been recruited and trained by the company. The company operates a subsidiary plant in Bangor, Maine, employing 40 workers.

NAUTEL has entered the export market with such success that the company estimates it has captured 50% of the world market for non-directional beacon transmitters.

The original concept of NAUTEL was for a research and development organization. Whilst the company has to some extent strayed from that ideal, it does not mean that research does not continue. Its most recent development is the use of Class D Power Amplifiers and Pulse width modulation techniques for the company's range of transmitters. This technique enables a DC to RF conversion efficiency of approximately 91%.

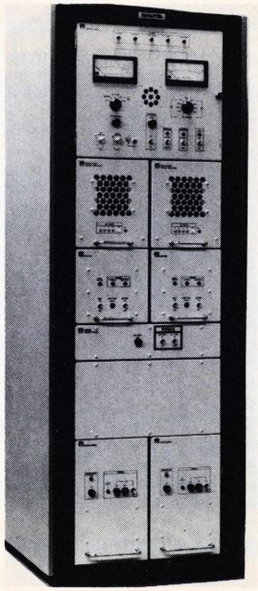
This technique has been used in the company's ND 4000BD beacon transmitter. In this Power 0 are used in a class D (switching) mode in both the RF power amplifier and the high level modulator to achieve this very high efficiency.

The company has not confined itself to the manufacture of non-directional beacon equipment. The product line includes HF and a series of fully solid state AM broadcast transmitters, ranging from 400 to 50,000 watts, operating on the same principles.

The success of the present product lines plus a continuing commitment to research and development will ensure that Nautical Electronic Laboratories Limited, located in what must be one of the most beautiful manufacturing environments in the world, can look with confidence into the future.

* * *

Nautel Non-directional beacon transmitter



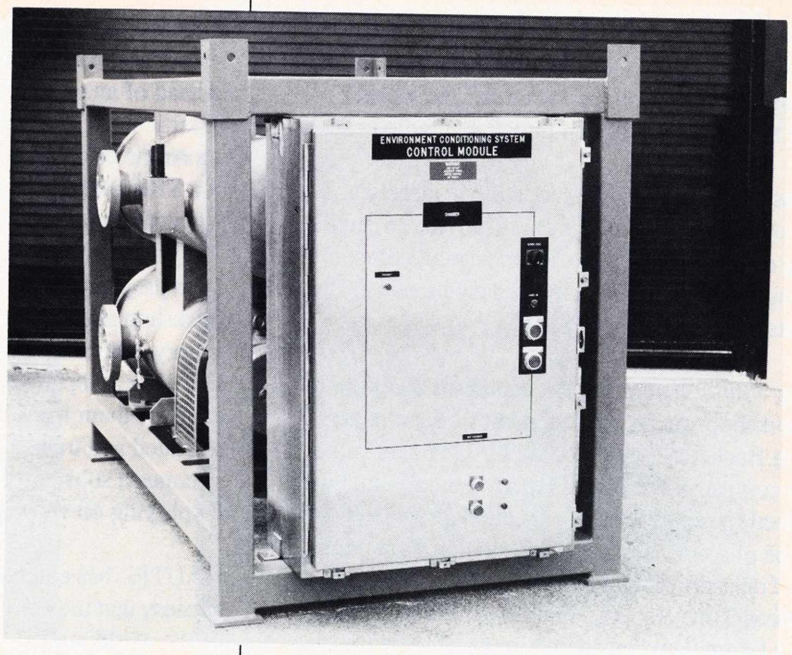
Nova Scotia Research Foundation Corporation
PO Box 790
Dartmouth, N.S. B2Y 3Z7

Tel. (902) 424-8670
FAX (902) 465-7384
Telex 019-22719

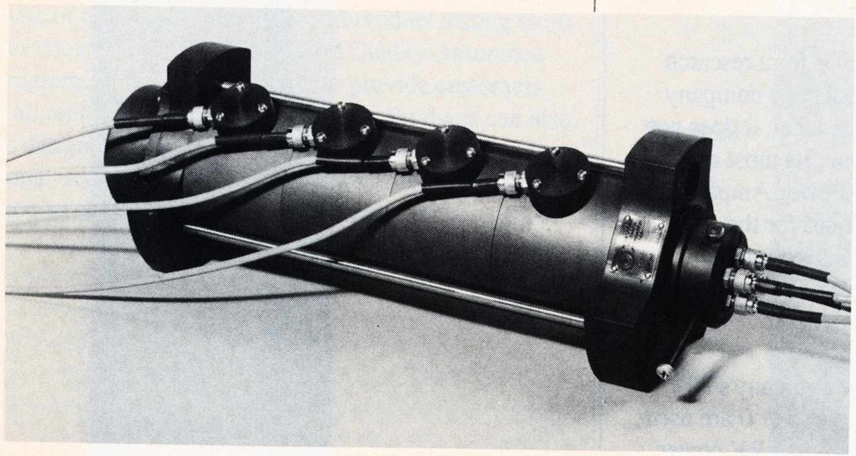
Contact: John A. Gillis

Nova Scotia Research was established in 1946 by the Province of Nova Scotia to use science and technology to assist in the economic development of Nova Scotia.

Three operating divisions—Industry Services, Applied Science and Product Development—carry out technical assignments each year for 600 companies and government departments. The Corporation's activities focus on two themes—assistance to industry in the solution of today's technical problems and new product/process innovation in response to tomorrow's opportunities. While the Corporation uses its capabilities to serve all sectors of Nova Scotia's industrial economy, particular emphasis is placed on technological support for secondary manufacturing industry. The Corporation emphasizes the potential for ocean industry development in Nova Scotia.



External Environmental Conditioning System (dessicant type)



Fiber Optic Rotary Joint Model 190

PRODUCT DEVELOPMENT
Ocean-related engineering, manufacturing and marketing group developing products for Nova Scotia manufacture with international markets.

- Marine Electrical Slip Rings
- Fluid Rotary Unions
- Diving Life-support Equipment
- Geophysical Marine Equipment
- Underwater Instrumentation

NORDCO Ltd.
PO Box 8833
St. John's, Newfoundland A1B 3T2

Contact: Frank D. Smith

Export sales to the world-wide ocean industry marketplace and supported by agents and distributors in:
Denmark
Holland
USA
France
Singapore
Western Canada
Germany
United Kingdom

Nova Magnetics Limited, a wholly-owned subsidiary company of NSRFC, designs and manufactures magnetically-coupled "zero-leakage" blowers and pumps for the nuclear and chemical industry.

Mechanical/electronic engineering and product design assistance for Nova Scotia industry.

Microelectronics assistance provided through the Applied Microelectronics Institute, a joint venture of NSRFC, Dalhousie University, and the Technical University of Nova Scotia.

FIBER OPTIC RO
TARY JOINT
Bi-directional, passive, optical connection of multimode fibers. Can be combined with one of NSRFC's electrical slip rings for high power and excellent signal quality in a single unit; or combined with a high pressure fluid swivel.

For use in dry or wet locations (including underwater) such as winches and other rotating interfaces where continuous signals must be maintained during rotation.

EXTERNAL ENVIRONMENTAL CONDITIONING SYSTEM (ECS) (Dessicant Type)
The External ECS is a continuation of the many years of design and manufacture of electrical slip rings, fluid rotary unions, and hyperbaric blowers for the world's diving contractors. The design philosophy has been one of uncompromising high quality and competitive pricing to ensure the same high reliability for diver life support system components.

DEEP TOWED SUB-BOTTOM PROFILING SYSTEM
The deep towed bottom profiling system gives high resolution sub-bottom profiles in water depths to one thousand meters. Operating at frequencies between 1000-3000 Hertz gives satisfactory resolution and penetration to 75 meters or more in soft sediments, and significant penetration in gravel and consolidated clays. Vertical resolution better than 50 cms.

Equipment meets need to provide high resolution sub-bottom surveys for: Pipeline; Submarine Cables; Offshore Platforms; Iceberg Scouring; Offshore Alluvial Minerals; and Dredging.

* * *

NORDCO (Newfoundland Oceans Research and Development Corporation) is an independent employee-owned company with specialized experience in marine resource development and engineering. Incorporated in 1975 in the Province of Newfoundand, and with head office and operating headquarters in St. John's, the Company is also registered in Alberta and Nova Scotia.

Formed initially to carry out programs related to the marine environment, NORDCO has since gained steadily increasing recognition for its application of research and state-of-the-art technology.

Projects and studies originally undertaken in both the research and engineering sectors for industries involved in the offshore have established the Company's reputation for offering consistent and reliable solutions. Examples of such projects include: resource development in the Canadian Arctic and off the eastern seaboard, with special emphasis on the acquisition of expertise and information on ice and cold water environments; fish harvesting; the impact of environmental forces on vessels and structures; and environmental forecasting.

This experience combined with the Corporation's continued growth and development in such high technology areas as remote sensing, image processing, acoustics, shiphandling simulation, HF radar and robotics, has led the Corporation to expand into more diverse overseas markets including the United States, Brazil, Mexico, Finland, Sweden, Norway, India, China, Korea, Sri Lanka and various African States.

By exploiting the dynamic relationship among its divi-

Tel. (709) 364-1200
FAX (709) 364-3550
Telex 016-4596

sions and approximately 100 professional, technical and support staff, NORDCO offers its clients a unique integrated systems approach enhanced by a firm Corporate commitment to its Quality Assurance Program and through its affiliation with organizations in continental America and Europe.

