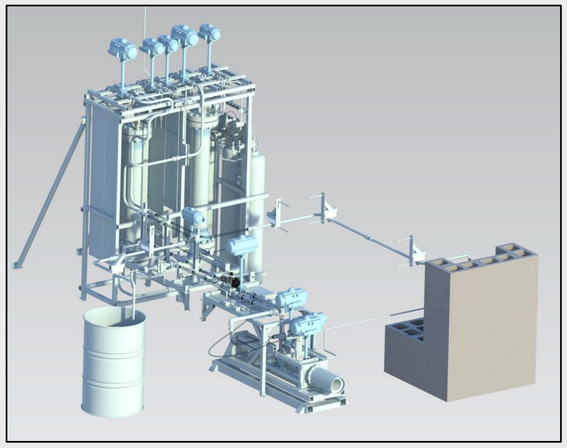
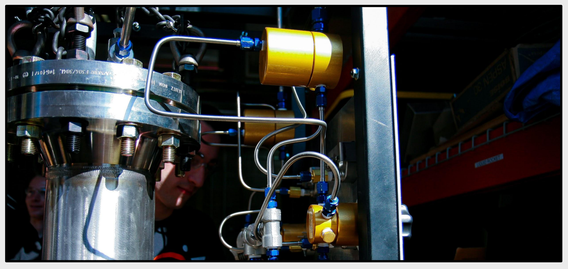
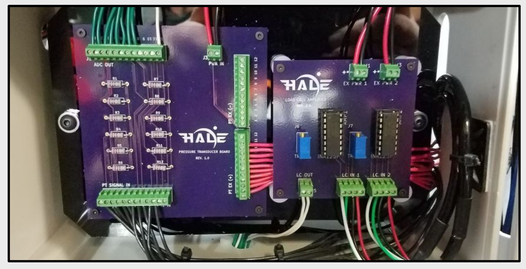
High Altitude Liquid Engine Team (HALE): Test Stand Development

The Oregon State University (OSU) High Altitude Liquid Engine (HALE) rocket team is a student-led, multidisciplinary team comprised of students majoring in business, physics, biochemistry, computer science, and a variety of engineering disciplines. The team's primary focus is on liquid propulsion systems and related launch vehicles. The Stellaris Test Stand provides a platform for testing liquid engines and characterization of propellants. This stand will allow for the liquid engine program to expand as future iterations of engines are developed and implemented into flight vehicles.





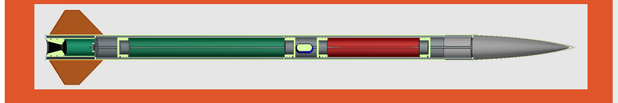


Technical Requirements

- Pressure fed system
- Capable of supporting 2000 lbf thrust
- Kerosene/liquid oxygen propellants
- Constant mass flow rate
- Remotely operable
- Capable of collecting data
- Autonomous firing and shutdown sequence

Design Selected

- Pressure fed via high purity Nitrogen gas
- Pilot/Dome loaded pressure regulators
- Stainless Steel run tanks
- Cavitating Venturis for flow rate control
- Cryogenic rated valves and pneumatic actuators
- LabVIEW/Python control and data collection system
- Relief valve and burst disk pressure relief system



Testing Conducted

Static pressure testing consists of pressurizing portions of the system with a non-reactive fluid to check for leaks and to ensure that the system can withstand design pressure.

Cold flow testing involves running through a full fire of the test stand, but with water in place of the fuel and oxidizer.

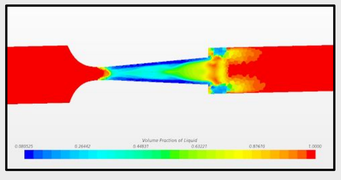
Cryogenic cold flow testing involves using non-reactive cryogenic analogs in place of fuel and oxidizer. Liquid nitrogen and IPA are used in place of LOx and kerosene.

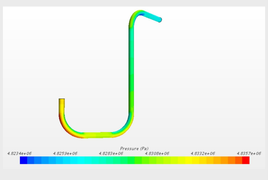
The hot fire will utilize LOx and kerosene to ignite and fire the attached engine.

System CFD

Computational fluid dynamics modeling (CFD) is being used in order to simulate steady state operation of the test stand. Simulation provides an alternative method of evaluating system performance.

A modular CFD model allows the team to predict internal flow conditions and test stand response with future test articles.





TEAM MEMBERS
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TECHNICAL ADVISORS
Dr. Nancy Squires
Devon Burson

PROJECT SPONSOR

PROJECT STATUS

- Test stand is undergoing final coldflow tests prior to static test fire.
- Submitted static test fire approval report and OSU is now one of six schools approved for static test fire.
- Data aquisition and control systems undergoing rigorous testing prior to first static test fire of the Mira engine.