

# Marine Geophysicist

## ROLE OVERVIEW

**You will use quantitative observation of physical properties to understand the seafloor and sub-seafloor geology.**

Geophysicists use the principles of gravity, seismic and electromagnetics to identify the structure and composition of the earth. The two main divisions of geophysics are exploration geophysics, which deals with the search of Earth's resources, and global geophysics, which uses the same techniques to study the earth, including earthquakes, magnetic fields and other phenomena. Job opportunities are best for candidates with master's degrees in geophysics or related areas.

Specializations in this field often include seismology and seismic interpretation, borehole geophysics, mineral exploration, engineering geophysics, environmental or groundwater geophysics, or computer processing and software development. Some of the most popular areas in which geophysicists are employed are architecture, engineering and related services in management, scientific and technical consulting services.

As a marine geophysicist, you must enjoy technical and engineering work with a technical mind and enjoy applying physics and mathematics in practical ways. Have computer proficiency and experience with various software packages. It may also be required to do extensive field research in remote areas and at sea for extensive periods of time.

## STRATA LEVEL: 3B – Technical Specialist

### Also Known as:

- Consultant Geophysicist
- Geophysical Engineer
- Project Geophysicist
- Exploration Geophysicist
- Operations Geophysicist
- Processing Geophysicist
- Quantitative Geophysicist

### Education and Experience:

- Bachelor of Science degree in geophysics, earth science, geophysics, geochemistry or a combination of geology and physics.
- Master's degree or Ph.D. is considered an asset.
- Licensed by, or eligible to register as a professional in a provincial or territorial association.

### Associated NOC(s):

- **2113** – Geoscientists and Oceanographers



## TECHNICAL



### Scientific Research Projects

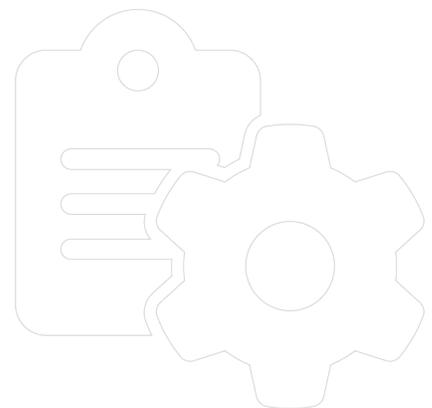
**Designs and implements research projects that follow the scientific methods using empirical and/or measurable observation in their research to improve, correct or increase knowledge in a field of study to solve specific problems.**

- Identify and define the project purpose, scope, and objectives to plan project resourcing, risks, and techniques to effectively manage project throughout lifecycle.
- Identify appropriate formats and system to capture and store scientific data to conform with relevant standards.
- Oversees requests for proposals to submit proposals to funders to obtain project funding.
- Review proposals, progress, impacts, and outcomes of STEM peers to evaluate research activities to provide feedback and improve scientific deliberation.

### Scientific Research

**Applies scientific methods and techniques using empirical and/or measurable observation in their research to improve, correct or increase knowledge in a field of study to solve specific problems.**

- Communicate geological findings through research papers, conference presentations, or other means to disseminate information.
- Researches the environmental effects on aquatic environments to determine the impacts of departmental initiatives, plans and activities.
- Plans and conducts seismic, geodetic, electromagnetic, magnetic, gravimetric, radiometric, radar and other remote sensing programs to identify and advise on anticipated natural risks.
- Plans and conducts analytical studies of core samples, drill cuttings and rock samples to identify chemical, mineral, hydrocarbon, and biological composition.



## Geospatial Surveys

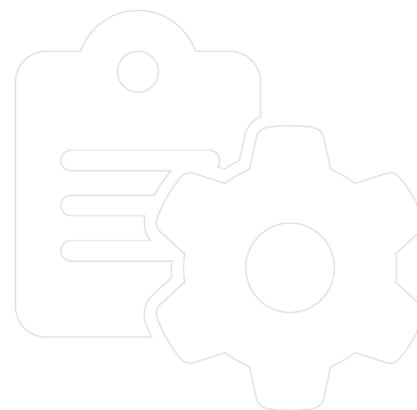
**Uses geospatial data and digital systems to map and analyze characteristics of the earth's surface to facilitate development activities.**

- Prepare and deploy satellite positioning or drone equipment to collect survey data.
- Acquire raster imagery to inform survey maps to interpret aspects of collected geospatial data.
- Report and archive data sets as latitude, longitude, and Cartesian coordinates to two different datums.
- Enter datasets into GIS or CAD software to prepare layered maps at effective scales, extension, and orientation to describe the data.
- Use manual methods to generate new map layers to meet survey specifications and requirements.
- Uses magnetometers and gravimeters to measure the spatial changes in the earth's magnetic and density properties to understand the extent of regional-scale geological structures.

