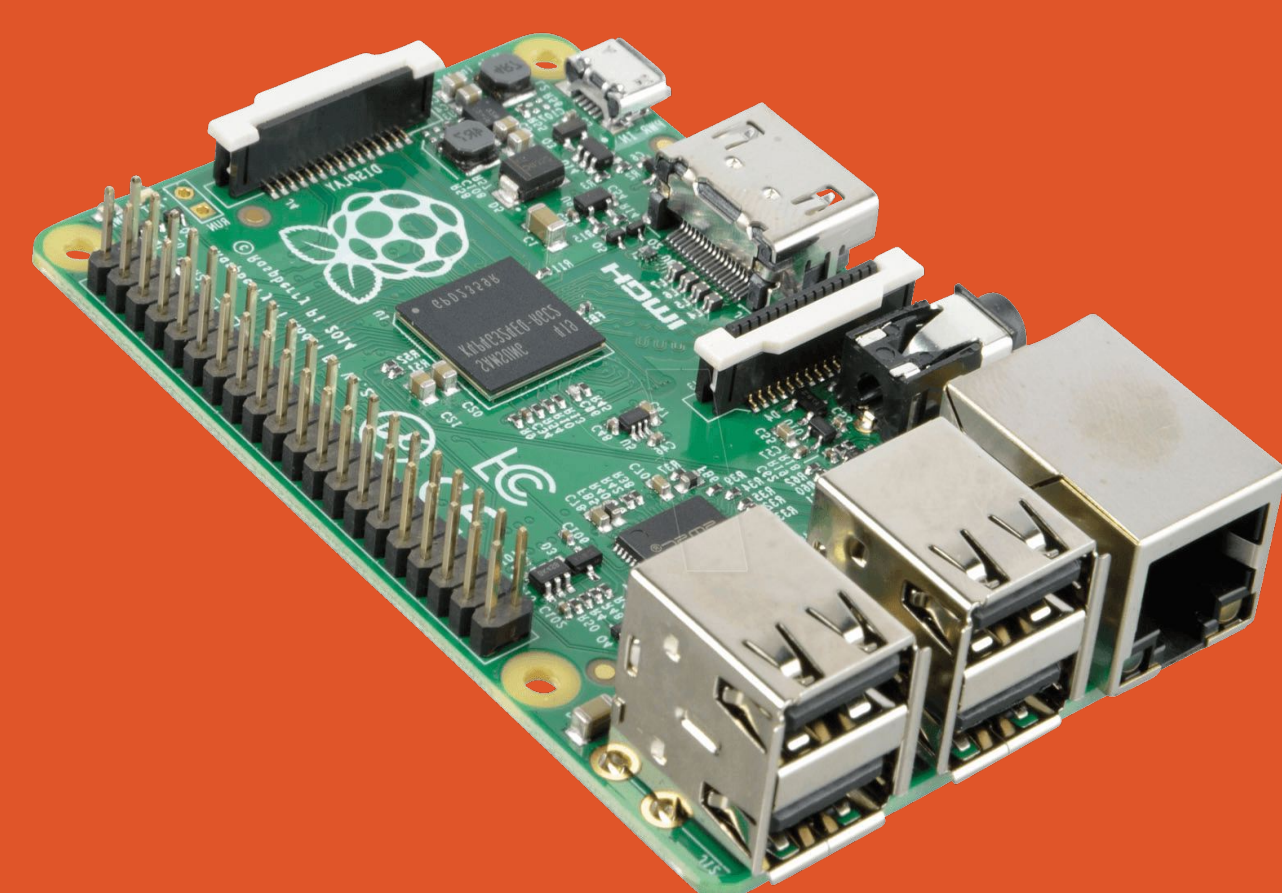


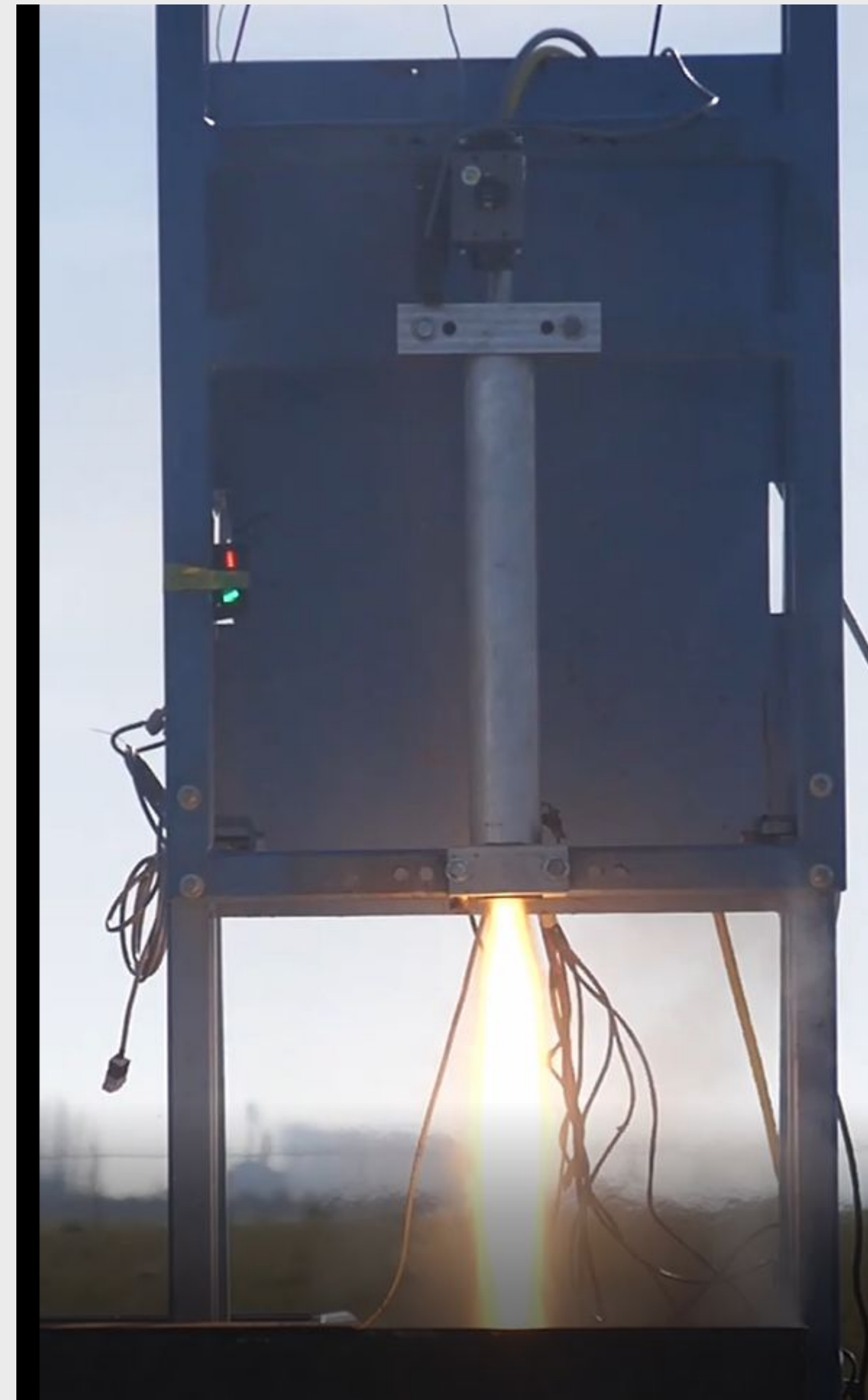
Computer Science & Electrical Engineering

- The team offers hands-on opportunities to students with little to no experience. We work with electromechanical systems and sensors commonly found in industrial settings. We provide an ideal environment for students to develop the programming skills needed operate control systems.
- EE-CS team reverse-engineered a long-range communications system this year. We collected and processed data from subscale engine tests through a modular design that seamlessly integrated sensors and testing equipment over a LAN network. Communicating with FPGAs and microcontrollers helps the team conduct rapid testing in a safe environment- improving the performance of our hybrid rocket engine.
- There is no point in iterative testing if you don't learn anything. The hybrid team has faced its fair share of setbacks, but we managed to collect and process data; allowing the team to learn from our mistakes. Rocket science is a great way to get experience in data acquisition and analytics.



Hybrid Rocket Team

Subhead: Combining the best of both worlds of solid and liquid rockets



Fuels

In our first test, paraffin wax was used as the solid fuel, which we found has been used before, but knew there had to be something more appropriate. This material may have worked better if the ignition system had worked as intended. Further research indicated that a fuel based on HTPB, a well known solid rocket fuel, would perform much better. Combining the correct proportions of the HTPB and other additives turned out to be a challenge, and