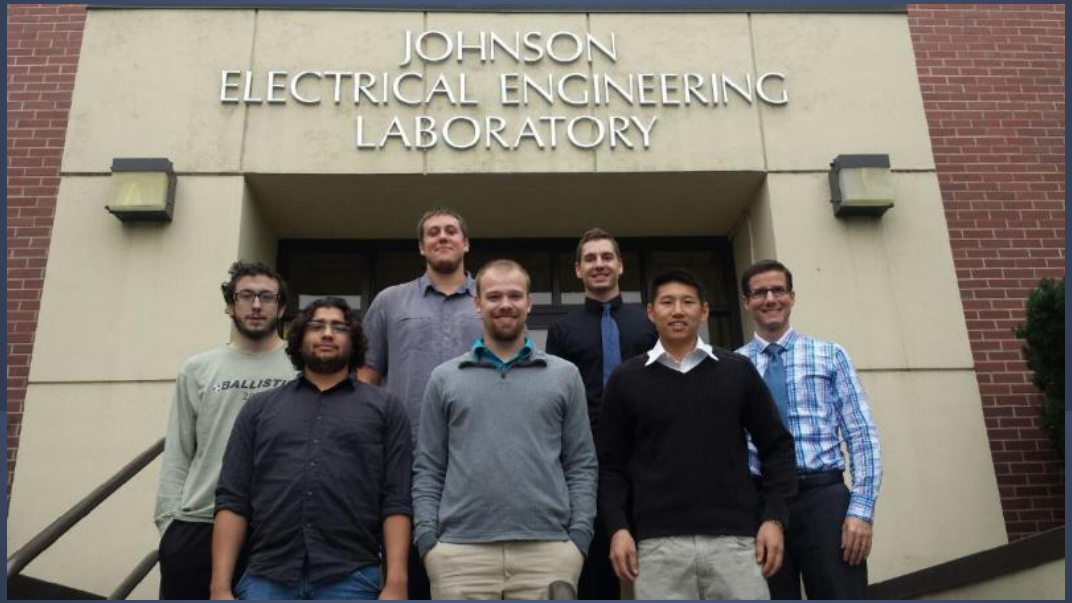
Robosub of the Palouse

University of Idaho Division Design Review



Project Background

2015 Robosub Competition

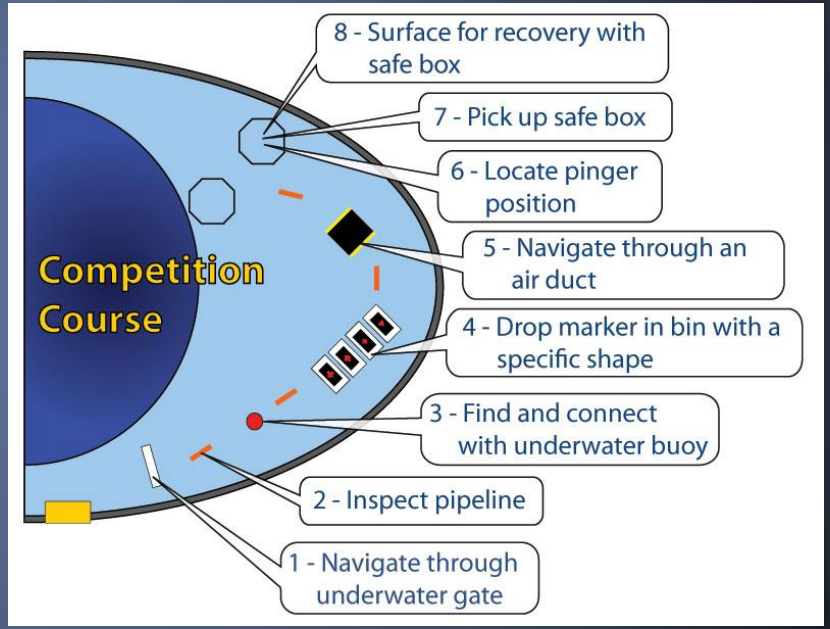
- History: 18th annual
- Type: Autonomous
- Location: San Diego, CA
- Participants: International
- When: End of July 2015

Previous Placings

- 2013 - 23rd
- 2014 - 21st

Tasks

Path	(CS)
Object recovery	(CS)
Sonar Detection	(EE)
Firing torpedoes	(ME)
Repositioning pin	(ME)
Picking up objects	(ME)
Dropping markers	(ME)



Computer Science

Status

Done:

- Filter Tree framework/GUI
- Basic Camera Calibration
- Cmake for Vision

Doing:

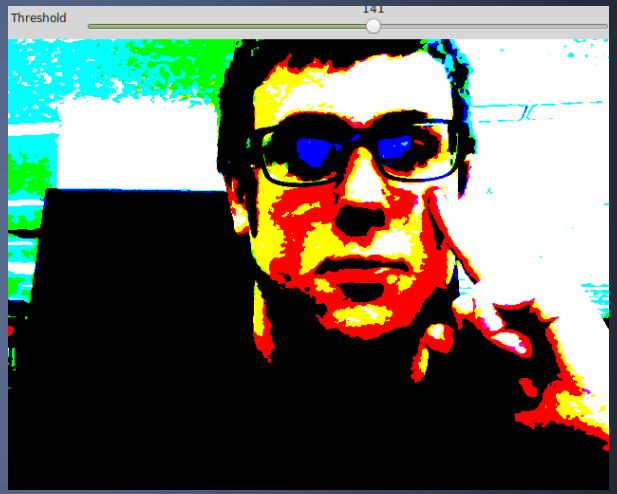
- Buying cameras
- Stereoscopic Camera Calibration

