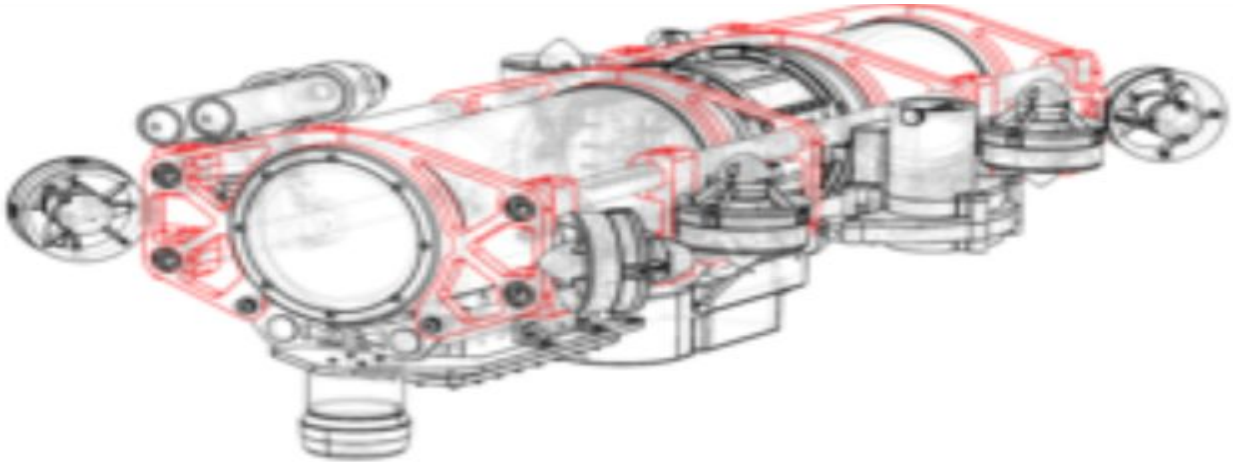
Carnegie Mellon TAUV (Tartan Autonomous Underwater Vehicle)



KINGFISHER

Project Description

Name: Acoustics Enclosure

Purpose and Specifications:

An enclosure is needed to hold hardware used to detect objects and aid the sub in navigation.

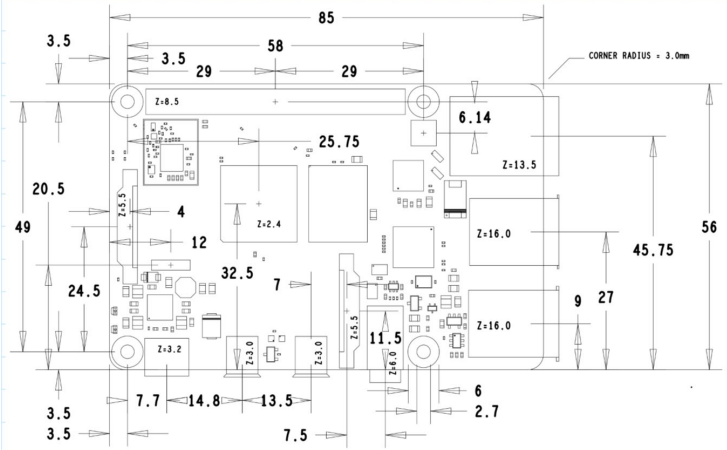
The enclosure hold:

- 2x ADALM Boards
- 1x Raspberry Pi
- 1x Power Board
- 4x Pre-Amps
- 4x XLR’s

Side Note:

- The enclosure should be made with easy access to hardware (For quick adjustments for competition runs)
- Enclosure should not clash with vehicle design (Too long, Extravagant geometries, etc.)

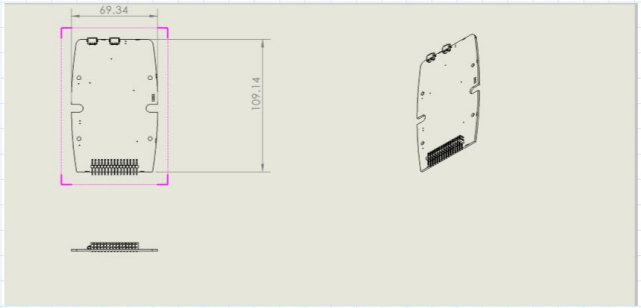
Hardware Specs.



Raspberry Pi

Length = 56mm

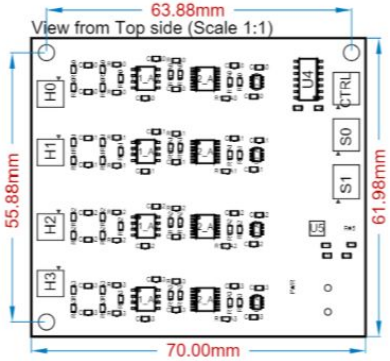
Width = 85mm



Adalm

Length = 109.14

Width = 69.34



Notes:

1. Mounting holes are M3 slip fit

Frontend Board

Length = 61.98mm distance b/w holes$_L$ = 55.88mm

Width = 70.00mm distance b/w holes$_W$ = 63.88mm

Hardware Specs.