NEW PRODUCTS

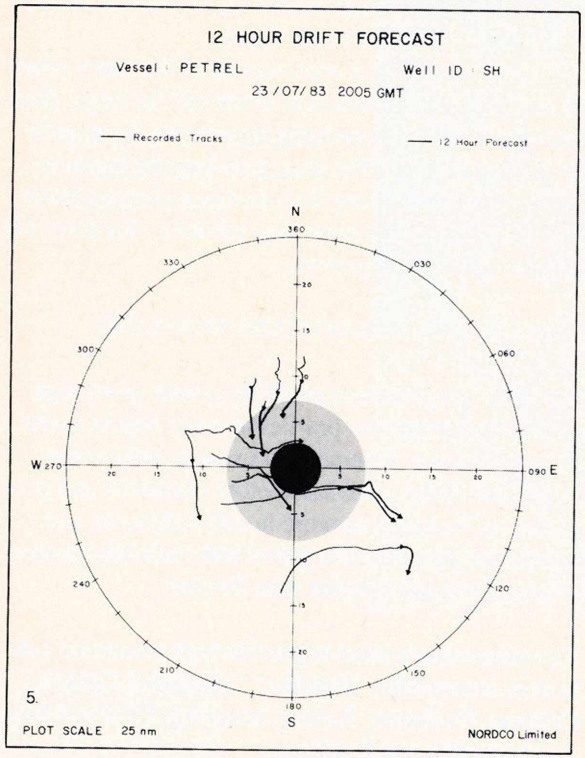
NORDCO provides in-house and client based:
- contracted R&D
- technical consultancy
- design studies
- prototype development
- fully engineered installations
- experimental and laboratory services

OFFSHORE SUPPORT

The Company provides a broad range of ocean-related products and services, including:
- geophysical surveys
- geotechnical investigations
- seabed sampling and mapping
- environmental monitoring and forecasting
- ice forecasting and monitoring
- oceanographic instrumentation, deployment and retrieval
- iceberg drift prediction
- complete ice management

MARINE ENGINEERING

NORDCO provides:
- innovative design and development for vessel designers and builders for the fishing, offshore drilling, supply and support industries
- continuing studies of Marine Transportation through sea ice



Example of 12 hour iceberg drift forecast

- marine monitoring, predictive and control equipment for motion and tow-monitoring, communications, and ballast control systems
- specialized installations
- modifications and improvements to existing client-owned equipment
- scale modeling
- tank testing

COMPUTER APPLICATIONS

The Company responds to needs, opportunities and challenges for large-scale operations, using powerful computers as interactive problem-solving tools. Resources are marshalled for specific applications, then integrated into management and control systems for:
- large-scale numerical and design modeling
- meteorological and oceanographic data processing
- socio-economic and impact studies
- statistical analyses
- perspective topography
- environmental monitoring

REMOTE SENSING

Through its Computing and Ocean Engineering Groups, NORDCO has established its capability with a wide variety of experience in both the operational and R&D aspects of remote sensing.
- high-resolution imagery for resource development
- monitoring and data collection and analysis operations

FISHERIES TECHNOLOGY

The Company has applied its multidisciplinary team approach to:
- harvesting technology
- processing
- aquaculture
- naval architecture
- vessel design and construction
- vessel operating/efficiency studies
- personnel training
- fishing charts
- fishing industry statistics
- socio-economic analysis and studies
- design and fabrication of fishery instrumentation

O'Halloran Campbell Consultants Ltd.
1730 Granville Street
Halifax, N.S. B3J 1X5

Contact: Daniel P. O'Halloran

Tel. (902) 429-9826
FAX (902) 429-5457

- fishery observers
- ecological impact studies

CONSULTING SERVICES
By combining apparently disparate disciplines the Company offers a range of consultancy services which include:
- feasibility studies
- planning
- implementation
- management studies and support

PROGRAM MANAGEMENT
As part of its policy to ensure viable, cost-efficient solutions, NORDCO offers its clients a complete program management service.
- project planning and scheduling
- field managers
- cost-control
- commissioning
- personnel training
- client representation
- tendering
- procurement
- project evaluation

NORDCO Limited is corporately committed to maintaining its performance record as a source of innovation, ideas and solutions, and maintain its dedication to excellence in the integration of products, service and management for the commercial, government, and military sectors.

* * *

O'Halloran Campbell Consultants Limited provides consulting services in the Atlantic Provinces in port planning and marine civil engineering, transportation, heavy civil engineering, multidisciplinary projects and associated fields. We provide a full range of services from project management of engineering assignments, planning and feasibility studies, preliminary and detailed designs and contract packages to site inspection and contract administration.

The company is based in Halifax and is a sister firm to W.G. Campbell Engineering Limited, a well established structural engineering organization. We have a team of professional engineers, technicians, draftsmen, clerical and field staff in the 20-30 size range, making us a medium size Maritime consulting group.

The company size is such that the principals are directly involved in all projects, and this is consistent with our approach of ensuring senior level guidance and supervision for all our work.

D.P. O'Halloran, MSc, PEng, President of the firm, has wide experience at a senior level in a broad variety of civil engineering projects and he has specialist training and experience in marine civil engineering and port planning. W.G. Campbell, LLB, PEng, Vice-President of the firm, has many years experience on structural design of numerous projects, and he has been constantly involved in site inspections during construction.

The company's principals both have over 25 years of engineering experience, substantially in the Atlantic Provinces. Since incorporation in 1980, we have successfully completed many projects, large, medium and small, and we have played significant roles in many general consulting and multidisciplinary assignments.

Recent projects have covered a wide range of services including land use and marine structures planning, port planning, wharf structures, bridge and roadway designs, foundations, parking facilities, site development, field inspections and so forth. As a prime consultant we also frequently undertake large scale multi-disciplinary engineering assignments involving sub-consultants such as planners, economists, management consultants, mechanical and electrical engineers, etc.

Transportation related projects are an important and growing segment of our total services. We are able to draw on excellent past experience on many significant projects, and we have undertaken large civil engineering assignments (some in association with others) over recent years. One of our objectives is to provide transportation planning and design services totally from within the Maritimes, in order to maximize local input and benefits.

We have excellent experience in feasibility studies, planning, design, management and construction inspection of marine and heavy civil engineering projects. We are thoroughly familiar with the preliminary and detailed design of alternative types of wharf structures, bridges, and buildings and with land development and construction cost estimating, as well as project control, scheduling and contract packaging.

We frequently use computer programs to assist with structural design, making use of our own programs (for

OceanChem Group
1000 Windmill Road, Suite 32
Dartmouth, N.S. B3B 1L7

Contact: Dr. S. MacKnight

Tel. (902) 463-0114
FAX (902) 466-5743

example, for concrete cribs, and SSP bulkheads) and structural programs such as STRUDL II. We have our own in-house computers, CAD terminals and programmable calculators. Word processing (specifications and reports) is carried out using Micom equipment.

Our in-house computers and programmable calculators are used on many projects on which programming is beneficial, and we have a sister firm which provides services in the field of computer aided drafting (CAD Services Limited).

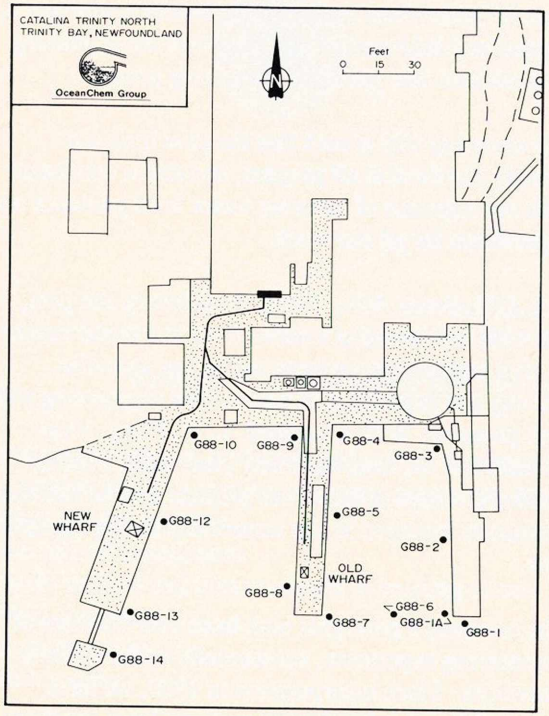
We frequently work closely with geotechnical consultants, and or civil engineers have a thorough understanding of soil mechanics.

Our planning and engineering services include:

- general project management
- planning/scheduling
- project control
- feasibility and preliminary studies
- development of design criteria
- detailed designs
- construction cost estimates
- tender documents
- site inspection and contract administration
- general consulting

* * *

OceanChem Group is a Nova Scotian owned and based group of companies specializing in studies relating chemistry to the environmental and earth sciences. Since its formation in 1982, the group has undertaken a wide variety of commissions across Canada for private, and municipal, provincial and federal government clients. OceanChem Group is continuously increasing the services and expertise to meet the increasing public concern for chemicals in our environment (chemical residues in workplace, food and water; hazardous chemicals; clean-up and disposal of contaminated materials and wastes).



The group has been designed to bring together the expertise necessary to provide a complete package to meet a client's needs. We can undertake program design; collect and analyze samples; interpret data; and represent a client before regulatory agencies. As necessary, we can then undertake the project management/ supervision as relates to the environmental component of a project to ensure that the activity meets all regulatory requirements.

RECENT PROJECTS

- Design and Field Verification of Sediment Sampling Guidelines (Environment Canada)
- Tabulation and Review of Data of Sediment Quality for Dredged Sediments from Atlantic Canadian Harbours (Transport Canada)
- Analysis of Biota for In-Place Pollutants Study in the Great Lakes (Ontario Ministry of Environment)
- Provision of Training Seminar Package on Leaking Underground Storage Tanks for Managers of Federal Facilities (Environment Canada)
- Pre-Dredging Evaluation and Environmental Monitoring Related to Dredging and Material Disposal for the Nova Scotia Dept. of Development Wharf, Pictou (N.S. Dept. of Development)
- Analytical services related to environmental monitoring of Seabright Ltd. and BP Selco gold mines. (Seabright and BP Selco)
- Site Assessment and Remediation for Decommissioning a Scrap-Yard (CN Real Estate)

Core drillings Trinity Bay Newfoundland

Oceanprobe Systems Manufacturing Inc.
100 Ilsley Avenue, Unit AA
Dartmouth, N.S. B3B 1L3

Contact: Dave Fissel

Tel. (902)465-3871
FAX (902) 464-0003
Telex 019-31590
Electronic Messages: ASL.EAST
(Envoy 100) OPE002 (CNCP Dialcom)

SERVICE OPERATING DIVISIONS

OceanChem Labs Ltd.
This division provides services in consulting and analytical chemistry. A large modern laboratory is maintained in the Dartmouth facilities with complete capabilities in inorganic and organic chemical analyses with an emphasis on trace and ultra-trace determinations.

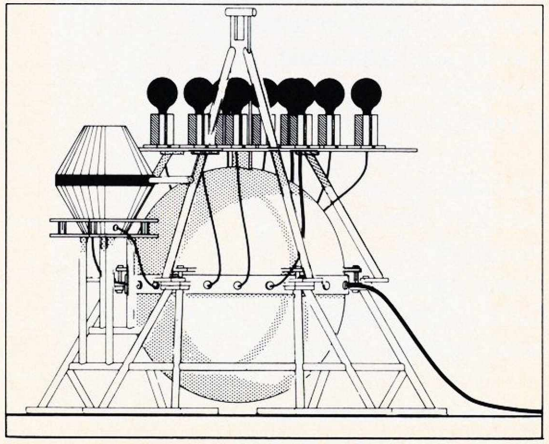
OceanChem Sciences Ltd.
This division provides consulting services in the environmental and oceanographic sciences. In-house staff works closely with a client and appropriate regulatory agencies to design an assessment or monitoring program to meet regulatory specifications and budget limitations.

OCL Services Ltd.
This division is responsible specifically for hazardous waste site assessment and remediation. Professional staff can undertake the necessary sampling and examination to determine the extent of a problem. From this information, remediation programs can be designed and undertaken. All activities are conducted within federal or provincial guidelines for the management of hazardous materials.