Camera Calibration

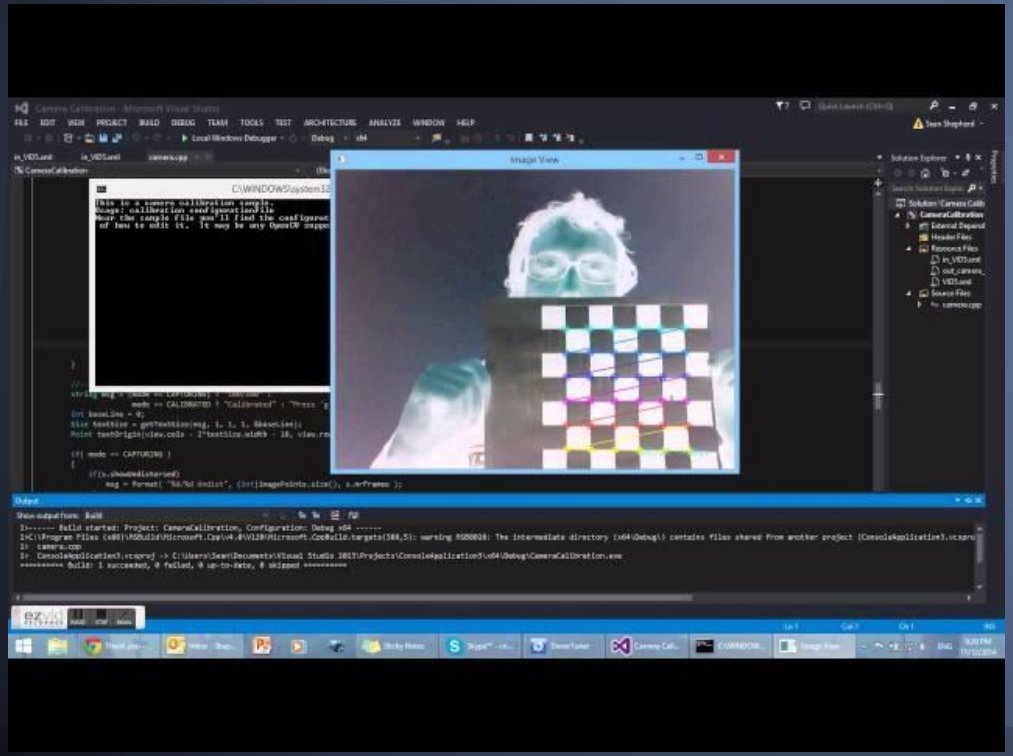
Design Solution: Using the OpenCV library to create a program to calibrate cameras from either a live feed, video, or image list. The settings will then be saved for future use.

Design Features:

- Can be used with or without the submarine
- Requires an easily obtained checkerboard
- Modular



Camera Calibration Continued



Current Progress:

- Single Camera Calibration

Constraints:

- Stereoscopic calibration will be needed for stereoscopic vision

Goal:

- Finish stereoscopic calibration before next pool test

Project Schedule

11/19 - Pool Test

- Stereoscopic camera calibration
- Filter Tree GUI

Future -

- Vision - Object detection, Robust Filter Testing GUI, I/O Framework for Video/Camera
- AI - Design Mission Controller, Design Task Controller, Design General Map of Pool

Project Schedule Continued...

Future Cont -

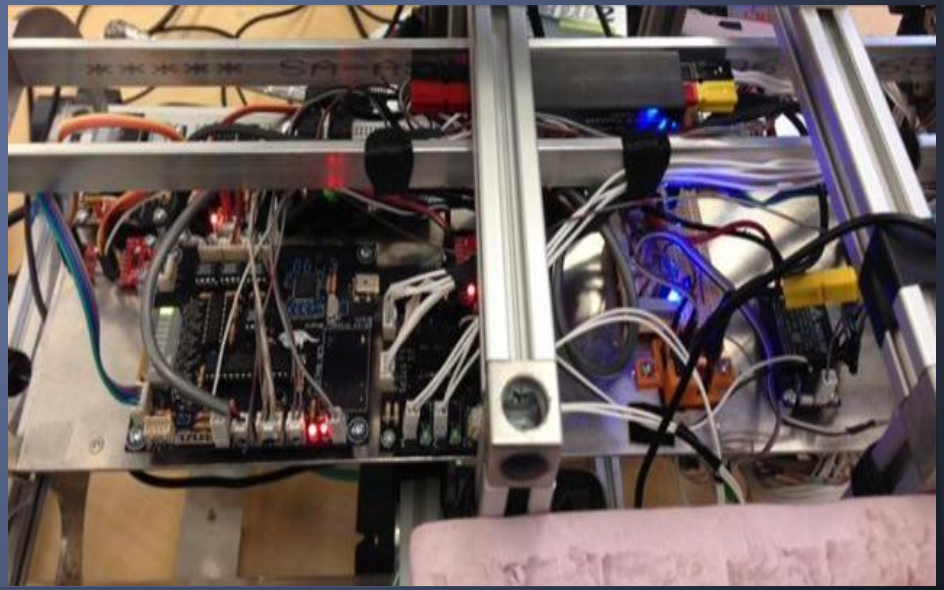
- Movement - Improve Fuzzy Logic, Physical Based Movement Systems
- Utilities - Rewrite Grapevine in C++

Reflection...

