



**NATO MARITIME GEOSPATIAL, METEOROLOGICAL & OCEANOGRAPHIC  
CENTRE OF EXCELLENCE**

Our Reference NU/MGEOMETOC COE/002/DIR  
Date 16 January 2026  
To TO WHOM IT MAY CONCERN  
Subject **CALLING NOTICE FOR THE FIRST EDITION OF THE MILITARY  
OCEANOGRAPHY COURSE, 16-20 MARCH 2026**  
Enclosures A. Course syllabus for the Military Oceanography Course  
B. Application Form

1. The NATO Maritime Geospatial, Meteorological & Oceanographic Centre of Excellence (Maritime GEOMETOC COE) on behalf of the NATO Military Oceanography Technical Panel (MILOC) is pleased to invite NATO Nations to participate in the first edition of the **INT-MO-37241 Military Oceanography Course**. The course will take place in person at the Centre's premises in Lisbon, Portugal, from **16 to 20 March 2026**.
2. This will be a pilot course and is designed to provide NATO and National Meteorological and Oceanographic (METOC) Subject Matter Experts (SMEs), Sonar operators and Anti-Submarine tactical advisors with a greater knowledge and understanding of the tactical aspects of Military Oceanography. On completion of the course, participants will be able to:
  - a. Understand the impact of physical oceanography conditions for maritime operations.
  - b. Understand Acoustic Oceanography (Underwater Sound) and its importance
  - c. Understand Modelling, Forecasting, and Decision Support Tools
  - d. Identify Oceanographic Impacts on Anti-Submarine Warfare (ASW)
  - e. Awareness of Environmental and Battlespace Characterization
  - f. Understand Sensor, Platform, and Weapon Oceanographic Impacts
  - g. Understand NATO Military Oceanography & METOC Support
  - h. Understand Polar and Littoral Oceanography
  - i. Understand the importance of Marine Mammal and Environmental Protection
3. This one-week course will be delivered by Subject Matter Experts from across NATO, including (CAN, GBR, NLD, TUR and USA) and the Maritime GEOMETOC COE along with other invited guest speakers and will consist of interactive lectures and some practical exercises covering the topics outlined in the course syllabus provided at Enclosure A.

## NATO UNCLASSIFIED

4. The course will start on Monday, 16 March, and ends on Friday, 20 March 2026. Daily sessions will run from 08:30 to 17:00. On Friday the course will end earlier, at 15:00.
5. The course will be conducted at NATO UNCLASSIFIED and will be delivered in English with no translation services available. Participants must have a language proficiency equivalent to English SLP 2222 or above.
6. Rank Requirements: Officers (OF-1 through OF-5) and NCOs (OR-5 through OR-9) along with civilian equivalents.
7. To apply for the course, interested personnel must complete the **Application Form** at Enclosure B and email it to the MILOC Secretary [james.bridge@nato.int](mailto:james.bridge@nato.int) and [info@mgeometoccoe.org](mailto:info@mgeometoccoe.org) no later than **20 February 2026**. Upon successful submission, candidates will receive a confirmation email acknowledging receipt of their application. The selection process will follow shortly thereafter, and all candidates will be notified of their acceptance status by **23 February 2026**. Administrative instructions – including details on accommodation, payment procedures, location, and other relevant information - will be send to selected students after acceptance.
8. **The course fee is €200 per student.** Students are responsible for their own travel and accommodation expenses and arrangements.
9. The Points of Contact (POCs) for the course are
  - a. The MILOC Vice Chair Mr Martin Taillefer (CIV) CAN-N [Martin.Taillefer2@forces.gc.ca](mailto:Martin.Taillefer2@forces.gc.ca)
  - b. The MILOC Secretary Lt Cdr Jim Bridge (OF-3) GBR-N [james.bridge@nato.int](mailto:james.bridge@nato.int)
  - c. Maritime GEOMETOC COE POC LTJG Mauro Silva (OF-1) PRT N, Public Affairs Officer, [mauro.silva@mgeometoccoe.org](mailto:mauro.silva@mgeometoccoe.org)

Director,

Miguel dos Reis Arenga  
CMG (OF-5) PRT N

## **COURSE SYLLABUS FOR THE MILITARY OCEANOGRAPHY COURSE (MARCH 2026)**

### **1. Course Introduction**

Program Intro, Welcoming Remarks, Future of MILOC & Opinion

### **2. Physical Oceanography for Naval Operations**

Ocean stratification (mixed layer, thermocline, deep layer)

Temperature, salinity, and density impacts on sound propagation

Internal waves and fronts, thermal haline circulation

Tides, currents, and eddies affecting ship and asset movement

Ocean Thermal Structure, Wind Mixing, Upper mixed layers, afternoon effects

### **3. Acoustic Oceanography (Underwater Sound)**

Ocean acoustics fundamentals: sound speed, propagation, ducting, convergence zones

Bathymetry and bottom composition and propagation impacts

Bottom and surface interactions (reverberation, scattering)

Sound tendencies, sound speed gradients

General sound propagation theory

Acoustic Refraction

UNDER THE HOOD OF SOUND: Cut-off frequencies, doppler, snell's law, calculating decibels

The changing soundscape as a submarine transits across a region

Sound speed profiles (SSP) and tactical implications

Ambient noise (biological, shipping, wind, ice, seismic)

