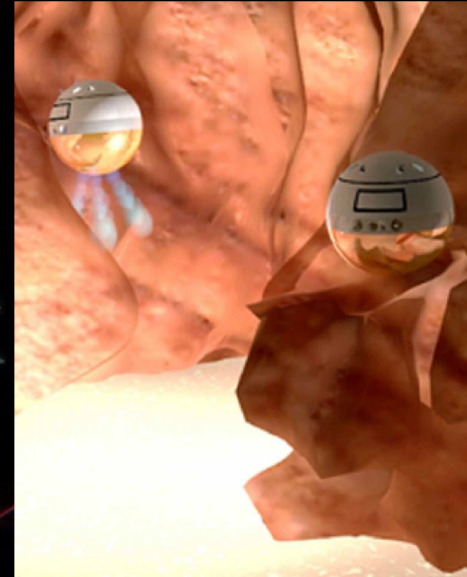
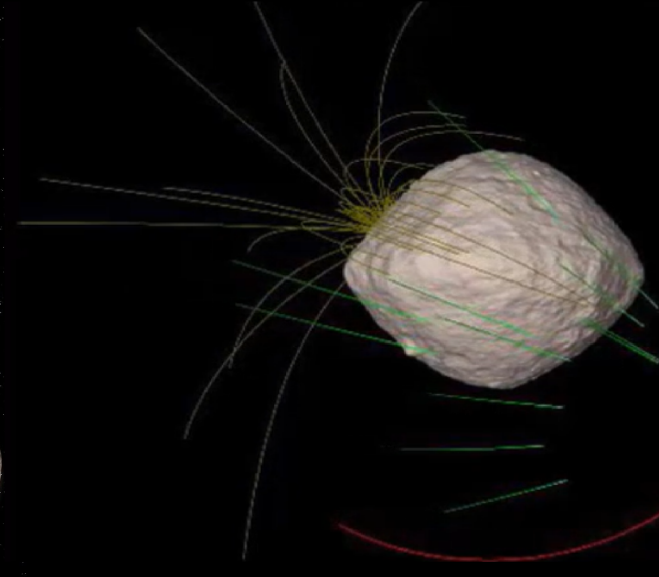
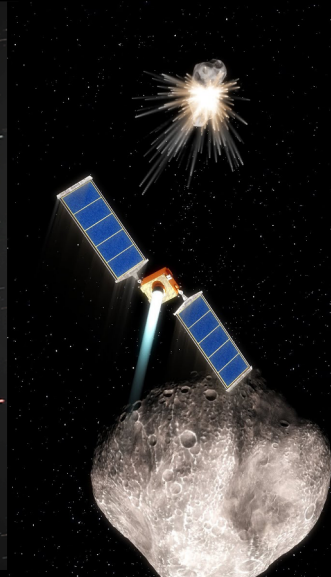
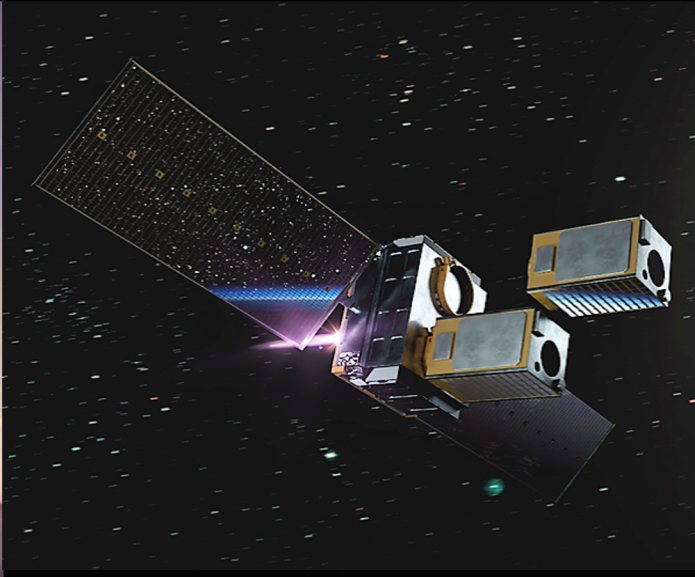


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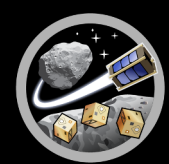
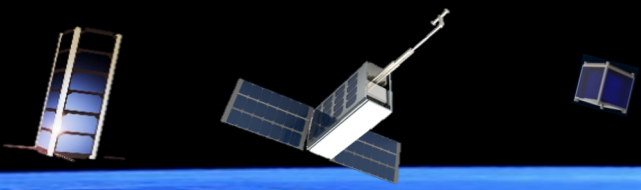


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PEM Self-Pressurization Tank Design

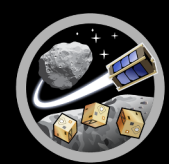
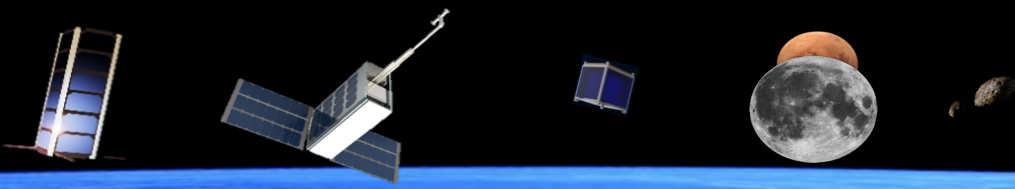
CJ Jauregui., Dr. Greg Ogden
Department of Chemical & Environmental Engineering
University of Arizona



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Presentation Outline

- **Big Picture**
 - **Where we fit in**
- **Objectives**
- **Background/Motivation**
- **Initial Research**
- **Potential Complications**
- **Calculations**
- **Equipment**
- **Challenges**
- **Next Steps**

