Project Update

GROUP 21: NEW HOUSING STRUCTURE FOR DEEP SEA EQUIPMENT

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Introduction

- Tether Operated Vehicle (TOV)
  - Purpose is for surveying and exploring
  - Vehicle is dragged behind ship using tether
  - Holds data collecting equipment
  - Winch and pulley system control TOV altitude

- Florida State's TOV
  - 3 feet x 3 feet x 3 feet galvanized steel frame
  - Cruises very slowly at about 2000 meters under water
  - Currently has 17 pieces of data collecting equipment
  - Weighs approximately 900 pounds with all equipment

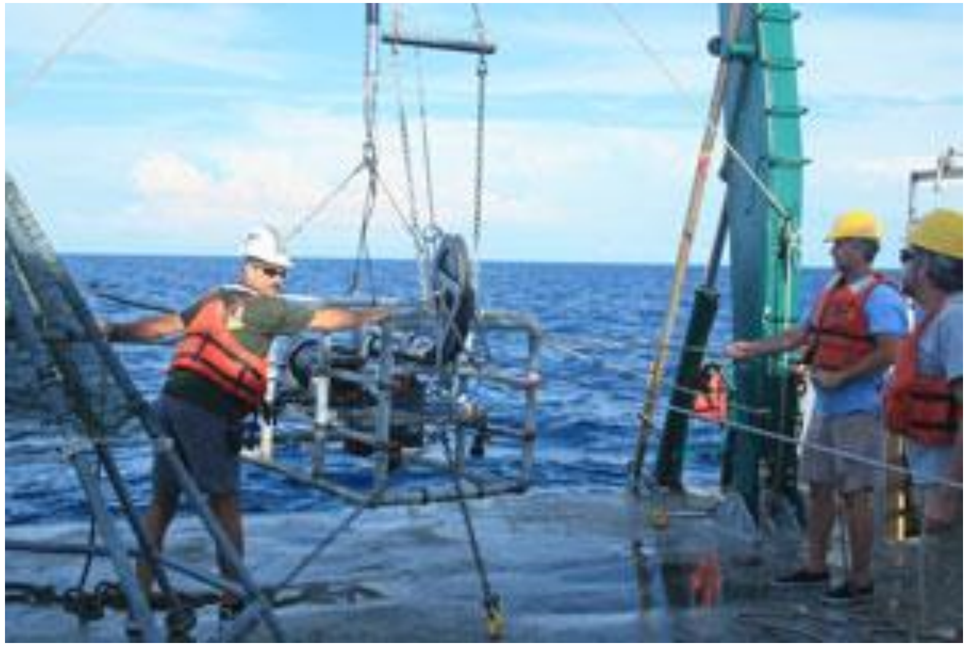


Figure 1: FSU TOV being loaded into water

Review Scope

Problem Statement: Florida State University's (FSU) current tether operated vehicle (TOV) (seen in Figure 2) has too much empty space, is too heavy, is difficult to move around, and does not tow parallel to ocean floor.

Project Scope: Update FSU's current TOV to address above issues.

Figure 2: FSU's current TOV

Objectives and Constraints

Project Objectives

- Maximize footprint area
- Reduce weight
- Increase modularity
- Maintain level towing angle, passively
- Minimize height of new frame

Project Constraints

- $2,000 budget, flexible if absolutely necessary
- Corrosion resistant
- Hold all necessary equipment
- No extra power consumption
- Modular - Components can move around the frame
- Impact resistant

Accomplished Last Semester

Background Research

Decided experimental analysis technique

Designed 4 possible designs

Narrowed down to 2 designs

Built the 2 scaled models

Material Selection

Began testing models

Background Research

University of South Florida Design

- C-BASS (The Camera-Based Assessment Survey System), seen in Figure 3
- Operating Depth: 250 meters
- Surfaces on sides and bottom promotes a straighter tow
- Taper and smooth edges
- Modular Design

