**Marine Institute of Memorial University of**

**Newfoundland and Labrador (MI)**

**School of Ocean Technology (SOT)**

**Program Descriptions**

**Remotely Operated Vehicles (ROV) Program**

**Ocean Mapping (OM) Program**

**for**

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# ROV Program

## PROGRAM DESCRIPTION

MI’s ROV Operator / Technician program is the only program of its kind in Canada. Preparing students to work with a wide range of vehicles, to perform ROV maintenance, to understand ROV systems and to work safely in unique ocean environments, this program provides a solid foundation in electronics and mechanical technology through classroom, industrial labs, simulators, and workplace training.

* Remotely Operated Vehicles (ROV) are used most notably for underwater intervention in the offshore oil and gas, nuclear, military, law enforcement, pipeline, and cable industries, as a substitute or supplement to commercial (manned) diving operations. These vehicles are especially suited for hazardous and difficult underwater operations.

* Due to the increased complexity in ROV operations, offshore operators have started to demand a higher level of quality assurance for ROV operators. Skills required by ROV operators include piloting, hydraulics, electrical & electronics, and workplace safety.

## MISSION

This two-year ROV program is designed to:

* Train students in ROV piloting, hydraulics, electrical, and underwater navigation.
* Train students in ROV deployment methodologies that encompass safety, inspection and operation.
* Prepare students for careers in underwater intervention in offshore oil & gas, nuclear, military, law enforcement, pipeline and cable industries as a substitute to diving operations
* Graduate students with a 2-year Technician Diploma.

## MAIN AREAS OF STUDY

The first year, academic Terms 1 and 2, begins in September with students studying math, physics, electro-technology, digital logic, and computer programming. ROV systems are introduced, as well as courses in oceanography, fluid mechanics, ROV electronics, and underwater acoustics. Written communication and computer programming is another feature of this first year.

Following Term 2, at the end of April, the 6 week Technical Session 1 teaches hands-on experience with electronic and mechanical fabrication and drafting, ROV tooling, instrumentation used on ROV’s, and ROV pilotage via simulators. A basic seamanship course introduces students to life at sea.

The second year, academic Terms 3 and 4, focuses on ROV operations and maintenance. It covers advanced hydraulics, industrial electronics & controls, electrical machines, maintenance, and safety. A workshop practice course adds a practical dimension to the theoretical knowledge.

ROV launch, recovery, and maintenance duties form a major part of work for the graduates in the ROV industry. On the operational side, computer interfacing techniques, data communication, and acoustic applications help in understanding the internetworked systems that comprise an ROV.

Term 4 is followed by the 6 week Technical Session 2 in which students receive hands-on experience piloting ROVs in open water and honing those skills in the simulator. This technical session also includes marine safety training required to work in the offshore industry.

Following Technical Session 2, students are required to complete a 320-hour work term in the local or international ROV industry.

## PROGRAM ENTRY

The program has two path of entry:

### Direct Entry

 Program entry regulations are the Marine Institutes minimum entrance requirements for Technician Diploma Programs. This consists of performance evidence in high school Math, English, and Science. Refer to the Admissions Section of the Marine Institute Calendar. Applicants should possess strong skills in both mathematics and science to enter this program

### Advanced Standing

 Applicants who have completed a three-year diploma of technology in either Electrical, Electronics, Mechanical, or Marine Engineering at another accredited postsecondary institution, or at the Marine Institute, may be eligible to receive Advanced

Standing in the program. Advanced Standing students commence their studies in Term 3 of this program, with the possibility of requiring a three-week bridging program to take place before the start of the Term 3 fall academic semester.

### Physical Requirements

 Proof of physical fitness must be provided by way of a valid CAPP offshore medical from an approved physician for registration in this program. Contact the Registrar’s Office for a list of physicians approved to conduct the CAPP medical.