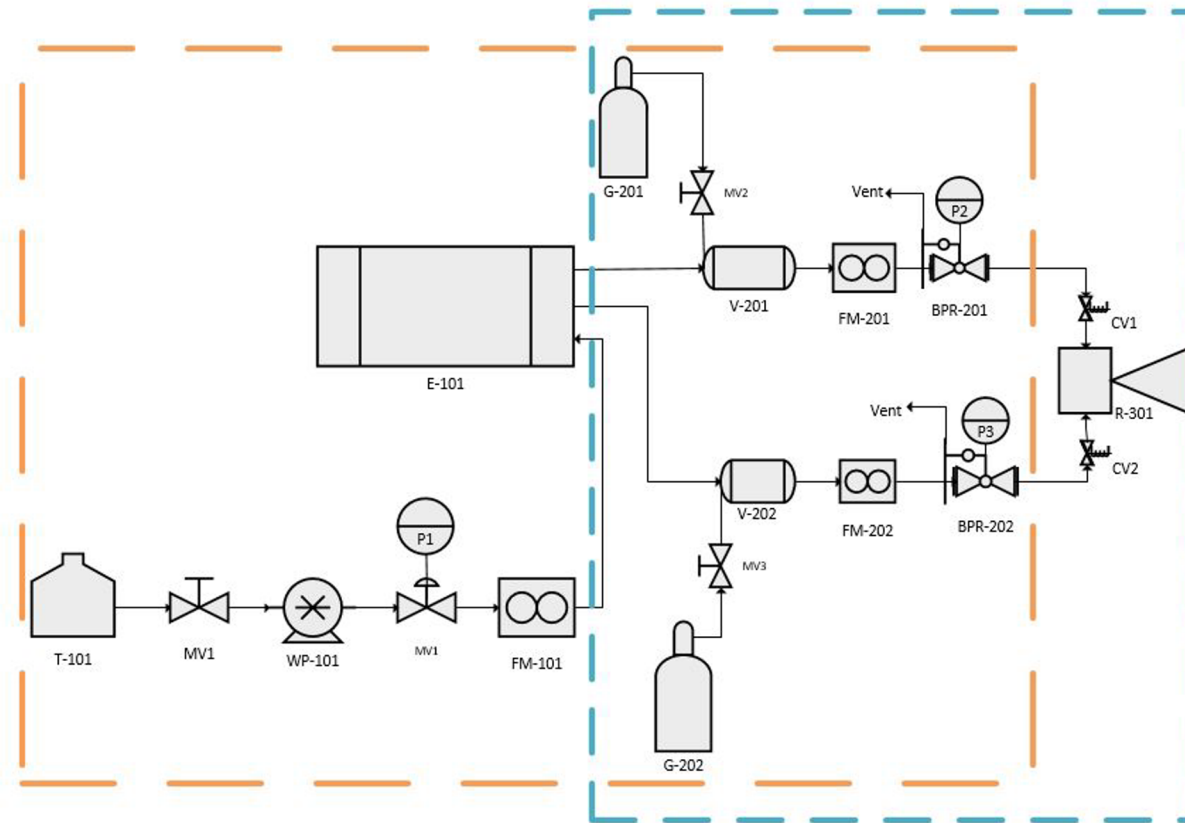


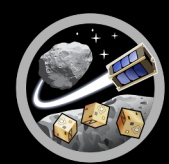
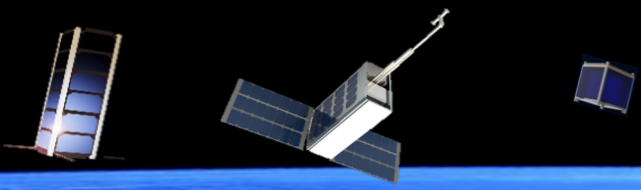
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Big Picture

- Develop Green Propulsion System for 1-3U CubeSat

T-101	WP-101	E-101	FM-101	G-201	G-202	V-201	V-201	BPR-201	BPR-202	FM-201	FM-202	R-301
Water Tank	Pressurization Pump	PEM Electrolyzer	Flow Meter	Hydrogen Cylinder	Oxygen Cylinder	Hydrogen Tank	Oxygen Tank	Hydrogen Back Pressure Regulator	Oxygen Back Pressure Regulator	Flow Meter	Flow Meter	Rocket Engine



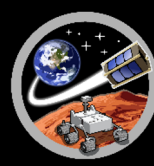


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Objectives

- **Literature study on relevant tank systems to evaluate various designs**
- **Design and eventual construction of a self-pressurizing tank apparatus to be assessed under various pressure conditions to determine feasibility**



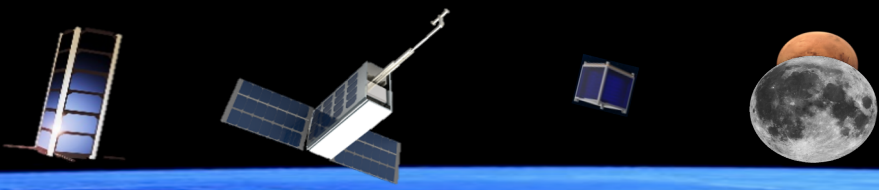


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Background/Motivation

- **CubeSat Propulsion Systems** historically nonexistent
- **“Development and Definition of a CubeSat Demonstrator for a Water Propulsion System”** by Colum Walter
 - No final proposed water tank
- **Motivation**
 - No compressor necessary
 - No hazards at launch