Specifications:

Default board setup: 26dB gain, differential output, P48 phantom-powered

Hydrophone Pre-amp

Equivalent Input Noise:	-120dBV	10nF input shunt, A-weighted 20Hz – 22KHz, 1KΩ output load
Total Broadband Output Noise:	-88dBV	10nF input shunt, Unweighted 10Hz – 90KHz, 1KΩ output load
Bandwidth:	14Hz - 90KHz	+0/-0.5dB, 1KΩ output load
	4Hz - 270KHz	+0/-3dB, 1KΩ output load
THD+N:	<0.01%	@1KHz, -60 to -20 dBV input,1KΩ output load
Max output:	>8dBV RMS	@1KHz, 1KΩ output load, 1% THD
Current consumption:	8.5 mA	48V Phantom Power (from mic preamp)
	3.4 mA	24V Phantom Power (from mic preamp)
Gain:	26dB	Differential: pins 2 & 3 (Standard—can be factory-modified)
Z out:	17 Ω	Each phase to ground
Z in:	10 MΩ	(Standard—can be factory-modified to filter low frequencies)
Physical:	Ø19.7mm x 66.8mm, 42g. (Built on Switchcraft AAA3MZ connector)	

Roll over image to zoom in

GDQLCNXB XLR Female Jack 3 Pin Panel Mount Jacks, XLR Female Socket Connector 4Pcs,Silver Metal Housing.

Visit the GDQLCNXB Store

★★★★★ 3 ratings

$8.29

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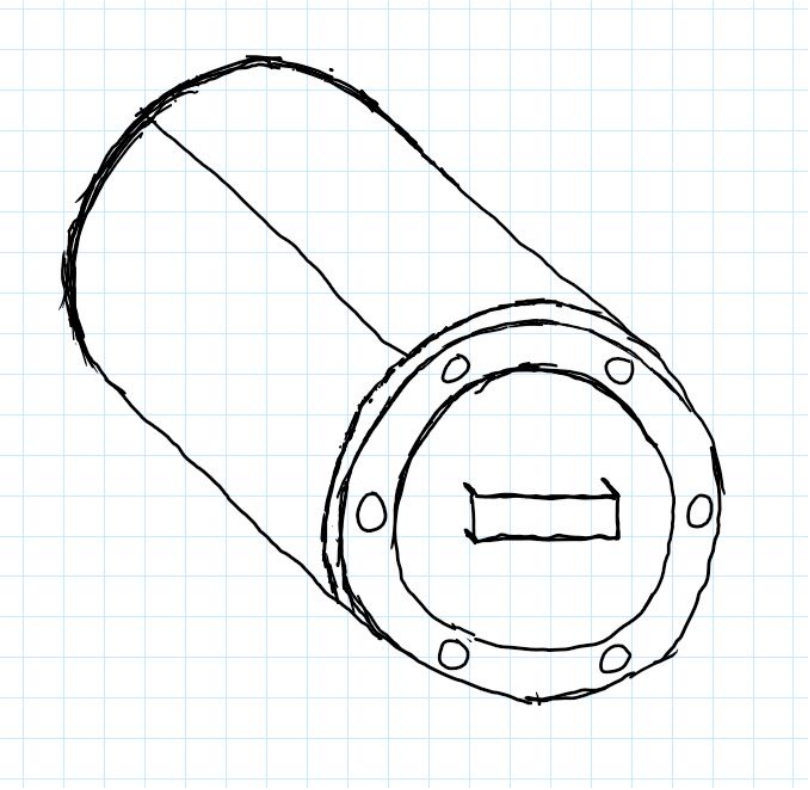
Product details

Brand	GDQLCNXB
Connector Type	XLR
Cable Type	XLR

- Product Name :XLR Female Jack 3 Pin - Chassis Panel Mount Jacks D Series Size.
- Packing : 4 Pcs XLR Panel Mount Socket
- Total Size : 31 x 26 x 21mm / 1.2" x 1.1" x 0.83"(L*W*H);Main Material : Plastic, metal,Silver Metal Housing.
- Heavy Duty Metal Design.Rivet or Screw in Design ,Patch Bay and Snake Cable Applications,Rack Mount and Rack Panel Ready.
- Rivet or Screw in Design,Separate ground contact to mating connector shell and front panel, Full GDQLCNXB Audio Guarantee.