## PROGRAM STRUCTURE

Length of the Program:

* 2 academic years (1 year for Advanced Standing students)

Number of Semesters:

* Four (4) 13 week academic semesters, two (2) technical sessions and one (1) 8 week work term

Number of Courses:

* 38 courses in 2 years of study

Work Terms

* Students do a 8 week (320 hour) work term at the end of Term 4

**PROGRAM OUTLINE**

## TERM 1

* CMSK 1104 (Introduction to Technical Reporting)
* ELTK 1103 (Introduction to Electrotechnology Applications)
* ELTR 2102 (Digital Logic)
* MATH 1101 (Introduction to Calculus)
* ONGR 1200 (Descriptive ONGR)
* SFTY 1104 (WHMIS)

## TERM 2

* CPSK 1102 (Introduction Applied Programming)
* ELTR 1301 (Control Electronics for ROV)
* FLDS 2108 (Introduction to Fluid Mechanics & Hydraulics)
* OMAP 2000 (Underwater Acoustic Applications)
* PHYS 1101 (Physics)
* ROVO 2200 (Introduction to ROV Systems)

## TECHNICAL SESSION 1

* ELTR 1104 (Electronic Fabrication Techniques)
* ENGR 1202 (ROV Drafting and Blueprints)
* ONGR 1301 (Instrumentation Oceanography)
* NASC 1304 (Seamanship for Ocean Technology Technicians)
* ROVO 1300 (ROV Simulator - Introduction)
* ROVO 1301 (ROV Tooling)
* WKPR 1306 (Computer Numerical Controlled (CNC) Fabrication)

## TERM 3

* CMSK 2103 (Soft Skills for Ocean Technology Technicians)
* ELTK 1303 (Electrical Machines and Power Systems)
* ELTK 2118 (High Voltage Safety)
* FLDS 2109 (Advanced Hydraulics)
* ONGR 1200 (Descriptive ONGR) For Advanced Standing Students Only
* ROVO 2200 (Introduction to ROV Systems) For Advanced Standing Students Only
* ROVO 2201 (ROV Operations)
* WKPR 2118 (Workshop Practice)

## TERM 4

* ELTK 2200 (Marine Electrical Troubleshooting)
* ELTR 2115 (Data Communications)
* ELTR 2116 (Industrial Electronic and Controls)
* ELTR 2215 (Microcomputer Interfacing)
* OMAP 2000 (Underwater Acoustic Applications) For Advanced Standing Students Only
* ROV0 2205 (ROV Maintenance and Launch and Recovery Systems (LARS))

## TECHNICAL SESSION 2

* ROVO 2300 (ROV Ship Interaction)
* ROVO 2301 (ROV pilot Training)
* ROVO 2303 (ROV Simulator - Advanced)
* SFTY 1102 (Basic First Aid (STCW A-VI/1-3)))
* SFTY 1128 (BST - Basic Survival Training)
* SFTY 2101 (H2S Alive)
* SFTY 2301 (Fall Protection)
* SFTY 1134 (Security Awareness Training for Seafarers without Designated Security Duties)

## WORK TERM

 WKTM 1105 (Work Term (8 weeks)

**CAREER**

## TYPICAL JOB TITLES

* ROV Pilot
* ROV Operator
* ROV Technician
* ROV Supervisor

## SAMPLE JOB DESCRIPTION

### ROV Pilot/Technician

* Repair and maintain Remotely Operated Vehicles and the associated support systems including Tether Management Systems, Winch and Launch and Recovery Systems, and Power Generation Systems
* Perform electrical, electronic, hydraulic and mechanical maintenance and repair duties for a multitude of electro/ hydraulic/mechanical systems
* Perform piloting duties for a multitude of subsea tasks including general visual inspections, survey, specialty tooling operation, construction, installation, pipeline and cable laying, search, salvage and recovery, and offshore oil drilling support
* Perform support duties including navigation and sonar operation, multimedia recording and record keeping, manipulator operation, inventory, planned and preventative maintenance, updating system specifications, logs and registers
* Opportunity to work globally

### ROV Supervisor

* Act as team lead for operation, maintenance, and repair of Remotely Operated Vehicle
* Plan ROV missions
* Act as liaison between ROV crew and vessel
* Accept responsibility for safe and effective ROV operations
* Accepts responsibility for documentation of ROV operations
* Participates in daily planning of offshore installation activity

### ROV Superintendent

* Engage in project planning for acquisition and deployment of Remotely Operated Vehicles and crews
* Interface with clients to determine ROV requirements and activity
* Present clients with optimal operational scenarios
* Interact with ROV Supervisor to ensure efficient Operations

## REMUNERATION

Typical salaries for an offshore ROV Operator / Technician working on a Work Class ROV System are:

* Trainee: $350 / day
* Pilot Tech: $550 / day
* Senior Pilot Tech: $750 / day
* ROV Supervisor: $800 / day

NOTE: As with other industries, there will be different rates for land based and offshore work, for work on various classes and types of equipment, and for various levels of competence and experience.