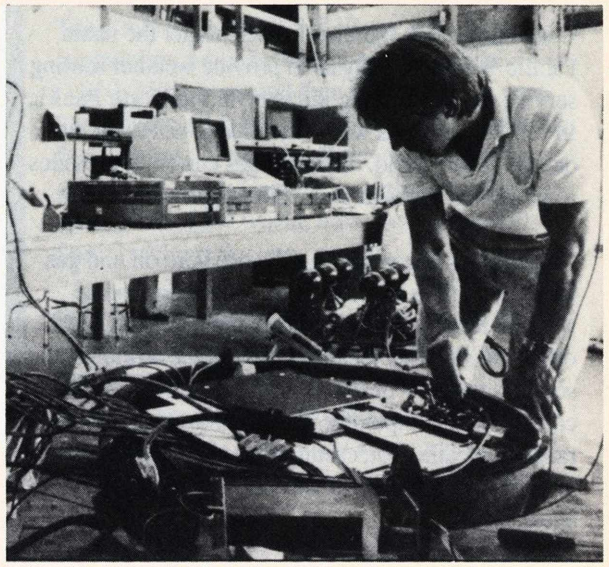
* * *

Oceanprobe Systems Manufacturing Inc. was incorporated in March, 1985, to develop and manufacture oceanographic and ocean-related products. The company's major focus is in the development of acoustic instruments for measuring physical oceanographic quantities. Oceanprobe Systems currently is developing an acoustic scintillation flowmeter, for measuring flows in rivers and ocean channels, and an enhancement module for echo sounders, which will increase their sensitivity through the application of correlation techniques. A hot-water ice drill, for boring large or deep holes in ice, is currently in production.

Oceanprobe Systems also offers custom design, development and support services in the field of instrumentation for measurement of oceanographic and other environmentally related quantities. A line of battery packs, used in specialized oceanographic instruments, is also manufactured. Oceanprobe Systems' activities are carried out in Sidney, B.C., and Dartmouth, N.S., where the company shares well-equipped laboratory and support facilities with its parent organization, Arctic Sciences Ltd., which has an extensive background in the scientific and technical study of all three of Canada's oceans.



A research instrument package designed to test concepts for acoustical measurement of directional wave spectra



Instrument under construction

Access to the experience and expertise of Arctic Sciences' professionals allows Oceanprobe Systems to maintain a vigorous research and development program directed at the production of economical and effective solutions to problems in environmental measurement.

For further information, please contact David Fissel.

* * *

Oceanroutes Canada Inc.
200-1496 Bedford Highway
Bedford, N.S. B4A 1E5

Contact: Rick Coates

Tel. (902) 835-1617
FAX (902) 835-6589
Telex 019-22888

Oceanroutes was founded in 1952 under the name Pacific Weather Analysis to provide weather routing service to the shipping industry in the North Pacific. In 1970, operations were extended to cover all the oceans of the world. Oceanroutes currently provides route advice to more than 1000 ships each month.

Oceanroutes began serving the offshore oil and gas industry in the early 1970s by providing marine weather forecasting and consultancy. Today, local offices in strategic locations around the world provide services to many of the world's major oil and offshore construction companies. Oceanroutes also provides a range of weather forecasting and data services to radio, television and the press, utilities and local government agencies.

Oceanroutes' world-wide offices are linked computer-to-computer by high speed communications lines, allowing the rapid transfer of data between offices. Oceanroutes provides the facility for clients throughout the world to access the computers directly to obtain real-time management information data and weather information.

Oceanroutes Canada Incorporated is one of the Oceanroutes companies specializing in the provision of meteorological and oceanographic services.

SERVICES

Optimum Ship Routing and Performance Evaluation
- Route recommendation and weather synopsis
- En-route weather advisories and diversions
- Daily progress reports
- Detailed voyage summary
- Evaluation of Performance Speed
- Post Voyage Analysis
- Speed and consumption monitoring
- Speed and consumption claim analysis

Offshore Weather Forecasting
- Site-specific spectral wave and weather forecasts
- Route forecasts for rig moves and tows
- Vessel response forecasting
- Weather window prediction
- On-site forecasters for critical operations
- Tidal predictions

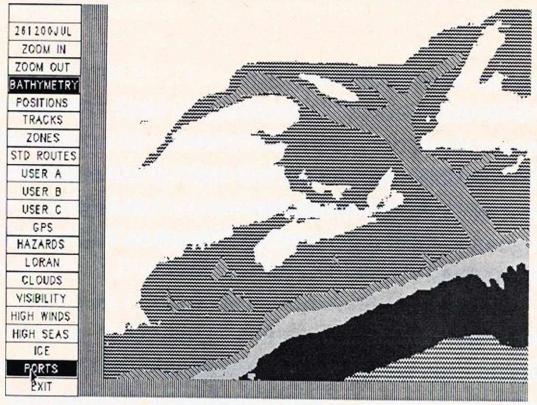
Meteorological and Oceanographic Consultancy
- Climatological studies
- Hindcast studies
- Spectral wave modelling
- Vessel downtime simulation
- Determination of design criteria
- Route evaluation and simulation
- Wave shoaling and refraction
- Current measurement and modelling
- Expert witness testimony

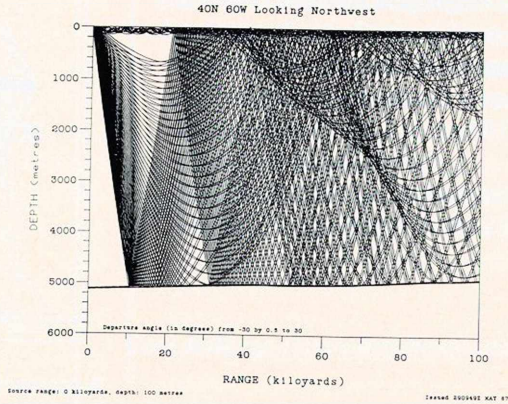
Data Collection and Analysis
- Advice on selection of equipment
- Deployment of sensors
- Collection and analysis of wind, wave and current data

The Oceanroutes Group has been providing marine meteorological services for some 30 years and has offices supporting the major offshore operations throughout the world. Training is offered in Canada and abroad.

* * *

Fleet Management System by Oceanroutes





Ray trace of acoustic sound waves by Oceanroutes

Orion Electronics Ltd.
Church Point
Digby, N.S. B0W 1M0

Contact: Mary Gaudet

Tel. (902) 769-3059
FAX (902) 769-2496
Telex 019-38506

Orion Electronics Limited, incorporated in 1975, is a wholly owned Canadian company specializing in the design, development and manufacture of electronic direction finding systems for land and marine use.

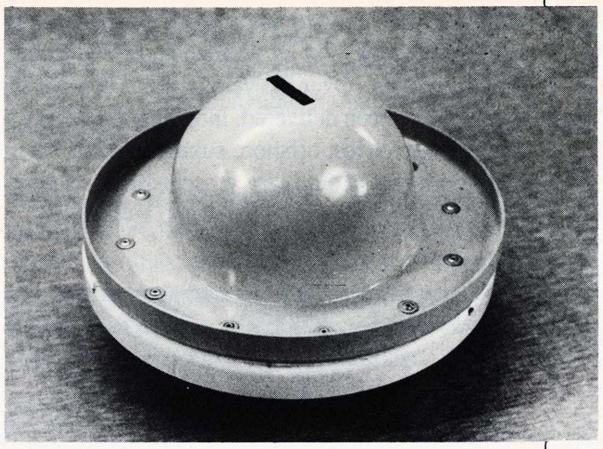
Orion's reputation as a leader in design and innovation has had a rapid growth. This reputation has been made possible by our emphasis on designing reliable products for professional use and responding to challenging problems.

Our equipment and services are being used by government agencies (transport, environment, fisheries, coast guard) in over 20 countries. Major oil companies, police forces, universities, research groups and general consultants are among our list of customers.

We manufacture a wide range of compatible direction finding transmitters, receivers and antennae for a variety of professional uses. Our various units allow for tracking on land, sea and air.

The heart of the Orion CAN-TRACK system is the R11-B portable DF Receiver, which is built to the highest standards of craftsmanship and uses high quality components for maximum reliability under the severest operating conditions encountered on ship, launch or aircraft installations.

State-of-the-art design with the ability to provide unambiguous bearings on signals as small as 0.1uV, with excellent interference rejection, make this receiver a world leader. This excellent sensitivity means that reliable bearings can be obtained from lower power transmitters at longer distances, thereby reducing search time and saving money.



The CAN-TRACK Receiver

The CAN-TRACK O.S.T. Buoy is used in conjunction with the R11-B receiver. The O.S.T. 2100 is a small free floating buoy used for tracking oil spills and conducting circulation flow studies. Virtually all the oil companies drilling off-shore Canada, as well as in many other parts of the world, now have Orion Oil Spill Tracking Systems on site.

Developed by Orion in conjunction with the Canadian Department of the Environment, the Can-Track Buoy has a drift characteristic similar to that of an oil spill. Deployed when a spill occurs, the Can-Track buoy keeps transmitting many weeks to let you find the spill at night.

To complete the package, Orion offers a wide variety of VHF antennae. Our range of antennae includes hand-held, magnetic mount vehicle, weatherproof ship and helicopter antennae.

Our Flexible Wavestaff manufactured under licence from the Nova Scotia Research Foundation Corporation is of interest to engineers concerned with ships, harbours and coastal structures as well as oceanographers engaged in wave-climate studies. We carry the Electronic Box for use in conjunction with Wavestaff to produce an electrical analog of instantaneous water level.

For further information on our equipment and capabilites contact our office at Church Point.

* * *

Pictou Industries Ltd.
1770 Market Street
Halifax, N.S. B3J 3M3

Contact: Robert Bezaron

Tel. (902) 421-1510
FAX (902) 429-0225

Pictou Industries Limited operates a long established shipbuilding and ship repair business at Pictou, Nova Scotia. The shipyard is located on the waterfront of Pictou Harbour, one of the better harbours on the south shore of the Gulf of St. Lawrence (latitude 45 41'N, longitude 62 34'W).

A wholly owned subsidiary of Canadian Shipbuilding and Engineering Ltd., one of Canada's largest shipbuilding enterprises, the shipyard at Pictou has been operating at the present location for over 100 years. In addition to the design and construction of vessels, Pictou is expert at both general repairs and major conversions, offering a full range of marine services, as well as industrial fabrications in steel and aluminium for industries such as mining.

Pictou Industries Limited has maintained a close association with the fishing industry over the years and has supplied a wide variety of steel-hulled fishing vessels to virtually every east coast fishing company, including stern trawlers, seiners, longliners, scallopers and clam dredgers. Major refits and conversions are also carried out, including hull lengthening, ice strengthening, re-engining and accommodation refits.

