LEARNING GOALS: After the completion of this workshop, students will understand:

1. To design and build an unmanned underwater vehicle that collects data on aquatic environment
2. To analyze, interpret and synthesize data collected from aquatic environments
3. To understand the role that data collection and research play in environmental management

CONCEIVE – What do I wish to accomplish through this project?

This stage involves guiding students in defining the goals of the project, then helping them develop conceptual, technical and action plans to meet those goals while considering the technology, knowledge, and skills that apply. This guidance is provided in the form of Essential Questions that use student’s preconceptions, and misperceptions then move them toward a deeper and more realistic understanding of the process and skills needed to complete the project.

ESSENTIAL QUESTIONS:

1. How can an unmanned underwater vehicle be designed and deployed to collect data in several different aquatic environments?
2. How is data collected in hard to access areas such as underwater?
3. What is the relationship between data analysis and decision making related to underwater environments?
4. How are marine environments surveyed?

NOTES:

DESIGN - How will I accomplish the project?

This stage focuses on creating the plans, drawings and algorithms that describe the product, process or system that will be implemented.

This camp will combine principles from engineering design, data analysis, and inquiry science to allow students to design and implement their own underwater remotely operated vehicle. The ROV will carry a payload designed to collect synchronous scientific data in the field. The research question, method, technical design, deployment, and analysis will be done by student teams of 2-3 participants.

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This camp will occur over 5 days. The first half of the week will entail the engineering, building, and testing of the ROV and the payload design. The second half will be in the field, testing the designs and collection data. Students will also explore the current research and technology being used to research marine ecosystems. They will also have the opportunity to explore SCUBA diving with the option of going on a certification dive.

NOTES:

IMPLEMENT - From an idea to a product!

This stage refers to the transformation of the design into a product. It includes hardware, manufacturing, software coding, testing and validation.

Day 1
- Introduction
- Safety
- Intro to engineering design
- Build and test first underwater ROV

Day 2
- Brainstorm experimental designs and questions
- Prototype the payload designs
- Test payload designs for waterproofness and feasibility
- Final experimental design (variables, analysis, experiment, etc)
- Begin ROV build with payload prototype

Day 3
- Safety and tool check out
- Test ROV design and payload
- Trial experimental runs
- Troubleshoot payload designs
- Field deployment and troubleshooting. Initial deployment will be at one site.

Day 4
- Marine analysis – coral reef research
- SCUBA session
- Field deployment at multiple sites

Day 5
- Data analysis
• Research presentation work
• Afternoon presentation

NOTES:

OPERATE – Does it work the way I planned?
This stage uses the built product, process or system to satisfy the intended goal.

To construct their experiment, students will use:
• PVC ROV build design from ?????
• LEGO Mindstorm bricks for data storage or Vernier Lab Pros
• Vernier lab probes. Probes available will include: pH, temperature, dissolved oxygen, gas pressure, conductivity, colorimetry, differential voltage
• Students may construct a payload from scratch for sample collection (i.e. water sampling, bottom sampling)
• Students will choose 3 locations to sample from
• GIS technology will be used with Google maps

NOTES:

RESOURCES NEEDED – What equipment and supplies do I need?

1 per team of 2-3 students:

• Water proof containers, (Tupperware, otter box, etc)
• Vernier probe depending on experiment
• Construction materials (PVC, neoprene, plastic, other waterproof materials)
• LEGO Mindstorm bricks w/ batteries
• Adapter between Vernier probe and the LEGO brick
• Multiple zip ties
• Underwater ROV build kit
• Silicone caulk and gun
• Lab notebook

For general student use:

• Hand tools
- Power tools – drills, saw
- Knives, scissors
- Hot glue guns
- Various construction materials
- Batteries
- Safety equipment

SET-UP