DALHOUSIE UNIVERSITY
*Department of Mechanical Engineering*

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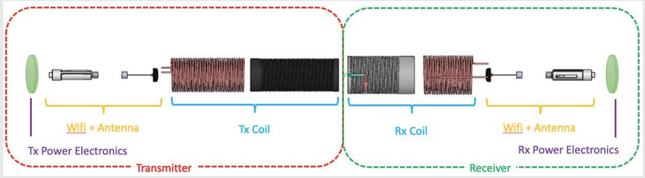
# Contactless Subsea Connector Housing Design

MOOG FOCAL™

## Problem Background

Last year, a wireless power/data transfer device was designed by an electrical capstone group for use on AUV's and ROV's. This device was made up of two coils that nest together to achieve power and data transfer.

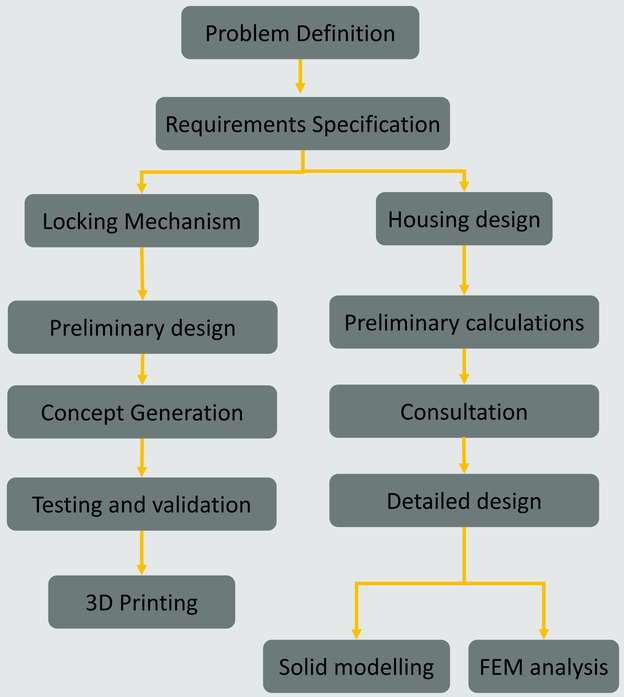



The objective of this project was to design the mechanical housing and locking mechanism for the contactless connector

A few of the main mechanical requirements of the device as defined by the team and the client were as follows:

| Requirement | Description |
|---|---|
| Operational Depth | 4000 m |
| Operational Life | 2 years |
| Operating Pressure | 6,000 psi |
| Material Compatibility | Sea Water, DC200 Silicone Oil |
| Material | Non-corrosive in seawater |
| Safety Factor | 2.5 |

## Design Process

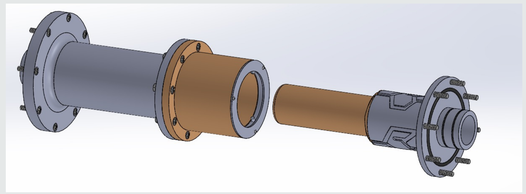


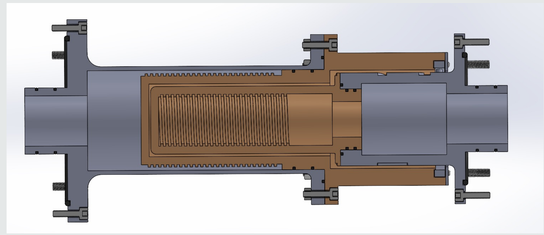

## Details of Design

### Summary of Design

The design features three main components: the locking mechanism, a male connector half, and a female connector half. The connector halves can be further broken down into two parts each. There is a plastic portion inside which the electrical coils will be seated. The remainder of device is made of a titanium alloy and contains the electronics of the device. Ultra-High Molecular Weight Polyethylene (UHMW) was chosen as material between coils as to not cause magnetic interference with the coils.

Titanium Alloy (Ti6Al4V) was chosen as the housing material due to its superior strength and seawater corrosion resistance.





### Locking Mechanism

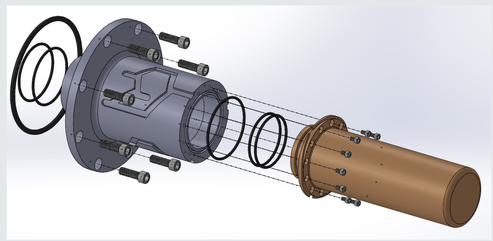
The locking mechanism is inspired by the retracting mechanism of the Modern Fuel Ballpoint pen. It is comprised of a one-way track and a rotating collar. When mating the two connector halves, the axial force produced by the AUV or ROV causes the rotating collar to move along the track until it reaches on of the extreme positions of the track. By applying an axial force in the reverse direction, the two halves are locked together. The device is then de-coupled be repeating that motion.

### Sealing Methodology

Given the high operating pressures, through consultation of standard industry practices and literature, two piston seals and a face seal were used to ensure adequate redundancy in the event of an O-ring failure

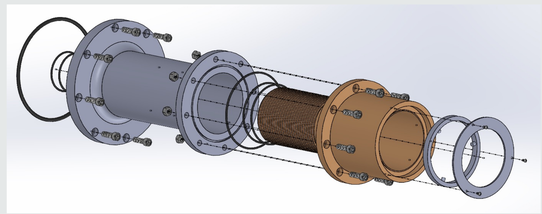
### Male Half

The male connector half houses the the track of the locking mechanism and is made in a 2-piece assembly. The forward section is the UHMW coil housing that will house the receiver coil. The aft is made from TiAl4V and houses the devices' electronics.



### Female Half

The female half is also made in a 2-part assembly. A UHMW section to house the coils, and a TiAL4V section to house the electronics of the transmitter coil. The locking collar sits in a racetrack and is free to rotate to allow the pegs to travel along the track on the male half.



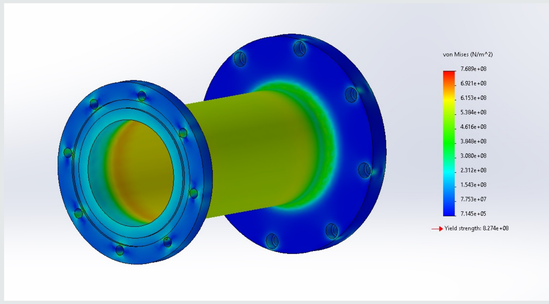
## Validation

### 3D Printing

- The locking mechanism was 3D printed and tested for functionality
- Results suggested that the locking mechanism works, but some modifications to the track were required
- Parts were 3D printed at ½ scale to validate compatibility

### FEM

- Preliminary FEM models were created to visualize stress concentrations in the design
- Majority of stress concentrations were found at flange interfaces and the inside surface of the vessel cylinder




## Conclusions and Recommendations

- The presented solution provides a novel approach to creating a mechanical locking system to use with AUV connectors
- Continue working with an electrical engineering team to optimize the coil design to fit within mechanical constraints
- Create prototype and conduct pressure tests and compatibility tests with electrical components
- Update design dimensions based on finalized electrical parts BOM

## Acknowledgements and References

**Client**
Mr. Deepak Jagannathan

**Electrical Capstone Team**
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**Faculty Advisor**
Dr. Darrel Doman, PhD, PEng

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