3rd Annual Eastern Shore Boat Engineering Challenge Rules

https://www.umes.edu/Tech/Pages/Eastern-Shore-Crab-Boat-Engineering-Challenge/

Sponsored by:
The University of Maryland Eastern Shore
The University of Maryland Center for Environmental Science
Kelvin® Educational

Grades:
9-12

Information/Rules Meeting:
November 6, 2017 from 4:00-5:00pm

Coaches Design/Build Workshop:
January 15, 2018 from 4:00-5:00pm

Registration Deadline with Names of All Team Members:
March 2, 2018 (submit to tslove@umes.edu)

Written Report and Design Drawings Due:
April 6, 2018

Competition Date:
April 2018 (TBA) from 11am-2pm at the University of Maryland Center for Environmental Science in Cambridge, MD. Directions available here.

Team Size:
Minimum of 4 but no more than 10 students.

Challenge Scenario:
Design, develop, build, and demonstrate a radio-controlled scaled model of a boat (student's can choose any boat design) intended to navigate between markers and rescue a floating object within a Chesapeake Bay location. The boat will be required to travel through a series of floating PVC markers worth various points (narrower markers are worth more points) within a specified amount of time. The boats will also have an opportunity to perform a separate rescue mission by carrying two baskets of supplies (32 ounces) to a stranded raft and tow it back to the starting point.

Boat Specifications:

The model must be scaled 1"=1-'0" (1:12) and conform to the following specifications:

- Any boat design is acceptable and the hull may be constructed of any rigid material.
- Boats may inadvertently contact (strike) each other, so ability to withstand minor collisions is a worthwhile (necessary) consideration – as is the watertight integrity and cushioning of the radio receiver/battery compartment.
- Propulsion will be provided by one electric motor and battery (specified below) operating at no more than twelve volts.
- Boat hull measurements must meet the following:
    - Length: No less than 24" but no larger than 40" including rudder and prop (remember must be able to carry two baskets securely).
    - Beam: No less than 8" but no larger than 12"
    - Maximum draft of the hull itself is not to exceed 2" when empty
- Boat Motor and Propeller specifications are:
    - Motor 9-12 VDC
    - 12,500 RPM
    - High Torque Kelvin # 850962
- Vessels must be painted or marked for identification with team name – and the quality of workmanship and finish will be a factor in judging. The model will be judged on how similar it looks to the full-scale boat design researched and presented in the student's design portfolio. (Use images to show what an example of the real-life boat looks like.)
- The boats will be judged on their reliability to complete the competition while incurring as little damage as possible to the structure and function.
- Boats may lose points for purposefully striking other vessels.
- Failure to adhere to the above requirements will result in significant loss of points.
- It is recommended but not required that each team provide a floor stand for their boat model, high enough to permit working on their entry during the challenge.

Required Boat Elements:

- The design does not have to include a full deck; supply baskets can (and for stability should) be stacked continuously up from the keel and may extend above the gun wales (upper edges of the hull), provided they are at least 1 inch below the top of deck Cabin.
- The boat must have a cabin that occupies at least 10% of the hull overall length. This cabin must extend 5 inches above the deck and at least 1 inch above the top layer of the supply baskets. No cargo may be loaded in way of the cabin.
- At least 35% of the length of the hull must be free of supply baskets. Room for workspace and rescue workers must be provided. This space may be split between the cabin and the rest of deck to be used for mechanical and/or electronics and battery access.
- The supply baskets which will be used are suet bird feed containers measuring 1-7/8" high x 5" wide x 5-1/4" long. They will be filled with 6 -8 large pebbles simulating life saving supplies; and when filled they must weigh approximately 16 ounces (450g) per basket. **Two containers should be provided by each team** and brought to the event.

Performance Demonstration Expectations:
The boat must demonstrate its maneuverability and speed by passing in between as many PVC markers as possible in the allotted amount of time. Boats cannot pass through the same marker more than two times to count for points. The second competition is the rescue portion in which students must load two baskets (32 ounces total) and transport them to a stranded raft (7" x 7") which is also carrying one basket (16 ounces) of people. Teams will then be expected to push the raft back to the specified starting point in as little time as possible. The open water course is approximately 350'. Supply baskets must be loaded prior to the launch of the boat.

Upon arrival at the competition site and after the judges' examination of their entry, each team must develop a plan for the speed and rescue competitions. Once in the water, each boat will perform a run getting underway from a launch ramp and maneuvering back to the ramp. The goal will be to have the most points in the speed competition, and the fastest time while still safely delivering the raft to shore (may not be capsized or lose the people [basket] on the raft) in the rescue competition.

For the rescue competition the boat must have adequate stability when fully loaded. This is important – test it before the challenge date! Stability is demonstrated by:

- Calculating metacentric height (GM) in excess of 7.5' (3/4") by placing a one lb. weight 4" on either side of the centerline and showing no more than 3 degrees of heel, OR
- Having a roll period (left – right – back again) of less than 2 seconds.

In evaluating the various trade-offs that must be made during the design phase, keep in mind that the course will be a few hundred feet long, and will be in the Chesapeake Bay, subject to whatever weather Mother Nature decides to deliver unlike a swimming pool or testing tank. Remember the objective is to model a boat that can reliably maneuver between markers, and transport supply baskets within the course. Speed is essential, but the key is control given the various factors discussed above.

Written Report and Drawings Criteria:

Evaluation Criteria:

Design/Written Report	20 points
Design and Construction	30 points
Oral Report (at event)	15 points
Performance Demonstration	35 points

*The format for the design and written reports as well as a judging rubric are provided on the website to help guide teams in developing these documents.

For More Information:
Please contact Dr. Tyler Love, Associate Professor/Coordinator of Technology and Engineering Education at the University of Maryland Eastern Shore – tslove@umes.edu or (410) 621-3448

Good Luck To Your School!