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OFFSHORE TECHNOLOGY SPECIAL

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In offshore race:

Teamwork, high technology make Canada strong contender

By H.R. Shaver
Ocean Industries Division
Industry, Trade and Commerce

Canadian off-shore technology, sharpened by the need to find new oil and gas resources in the hostile environment of the Arctic Ocean and the North Atlantic, is winning world attention with the development of undersea exploration techniques that are equally applicable to tropical waters.

The success enjoyed by Canadian companies in this highly competitive and rewarding field has been brought into sharp focus in the past eight or 10 years as more and more countries in the world seek hydrocarbons and minerals at the bottom of the sea.

From the tropical waters off Brazil and Mexico, to the North Sea and the pack ice of the Arctic, Canadian technological developments are being applied to the solution of discovery, development, and production problems in many parts of the world.

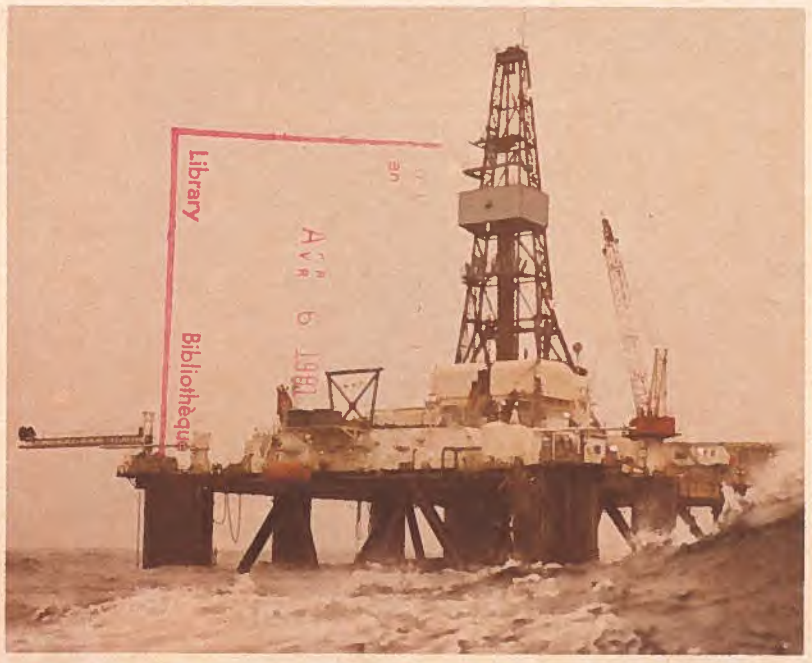
Developing products and services in response to current and forecast demands, Canada is, for instance, currently engaged in such areas as the development of multi-cell hydrostatically-supported offshore structures, subsea completion systems and riser buoyancy systems.

But there is more to this challenging and lucrative field than the strictly commercial aspect: Canada's ocean industry operates in an extensive infrastructure of government and university scientific and operational ocean facilities and services.

The Canadian Hydrographic Service, and the Bedford Institute of Oceanography are widely known and respected as are new institutions, such as the Canada Centre for Inland Waters and the Pacific Institute of Ocean Sciences. Universities, particularly those in the Atlantic Provinces, have strong ocean programs.

In addition, other science-oriented government institutions are launching programs within their overall mandate to form part of the comprehensive Canadian Ocean effort. An example of this is the establishment of The Arctic Vessel and Marine Research Institute (AVMRI).

The Arctic Vessel and Marine Research Institute being built at Memorial University in St. John's, Newfoundland, by the National Research Council will make it possible for engineers and scientists to test equipment on a scale beyond that of any other research facility in the world. It will have the largest ice tank ever built, to test the performance of scale



model ships in ice conditions equal to those encountered in the High Arctic, and another which can produce waves comparable in size with those encountered in the Atlantic Ocean. The facilities of AVMRI are available to industry.

One of the most important characteristics of the ocean industry is international mobility. The products and labour of many countries are invariably required to bring offshore oil fields into production and this is developing a tradition of co-operation worthy of the "common heritage of all mankind" philosophy.

Canadian ocean industry firms have formed a Canadian Ocean Industries Association to pool their resources and work together.

Twenty-one companies have committed themselves to the COIA, and another 10 are seriously considering membership. President of the COIA is John Stirling, president of Fathom Oceanology Ltd., which is based in Toronto.

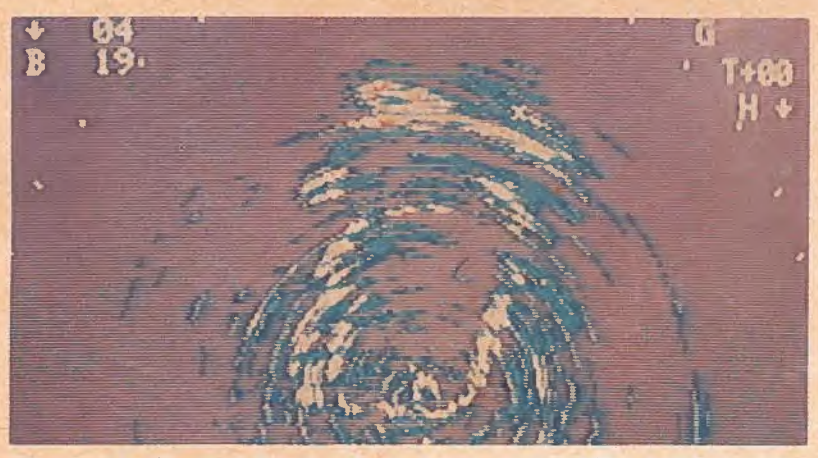
Clearly, technical and operational problems call urgently for solutions. Because of the severity of the Canadian offshore environment, Canadian companies have assumed that their technical challenge would result from deep water, unfavourable climate operations. In a very real way, they have anticipated current requirements and hence find themselves in a position to offer products of superior performance.

Ernest Pallister, chief executive officer of Pallister Resource Management Ltd. of Calgary, chairman of CanOcean Resources Ltd. of Vancouver, and member of the board of Memorial University's Centre for Cold Ocean Resources Engineering (C-CORE) puts it: "When we can operate in ice, everywhere else is a piece of cake."

The statement, indeed, is a valid confirmation of the high-quality service, products and capabilities that Canada can provide the offshore industry!

Canadian government and industry are eager participants in industrial conferences and trade shows such as the Offshore Technology Conference, Houston, Texas.

Omni-directional scanning sonar for simultaneous viewing at all bearings



Part of C-Tech's omni-directional scanning sonar, this DCU-30 Display Control allows for easier and more accurate comparison of the echoes.

C-Tech Ltd. of Cornwall, Ontario, manufactures a line of omni-directional scanning sonar. Its instruments, developed by the application of a patented high-speed electronic scanning process, permit simultaneous viewing of undersea conditions at all bearings, 360° around the mounting platform. This scanning process obtains .625° angular resolution in the horizontal plane.

The company offers three models of Omni Sonar, the LSS-68, CSS-30, and DCU-30 Display Control.

The DCU-30 uses an eight-colour presentation to differentiate between echoes of different intensity. Among other things, this allows for easier and more accurate comparison of the echoes. This can be switched to a grey scale, where 16 shades of grey are used to indicate differences in echo signal intensity.

A 300 mm (12-inch) colour TV tube is used to present a large amount of information. Alpha numeric information about the operating range (continuous 200 to 4,000 m) and operating tilt (+3 to 60 below) is presented at all times. If a particular target echo is of interest, detailed information about that echo can be obtained by touching the relevant part of the display with a light pen. Horizontal distance to the echo source, its vertical depth, and its bearing relative to the ship will be presented. Up to five flashing cursor markings, indicating movement position of a target to the ship, can be placed on the screen with a light pen.

If a displayed frame looks interesting but more information would be useful before making a commitment decision, that frame can be stored in a memory, to be recalled at any time in the future.

A remote monitor can be operated from the control unit. The DCU-30 utilizes new noise removal techniques to further eliminate bothersome ship and sea noise.

CSS-30 Omni Sonar
This instrument, using a C-Tech patented high-speed scanning mechanism, provides simultaneous full-time viewing of the sea at all bearings 360° around the vessel. The CSS-30 is available in frequencies of 36kHz, 33kHz, 30kHz, or 26kHz, with operational ranges of 250, 500, 1,000, 2,000, and 4,000 m. Tilting of the sonar beam from 3 degrees above to 60 degrees below the horizontal is possible through electronic phasing of the elements of the cylindrically-arrayed transducer. The CSS-30 has transmitter power level of 5,000 watts. An optional addition can increase its transmitter power to 10,000 watts.

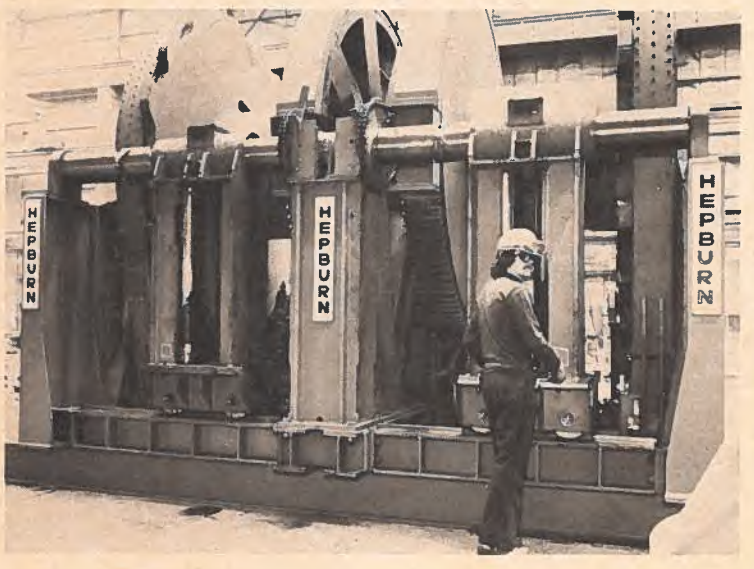
LSS-68 Omni Sonar
The LSS-68 permits simultaneous viewing of a 200-degree sector of the sea around the boat. It is possible to rotate the multi-element transducer up to 175 degrees in either direction, in order to obtain full 360-degree coverage. The transducer is mechanically tiltable to a full 90 degrees. Operating at 74kHz, the LSS-68 Omni Sonar has operating ranges of 125, 250, 500, 1,000 and 2,000 m. Video information is presented on a 25.4 cm (10-inch) CRT and audio through a horn type speaker.

Company contact: **Gordon Peters, Marketing Manager, C-Tech Ltd.**, 1150 Montreal Road, Cornwall, Ontario, Canada K6H 5S2. Tel. (613) 933-7970; Telex: 05-811538.

