

Combustion Chronicle Issue 2

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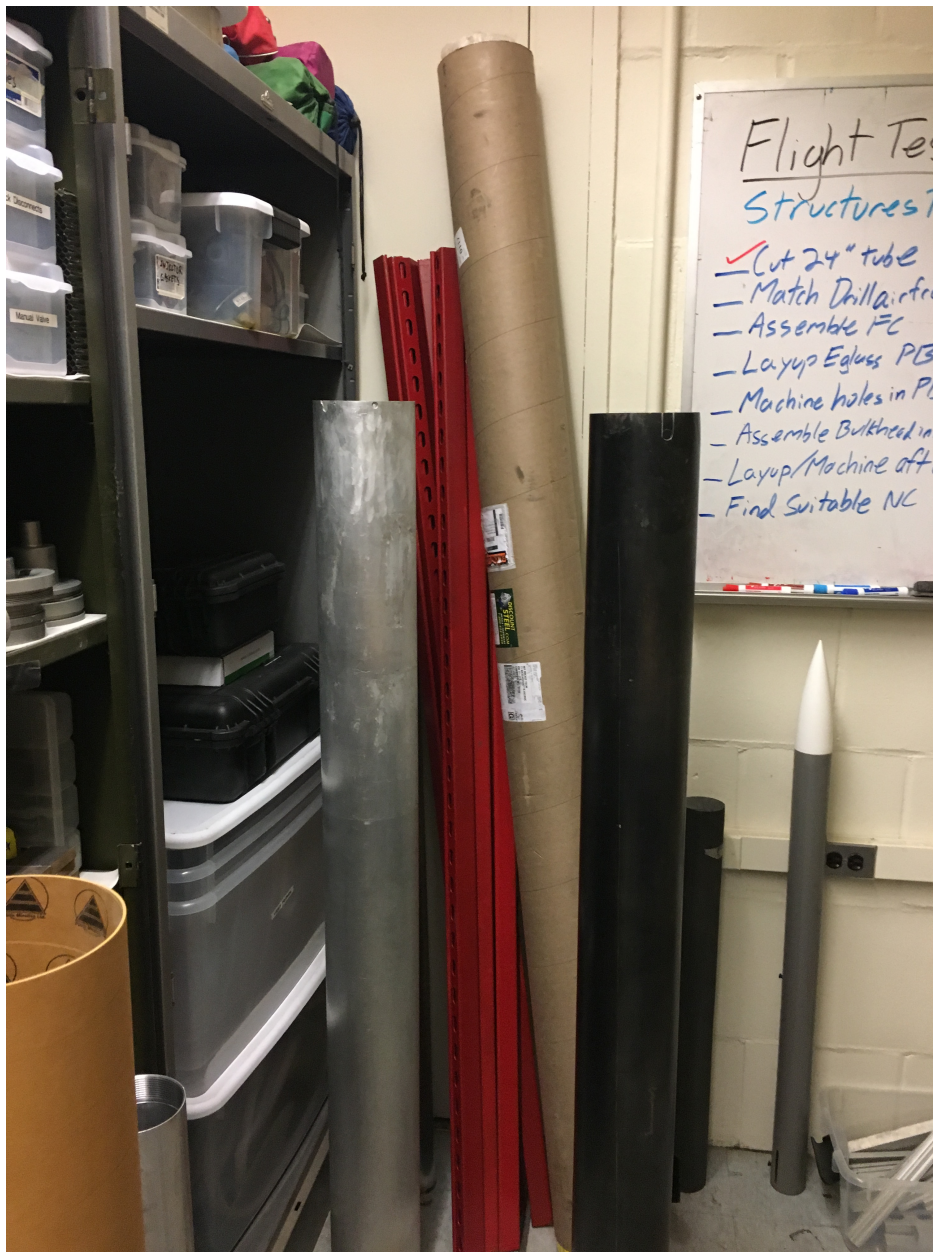
Summary

Hardware is arriving, ITAR training occurred, 6" motor design was iterated, and a static fire will happen next week.

Hardware Acquisition

We received a lot of hardware this week that puts us closer to building and testing our rocket motors. The second order of steel for the test stand came in, and construction can now begin. The hydraulic pump for the hydrostatic tests came in as well. This pump will allow us to pressurize the case to its test pressure of 1,500 psi and verify its structural integrity under motor pressures. Its hand-operated design and portability allows us to test the case with minimal additional equipment.

The fuels precursor cabinet was moved and the shake table placed on top of it. The mixer and shake table still need some work to remove rust before mixing can occur. Anthony is going to check the 220V power in lab and ensure that it's working.



The bulk of the test stand stock is in lab.