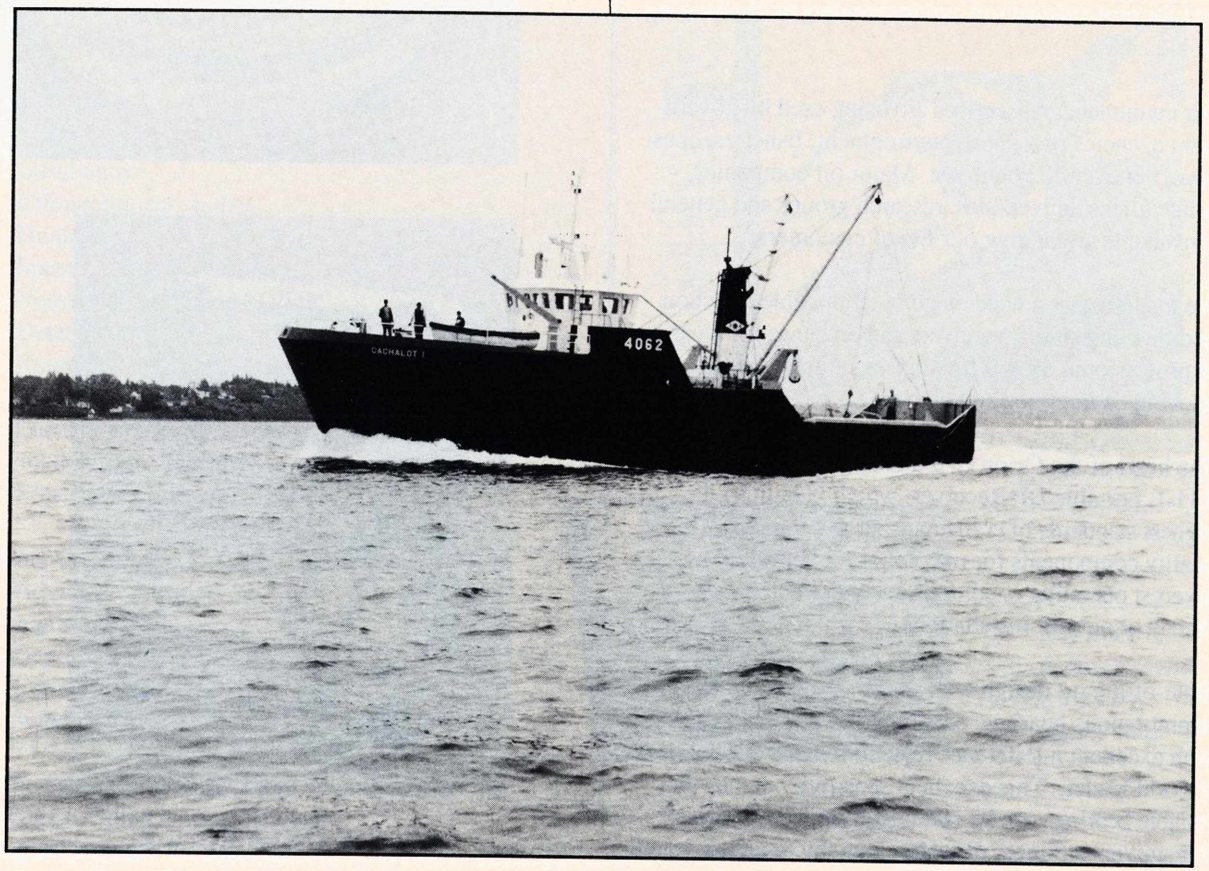
The existing yard facilities cover ten acres, of which 44,000 square feet represents metal fabrication area and 56,000 square feet represents other manufacturing areas such as carpentry, electrical, machine and pipe shops.

Facilities include a 3000 metric ton marine railway and adjacent 3-position side transfer. This permits multi-ship and extended refits to be undertaken. All marine trade skills are available.

Although the shipyard has worked closely with the fishing industry, it is by no means limited to building fishing vessels. Over the years dozens of steel-hulled vessels have been delivered, including passenger and automobile ferries, offshore supply vessels, ocean tugs and barges, naval auxiliary vessels, fisheries research vessels, fisheries patrol vessels and icebreakers.

Industrial fabrication work has included storage tanks and pressure vessels, underground mine cars, propulsion nozzles, coal hoppers, blast furnace gas main piping and transformer tanks

* * *



Cachalot I stern scalloper 97' built by Pictou Industries

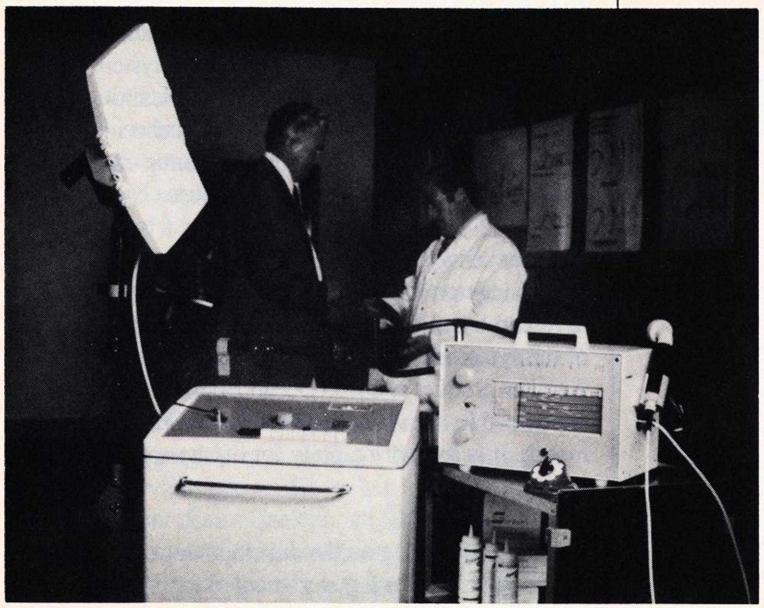
Rayonics Scientific Inc.
473A Windmill Road
Dartmouth, N.S. B3B 1B2

Contact: George Hemming

Tel. (902) 463-3344
FAX (902) 465-2370
Telex 019-31409

Rayonics Scientific Inc., Atlantic Division, incorporated in 1965 as Atlantic Instrumentation Services Ltd. to offer a complete range of technical services for the calibration, repair and maintenance of electrical, electronic, mechanical and physical properties equipment and instrumentation in the industrial, medical, communication and research fields.

Rayonics Atlantic has electronic instrumentation manufacturing expertise and facilities and has developed and manufactured under contract a unique instrumentation package for dynamically testing sonar equipment performance for the Canadian Navy. Currently engineering work is being done to design a series of depth sounders and recorders and work has started on the design of a series of nuclear hazard radiation monitors.



Rayonics Atlantic also resells quality lines of scientific, analytical and research apparatus and instrumentation to customers in research, educational, industrial and medical fields.

Rayonics Atlantic offers field service, calendar inspections, start up and commissioning services for hospitals, research facilities, processing plants communication, and the energy industries. Rayonics Atlantic also has considerable expertise in administrating commercial and government contracts in repair, modification, overhaul and calibration of test instrumentation, and enjoys the unique position of being the only facility in the Atlantic Region with trained personnel capable of repairing, installing and calibrating a wide range of sophisticated medical diagnostic equipment.

Rayonics Atlantic stresses the importance of service. Quality of products or services is largely dependent upon the efficiency and reliability of electronic test and control equipment and personnel. Rayonics Atlantic uses qualified personnel and has a fully equipped calibration laboratory and clean room with standards traceable to NBS or NRC and certified to DND AQAP1, AQAP4, and AQAP6 and also complying with CSA Z299-1.

* * *

Seakem Oceanography Ltd.
Bedford Institute, PO Box 696
Dartmouth, N.S. B2Y 3Y9

Contact: Fred Guptill

Seakem Oceanography Limited is a research, development and consulting firm with offices in Dartmouth, Nova Scotia and Sidney, British Columbia. The company's current staff nationwide consists of 70 scientists and technicians with specialties in environmental assessment, toxicology, aquaculture, chemistry, aquatic biology and oceanography. Seakem's Dartmouth, Nova Scotia facility employs ten professionals and support staff in in 3,900 square foot space in the Argo Building, situated adjacent to the Bedford Institute of Oceanography. This facility includes modern chemical and biological laboratories, an electronics workshop and instrument calibration and a maintenance facility which includes a spacious warehouse and staging unit.

Seakem's Dartmouth staff have extensive experience in toxicity evaluation and assessment of contaminants in the aquatic environment. The operation has facilities for conducting bioassays either in house or through rented wet labs at the Bedford Institute of Oceanography and Dalhousie University. The arrangement has permitted assessment studies of both short and long term toxicity of contaminants to marine and freshwater organisms. Studies ranging from the effect of acidity on metal accumulation in salmonids, to the sub-lethal effects of dissolved oil on marine fish and invertebrates have been carried out here. The company is a leader in Canada in the investigation and testing for effects of hydrocarbons and drilling muds on marine organisms.

The chemical research capability is supported by a trace organics laboratory with instrumentation for hydrocarbon analyses by gas chromatography, infrared spectroscopy and ultraviolet fluorescence. The lab is equipped to do all routine chemical analyses of water,

Seastar Instruments Ltd.
PO Box 696
Dartmouth, N.S. B2Y 3Y9

Tel. (902) 469-0932

Contact: Fred Guptill

including nutrients, dissolved oxygen, conductivity and salinity. The lab supports environmental and toxicity studies carried out by the company and conducts specialty projects in development of aquatic standards and methods.

In addition, the Dartmouth lab has a capability for monitoring of radioisotopes in sea water and is certified as a low level laboratory. Trace metal and other contaminant analyses are carried out by Seakem's Sidney, B.C. operation, where all types of modern analytical instruments and sample preparation/ extraction equipment are maintained. The Sidney lab is one of the few analytical laboratories in Canada certified by the Standards Council of Canada for trace organic analyses.

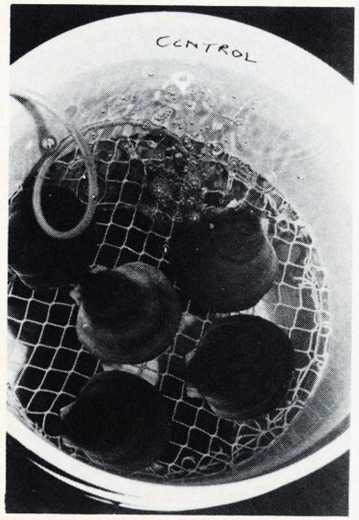
The company's capabilities in biology include the field sampling of plankton, fish and benthos, sorting enumeration and identification of benthic invertebrates, and physiological/biochemical/histopathological studies. Seakem has dissecting and compound research microscopes for general use and taxonomic work.

Seakem also offers services for aquaculture, including site selection and evaluation, water quality analysis and monitoring, and diagnostic services. It has successfully carried out a project to determine suitable chemical test kits for aquaculture facilities, has been involved in a feasibility study of a fibre optic chemical sensor, and is carrying out a study of effects of suspended sediment on aquaculture organisms. The company has experience with major aquaculture species, including Atlantic Salmon and brook trout, through its toxicity projects.

