



Liquid Test Stand Development

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Background



- Oregon State Rocketry
 - Solid propellant and hybrid rockets
 - Liquid Engine Research
- Project Overview and Motivation
 - Base 11 Space Challenge
 - Required Infrastructure

Oregon State Rocketry

The background image shows a complex industrial setting, likely a rocket engine test cell. A person wearing a blue nitrile glove is visible, working on a large, metallic, cylindrical component. The component is secured with various bolts and nuts. In the background, there are metal structures, pipes, and a bright yellow light source, possibly a flame or a lamp, creating a high-contrast scene.

Solid Propulsion Senior Design Rocketry Teams:

- Experimental Sounding Rocketry Association (ESRA) – 30k
- High Altitude Rocket Team (HART) – 80k

Hybrid Propulsion Undergraduate Rocketry Team:

- Hybrid Rocketry HTPB/ Nitrous Oxide – 10k

Liquid Propulsion Graduate Research Project:

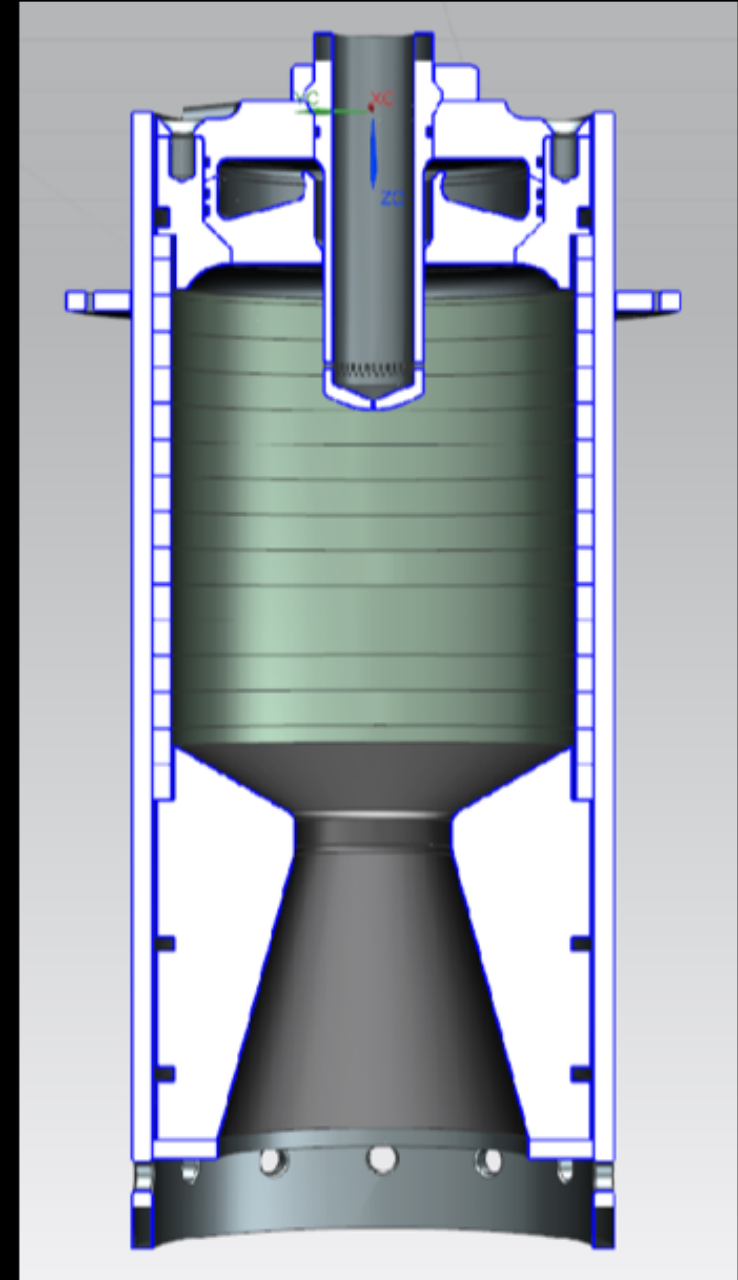
- Preliminary Engine Research/Injector Cold Flow Testing



Liquid Bipropellant Rocket Engine

Engine Specifications:

- Kerosene\Liquid Oxygen
- 2000 lbf Thrust
- Pintle Injector Design
- Ablative G10 Liner
- 350 psi Chamber Pressure





Test Stand Requirements



Tank Stand

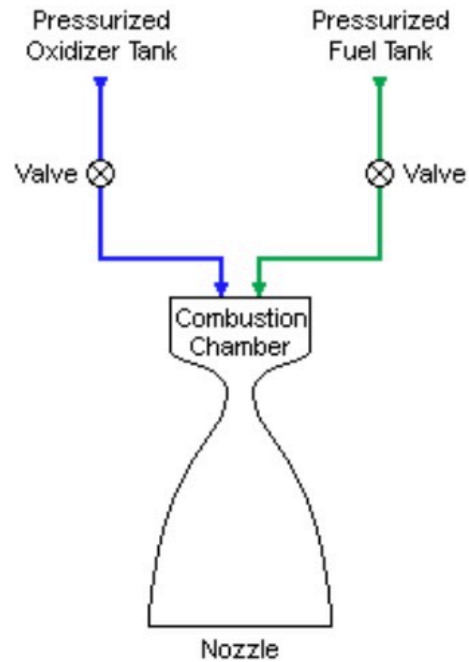


Fig. 1.11 - PRESSURE-FED

Initial Design Decisions:

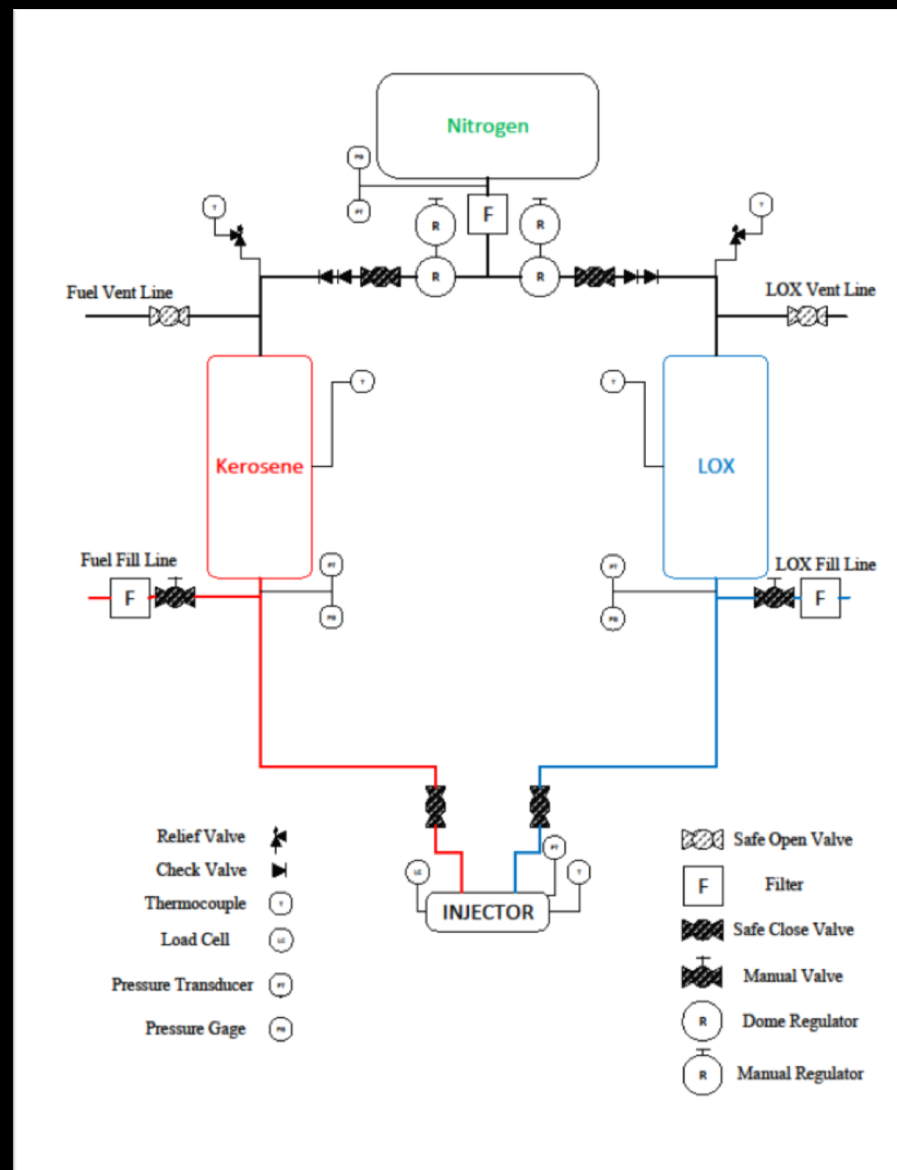
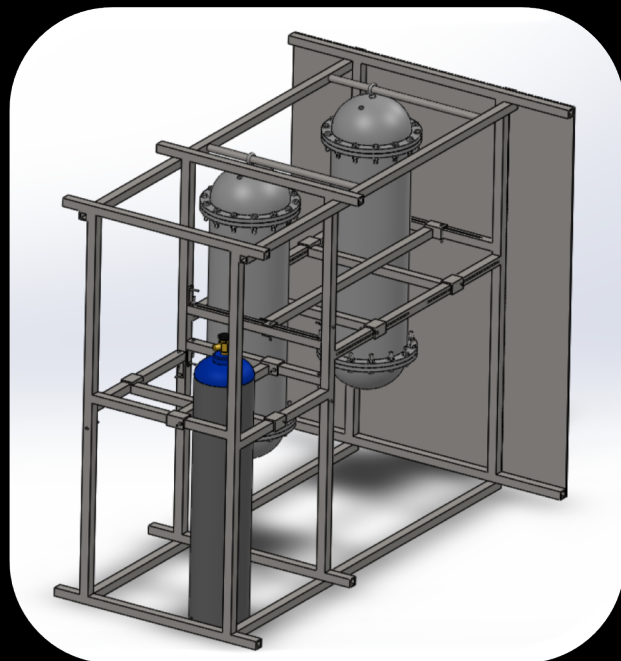
- Pressure Fed (Regulated) Cycle
- Entirely LOx Compatible
- Automated for Safety
- Robust for Potential Anomalies
- Strong Enough to Handle 4000 lbf Engine



