ROV Design and Oil Spill Response

PRINCE WILLIAM SOUND SCIENCE CENTER

Agenda

- Introduction to ROVs
- Company teams conceptual design of ROV
- Build ROV
- Peer review of ROV design
- Continue to build ROV
- Poolside rules and challenge review
- Float test in pool
- Challenge competition in pool
- Clean up
- Wrap up

What is an ROV?

- Who can tell me what is an ROV?
- How can ROVs help us in the ocean?
- How do we operate an ROV?

worksheet question

What is an ROV?

- ROV =

  Remotely

  Operated

  Vehicle

- Unoccupied, remotely controlled submersible vehicle
- Used in deep and shallow underwater applications

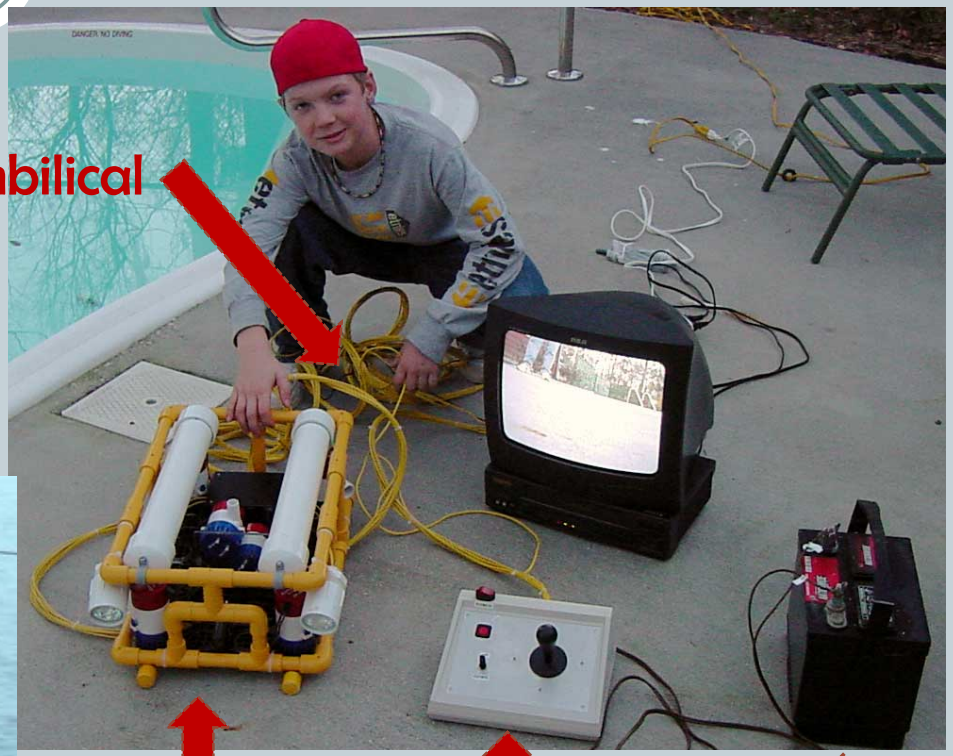
http://uncw.edu/nurc/systems/rov.htm

http://oceanexplorer.noaa.gov/explorations/05arctic/logs/july23/media/dripping_rov.html

What parts does an ROV have?

- Arms/manipulators
- Navigation, GPS, Sonar
- Lights
- Camera
- Collection

- Other specialized tools



Our Arctic is Opening Up

The Arctic is facing major challenges as the ice melts

More shipping, oil and gas exploration happening

An oil spill in the Arctic would be a huge disaster

Many plants and animals would be harmed

http://www.protect-the-arctic.com/

CIDS, Glomar Beaufort Sea II, Japan

What is it like in the Arctic?

- Remote
- Dark
- Extreme weather
- Shallow water
- Ice covered water
  - The ice is often unpredictable
- Freezing conditions

http://coastguard.dodli

http://www.polarfield.com/blog

http://www.alaskadispatch.com/

http://www.arcticscience.org/whyStudy.php

worksheet question

How could using ROVs help us in the Arctic?

worksheet question

Oil Exploration

During a recent exploratory oil drilling mission, the Black Gold Oil Company (BGOC) successfully located an offshore, ice-covered oil reserve and started extracting

Then….