Studies in the physical sciences focus on physical oceanography. Seakem maintains a large pool of data collection instrumentation to measure waves, currents, tides and wind. The company has diagnostic instrumentation (voltmeters, oscilloscopes, signal generators) required to calibrate and service instruments of this kind. It operates a wave buoy calibrator to allow controlled calibration of heave and directional sensors in wave measuring buoys. Custom-written software is maintained for translating data from instruments tapes and for performing time series and statistical analyses.

In short, the company has the capability of mounting almost any form of aquatic monitoring and assessment program, in the ocean or in freshwater with the full range of field instrumentation available.

* * *



Seakem toxicity test for scallops

Seastar Instruments Limited is a young company specializing in research, development, and manufacturing of electronics and chemical products for oceanography and the earth sciences. The company operates from offices in Sidney, British Columbia and Dartmouth, Nova Scotia.

Seastar was formed in 1983 as the instrument manufacturing arm of Seakem Oceanography Limited, an oceanographic and environmental consulting and research and development firm based in Sidney, British Columbia. The companies share 4,200 square feet of leased facilities in Dartmouth, Nova Scotia.

The Dartmouth facility, established in July 1985, handles contract R&D in electronics and instrumentation, and employs 15 people in the engineering and technical fields. Seastar developed and markets ECOLOG II, a dual beam echo sounder system for fisheries and other aquatic research applications, the first such system to use simultaneous echo integration and target strength estimation. Electronic components and transducers are constructed in house.

The company produces also a commercial version of a bottom referencing towed instrument platform for use in research and bottom surveys, and contracts services of the system for geological and fisheries surveys. Another product is OBS (Ocean Bottom Seismometer), developed by the Atlantic Geoscience Centre in Dartmouth. It is used principally for offshore geophysical surveys.

Work is proceeding on the development of a multi-frequency sonar for a government client. The Dartmouth facilities include office, laboratory and manufac-

Tel. (902) 463-0932
FAX (902) 464-9602

turing space, which Seastar shares with Seakem Oceanography Limited. Included are an electronics lab, an acoustics test tank and electronics test area, and instrumentation warehousing and storage space.

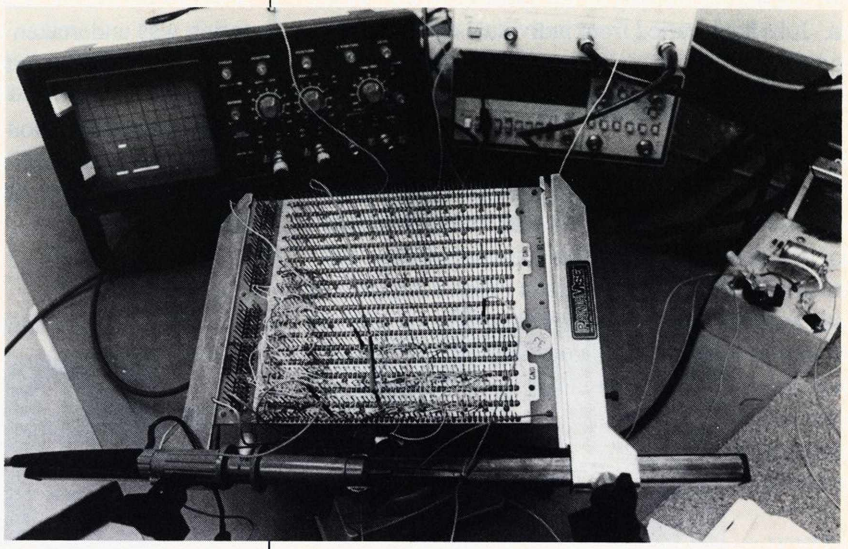
Seastar Instruments' west coast facility manufactures a wide range of oceanographic instrumentation and electronics products, a variety of fibre optic products for laboratory and field use, and a line of ultra-pure chemicals for trace analysis. The company's first product was a microprocessor controlled in situ water sampler, a self contained pumping system with feedback loops to monitor and control pumping rate. The system in currently unique in the world and sales have been the backbone of the company's development. This product was followed by a line of instruments including data buoys, instrument interfaces, acoustic releases, and pinger/transponder products.

The attractiveness of fibre optics as a new technology for ocean instrumentation induced Seastar to embark on several development projects in this field. The company markets an ultra stable power supply for use with lasers and a low cost single mode pig-tailed laser diode. Now under development are fibre optic sensors for dissolved oxygen and salinity and a fibre optic accelerometer, currently at the testing phase, with potential for use in oceanic wave buoys and aircraft.

Seastar has at the same time capitalized on expertise in Chemical Oceanography to market a line of ultra pure chemicals (solvents and acids) for use in trace analysis and contaminant determinations. In addition, Seastar developed a line of chemical modules designed to fit on the Seastar's microprocessor controlled in situ sampler to meet needs in trace sampling of major classes of contaminants, including hydrocarbons, trace metals and radionuclides. Seastar is currently the only company that offers such chemical extraction columns and a supporting analytical service world-wide.

* * *

Construction of electronic components for dual beam echo-sounder ECOLOGII by Seastar



ECOLOG II dual beam echo sounder and towed "fish"

SEATECH Investigation Services Ltd.
1127 Barrington Street, Suite 17
PO Box 2161, Station M
Halifax, N.S. B3J 3C4

Tel. (902) 423-5296
FAX (902) 420-0674

Contact: Clive MacGregor

SEATECH was formed in 1980 to provide environmental consulting services in chemistry and biology of the oceans. Since that time the company has carried out studies in regions as diverse as the Norwegian North Sea and the estuary of the Orinoco River, Venezuela. Jobs have varied from individual chemical or biological analyses to multidisciplinary multiyear studies costing several hundred thousand dollars.

SEATECH, a relatively small company (seven staff), has its offices and laboratory in Halifax, Nova Scotia, on the east coast of Canada. Its staff includes marine biologists, divers, chemists and oceanographers. The chemistry laboratory specializes in organic analyses in aquatic systems. Marine biologists have a microscope laboratory as well as specialized microbiological capabilities. SEATECH owns many pieces of oceanographic equipment for scientific studies, including: samplers, salinity meters, recording current meters and other specialized equipment.

SEATECH carries out three types of studies:

- specialized aquatic research
- oceanographic environmental assessments
- emergency response

An example of the first type of study was the development of a trace organic technique to differentiate terrestrial from marine organic carbon in offshore sediments. The second type of study typically involves preconstruction assessment of potential environmental impacts from a given structure or operation. A study involving assessment of oceanographic conditions and their effect on sewage dispersal impact from a proposed ocean outfall was just recently completed for Grenada, West Indies. The final type of study most often involves responses to oil spills from oil drilling platform blowouts. SEATECH has surveyed and traced spills by using specialized shipboard equipment in several east coast Canada spills. In one case, monitoring was undertaken continuously for six months, including during severe winter conditions.

Additional information or brochures on specific aspects of SEATEC's services can be obtained by contacting Clive MacGregor or Michael Fraser at the above address.

* * *

Diver recovering current meter

Seimac Ltd.
1378 Bedford Highway
Bedford, N.S. B4A 1E2

Contact: Joseph H. Seiler

Seimac Limited is a measurement system design company whose principal activities are the design, development, production and support of marine electronic devices and systems, and training, consultation and system integration. The Company has earned success in the ocean and Arctic instrument field by actively providing instrument solutions to the ocean scientific and Navy communities since 1975.

Seimac Group has two companies, the original Seimac Limited, which designs and manufactures instruments used in the collection of data, and Oceanroutes Canada Incorporated, which designs and maintains computer software systems. They are a successful combination in Arctic data collection and data processing.

A wide range of ocean related scientific instruments is designed and manufactured by Seimac at their Bedford, Nova Scotia location. Seimac holds special expertise in the production of low-power and arctic data logging equipment. Most devices are microprocessor based. Seimac's cold electronics module series of single board computers interface to ARGOS satellite transmitters, making worldwide remote data collection possible.

Seimac maintains a complete repair and calibration facility and provides a full range of training support for clients.

ICE BEACONS

Seimac manufactures both ground and air deployable beacons. Ice beacons are placed on the ice and fitted with an ARGOS PTT to provide position tracking as the ice moves. The cost of the beacon is usually less than the cost of deployment when placed by use of a

Tel. (902) 835-9686
FAX (902) 835-6589

skidoo or helicopter. However, if an air deployed version is used, multiple beacons can be placed using longer range fixed wing craft, and both costs and range of the operations can be improved significantly.

ICE PENETRATORS

Seimac manufactures flexible penetrators. Ice Penetrators are sensor staffs fitted with thermistors placed through the ice. The temperature along the staff, the change in slope of the line, plotting consecutive sensor temperatures, shows a distinct corner at the ice water interface. The thickness of the ice and the growth and decay rates can be observed. Penetrators can be rigid or flexible, the latter being easier to transport.

SURFACE TRACKING BUOYS

Seimac builds the barrel type of buoy, which can be outfitted with salinity, temperature, barometric pressure and other sensors in addition to the ARGOS PTT used for positions.

ACOUSTIC DATA COLLECTORS

Seimac has developed various types of Acoustic Data Collectors. They are usually constructed using a surface platform, a cable with suspension and motion reduction paraphernalia, and the hydrophone. Such devices are used for acoustic research to support Navy needs, to listen for and characterize ice noises and detect the onset of breakup in spring and to detect events such as pipeline blowout, or passing vessels.

UNDERWATER OR UNDER ICE PROFILERS

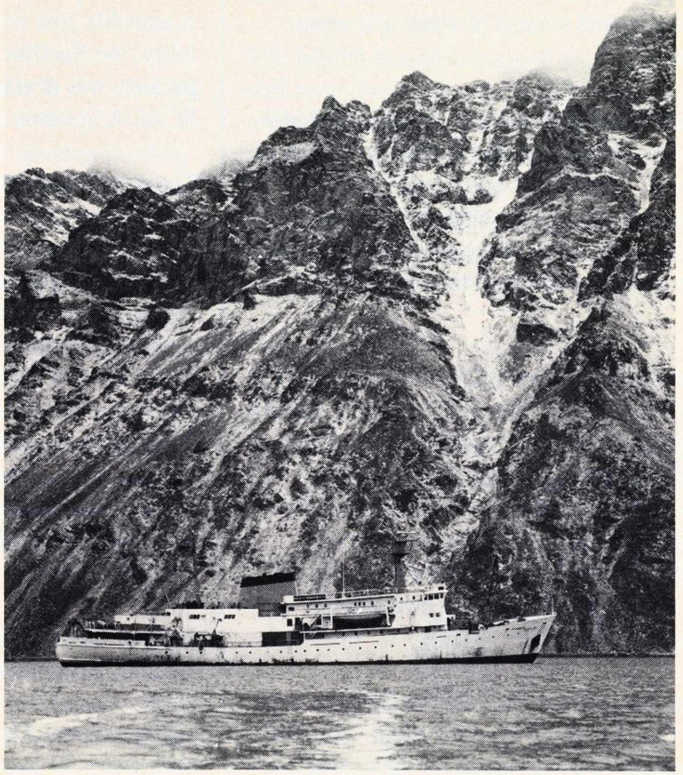
Underwater of Under Ice Profilers are usually complex contraptions that raise and lower a sensor head in some preprogrammed or manually controlled pattern. Seimac is currently working on a method to alter the buoyancy of the sensor head by expanding and contracting a bladder using a piston to cause rise or fall on the pilot cable. Most profilers use ARGOS to remove data although Seimac also has experience with placing mass storage units underwater.