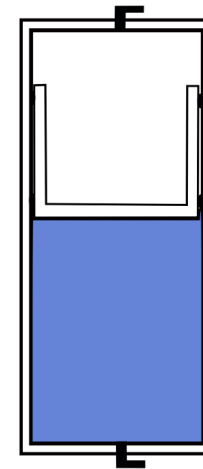
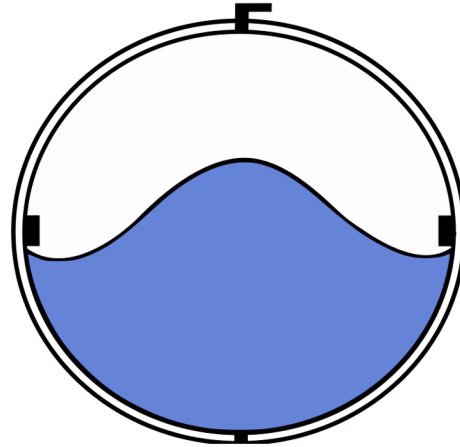
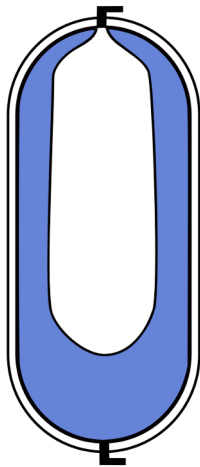


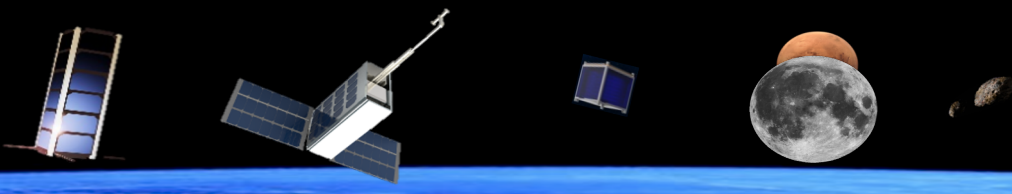


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Initial Research

- Different tank types
 - Propellant Management Devices
 - Positive Expulsion Devices
 - Bladder Tanks, Diaphragm Tanks, Piston Tanks

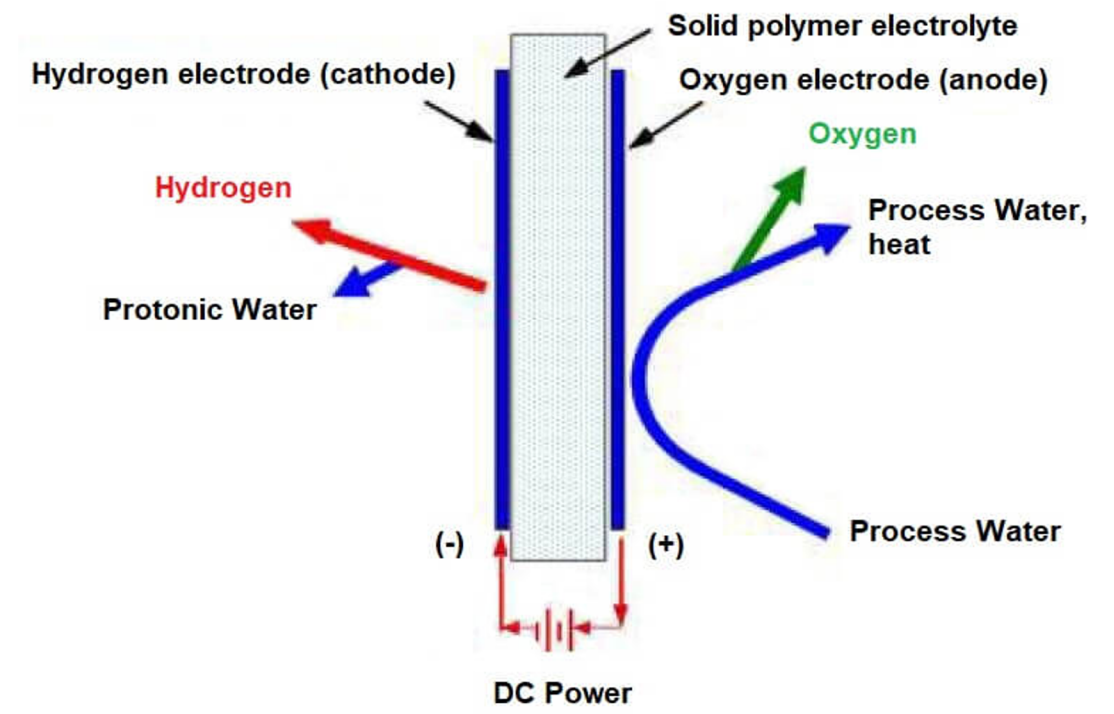


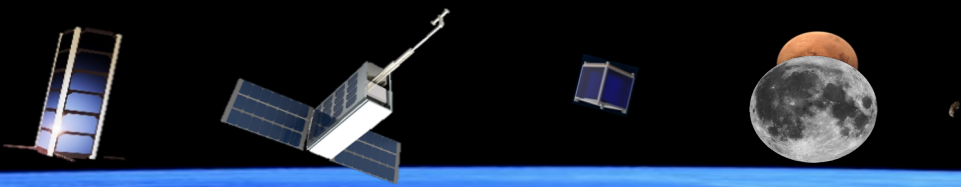


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Potential Complications

- PEM oxygen product line contains liquid water
- No water can be in oxygen side of tank
- Possible solutions
 - Tank separator
 - Filter or membrane