# Ocean Mapping Program

## PROGRAM DESCRIPTION

The ocean mapping degree program is designed for anyone who has an interest in the ocean. A prospective student could range from a high school graduate, who is an explorer at heart and wants to map the unknown, to a seasoned industry worker who needs a refinement of skills or to learn about the technical and operational requirements and applications of the latest ocean technology.

The Ocean Mapping Program prepares graduates to enter the workforce with an advanced level of technological literacy and competency with respect to marine technology. It will:

* Immerse students in both the theory and practical aspects of marine technology, allowing for seamless transition from the classroom to the real world.
* Provide the students with the necessary expertise in all aspects of ocean mapping, including acquisition, processing and management of physical, biological and chemical data pertaining to the ocean.
* Integrate and apply the use of satellite imagery and other methodologies to determine in many parameters in the ocean.
* Develop the skills to design, develop, store, analyze, manage and disseminate spatial and attribute information within a Geographic Information System (GIS).
* Examine the ocean cube – comprised of the surface, water column, seabed and seabed substrate.
* Operate and troubleshoot traditional and industrial standard marine surveying equipment within relevant working environments.
* Operate and troubleshoot oceanographic instrumentation equipment within relevant working environments, both on land and at sea.
* Utilize electromagnetic and acoustic remote sensing technologies for advanced analysis of marine data.
* Design, develop and manage Geographic Information Systems (GIS) from the developer, analyst, Information Technology (IT), manager and end-user perspective.

## MISSION

The mission of the Ocean Mapping Programs is to:

* Provide a solid understanding of ocean mapping technologies through the practical applications of marine surveying, remote sensing, oceanographic instrumentation and Geographic Information Systems for the acquisition, processing, analysis, dissemination, and management of ocean data.

* Provide comprehensive knowledge of the theory and practice of hydrographic surveying and applied disciplines.
* Provide an environment to practice analytical reasoning, decision-making, and problem solving and solution development as it relates to Marine Geomatics.

* Graduate students with a 3 year Marine Institute (MI) Diploma of Technology complimented by a Memorial University of Newfoundland (MUN) Bachelor of Technology Degree.

## PROGRAM ENTRY

Physical Requirements • Students will be required to pass a Marine Institute medical.

Direct Entry

* As per the Marine Institutes minimum entrance requirements for Diploma of Technology Programs, Refer to the Admissions Section of the Marine Institute Calendar.

* Applicants should possess strong skills in both mathematics and science to enter this program

## MAIN AREAS OF STUDY

The Joint Diploma of Technology / Bachelor of Technology in Ocean Mapping is a comprehensive and intensive four (4) year joint diploma / degree program. It consists of eight (8) academic semesters of thirteen (13) weeks duration, three (3) technical sessions of six (6) weeks duration, and one (1) Work-Term placement of eight (8) weeks or three-hundred and twenty (320) hours duration that takes place after the final technical session.

The seventy (70) courses in the program cover elements ranging from core math and science concepts and methodologies to intermediate and advanced ocean mapping related technologies. The program incorporates additional courses that revolve around the integration of project management, technology management, societal context, and research analysis.

The first year of the Ocean Mapping program (Terms 1 and 2) is similar to the common first year structure of other programs at the Marine Institute, with the inclusion of some program specific areas of study. All students will complete core courses in Mathematics, Physics, Chemistry and Electrotechnology. Additionally, students will:

* Complete a communication skills course designed specifically for the School of Ocean Technology pertaining to technical report writing in semester one.
* Complete a course covering the fundamentals of oceanography in semester one.
* Complete a short safety course in WHMIS in semester one.
* Complete a course covering the fundamentals of underwater acoustic applications in semester two.

Following Term two, a six-week technical session is completed where students become actively engaged in the practical application of ocean mapping technology in the fields of Hydrography, Tides, Global Positioning Systems (GPS), Surveying, and Oceanographic Instrumentation. Some of the practical elements associated with data acquisition are performed at sea on a Marine Institute vessel. Students will also complete a specialized math course focusing on spherical trigonometry as well as two courses that focus on general seamanship and security awareness while performing duties on a vessel at sea.