Electrical Engineering

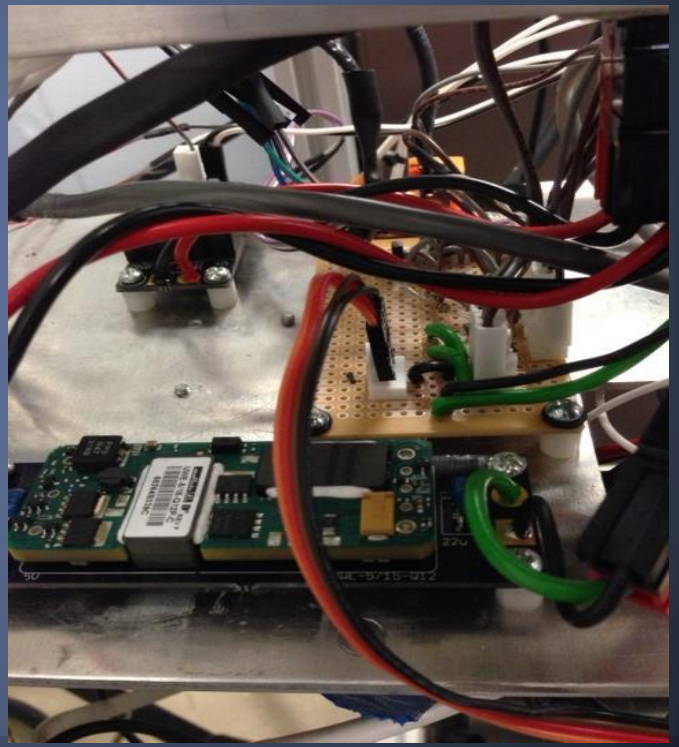
Current Electrical System

- Excessive Wear on the boards
- Difficult to access
- Wire Nest
- Space Waste



Current Electrical System

- Flawed PCB design
- Poor Esthetics for Competition
- Power Cutoff Circuit redesign and PCB conversion

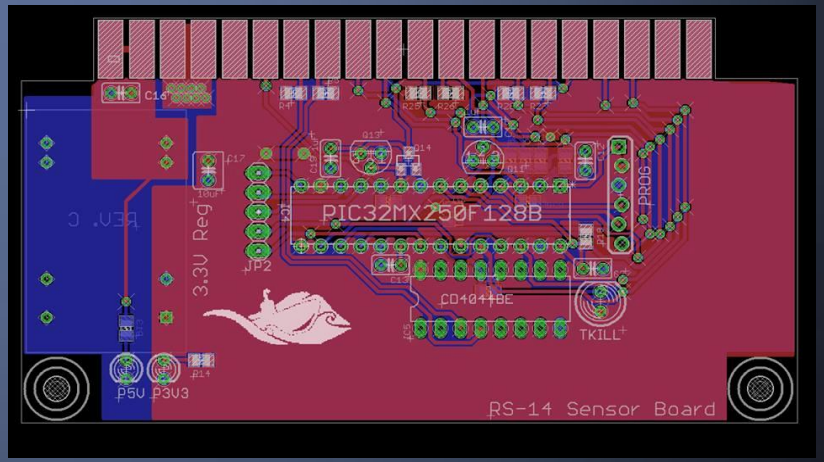


PCB Modifications

Design Solution: Tear up circuit traces on current PCBs and add edge connectors. Fix PCB design errors detected during circuit testing and installation.

Design Features:

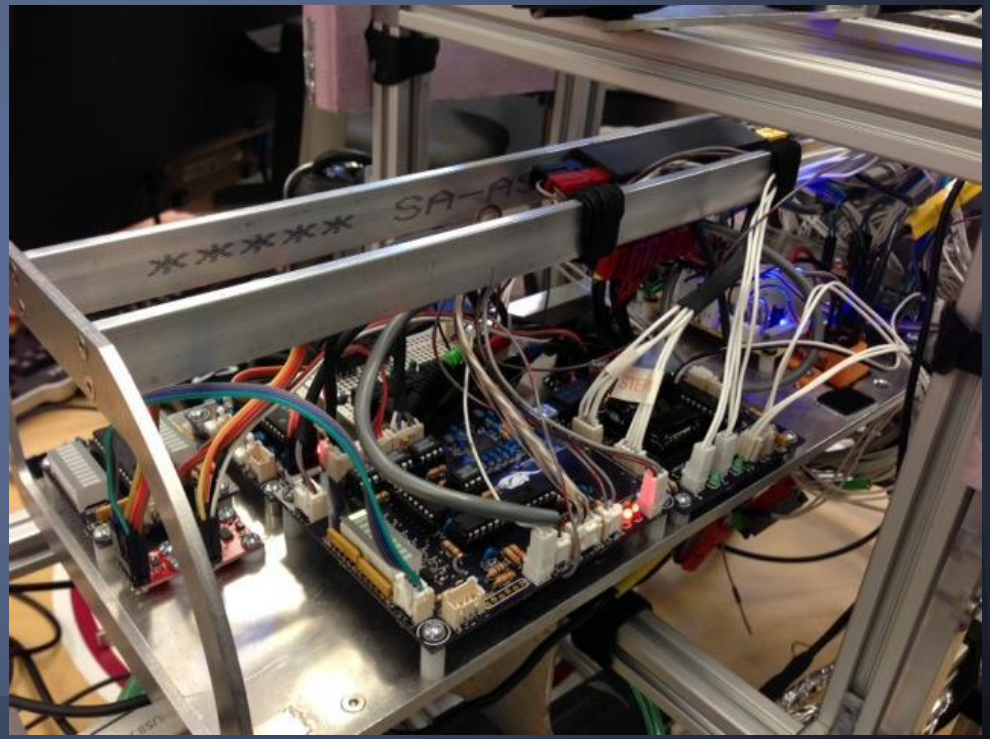
More robust and comp
system. Less prone to errors and failure.