Initial Approach

Initial Approach - Body

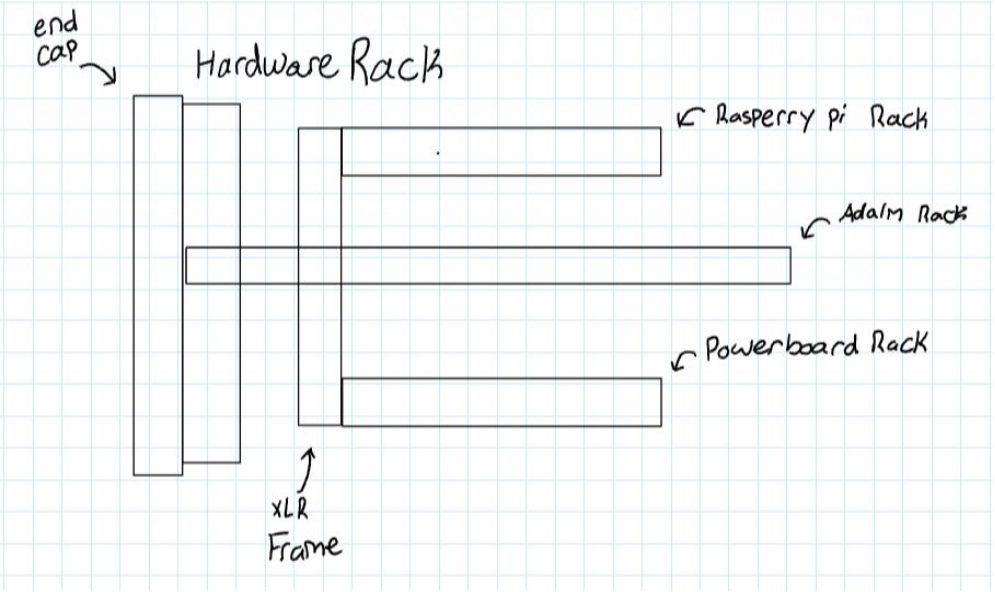


- Simple cylindrical tube design with a removable faceplate for easy access to hardware.

- O-rings are fixed to both ends of the tube to prevent water from seeping in

Note/Concern: The removable faceplate has to be sealed in a way that allows it to be easily removed while preventing water intrusion.

Initial Approach - Hardware Rack



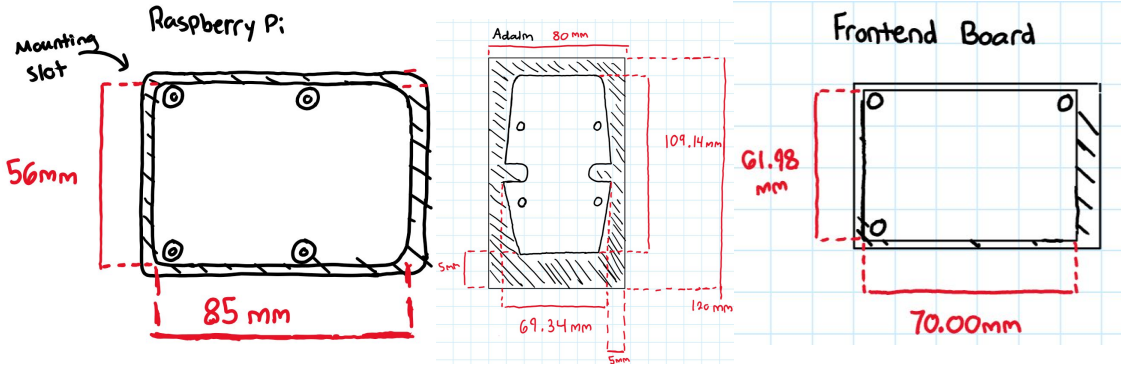
- The distance between the Raspberry Pi and ADALM should be at least 20mm due to the height of the board and its components.

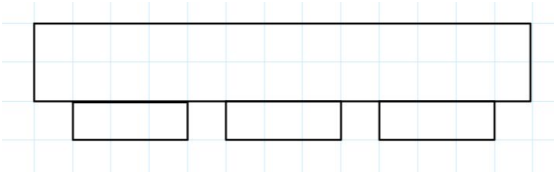
- The XLR's will be screwed into the same plate that each rack extrudes from, minimizing the length of tube needed

Potential Design Issues:

- The racks are only supported at the XLR Frame which could lead to sagging and deformation of the part.
- The issue stated also applies to the connection of the rack to the end-cap, which is held by a single beam

