Design Requirements for an ROV for Marine Science Education

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Abstract

Commercially available remotely operated vehicles (ROVs) on the market today typically fall into one of two

Figure 2

to the University of New Haven, it was also decided to limit the ROV to a maximum depth of 320 feet (the maximum depth of Long Island Sound). A solid model of the prototype design is shown in Figure 6.

Figure 6
Prototype ROV solid model

Frame

In designing the frame, the use of metal was avoided, where possible, to minimize weight and cost. This was also considered to be advantageous due to the corrosive properties of seawater. PVC was originally considered as a possible frame material, as it is highly corrosion resistant and will easily withstand the pressure at this depth. However, it lacks rigidity, and it was expected that a PVC frame might experience twisting when the vehicle was lowered into or lifted out of the water. In light of this, fiberglass was selected as an alternative. Although it is more expensive than PVC, it is still economical, and its rigidity, corrosion-resistance, and workability are attractive. The frame is designed to have a small footprint (2 ft x 1.5 ft x 1.5 ft) and to provide numerous attachment points for instrumentation.

Buoyancy

The ROV was designed to be slightly positively buoyant. Although this means that the ROV will require power to sink, it also ensures that the ROV will float to the surface in case of malfunction. Foam floats coated with a marine paint are located on the top of the vehicle to provide positive buoyancy. Trymer 2000 insulation is selected as the float material, as it is readily available on the University of New Haven premises and exhibits good density and water absorption characteristics. The floats are countered by a ballast that the user can adjust according to the amount of instrumentation equipped on the ROV to provide the desired buoyancy.

Pressure Vessel

A pressure vessel is installed in the ROV to house the onboard electronics and camera. A length of 6 inch Schedule 80 PVC is selected for the pressure vessel body, with an acrylic dome capping one end to provide a window for the camera.

Camera

The camera selected is an HD 720p wing camera, originally designed to be mounted on a remote control airplane or glider. This device offers up to three hours of high quality video which can be easily streamed to a computer in real time. It is mounted on a LynxMotion micro pan/tilt system, which allows the user to orient the camera precisely.

Propulsion

A thruster specifically designed for ROV use, the CrustCrawler High-Flow 400HFSL, was selected to provide propulsion. Although these are quite expensive, they grant significant benefits to the ROV in terms of thrust, maintenance, and reliability. To reduce the cost, it was decided to minimize the number of thrusters used on the vehicle. The ROV is required to move forward and aft, and

work will eventually produce a valuable teaching aid for marine science departments.

References

[i] RMS Titanic. (n.d.). Retrieved September 7, 2013, from