Hypergolic propellants (hypergols) are propellants that ignite shortly after contact. They omit the requirement of an ignition system, making hypergolic engines simple, reliable and capable of being throttled several times. These advantages make them desirable for deep space missions. However, the applications are severely limited by their toxicity and reactivity. In an effort to increase the safety of manufacturing, shipping, and storing, these propellants can be combined with different gelling agents.

The focus of this project is to build an optically accessible combustion chamber pressurized at 200 psi to compare the performance of gelled and neat Monomethyl Hydrazine (MMH) and Red Fuming Nitric Acid (RFNA). The fuel samples of MMH will be gelled with either Hydroxypropyl Cellulose (HPC) or fumed silica at various weight percentages and oxidizer samples of RFNA will be gelled with fumed silica. The propellants will be injected at different mixture ratios into the combustion chamber, using an existing impinging jet mechanism, where the reaction will be recorded via high speed cameras focused on the incoming jets of propellants. Data acquired through testing the propellants in this system will allow for calculation of ignition characteristics, combustion efficiency, and specific impulse for both neat and gelled propellants. The final results will help in the further understanding of neat and gelled hypergolic propellants in terms of their performance and behavior in a high pressure environment. This project is a gateway into the testing of other gelled hypergols and applying the knowledge into building safer and more efficient hypergolic engines.