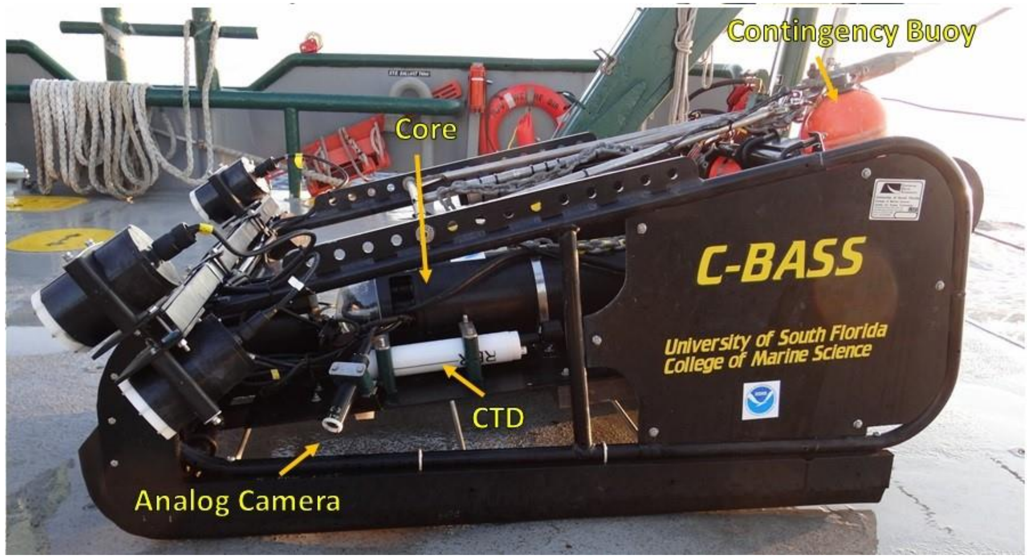


Figure 3: USF's vehicle, the C-BASS

Background Research

University of Mississippi Design

- Cylindrical design with inside support, seen in Figure 4
- Operating depth: 2000 meters
- Single connection point raises concerns with consistent orientation and footprint
- Would require much more volume for oceanography equipment

Figure 4: UM's vehicle, cylindrical shape

Design Concept 1

Advantages

- Square footprint maximizes area
- Allows all equipment to have a clear line of sight to ocean floor
- Low height will promote ease in deployment and retrieval

Disadvantages

- Increase in footprint will lead to an increase in volume

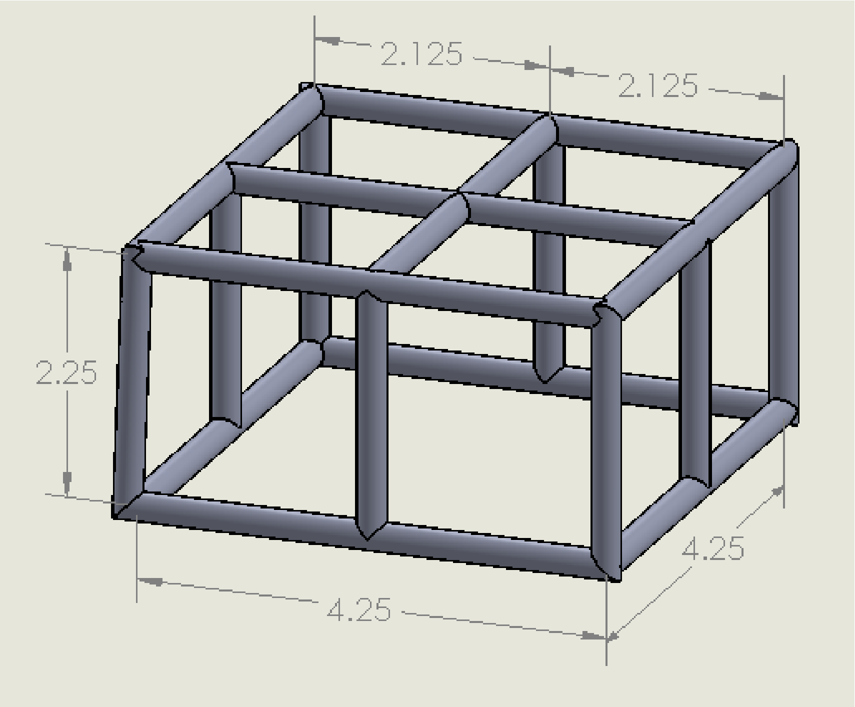


Figure 5: Design concept #1, units in feet

Design Concept 2

Advantages

- Footprint area larger than current TOV
- Allows all equipment to have clear view of ocean floor

Disadvantages

- Weight distribution could be uneven
- Smaller footprint area than design concept 1

