OIL SPILL RESPONSE/ROV DESIGN SLIDESHOW WORKSHEET

Name: _____ Date: _____

1. What is an ROV?

   _____

   _____

2. How can ROVs help us in the ocean?

   _____

   _____

3. How do we operate ROVs?

   _____

   _____

4. What are 3 environmental challenges to working in the Arctic?

   1. _____

   2. _____

   3. _____

5. How could using ROVs help us in the Arctic?

   _____

   _____

VOCABULARY

1. ROV

   _____

2. Umbilical

   _____

OIL SPILL RESPONSE CHALLENGE OBJECTIVES AND SCORING

(100 points total)

During a recent exploratory oil drilling mission, the Black Gold Oil Company (BGOC) successfully located an offshore, ice-covered oil reserve and started extracting oil. The location was near a large opening completely surrounded by ice. While BGOC was in the process of pumping oil, there was a magnitude 5.5 earthquake which resulted in part of the pumping equipment separating under the ice. The BGOC had emergency response protocols in place and were able to shut down the pump within one hour, but not before oil was released both under the ice as well as into the large area of open water surrounded by ice.

BGOC has contracted your company to build an ROV and then use it to locate, sample and identify ice-trapped oil, and help with both under-ice and ocean surface response operations:

Task 1: 5 points
Perform a scouting mission to search for pools of oil trapped under the ice.
Simulated by driving the ROV back and forth to a small stationary underwater ring

Task 2: 5 points
Take a sample from a pool of oil in the ice.
Simulated by surfacing the ROV inside a large floating ring and holding position for 5 seconds

Task 3: 10 points
Return sample and have it analyzed.
Simulated by positioning the ROV in front of a stationary underwater square and holding position for 5 seconds

Task 4: 20 points
Deliver a piece of equipment inside an underwater work station.
Simulated by flying ROV through a large stationary underwater ring (**5 points**), picking up an underwater small ring (**5 points**) and depositing small ring on a PVC arm (**10 points**)

Task 5: 10 points
Transport floating equipment**.**
Simulated by throwing a beach ball out onto water's surface and returning it using the ROV

Task 6: 25 points
Respond to an open water surface oil patch in a polyana**.**
Simulated by gathering and removing floating popcorn/ping-pong balls from the water's surface

Teamwork: 25 points
All team members participate in designing, building, and breaking down the ROV (***10 points***). All team members drive ROV during challenge (***5 points***). Team members give each other positive encouragement (***5 points***). Team members observe and obey all safety rules (***5 points***). Team members bicker, argue, or act with disrespect ***(-5 points***).

In Water
Teams will have 15 minutes to test their ROVs in the water and make any changes to buoyancy, attachments, etc. Once the competition starts teams will **lose 5 points for each pool-side modification** to their ROV. Please do not pull the tether to speed recovery of items; teams will **lose 5 points each time they pull the tether**. There will be a "seal" in the water to help recover tangled machines however a team will **lose 5 points if they use the seal**.

COMPANY NAME:
_____

TEAM MEMBERS:
_____

Draw your ROV design below.

Approved by Teacher _____

POINTS TO PONDER WHEN DESIGNING ROVS

STRUCTURE
The structure is the frame and keeps the ROV together

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

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 (at the surface or down in the water?

MOTOR PLACEMENT

- Attach motors with zip ties
- The propellers should not be able to hit a wall or floor
- 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
- Test motors so you know which way they spin before attaching them to the frame

BUOYANCY

- You will use foam insulation for flotation; flotation goes over weights.
- Attach floatation with zip ties
- The top of the ROV should float level just at the surface; floatation needs to attach on the top of the ROV.
- 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 (additional weight) if needed

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

"Points to Ponder" adapted from "What works, what won't: 10 rules for designing a sub" in Build Your Own Underwater Robot by Harry Bohm and Vickie Jensen.