## Geophysical Surveying

**Uses geophysical survey equipment and digital systems to develop models and map characteristics of the earth's subsurface to facilitate development activities.**

- Follows appropriate procedures to calibrate and recalibrate instruments and equipment to ensure accurate measurements and quality control.
- Applies bathymetry and backscatter mosaics derived from multibeam sonar surveys to produce a high spatial resolution to create maps of the seafloor.
- Analyzes variations in the geomagnetic fields to choose the sensitivity of magnetometers for measuring the magnetic fields and magnetic anomalies.
- Uses a gravitational wave sensor to analyze the relative shift in gravitational waves to detect the magnitude of seismic waves.
- Interprets seismic reflection survey data to create offshore ground models to provide offshore ground modelling and geohazard and offshore geophysical consultancy.



## Geophysical Signal Detection

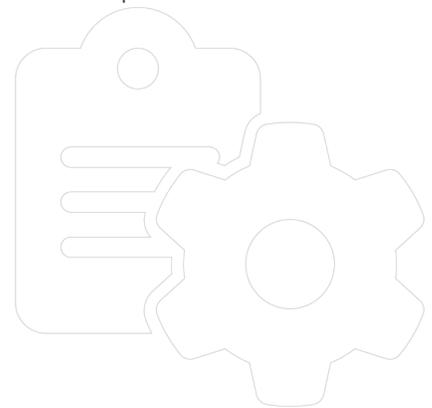
**Applies geophysical and mathematical techniques to consider the time, frequency domain, and frequency variation to gather and recognize geophysical signals.**

- Applies the Fourier expansion of a time-domain signal to estimate the heat distribution of a body to analyze the multi-dimensional signals such as the electromagnetic waves.
- Localizes the speed and direction of a particular signal to establish spacetime filtering problems for the design of filters for spacetime signals.
- Utilizes the beamforming approach to filter spacetime signals to isolate signals travelling in a particular direction.
- Implements the upward continuation method to estimate the depth of the magnetic materials beneath the earth for fewer wave number anomalies associated with the shallow magnetic sources.

## Data Analysis

**Applies recognized statistical tools and techniques to interpret and analyze data for the purposes of uncovering trends, patterns, and opportunities to enable strategic decision making.**

- Confirm data is sufficient and valid prior to analysis to ensure data was collected with current legislations, survey plan, and specifications.
- Design data analysis studies that align with organizational practices to collect, compile, and analyze data.
- Use appropriate methodologies and techniques to analyze field survey data to produce accurate, reliable, and unbiased results.
- Apply mathematical models to perform analysis and derive solutions to specific problems.
- Seeks feedback from other technical specialists to confirm interpretations and ensure all conclusions are aligned with project plan.
- Prepares technical and research reports on observations, findings, and/or impacts to communicate results to stakeholders, industry, government, or the public.



## PERSONAL AND PROFESSIONAL



### Communication

**Positively directs outcomes by delivering communication that results in a better understanding of goals and objectives and that capture interest and gains support for immediate action.**

- Communicates the project or organization mission and directive to ensure all team members share a cohesive vision for the progress of the organization.
- Prepares comprehensive reports that clearly identify project objectives, scope, research findings, alternatives, and recommendations to create a defensible assessment report.
- Actively listens to team members and managers to understand different perspectives and incorporate feedback into workplace tasks.
- Communicates with other team members to share information and resources to exploit opportunities and efficiencies.

### Collaboration

**Engages in professional collaborative efforts with members of the team, including sharing information and expertise, utilizing input from others, and recognizing others' contributions to work towards common goals.**

- Provides operational expertise and technical direction as appropriate to ensure harmonious and efficient operations.
- Shares relevant and useful knowledge, experience, or expertise to aid team members accomplish their objectives more efficiently or effectively.
- Works cooperatively with multiple stakeholders, demonstrating a willingness to consider alternative approaches, ideas, or insights.
- Provides team members with constructive feedback and perspective to aid in the completion of a task or goal.
- Advise operation crews or supervising agencies on construction, land use, or resource management to provide information for use in regional development, site selection or development.