Initial Design - Mounting Slots



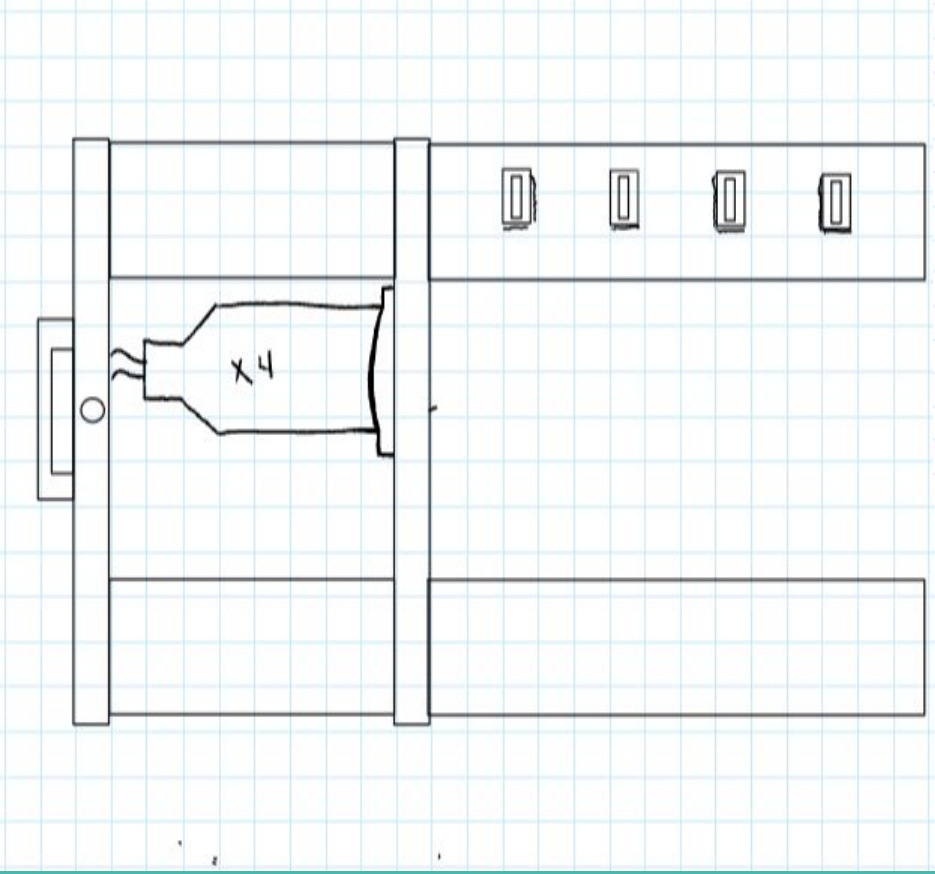


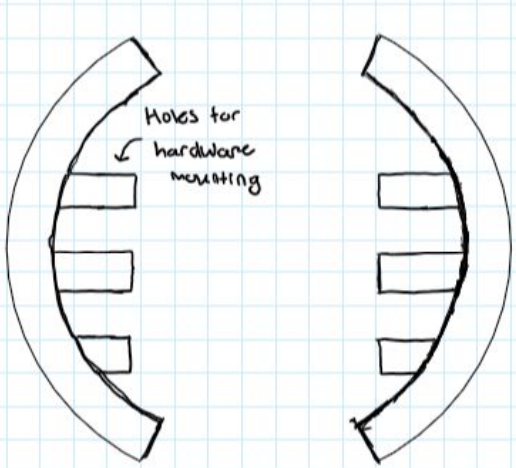
- Each Mounting Slot has “teeth” that will fit into the hardware rack.
- Rectangular teeth prevent forward and backward sliding.

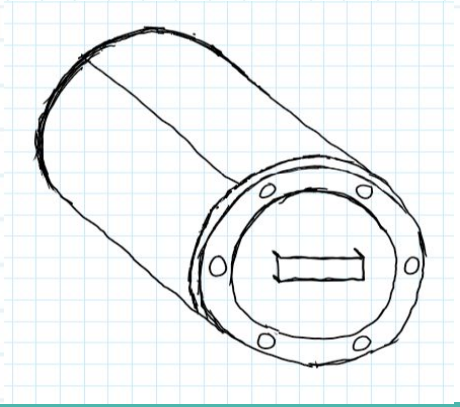
Potential Design Issues:

- How will movement along the y axis be prevented? The hardware should be fully constrained.

Initial Approach (Composed)