Scope of Project

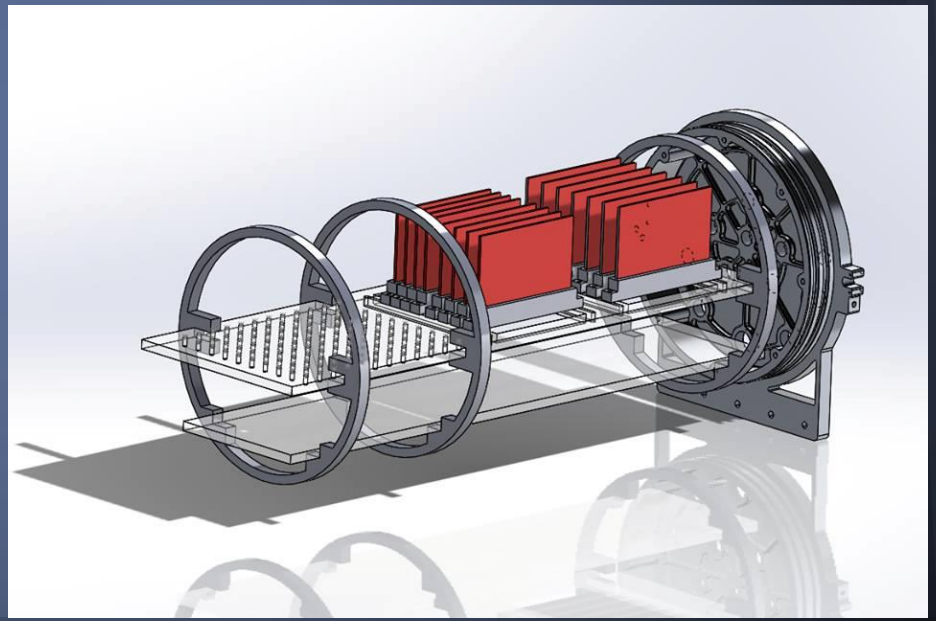
Problem Definition:

Redesign PCB layout from cumbersome, tangled mess that take up a lot of space.



PCB Conceptual Design

Design Solution: Streamline edge-connector system. Allows for quick board removal and inspection. Removable tray with extra space for further upgrades.



Project Schedule

This Semester:

- Design Power-Cutoff PCB
- Edge-connector implementation
- Bug fixes

Next Semester:

- Continue edge-connector implementation
- Testing/Troubleshooting
- LED signaling system

Mechanical Engineering

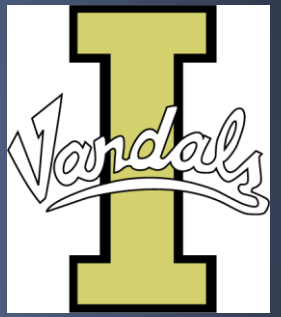
Review of Necessary Modifications

Sub Modifications:

- Bottom Claw System
- Pin Removal System
- Maker Dropper
- New Pneumatic Housing
- Camera Waterproofing
- Relay Bracket
- Aesthetics & Buoyancy

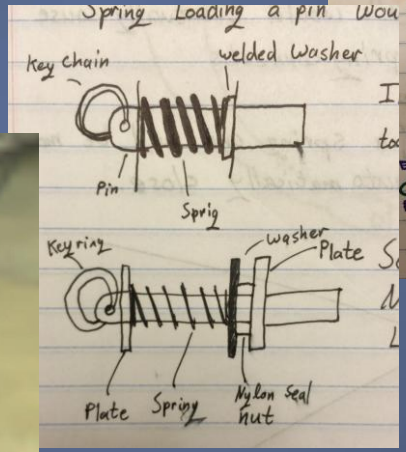
Other Projects:

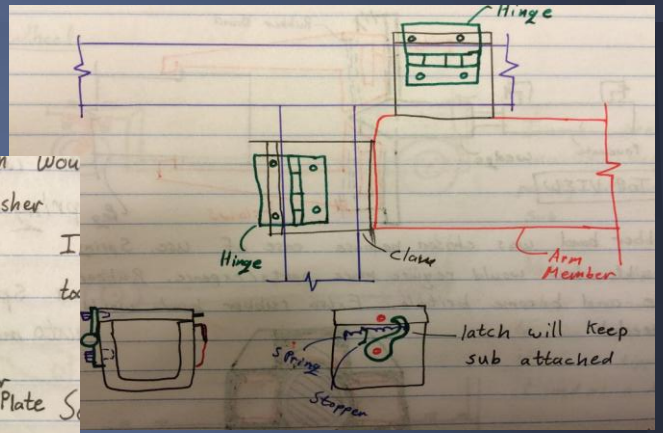
- Sub Stand
- Additional Battery Tube



Sub Stand

Problem Definition: The sub currently cannot be placed on a table while fully assembled.





