

Destination: Space

OSU's HALE rocket team aims to design, construct, and fly a liquid bi-propellant powered flight vehicle to the Karman line. The Karman line sits at 328,000 ft, and is the internationally recognized boundary between Earth's atmosphere and space.

In order to achieve this goal, HALE is validating first generation versions of flight vehicle subsystems by creating a subscale flight vehicle with an altitude goal of 30,000 ft. The subscale vehicle will prove as a testing ground for the technologies and expertise needed for a space shot attempt.

In contrast to many existing rocket teams at OSU, the technical challenges associated with HALE's goal means that the team works towards the subscale and full scale vehicles over a longer period of time. This necessitates a focus on passing on generational knowledge, and HALE has a focus on involving underclassmen to carry the torch.



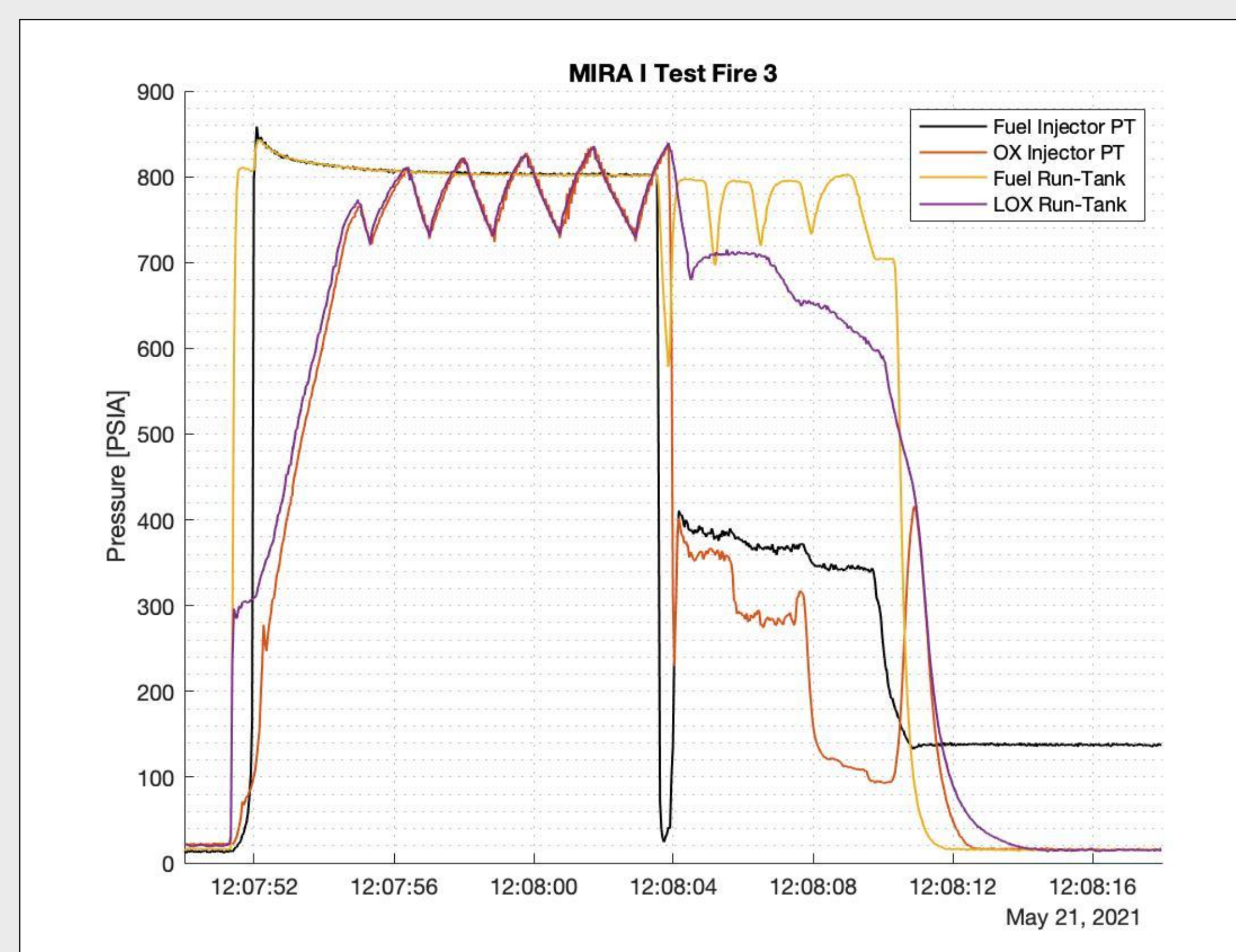
High Altitude Liquid Engine (HALE) Rocketry Team

Fall - Winter 2021 Capstone



Looking Forward

Due to the work of the Fall-Winter 2021 Capstone team, the progress of the HALE project has been significantly advanced. Not only were the subsystems successfully designed and manufactured, but new industry connections and sponsorships were formed, new undergraduate volunteers were added, and invaluable aerospace experience was obtained. HALE is currently targeting a Spring 2023 launch of the subscale flight vehicle, and when this milestone occurs, it will be directly due to the efforts of this capstone team, their predecessors, and their eventual successors.



Projects

The 2021 Fall-Winter capstone members of HALE are split into three subteams, those being Electric Pumps, Main Flight Valves, and Vertical Test Stand. A short overview of each will follow.

Electric pumps:

Set of electric pumps that pressurize the fuel and oxidizer and deliver them to the engine. This year's team began testing of a prototype fuel pump, and used what they learned to design a new Barske style pump iteration. The pumps are to provide 500 PSI and will accomplish this by spinning at 20,000 RPM.

Main Flight Valves:

A set of valves along with an actuation system that control the flow of fuel and oxidizer into the injector plate. HALE's engines use RP-1 as fuel and liquid oxygen (LOX) as an oxidizer. Liquid oxygen has a boiling point of -297.3 °F, which causes some complications for operating valves. To account for this, the LOX valve was retrofitted to be compatible with cryogenics. The valve system is pneumatically actuated.

Vertical Test Stand:

The vertical test stand consists of a trailer that will act as a mobile launch and test platform. The stand is equipped with hold downs and load cells to allow the vehicle to be tested upright in a fully stacked configuration, while also having pressurant tanks and a guide rail to perform a launch. The stand can accommodate engines with up to 4000 lbs of thrust, and will be used to test the subscale and full scale.

