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NBRR ROV Workforce Program

Outline: Curriculum for Remotely Operated Underwater Vehicles (ROVs)

I. Introduction to ROVs

- **Definition and purpose:** Explain what an ROV is and its applications in various fields (e.g., oceanography, marine biology, underwater exploration).
- **Historical overview:** Discuss the evolution of ROV technology and significant milestones.
- **Components of an ROV:** Describe the key components of a ROV, including the vehicle body, propulsion system, control system, sensors, and manipulator arms.
- **Discuss the importance of safety briefings when working with ROVs:** in the shop, on deck or in the water. All team members have stop work authority.

II. Basic Principles of ROV Operation

- **Buoyancy and stability:** Explain the concepts of buoyancy and stability as they relate to ROVs, including how they are achieved and maintained. Discuss positive buoyancy and why it is important.
- **Explain that buoyancy will differ when operating the ROV in fresh versus salt water.** Discuss this important effect.
- **Motion and control:** Discuss the different types of motion an ROV can perform (e.g., forward, backward, up, down, rotation) and how they are controlled using thrusters and control systems.
- **Navigation and positioning:** Explain the various methods used to determine an ROV's position underwater, such as acoustic positioning systems and inertial navigation systems.
- **Discuss the importance of proper tether management.** Explain the importance of teamwork.
- **Describe the roles of ROV team members and the importance of developing and executing a coherent dive plan.**

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III. ROV Sensors and Instrumentation

- **Types of sensors:** Discuss the different types of sensors used in ROVs, including cameras, sonars, mass spectrometers, acoustic monitoring, magnetometers, environmental monitoring and conductivity sensors.
- **Data acquisition and processing:** Explain how data from sensors is collected, transmitted, and processed to provide useful information about the underwater environment.
- **Sensor calibration and maintenance:** Discuss the importance of sensor calibration and maintenance to ensure accurate and reliable data.

IV. ROV Manipulator Arms

- **Types of manipulator arms:** Explain the different types of manipulator arms used in ROVs, including hydraulic and electric arms.
- **Operation and control:** Discuss how manipulator arms are operated and controlled, including the use of joysticks and other input devices.
- **Applications of manipulator arms:** Explain the various applications of manipulator arms in ROV operations, such as collecting samples, manipulating objects, and performing maintenance tasks.

V. ROV Control Systems

- **Types of control systems:** Discuss the different types of control systems used in ROVs, including wired and wireless systems.
- **Control interfaces:** Explain the various types of control interfaces used to operate ROVs, including joysticks, touchscreens, and computer-based systems.
- **Autonomous operation:** Discuss the concept of autonomous operation for ROVs and the challenges involved in developing autonomous control systems.

VI. ROV Design and Construction

- **Design considerations:** Discuss the factors that must be considered when designing an ROV, such as size, weight, power requirements, and mission objectives.
- **Materials and construction techniques:** Discuss the different materials used to construct ROVs and the various construction techniques employed.
- **Safety and environmental considerations:** Discuss the safety and environmental considerations that must be taken into account when designing and operating ROVs.

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VII. ROV Applications and Case Studies

- **Oceanography and marine biology:** Discuss the applications of ROVs in oceanography and marine biology research, including studying ocean currents, mapping the seabed, and observing and collecting marine life.
- **Underwater exploration and archaeology:** Discuss the applications of ROVs in underwater exploration and archaeology, including exploring shipwrecks, searching for lost artifacts, and conducting underwater surveys.
- **Industrial applications:** Discuss the applications of ROVs in various industries, such as offshore oil and gas exploration, underwater construction, and environmental monitoring.

VIII. ROV Maintenance and Troubleshooting

- **Routine maintenance tasks:** Discuss the routine maintenance tasks that must be performed on ROVs to ensure their proper functioning, including cleaning, inspection, and lubrication.
- **Troubleshooting techniques:** Discuss common problems that may arise with ROVs and the troubleshooting techniques that can be used to diagnose and resolve these problems.
- **Safety procedures:** Discuss the safety procedures that must be followed when working with ROVs, including emergency procedures and first aid.