All of the foregoing collect environmental data and in general, are designed to run on batteries for a long time in remote areas. ARGOS gives position data automatically, and no other system is as available worldwide.

* * *

CSS Hudson in Cambridge Fjord, Baffin Island

photo credit BIO



Surfline Engineering Ltd.
170 Joseph Zatzman Drive
Dartmouth, N.S. B3B 1L9

Tel. (902) 463-3550
FAX (902) 463-0216

Contact: Michael McAloney

Surfline Engineering Limited designs, manufactures, installs, and provides technical support for a family of Supervisory Control and Data Acquisition (SCADA) products. The company also provides services, including project and system design engineering, design and manufacture of PLC-based control and instrumentation systems, and software development.

Since 1975, Surfline Engineering Limited has been designing and manufacturing systems in the broad fields of instrumentation, industrial control, and data acquisition. Approximately 80 % of our business deals with the monitoring and control of water and wastewater systems.

In 1976, Surfline developed the CSA-approved Model 214 duplex pump control package for use in sewage pumping stations. It provides automatic control, protection, and sequencing of pumps in response to wet well levels. This unit is still being produced, and over 500 have been used on pumping stations in Maritime Canada.

In 1980, we produced our first SCADA system, which is located in Kings County, Nova Scotia. It is the first such comprehensive computer-based system in Eastern Canada. After installing a second major SCADA system for the City of Edmundston, New Brunswick, we realized that SCADA systems in the water and wastewater field were going to grow dramatically, so we decided to design and produce our own system components and software.

The first project using these internally-designed components was the Charlottetown Water System. An IBM Model XT computer was purchased for the central site and Allen-Bradley programmable logic controllers (PLCs) were used at each remote. We designed a microprocessor-based communication processor to provide radio communication and a custom software package for central site control and display of system status. The Millidgeville Treatment Plant was installed at the same time (1983) using Allen-Bradley programmable controllers, and IBM Model XT central computer, and custom software designed by Surfline. Both systems have proven to be very reliable.

In order to produce specialized systems at a more reasonable cost with exceptional communications capability, the Surfline Remote Terminal Unit (RTU) package was developed and has been used on our SCADA systems since 1984.

The majority of recent "standardized" wastewater control and monitoring systems are typical of the Dartmouth City system which uses Surfline proprietary products and has been in successful operation since 1985. The City of Dartmouth system consists of 26 sewage lift stations monitored remotely by UHF radio. There are two IBM computers at separate base stations. One computer is at the City Works Department, and the other is in the City Engineer's Office. There is a remote printer located at the third site, which is also connected to the system by radio. This printer is used to report alarms for periods when the computers are not being monitored.

Each of the remote stations consists of a Surfline 9009 Remote Terminal Unit (9009-RTU) in a weathertight panel. Each RTU monitors 16 status points and six analog values. These stations are scanned for all data once every 30 seconds. The stations are equipped for possible future expansion, and the system can accommodate additional stations.

Each of the two central computers is an IBM personal computer equipped with a colour monitor and printer. Both computers have a 10 MB hard disk for long-term data storage (minimum three years). These computers are equipped with custom software to monitor the system continuously, report any alarms, record data, produce reports, and schedule equipment maintenance.

During 1987, we completed development of the Model 9015 microprocessor-based pump controller for use primarily in water and wastewater pumping stations. This unit provides protection and control of the pumps, and in addition, has complete communication capability for either radio or landline circuits. We can now provide a complete pump or motor control and monitoring unit in a single compact package.

As a supplier of our own complete SCADA packages, we frequently write central station software for IBM PC and compatibles.

Surfline Engineering Limited is located in the Burnside Industrial Park in Dartmouth, Nova Scotia. Our facility houses the engineering development office, drafting department, and electronics lab. Also included in this building is our CSA-approved manufacturing facility, which produces electrical control system packages for municipal and industrial customers.

* * *

Survival Systems International
70 Neptune Crescent
Dartmouth. N.S. B2Y 4M9

Contact: Pat McGlone

Tel: (902) 466-2233
FAX (902) 466 6889
Telex 019 21895

Incorporated in 1982, Survival Systems has never changed its basic concept -- to develop technology and provide services in the interest of public safety.

In 1988 Survival Systems merged with the National Safety Council of Australia Victorian Division (NSCA). The NSCA is a non-government company incorporated in Victoria, Australia, operating as a safety and emergency service throughout Australia and worldwide. The resultant Survival Systems group of companies offers over 70 years of experience and vast resources providing safety services to the community.

The exchange of technology and expertise between the two hemispheres has enhanced our ability to provide clients worldwide with the services they require.

Survival Systems was formed to provide comprehensive contingency programming, safety and survival training to Defence, Coast Guard and offshore oil industry personnel. We have continued to expand our operation and now offer comprehensive training, consultancy and emergency services across the whole safety, search and rescue spectrum.

At Survival Systems, we believe in a total package approach. We have the ability to design and develop packages, including recommended training, safety procedures, equipment and facilities, which can be easily implemented.

Survival Systems is committed to providing the best available services and the lowest possible cost, whilst maintaining the highest professional standards.

TRAINING PROGRAMS

Survival Systems has achieved an international reputation for consistent, high-quality and relevant training programs. Using fully-equipped, modern facilities based in Dartmouth, Nova Scotia (Canada) and Sale, Victoria (Australia), we offer a wide variety of training programs.

- underwater escape
- sea survival
- fire fighting
- search and rescue
- industrial emergency
- occupational health and safety
- management and leadership

Our management and instructors will develop training packages specially designed to meet client needs.

TRAINER TRAINING

Survival Systems can build training programs for trainers. Using our own resources, complete training packages are custom made for use by individual organizations.

Such packages include all the material required to put the program into practice. We can train your trainers in instructional techniques which enable them to deliver the material. Continuing proficiency and currency training is also available.

EMERGENCY SERVICES

A rapid response capability using fixed and rotary wing aircraft, and highly trained pararescue personnel, provides Search and Rescue services in both marine and land emergency situations.

MODULAR EGRESS TRAINING SIMULATOR (METS)

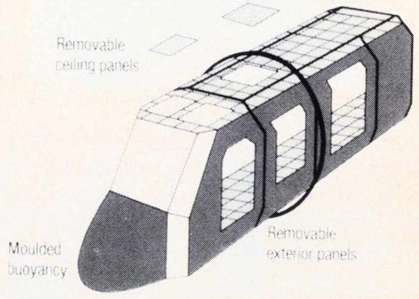
Our Modular Egress Training Simulator (METS) is a new approach to the field of Underwater Escape Training.

Unlike other Egress Trainers, METS is a system that enables the user to customize the Simulator to the specifications that most suit his needs. This is done by attaching tailor-made Modules, and it is these Modules that are the key to the unique design of the METS system.

The METS is simple enough in design and operation that it can be easily relocated from one training location to another. It can be used both indoors (using a pool) and outdoors (pool or dockside).

METS provides training in a realistic environment which enables personnel to receive the maximum training benefit.

* * *



The METS — latest technology in simulation training

Systems Engineering & Automation Ltd.
PO Box 13606, 39 Pippy Place
St. John's, Newfoundland A1B 4G1
Tel. (709) 364-2075
FAX (709) 364-8098
Telex 016-4526 SEA

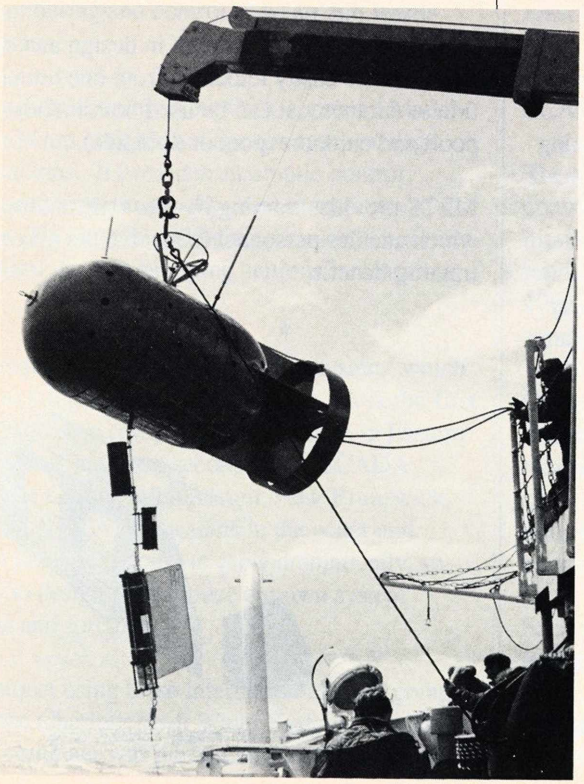
Contact: Jerome P. Byrne

Systems Engineering & Automation (SEA) Limited serves the industrial, commercial and marine/offshore sectors in the field of microprocessor technology. With a highly motivated and dedicated team, SEA designs, develops and manufactures motor control circuits; process control loops; data collection systems; pump control systems; robots; fixed and variable mimic displays; colour graphics for process and digital control; programmable controller (PC) systems; energy management systems; telemetry systems; and computer interfacing equipment.

The systems are of rugged industrial and marine construction using quality manufacturing techniques. They are thoroughly tested and undergo careful quality control inspection.

SEA Limited provides in-house or on-site training for any equipment or systems designed by the company.

* * *



Mooring a current meter array

photo credit BIO

Technical University of Nova Scotia
Aquaculture Technology Unit
1360 Barrington Street
Halifax, N.S. B3J 2X4

Contact: David Roberts

The ATU is an integral part of the Canadian Institute of Fisheries Technology (CIFT) at the Technical University of Nova Scotia (TUNS) and was initiated under the supervision of Dr. Richard Ablett.

The mandate of the ATU is to work with members of the industry in support of the development of technologies and equipment required for aquaculture in Atlantic Canada.