A magnitude 5.5 earthquake struck and part of the pumping equipment separated under the ice

BGOC has contracted your company to build an ROV and:

1) Perform a scouting mission to search for pools of oil trapped under the ice
2) Take a sample from a pool of oil under the ice
3) Return the sample to an analyzing station
4) Transport a piece of surface equipment
5) Respond to the open water spill in the polynya and remove oil from the surface

Agenda

- We are going to build ROVs to "respond" to an oil spill that occurs in the Arctic
- Break into Companies of 3-4 students each
- Study frame designs provided
- Review Points to Ponder
- Design your company's ROV frame
  - You must design your ROV before getting the bag of ROV parts
  - Parts and challenge props are available to study
- Peer review of designs part way through build
- Float test in pool before challenge begins

Your Parts

- PVC pipe (different lengths)
- PVC joints
  - L
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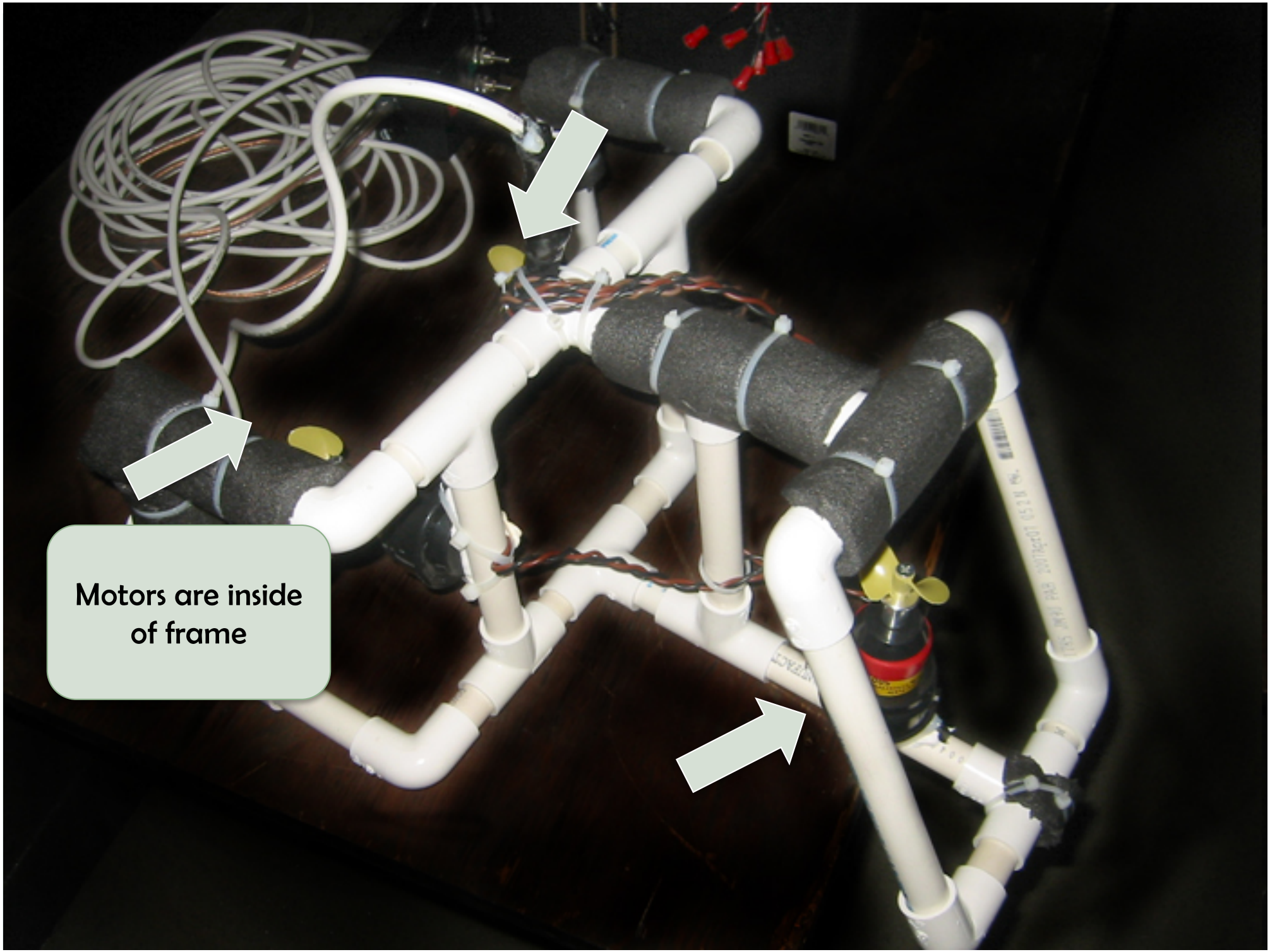
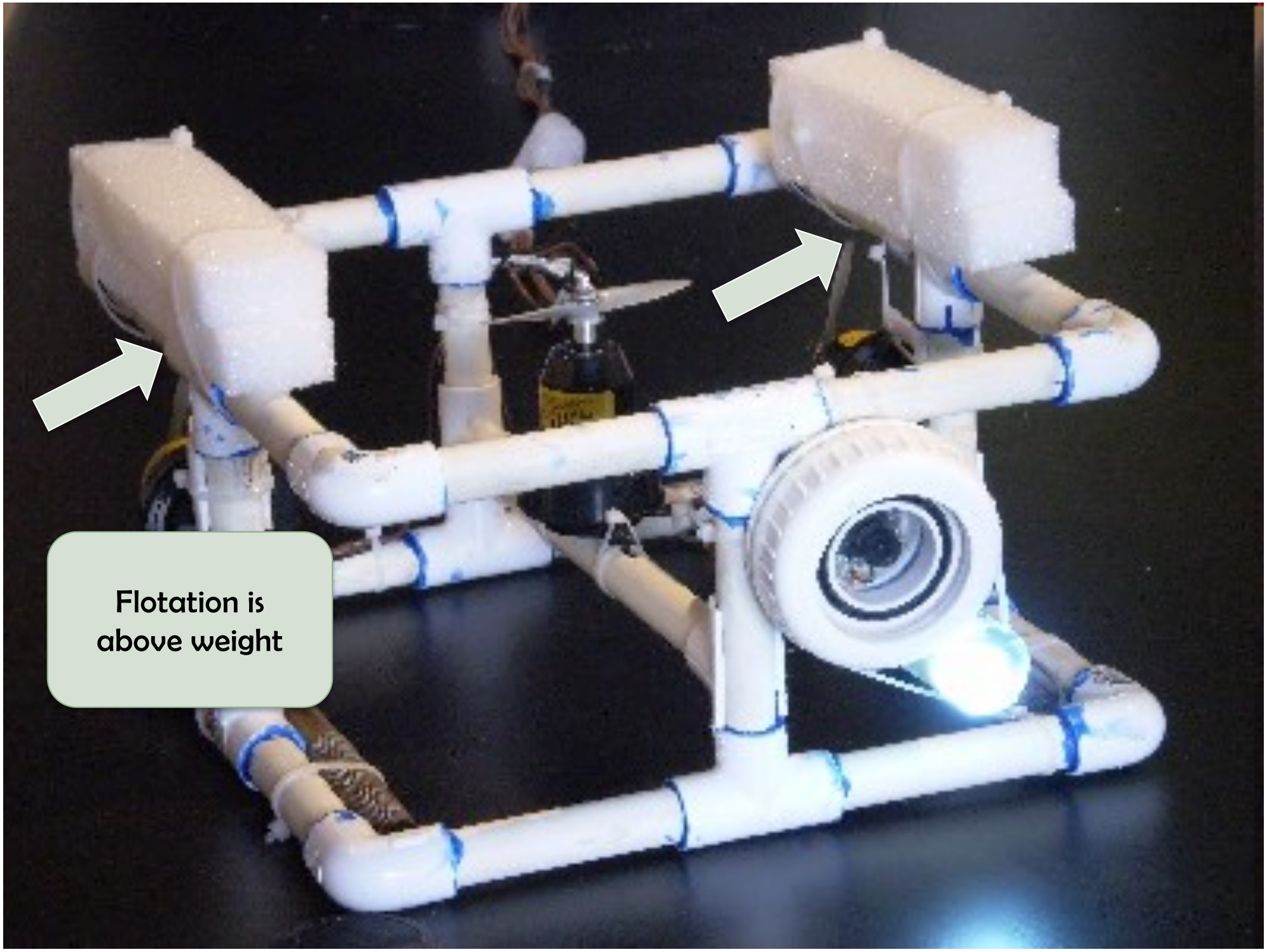
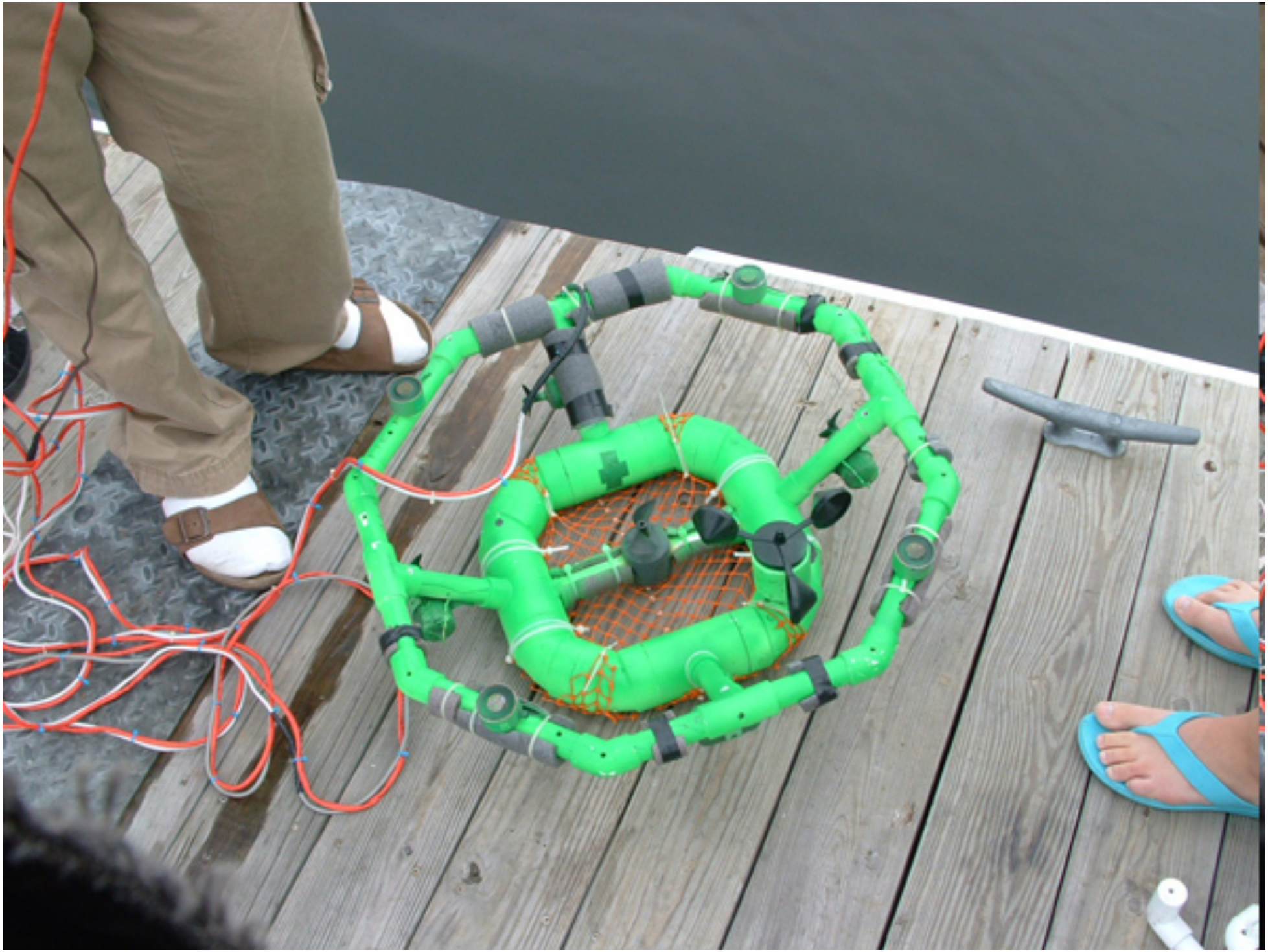
  - —
- 1 control box, umbilical, and set of 3 motors
- Battery and harness
- Foam floatation
- Zip ties
- Electrical tape
- Weights
- Netting
- Clippers
- Pliers