Canada at OTC '81

The following Canadian companies are exhibiting in Canada's National Stand:

Arctec Canada Ltd.; Bel-Aire Shipyards Ltd.; CANFLEX Manufacturing Inc.; Fathom Oceanology Ltd.; Gearmatic Company Ltd.; Greening Donald Ltd.; Guildline Instruments; Halifax Industries; John T. Hepburn Ltd.; Huntec ('70) Ltd.; International Submarine Engineering; Marinav Corporation; Marine Industries Ltd.; Mesatech Systems Ltd.; Lavalin Services Inc.; Mustang Inc.; Nordco; Okanagan Helicopters; Rolls Royce Can. Ltd.; Saint John Shipbuilding & Drydock Co. Ltd.; Stelco; Varian Associates of Canada Ltd.; Vickers Stanwick Systems Inc.; Tri Ocean Engineering Ltd.; Bristan Aerospace; Canadian Marconi Company; Ice Engineering Ltd.; Allandy Consulting Ltd.; Hawker Siddeley Canada Inc.; Dreco Ltd. **(Stand Numbers 1211 and 1291)**



Bedford Institute: Its field is oceanography!

The Bedford Institute of Oceanography, located in Halifax harbour's Bedford Basin, houses components of three federal government departments — the Department of Fisheries and Oceans, the Department of Energy, Mines and Resources, and the Department of the Environment. **Its principal functions are:**

Charting the navigable waters of Eastern Canada;

Conducting long-term (strategic) research in ocean science to satisfy future regional and national needs; and

Performance of short-term applied studies to meet current regional and national needs.

Eastern Arctic and Altantic waterways off Canada's coasts are the principal working areas for the five distinctive white-hulled ships of the BIO fleet, but many have ventured further afield. One institute vessel, the **CSS Hudson**, for example, became the first ship ever to circumnavigate the Americas during the famous Hudson '70 Expedition.

The Bedford Institute was established in 1962 as Canada's first federal research centre devoted to the field of oceanography. Investigations in this field had previously been carried out by small groups and individuals, generally with insufficient resources to undertake major oceanic research. Establishment of the institute brought together in one location the major scientists, hydrographic surveyors, technical and support staff, ships and other facilities needed to carry out large-scale ocean science programs.

Atlantic Oceanographic Laboratory

The Department of Fisheries and Oceans operates the Atlantic Oceanography Laboratory, the Marine Ecology Laboratory, the Atlantic Region, Canadian Hydrographic Service and the Marine Fish Division.

Programs of this unit focus on physical and chemical oceanography. Studies are oriented toward solving problems relating to marine fisheries and in gauging the impact of oil/gas exploration and shoreline activities on the marine environment of the Atlantic and Eastern Arctic.

Much attention is devoted to the continental shelf, investigating large-scale changes in currents and temperatures caused by variations in climate and river run-off. The laboratory investigates short-term problems affecting bays and harbours, provides wave information for the North Atlantic, monitors bottom temperatures in support of fisheries research, and coordinates the scientific assessment of ocean-dumping permit applications.

It responds to marine emergencies by providing information on movement of oil from a spill.

In the field of chemical oceanology, the lab investigates chemical processes in sea water and the pathways of pollutants in the ocean. The work includes continuing studies of the occurrence and behaviour of trace metals such as iron and mercury in the waters and sediments of the Gulf of St. Lawrence. A major effort has been made in the Arctic to determine the background levels of petroleum residues, PCBs, and DDT.

Techniques for measuring gas exchange between atmosphere and ocean have been developed and applied. A program to assess the marine environmental changes resulting from the operation of coastal nuclear power plants is underway.

Marine Ecology Laboratory

This laboratory is responsible for undertaking ecological research in support of the management of renewable resources, specifically the commercial fisheries. To be successful, such management requires an understanding of how the biological system works at each step in the production process.

Since the food chain in the ocean is dependent upon microscopic unicellular plants (the phytoplankton), a substantial part of the program is concerned with the production and growth of phytoplankton populations. Corresponding research is concerned with zooplankton, the next step in the food chain. At higher levels, the emphasis is on factors affecting the survival of larval fish, the response of fish populations to changes in their physical environment over a period of years, and the productivity of multispecies fisheries and their management.

One of the main objectives being to study the long-term effects of pollutants on the general health and productivity of marine ecosystems. Currently, the main emphasis is on petroleum hydrocarbons.

The other major part of the work of this laboratory is concerned with environmental quality, one of the main objectives being to study the long-term effects of pollutants on the general health and productivity of marine ecosystems. Currently, the main emphasis is on petroleum hydrocarbons and organochlorine compounds such as PCBs and DDT. The environmental consequences of tidal power in the Bay of Fundy are also being studied.

Canadian Hydrographic Service

Along the Atlantic coast there are some 75 ports and more than 1,200 small craft harbours. These have many thousands of vessel arrivals and departures each year. Thus the accurate charting of the adjacent waters is essential to the safe, orderly, and efficient conduct of shipping, particularly since federal regulations require all vessels to carry the latest editions of Canadian charts in Canadian waters.

It is the responsibility of the Hydrographic Service to chart these waters, as well as adjacent international waters and eastern Arctic waters. Depth measurements and other data required are collected during special cruises by BIO vessels. These data are then compiled into new nautical charts (or are used in the updating of existing charts) by cartographers working at the Institute. There are many years of work ahead before all areas are charted to modern standards. For example, there are still substantial areas where charts are based on the lead-line surveys of more than a century ago.

Marine Fish Division

This unit is an integral part of the DFO fisheries management organization, Maritimes Region. Its research is directed at the population dynamics of fish stocks, assessing the effect of fishing, and predicting the response of stocks to regulatory measure. The area covered includes the southern Gulf of St. Lawrence, Scotian Shelf, Bay of Fundy, and Georges Bank.

The division is responsible for managing a long-term monitoring program begun in 1977 to improve understanding of the mechanisms that regulate larval fish distribution, growth, and mortality. Known as the Scotian Shelf Ichthyoplankton Program, it involves frequent cruises by the research vessel Lady Hammond. Other work includes the development of theoretical models for use in the assessment of fish stocks.

Atlantic Geoscience Centre

This laboratory, serving the Department of Energy, Mines and Resources, has the broad role of providing advice and information about the earth beneath the oceans that surround Canada's coastlines. Hence its programs are directed toward description of the offshore region and the understanding of the geological processes, as they operated in the past and as they operate now. This is achieved by constructing surveys and experiments in various parts of the vast region that extends from the northwest Atlantic Ocean to the North Pole.

Investigations are undertaken of the sedimentary basins of eastern Canada and the eastern Arctic, both onshore and offshore. The results are used in the assessment of oil, gas, and coal resources and in the inventory of rocks. Marine geologists, geophysicists, and palaeontologists combine their efforts in this work, which makes considerable use of the geological samples from offshore wells.

The continental margins and adjacent ocean basins are mapped in terms of their geology and various geophysical characteristics. This is achieved through regional surveys conducted by the Centre. Interpretation of the survey data often leads to questions that can be answered only by conducting specific experiments and new technological developments are continually being sought to improve the efficiency of surveys and increase the range of observations that can be made.

Research into marine geological processes, such as sediment movement and iceberg scour, constitutes an important part of the Centre's program. These processes are investigated to assist in solving practical problems pertaining to oil spills in coastal regions, tidal power projects, wellheads on the ocean floor, etc. A great deal of work also goes on in the development of the sophisticated instruments required in this research.

Resource Management Branch

The Maritimes Office of the Resource Management Branch is also located at the Institute. It exercises regulatory control over offshore hydrocarbon exploration, drilling, and production activities off the east coast, to ensure compliance with the Oil and Gas Production and Conservation Act. The region of concern covers the Scotian Shelf, the Gulf of St. Lawrence, Hudson Bay and Hudson Strait. The office acts as the curator of information generated by the drilling operations, including geological samples which are of considerable scientific value.

Seabird Research Unit

The reproductive and pelagic ecology of seabirds are the main subjects of research carried out by this unit of the Department of the Environment. To date, the emphasis has been in the eastern Arctic and the Atlantic provinces, where the objective has been to develop an information base that will provide estimates and predictions of the impact of offshore oil and gas development on the seabird population.

Inquiries should be addressed to: **John Hall, Communications Branch, Department of Fisheries and Oceans**, 7th Floor, 240 Sparks Street, Ottawa, Ontario, Canada K1A 0H5, Tel. (613) 995-2075.

Wearing Mustang survival clothing made mandatory for many offshore operations

Mandatory wear in many of Canada's offshore operations, Mustang Sportswear Ltd.'s floater coats, cold water survival coats and suits and Anti-Exposure Coveralls have received numerous certifications. Most are approved by Canada's Department of Transport and the United States Coast Guard.

Mustang Sportswear Inc. of Richmond, British Columbia, has extended its range of activities from providing well-designed sports jackets that will also keep the wearer afloat in the event of a mishap to the production of industrial garments, used particularly by seamen, offshore oil workers, and all others whose work exposes them to the hazards of accidents in frigid waters.

The Mustang anti-exposure coverall is a thermally-protective industrial garment that offers maximum flotation capability without restricting movement. Closed-cell foam insulation protects the wearer against the otherwise rapid loss of body heat in cold water (hypothermia) and significantly increases survival time.

Other popular Mustang products providing both hypothermia protection and flotation are the U Vic Thermofloat cold water survival coat, the Admiral Floater Coat and the Standard Floater Coat.

All these Mustang garments have been approved by the U.S. Coast Guard and Canada's Department of Transport (Marine), as well as by kindred overseas regulatory agencies.

During the past four years, Mustang Floater products have been used by increasing numbers of workers in the offshore petroleum and transportation industries. Companies involved in helicopter personnel transfer to offshore platforms in the Beaufort Sea have made it mandatory that all in-transit personnel wear either a Mustang anti-exposure coverall or a Thermofloat jacket.

In developing its protective equipment, Mustang has worked closely with cold water researchers at the University of Victoria to ascertain performance requirements of thermally-protective industrial flotation clothing.

As a result of these efforts, the company's specifications and techniques have been refined and improved to the point where its garments are known to industry and government agencies around the world. The company is now developing what can be accurately described as a state-of-the-art survival suit.

The widespread acceptance of its equipment by the offshore oil industry has demonstrated that Mustang Sportswear Inc. is a committed and valuable contributor to Canada's offshore technology export market.

Interested parties should contact: **Dwight J. Davies, Vice President, Mustang Sportswear Inc.**, 540 Beatty Street, Vancouver, British Columbia, Canada V6B 2L3. Tel. (604) 688-3596; Telex: 04-55147; Cable: FLOATER.

