

Flight-Ready Electric Feed System

MME 2018-2019 Capstone Project



SPONSORS:

Portland State Aerospace Society
Oregon NASA Space Grant Consortium

INDUSTRY ADVISOR:

Andrew Greenberg

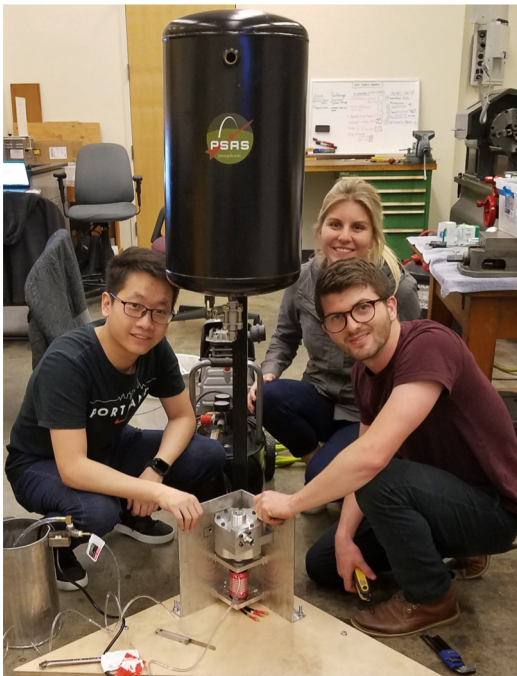
PRINCIPLE INVESTIGATOR:

Dr. Mark Weislogel



TEAM MEMBERS

Shayli Elrod	Julio Garcia	Henry Ju	Nick Sheldon	Jonas Mendoza	Philip Wahl
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PRESENTATION AGENDA

- Project Proposal
- Project Requirements
- Design
- Manufacturing
- Results
- Continuation

CAPSTONE PROPOSAL

PROJECT SPONSOR

Portland State Aerospace Society

Oregon NASA Space Grant Consortium

PROJECT PROPOSAL

Develop an Electric Feed System to pump two propellants for a liquid rocket engine.



CUSTOMER REQUIREMENTS

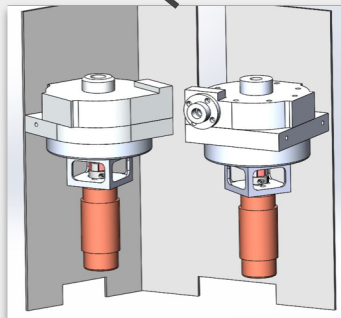
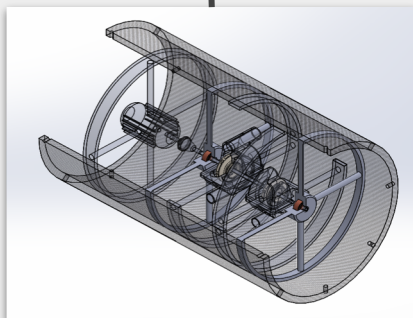
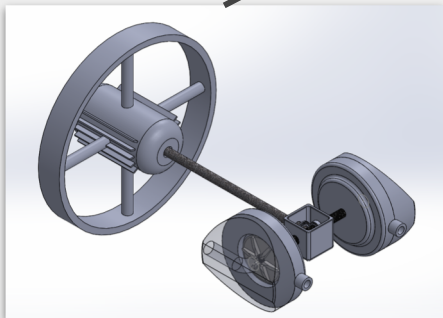
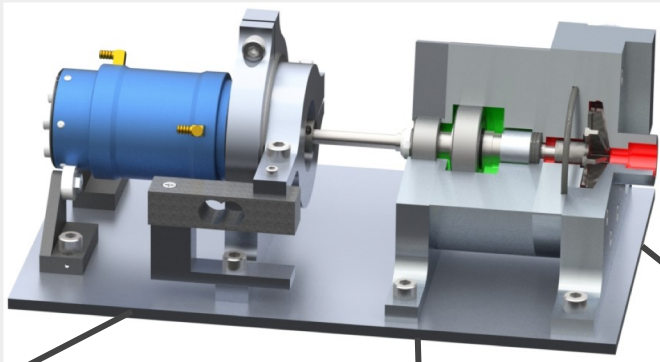
CUSTOMER REQUIREMENTS	
REQUIREMENT	PRIORITY
Must be tested with liquid nitrogen (LN2) and isopropyl alcohol (IPA)	5
Must safely keep the propellants separated at all times	5
Should have emergency shut off procedure and battery cutoff	5
Must deliver propellants at 450psi with NPSH of 45-100psi	4
Should have embedded sensors for data acquisition	4
Should have embedded sensors for feedback and control	3
Must be compatible with liquid oxygen (LOX)	3

