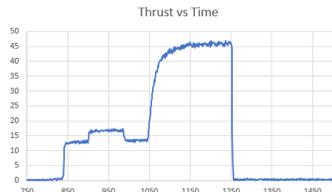


Project Description

- Typical rocket systems are constrained by the amount of oxidizer and fuel they can carry. The air-augmented system would use air as a free oxidizer to allow for combustion while using less on-board oxidizer. Our project objective was to create a hybrid rocket system that could be augmented by air to provide enough thrust to help offset drag and effectively increase the range of the system.
- **Project Constraints**
 - No complex mechanical designs
 - Thrust from air-augmentation cannot be negligible
- **Project Requirements**
 - System can throttle oxidizer flow to 25% and back up to 100%
 - Prototype must maintain thrust during combustion by increasing pressure to the choking mass flow rate at the throat and not at the injector
 - The throttling valve must throttle in a near-linear fashion
 - The system should ignite with no less than 80% reliability

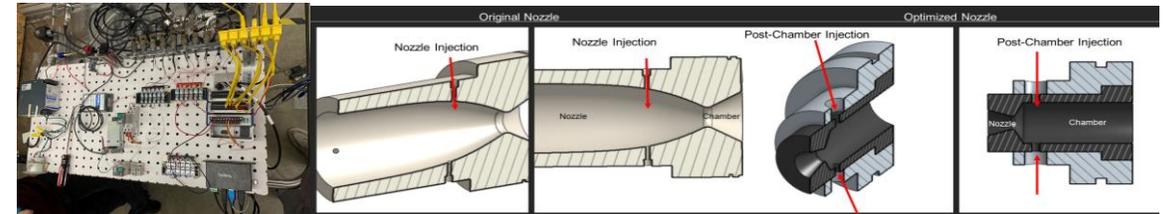
Performance Review

- Extensive testing resulted in data from the venturi, the injector, and the nozzle
- All testing was done in the USU test cell and all safety precautions were taken
- Testing ensured shockwaves were not present at optimal operating pressure
- The team used thermocouples, pressure transducers, load cells, and a venturi to obtain data at multiple points throughout the system to determine the performance of the design



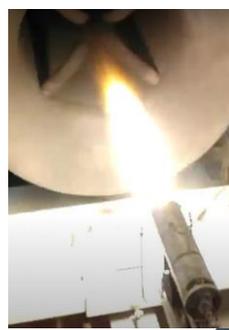
Design Description

- All instrumentation on cart
- Rocket motor was attached to cart
- The motor was controlled by LabView
- Nozzle was optimized
- Air intake position was changed from nozzle to post chamber for better mixing
- Chamber pressure and O/F ratios were optimized



Conclusion

- The design successfully met all requirements and constraints designated by the customer
- The team learned about the linearity of different ball valves, how to optimize a rocket motor, how to utilize different instrumentation, and the importance of communication with the customer and clearly defining expectations
- The team recommends that for future work the valve be upgraded to allow for more precise throttling and using a more realistic oxidizer in testing



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