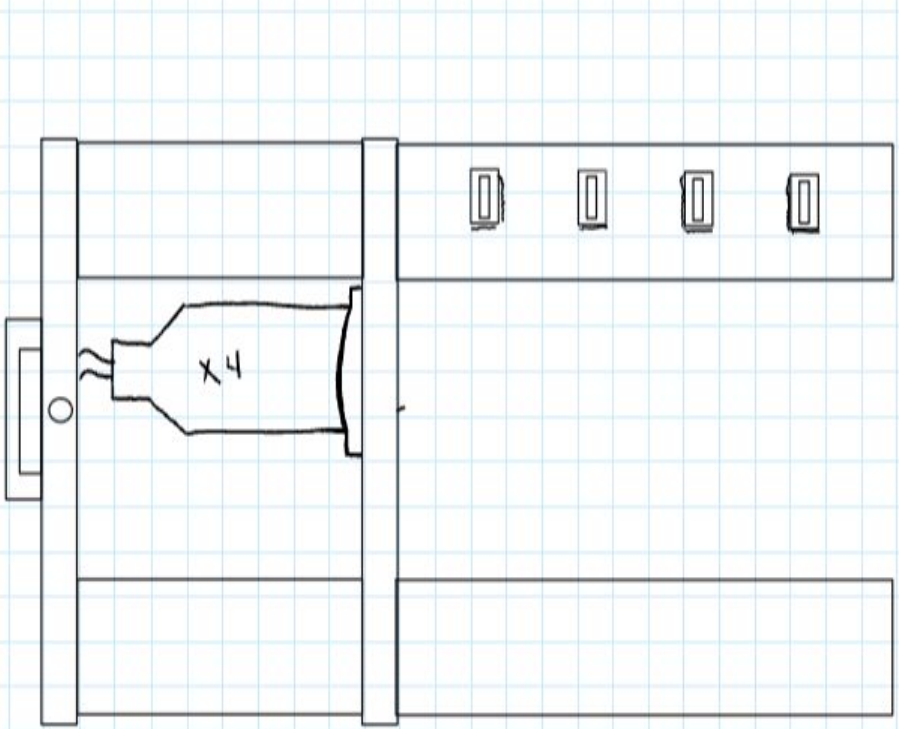


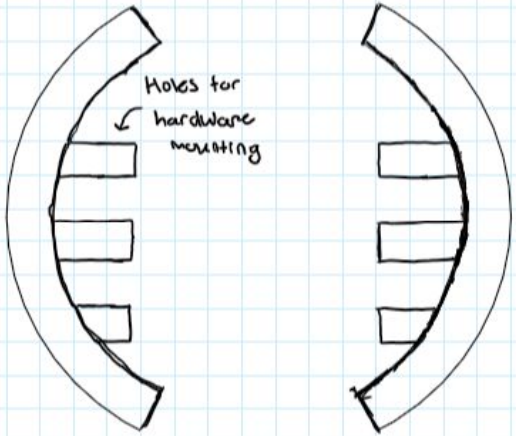


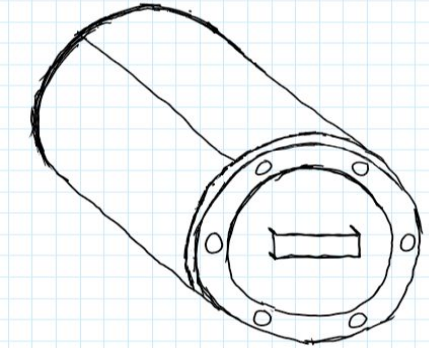
Solution to XLR Frame & Hardware Rack Integrity:

The frame has supporting beams connecting to the removable faceplate, providing a robust structure for the hardware rack.

Initial Approach (Composed)







Solution to constraining the mounting slots:

The mounting slots will be press fit, so they will not fall out during operation.

Alternatively, along the end-cap on the far end of the enclosure, there are bars that will be fixed to the end-cap. These bars slide along the top edge of the hardware racks, blocking any upward motion.

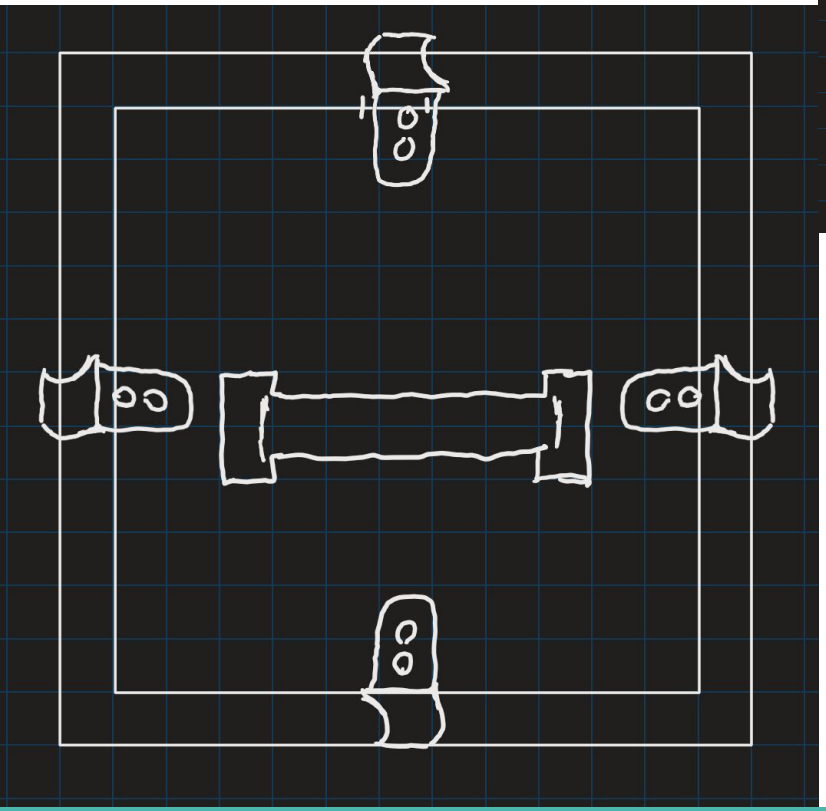
Initial Design Review

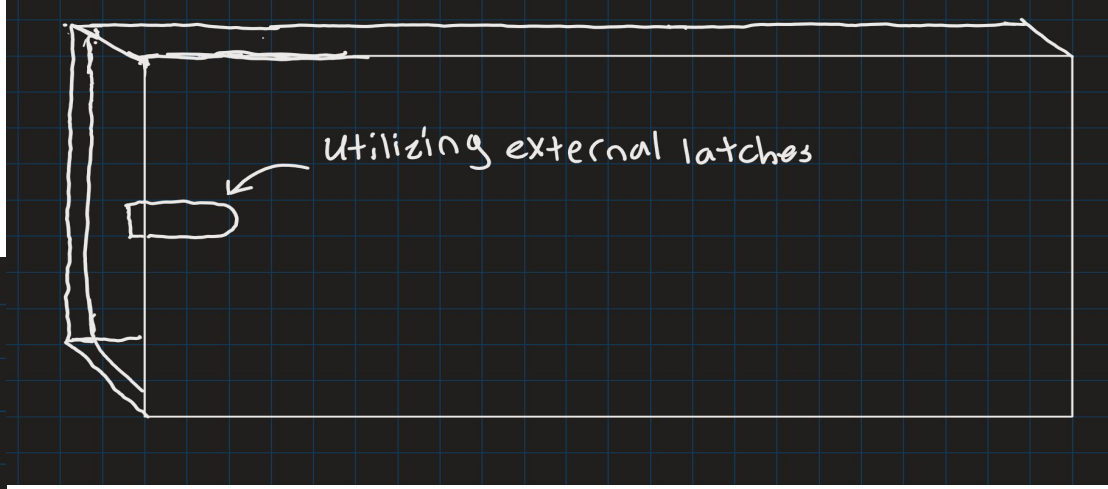
Problems/Things to Fix

- The boards are not constrained in the Y (defining y axis as vertical). As the sub maneuvers we want the boards to be in place.
- The cylindrical profile makes it difficult to place boards with appropriate spacing (<5mm between board heights)
- The cost of production is too similar to the price of buying a premade enclosure
- 3D printed parts may have geometries difficult to replicate (the hardware rack specifically)
- The method of sealing the enclosure isn’t as efficient as desired (6 bolt holes)