ENGINEERING REQUIREMENTS

ENGINEERING REQUIREMENTS			
REQUIREMENT	UNIT	ORIGINAL VALUE	FINAL VALUE
Pressure	psi	400	450
Mass Flow	lbm/s	2.04	2.04
Total Shaft Power	kW	5	5
IPA Rotational Speed	rpm	20,000	35,600
LN2 Rotational Speed	rpm	15,000	24,400
Engine Thrust	kN	2.2	2.2
Module Diameter	in	12	12

DESIGN

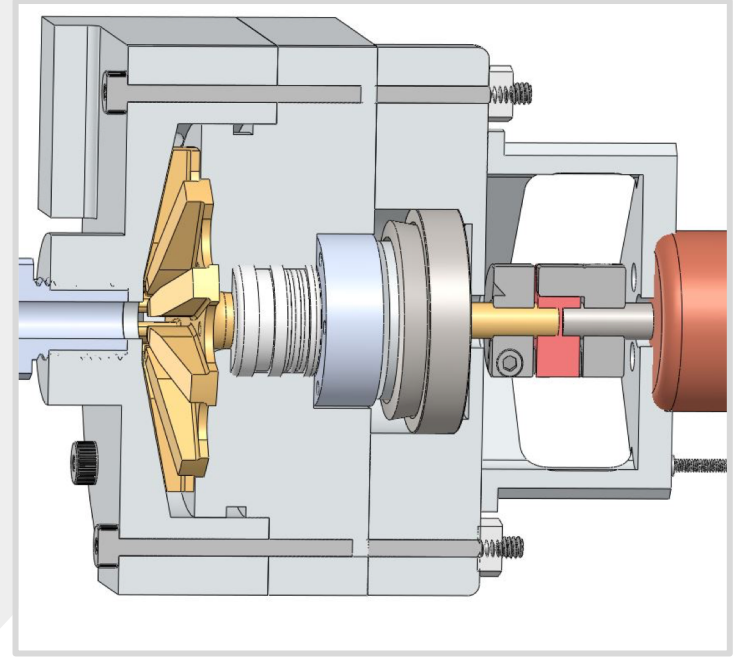
CONCEPTION



DESIGN

IPA PUMP

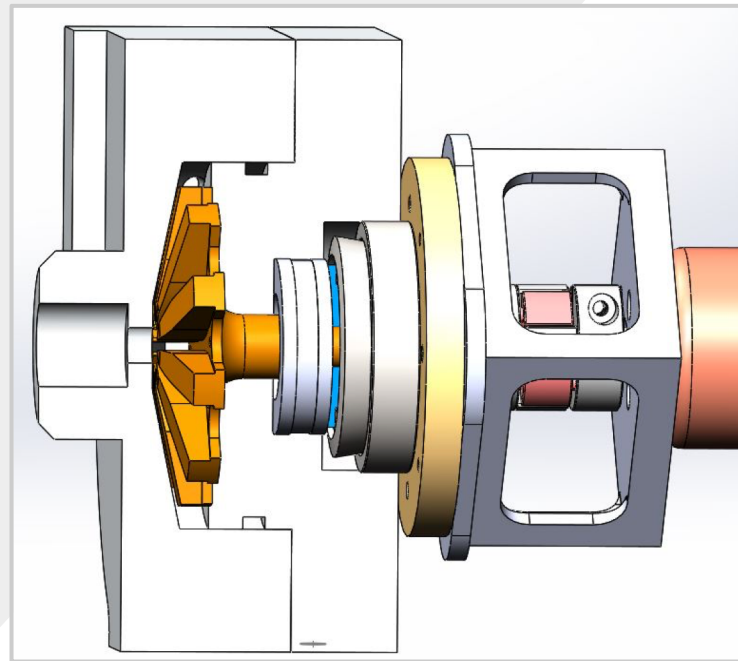
- 3.0" Impeller Diameter
- 35,700 RPM
- 1.7 kW Power
- FlowServe Type 15 Seal
- Stainless Thrust Bearing
- 6061 Aluminum Case and Impeller