Sound propagation implications, shadow zones

### **4. Ocean Modelling**

Shallow water & ASW Implications

Sonic Layer Depth and SSP structure

Upslope / Downslope Enhancement, Topographic Shading, Bathymetric Shadow Zones

Transmission loss

Absorption/Scattering

Tactical acoustic modelling in an ASW

SONAR Equation

Development of acoustic modelling and propagation

Range dependance vs Range independent propagation schemes

General Acoustic Modelling theory

Ocean modeling and forecast products: model types, strengths, limitations

Geometric sound spreading and examples

### **5. Oceanographic Impacts on Anti-Submarine Warfare (ASW)**

Detection ranges and sonar performance prediction

Tactical implications for ASW, sonar performance, weapon/sensor effectiveness

Sensor Placement

Understanding Tactical Decision Aids (TDAs) for ASW planning

Submarine's Best Depth to Avoid Detection

Calculating a submarines range, depths and bearings

Influence of bathymetry, seabed type, and sediment

Convergence zone exploitation, bottom bounce, and surface ducting  
Environmental challenges for naval operations (ASW, surface, SAR, comms)  
Definitions of shallow water and impacts  
Tactical Decision Aids (TDAs) and sonar employment optimization  
Examination of a tactical scenario  
In-tempo modelling / mini tactical gaming for decision making  
Definitions of Littoral battlespace

#### **6. Environmental Awareness and Battlespace Characterization**

Recognition of tactical opportunities (environmental advantage)  
Environmental Battlespace Awareness (EBA) and its relevance to military operations  
Maritime Environmental Threat and Opportunity Recognition  
ASW Tactics vs Tactical Oceanography Operational Oceanography Intelligence (OPINTEL)

#### **7. Sensor, Platform, and Weapon Oceanographic Impacts**

SONAR Equations  
Passive Sonars  
Active Sonars  
Ocean effects on mine warfare and seabed operations  
Future capabilities – AI modeling, autonomous sensing, data fusion  
Mine warfare considerations: seabed characterization, bottom type, water clarity

#### **8. Military Oceanography & METOC Support**

Planning METOC support to a NATO maritime operation (e.g., SNMG, JTF)  
NATO data sharing, reporting formats, and collaborative workflows  
METOC support to underwater operations (submarines, UUVs, sonobuoys)  
Environmental information as operational intelligence  
Decision support tools: METOC DSS, NATO recognized environmental picture  
METOC support to Joint Operations Planning: integrating into J3/J5  
METOC Support to Maritime Domain Awareness

#### **9. Modelling, Forecasting, and Decision Support Tools**

Use of Tactical Decision Aids (TDAs) for mission planning  
Data sources: satellite, in situ, gliders, buoys, ARGO floats  
Probabilistic forecasting and risk assessment (Monte Carlo, ensembles)  
Ocean and acoustic prediction systems (COAMPS, NCOM, HYCOM)  
Data Collection, Data Integration and data modelling

#### **10. Polar and Littoral Oceanography**

Arctic oceanography (ice edge acoustics, under-ice operations)  
Shallow water acoustics and coastal complexity  
Environmental challenges in choke points, fjords, archipelagos  
Arctic oceanography: ice types, marginal ice zone, thermohaline layering  
Littoral oceanography: sediment, turbidity, current dynamics, tides, river plumes  
Sediment transport, turbidity, and biofouling effects

#### **11. Marine Mammal and Environmental Protection**

Marine Mammal Mitigation and legal obligations  
Acoustic safety zones and environmental operating constraints  
Use of environmental compliance tools during operations  
Tactical Application of Bioluminescence

APPLICATION FORM

**Course Title: Military Oceanography Course - Pilot for 2026**

**Dates: 16-20 March 2026**

**Location:** Maritime GEOMETOC COE, Lisbon, Portugal

Address: Rua das Trinas 49, 1249-093 Lisbon, Portugal (co-located with Portuguese Hydrographic Institute).

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**1. Personal Information**

Full Name: Juliette GARRIC

Rank (Including NATO Rank): OFF-2

Nationality: France

Service/Branch: Hydrography

Organization/Unit: Shom

Position/Function: Manager of oceanographic defence products

Official Email: juliette.garric@shom.fr

Phone (including country code): +33 (0)2 56 31 21 94

Alternative Email (if applicable): \_\_\_\_\_

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**2. Course Requirements**

The following language proficiency skills in English are required to attend: SLP 2222, level 2 in listening, level 2 in speaking, level 2 in reading, and level 2 in writing (self-assessment in accordance with STANAG 6001 Ed.5)  Yes  No

Other (please identify): \_\_\_\_\_

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**3. Payment Information**

Course Fee: €200 per student.

I confirm that my organization/unit will cover the course fee.

I will personally cover the course fee.

#### 4. Additional Information

How did you hear about this course?

- MILOC Technical panel
- Maritime GEOMETOC COE Website
- NATO Internal Communication
- Colleague/Superior
- Other (please specify): \_\_\_\_\_

Do you have any dietary restrictions or special requirements?

- No
- Yes (please specify): \_\_\_\_\_

Any additional comments or requests, please let us know:

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#### 5. Acknowledgment & Signature

I confirm that the information provided above is accurate. I understand the course requirements and agree to comply with the registration and participation guidelines.

Signature: \_\_\_\_\_

Date: 18/02/2026

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#### Application Information

- Deadline for applications: **20 February 2026**.
- Please complete and submit this form to the MILOC Secretary [james.bridge@nato.int](mailto:james.bridge@nato.int) and the Maritime GEOMETOC COE POC [info@mgeometoccoe.org](mailto:info@mgeometoccoe.org)