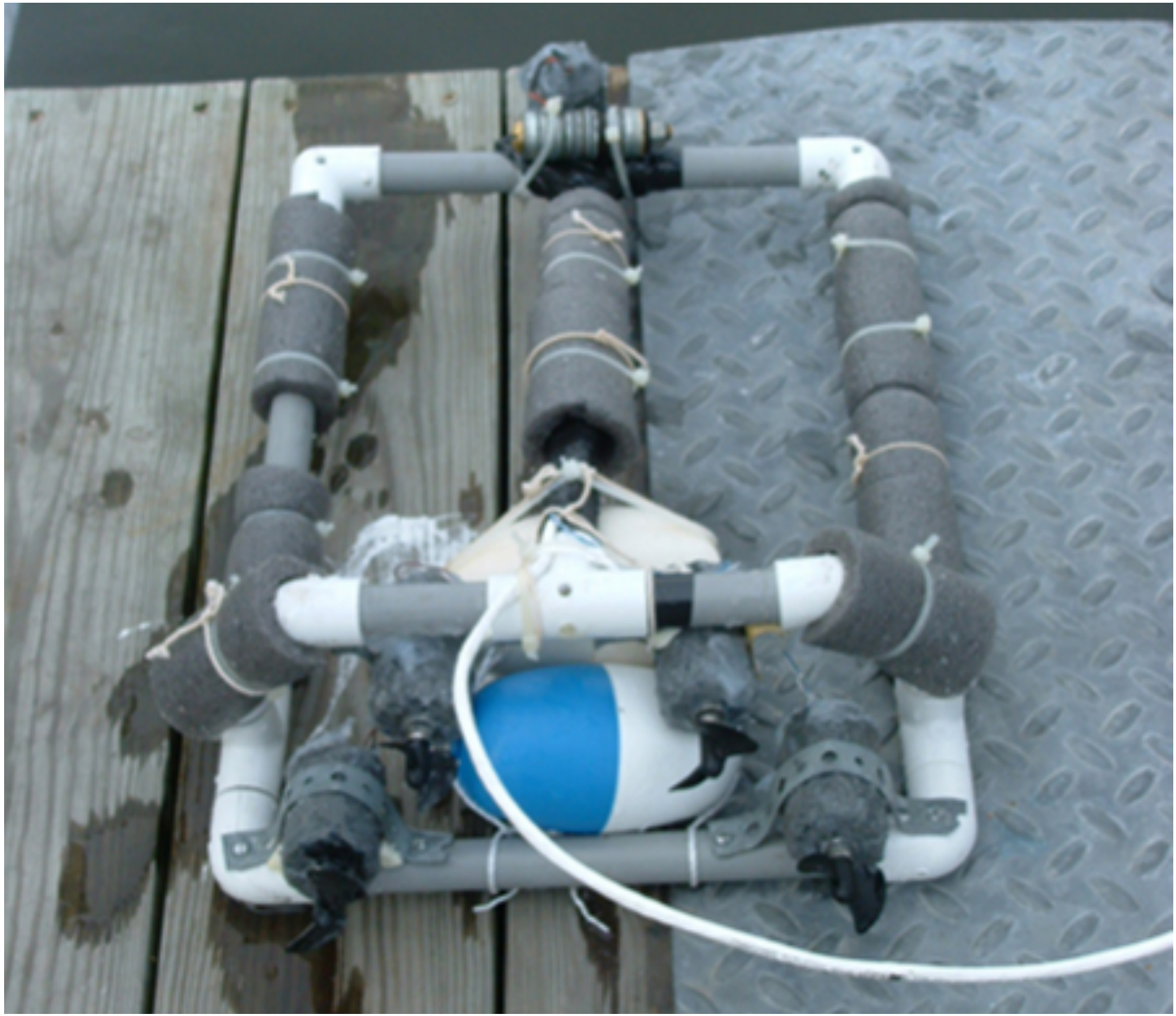
http://www.mbari.org/education/rov/step21.html