Due to its close association with CIFT and other departments at TUNS and Dalhousie University, the ATU is capable of carrying out technology transfers and research and development projects at several levels and investigating many aspects of an operation, including:
- site evaluations
- aquaculture farm design
- improvements to existing operations
- design and construction of specialized equipment
- processing of aquaculture products
- cold storage analysis

As with any type of research, funding is always a problem. In recognition of the fact that many projects would require financial assistance, the ATU has been instrumental in aligning potential clients with the available funding agencies in Nova Scotia.

Since its establishment in 1986, a range of research projects has been undertaken and completed.

PROJECTS
The second phase of the ATU's work with submersible salmonid cages has been completed and publication of the findings should be out soon in "Aquaculture Engi-

Technical University of Nova Scotia
Canadian Institute of Fisheries Technology
PO Box 1000
Halifax, N.S. B3J 2X4

Contact: Andrew D. Woyewoda

Tel. (902) 429-8300, Ext. 2017

Tel. (902) 429-8300
Telex (TUNS) 019-21566

neering." A condensed version of the study can be found in the proceedings of the 1987 annual meeting of the Aquaculture Association of Canada.

A prototype automatic/demand feeder for marine conditions has also been completed and is now in the process of being updated for long-term testing. The feeder has been designed to cover a variety of feeding regime programs and function reliably in adverse maritime weather conditions.

The ATU has been involved in the design and construction of a plastic-based surface ring cage. The client has since built additional ring cages for rearing salmon. The cages were deployed and exposed to several winter storms, which resulted in extensive damage to traditional wooden cages moored at the same site. To date, maintenance has been negligible for the ring cage. Construction is simple (one day) and lifespan and maintenance are expected to be superior to wooden cage designs. Costs are competitive with wooden cages and significantly less than Norwegian steel systems.

The ATU has been involved in site evaluations for land based salmonid aquaculture in Cape Breton, N.S. Recent work has included design and evaluation of long-term holding systems for American lobsters and establishment of Arctic charr brood stocks in N.S.

The ATU offers an information service for anyone who has technical questions. Often, problems in the aquaculture industry are common to several operations and answers can be beneficial not only to the specific operator but the industry in general.

* * *

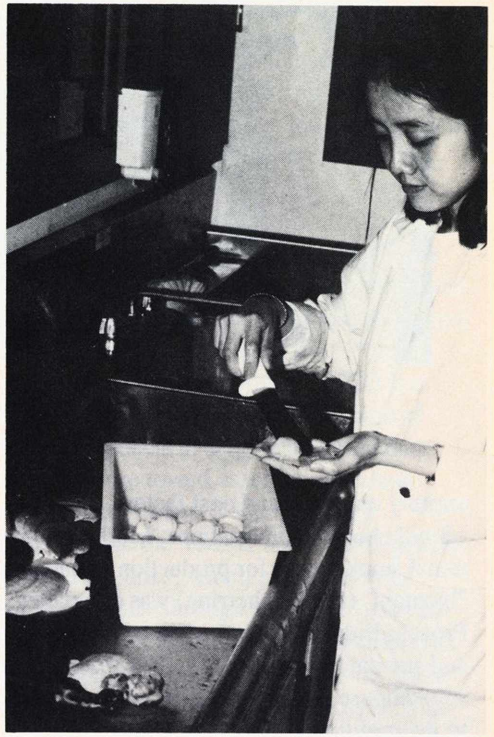
The Canadian Institute of Fisheries Technology (CIFT) of the Technical University of Nova Scotia is a centre of excellence for graduate education and research in fish process engineering and seafood science. Established in 1979 and located in downtown Halifax, this government approved resource centre for advanced technology is affiliated with the Department of Food Science and Technology, which offers degrees at the Master's and Ph.D. levels. The Institute provides R&D services on a cost recovery basis to industry and to various governmental and international agencies. Courses to industry also make up part of the Institute's activities.

Most aspects of seafood processing and food science are addressed by CIFT. Areas of major emphasis include fish and food process engineering and technology, food biochemistry, food rheology, fats and oils, and aquaculture technology. Cooperating with industry and government, the Institute promotes technology transfer and the development of advanced technology to utilize more effectively the seafood resources in Canada and throughout the world.

RELEVANCE TO INDUSTRY

Facilities include a food engineering pilot plant and a computer controlled cold storage area, plus well equipped laboratories for food chemistry, microbiology, food texture, marine oils, microanalyses and sensory panel evaluation. Examples of the focus and milestones achieved by the Institute are:

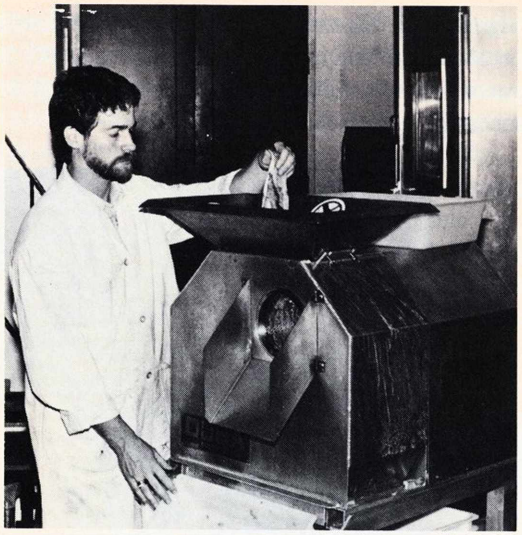
- Drying of salt fish: A major study on moisture diffusion in heavy salted cod during convection drying. The technology was transferred to a Nova Scotia company to increase efficiency of its salt fish drying operation.
- Computer control of retorts for thermal processing: Program logic for computer control of retort sterilization of canned food has been developed at CIFT. The system is now installed in one of Canada's largest canneries.



Assessing process related factors affecting frozen quality of scallop meats

- Shelflife extension of seafood: A number of agents and protocols have been tested by the Process and Product Science group for extension of seafood product shelflife in refrigerated or iced storage.

Adoption of new preservation technologies will depend



Prototype deboner for utilization of small fish in developing countries

entirely on safety and cost factors.
- Smokehouse modifications: Mechanization of a traditional smokehouse for production of hard cured "bloaters" (smoked herring) was completed by the Process Engineering group in order to increase output and standardize quality. Product from this modified smokehouse was an attractive golden colour compared to the traditional dull copper hue.
- Parasite detection: Optimal character and intensity of overhead and candling table lights for visual detection of parasites from cod fillets during in-plant trimming has been determined. A prototype is being developed by a Nova Scotia firm.
- Packaging technology: Various packaging strategies have been applied to preserve frozen quality of seafood products. Benefits of oxygen impermeable packaging for prevention of rancidity have been well demonstrated to industry. This technology is expected to have wide application in the seafood industry.
- Deboner for Thailand: Trials of a small deboning machine have been undertaken successfully in cooperation with the Thailand Department of Fisheries. The deboner, designed for application to the shrimp by-catch, was developed at CIFT in collaboration with a company in Nova Scotia.
- Analytical services: The Institute offers a full range of analytical and sensory seafood quality assessment services on a cost recovery basis.
- Test strip for fish quality: An indicating colour-strip has been developed as a field test for fish freshness.
- Surimi technology: Solutions to technical problems of surimi production using a variety of lower-valued species are being sought. Industry has cooperated in certain phases of the study.
- Marine oils and omega-3: The reputation of CIFT for marine oils research has led to numerous requests from the U.S. for analytical services to determine polyunsaturated fatty acids of the omega-3 family of biomedical interest. Research of this group has also focused on animal feeding trials of fish meals to produce omega-3 enriched meat products.
- Petroleum tainting of seafood: Both fish and shellfish readily absorb undesirable flavours when exposed to petroleum based products. Extensive CIFT studies have demonstrated the vulnerability of mussels, flounder, cod and scallops to tainting.
- Aquaculture: Explosive growth of the aquaculture industry in the Maritime region has been assisted by the design and construction of a polyethylene ring sea cage by CIFT suitable for surface cultivation of Atlantic salmon. The Aquaculture group has also addressed other projects related to design of holding facilities and fish nutrition.

TECHNOLOGY TRANSFER

The Institute, with the support and cooperation of the National Research Council supports an Office of Technology Transfer to serve as a first contact point to CIFT for industry. Members from the Office travel to seafood processing plants in the four Atlantic Provinces to provide a liaison service and encourage industry to take advantage of facilities and human resources of CIFT. The Office transfers information and technology transfer to this sector to overcome short term difficulties and help achieve longer term goals and development. The Office also endeavours to promote commercial application of CIFT developed technologies.

RESEARCH AND ACADEMIC DIVISIONS OF CIFT

- Process and Product Science
- Fisheries Process Engineering
- Marine Lipids
- Seafood Biochemistry
- Seafood Microbiology
- Process Biotechnology
- Product Development
- Technology Transfer

To learn more about programs and projects at CIFT and the Department of Food Science and Technology at the Technical University of Nova Scotia, contact any of the above departments through the central switchboard of the university.

* * *

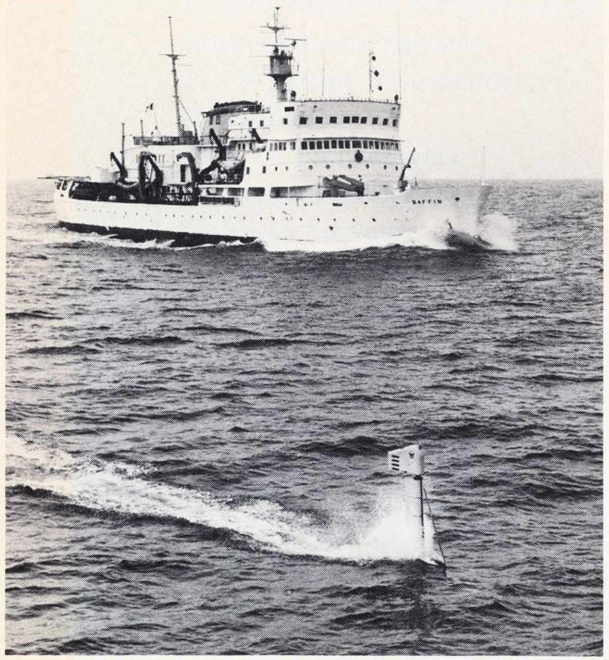
Universal Systems Ltd.
PO Box 3391, Station B
Fredericton, N.B. E3A 5H2

Contact: S.E. Masry

Tel. (506) 458-8533
FAX (506) 459-3849
Telex 760-1184 USLS

Universal Systems Ltd. is a digital mapping company that develops and markets state-of-the-art software systems with extensive applications in computer-assisted mapping and topological database management.

The system marketed under the name of CARIS (Computer Aided Resource Information System) was designed on a base of extensive research in data structures and the management of geographical data. All CARIS hardware consists of unmodified, off-the-shelf components.



