Executive Summary

This month, I had three test with a 7.5 mm nozzle throat diameter. I added the check valve back into the plumbing. Bottom line, it didn't work. I will go back to a 6.0 mm nozzle throat diameter for the Mk I Viper. Also, this month, I added a color analyzer to my diagnostics to help determine the optimum starting concentration for infusion of $KMnO_4$ into the PLA.

Technical Stuff

This month, I had three test with a 7.5 mm nozzle throat diameter. I added the check valve back into the plumbing. The first test blew up. In the second test, I reduced the edzieba flow restrictor orifice to 5.0 mm diameter and kept it at the end of the fuel core. The results were a little better. I got a pressure spike of ~ 180 psia in the mixing chamber and a thrust spike of ~ 36 N (based on the mass of the engine, engine mount, and added mass). The thrust spike caused the rocket engine to jump off the hook attached to the load cell. As such, I don't have real thrust data. In the third and final test of the month, I moved the flow restrictor to the nozzle inlet. The results were dismal with ~ 2 seconds to ignition and ~ 2 second burn time. In summary, this month was a try it and see if it works, it didn't.

Also, this month, I added a color analyzer to my diagnostics. I use the color analyzer to check the color of the fuel core after infusing, cleaning, and drying for ~ 2 weeks. I'm collecting data related to the starting concentration for infusing $KMnO_4$ into the PLA fuel core. The first batch, usually with four, 6 cm fuel cores, has a $KMnO_4$ concentration of 76 gm/L at room temperature. The second batch has a lower concentration but still ignites in ~ 0.3 sec, and so on with the third batch, the fourth batch, etc. I will continue using this solution at decreasing concentration until I fail to get ignition. The next solution will start at 50 gm/L and so on until I determine the optimum concentration.

Finally, I continue to work on the flight system. I have decided to put the servos in the rudder and wing with a short connecting rod. This changes the center of mass. To compensate, I'll move more of the electronics to the nose section.

Next month, I will go back to the 6.0 mm nozzle throat diameter and continue testing to optimize the engine. Also, I'll continue working on the flight system aiming for a spring launch.