

Training Course on Underwater Robotics

Professional Development Training Course Outline

Category	Blue economy	Duration	10 Days
Base Fee	\$3,000 USD	Delivery Mode	Online / On-site Hybrid

Course Introduction

The field of **underwater robotics** is experiencing rapid growth, driven by increasing demands for **ocean exploration**, **offshore infrastructure inspection**, and **environmental monitoring**. This comprehensive training course provides participants with the essential knowledge and practical skills to excel in this cutting-edge domain. Participants will gain a thorough understanding of the design, operation, and maintenance of various **underwater vehicles**, including **Remotely Operated Vehicles (ROVs)** and **Autonomous Underwater Vehicles (AUVs)**. The curriculum emphasizes hands-on experience and real-world applications, preparing individuals for successful careers in the burgeoning **marine technology** sector.

Training Course on Underwater Robotics delves into the core principles of **robotics engineering** as applied to the unique challenges of the underwater environment. Key areas of focus include **underwater navigation**, **sensor integration**, **hydraulic systems**, and **electrical systems**. Through a blend of theoretical instruction and practical exercises, learners will develop proficiency in piloting, troubleshooting, and deploying **submersible robots** for a wide range of tasks, from **deep-sea exploration** to **infrastructure maintenance**. The course also covers critical aspects of **underwater safety protocols** and **operational best practices**, ensuring graduates are well-equipped to contribute effectively and safely to the **oceanographic research**, **offshore energy**, and **underwater inspection** industries.

Programme Curriculum

Training Course on Underwater Robotics

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Course Duration

10 days

Course Objectives

This training course is designed to equip participants with the following key skills and knowledge:

1. Understand the fundamental principles of **underwater robotics** and its diverse applications.
2. Identify and differentiate between various types of **underwater vehicles,** including ROVs and AUVs.
3. Gain practical experience in the **operation and piloting of underwater robots.**
4. Learn the principles of **underwater navigation and positioning systems.**
5. Develop skills in the **integration and calibration of underwater sensors.**
6. Understand the fundamentals of **underwater communication technologies.**
7. Acquire knowledge of **hydraulic and electrical systems** used in underwater robots.
8. Master **pre- and post-mission procedures** for underwater robotic deployments.
9. Develop **troubleshooting and basic maintenance skills** for underwater vehicles.
10. Understand the importance of **safety protocols and risk assessment** in underwater operations.
11. Learn about **data acquisition and interpretation** from underwater robotic systems.
12. Explore the applications of **artificial intelligence in underwater robotics.**
13. Gain insights into the future trends and advancements in **marine autonomous systems.**

Organizational Benefits

Investing in this Underwater Robotics Training Course offers significant benefits for organizations operating in or looking to enter the marine environment:

- **Enhanced Operational Efficiency:** Trained personnel can operate and maintain underwater robotic systems effectively, leading to faster project completion and reduced downtime.
- **Improved Safety:** Proper training ensures that personnel understand and adhere to safety protocols, minimizing risks associated with underwater operations.
- **Cost Reduction:** Skilled operators can perform inspections, maintenance, and data collection tasks more efficiently, reducing the need for expensive human divers in many scenarios.
- **Access to Advanced Technology:** Equipping staff with the knowledge to utilize advanced underwater robotics opens up new possibilities for exploration, research, and operational capabilities.
- **Increased Innovation:** A well-trained team can better leverage the capabilities of underwater robots to develop innovative solutions and approaches to marine challenges.

- **Competitive Advantage:** Organizations with skilled underwater robotics personnel gain a competitive edge in the rapidly evolving marine technology landscape.
- **Higher Quality Data Collection:** Trained operators can ensure the accurate and reliable collection of underwater data for analysis and decision-making.
- **Reduced Environmental Impact:** Utilizing robots for certain tasks can minimize the environmental impact associated with human underwater activities.