## Problem Solving

**Identifies problems and uses logic, judgement, and evidence to evaluate alternative scenarios and recommend solutions to achieve the desired goal.**

- Takes an unbiased stance to interpreting new information to solve a problem in an object manner.
- Applies logical and iterative analysis to evaluate events and outcomes.
- Considers all pieces of information when attempting to solve problems to produce a cognisant and comprehensive solution.
- Identifies, evaluates, and generates solutions to concerns brought forth by team members to maintain a harmonious workflow.



## LEGAL, REGULATORY, AND POLICY



### Regulatory Compliance

**Adheres to specific regulation and legislation within a defined jurisdiction to monitor organizations compliance and implementation of best practices.**

- Provides relevant information for the submission of offshore resource extraction licences and permits.
- Evaluate internal project applications to ensure compliance with environmental regulations, legislation, and policies.
- Participates in the development of internal policy and procedures to ensure assessments are conducted in accordance with all legal requirements.
- Communicates regulations and guidelines for responsible drilling activities with decision makers and other technical staff to ensure unnecessary risks are avoided.

### Health and Safety Procedure

**Adheres to and advocates for specific workplace safe operating procedures and occupational health and safety requirements within a defined jurisdiction to ensure the health and safety of others.**

- Establishes safeguards and best practices within a project team to align with organizational health and safety plans to ensure the safety of all team members.
- Leads routine safety meetings with project team members to ensure all parties are aware of potential risks and hazards.
- Participates in safe workplace training as required to ensure an up-to-date understanding of health and safety best practices.
- Applies appropriate health and safety procedures in all aspects of work to ensure zero incidents.
- Ensures undivided attention while carrying out projects to ensure geological operations do not impact or damage the surrounding environment.



## ENVIRONMENTAL



### Benthic Habitat Research

**Applies a variety of methodologies to generate detailed geo-referenced data sets and maps of the underwater environment to make informed policies and designs.**

- Uses bathymetry and heliborne georadar to measure water depth to determine the topography of the seabed for hydrographic surveys and production of Digital Terrain Models.
- Uses sidescan Sonar systems to acquire seabed imaging, including underwater structures, for the classification of the material of the seabed.
- Works with various surveying strategies, benthic video, and still photography to observe, explore, and characterize benthic habitats and seafloor features over an area.

### Resource Identification

**Use digital systems, equipment, and sensor technologies to identify natural resource deposits in marine environments to estimate resource potential and provide data to influence decision making.**

- Locate and estimate probable natural gas, oil, or mineral ore deposits or other underground resources, using aerial photographs, charts, or research or survey results to conduct extraction operations.
- Applies multi-spectral remote sensing of the marine environment to ensure appropriate resource management.
- Conduct geological or geophysical studies to provide information for use in regional development, site selection, or development of public works projects.
- Interpret field surveys and laboratory research to prepare geological maps, cross-sectionals, charts, or other reports to plan mineral extraction, land use, and resource management.
- Conducts seismological investigations to determine subsurface faults and other structural variables to determine the location of natural resources for the purpose of extraction.



## Marine Research Ethics

**Must be mindful of the impact that marine seismic surveys may have on animal life, especially those using sound as the primary method of communication.**

- Adheres to protocols to maintain an appropriate distance between marine mammals and potential noise sources to prevent physical damage to marine life.
- Adheres to regulations to prevent low-level noise from causing temporary threshold shifts in hearing that obscure vital sounds for marine life.
- Ensures protective measures are employed to address site-specific environmental conditions of each operation to ensure that sound exposure and vessel traffic do not harm marine mammals.
- Ensures that disturbance whilst surveying is planned to avoid sensitive areas during specific time periods such as during breeding and feeding.
- Establishes exclusion zones around the seismic source to further protect marine fauna from potentially detrimental effects of sound.

## Seabed Surveying

**Survey subtidal marine seabed habitats to measure, interpret, and communicate seabed data to plan and develop coastal management activities.**

- Plan surveys according to established policies and procedures to map specific marine seabed habitats.
- Uses remote sensing methods to identify seabed features to map specific environments to plan marine development activities.
- Apply spatial-data processing methods to reveal habitats and interpret geological properties to facilitate scientific research and coastal development.
- Perform field checks to confirm optimal data quality under different water column conditions to apply quality assurance and control procedures to data collection.
- Utilizes ground penetrating radar (GPR) to map internal structures of the ground for underground resource mapping and visualizing possible challenges.
- Links data to ground-truth information and recognized biotope substrate descriptors to identify marine habitats and explain their geospatial context.
- Presents data and findings to stakeholders and wider audiences to contribute to discussions on seabed habitats, interpretations, limitations, and significance.