Regular vessels to drill rigs

No task too tough for shipbuilding, repair company

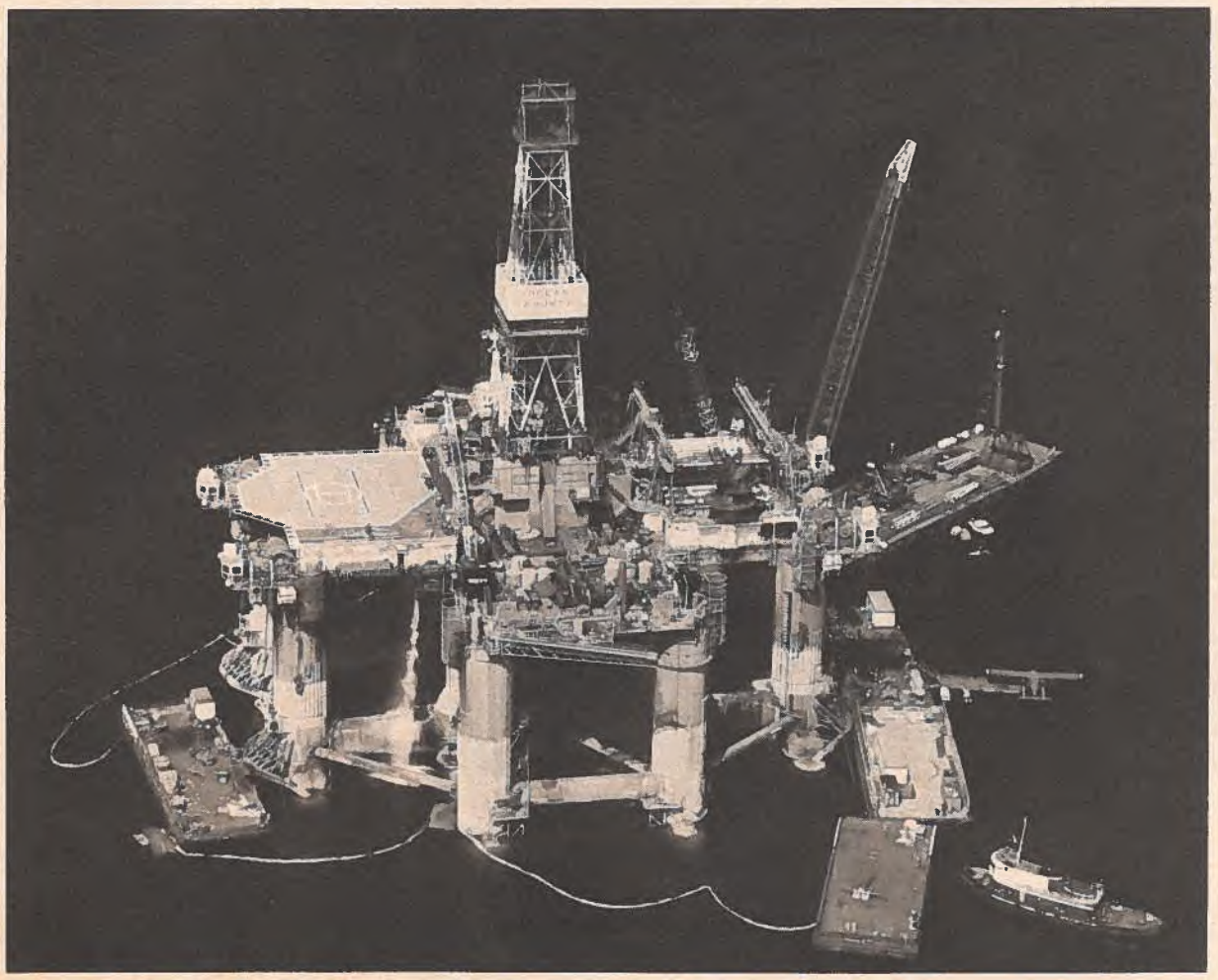
Vancouver Shipyards Co. Ltd., a Genstar Company established at the turn of the century, is a modern shipbuilding and repair yard, located in Vancouver, British Columbia, Canada's gateway to the Pacific.

Its modern facilities for new construction include a level shipbuilding berth and side launchway — large enough to permit the simultaneous construction of two vessels 160 metres (525 feet) long and 30 metres (98 feet) beam. The company's "Syncrolift" all-tide marine elevator can accommodate vessels of up to 90 metres (295 feet) in length, 21 metres (69 feet) beam and 1,500 tonnes displacement.

In addition to repairs, overhauls, and conversions, Vancouver Shipyards builds all types of vessels up to 15,000 DWT, including jack-up and semi-submersible drill rigs, drill ships, working platforms, supply vessels, tugs, ferries, fishing vessels, and all types of barges and cargo vessels.

The company also carries out voyage repairs to deep-sea vessels while at their loading births or anchorage, or even on the run. It is the official repair representative on the Canadian West Coast for Sulzer and M.A.N. engines.

Vessels that cannot be accommodated on the Syncrolift are dry-docked in the Government Graving Dock in Esquimault, which, with its impressive dimensions of 358 m x 41 m (1,173 feet x 135 feet) is large enough to accommodate most of the ships in the Pacific trade.



Noted for its dependable, efficient work and its ability to always meet delivery deadlines, Vancouver Shipyards Co. Ltd. is shown carrying out extensive repairs and modifications to the semi-submersible drill rig "Ocean Bounty."

Vancouver Shipyards company is constantly carrying out repairs and scheduled maintenance on tugs, barges, fishing vessels, ferries, naval vessels, government vessels and yachts. The company employs specialists from all branches of the marine trades to enable quick turnaround time on repairs, overhauls and conversions, and to ensure that delivery deadlines are met on all types of new construction. It also has a capable and efficient engineering and drafting staff.

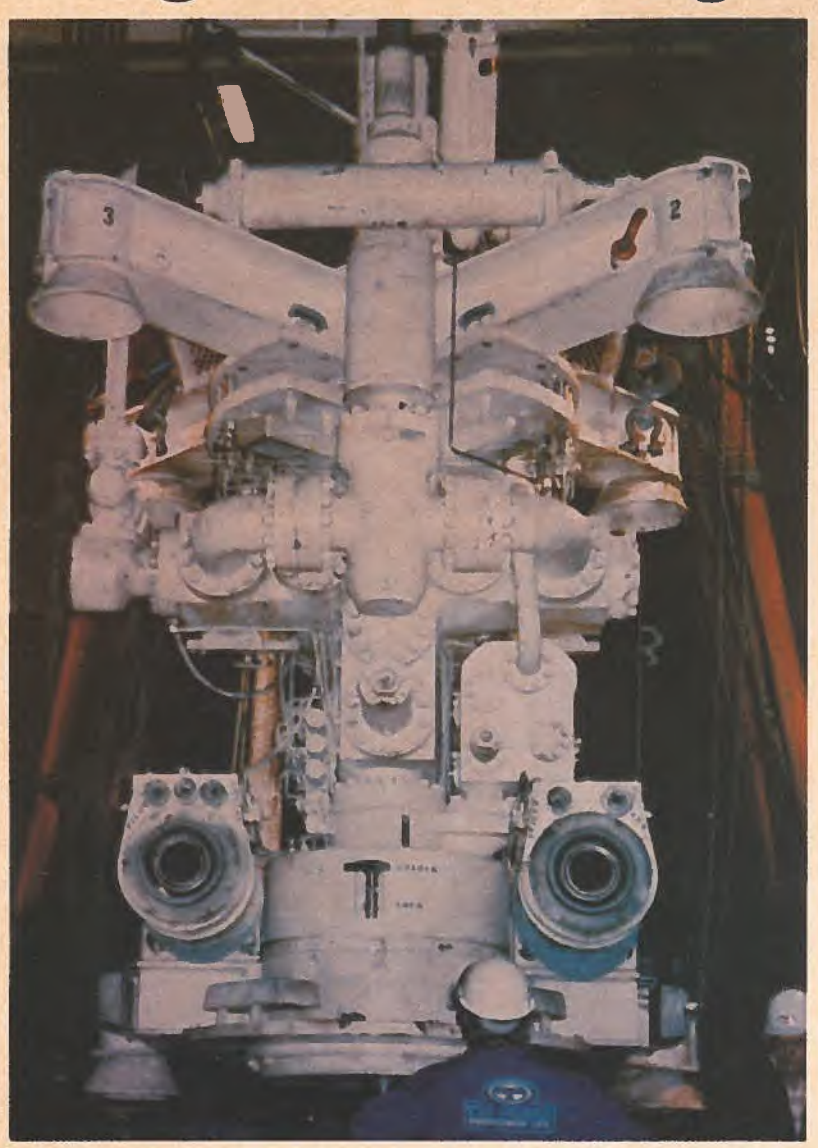
As an example of its ingenuity in solving repair problems, the company was called on to carry out extensive winch repairs and modifications to the semi-submersible drill rig **Ocean Ranger**. As the vessel was too high to pass under the Lions Gate Bridge, it was directed to Port Alberni on the West Coast of Vancouver Island. Vancouver Shipyards sent its work crew to Port Alberni and the job was done there, right on schedule.

Another ship, the **Ocean Bounty**, also underwent extensive repairs and modifications at Nanoose Bay on Vancouver Island. Due to the short period of time (21 days) allowed before the ship had to sail for Las Palmas in the Canary Islands, Vancouver Shipyards decided to have its repair team sail with the ship and make its repairs en route. The original plan called for one crew to work until the ship reached Valparaiso, Chile, where another crew would be on hand to take over for the rest of the voyage. The team worked so effectively, however, that all the repairs had been completed by the time the ship arrived in Valparaiso.

As V. Gadsby, vice-president, marketing and technical services, put it: "Another job expeditiously carried out by Vancouver Shipyards Co. Ltd."

Correspondence should be addressed to **Mr. V. Gadsby, Vice President, Marketing and Technical Services, Vancouver Shipyards Co. Ltd.,** 50 Pemberton Avenue, North Vancouver, British Columbia, Canada V7P 2R2. Tel. (604) 988-6361; Telex: 04-352740; Cable: Vanship.

Designed for drilling



Subsea tree designed by Tri Ocean for use on first subsea completion under Arctic ice pack. Tri Ocean is engaged internationally in the design and project management of offshore platform drilling packages and arctic drilling and subsea completion projects.

Tri Ocean Engineering Ltd., a Calgary-based engineering company, has competed successfully in international trade markets for the past five years, in the course of which it has obtained major contracts for the design and project management of offshore platform drilling packages and arctic drilling and subsea completion projects.

The company was established in 1976 as an employee-owned fully Canadian company. Prior to its incorporation, its engineer shareholders worked together with a major oil company and an international drilling contractor. Since then, Tri Ocean has been engaged in projects in Canada, the United States, Britain, Norway, the Netherlands, Greece, Gabon, Australia, Vietnam, Singapore, and Japan.

Its most recent contract was the award of the complete detailed engineering design of a self-contained platform drilling rig for the North Rankin 'A' platform being developed for Woodside Petroleum Development Pty. Ltd. for use on the North West Australian Shelf. Installation is scheduled for late 1982.

Other contracts which have been awarded to Tri Ocean, despite strong international competition, include the complete design, on-site engineering supervision, offshore hook-up and commissioning of the drilling modules for the Mobil Statfjord 'B' 42-well drilling and production platform. This platform is to be installed in the Norwegian sector of the North Sea this year, at a total estimated project cost of approximately $2.2 billion.