DESIGN

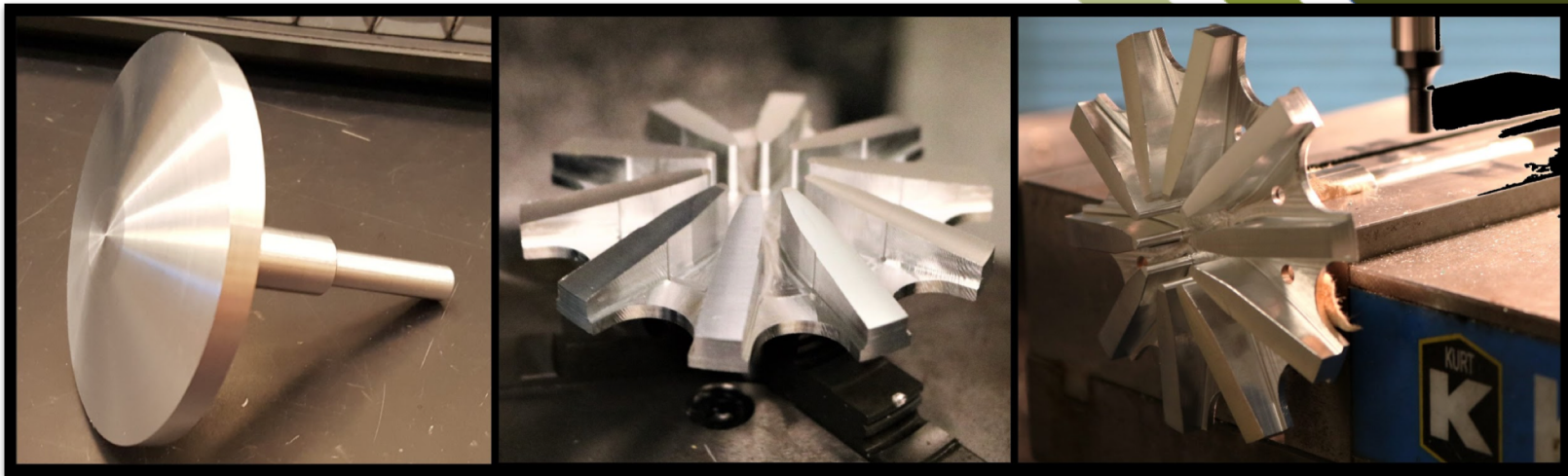
LOX PUMP

- 2.5" Impeller Diameter
- 24,300 RPM
- 2.1 kW Power
- Teflon Seal
- BOCA Ceramic Bearing
- Stainless Thrust Bearing
- 6061 Aluminum Case and Impeller