Revised Design

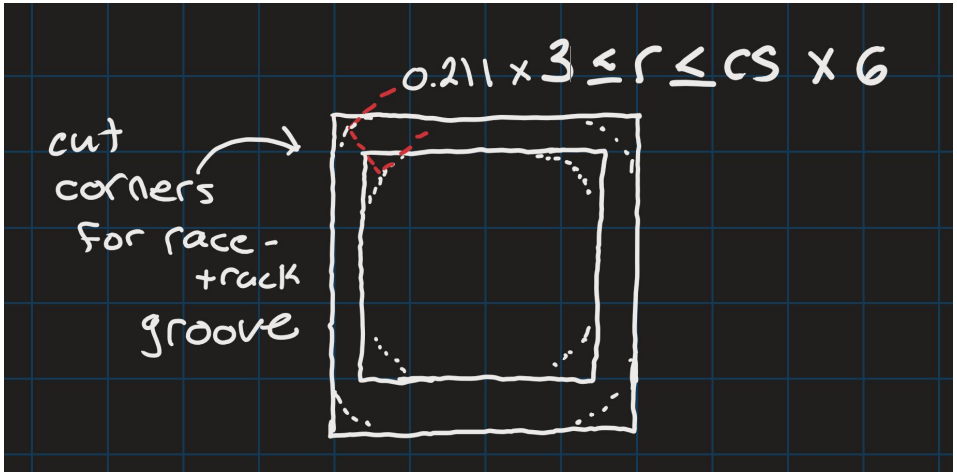
Revised Body





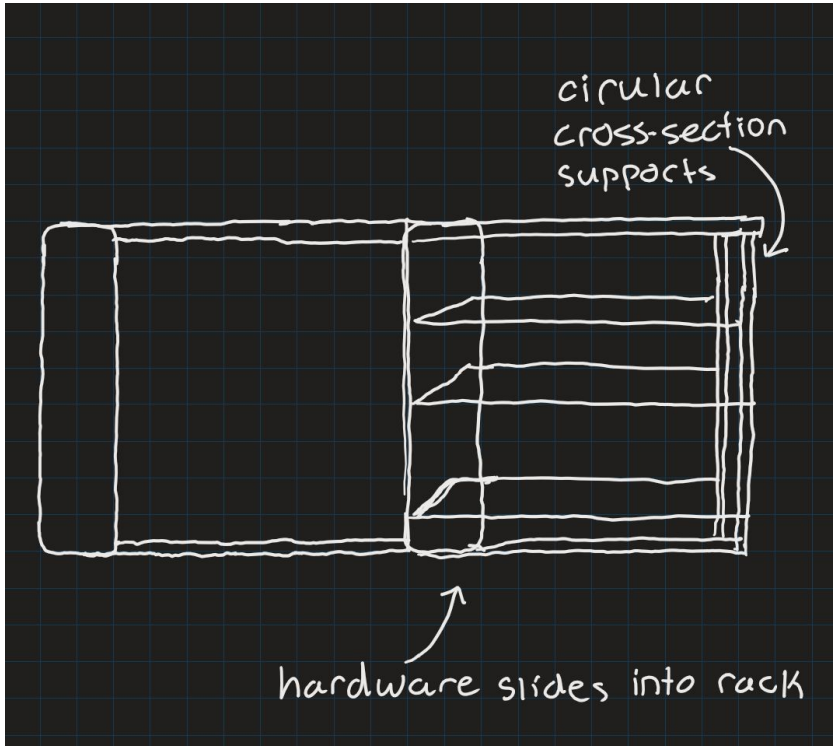
- New design replaces boltholes with latches (external latches decrease release and reset time)
- Switched from cylindrical design to box design (Utilizing more space within the enclosure to use minimal material)
- Latches will be fixed to connect at a 90 degree angle and distances are set for maximum grip strength on the faceplace.

