New Housing Structure for Deep-Sea Equipment

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Abstract

Florida State's Earth, Ocean, and Atmospheric Science group currently has a tether-operated vehicle (TOV) that has too much empty space, is too heavy, is difficult to move around, and does not tow parallel to the ocean floor. The goal for this project is to design and fabricate a new frame for FSU's TOV to address these issues.

Project Definition

- Objectives
  - Maximize footprint area
  - Reduce weight
  - Maintain level towing angle, passively
  - Minimize height
  - Increase mobility
- Constraints
  - $2,000 budget, flexible if necessary
  - Corrosion resistant
  - Hold all necessary equipment
  - No extra power consumption
  - Impact resistance

Stress Analysis

- Equipment loads applied mid beam: 500lb
- Drag loads applied on frontal beams: 784lb (overestimated)
- Constraints applied at tether points
- Max stress of 860 psi
- Max deflection of 0.007 inch
- With Aluminum 6061's yield stress, safety factor of 47

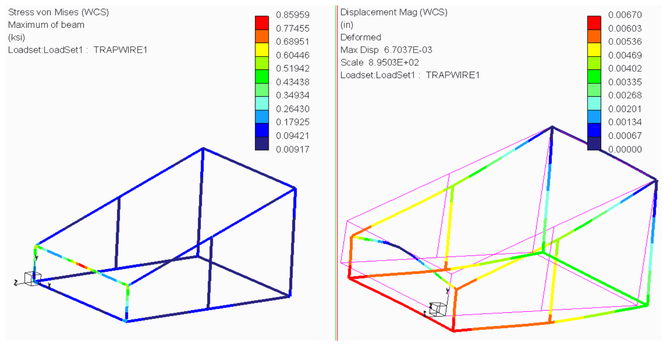

Fig 1. Left: Stress Analysis (psi)Right: Deflection Analysis (inch)

Design

- 2-3/8 inch outer diameter, 0.218 inch thickness
- Aluminum 6061
- Reduced average height
- Increased footprint area
- Plastic side surfaces are added for reduction in yaw and translational motion
- Feet are added for safety and ease of attachment of wheels

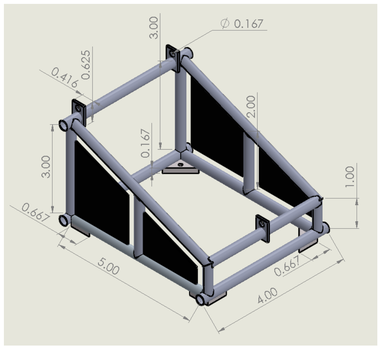

Fig 2. Final design with added auxiliary attachments (feet)

Experimental Techniques

Features such as side surfaces, fins, and holes are added to the model throughout testing to determine best way to keep constant orientation.

- Models made from steel
- Cable for bridle: fluorocarbon line
- Cable for tow: Half-inch braided steel cable
- Model dragged in pool in front of grid back drop to see if parallel to lines.

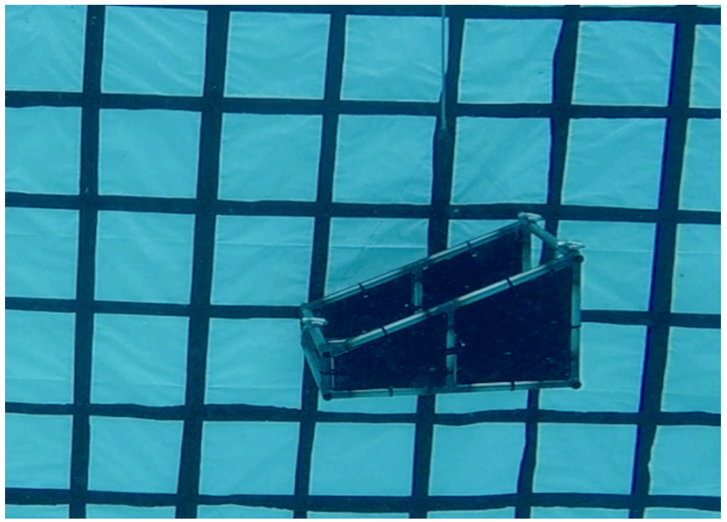

Fig 3. Trapezoidal model testing in front of grid backdrop to analyze tilt. This image is from a successful test.

Results

- Exploited a maximized footprint area while reducing unnecessary volume.
- With preset bridle cable lengths, the TOV towed straight while maintaining a level towing angle.
- Top surfaces diminished the straight tow gained by side surfaces .

Financial Breakdown

The following pie chart is a financial break down of the final prototype cost.

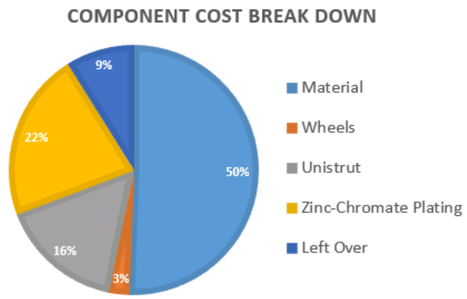

Fig 4. Pie chart showing financial breakdown

Table 1. Itemized component cost

Component	Use of Funding
Material	$1,016
Wheels	$54
Unistrut	$322.00
Zinc-Chromate Plating	$440
Left Over	$178

Future Work

- Order Full Scale Material
- Machine Full Scale TOV
- Attaching deep-sea equipment to frame
- Full in water submersion

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