Test Stand Design



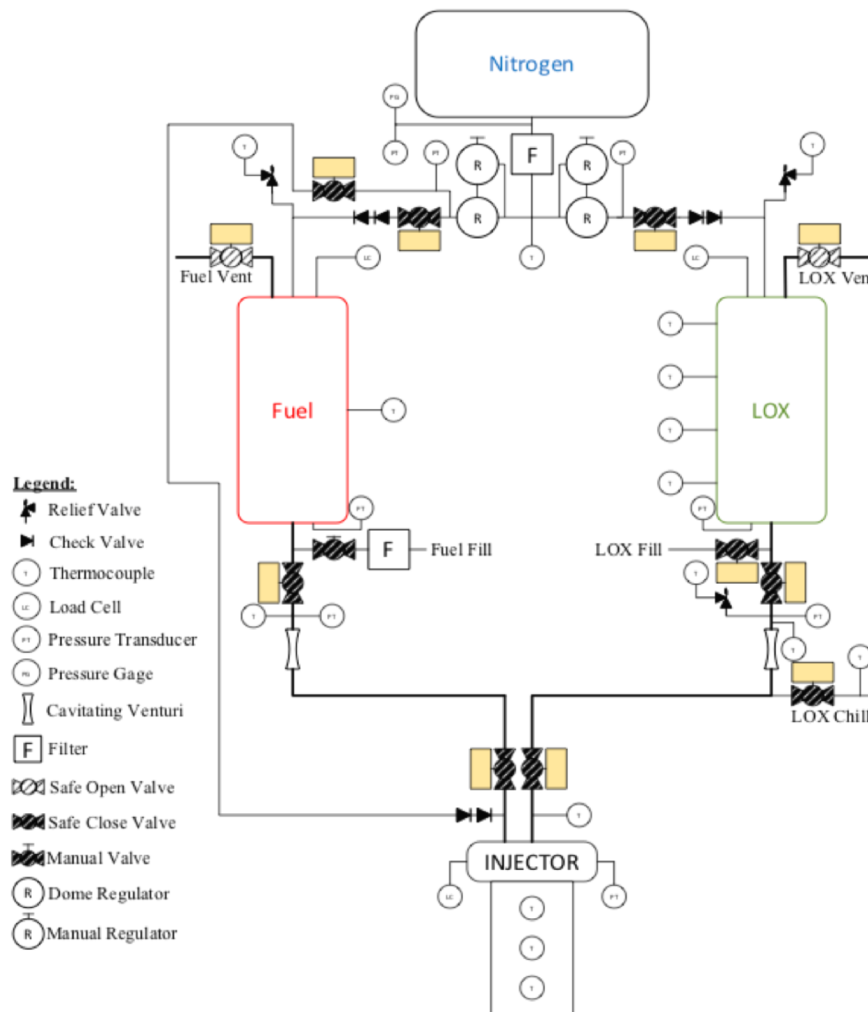
Test Stand Design