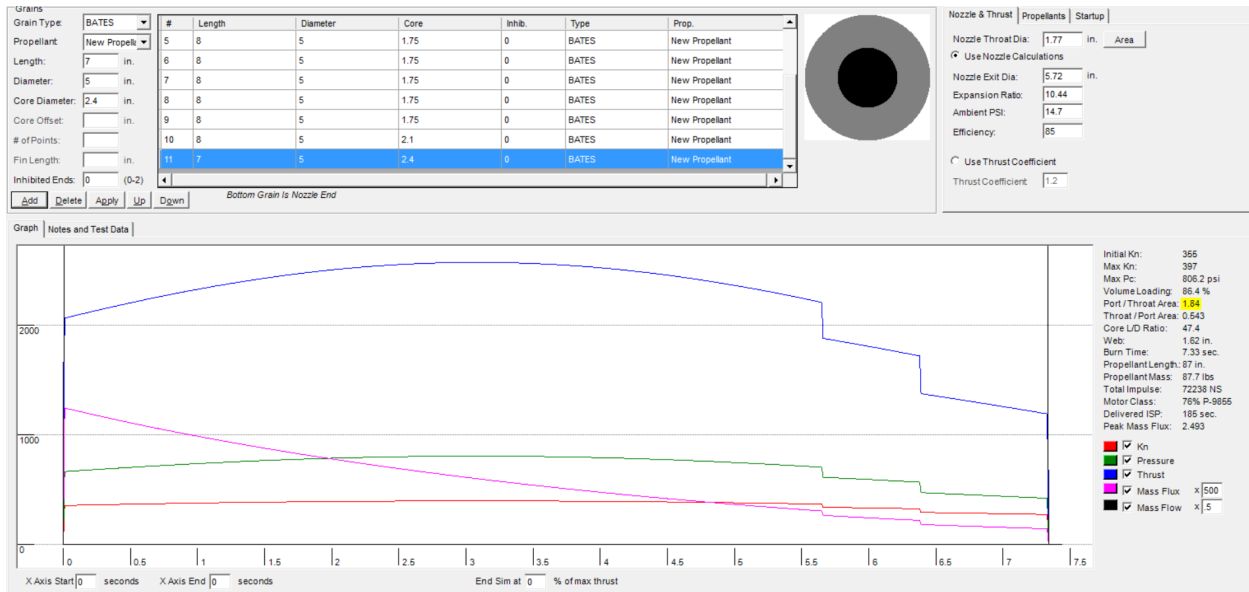
Export Control Training

On Tuesday, several Rocket Team members underwent export control training offered by the Office of Sponsored Programs. As many of our propellant precursors and some of our research is deemed export controlled by the International Traffic and Arms Regulation (ITAR) and the Export Administration Regulation (EAR), members who mix propellant need to be aware of the rules and restrictions. The successful completion of this training put us one step closer to mixing propellant.

6" Motor Design Update

Burnsim simulations were conducted several weeks ago to develop a rough design for our full scale 6" diameter motor. Burnsim is a program that allows us to predict the thrust curve and other burn properties of our motor given the number and shape of the propellant grains.

The original simulations were conducted assuming a 5.5" propellant outer diameter, but after finalizing selection of our liner and casting tube, the outer diameter of the propellant grain was found to be 5.0". This forced us to redesign the motor, as we lose a significant amount of propellant at a smaller diameter. The aspect ratio of the new design is larger than the original, as it calls for 10-11 grains instead of 7. To counteract erosive burning effects near the aft end of the motor, the bottom two grains feature larger cores to reduce mass flux.



Updated motor design in Burnsim

Upcoming Static Fire and Characterization Plans

Our contact at Crow Island gave us the green light to test at their facility next week-end! We will be burning our 98mm 4-grain motor to test our new radially bolted case design. This is tremendous, as static firing this early in the year sets the pace for a busy testing schedule to come. In order to make this deadline, several things have to happen. For one, the test stand needs to be fixed and DAQ readied. The ignition equipment needs to be verified, and cameras lined up. Motor wise, the o-ring groove on the forward closure/liner interface needs to be turned down and everything fit-checked. Word on transportation/who can attend will come later.

Looking further, the next steps will be to validate the new mixer and characterize the new propellant formulation. These objectives will be accomplished simultaneously. To characterize the propellant, samples will be burned at different pressures, with burn duration data collected from each test. This will be accomplished with 98mm 1-grain

motors, which can be mass-produced with our new mixer – one batch from the new mixer will produce up to 12 98mm grains. For characterization, 10 98mm grains will be burned with varying nozzle sizes, producing different burn rates. A regression will be performed with the collected data to determine the burn coefficient and exponent, allowing us to better understand our formulation and design motors more accurately.

Looking Ahead

- Hydrostatic testing of the new motor case needs to occur, but if the static fire is successful before then, we'll consider it tested.
- Items in the "Upcoming Static Fire" section need to be completed in order for static firing to occur.
- The new mixer needs to be refurbished and tested.
- New members: sign up for Todd's shop training.