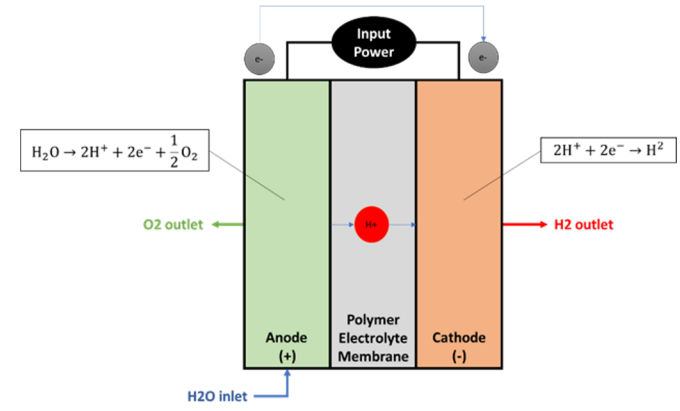


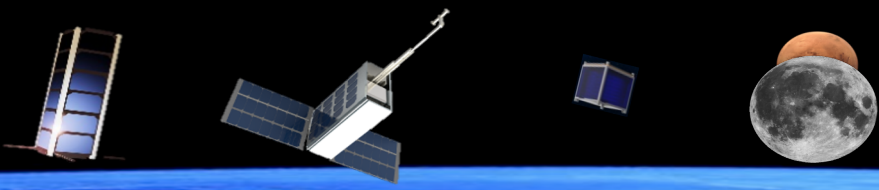


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Calculations

- Flow rates from Titan EZ-60 Stack
 - Water: 4 mL/hr
 - Oxygen: 0-30 mL/min
- Proposed experiment runtime of 1 hour
 - Minimum tank volume 4 mL
 - If oxygen confined to 10 mL:
 - Pressure: 180 atm

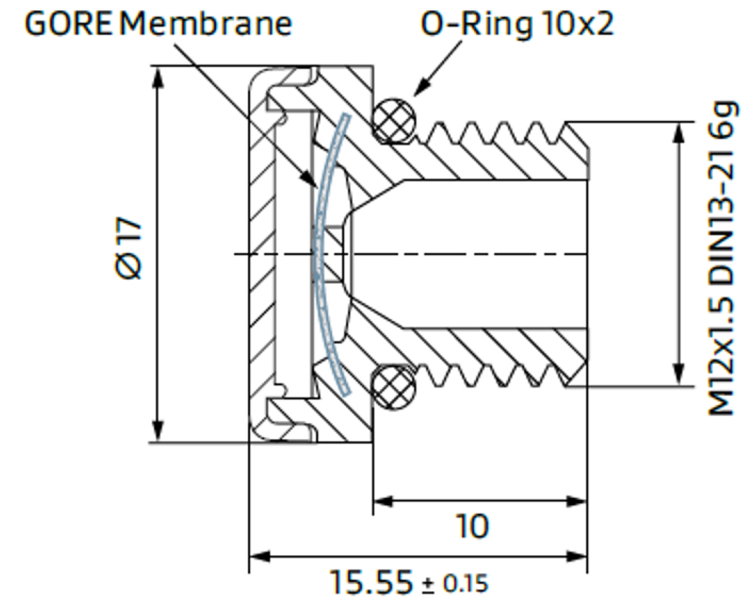


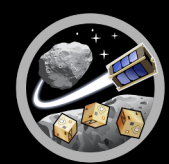
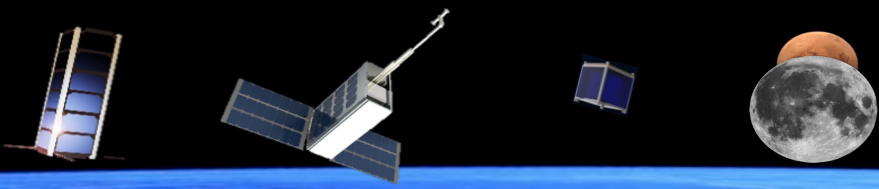


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Equipment

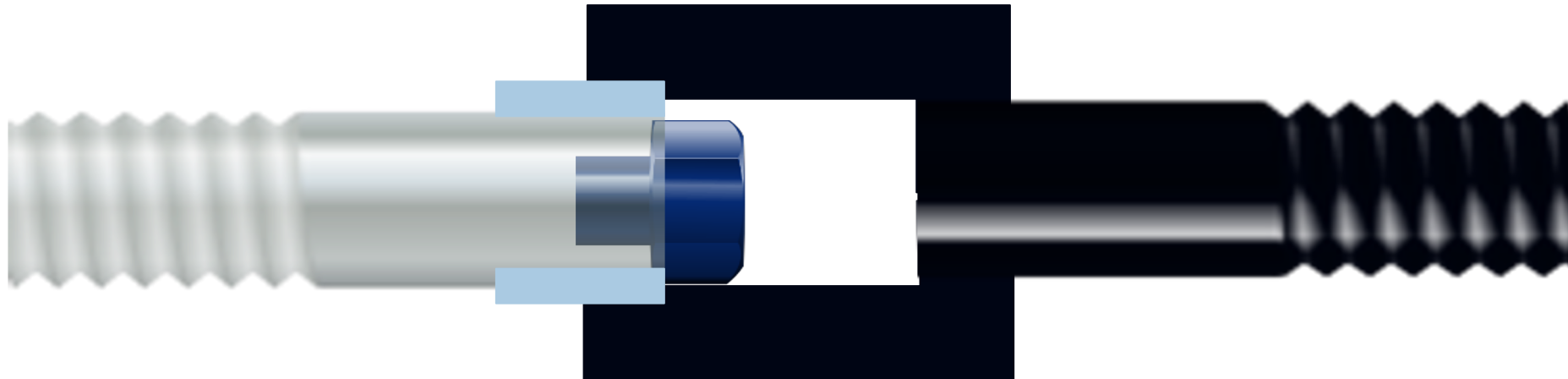
- Gore PolyVent Standard
 - Model: PMF100321 (gray)
 - Typical Airflow: 450 ml/min

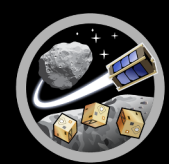
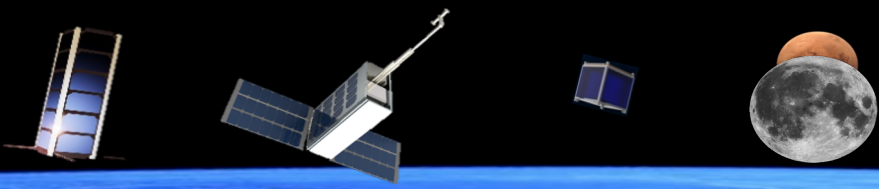