http://www.gearfuse.com/build-your-own-underwater-robot/



http://web.mit.edu/seagrant/edu/seaperch/SPGallery/ROV_design_2005/pages/DSCF1207_0101.htm



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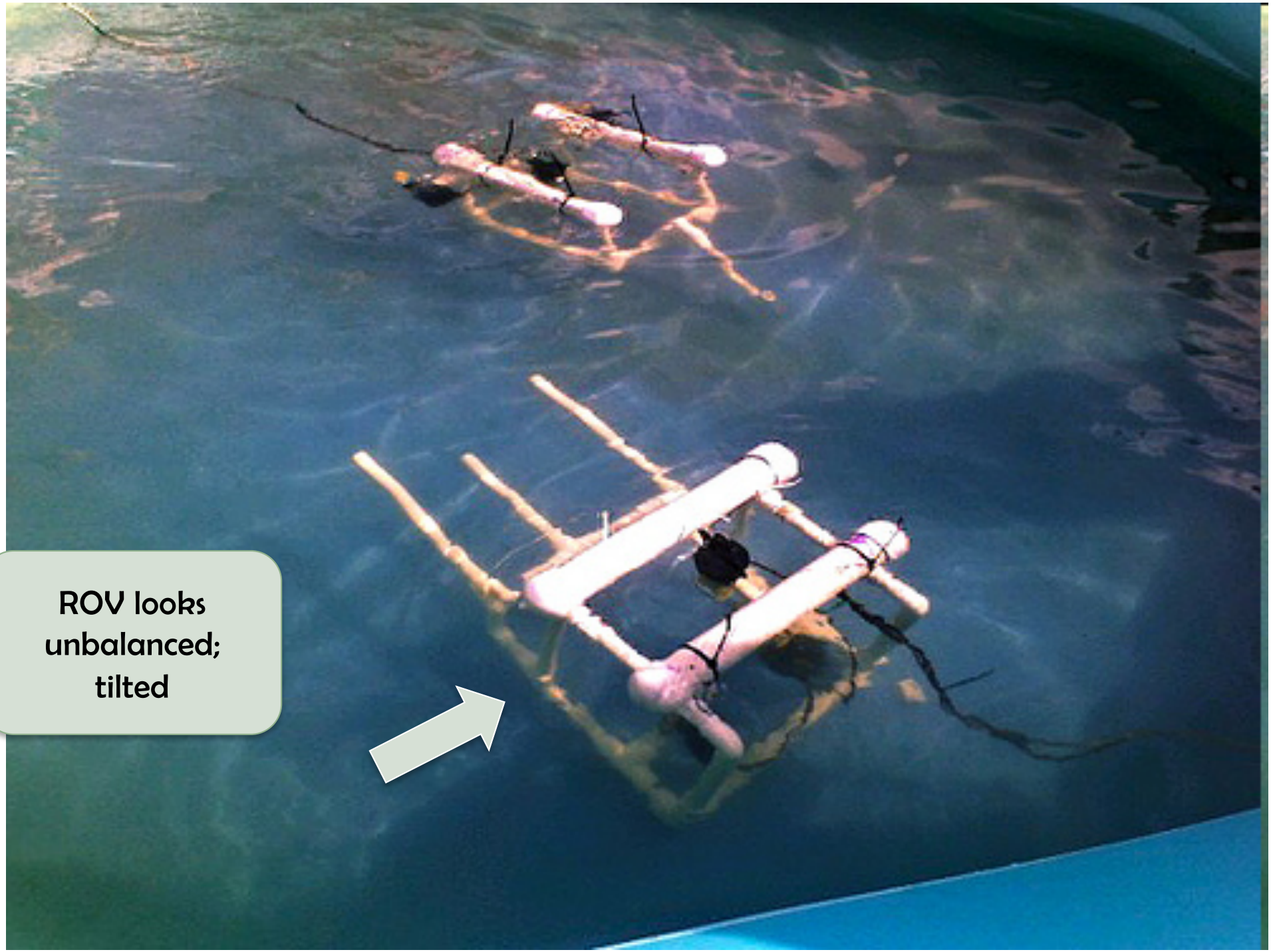
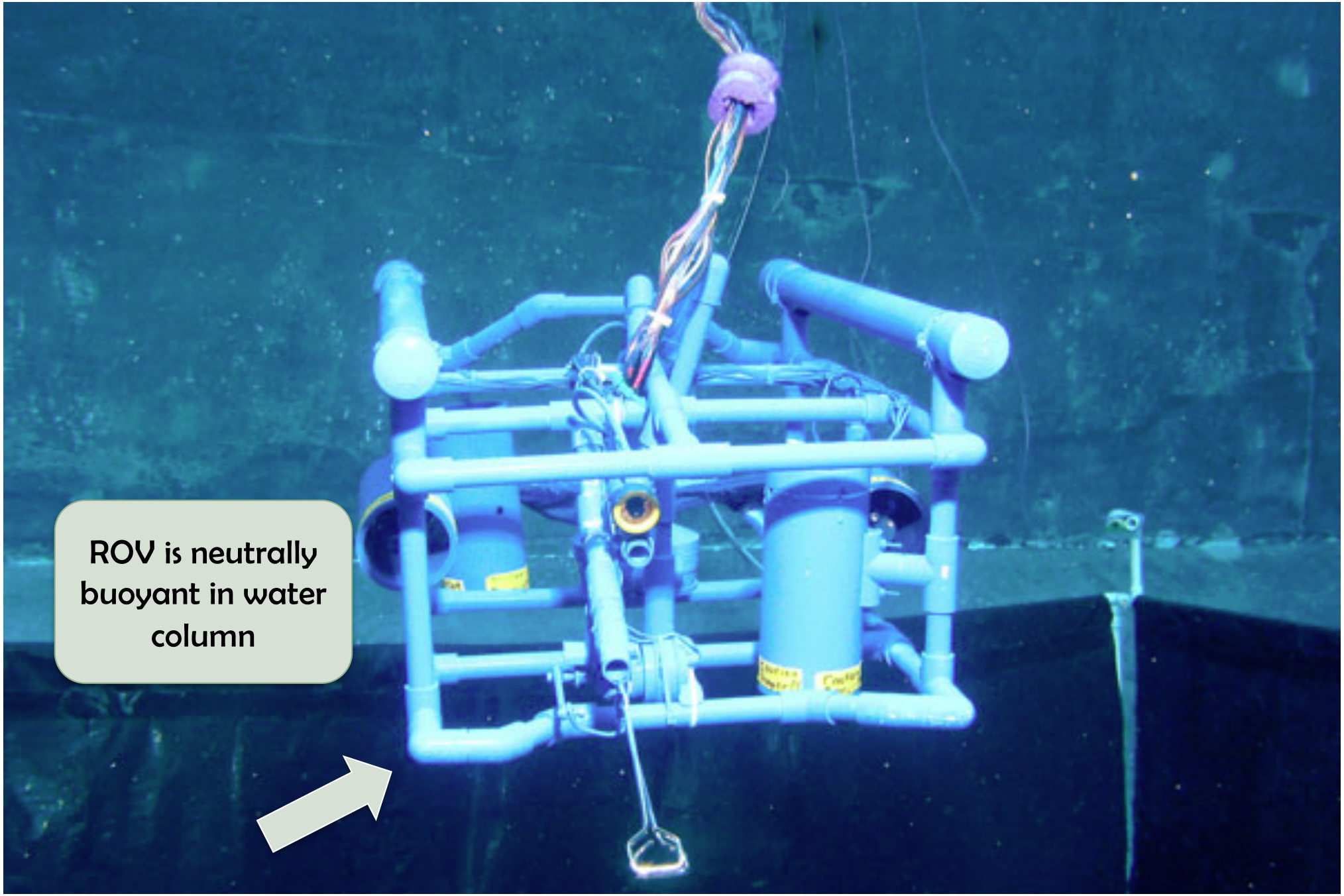
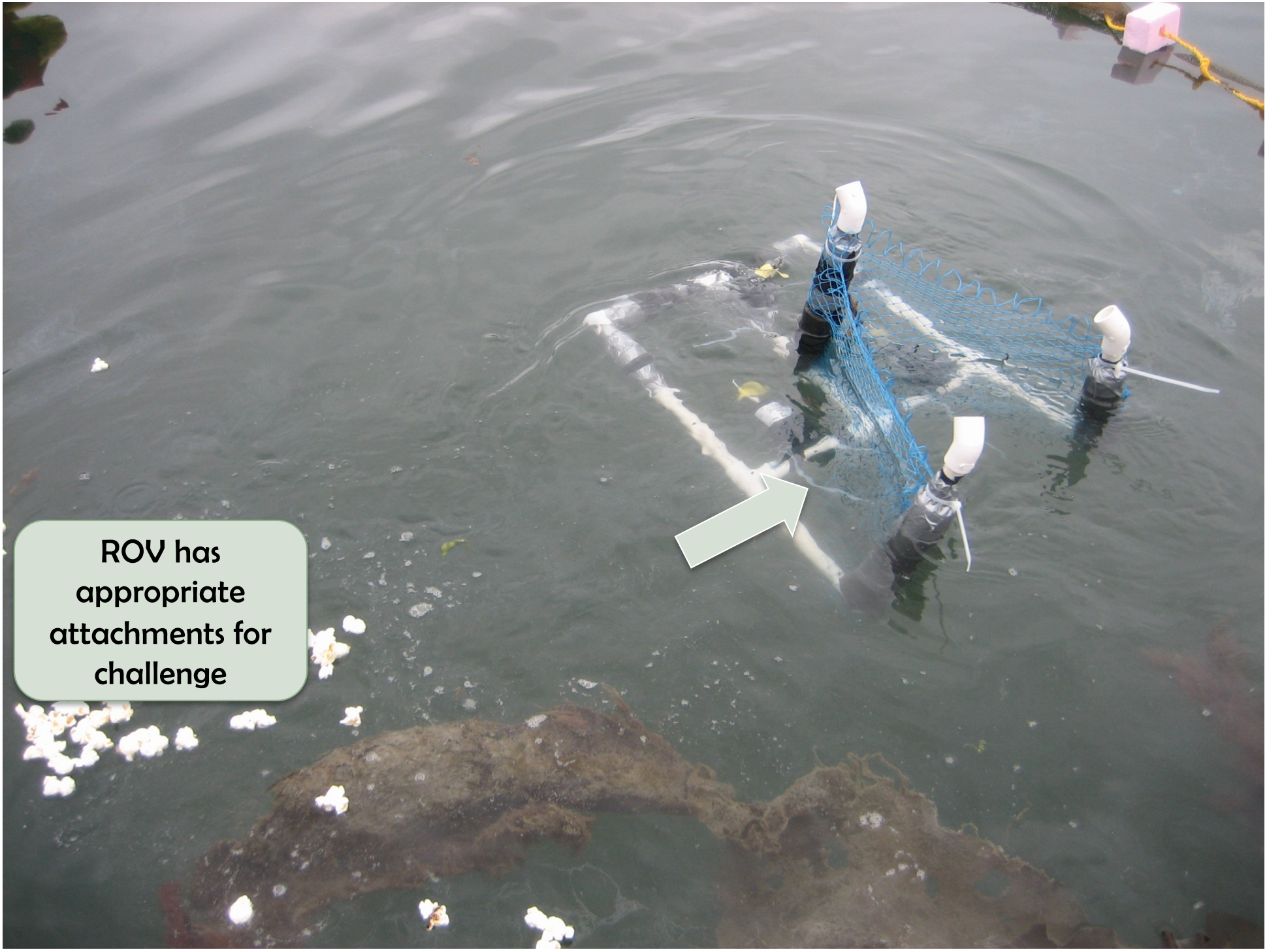