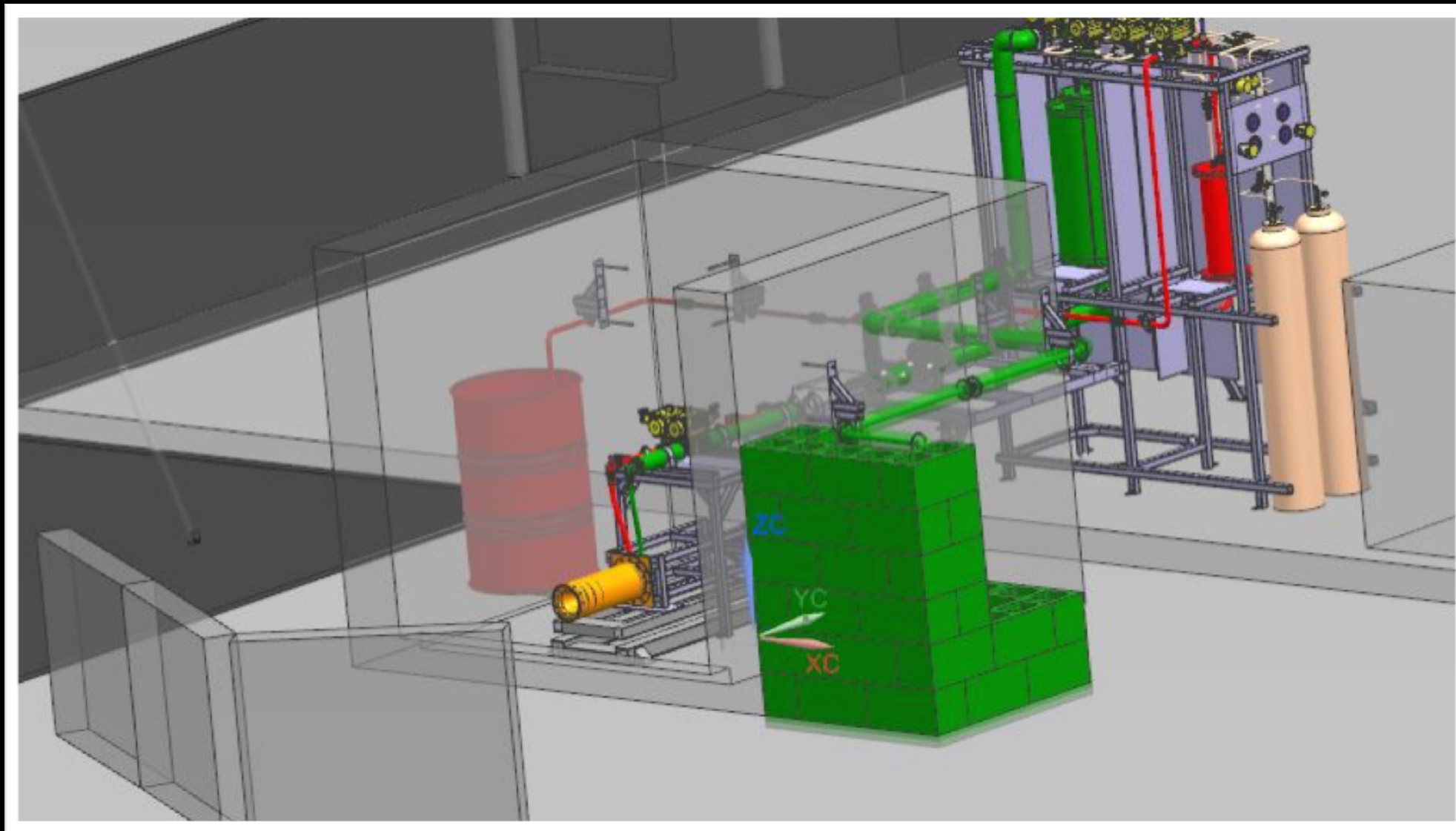
Test Stand Design

SHARPE VALVES