Revised Faceplate



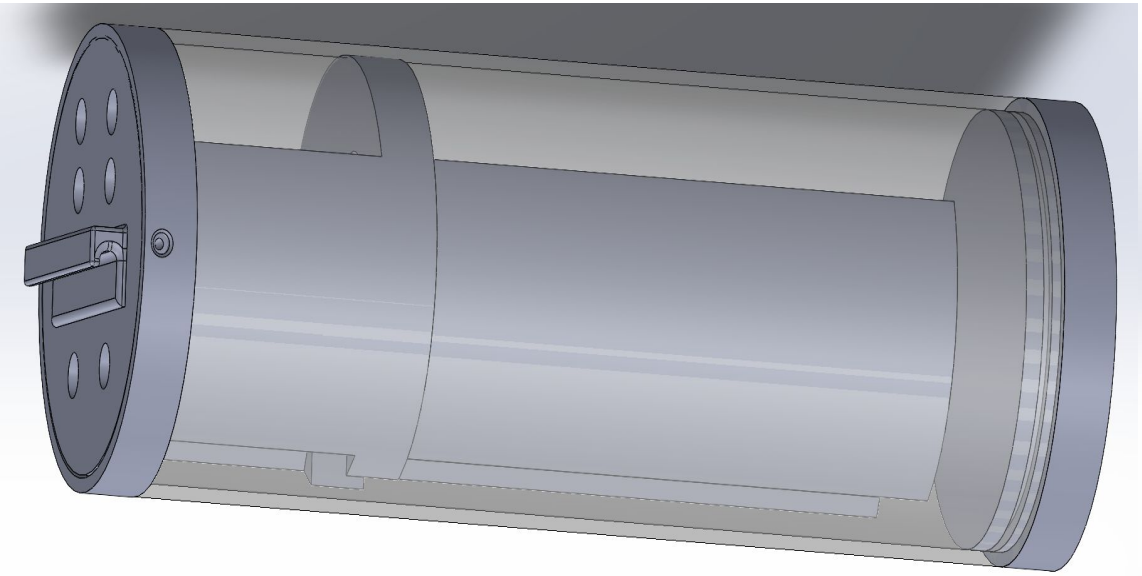
- New faceplate uses a filleted rectangular profile, also called a racetrack groove
- For the ideal O-ring fit, we use a convention that the radius of fillet is between 3x Cross-Section and 6x Cross-Section.
- This faceplate will be epoxied on and will not have to utilize bolt holes, allowing for minimal surface area where only the o-ring needs to be held.

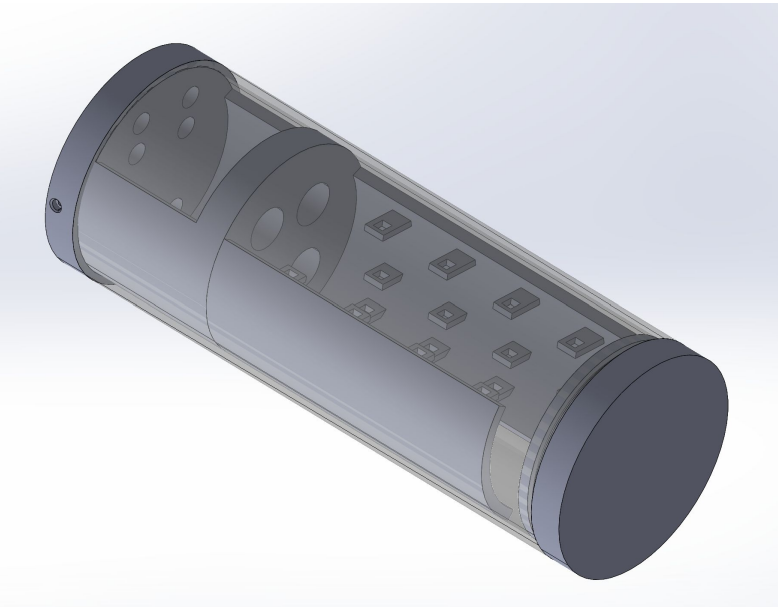
Revised Mounting



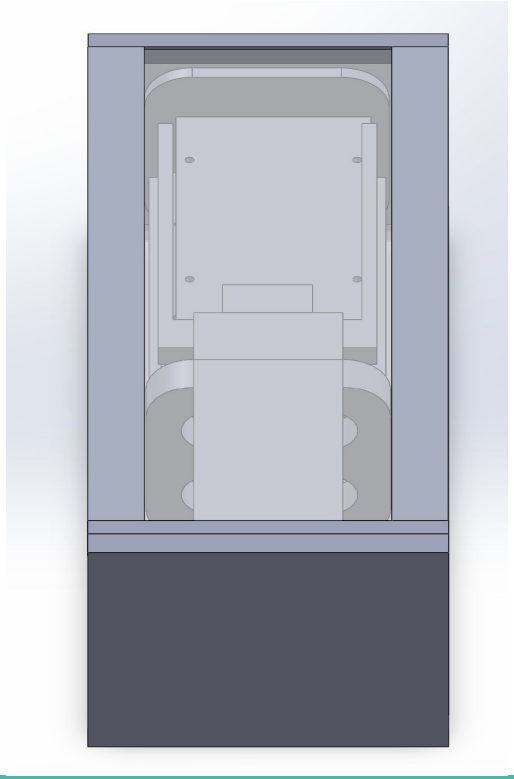
- This uses a sliding rack approach to constrain in the x and z directions (z axis is vertical)
- Mounts are constrained in the y when inserted into the enclosure where it will sit against the inner wall of the endcap
- The rack is cantilevered off of a plate on the removable faceplate, supported by circular cross-section beams