Target Audience

This training course is ideal for individuals in various roles and industries, including:

1. **Offshore Oil and Gas Personnel:** Technicians, engineers, and inspectors involved in subsea infrastructure maintenance and inspection.
2. **Marine Scientists and Researchers:** Individuals utilizing underwater robots for data collection, environmental monitoring, and exploration.
3. **Naval and Coast Guard Personnel:** Those responsible for underwater surveillance, mine countermeasures, and search and rescue operations.
4. **Underwater Surveyors and Inspectors:** Professionals conducting seabed mapping, pipeline inspections, and structural assessments.
5. **Aquaculture Professionals:** Individuals using underwater robots for monitoring fish health and infrastructure.
6. **Renewable Energy Sector Employees:** Technicians working on offshore wind farms and other underwater energy installations.
7. **Search and Rescue Teams:** Personnel deploying underwater robots for locating and recovering objects or individuals.
8. **Engineers and Technicians:** Professionals interested in specializing in the design, development, and maintenance of underwater robotic systems.

Course Outline

Module 1: Introduction to Underwater Robotics

- Overview of the history and evolution of underwater robotics.
- Classification of underwater vehicles: ROVs, AUVs, Hybrid Vehicles.
- Applications of underwater robotics across various industries.
- Key components and systems of a typical underwater robot.
- The unique challenges and opportunities of operating in the underwater environment.

Module 2: Principles of Underwater Navigation and Positioning

- Introduction to underwater acoustics and its role in navigation.
- Different types of underwater positioning systems: USBL, LBL, SBL.
- Inertial Measurement Units (IMUs) and Doppler Velocity Logs (DVLs).
- GPS and its limitations underwater; alternative positioning methods.
- Practical exercises in interpreting navigation data and waypoints.

Module 3: Underwater Sensors and Instrumentation

- Overview of common underwater sensors: sonar, cameras, depth sensors.
- Water quality sensors: temperature, salinity, dissolved oxygen, pH.
- Acoustic imaging and profiling systems.
- Integration and calibration of different sensor types.
- Data acquisition and logging techniques for underwater sensors.

Module 4: Underwater Communication Technologies

- Principles of underwater acoustic communication.
- Different types of acoustic modems and their characteristics.
- Optical communication methods in underwater environments.
- Tethered communication systems for ROVs.
- Challenges and limitations of underwater communication.

Module 5: Hydraulic and Electrical Systems in Underwater Robots

- Fundamentals of hydraulic power transmission underwater.
- Components of a hydraulic system: pumps, actuators, valves.
- Principles of underwater electrical power distribution.
- Waterproofing and pressure compensation techniques for electrical components.
- Safety considerations for high-voltage systems in underwater robots.

Module 6: ROV Operation and Piloting Techniques

- Introduction to ROV control consoles and user interfaces.
- Basic piloting maneuvers: forward, backward, lateral movement, vertical ascent/descent.
- Advanced piloting techniques: station keeping, object manipulation.
- Operating ROVs in different underwater conditions and environments.
- Emergency procedures and troubleshooting during ROV operations.

Module 7: AUV Operation and Mission Planning

- Understanding AUV autonomy levels and control architectures.
- Mission planning software and waypoint programming.
- Pre-mission checks and deployment procedures for AUVs.
- Tracking and recovery of autonomous underwater vehicles.
- Data retrieval and post-mission analysis for AUV missions.

Module 8: Underwater Imaging and Data Acquisition

- Principles of underwater photography and videography.
- Different types of underwater cameras and lighting systems.
- Techniques for capturing high-quality underwater imagery.
- Data logging and storage methods for video and still images.
- Introduction to photogrammetry and 3D modeling from underwater images.

Module 9: Underwater Manipulation and Tooling

- Types of robotic manipulators used on underwater vehicles.
- Operating and controlling manipulator arms for various tasks.
- Introduction to common underwater tools: cutters, grabs, cleaning systems.
- Attaching and detaching payloads and tools underwater.
- Safety considerations for underwater manipulation tasks.