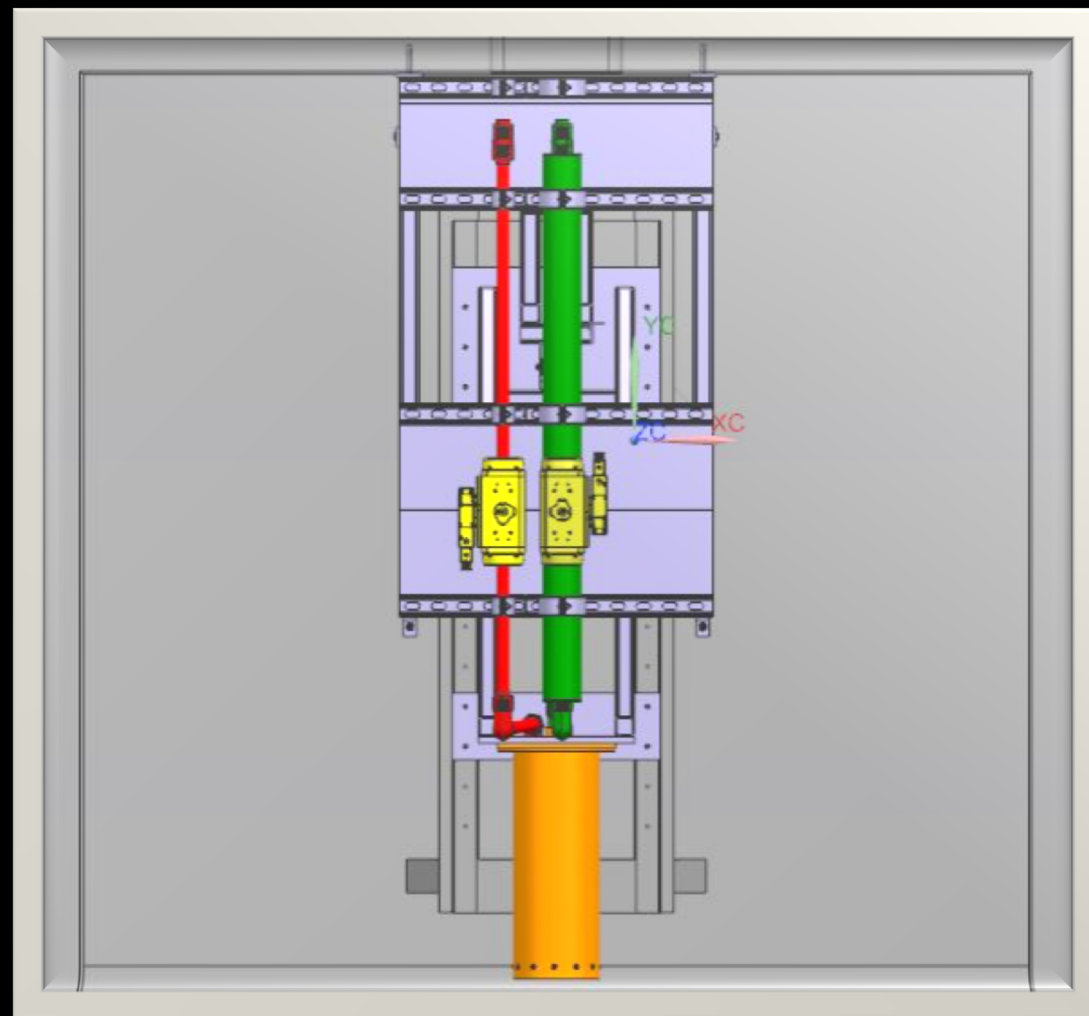
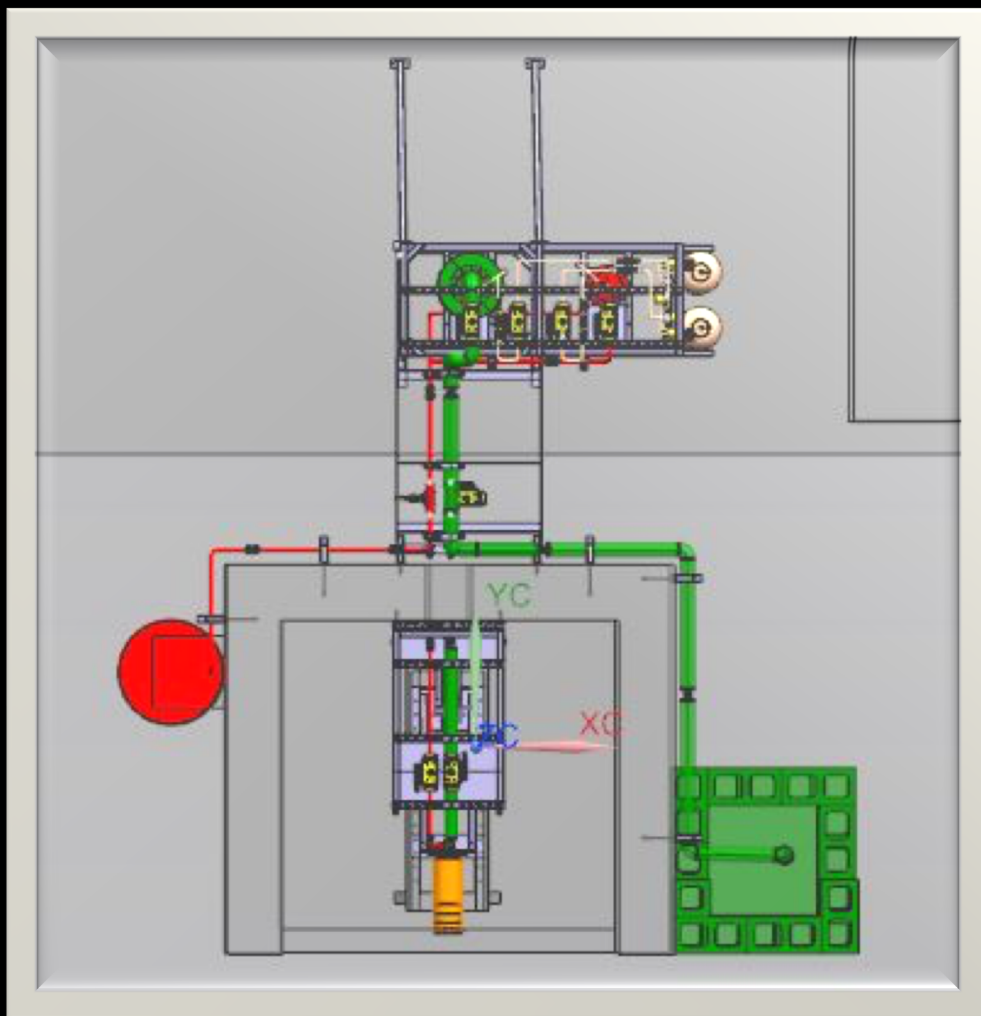