when the proportions were incorrect, the resulting mixture remained semi-liquid and unusable. Tools were developed to help us not only mix the right proportions, but also the right quantities for the volume in the moulds we had so that we did not waste any material.

Fuel Geometries

- There are various geometries that have been tested and that are being planned to be used. For the solid fuel we tested both a simple tubular design, as well as a 'waggon wheel' hole pattern to increase the reacting surface area. While both worked to an extent, further testing is needed to refine the design to maximize specific impulse and stability as it burns.

Manufacturing

- The Hybrid Rocket team makes the entire rocket from scratch, so there is a lot of manufacturing involved in making the different components
- Full Scale Nozzle Design
 - Converging
 - The full-scale nozzle will be made on the Fadal 4525 CNC machine in Rogers. Tool paths have been made, and a wax prototype has been completed, and the final version will be made out of one of the heat resistant materials listed below
 - Diverging
 - The Diverging section of the nozzle will be made on both the Fadal 4525 and the HAAS lathe CNC. The tool paths have been finished.
- Space Grade Materials
 - Inconel
 - Grade 5 Titanium
 - Stainless Steel
- In House CNC Machining
 - Here at the Hybrid Rocket Team we place a tremendous amount of effort on using out CNC Turning and four axis Vertical Milling Machine to produce our variable components.
- Future teams will have access to the CNC machines in Rogers and will be involved in the manufacturing of the fullscale nozzle, injector plate, and more.