Module 10: Inspection and Non-Destructive Testing (NDT) Underwater

- Visual inspection techniques for underwater structures.
- Introduction to underwater NDT methods: UT, MT, CP.
- Deployment and operation of NDT equipment using underwater robots.
- Data interpretation and reporting of underwater inspection results.
- Standards and regulations for underwater inspection.

Module 11: Maintenance and Troubleshooting of Underwater Robots

- Preventive maintenance procedures for ROVs and AUVs.
- Basic troubleshooting of hydraulic and electrical systems.
- Identifying and addressing common mechanical issues.
- Repair and replacement of underwater components.
- Post-mission cleaning and storage procedures for underwater robots.

Module 12: Safety and Operational Best Practices

- Risk assessment and hazard identification in underwater operations.
- Emergency procedures and contingency planning.
- Communication protocols and teamwork in underwater deployments.
- Regulations and guidelines for operating underwater robotic systems.
- Environmental considerations and responsible use of underwater technology.

Module 13: Artificial Intelligence and Future Trends in Underwater Robotics

- Introduction to AI concepts relevant to underwater robotics: computer vision, machine learning.
- Applications of AI for autonomous navigation and object recognition.
- Developments in bio-inspired underwater robot designs.
- The role of swarm robotics and multi-vehicle collaboration underwater.
- Future trends in underwater power sources and communication technologies.

Module 14: Practical Deployment and Mission Simulation

- Hands-on exercises in deploying and recovering underwater robots.
- Simulated mission scenarios covering various applications.
- Team-based exercises in mission planning and execution.
- Data analysis and reporting based on simulated mission data.
- Assessment of individual and team performance in practical scenarios.

Module 15: Project Development and Presentation

- Participants work on a small project applying the learned concepts.
- Project topics can include mission planning, sensor integration, or system design.
- Guidance and mentorship provided by instructors.
- Final project presentations by participants.
- Feedback and evaluation of project work and presentations.

Training Methodology

This course employs a blended learning approach that combines:

- **Interactive Lectures:** Engaging presentations covering the theoretical foundations of underwater robotics.
- **Hands-on Practical Sessions:** Direct experience with operating, deploying, and maintaining underwater robotic systems.
- **Simulation Exercises:** Utilizing software tools to simulate underwater missions and scenarios.
- **Case Studies:** Analyzing real-world applications and challenges in underwater robotics.
- **Group Discussions:** Facilitating knowledge sharing and problem-solving among participants.
- **Demonstrations:** Showcasing the capabilities of various underwater robotic technologies.
- **Project-Based Learning:** Applying learned concepts to a practical project.

- **Site Visits (Optional):** Visiting relevant industry facilities or research institutions (subject to availability).

Register as a group from 3 participants for a Discount

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Certification

Upon successful completion of this training, participants will be issued with a globally- recognized certificate.

Tailor-Made Course

We also offer tailor-made courses based on your needs.

Key Notes

- a. The participant must be conversant with English.
- b. Upon completion of training the participant will be issued with an Authorized Training Certificate
- c. Course duration is flexible and the contents can be modified to fit any number of days.
- d. The course fee includes facilitation training materials, 2 coffee breaks, buffet lunch and A Certificate upon successful completion of Training.
- e. One-year post-training support Consultation and Coaching provided after the course.

Upcoming Scheduled Sessions

Start Date	End Date	Location	Price
07 Sep 2026	18 Sep 2026	Physical	\$3,000
14 Sep 2026	25 Sep 2026	Physical	\$3,000
21 Sep 2026	02 Oct 2026	Physical	\$3,000
28 Sep 2026	09 Oct 2026	Physical	\$3,000
05 Oct 2026	16 Oct 2026	Physical	\$3,000
12 Oct 2026	23 Oct 2026	Physical	\$3,000

Start Date	End Date	Location	Price
19 Oct 2026	30 Oct 2026	Physical	\$3,000
26 Oct 2026	06 Nov 2026	Physical	\$3,000

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