Test Stand Design





Test Stand Design





Manufacturing & Assembly



Tank Stand



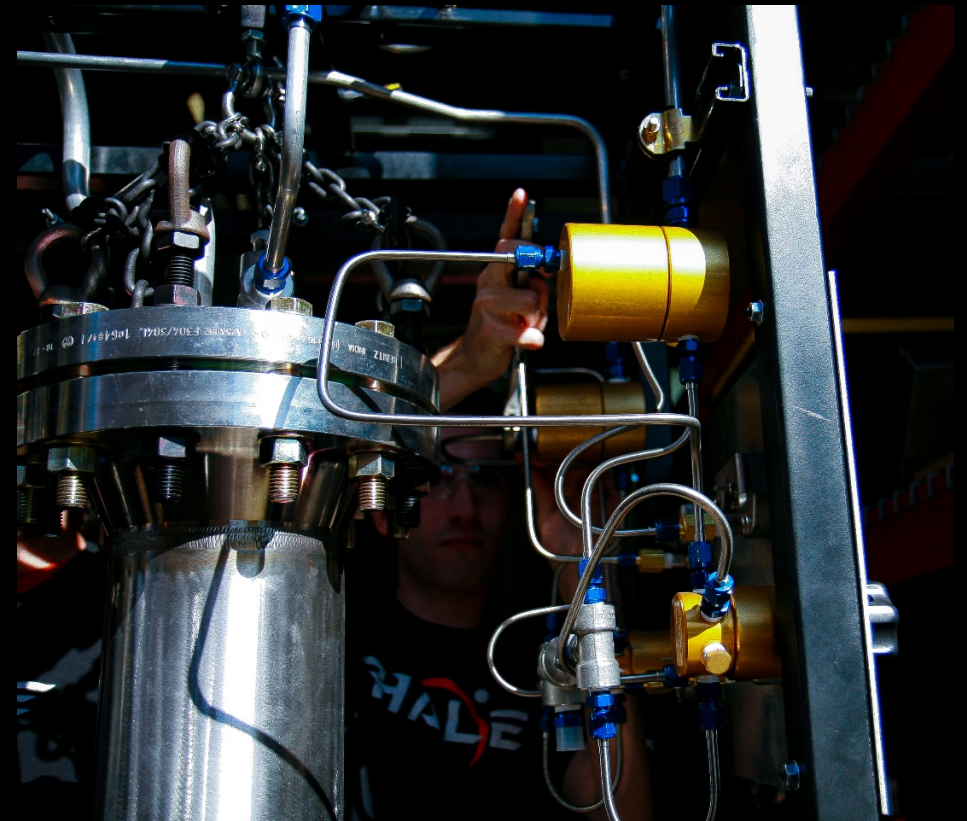


Lines



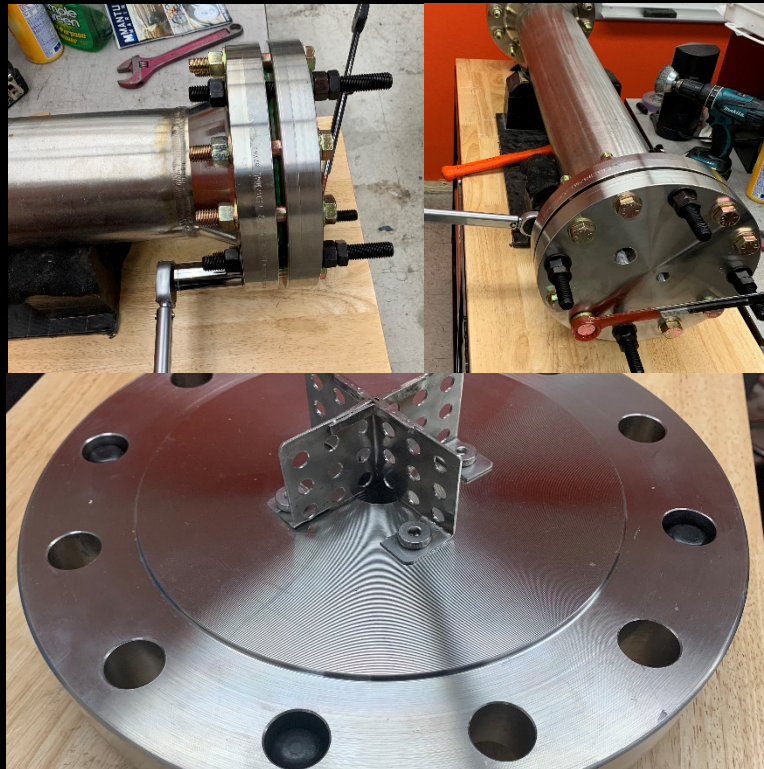


Pressure Regulators





Run Tanks





Propellant Path to Engine





Engine Sled Mount





LOx Catch

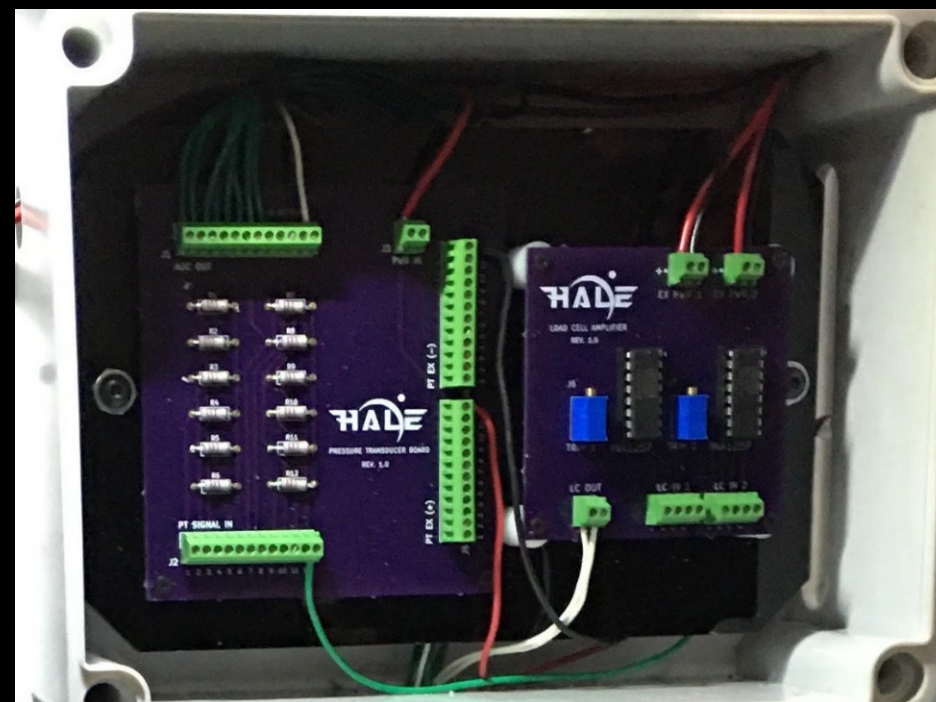




Testing Timeline & Future Work



Data Acquisition





System Controls

Python



LabVIEW

```
pyign — IPython: pyign/functions — -bash — 101x25
(base) Devons-MacBook-Pro-2:pyign devonburson$ python functions -g

Initialize System:
(SAFE MODE) Ignitor State = 0
(NO GO) GO/NOGO = [0, 0, 0]

Turn Control Panel and Fuel Panel "GO/NOGO" states to "GO":
