Executive Summary

This month, I mounted a static engine test stand, a load cell to measure thrust, and a test article with a blast shield around the oxidizer tank to my rocket engine test stand. To run a static engine test, I need to pressurize the oxidizer tank to 140 psig and turn off the fill valve. Adding a blast shield around the oxidizer tank makes it safer and is part of my KISSES principle of "Keeping it Safe". Over the next month or two I'll be testing fuel grain lengths of 11.5, 12.5, and 13.5 cm to narrow done the ideal fuel grain lengths for best overall performance.

Technical Stuff

The main objective this month was to set up a static engine test stand, mount a load cell to measure thrust, and set up the test article with a blast shield around the oxidizer tank. To run a test, I need to get close to the rocket after pressurizing the oxidizer tank to turn off the fill valve. Although the Soda Stream® bottle hasn't exploded while pressurizing to 140 psig, it still makes me nervous and it is part of my KISSES principle of "Keeping it Safe". The test article itself is the same system I've been using for over a year. I've added some PLA struts, the blast shield, and three 36" threaded screws to keep everything in place. The rocket engine assembly with blast shield is shown in the picture below. Also shown in the picture is the fill station to the left and CO_2 tank to the right. The load cell and electronics are shown in the picture to the right.

The 5 kg load cell is mounted to the top of the test stand such that the rocket engine hangs from the load cell. I use an HX711 balance module and an Arduino UNO with a data logger for the diagnostics. Open source programs for the Arduino/HX711 are readily available on the web. Calibration is by using 500 gm and 1000 gm standard laboratory masses.

Hanging the rocket engine from the load cell gives me the gross liftoff mass (or wet mass), the thrust, and the burnout mass (or dry mass). With the thrust and mass flow rate, I can determine the specific impulse and using the ideal rocket equation, determine the ideal burnout velocity. I believe that the ideal burnout velocity is a better measure of the overall system performance. Over the next month or two I'll be testing fuel grain lengths of 11.5, 12.5, and 13.5 cm to narrow done the ideal fuel grain lengths for best overall performance.