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Proposed Vent Housing Design

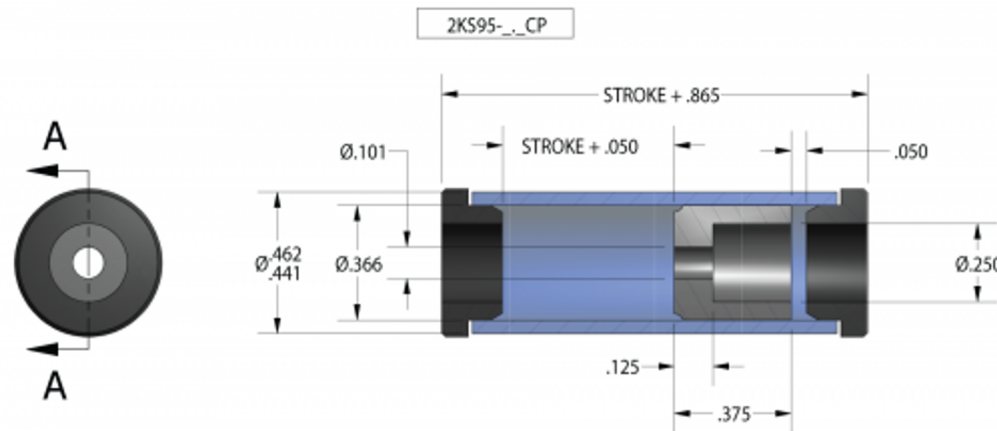


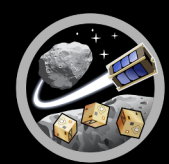
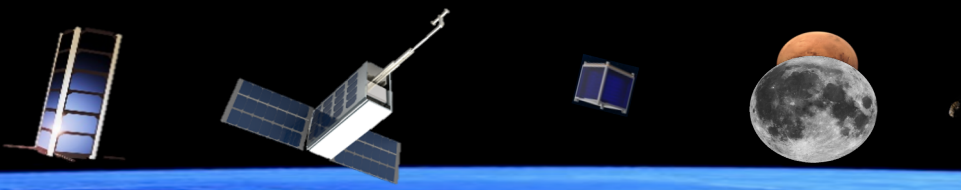


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Equipment

- Airpot Piston-Cylinder set
 - Model: 2KS95-8.0CP
 - Available Volume: 14.3 mL
 - Customer made housing

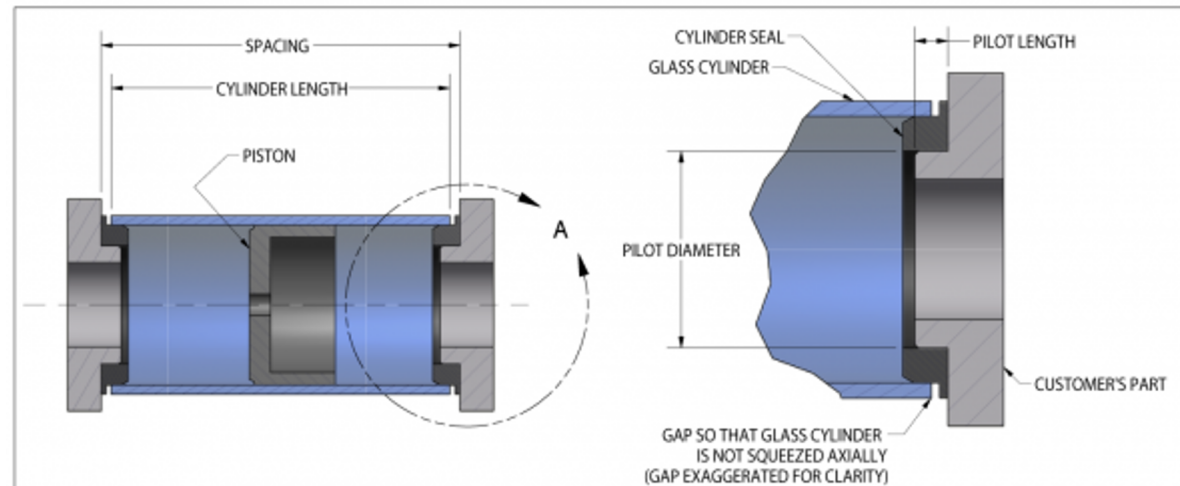


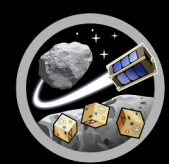
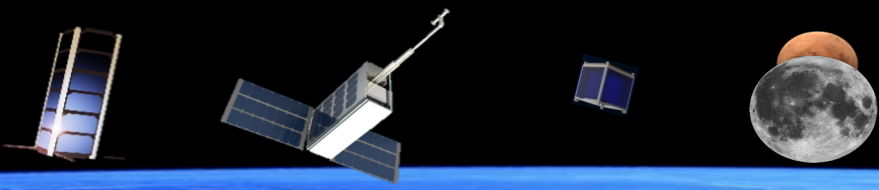


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Proposed Tank Housing Design