(GO) GO/NOGO = 1 {Control Panel}
(NO GO) GO/NOGO = 0 {LOX Panel}
(GO) GO/NOGO = 1 {Fuel Panel}

(NO GO) GO/NOGO = [1, 0, 1] {System}

Attempt to set "Ignitor" state to "ACTIVE":
(SAFE MODE) Ignitor State = 0

Failed to set "Ignitor" state to "ACTIVE" until all Operator Panel "GO/NOGO" states are set to "GO"

Turn LOX Panel "GO/NOGO" state to "GO" and set "Ignitor" state to "ACTIVE":
(GO) GO/NOGO = [1, 1, 1]
(ACTIVE) Ignitor State = 1

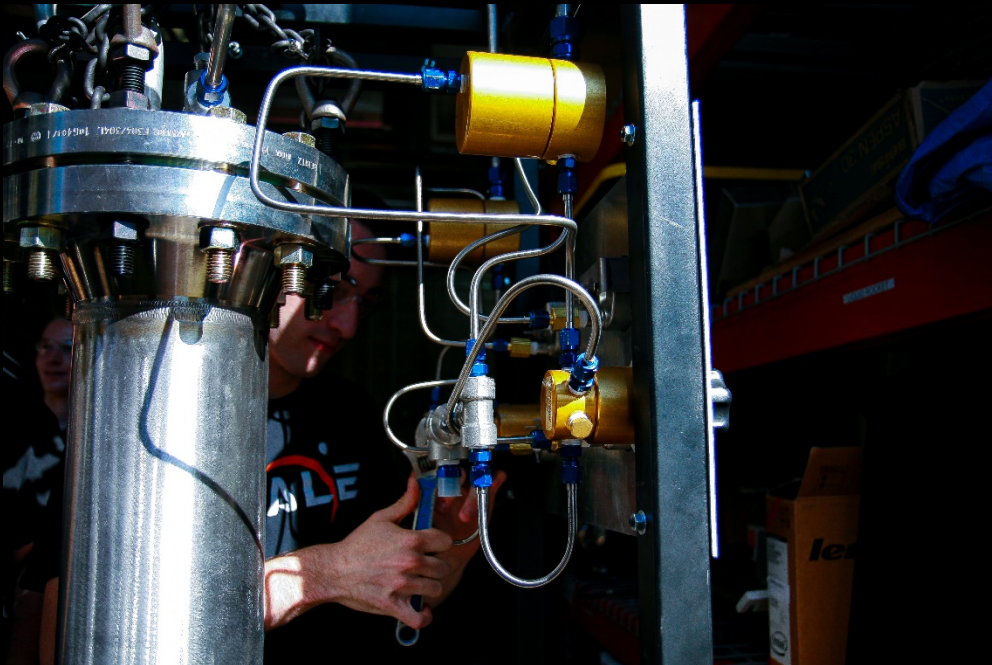
(base) Devons-MacBook-Pro-2:pyign devonburson$
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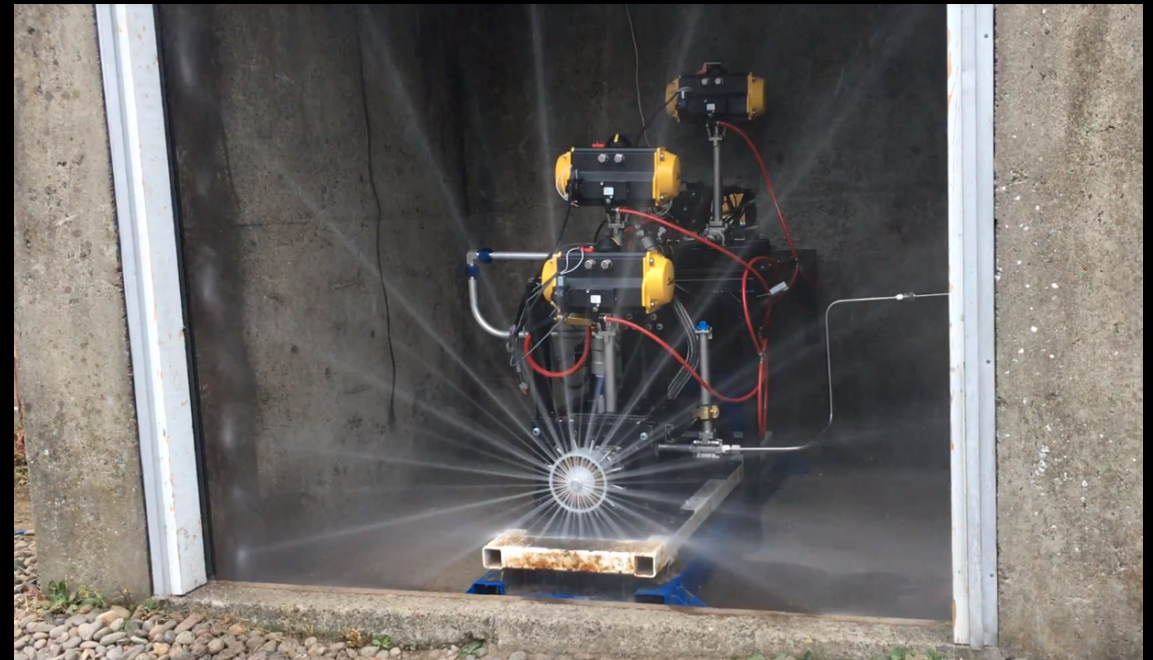


Testing

Leak Check / Hydrostatic



Cold-Flow







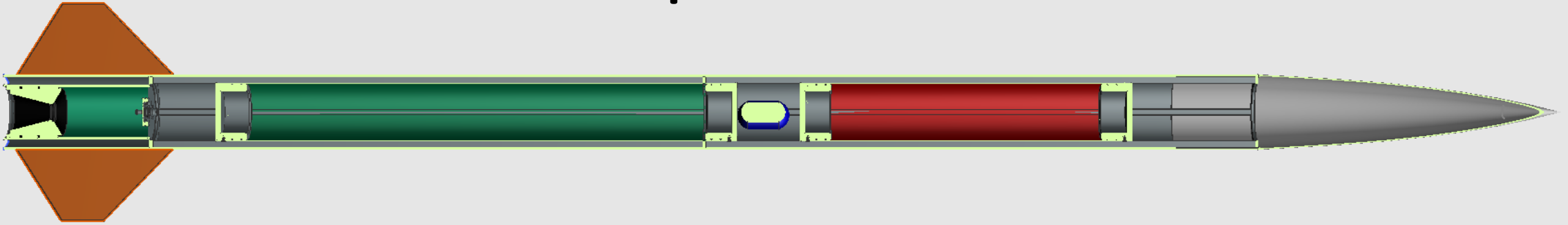