Need: Ability to leave sub assembled
Constraints:Must be mobile and fit in a car
Deliverables:Sub Stand/Case

Sub Stand Continued

Design Solution: To solve this we designed a stand to hold the sub while being worked on.

Design Features:

- Holds sub at working height 24”-36”
- Moves vertically
- Rotates about sub central horizontal axis
- All Terrain Mobile
- Double as a presentation stand with acrylic case.

Sub Stand Connector

Final Sub Connector:

Alternate Battery Tube

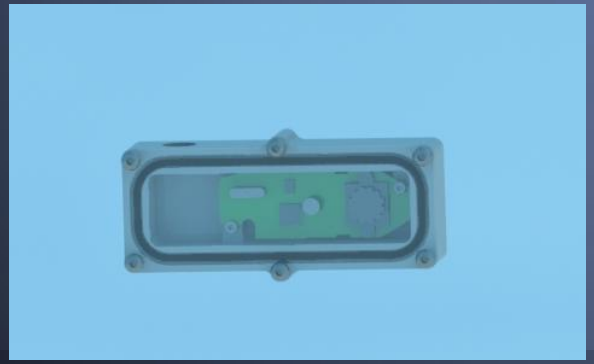
Problem Definition: Make an additional Battery tube which will allow for hot swapping

Materials:
Clear Polycarbonate Tube
Black Delrin Resin Rod
O-Rings

Camera Waterproofing

Problem Definition: Poor camera performance has led to the EE and CS team decision to replace the camera this year. The new cameras will need to be waterproofed and mounted.

Current Camera Housing



Needs:

- Water Proof
- Optimize View
- Mounting Bracket

Constraints:

- EE and CS

Deliverables:

- Waterproofed camera housing that mounts to the sub.

Relay Bracket

Current Progress:

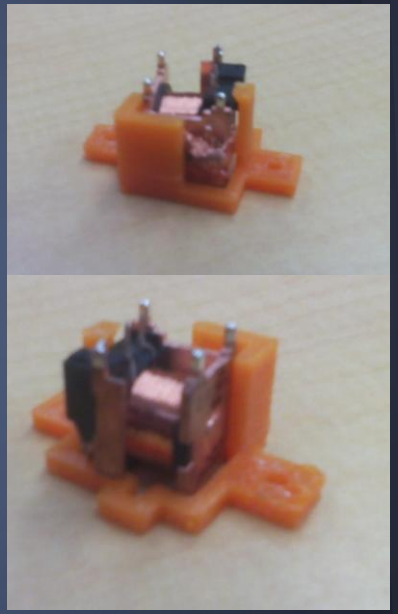
- Dimensioned

Problems:

- Bracket slides underneath current PCB design
- If re-printed now it will not fit correctly

Goals:

- Have ready to go when new PCB is built



Bottom Claw System (BCS)

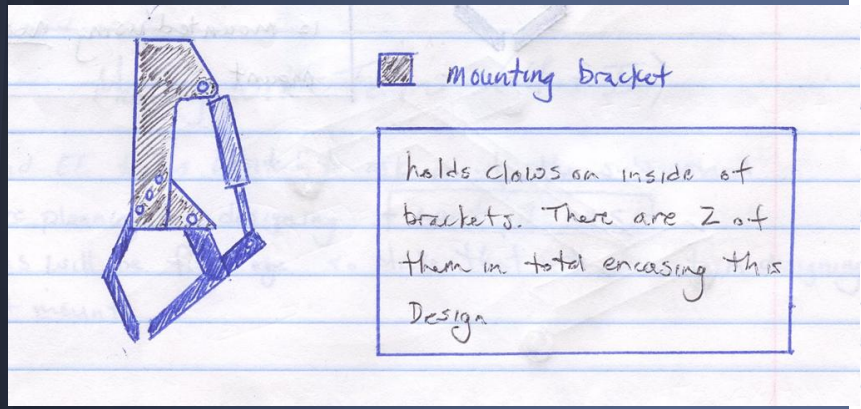
Problem Definition: Wanted a more efficient claw design for this years competition