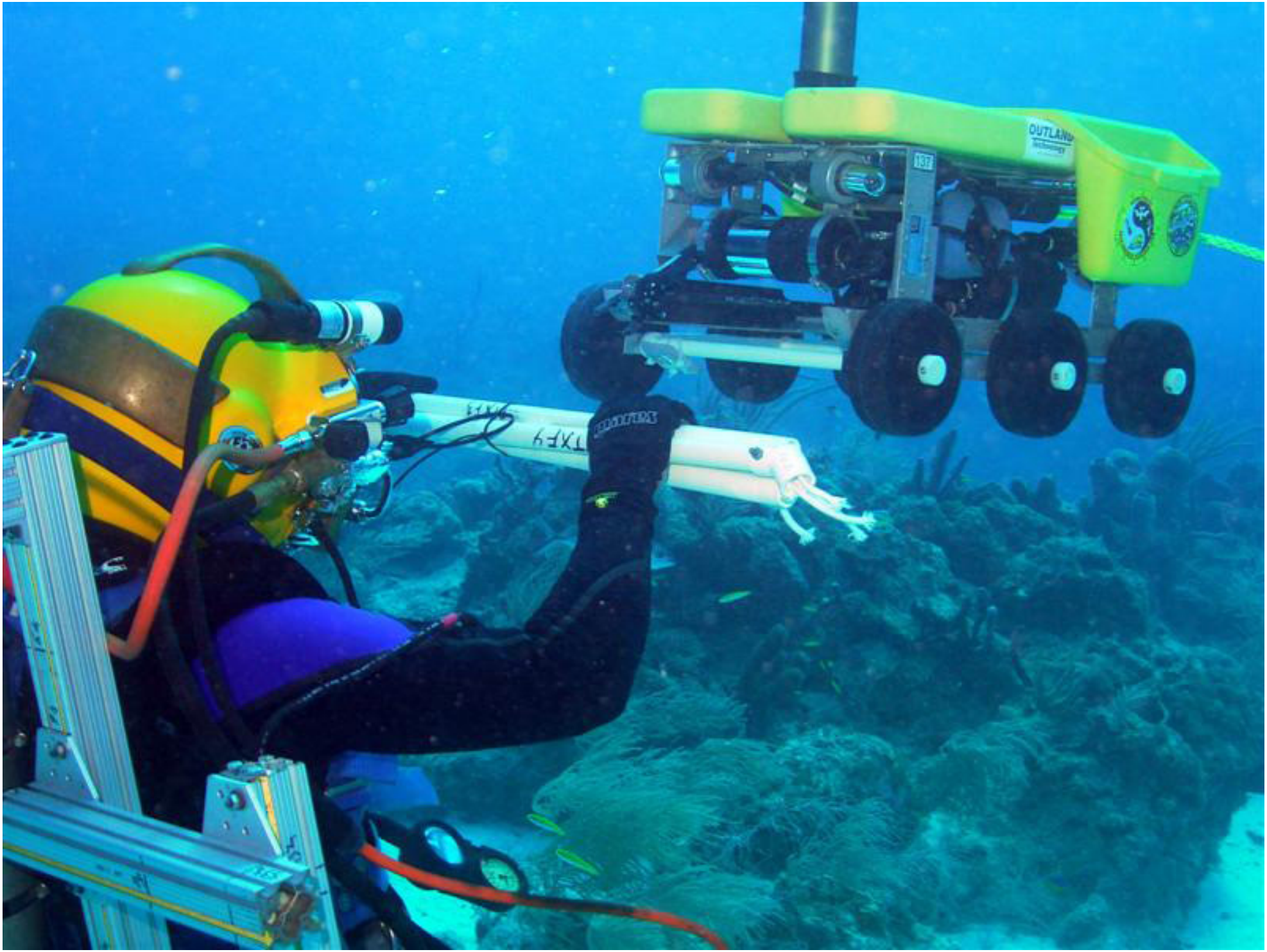
http://farm3.static.flickr.com/2179/1519760291_a9bcb213a6.jpg?v=0