Other North Sea platform rig projects which have been handled by Tri Ocean include the Cormorant 'A' platform drilling packages and the Shell Brent 'D' platform drilling package for Shell/Exxon. Both projects encompassed the complete structural, mechanical and electrical design, as well as on-site engineering, offshore hook-up and project commissioning. The Cormorant 'A' platform project also included the complete project management, procurement and contract administration for Shell/Exxon.

Arctic Experience

Since 1973, company engineers have worked with Panarctic Oils Ltd. to develop the offshore ice platform drilling concept for which Tri Ocean modified existing land-drilling rigs for use offshore and designed a unique subsea blowout preventer and riser system. Tri Ocean evolved the concept to the point where the Drake F-76 well was drilled, completed and flowed to shore to test the feasibility of offshore Arctic Island production under the ice.

The Cormorant 'A' North Sea platform, with drilling modules by Tri Ocean Engineering Ltd.

For this 1978 project, Tri Ocean was responsible for the design of the aircraft-transportable 3,048 m (10,000-foot) capacity drilling rig capable of drilling onshore or offshore, the specially designed subsea blowout preventer system, the hydraulically-controlled subsea production tree and an onshore gas-testing plant used for extended testing of the production concept.

Tri Ocean personnel have also been involved in the engineering and operation of other offshore exploration programs in the Arctic.

Wide Experience

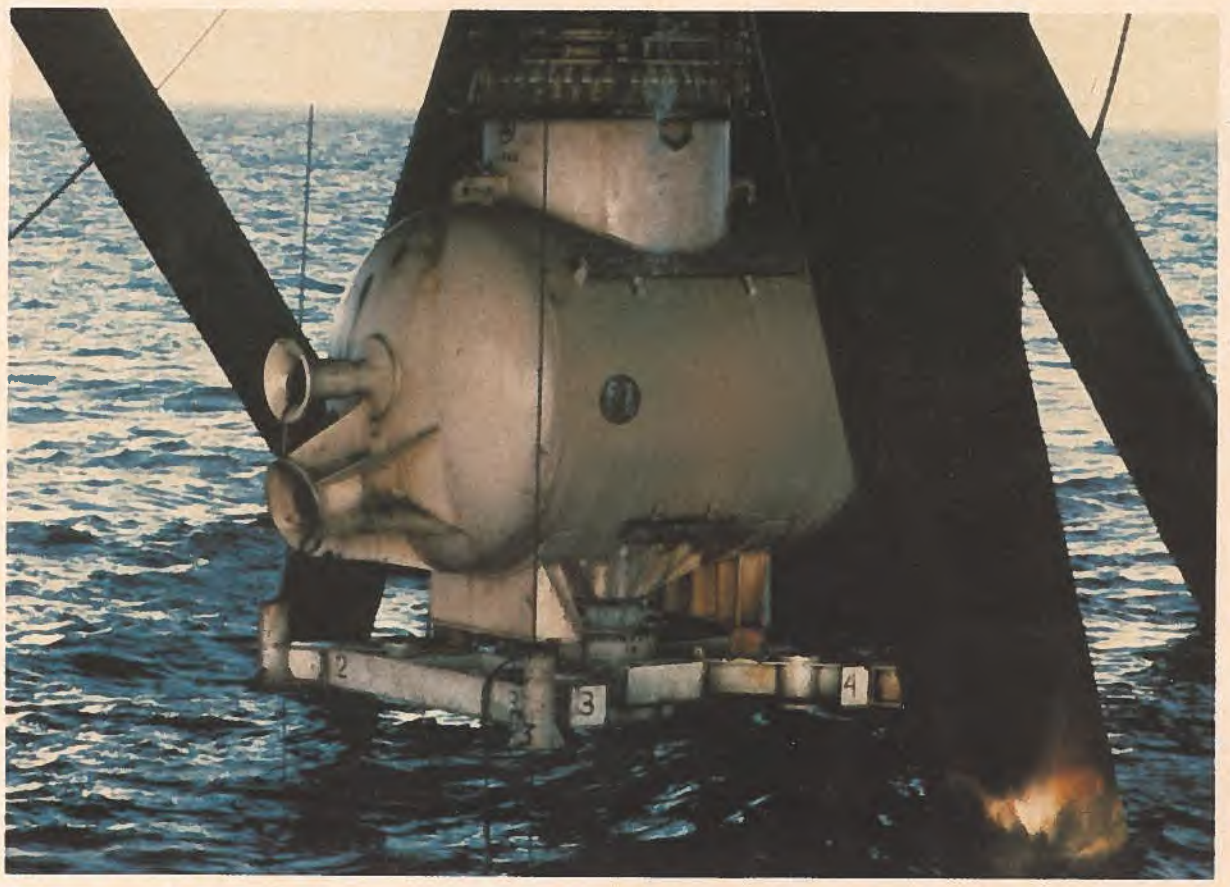
For the past several years, the company has provided engineering and project management services for various onshore and offshore projects, including project responsibility for the drilling of two offshore wells in the South China Sea. Tri Ocean has provided engineering for various production development and product-handling studies for Canada's east coast and the North Sea, logistical support studies for North Sea production platform complexes, and on-site engineering support for offshore drilling operations in the Arctic, on both coasts of Canada, in the Gulf of Mexico and the West Coast of the United States.

Tri Ocean personnel have also been responsible for the design of platform jackets and topside production facilities for Nova Scotia and the Gulf of Mexico. In addition it has designed and assumed project management of pipeline gathering systems, production handling and separating facilities, and large waterflood and gas compression plants in Alberta, in addition to the design and construction supervision of several land drilling rigs of various sizes.

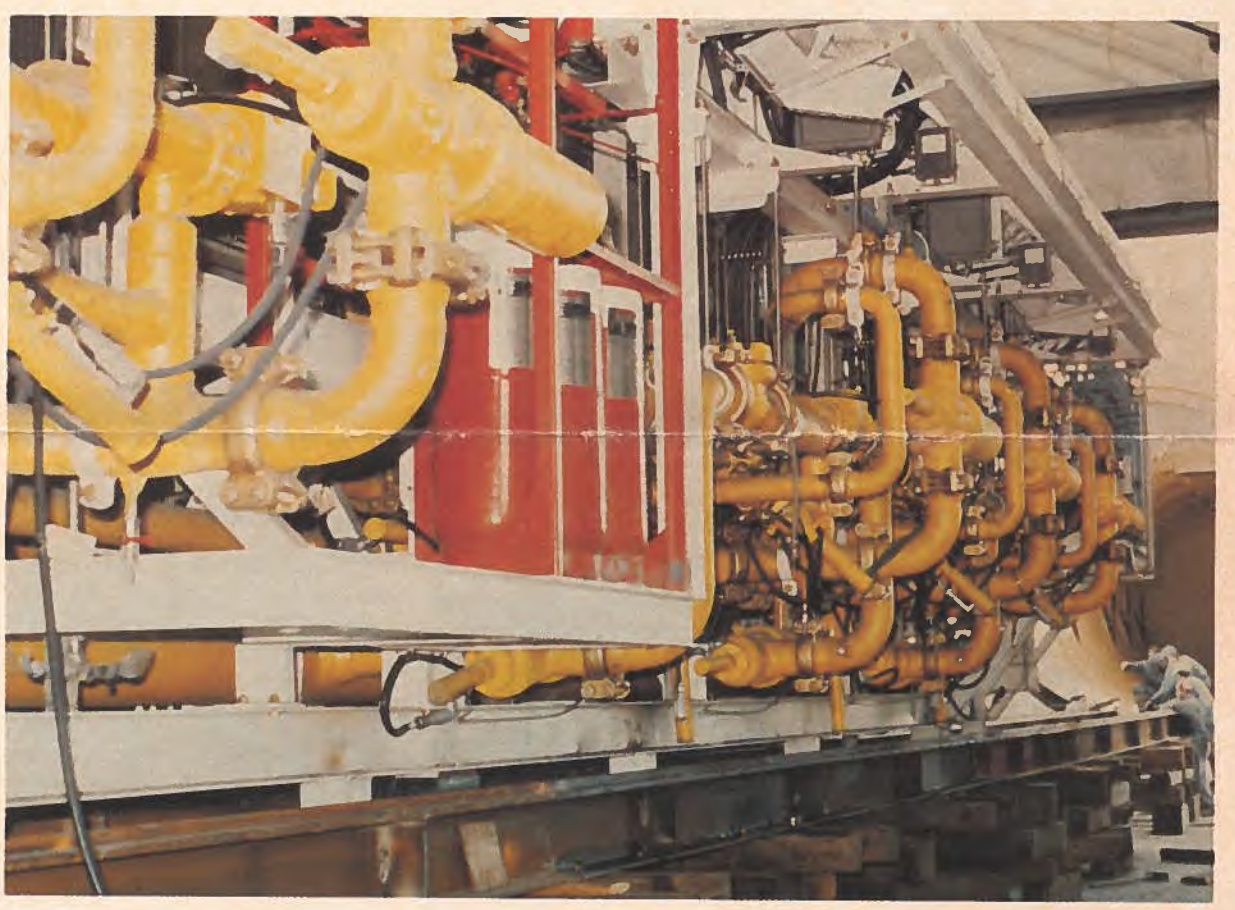
In summary, Tri Ocean has in-house expertise in varied offshore and onshore drilling and production areas. It is unique in Canada, in that it provides — within one group — a high level of technical competence and experience in both the engineering/project management and operational phases of offshore development.

Inquiries should be forwarded to: **Ray A. McBeth, P. Eng., Senior Project Engineer, Tri Ocean Engineering Ltd.,** 500-808 Fourth Avenue S.W., Calgary, Alberta, Canada T2P 0K4. Tel. (403) 264-7320; Telex: 03-822798.

CanOcean Resources Ltd. well ahead



CanOcean wellhead cellar being run to subsea wellhead from deck of rig. The company has installed wellhead cellars off the coast of Brazil and in the Gulf of Mexico. Once an exclusively "dry" company, CanOcean has expanded its range of products to include "wet/dry" and totally "wet" systems.



Manifold centre internal piping configuration prior to insertion into pressure hull. CanOcean's manufacturing plant is an ASME-U2 certified pressure vessel shop, fully equipped to produce diving bells and subsea chambers, decompression chambers, refinery and other specialty pressure vessels.

CanOcean Resources Ltd. (formerly Lockheed Petroleum Services Ltd.) of New Westminster, British Columbia, is a leading world developer and vendor of undersea oil-well production and maintenance technology, with installations in the Gulf of Mexico, the North Sea and offshore Brazil.

Among its achievements, CanOcean designed and constructed the first wellhead cellar and the largest subsea manifold centre, has carried out the deepest subsea well completions, and executed the first one-atmosphere pipeline tie-in.

In the North Sea, the company applied its special techniques to welding production pipelines at 159 m (520 feet) water depth and in the Gulf of Mexico it developed its manifold system of gathering production from a number of small sub-sea wells into a larger control reservoir, from which the oil is pumped to the surface.