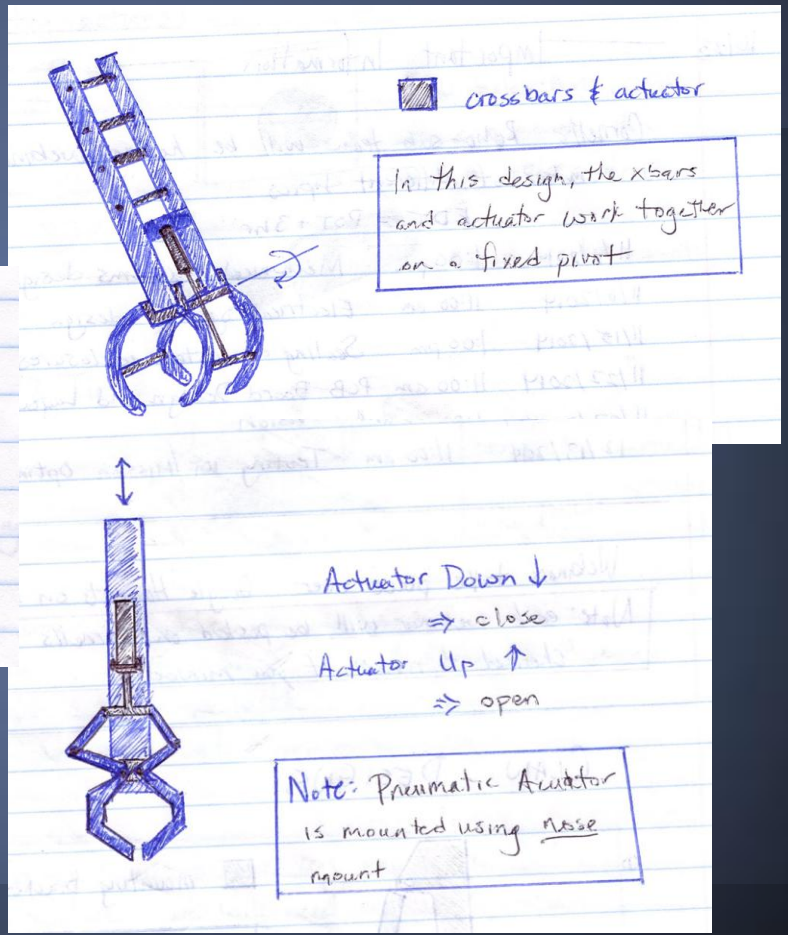
Specs:

- 2 ½” actuation
- 6” claw separation
- 8.5 lb grip strength

BCS Continued...

Alternate Designs





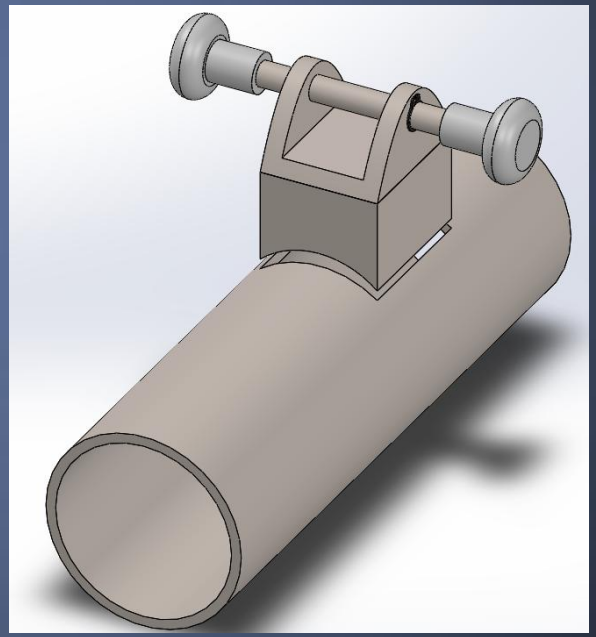
Pin Removal System (PRS)

Problem Definition:Manufacture PRS to reposition magnetic pin

Specs:

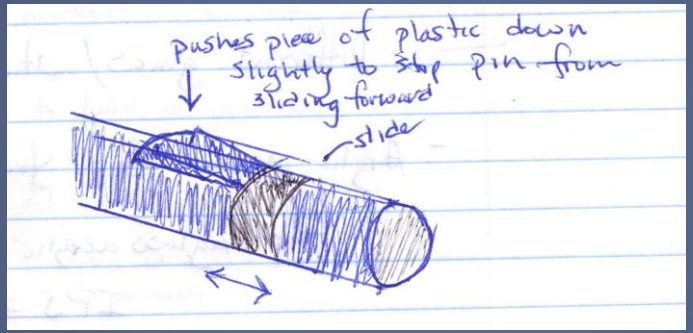
- 1 ⅛” Tube Inside diameter
- 4” min Tube length
- 5 lb min Grip strength

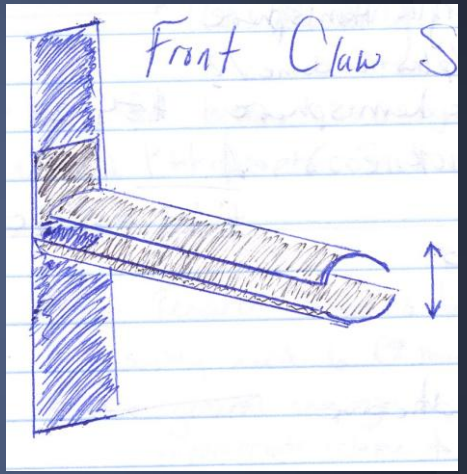
Latest Render:

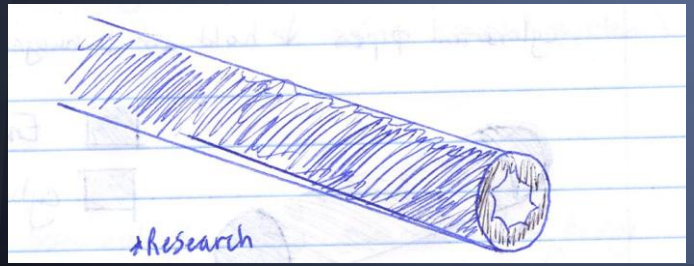


PRS Continued...