The second year of the Ocean Mapping program (terms 3 and 4) marks the beginning of a more concentrated effort towards the theory and application of Geographic Information Systems (GIS), Remote Sensing, Terrestrial Surveying and Hydrographic Surveying, with emphasis placed on the utilization of ocean and ocean-related data. Students will complete introductory courses in Geographic Information Systems (GIS), Marine Geology and Geophysics, Intermediate Surveying Practices and Advanced Tides and Water Levels along with a communication skills course covering relevant interpersonal soft skill concepts. This semester also marks the point in the program where students begin enrolling in the Bachelor of Technology (B. Tech) courses required for the Degree portion of the program. Introductory courses in Optical Remote Sensing, Computer Networking, Sidescan Sonar and Geophysical Remote Sensing and Multibeam Sonar occur in term four. These courses focus on the theory and practical application of the technology in terms of data collection techniques, installation and deployment, data analysis interpretation and dissemination. Students will also complete a Linear Algebra course along with a Bachelor of Technology course as required for the Degree portion of the program

Following term four, the six-week Technical Session II will be completed whereby the students become actively engaged in intermediate techniques associated with field data collection, system design, implementation techniques and best practices utilized for data processing and visualization. Students also complete a series of short courses associated with Marine Safety, including Standards of Training, Certification and Watch keeping (STCW) - Basic Safety, the Restricted Radio Operator’s Certificate, and Marine Basic First Aid (MBFA), all of which are essential when working within a marine environment.

The third year of the Ocean Mapping program marks the beginning of the more advanced ocean mapping techniques whereby students learn methods and techniques used in the fields of data design and management as well as overall system integration and performance. Students will complete advanced courses in Geographic Database Design and Management, Shipboard System Integration and System Performance in semester five. Students will also complete an Advanced Remote Sensing course focusing on thermal imagery and radar technology as well as continuing with the Bachelor of Technology Degree requirements. In term six, students follow advanced courses in web based mapping, marine GIS and Nautical Cartography. Students will also learn advanced surveying practices in terms of data acquisition and analysis and specialized hydrographic applications such as port management and coastal engineering, offshore geophysics, construction hydrography and seismic surveying. Students also continue with the Bachelor of Technology Degree requirements.

The six-week Technical Session III follows term six. Students become actively engaged in advanced techniques associated with field data collection, advanced system design and implementation techniques and best practices as well as advanced techniques utilized for data processing and visualization. Students also complete a series of short courses to cover introductory navigation concepts and techniques as well as Confined Space Entry Awareness and the Small Vessel Operator Proficiency. They also complete a ROV Survey Operation course that focuses on the utilization of remotely operated vehicles as a means of conducting elements of a hydrographic survey.

Immediately following the third Technical Session, students complete a comprehensive workterm placement component where they become fully immersed with an ocean mapping related company and performing the tasks required within industry. The duration of the work term is flexible by design, as it will reflect the individual job duties of each student. Students are required to complete either an eight-week work term or a total of 320 hours to fulfill the requirements of the workterm.

The fourth and final year of the Ocean Mapping program builds on all the fundamental concepts learned throughout the duration of the program and allows the students to immerse themselves in the project management side of the technology. Students will complete a capstone project in which students design and develop a rigorous ocean management data management project that aims to link all the program’s concepts and techniques through the design, development, and dissemination of a relevant issue or trend in ocean mapping. The topics are wide in scope and can range from intermediate data collection techniques and practices to the development and implementation of commercial software. Students also complete a Nautical Chart Production course adhering to acceptable hydrographic standards, a Weather and Climate course to round out the students’ expertise, an International Law of the Sea course and will continue with the Bachelor of Technology Degree requirements.