It is now developing new technology to permit the application of its skills in places like the Beaufort Sea, the Arctic islands and the Labrador Strait. To this end, the company has recently completed the first stage of its study of production problems in such remote, hostile and ice-infested environments. Its conclusions are that production is feasible under such conditions, but development costs will be 10 to 15 times as high as those for an average land-based well.

"Each of these northern areas presents its own problems," says Michael Apostolidis, senior vice-president and general manager of CanOcean Resources, "and each requires its own set of solutions."

There are icebergs off the coast of Newfoundland, he explained by way of example, while the Beaufort and the Arctic islands have winter ice cover and a summer breakup, with shore-fast ice and ice floes. All three areas pose quite different problems.

It is possible, Mr. Apostolidis says, to build wellhead and delivery systems to withstand such a marine environment — the so-called wet systems — but they are difficult to maintain. CanOcean's specialty is building enclosed systems that allow service in a shirt-sleeve atmosphere by technicians introduced from its special mating diving bell.

More than half of CanOcean's staff are highly experienced engineers, with years of background in such diverse fields as naval architecture, drilling, production, processing, pipeline design, LNG processing, and a wide variety of other disciplines. The company also draws on the services of geologists, geophysicists, reservoir engineers, and other specialists through its corporate associations.

Engineering design has been the company's primary strength, resulting in a unique technology applicable to a wide variety of offshore and subsea developments. Its head office plant is an ASME-U2 certified pressure vessel shop, fully equipped to produce diving bells and subsea chambers, decompression chambers, and refinery pressure vessels, and is certified to weld HY80 and HY100 steels and other high-strength materials.

Correspondence should be addressed to: **Maureen Purnell, Communications Co-ordinator, CanOcean Resources Ltd.**, 610 Derwent Way, New Westminster, British Columbia, Canada, V3M 5P8. Tel. (604) 524-4451; Telex: 04-351372; Cable: (CANOCEAN NWR).

Hydrostatically-supported sand islands prove efficient structures

Sandisle Structures Limited, of Islington, Ontario, leads the way in offshore construction of hydrostatically-supported submerged sand structures. A revolutionary alternative to conventional jacket and concrete structures, the company's "sand islands" are less expensive to build and take less time to construct.

The structure is formed by hydraulically placing sand fill inside an impervious rubber wall, similar in texture to conveyor belt material, while extracting water from the placed sand through a system of internal drains to prevent the build-up of pore-water pressure.

The whole concept of the invention is based on the theory that the natural hydrostatic pressure of the surrounding water confines the sand to the point where its internal shear strength is almost equal to that of concrete.

Moreover, sand is one of earth's most plentiful commodities and, when used in this way, will always remain stable and can, in fact, support loads equal to about three-quarters of its own weight. Prefabricated floating units can be sunk onto such structures to create islands, breakwaters, or above-water temporary or permanent working areas.

Offshore structures in Arctic waters must be designed to resist iceberg impact and/or ice floe pressure. The immediate advantage of a sand island is that it has the engineering properties of large mass and, when stopping an iceberg, has the ability to deform without breaking, thereby reducing the impact forces.

Such deformation of the sand mass can be accommodated without damage to the outer rubber wall because strength is combined with flexibility.

The successful performance of a prototype constructed in 15 metres (50 feet) of water in Christchurch Bay off the south coast of Britain has aroused solid interest in marine communities around the world.

Sandisle Structures engineers are continuing to develop a variety of applications of the system, including offshore mining or ventilating shafts, lighthouse foundations, offshore power stations, sites for industrial activities, and embankments. It is believed that sand islands can be constructed ultimately to 200 metres (656 feet).

Company contact is: **Victor Milligan, Sandisle Structures Ltd.**, 6th Floor, 170 Attwell Drive, Rexdale, Ontario, Canada M9B 6C7. Tel (416) 675-7341.

Satellite-assisted navigational aid successfully positions ships at sea

Canadian Marconi Company's CMA-751 transit satellite doppler receiver enables ships to calculate their positions at sea by signals received from any of six operational satellites now in orbit around the North Pole. The instrument measures the Doppler shift of the passing satellite to determine its position to within 30 metres RMS, or, if the ship is under way, integrates the ship's speed and heading data with the satellite reading to determine its current position. The error for such a reading is 0.2 nautical mile for each knot of ship velocity. The CMA-751 will provide continuous real time shipboard navigation, automatically processing data from the ship's speed log and gyro compass along with the satellite fix. Standard navigator information is displayed on a CRT screen including great circle or rhumbline sailing. It can be combined with the CMA-770 I/O Processor to expand the basic navigation set to operate with additional navigation aids such as OMEGA, LORAN C and Doppler Sonar. Navigational aids can be integrated to meet the specific requirements of oceanographers, the offshore oil industry, cable-laying vessels, fisheries research vessels, hydrographic vessels, geophysical vessels and others.

Contact is: **Mr. J.L. Coffell, Advertising Manager, Canadian Marconi Company**, Siege Social, 2442, Avenue Trenton, Montreal, Quebec, Canada H3P 1Y9. Tel (514) 341-7630, Telex: 05-827822.

Simple, efficient design spells success

Established only five years ago by a man whose job with British Petroleum in Britain was to observe major oil spills throughout the world, Morris Industries Ltd. of North Vancouver, British Columbia, has introduced oil skimmers that are simple in design, light in weight, and more efficient than the cumbersome drum- or belt-type skimmers originally assigned to the clean-up task after a spill.

Morris disc skimmers remove more oil per minute than the conventional types because the collecting discs rotate at a set speed and the oil they gather is wiped clean by scrapers, which direct it into a collecting area.

The MI-2 skimmer is completely portable, weighing only 18 kg (40 pounds) and operated by a standard 12-volt car battery, yet it will pick up 45 litres (10 gallons) a minute. It is recommended for dealing with relatively small spills of up to 9 000 litres (2,000 gallons).

The machine and its 15 metres (50 feet) of hose is packed in two suitcase-like containers. "Effectively," says President David Morris, "one person can throw the cases in the back of a station wagon, drive out to the site, and be in operation in minutes."

The portable machine's big brother, the MI-30, can be handled by two men and pick up 450 litres (100 gallons) a minute, or approximately 30 tons per hour.

The company is now developing a catamaran vessel, carrying a high-rate recovery device and a fixed-installation oil recovery unit for use in oil refineries.

Company contact is: **Graham M. Parkes, General Manager, Morris Industries Ltd.**, 1527 Columbia Street, North Vancouver, British Columbia, Canada V7J 1A3. Tel. (604) 986-2189.

Reliable deck, drill-rig machinery help make Hepburn a household word

Twin-drum anchor winches by John T. Hepburn Limited are used for the accurate positioning of a drillship while drilling operations are under way.

Years of design and production experience in the demanding marine and offshore fields have established John T. Hepburn Limited as an internationally accepted producer of reliable deck and drill-rig machinery.

The company's contributions to the offshore industry include mooring machinery specially designed for the TSG production platform used in the *Maureen* field in the North Sea.

The traction-type winches for this project provide a continuous pull of 200 tonnes and have a brake-holding capacity of 500 tonnes. The storage drum accommodates 2800 metres (9,184 feet) of 90 mm (3.5-inch) diameter wire rope.

Hepburn BOP handling cranes are designed for use singly or in tandem to position and service BOP stacks on drill rigs. All motions of the hydraulically operated bridge-type crane are controlled by one operator at deck level, from a console fitted with individual load gauges for each hoist hook. Responsive manual valves provide sensitive control for accurate positioning. The hydraulic hoses supplying power to the crane are supported in a specially designed Hepburn Carrier System to eliminate looped hoses.

The company's twin-drum anchor winch has a stall pull of 200 tonnes and a storage capacity of 1100 metres (3,650 feet) of 75 mm (3-inch) diameter wire rope on each drum.

Hepburn anchor-chain tensioning units have been developed to provide an economical alternative to the conventional anchor windlass or winch for the tensioning of anchor chain or for long-term moorings of large vessels. The compact tensioning units can also be used when space is severely restricted.

They may also be adapted for the hoisting of heavy, chain-suspended loads. The holding capacity of the tensioning unit equals the breaking strength of the chain and the unit can heave in and pay out chain at predetermined speeds to any pre-arranged tension.

The chain-tensioning units may be arranged for operation from a portable hydraulic power unit. Hepburn roller-type chain chasers are uniquely designed for use with combination wire-rope and chain cable moorings, accommodating chain sizes up to 82.5 mm ($3^1/_4$ inches) of "wishbone" body construction. The chain chaser has an opening 91 cm (36 inches) wide to accommodate the anchor shank. The body is moulded in a streamlined form to minimize drag forces and is designed to withstand the breaking strain of a wire rope pennant line 63.5 cm (25 inches) in diameter.

Hepburn's manufacturing capability is well demonstrated in the thruster units used for the propulsion and dynamic positioning of semi-submersible drilling rigs. Powered by a 3,000 h.p. motor, the thrusters, each weighing 98.3 tonnes (108 tons), are approximately 13 metres (42.5 feet) high and 4.1 metres (13.6 feet) in diameter.

John T. Hepburn Limited has, in advanced stages of commercial development, a sophisticated system that is designed to allow the dry emergency evacuation of personnel from drilling rigs and production platforms. Other applications for this type of equipment include the transfer of stores and liquids to offshore installations in severe weather conditions.

Persons interested in further information on Hepburn should contact: **Mr. A.D. Booth, Technical Representative, Marine Sales, John T. Hepburn Limited**, 914 Dupont Street, Toronto, Ontario, Canada M6H 1Z2 Tel. (416) 671-2200; Telex: 06-968793; Cable: Hepburn, Toronto.

Deep problems deftly fathomed

Fathom's oceanographic towing system undergoes "at sea acceptance testing" in the Baltic Sea during December, 1980.

Launched only 13 years ago, Fathom Oceanology Limited has become a respected supplier of technological hardware to the oceans industries market.

With a wide range of international clients, Fathom's purpose is to exploit opportunities in the ocean engineering field through the design, development and manufacture of specialized equipment for shipborne service and offshore structures.

Fathom's key to success has been its ability to incorporate an understanding of the marine environment with the mechanics and hydrodynamics of moving objects through the oceans or, in other words, reducing drag.

The cornerstone of the company's product line is its variable depth towing system. It has been successfully applied to uses as diverse as naval defence and basic oceanography. The systems comprise three major components — the towed unit, which is called the "fish," a faired cable, and a winch, combined with a launch and recovery system.

The fish is available in various forms, ranging from large, precision models manufactured in stainless steel, to smaller towed vehicles, which are supplied in several configurations, depending on the end use and size of instrument packages. Other parameters affecting fish design, and therefore choice, are towing speed, depth and weight requirements.

Fathom fish are being used for water sampling, seismic side-scan, sub-bottom profiling, video work, magnetometer surveys and fish-finding sonar.

Fathom's answer to the towing cable drag problem is through the use of its patented "Flexnose" fairing. This fairing has the lowest drag coefficient available. "Flexnose" is flexible enough to bend around a pulley. In the water it presents a smooth, clean profile that does not interrupt the hydrodynamic flow.