Alternate Designs:







Marker Dropper System (MDS)

Problem Definition: Current system design is dependent on actuation of the front claws. We want to separate the two systems as well as release markers from each dropper indepently of one another.

Deliverables:

- Independent MDS
- Solidworks Design
- BOM

Needs:

- Redesign MDS

Constraints:

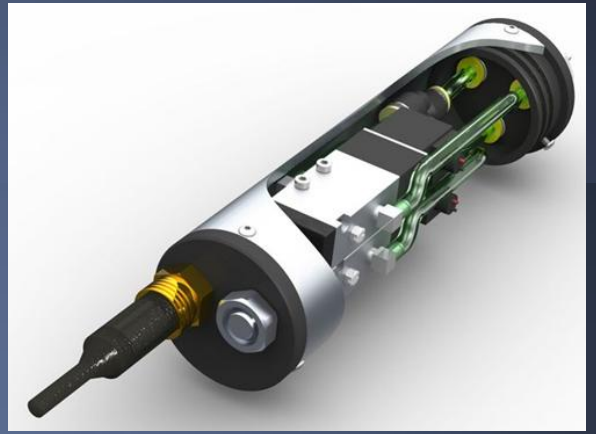
- Space availability

Pneumatic Housing

Problem Definition: The current design only has one pneumatic system while the other subsystems are powered electronically. This year we decided to replace all of the electronic motors with pneumatic actuators causing a need for a new housing for the pneumatic controls.

Deliverables:

- Larger pneumatic housing
- Bill of Materials



Needs:

- Organization of pneumatic system
- Waterproof

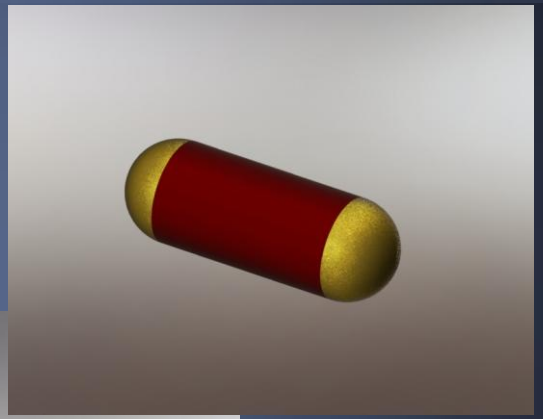
Constraints:

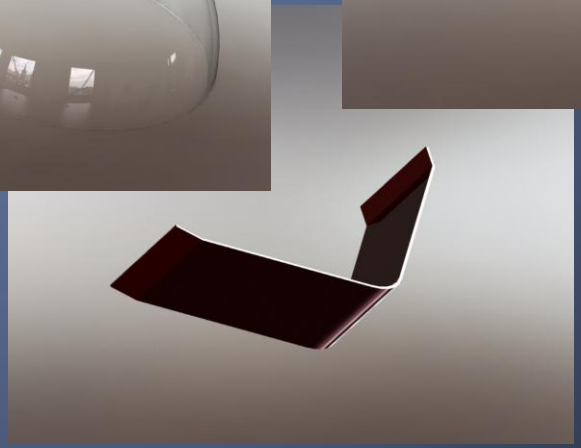
- Space availability
- Pressure Testing

Aesthetic Design

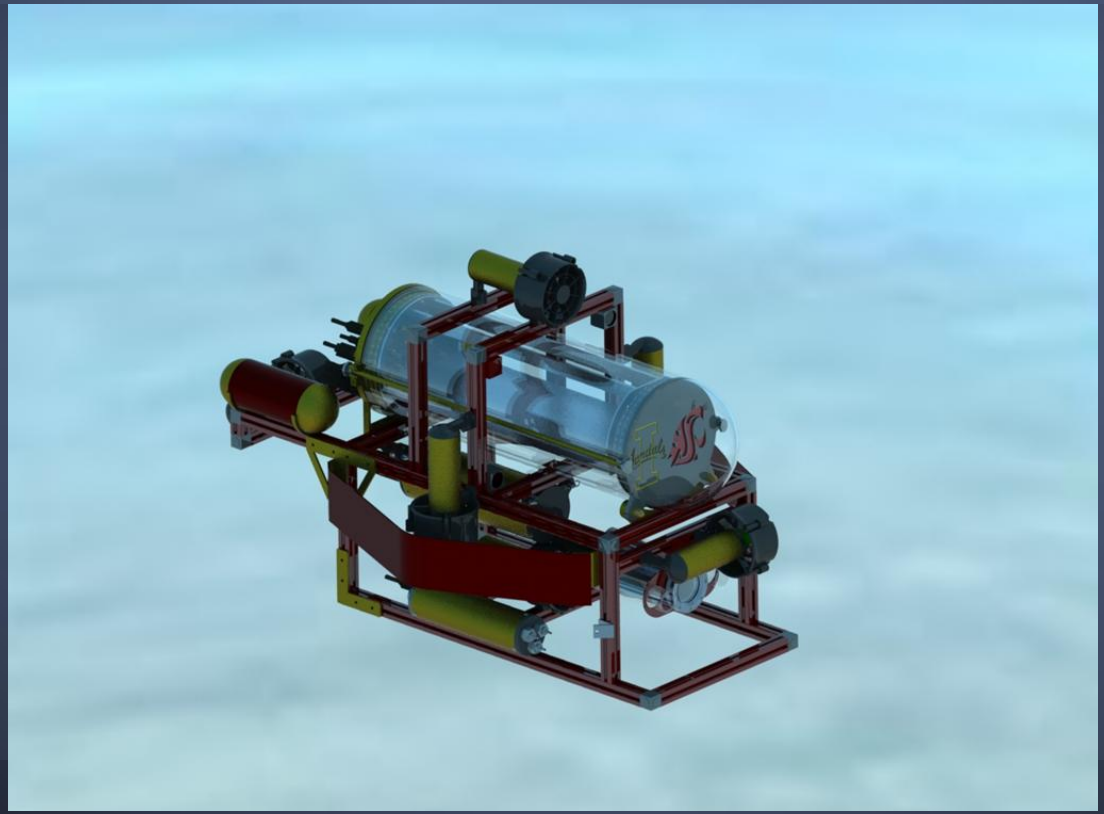
Project Changes:

- Acrylic hemisphere
- Anodizing Sub Frame.
- Flotation Capsules
- Side Guard
- Integrated LED’s





Final Aesthetics Design



Cost Estimate

Budget

$6,667

BCS

-$300

Sub Stand

-$200

Battery Tube

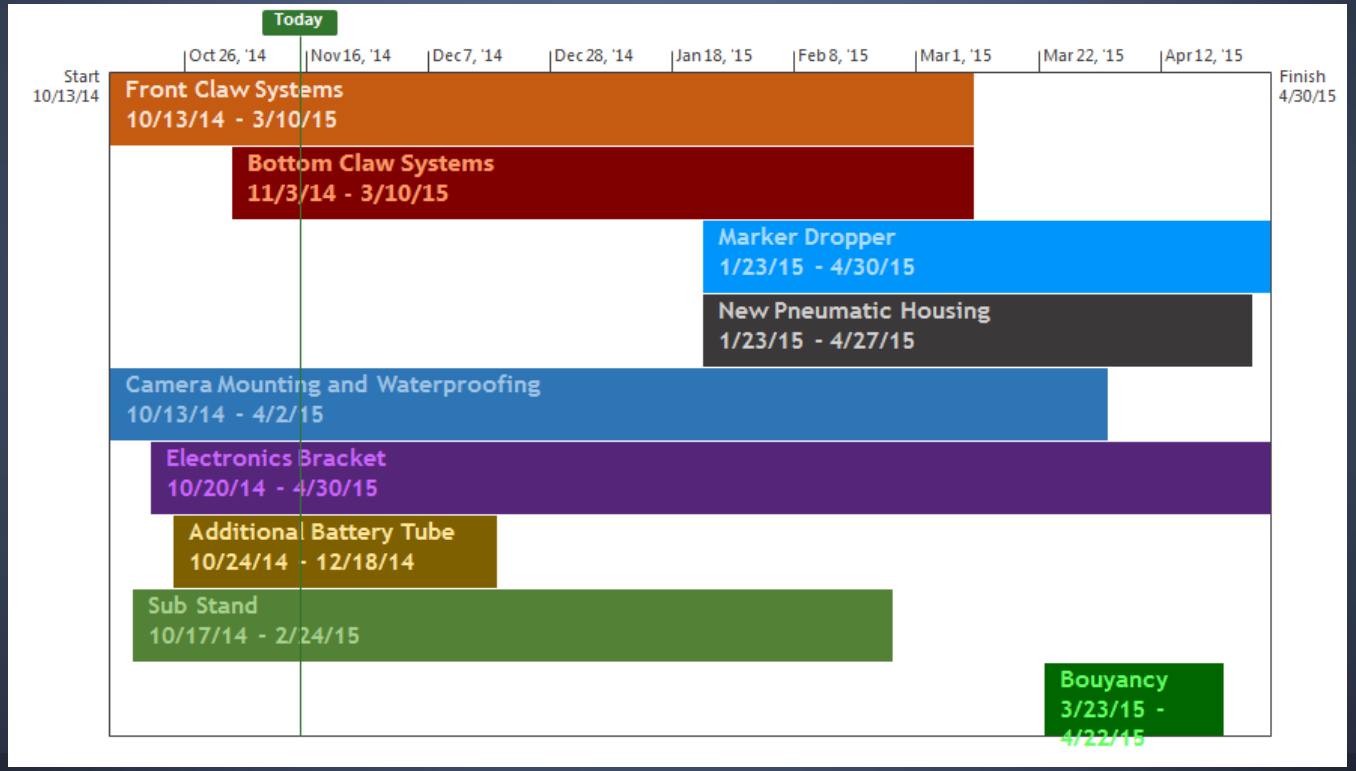
-$100

PRS, pneumatic housing, camera waterproofing, Aesthetics, MDS

TBD

$6,067

Project Schedule (ME)



Questions?