Liquid Test Stand Development:

Project Timeline:

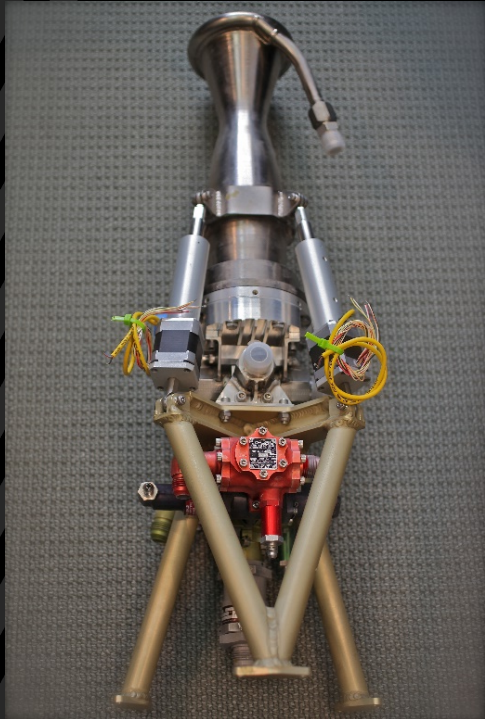
- November 2019 – Continued Cold Flow Testing
- December 2019 – Cryogenic Cold Flow Testing
- Winter 2020 – Hot Fire Testing



Parallel Development / Future Work



Thrust Vector Control



Regen Nozzle



Expansion Nozzle

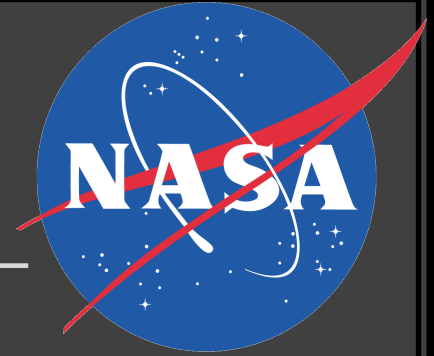


Aerogel





Acknowledgements



- NASA Space Grant
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- Marshall Space Flight Center

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- Base 11 Space Challenge
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- Brian Jensen
- Richard Garcia





Questions?