The advantages of using a faired cable are greater than may be immediately apparent. First, to obtain a specific towing depth, "Flexnose" uses significantly less cable. Under all conditions, constant towing speed can be increased, enabling the research vessel to cover a greater area per day. As a bare cable system is exposed to ship surge and/or varying underwater currents, the towing depth will fluctuate greatly. With a faired system, the influence of the variance of actual towing speed does not affect the towing depth because of the steeper towing angle. Precision depth capability has increased the accuracy of instrument packages.

Since space is a premium on any ship, Fathom has learned the art of packaging a towing system's onboard equipment under the most rigorous requirements. Systems have been built to fit under helicopter decks, between decks, and on small vessels such as hovercraft.

(The commercial packages benefit from this experience with the military and offer many features. The handling system comprises three major components which, when supplied together, form a sophisticated unit. Simpler configurations can, of course, be supplied).

The winch is designed to handle faired cable without costly grooving of the drum. Transfer of the cable to the instrumentation on board can be accomplished without slip rings and rotary joints by using Fathom's optional "Sidewinder."

The fish is launched and recovered while the ship is under way, with all necessary controls centrally located and easily operated by one man. A motion compensator can be supplied, integrated with the spooling mechanism to further reduce the influence of a heaving ship. The handling package is powered by a hydraulic unit that can be located remotely if required. The whole towing system is easy to install and remove when the ship is not towing. This permits further flexibility by allowing one unit to be used by several ships.

Fathom has applied its expertise in hydrodynamic drag in two directions. Now a low-cost, reusable clip-on fairing is available without sacrificing the drag coefficient. These fairings, called "Rigstream," have been successfully used on towed systems, buoy moorings, tethered instruments and offshore mooring lines.

In the opposite direction, Fathom now produces fairings for large pipes experiencing high current conditions. "Pipestream" is geared toward marine risers, limiting drag, bending stresses, vibration and fatigue, without adding any weight to the system. "Pipestream" has been used successfully by several major companies in the offshore oil and gas industry, in areas where conditions proved unacceptable to standard drilling practices.

Fathom has an easier and less costly solution where high vortex shedding conditions exist but drag is not a problem. "Starstrake" accomplishes this by "spoiling" the water flow around a circular member, greatly reducing the induced vibration and, therefore, the potential failure due to fatigue.

Fathom is continuing to solve problems in depth through its development of CASCAN, a new, light-weight riser buoyancy system, and in other areas of technological breakthrough as the world continues to explore the ocean frontier.

Inquiries should be directed to: **Mr. Les Truxa, Fathom Oceanology Limited**, 863 Rangeview Road, Port Credit, Ontario, Canada, Tel. (416) 274-1551.

Deeptowed seismic system adroitly performs profiles

Huntec's deeptowed seismic system gives unmatched resolution of the seismic section and allows the system to operate in weather conditions that would render other equipment inoperable.

Huntec's Hydrosonde Deeptowed Seismic System is a seismic profiler which combines high resolution capability, quality performance in adverse sea conditions, hands-off operation and on-line digital processing with calibrated reflectivity metrics.

Manufactured by Huntec ('70) Limited, of Scarborough, Ontario, the system is built into a suite of modules engineered for operation in the world's toughest offshore environment. It is intended for use in the water depths and weather conditions generally found over continental shelves and margins.

A transmitter (a boomer type source and energy supply), and two receiving hydrophones are placed in an underwater instrument package or "fish," which can be towed at depths to 200 m (655 ft.) and speeds to 8 knots. Because the instrument operates in close proximity to the sea floor during a survey, it achieves increased incident signal strength and sharper resolution of topographic features, due to the smaller area of the sea floor insonified by each shot.

To reduce the effects of fish motion from the graphic records, the position of the fish is continuously monitored and the firing time of the boomer controlled to counteract the effects of this motion. This produces an increase in the registration from shot to shot, and an accompanying increase in the amount of detail which can be obtained from the graphic records. The combination of motion compensation and deep towing gives unmatched resolution of the seismic section and allows the system to operate in weather conditions that would render other equipment inoperable.

The outgoing pulse of the Deeptow System is short in duration, producing layer resolutions of 0.15 m in stratified sediment. The clean pulse shape results in graphic records that are easy to interpret — a considerable advantage if any signal processing is to be performed on the data.

The sharply defined and consistent nature of the outgoing pulse has made possible the development of a unique "hands-off" system for processing graphic records. Once the system has been switched on, records of consistent quality are obtained with a minimum of operator intervention.

Reflectivity Metrics displayed alongside the graphic records aid in the identification of different lithologic units and provide a sensitive indicator of "gradings" between differing units. They enable the interpreter to extrapolate with confidence between sampling sites, dramatically reducing the number of sites that must be occupied to prove an area.

DTS Systems are operated simultaneously with air guns and side-scan sonars to provide data for regional geological surveys at speeds to eight knots.

Other applications: pipeline and cable route selection studies, prospecting for aggregates for the construction of artificial islands and breakwaters or for mineral deposits, and site specific surveys for drill rig and platform foundation studies.

Military applications include bottom "hardness" surveys of harbours and approaches, large-scale mapping of acoustic reflectivity and attenuation of the seabed and sub-bottom units to depths in excess of 50 metres. (164 feet).

Inquiries should be addressed to: **Mr. G. Luyckx, Production Manager Huntec ('70) Limited**, 25 Howden Road, Scarborough, Ontario, Canada M1R 5A6, Tel. (416) 751-8055, Telex: 06-963640, Cable: Huntor, Toronto

It's all in the (marine) bearing!

The company calls it the first really significant development in its field in 20 years! They're referring to the Thordon water-lubricated marine bearing that is manufactured by Thomson-Gordon Limited of Burlington, Ontario. The bearings have been installed in hundreds of ships around the world, from small fishing and pleasure craft to racing boats, hydrofoils, tugs, naval craft and commercial freighters right up to 80,000GWT tankers. Thomson-Gordon took the traditional bronze-backed, rubber marine bearing and improved it by eliminating the metal backing. At the same time, its high natural abrasion resistance improved its performance in clean and dirty water. Thordon has a low dry coefficient of friction, which means no low-speed chatter or rumble. It also has the ability to shorten normal 4:1 L/D ratio to as low as 2:1, giving shaft/bearing assemblies greater freedom and flexibility. Thordon can be machined to size from semi-finished blanks containing fully-finished water grooves — or it can be purchased fully-moulded to required sizes for immediate replacement. Thomson-Gordon, which has been in business since 1911, developed Thordon in 1961, and only began fitting marine bearings in 1975. Currently, bearings are sold exclusively through distributors in 41 countries. (Photo shows yellow Thordon staves in marine bearing).

Company contact is: **George A. Thomson, President, Thomson-Gordon Limited**, 3225 Mainway, Burlington, Ontario, Canada L7M 1A6. Tel. (416) 335-1440; Telex: 0618705.

Seasoned performer rigorously sets shipbuilding record!

Saint John Shipbuilding & Dry Dock Co. Ltd. has been building ships of all types and sizes for many years, but perhaps its most noteworthy achievement was the design and construction of an Arctic Class 3 Icebreaker — with anchor handling capabilities — in 272 days during 1979.

Canmar Kigoriak is the first vessel to be built to the rigorous requirements of the Canadian Arctic Waters Pollution Prevention Regulations, Class 3. It also meets Lloyd's Register of Shipping tough criteria for a Class 1000 A1 icebreaker.

The **Kigoriak** (the name means "Northern Lights" in the Inuit language) was built to operate in the Beaufort Sea and western Arctic Ocean, providing support services to the drill ships exploring for oil in that area. To meet these highly specialized requirements, the builders had to incorporate the latest icebreaking technology while using standard off-the-shelf equipment in its construction. The hull form itself represents a new conception for a vessel of its type. It is a barge-type structure with a single chine and a spoon-shaped bow. The shell plating is high tensile steel below the main deck, with the bulwarks and superstructure fabricated from normal shipbuilding steel.

Tenders for this unique icebreaker were called by Dome Petroleum in early November, 1978, the contract awarded on December 6, and the ship handed over to the owner on September 4, 1979. It is now employed in its intended role by Dome's subsidiary, Canadian Marine Drilling Limited.

Out of Saint John Shipbuilding, the "Canmar Kigoriak", the first vessel to be built to the rigorous requirements of the Canadian Arctic Waters Pollution Prevention Regulations, Class 3.

Support services to the drill ships include anchor handling and station moves, the supply of pipe, cement, specialized equipment, and consumable stores. The **Kigoriak** is equipped with ship fuel oil transfer and metering facilities.

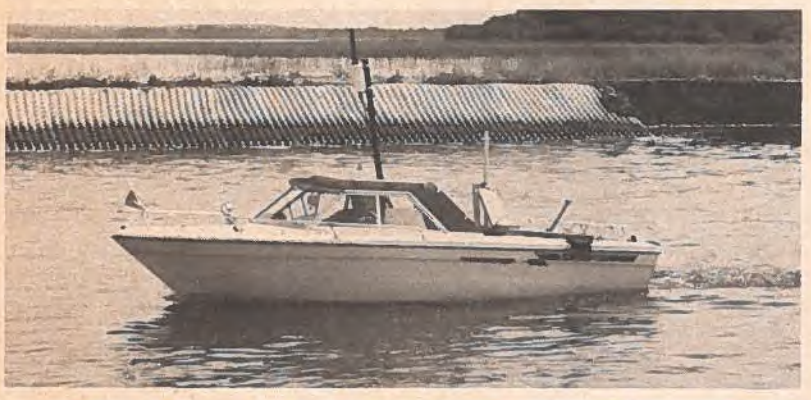
One of its primary responsibilities is to prevent the encroachment of wind-driven ice flows on drilling sites during the open water period. Another is to assist the drill ships to move stations as required. To carry out this duty, sophisticated deck machinery has been installed, including a triple-drum electro-hydraulic anchor-handling winch. Two drums are used for breaking the drill ships' anchors out of the sea floor, and the third is used for towing. It is capable of stowing 1000 metres (3,280 feet) of 60 mm (2.4-inch) steel wire.

Other deck equipment includes two 13.65-tonne (15-ton) vertical capstans, two storage reels, capable of holding 2000 metres (6,560 feet) of 70 mm (2.8 inch) wire, and a Favco hydraulic deck crane.

High quality accommodation has been provided on the forecastle deck for the crew of 29 and as many as 12 passengers. A lounge, mess, galley, storm rooms, crew change rooms, gymnasium and sauna are located on the main deck, directly below the quarters.

Company contact: **Mr. D.I. Jones, Director of Marketing and Sales, Saint John Shipbuilding and Dry Dock Co. Ltd.** P.O. Box 970, Saint John, New Brunswick, Canada E2L 4E5, Tel. (506) 693-9941; Telex: 014-47243.