## PROGRAM STRUCTURE

The Ocean Mapping Program is a four-year program that consists of:

* Eight (8) thirteen-week academic terms
* Three (3) six-week technical sessions and One (1) work term.
* Seventy (70) courses

### Term 1

* ONGR 1200 (Descriptive Oceanography)
* CMSK 1104 (Introduction to Technical Reporting)
* MATH 1101 (Introduction to Calculus) or MATH 1100 (Pre-Calculus) - if required
* CHEM 1100 (Chemistry)
* PHYS 1100 (Physics)
* ELTK 1100 (Electrotechnology)
* SFTY 1104 (WHMIS) (4 hour online certificate)

### Term 2

* OMAP 2000 –(Underwater Acoustics Applications)
* CHEM 1200 (Chemistry)
* MATH 1200 (Calculus)
* PHYS 1200 (Physics)
* ELTK 1200 (Electrotechnology)
* CPSK 1102 (Introduction to Applied Programming)

### Technical Session I

* GEOG 1301 (Surveying and GPS)
* ONGR 1302 (Hydrography and Tides)
* ONGR 1301 (Instrumentation Oceanography)
* NASC 1304 (Seamanship for Ocean Technology Technicians)
* SFTY 1134 (Security Awareness Training for Seafarers without Designated Security Duties)
* MATH 2204 (Spherical Trigonometry)

### Term 3

* GEOG 2101 (Intermediate Surveying Practices) • GEOG 2102 (Mapping and GIS)
* ONGR 2107 (Marine Geology and Geophysics)
* OMAP 3500 (Advanced Tides and Water Levels)
* CMSK 2103 (Soft Skills for Ocean Technology Technicians)
* ENGLISH 1000 Level Course
* STAT 2108 (Applied Statistics)

### Term 4

* GEOG 2200 (Remote Sensing)
* OMAP 2200 (Side-Scan Sonar and Geophysical Remote Sensing)
* OMAP 2201 (Multibeam Sonar)
* ELTR 2118 (Introduction to Computers and Networking)
* MATH 2203 (Linear Algebra)
* MSTM 4090 (Introduction to Technology)

### Technical Session II

* OMAP 2300 (Field Deployment and Data Collection)
* OMAP 2301 (Data Processing and Visualization)
* NASC 2107 (Restricted Operator’s Certificate – Maritime Commercial)
* SFTY 1102 (Marine Basic First Aid)
* SFTY 1114 (STCW Basic Safety - STCW’95 VI/I))

### Term 5

* GEOG 3102 (Geographic Database Design and Management)
* GEOG 3104 (Advanced Remote Sensing)
* OMAP 3100 (Shipboard System Integration)
* OMAP 3101 (System Performance)
* MSTM 4010 (Assessment & Implementation of Technology)
* MSTM 4060 (Advanced Technical Communications)

### Term 6

* GEOG 3201 (Advanced Surveying Practices)
* GEOG 3202 (Web-based Mapping)
* GEOG 3203 (Marine GIS and Nautical Cartography)
* OMAP 3202 (Specialized Hydrography)
* MSTM 4012 (Occupational Health and Safety Legislation and Management)
* MSTM 4040 (Project Management for Technologists)

### Technical Session III

* NASC 3309 (Introduction to Navigation)
* OMAP 3300 (Advanced Survey Design and Implementation)
* OMAP 3301 (Advanced Data Processing and Visualization)
* ROVO 3300 (Remotely Operated Vehicle Survey Operations)
* SFTY 1124 (Confined Space Entry Awareness)
* SFTY 1125 (Small Vessel Operator Proficiency)

**Work Term**

* WKTM 3302 (to follow Technical Session III)

### Term 7

* GEOG 3402 (Nautical Chart Production)
* OMAP 3401 (Data Management Project I)
* MSTM 4014 (Technology and the Environment)
* MSTM 4020 (Economic Management for Technologists)
* MSTM 4030 (Technology in the Human Context)
* MSTM 410A (Technical Project and Report I)
* ONGR 3500 (Weather and Climate)

### Term 8

* OMAP 3200 (International Law of the Sea: Geomatics Perspectives)
* OMAP 3201 (Applications of Underwater Acoustic Data)
* OMAP 3501 (Data Management Project II)
* MSTM 4070 (Special Topics in Technology)
* MSTM 410B (Technical Project and Report II)
* B. Tech Elective

## CAREERS

Ocean Mapping graduates will be entering a broad and diverse field with a variety of specific niches that require the services and expertise acquired within their program and through their training. Until now, there was never a formal job title of Ocean Mapper because the typical roles were traditionally performed by a group of people. Graduating as an Ocean Mapper, students will be technologically literate and competent in all the sectors of the industry, thus making them extremely employable and attractive to local, national and international companies.