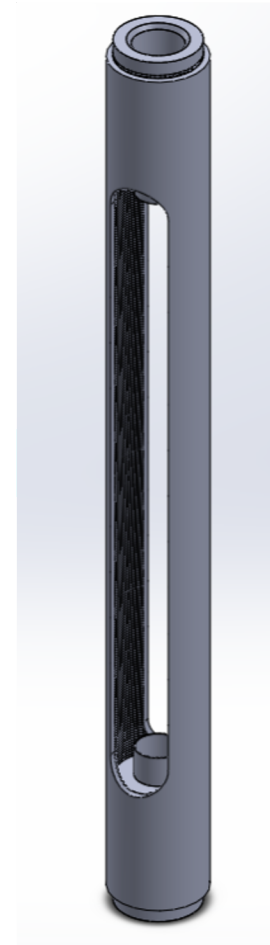
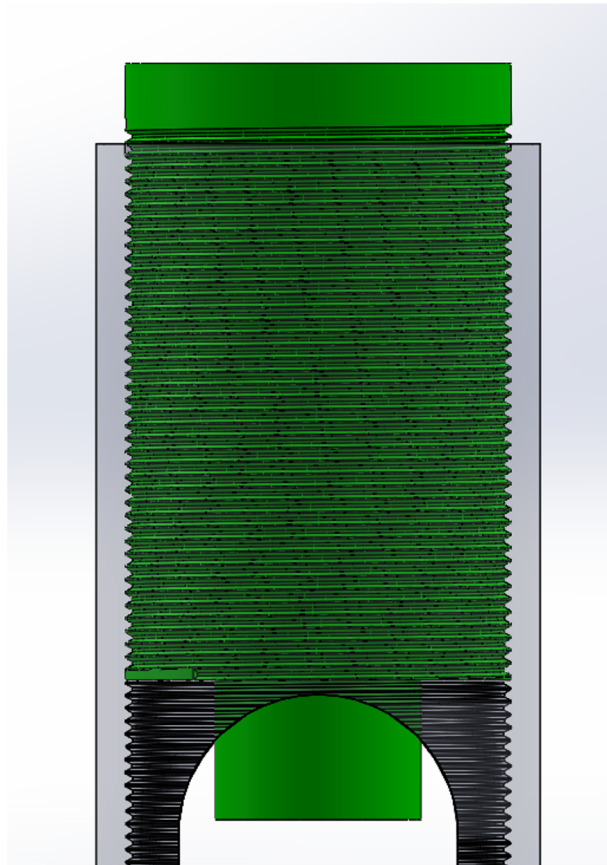
- To be machined from a $\frac{1}{4}$ straight threaded pipe
- Ends tapped for a $\frac{1}{16}$ NPT fitting
- Silicone rubber seals provided by Airpot



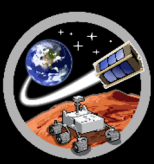
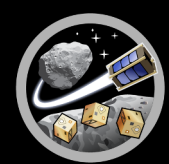
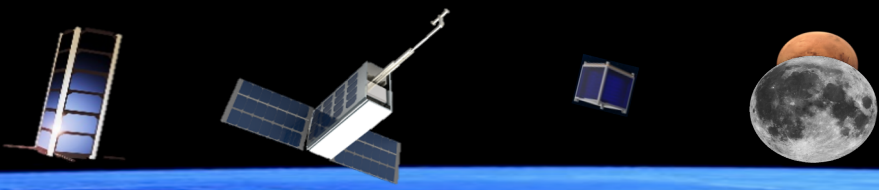


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Initial Design for Piston Tank Housing

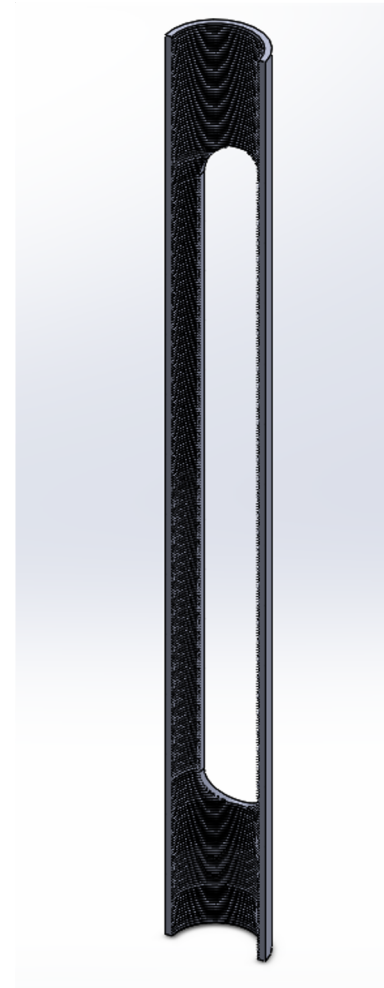
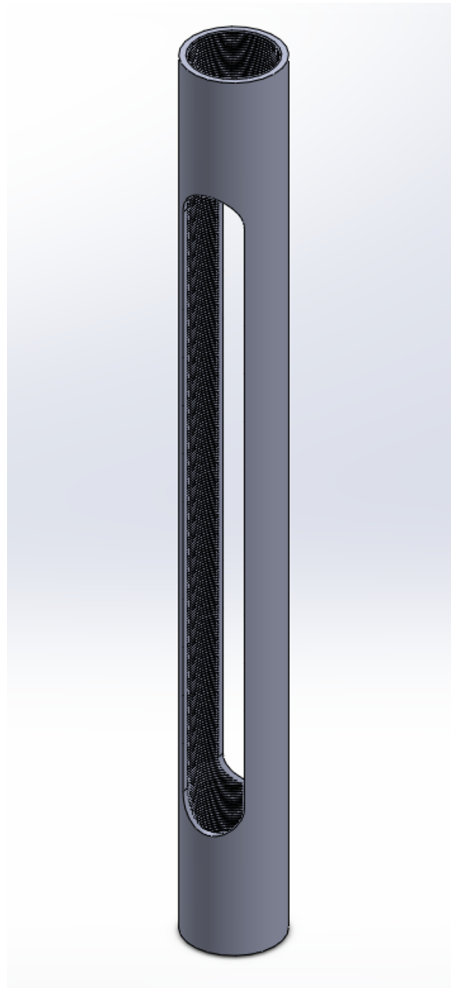