Surveys are their service specialty



Conducting a hydrographic and mapping survey, MMM uses its Tellurometer MRD-1 and Edo-Western 4034C Echo Sounder.

Established 30 years ago as a traditional geodetic and topographic surveying organization, Marshall Macklin Monaghan Limited, of Don Mills, Ontario, has moved into photogrammetric and mapping services (1975), hydrographics services (1976) and gravity surveys (1980). Today, with a roster of more than 140 professionally and technically qualified experts and a total staff of some 400, the company is active throughout Canada and many countries overseas.

MMM has offices in Toronto and other Ontario cities; Calgary and Edmonton in Alberta; and Vancouver in British Columbia. Overseas locations established through its affiliated firm, Cansult Limited, are in Riyadh, Medinah, Abu Dhabi, Muscat and Cairo.

Hydrographic services include surveys for charting and dredging, offshore positioning, and water level and tidal analysis. Past projects undertaken by MMM have involved soundings, offshore positioning and tidal measurement and analysis for the determination of the vertical survey datum, and have been carried out in Newfoundland, Ontario, Alberta, and the Middle East. The firm has also been active in Doppler satellite positioning techniques and has complete software for the adjustment of large networks.

As part of a provincial environment study, MMM recently conducted a hydrographic and mapping survey for the Alberta Department of Environment on Wabamun Lake, west of Edmonton, using a Tellurometer MRD-1 to provide offshore positioning.

The MRD-1 in the three-range mode, was found to be ideal for the long, narrow shape of the lake. Sounding lines were controlled by conning the survey launch along a line of constant easting while fixes were automatically recorded and marked on the depth recorder at specific time intervals. Although the lake was large (8300 hectares) it was necessary to use a small launch because of the shallow water and heavy weed growth. The launch did not offer much room for equipment but was found to be quite suitable for the system. One operator easily handled the necessary monitoring of the MRD-1 and depth sounder.

MMM will be using the MRD-1 early this year to position a helicopter engaged in a gravity survey in the Arctic. Further research is planned with a view to extending the capabilities of the MRD-1 as a three-dimensional positioning system for aircraft.

Company contact is: **S. James Statham, Chief of Control and Hydrographic Services, Marshall Macklin Monaghan Limited,** 275 Duncan Mill Road, Don Mills, Ontario, Canada M3B 2Y1. Tel. (416) 449-2500; Telex: 06-966695.

Successfully roping offshore market!

Greening Donald President, Tom Carney has reason to smile as Plant Superintendent Ken McKenzie affectionately pats the company's bread and butter winner — wire rope — used in a variety of offshore and other industrial applications.

With five manufacturing plants in Ontario and branches in Nova Scotia and Alberta, Canada, and South Plainfield, New Jersey, Greening Donald Co. Ltd. of Hamilton, Ontario, is the oldest continually operating wire rope manufacturer in the western hemisphere.

In addition to wire rope, the company makes a complete line of woven screens, perforated and fabricated metal products and stainless steel wire — all of which are used in the offshore industry. The company's products are in use in oil exploration activities around the world, including such areas as the North Sea and the Beaufort Sea.

Wire rope, including rope assemblies, is the most important offshore product line. Greening Donald can manufacture anchor ropes up to 128 mm (five inches) in diameter. When larger diameters or extremely long lengths are required, Greening Donald's European associate company is capable of supplying the largest diameters and longest lengths in the world.

Realizing that technical and distribution service are essential to this highly developed industry, Greening Donald has specialized in application engineering. The company's technical staff have conducted studies on semi-submersible rigs, drill ships, and pipe-laying barges, analyzing critical wire rope installations and problems unique to the offshore industry. Special attention has been given to riser tensioner ropes, which are possibly subjected to more types of loading than that of any other wire rope application.

A completely new concept in rope design — plastic-filled steel rope — manufactured by Greening Donald and sold under the trade name P.F.V. (Plastic Filled Valley) has produced phenomenal results (as much as 400 per cent longer life) in the mining and logging industries and is presently being tested on oil exploration installations. The company is confident there will be a number of successful applications for this product on offshore equipment.

Wire rope assemblies and slings are other products in which Greening Donald has been a leader since the development of the mechanical splice. These products are used by the offshore industry in many areas. Greening Donald manufactures the full range of pendant lines at its branches in Nova Scotia and Alberta, as well as in its main plant in Hamilton.

The company's other offshore product lines include stainless steel shale shaker screens, oil well measuring lines, and perforated non-slip grating. The stainless steel wire for the measuring lines and shaker screens is made at Greening Donald's new specialty wire mill, the wire cloth for the screens at its weaving plant, and the finished screens at its fabricating plant.

Perforated non-slip grating is made at the company's Ontario perforating plant, believed to supply the fullest range of perforated metal in North America. It is available to Canadian and overseas customers from Greening Donald and to U.S. customers from the company's subsidiary Mundt Perforations Inc. in New Jersey. The corporate and sales department headquarters are located in Hamilton.

Contact: **Mr. R. Sullivan, Marketing Assistant, Greening Donald Co. Ltd.,** P.O. Box 430, Hamilton, Ontario, Canada L8N 3J3. Tel. (416) 528-5971; Cable: Greendon Hamilton.

Position-fixing, survey services earn Marinav international markets

Marinav Corporation, with headquarters in Ottawa and offices in Calgary, Houston, Singapore and London, has established an international reputation in the offshore services industry.

As the search for offshore energy resources continues at an ever-increasing pace, exploration companies are drilling and conducting seismic surveys in ocean depths considered impossible only a decade ago. Pipelaying technology has developed to the point where special-purpose barges can operate and lay pipelines in unprecedented depths. Navigation plays an important part in all these offshore activities and Marinav's position-fixing and survey services are in demand worldwide.

To meet this demand, Marinav employs a staff of professional engineers, technicians, hydrographers, surveyors and technologists who average more than 20 years' experience in marine and land resource survey operations. During recent years, Marinav personnel have undertaken survey projects for government and industry throughout the world, including West Africa, Alaska, the Canadian Arctic, Great Lakes, South America and the Caribbean.

Marinav owns and operates a complete range of specialized navigation equipment for marine operations. These include short-range, high-precision microwave systems for the accurate positioning of ships operating within line of sight from the shore, and other systems which provide both long-range capabilities and reliable, accurate navigation.

Satellite navigation plays an important role in Marinav's offshore capability. The Navy Navigation Satellite System or TRANSIT comprises six satellites which continuously travel around the earth in polar orbits. Each satellite continuously broadcasts its orbital data and, independent of any shore-based transmitter, a ship can determine its precise latitude and longitude from these broadcasts by using a satellite navigation receiver.

In little more than a decade, the TRANSIT polar orbiting satellite system has revolutionized pinpoint positioning, both on land and at sea. Where it is necessary to establish final drilling rig positions or geodetic control points, Marinav provides doppler satellites survey Geoceivers, supported by complete data processing services in Canada and Britain.

With geophysical exploration moving to ever-increasing distances offshore, it is difficult to satisfy the precise navigation requirements with a single electronic positioning system. Marinav's integrated navigation systems combine the best features of two systems to improve and confirm the navigation positional accuracy.

In addition to providing navigation services, Marinav undertakes offshore engineering and hydrographic surveys and maintains a comprehensive inventory of oceanographic equipment, including precision depth sounders, side-scan sonar, and sub-bottom profilers.

Marinav can undertake survey-related software developed to support the most demanding survey requirements, whether they be related to multi-parameter data acquisition techniques or the integration of navigation systems.

Marinav's Autoplot systems have been designed and developed to provide onboard real time navigation, recording and charting facilities. Computer based, these systems provide real time conversion of the navigation data to XY co-ordinates for track plotting, track guidance, recording and the marking of external recorders.

Supported by modern maintenance facilities and specialized test equipment at their Ottawa base, Marinav's experienced technical and field engineers undertake in-plant and in-field maintenance. A wide range of survey-related electronic interfaces and peripheral equipment is designed and manufactured by Marinav's engineering staff.

Marinav Corporation is continually exploring methods to improve the company's service capability and ensure that the most modern state-of-the-art equipment is available to the offshore industry.

Correspondence should be addressed to: **Mrs. P.A. Fletcher, Marketing Administrator, Marinav Corporation,** 1140 Morrison Drive, Ottawa, Ontario, Canada K2H 8S9. Tel (613) 820-6600; Telex: 053-4117.

National Research Council of Canada

Making waves in Arctic vessel and marine research attracts attention

The Arctic Vessel and Marine Research Institute of the National Research Council of Canada (AVMRI) is now being developed on the campus of Memorial University at St. John's, Newfoundland, incorporating the work and facilities of the existing Marine Dynamics and Ship Laboratories group, to which new laboratories will be added.

The laboratories' services are available to industry on a neutral basis and, long term in-house programs which would not, in the interim, be commercially viable, are carried out following the researchers' initiatives.

AVMRI utilizes the interrelated approaches of theory and experiment in its work and carries out an essential and important part of its work at sea on ships. Modern computers and electronic instrumentation are used to the fullest extent and it is only through these means that the programs can be undertaken.

Projects and programs vary from purely theoretical and mathematical (such as those dealing with the mathematics of hull definition and propeller vortex theory) through to the carrying out of advanced designs involving hydrodynamic knowledge and experience. Spectral and statistical analysis techniques are in general use in connection with sea-keeping programs.

Among others, the following subjects are considered on a day-to-day basis: environment data (wind, waves, currents, ice); seakeeping (motions, vibrations, forces, pressures, using spectral and statistical theories); manoeuvring; stability; hydrodynamic forces and moments; hydrodynamic flow; propeller vortex theory; propulsion; hydrodynamic drag; propulsion and forces in ice; manoeuvring in ice; shallow water effects; mooring problems; general science and engineering.

It is often useful in considering marine research projects and programs to categorize them by type of craft. Then the subjects listed above are applied in the studies, whether ultimately for design, safety or other considerations. Categories include bulk carriers, high speed vessels, ferries, miscellaneous craft, tugs, barges, yachts, hydrofoils, fishing vessels, Arctic bulk carriers, icebreakers (patrol support), submersibles and towed submerged bodies, ocean platforms and structures.

The research may be directed toward predictions of performance, design improvements, the comparison of various alternate solutions, the invention of new ways and means or generally to advance knowledge and improve techniques. The work may be internally sponsored by NRC as a result of laboratory initiatives, or carried out under repayment on request from Canadian government or industry. Every effort is made to assist companies individually and collectively within the NRC operating procedures. Various programs have been undertaken of a national and international co-operative nature.

Ice-Related Research

Most of the considerations associated with the work of the Institute in clear water situations also apply in arctic or ice-covered environments, with all the added enormous complications due to the presence of ice.

The staff at the Ottawa laboratories have been involved with Arctic considerations and research over many years, including the carrying out of full-scale research and, more recently, self-propelled model investigations in a pilot synthetic ice tank 35 m long by 7 m wide and 1.2 m deep (115 feet by 23 feet by 4 feet). This pilot tank has been useful in developing overall experiments for a few vehicles.

