## Build an ROV for Use in Ecology Research

Lesson plan, Student materials, Teacher notes, Supplemental materials

*Topics*

* ROVs
* Engineering/ Design
* Research

*Resources*

<http://seaperch.mit.edu/build.php> MIT’s Instruction manual to build the ROV from scratch

<http://www.marinetech.org/angelfish-kit/> ROV kit with assembled motors and control box from MATE (Marine Advanced Technology Education)

<http://ngm.nationalgeographic.com/2013/06/125-deepsea-challenge/submersible-interactive>

*BUILD YOUR OWN UNDERWATER ROBOT AND OTHER WET PROJECTS* By Bohm and Jensen

ManyLabs sensors: <https://www.manylabs.org/hub/hardware/>

<http://www.riverwatch.ab.ca/how_to_monitor/do_info-increase.cfm> Dissolved Oxygen information

<http://www.unc.edu/~shashi/TablePages/dissolvedoxygen.html> Dissolved Oxygen Information

*Learning Objectives*

* Students will brainstorm design and draw a blueprint
* Students will construct a working ROV
* Students will apply the scientific method
* Students will test their construction, cycling through trial and error

*Assessment*

* Design your own Submersible Blueprint

*Students must apply what they learned about pressure and depth and the materials used to withstand these conditions in a blueprint of a submersible design. They can be creative but the goal is for them to apply and connect the principles and materials used by engineers to adapt the machines to the physical conditions at depth.*

*Extensions*

* Students will use the ROV to collect samples and test water quality
* Students will investigate and research the ecosystem in order to test their hypothesis
* Students will develop a hypothesis about the health of an ecosystem

*Essential Questions for Extension Project*

* How do Scientists use ROVs for exploration?
* What can the data we collect tell us about the health of an ecosystem?

*Timeline Overview*

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|  | Day 1 (45-50 mins) | Day 2 (45-50 mins) | Day 3 (45-90mins) |
| Activity | Brainstorm ideas for blueprint. Follow guidelines on included worksheet. Can be done as a class or in groups. | Students draw their blueprints. And present them in class. | Students begin ROV Construction. Follow either timeline below. |
| Materials | Worksheet: Design your own underwater craft  Sketch paper; rulers; pencils | Large paper; rulers; protractors; pencils | ROV in a Bag kit/ materials OR materials listed below for full construction |

*Timeline for ROV in a Bag* [*http://www.marinetech.org/angelfish-kit/*](http://www.marinetech.org/angelfish-kit/)

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | Day 1 (45-50 mins) | Day2 ( two 45-50 min.) | Day3 (60-90 mins) | Day 4 (60-90 mins) |
| Activity | Measure and cut PVC to necessary lengths (done by teacher) Assemble ROV frame (see diagram below) | Wire control box ( if it is not pre-wired) | Mount motors and test with battery | Test ROV in pool or pond |
| Materials | PVC pipe and PVC cutter or saw;  Work Gloves  PVC pipe; PVC connector elbows and Ts; diagram of complete frame | Soldering Iron; Solder wire;  Instructions found in *BUILD YOUR OWN UNDERWATER ROBOT AND OTHER WET PROJECTS* By Bohm and Jensen | Motor mounts or zip ties, motors from kit, 12V battery, alligator clips | 12V battery, alligator clips, floatation (I used a foam buoy float), weights, Assembled ROV, extension cord. |

*Timeline: Full construction Refers to MIT’s Seaperch Construction Manual (see link).If you choose to do the* full construction, read the manual for detailed instructions, tools and materials

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| **Goal** | **Time Required** | **Materials** <http://seaperch.mit.edu/build.php> |
| Assemble Vehicle Frame | 2-3 hours | 5 ft. (1.5 meters) of 1/2” PVC pipe,10 1/2” PVC elbows,4 1/2” PVC T’s  15” Plastruct H-beam, 2 Football Floats, 3 Motor Mounts  6 #6 x 1/2”Screws,6 #6 washers, Netting, Tie Wraps (zip ties) |
| Assemble Thrusters | 3-4 hours | Tether wire, Soldering iron, Solder, 3 film cans with caps, 3 12 volt DC motors,3 Bushings, 3 Propellers, Wax bowl ring (1/2 ring), Water  Electrical tape, Butyl Rubber tape, #24 stranded hook up wire, Red  #24 stranded hook up wire, Black, 12 volt battery,  1/2" PVC pipe scraps (~2” or 5cm long),Paper towels,Rubbing Alcohol |
| Assemble Control Box | 6 hours | Control box, 2 push-button switches, 2 toggle switches  2 alligator clips with sleeves (one red one black), Fuse cap wireFuse (10 A slow blow fuse), Speaker wire, 1 loose red wire (#24 stranded hookup wire), 1 loose black wire (#24 Stranded hookup wire), Soldering iron  Drill, 1/4” drill bit, Nut driver, Wire cutter, Wire stripper, Small Phillips Screwdriver |