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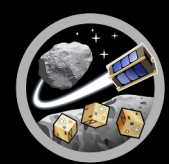
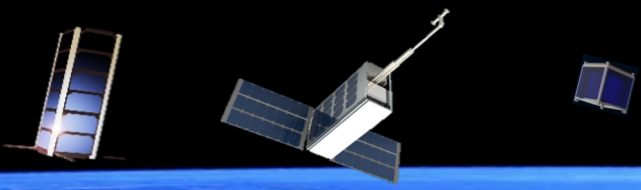


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Housing Shell

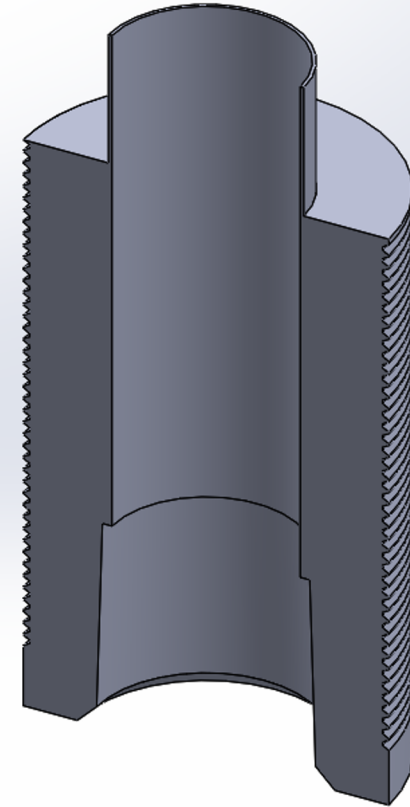
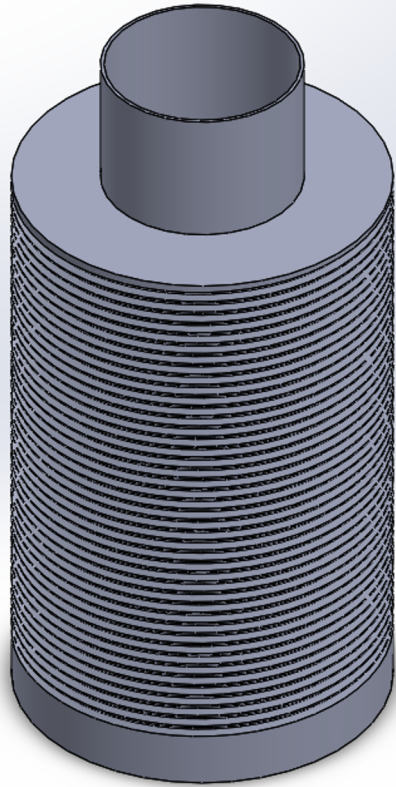


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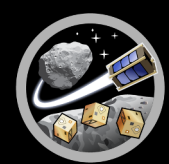
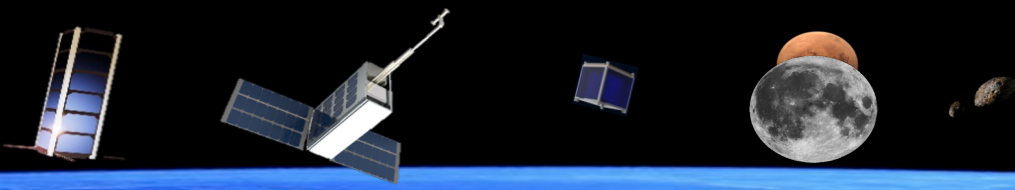


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Housing Ends



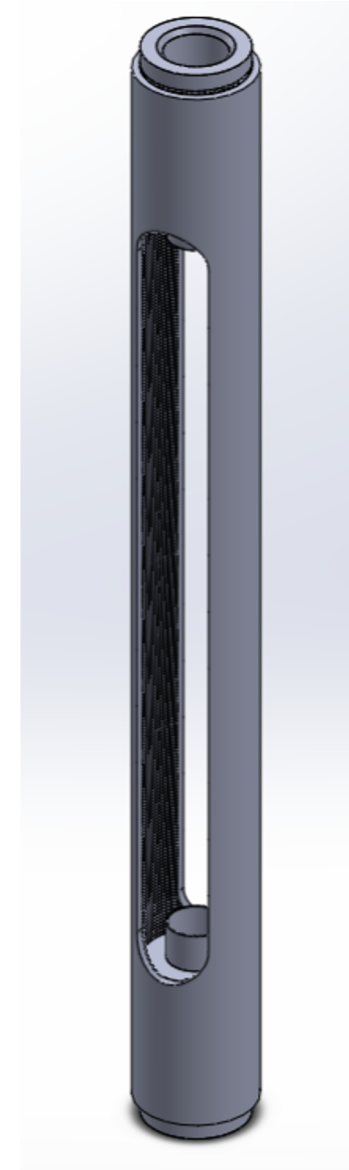
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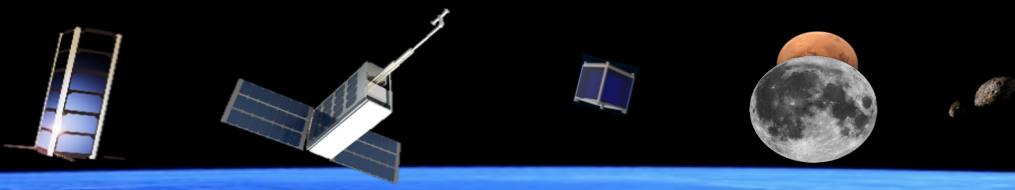


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Challenges

- **Project started in January**
- **Access to SolidWorks**
- **Obtaining equipment information**
 - **Corresponding with companies**
- **Balancing Senior workload and project goals**