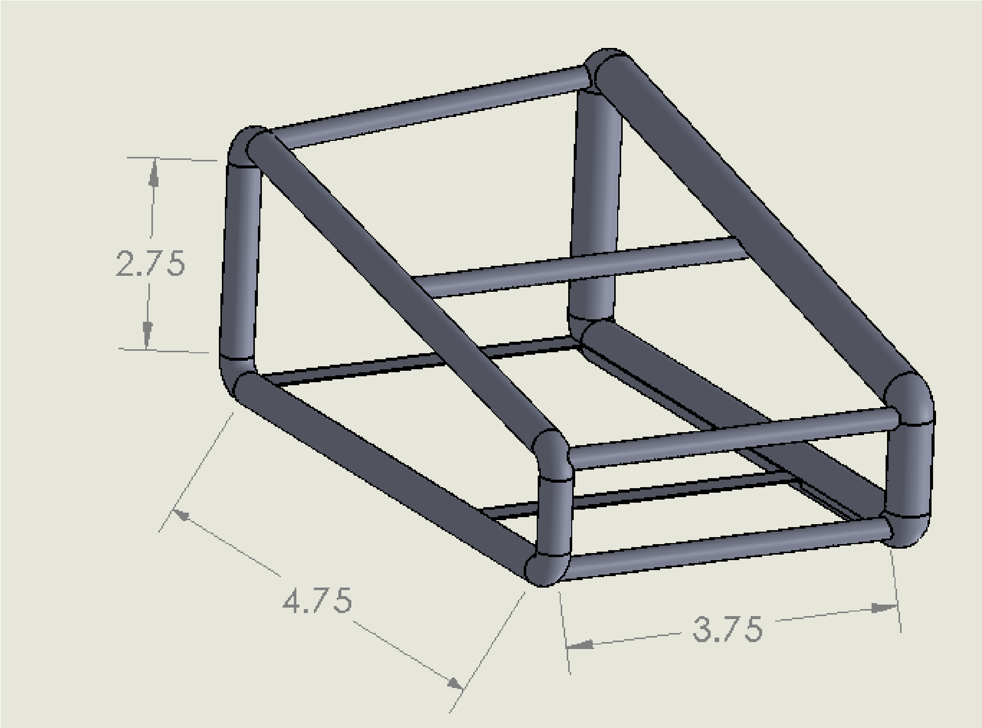


Figure 6: Design concept 2, units in feet

Analysis Techniques

- Computer Simulation
  - Advised by professor that simulation would be too complicated

- Experimental Models
  - Vehicle Behavior
  - Water Effect
  - Tether Location
  - Geometry Effect

Figure 7: Flow Flume in physics building

Models

- Base Design
  - Features such as side surfaces and holes will be added to the model throughout testing to determine the best way to keep constant orientation
  - The connectors and main surfaces are made from aluminum and press fitted together
  - Holes added for varying cable placement

- Cable for model: fluorocarbon line for ease of placement and attachment. Steel cable attached