http://www.darkerview.com/darkview/index.php?/archives/240-The-2008-MATE-ROV-Challenge.html


ROV has appropriate attachments for challenge

PWSSC



http://www.asc-csa.gc.ca/eng/missions/neemo9/report.asp

Points to Ponder: Structure

The structure is the frame and keeps the ROV together

- Bigger ≠ Better
- Think of what the ROV must do to accomplish the tasks
- Distribute weight evenly

Points to Ponder: Purpose

- What are the specific tasks of the challenge?
- What shapes/attachments/tools does your ROV need to accomplish the tasks?
- Where in the water column does your ROV need to operate?

Points to Ponder: Motor Placement

- Attach motors with zip ties
- Motors must be completely inside the frame
- Motors must be underwater when the ROV is at the surface
- Up/down motor is best placed as close to the center of the ROV as possible
- Side motors can be placed at front, middle or back of ROV but must be balanced
- If the motors are not balanced, the ROV will tilt
- Test motors so you know which way they spin before attaching them to the frame

Points to Ponder: Buoyancy

- You will use foam insulation for floatation
- Attach floatation with zip ties
- ROV should be neutrally buoyant and balanced
- Think of where your weight is
  - You want floatation over the weight
  - Balance floatation so ROV doesn't tilt or point up/down
- You can attach ballast if needed

Points to Ponder: Operation

- You will be by water – **you are not to go into the water**
- Tether Manager controls tether for the ROV Operator. Operator will pass the control box to Tether Manager when his/her turn is up. The next person in line will become Tether Manager, etc.
- Keep batteries away from water
- Do not drop control box in water

DESIGN YOUR OWN ROV!