The CSS Baffin during sea trials of the "Dolphin" (in foreground)

photo credit BIO

Universal Systems also engages in contract research and development. Under contract with the Canadian Hydrographic Service, the firm has developed an electronic chart system that integrates radar, hydrographic chart data, ship's position, and other related information to provide geographic information. Universal Systems also produces digital maps, charts and plans.

* * *

VEMCO Ltd.
RR 4, Armdale
Halifax Co., N.S. B3L 4J4

Contact: F. Voegeli

VEMCO was formed to produce acoustic telemetry systems to supply marine biologists with the tools for fish tracking and data telemetry. These tools include miniature transmitters which send a series of acoustic pulses to identify an animal or encode data from sensors such as pressure, temperature, swim speed, electromyogram or ECG. Directional hydrophones and ultrasonic receivers are used to locate transmitters and convert the signals to audible pulses; internal telemetry decoders are available to present real time data on a liquid crystal display.

A diver held receiver is also available for transmitter recovery, or relocation of underwater sites marked with transmitters, avoiding the use of surface marker buoys.

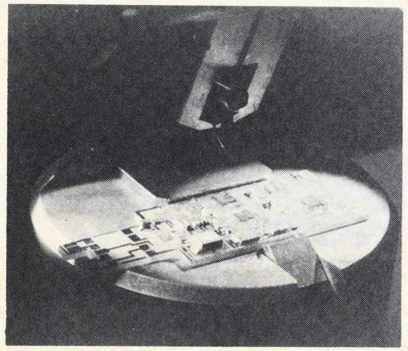
In the nine years since its formation, VEMCO has expanded the product line to include a full range of acoustic telemetry products to acquire and send data from small fish or large towed assemblies such as fishing nets or plankton nets. Recent product announcements include the VM-01 and VM-02 general purpose acoustic data links, which can be used to transmit data acoustically through the water between any two devices that use standard RS-232C serial data ports. A typical application of the data link is telemetry from moored oceanographic instruments such as current meters or or pollution monitors. A number of such instruments can send data acoustically to a single surface buoy, which can be fitted with third party satellite or radio links to shore.

To complement the standard product line VEMCO provides custom design services for projects requiring additional hardware or software.

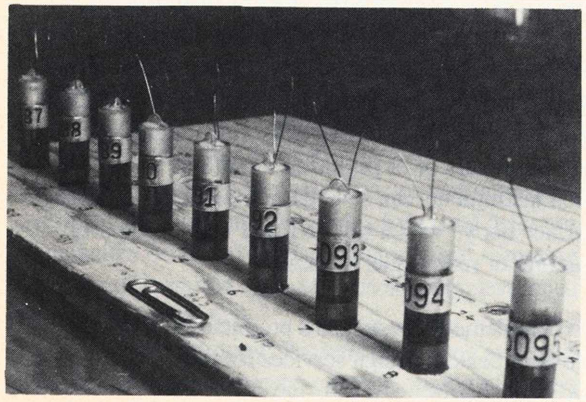
Tel. (902) 852-3047
Telex 019-21828 HFX APPMBC

Sales of VEMCO telemetry systems are typically 50% domestic and 50% export. Major customers are marine biological research groups and oceanographers in universities and government laboratories. VEMCO has sales representatives in West Germany, Japan, Portugal, and Italy.

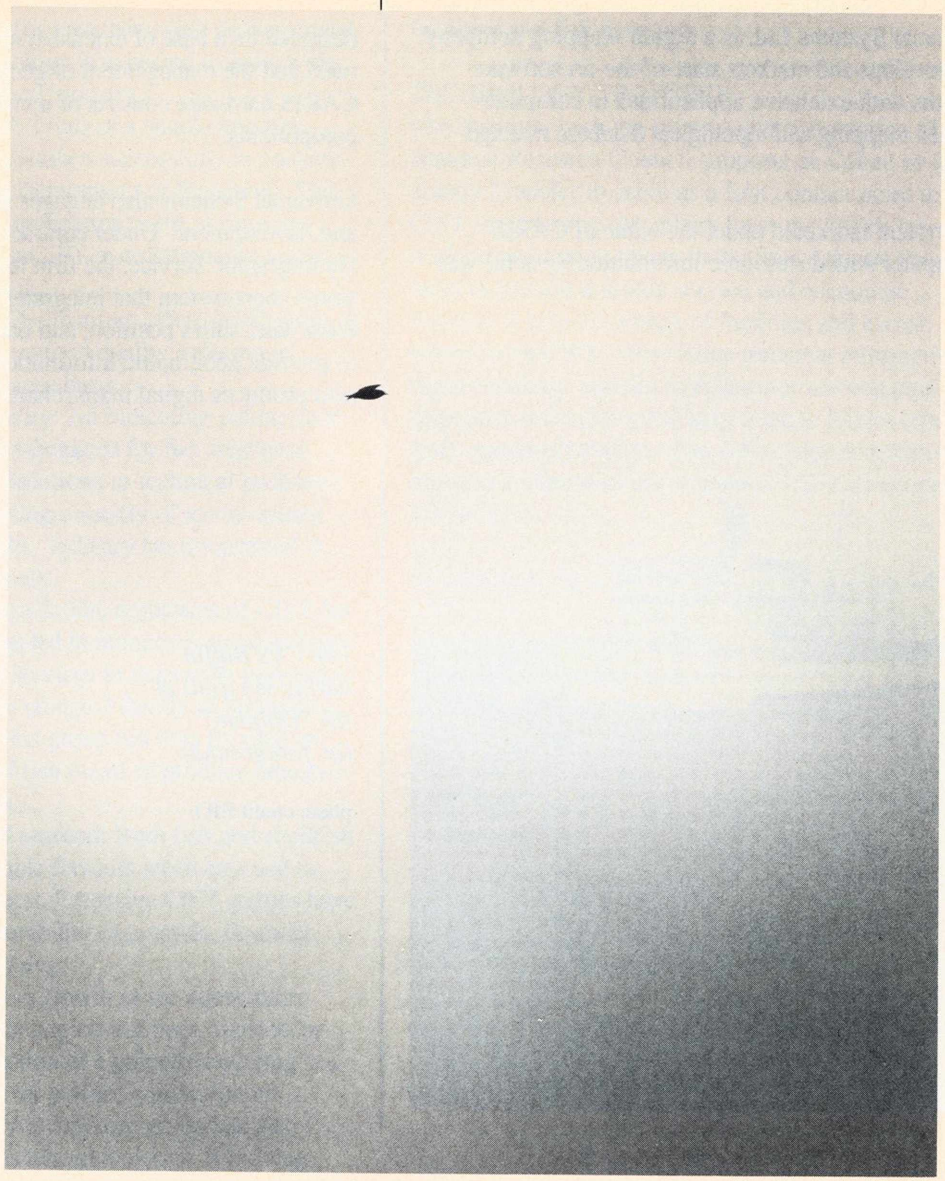
* * *



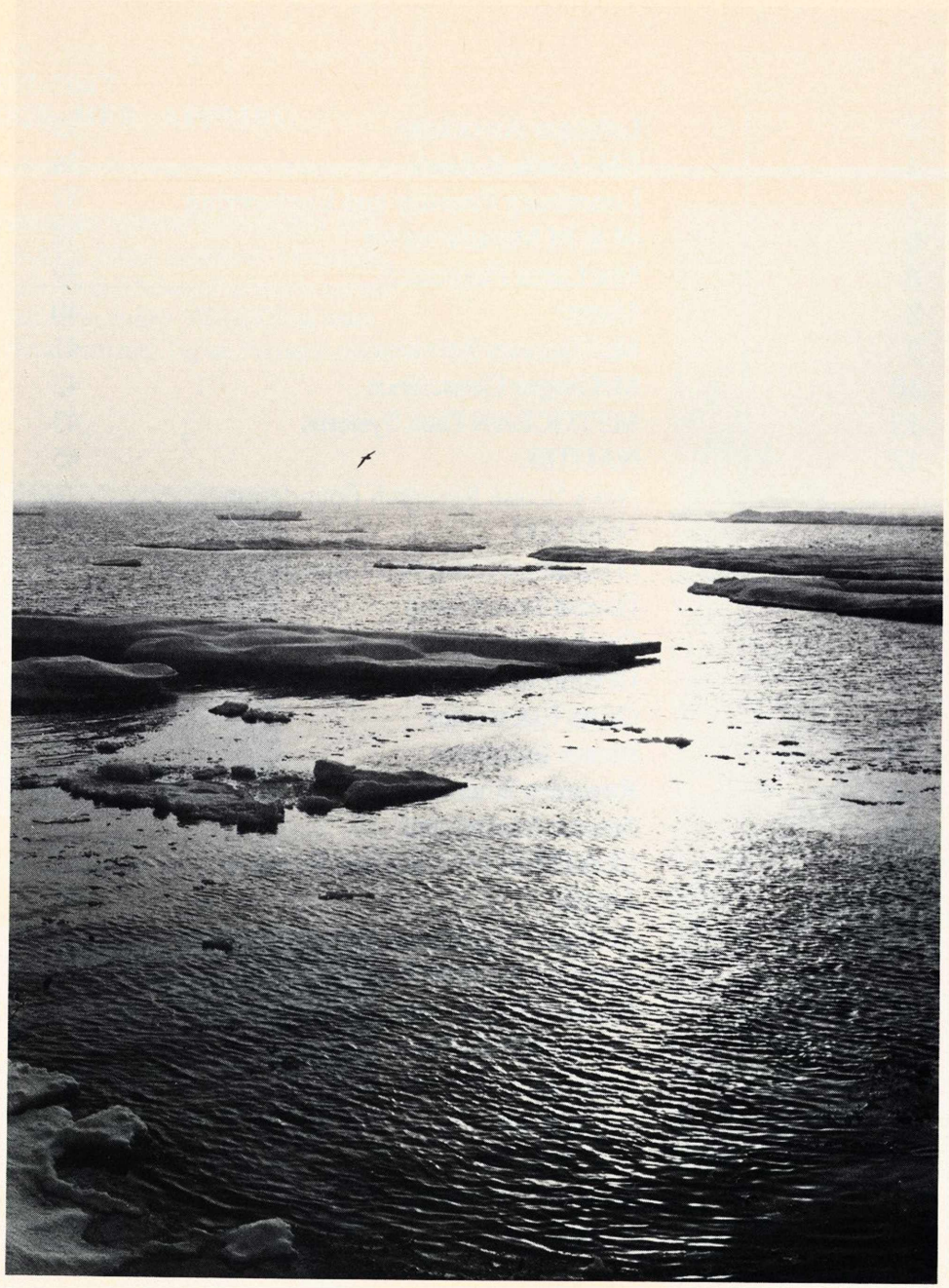
Hybrid circuit board under assembly for transmitter



V2 minature ultrasonic transmitters 8mm diameter



INDEX



The sea never changes and its works, for all the talk of men, are wrapped in mystery.

—Joseph Conrad