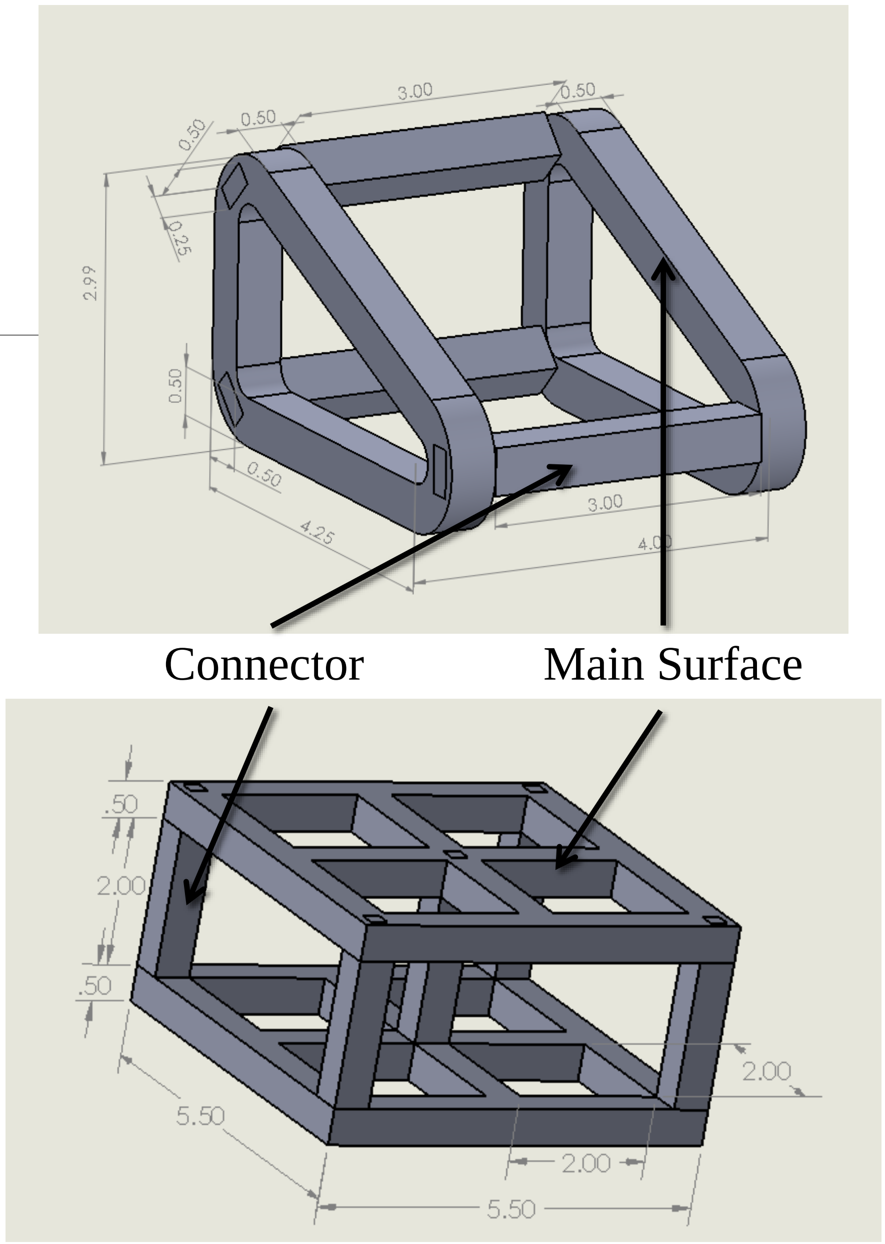


Figure 8: Square and triangular models, units in inches

Testing Models

What are we testing for?

- System Stability
- Bottom surface parallel to ocean floor
- Roll, yaw, and pitch of the structure

Optimal connection sites for tether connection

- Significant influence on rotational tendencies

Testing Models

- Model testing was successful
- Unfortunately, these models do not give completely accurate information
- New models are being made
  - Circular cross section hollow piping

Video

Material Selection

- Thorough analysis was conducted to determine adequate set of materials to choose from
- Materials were excluded based on constraints of mass, ability to withstand impact, as well as hold the weight of the components and the tethered force
- Additional limitations included the isolated consideration of nonferrous materials
- Finally, a cost analysis was performed based on sizing
- This resulted in the selection of Aluminum as our structure's material

Potential Challenges

- Time
  - Ordering materials, variable shipping time
- Location of cable attachment
- Possible Risks
  - Safety concerns during machining and assembly
  - Risk during deployment and retrieval while hanging from cable
  - Wheels: risk having large weight on wheels, could be uncontrollable on unstable boat

Current Estimated Budget

Table 1: Table showing various expenses for project

Expenses	
Current Models	Out of Pocket
New Models	$100 - $ 250
Full Scale Materials	$900 - $ 1,100
Fabrication	$200 - $ 300
Total Cost	~$1,650
Budget	$2000
Remaining Budget	~$350