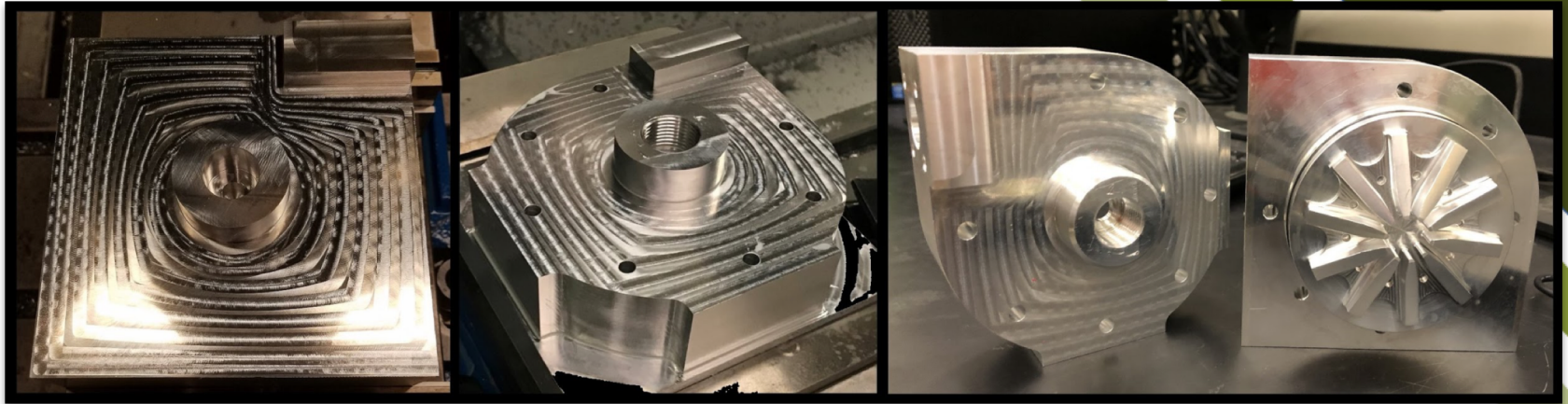
MANUFACTURING

Impeller

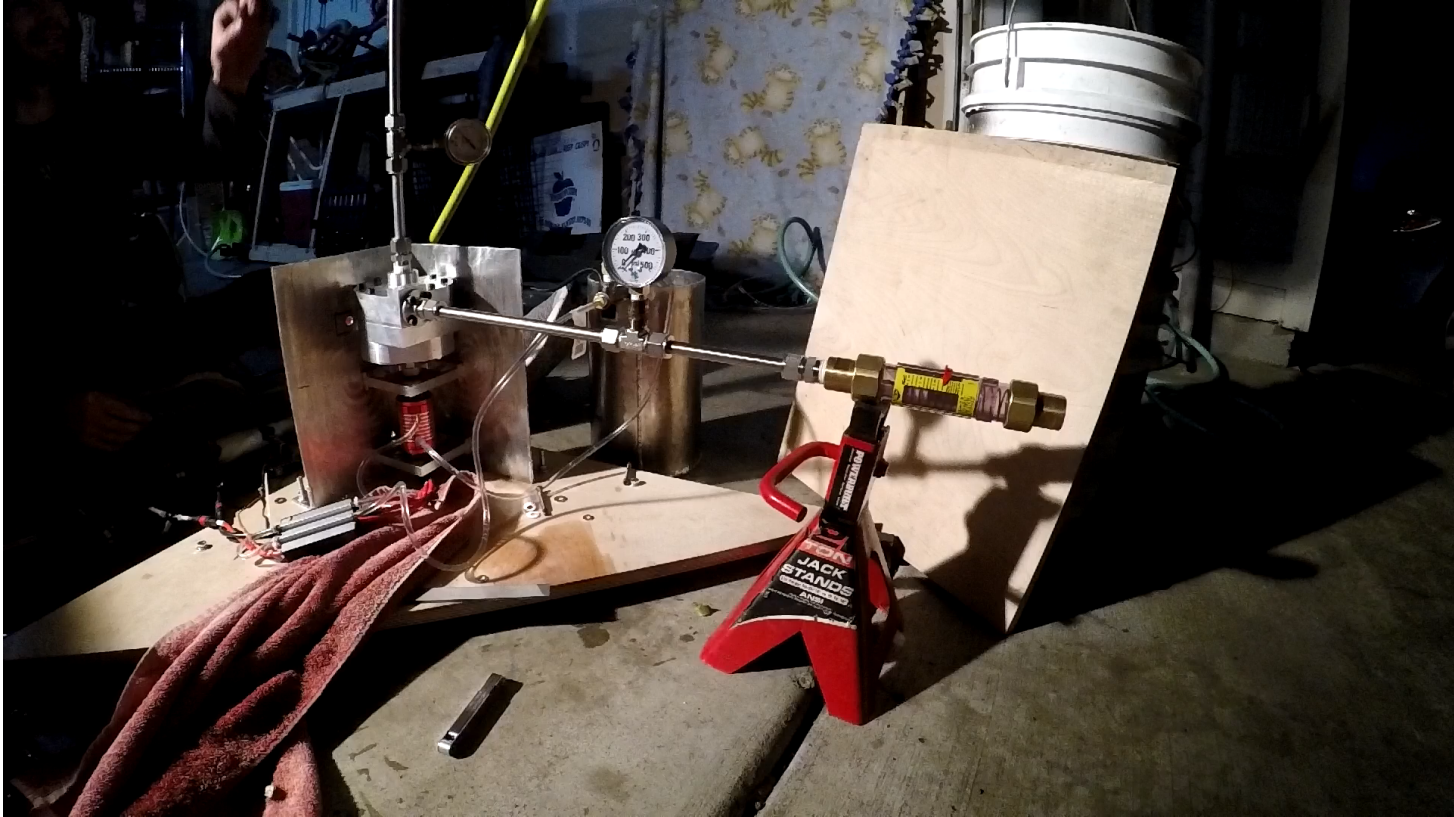


MANUFACTURING

Pump Case



RESULTS



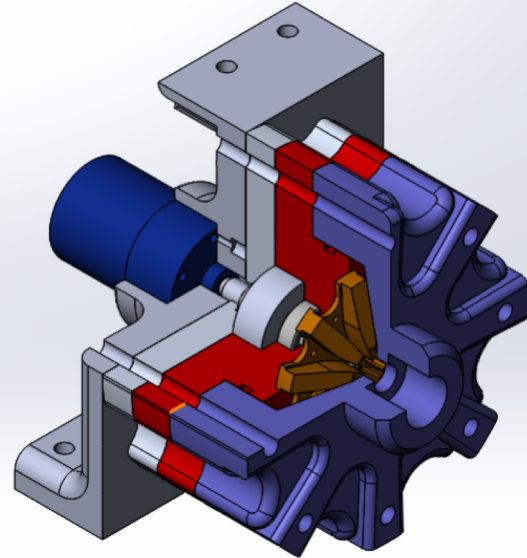
RESULTS



CONTINUATION

WEIGHT REDUCTION

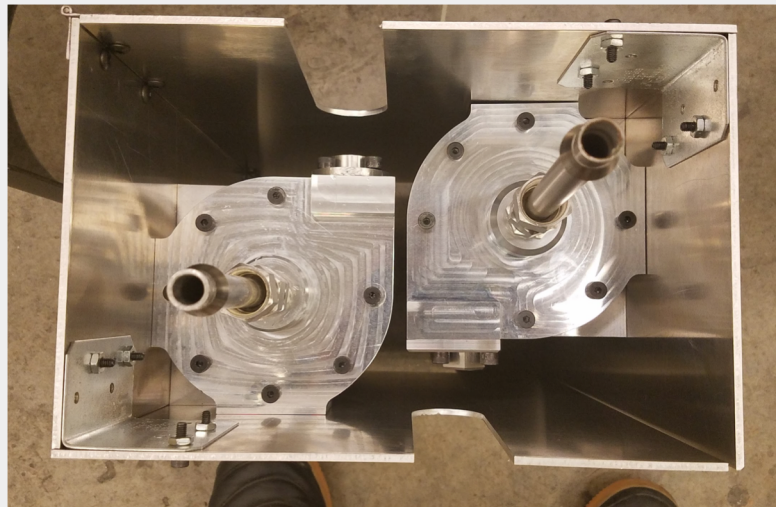
- Case Geometry
- Integrated Motor Assembly
- Reduce Hardware



CONTINUATION

AIRFRAME INTEGRATION

- Develop mounting system
- Design Internal Piping
- Identify Flow losses
- Sensor integration



THANK YOU



Portland State Aerospace Society

Oregon Space Grant Consortium

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Portland State MME Department