Graduates of this program are expected to avail of careers in a variety of areas, ranging from the private sectors and consultant agencies, provincial and federal government departments as well as educational and research institutions. One of the great aspects of the program is that graduates can seek employment either at sea or ashore or a combination of both because the knowledge and expertise they have attained will apply to both environments. Graduates may find themselves at sea on a survey vessel operating equipment to collect process and analyze information. Many opportunities also exist where graduates can work ashore in a scientific capacity, analyzing and presenting data

## SAMPLE JOB DESCRIPTIONS

Typical job titles that would be open to a graduate of this program include:

* Ocean Mapper
* Hydrographic Surveyor
* GIS Technician / Specialist
* Remote Sensing Specialist
* Instrumentation Oceanographer
* Applied Researcher
* Special Projects Team Lead
* Spatial Database Analyst
* Database Administrator
* Web Developer
* Systems Analyst
* Project Manager
* Computer Programmer
* Computer Network Specialist

Hydrographic Surveyor

* Ability to undertake industrial activities including the precise positioning, data acquisition, processing, analysis, management and dissemination of marine environments
* Ability to measure and map the sea-surface, water column, seafloor and seafloor substrate
* Ability to utilize software and equipment relating to satellite and terrestrial positioning, single beam echo sounders, multibeam echo sounders, laser scanners, LiDAR and Side-Scan Sonar for the production of nautical charts and maps
* Ability to utilized remotely operated (ROV) and autonomous (AUV) underwater vehicles for hydrographic data acquisition
* Ability to manage projects and produce reports
* Ability to provide accurate and reliable information for other disciplines such as navigation, dredging,
* environmental monitoring, oils and gas and oceanographic research
* Ability to work as a team of technical specialists

Spatial Database Administrator

* Experience with Oracle or SQL Server installation, configuration and administration, with strong abilities using either Oracle Spatial or SQL Server Geography and Geometry data types.
* Spatial Database Backup and Recovery
* Archive Log Management
* ESRI ArcSDE tuning and configuration
* Strong understanding of the geodatabase, including the types and their usage
* Experience with raster and vector data loading with change control and optimization
* Ability to install and configure a Windows environment
* Ability to design, configure and maintain a spatial data warehouse • Ability to handle large quantities of data in a seamless environment.

GIS Technician / Specialist

* Work with the project management team to plan and implement new systems within a marine environment
* Deploy marine applications onto web servers and configure systems based on identified requirements.
* Maintain a high implementation quality standard through attention to detail and thorough review and testing procedures.
* Deliver written material as need to summarize implementations, report on status or provide clients with how-to instructions
* Support existing client implementations by troubleshooting and diagnosing issues, providing clients with guidance and feedback and applying hot fixes where necessary.
* Provide technical guidance regarding the implementation of ArcGIS Server and integration requirements within marine-based solutions
* Install and manage ArcGIS Server systems
* Work with clients on the configuration of Map Services, layer definitions, cartography, thematic map definitions, and map server performance tuning.
* Process/prepare data for web sites, configure map server settings, and create static HTML content.

Remote Sensing Specialist

* Competence in using ArcGIS Desktop and Server including processing and manipulation of a wide variety of spatial data, building databases, spatial analysis, 3D visualizations & map production;
* Experience in Remote Sensing techniques, such as classification, feature extraction and image analysis using Idrisi Taiga software or equivalent;
* Competence in digital Photogrammetry and orthophoto production, preferably using PCI Geomatica or equivalent
* Familiarity with sub-metre GPS applications, including data acquisition and post-processing;
* Abilities in a relevant language such as C++, Python etc. an advantage;
* Experience with web approaches, interfaces, & protocols such as html, xml, css, php, etc;
* Familiarity with implementation of OGC compliant standards such as WMS, WFS, etc;
* Sound understanding of computer networking, client-server and database technologies.

### Remuneration

Typical salaries for an Ocean Mapper:

* Entry Level Salary: $50,000 - $60,000 per year
* Senior Level Salary: $80,000 - $100,000 per year
* Entry Level Day Rate: $325 / day
* Experience Day Rate: $700 / day

NOTE: As with other industries, there will be different rates for land based and offshore work, for work in various roles and on various types of equipment, and for various levels of competence and experience.