Actively Sealed Cryogenic Coupler

T520 | Jason Goldstien | Lauren Roche | Sean Rodney
Valerie Rodriguez | Nick Sgammato
Project Advisor: Shayne McConomy Project Sponsor: James Buzzell

FAMU-FSU Engineering

Objective

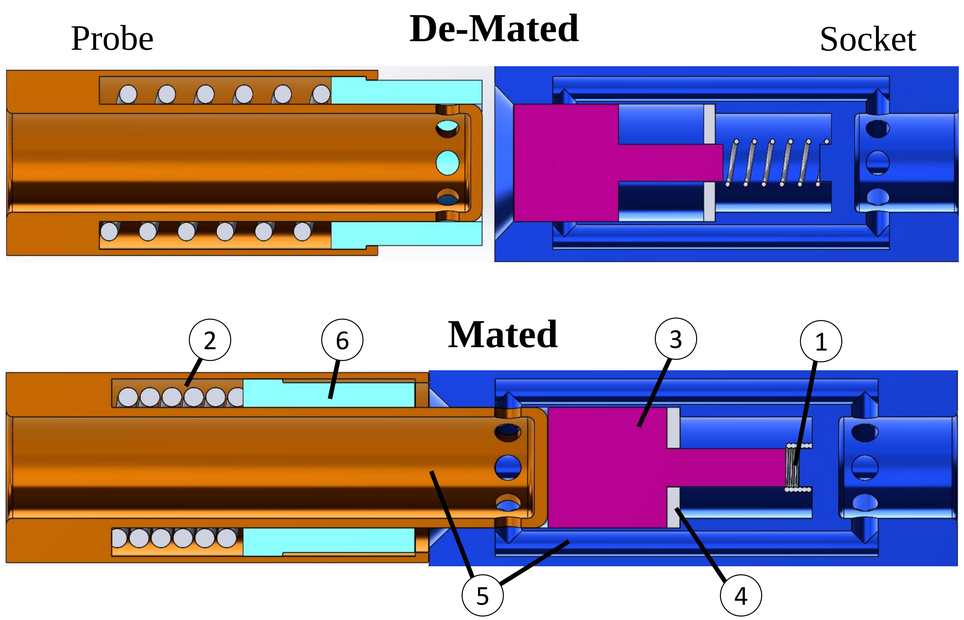
The objective of this project is to design, build, and test an actively sealed coupler that prevents the leakage of cryogenic fuel during the transfer from depot to vessel.

Background

Cryogenic fluids (Liquid Hydrogen/Liquid Oxygen) are used in deep space missions to fuel space vessels. Fuel transfer between a lunar fuel depot and space vessel is regulated by couplers. A good coupler design limits the fuel leakage and allows for deep space exploration.

Key Goals

- Protect from contamination and heat
- Survive a 90-day lunar mission
- Prevent and monitor leaks



Targets and Testing

The tests being conducted analyze the thermal properties of the system and the products ability to retain fuel in the desired conditions. The fuel is to be maintained at or below 80 degrees Kelvin. Internal and external leakage are targeted to be maintained at about ≤ 500 and ≤ 50 SCIM LN_2 respectively.

Future Work

1. Order materials
2. Refine design
3. Machine final design
4. Conduct cryogenic testing at the NHMFL

Components

How does it work? With force-held contact, the probe and receiver springs compress, the flow channels align, and fuel can flow from the depot to the spacecraft. When de-mated, the springs block the flow channels to prevent leakage.

Double-Poppet Valve	Force-Held Lock	Insulation	Encapsulated O-ring
Dual spring-loaded actuators to control flow	Connection facilitated by the spacecraft pilot	Multi-Layer Insulation (MLI) and a double vacuum wall	Solid core, PFA coated