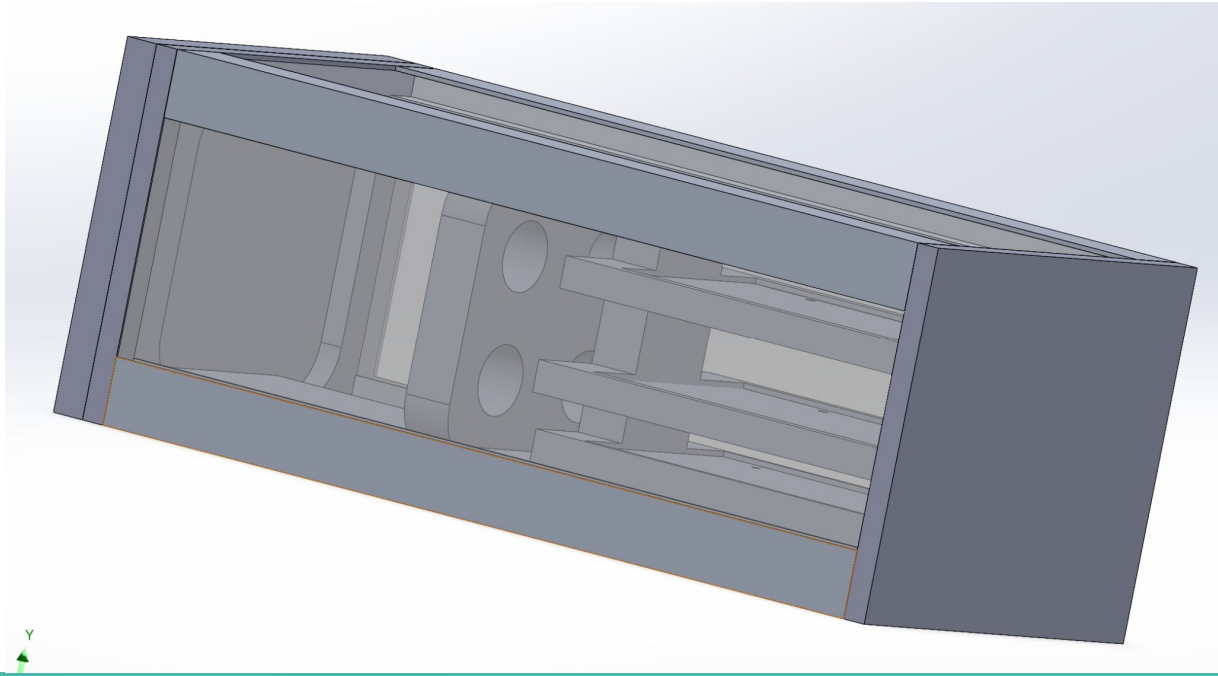
Solidworks Design: 1



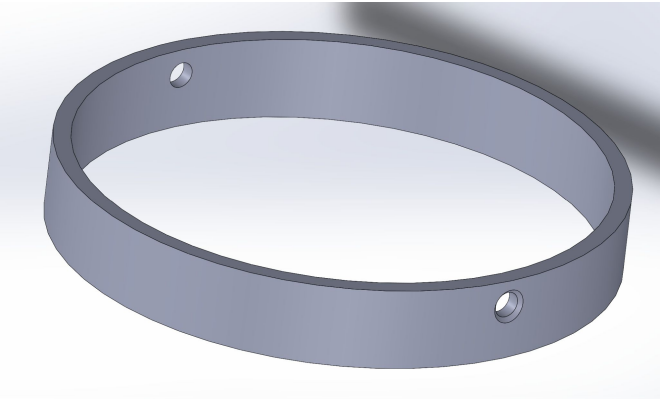


Solidworks Design: 2

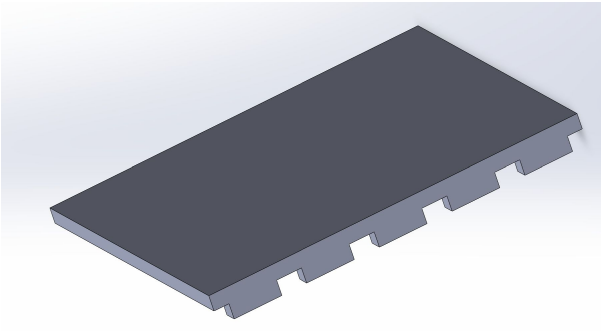




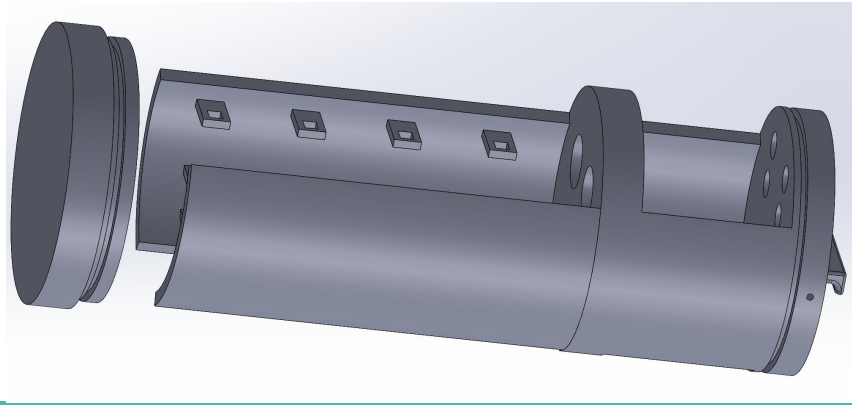
Additional Sketches and CAD



- Tube ring design.
- This is fixed to the tube using epoxy and allows screws to drive through into the hardware plate.



- Hardware mount concept



- Full assembly without Tube