In the past two years, the Ottawa laboratories have carried out model experiments for clear-water operation on polar-class icebreakers, both government and commercial, but these particular programs stopped short of experiments in simulated ice, which were carried out in other laboratories.

Model radio-controlled manoeuvring experiments have been completed for an Arctic LNG carrier. This series included iceberg-avoidance manoeuvres, using model simulated icebergs, and the company involved was pleased to use the program to give experience to one of their ship captains.

The research program being planned for St. John's is based on Canadian priorities and takes into account all the research considered by the aforementioned groups.

Existing Laboratories, Ottawa

These facilities, which are significant internationally, comprise a towing tank 137 m long, 7.6 m wide and 3 m (450 feet by 25 feet by 10 feet) actual water depth; a manoeuvring basin 122 m long, 61 m wide and 3.7 m (400 feet, 200 feet and 12 feet) actual water depth; a cavitation (water) tunnel; and the necessary specialized workshops, drawing office, computer equipment, and information centre.

The towing tank is equipped with a towing carriage with modern computer instrumentation, a wavemaker and wave absorber, and viewing ports. The tank may be regarded as of medium size internationally, although it is the second largest in North America. The manoeuvring basin is the largest of its kind in the world and is equipped with wavemakers so that radio-controlled models may be propelled at different headings to the waves.

Planned New Laboratories, St. John's

These will feature an Arctic Vessel Research Laboratory (ice tank) 80 m long, 12 m wide and 3 m (262 feet, 40 feet and 10 feet) in water depth, for experiments in ice of controlled characteristics to simulate the arctic marine environment. A Clear-Water Towing Tank Laboratory, 200 m long, 12 m wide and 8 m (656 feet, 40 feet and 26 feet) in water depth, will permit significant hydrodynamic investigations with a new range of scale factors. A Stability (wave) Tank Laboratory 75 m long, 32 m wide and 3 m (246 feet, 103 feet and 10 feet) in water depth will permit experiments for a wide range of wave spectra. These will be provided with state-of-the-art instrumentation for data acquisitions and processing. The laboratories' activities will be supported by extensive shop facilities, which will include the use of numerically controlled milling machines in the model-making process. It is planned to inaugurate the Ice Tank and support facilities in 1982, with the Clear-Water facilities following in 1983.

AVMRI — St. John's

It is agreed that both the Federal Government and Province of Newfoundland and Labrador research and development programs could be met most effectively by the establishment of NRC laboratories for research on ice and marine dynamics on the campus of Memorial University of Newfoundland. NRC has agreed to build and operate such facilities.

It is intended that users of the facilities should have a major influence on the research program. An Advisory Committee on Arctic Vessel and Marine Research has been established by NRC to assist in achieving this objective.

The committee, which is composed of government and industrial users and representatives of other interested agencies, is charged with the task of providing NRC with the benefit of their collective expertise and is to offer guidance in matters pertaining to program planning, scheduling, and use of the facilities. The process will be accelerated by contracting out many of the operations of the facilities, in conformity with the government's policy.

The design and procurement by NRC of the major installed experiment equipment is the subject of detailed study. The ice tank is to be capable of operation at reduced depth, and a "drain down" storage tank is to be provided for this purpose. Some model experiments on a hydraulic current system for this tank have been conducted and further detailed experiments are planned. This system will allow currents in the tank with or without an ice cover.

Models up to 12 m (40 feet) in length can be used in this tank and uniform ice up to 15 cm (6 inches) thick will be used in the experiments, which will be carried out at scaled strengths, and at full-scale strength for some items. The tank, being the largest of its kind planned in the world, will allow experiments to be conducted with minimum corrections for Reynolds Number effects and minimum ice-modelling scaling problems.

The size of the tank is such that essential manoeuvring data can be obtained with somewhat reduced-size models. It is to be expected that the experiment limitations of smaller tanks can be established.

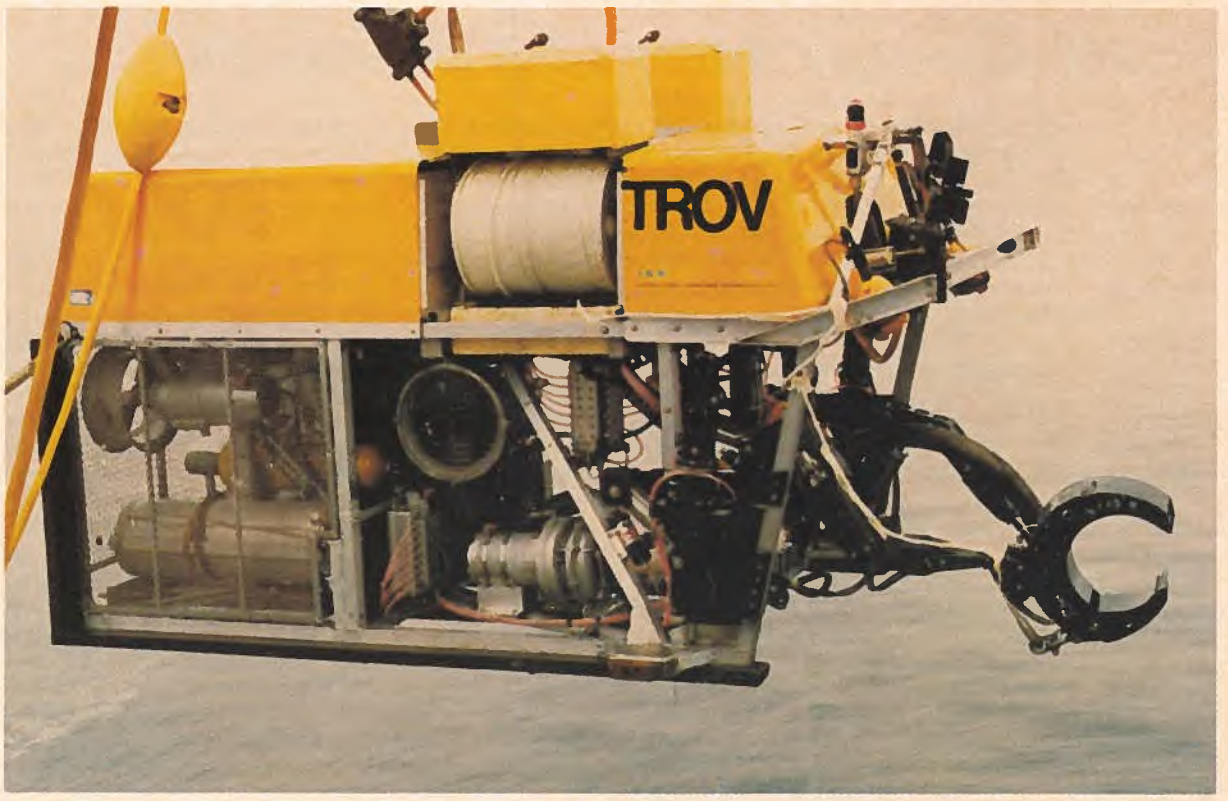
The large clear-water tank, which is compatible in size with the ice tank (using the same size of models), will be equipped with a computer-controlled wavemaker at one end, for reproducing various sea spectra, and the scope will include deep water experiments for ocean platforms, moored ships, etc.

The stability tank will have segmented flap-type wavemakers on two adjacent sides and will have some reduced depth capability. A large range of directional sea spectra will be available for realistic representations of storm conditions for experiments with all types of vessels. Model experiments on the wavemaker system are to be conducted as the design progresses.

The Institute will then comprise major facilities for research in a range of environments, on marine vessels, marine structure, and marine technology in general.

Inquiries, specifying areas of interest, should be addressed to: **Mr. S.T. Mathews, AVMRI Program, Director, Marine Dynamics and Ship Laboratory, National Research Council of Canada,** Ottawa, Ontario Canada K1A 0R6 Tel. (613) 993-2265 Telex: 053-3386.

Versatile submersible vehicles perform variety of functions



The TROV is the largest of the remotely controlled vehicles built by I.S.E. at the moment. Ranging in length from 2 metres (6.5 feet) to 5 metres (19.4 feet) and in displacement from 1400 to 2700 kg (1.5 to 3 tons), they are fitted with four thrusters — two fore and aft, one lateral and one vertical — and 4-function or 7-function manipulators, according to the underwater tasks they will be required to perform.

TROV, TREC, and DART are names to conjure with in the world of undersea exploration. They are three models of underwater vehicles built by International Submarine Engineering Ltd., of Port Moody, British Columbia.

All three craft are remotely controlled and capable of operating at depths ranging from 400 to 1000 metres (1,300 to 3,000 feet). They are used for a variety of tasks, which include pipe line inspection, platform inspection, under-ice operations, instrument platforms, torpedo recovery, deep ocean mining exploration, manipulative tasks, telecommunications cable surveys, leak detection, template alignment, salvage, and debris survey. A vessel built by ISE has been used in the search for the Titanic!

The smaller TREC, usually 1.4 metres (4.5 feet) long and weighing 250 kg (550 pounds), are fitted with 3-function manipulators.

Smallest of the three is the DART. It is designed for inspection only, but is capable of diving to 1000 m (3,048 feet).

International Submarine Engineering Ltd. is currently building a new manned and/or remotely controlled vehicle. It can be operated from an umbilical under remote control or with a man inside, or operated unmanned without an umbilical. The latest addition to the I.S.E. line is fitted with spatially correspondent arms, one of which is tactile in two planes.

In 1980, I.S.E. and associated companies designed and built the towed system which was used in the search for the Titanic in 4000 metres (13,000 feet) off the coast of Newfoundland.

Inquiries may be addressed to: **Mr. J.R. McFarlane, President, International Submarine Engineering Limited,** 2601 Murray Street, Port Moody, British Columbia, Canada V3H 1X1. Tel. (604)-931-2508; Telex: 04-353554; Cable: SUBENG.

Okanagan where oil, gas action is!

Okanagan Helicopters Ltd. of Richmond, British Columbia, is Canada's largest helicopter operator and the third largest in the world, with more than 40 bases across Canada.

When it began in 1970, about 75 per cent of its business originated in its home province. Today, only 15 per cent of its revenue comes from British Columbia. The rest is earned in operations around the world.

Okanagan's biggest customer has been anywhere oil and gas exploration is active. The rest of its income comes from the forestry and mining industries in Canada and other parts of the world. The company now has a Southeast Asia regional headquarters in Singapore, operations in the Philippines, Thailand and India and operates a fleet of eight helicopters. Recently it began operations in Australia, employing six helicopters to provide services to offshore drilling rigs off the Western Australia and Victoria coasts.

The company provides contract service to drilling operators, flying oil rig crews to offshore operations and transporting equipment and provisions. Many of its overseas contracts are undertaken as joint ventures with helicopter companies based in the country where the work is located.

Contact is: **Mr. J.W. Pitts, Okanagan Helicopters Ltd.,** 4391 Agar Dr., Richmond, British Columbia, Canada V7B 1A5. Tel. (604) 278-5502; Telex: 04355594.