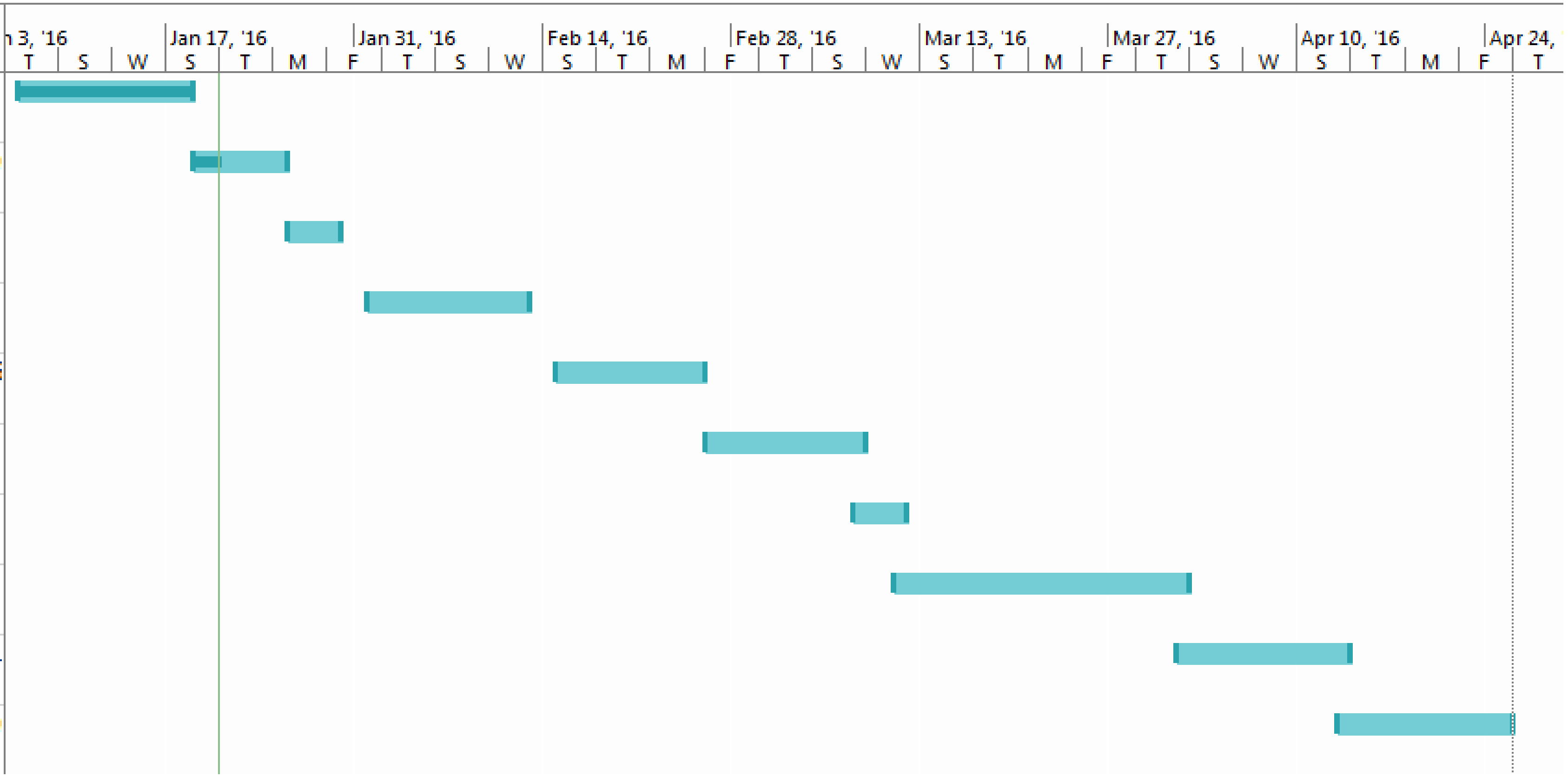
Future Plans

- Machine new cylindrical hollow models
- Test new models
- Choose best design
- Machine full scale design
- Attach data collecting equipment
- In water submersion test
- Application in cruise

Gantt Chart

Table 2: Gantt chart outlining the upcoming plans for the project

ID	Task Name	Duration	Start	Finish
1	Complete Original Model Testing	9 days	Wed 1/6/16	Mon 1/18/16
2	Design New Models	5 days	Tue 1/19/16	Mon 1/25/1
3	Order Material	4 days	Tue 1/26/16	Fri 1/29/16
4	Send For Cutting	10 days	Mon 2/1/16	Fri 2/12/16
5	Machine/Assembly	9 days	Mon 2/15/1	Thu 2/25/16
6	Test New Models	8 days	Fri 2/26/16	Tue 3/8/16
7	Design Full Scale Model	4 days	Tue 3/8/16	Fri 3/11/16
8	Order Full Scale Material	16 days	Fri 3/11/16	Fri 4/1/16
9	Send For Cutting	9 days	Fri 4/1/16	Wed 4/13/1
10	Machine/Assembly	9 days	Wed 4/13/1	Mon 4/25/1



Conclusion

- Project Overview
  - Design new TOV

- What was accomplished last semester
  - Material selection
  - Design concept selection
  - Model design/build/test

- What has been done since last semester
  - Completion of model testing

- Upcoming plans
  - New hollow circular models
  - New tests
  - Final Design

References

[1] "The Camera-Based Assessment Survey System (C-BASS) - USF College of Marine Science." The Camera-Based Assessment Survey System (C-BASS) - USF College of Marine Science. N.p., n.d. Web. 24 Sept. 2015.

[2] "UM Scientists Help save the Day with I-Spider." The Daily Mississippian. 10 Oct. 2013. Web. 24 Sept. 2015.

[3] "Deep-C Consortium: Voices from the Field: Geomorphology Cruise aboard the RV Weatherbird II." Deep-C Consortium: Voices from the Field: Geomorphology Cruise aboard the RV Weatherbird II. N.p., n.d. Web. 24 Sept. 2015.

[4] Macdonald, Ian. "Asphalt in the Seep Ecosystem." Deep-C Consortium. Deep-C Consortium, 2004. Web. 15 Nov. 2015. <https://deep-c.org/news-and-multimedia/in-the-news/asphalt-in-the-seep-ecosystem>.

Questions, Comments, or Concerns?