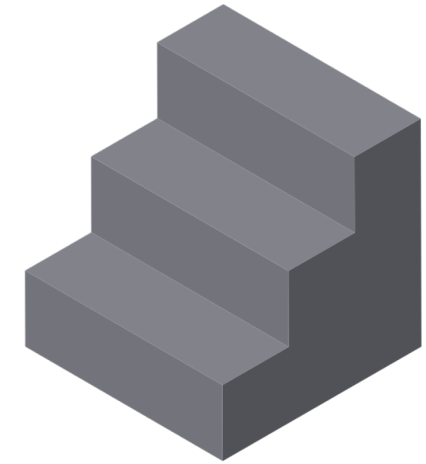


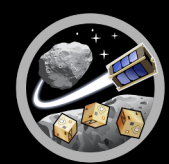
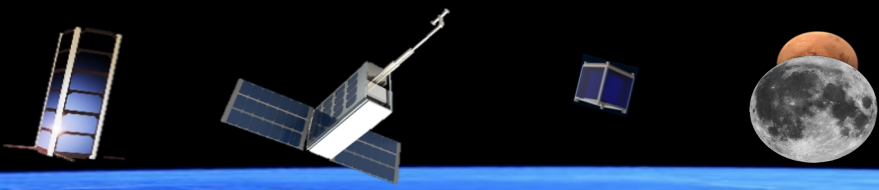


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Next Steps

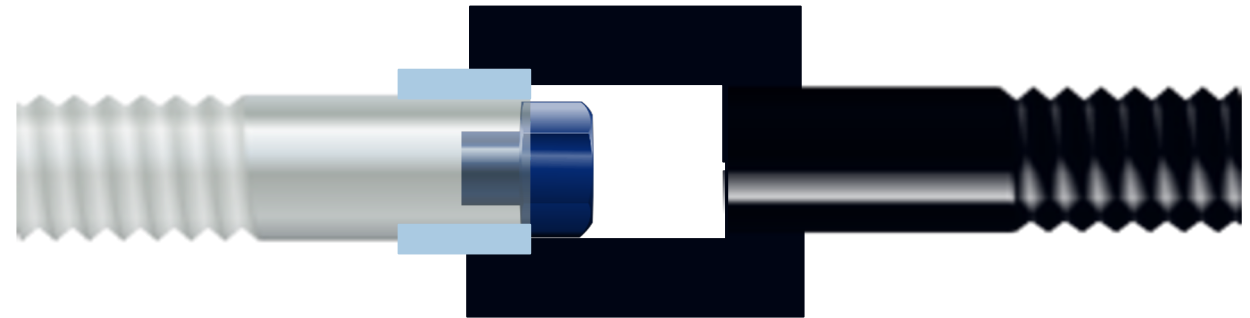
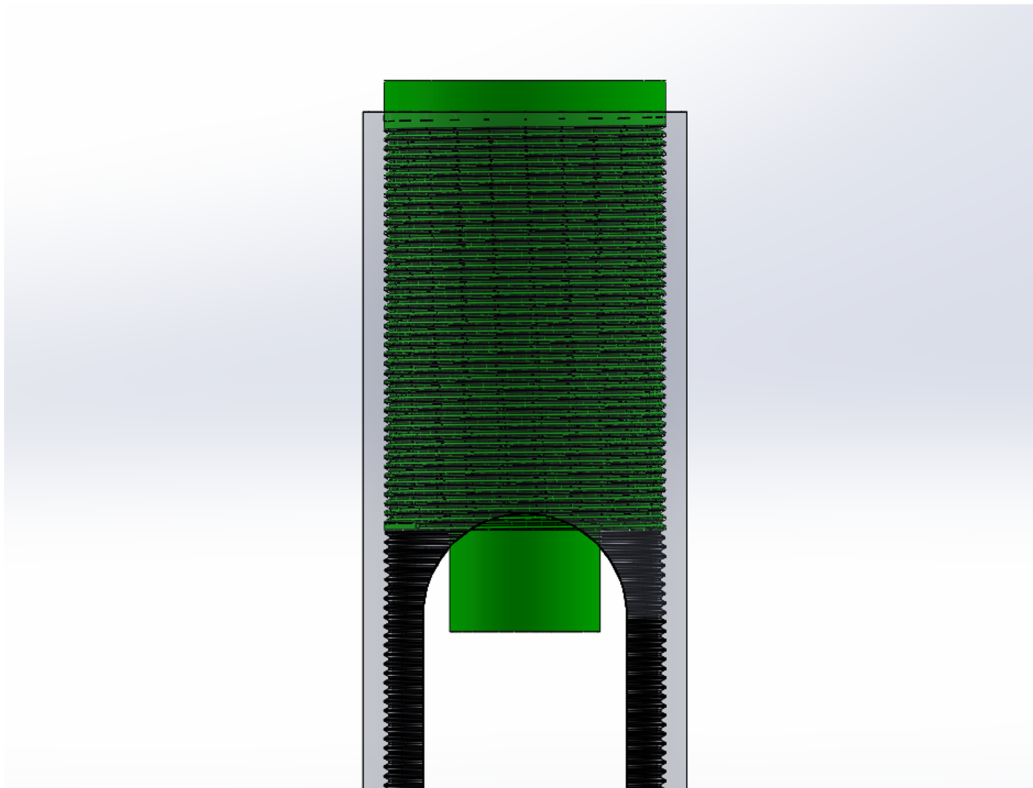
- Place order for Piston-Cylinder set
 - Start machining housing
- Finalize vent housing design
 - Order required parts and construct
 - Assess impermeability of vent under pressure
- Begin construction and experimentation of tank apparatus

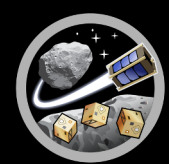
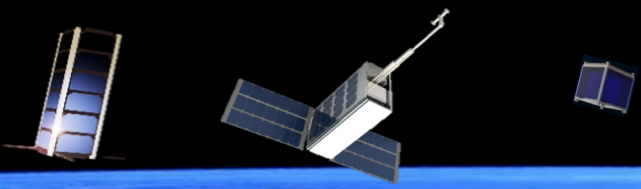




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Questions?





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