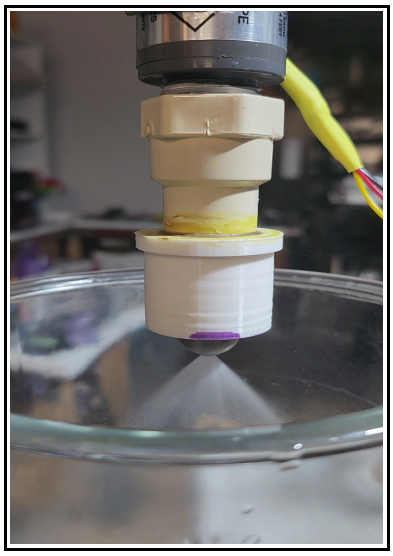
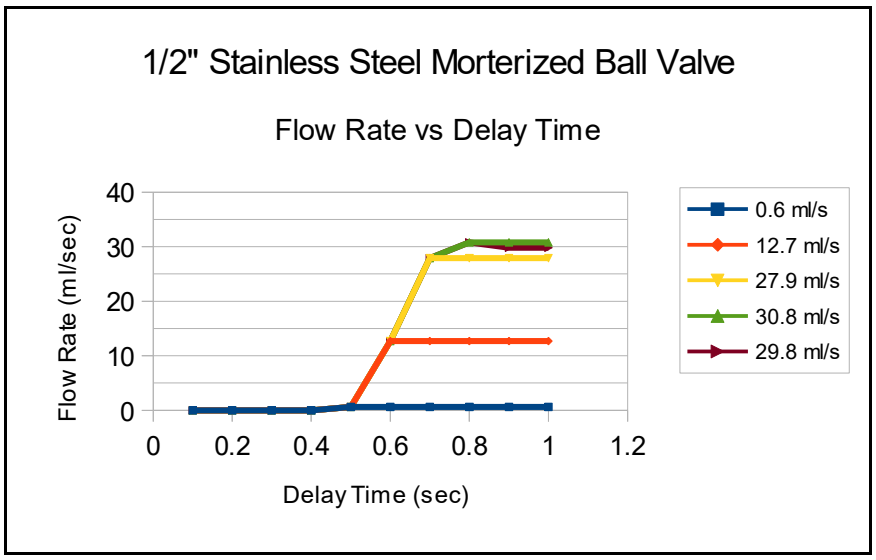
Executive Summary

This month, I worked on upgrading from my plastic solenoid valve with a mass of ~ 94 gm with a stainless steel motorized ball valve with a mass of ~ 330 gm. As soon as I add a motorized ball valve, I have transition to a Class II rocket motor.

Technical Stuff

This month, I worked on upgrading from my plastic solenoid valve (rated at 114 psig) with a mass of ~ 94 gm with a stainless steel motorized ball valve (rated at 150 psig) with a mass of ~ 330 gm. Most of the month was spent on the electronics. I played with an Arduino motor shield, on/off switches, and delay timers to open the ball valve under a controlled process. The picture shows the opening of the ball valve with a stainless steel 1/4" spray nozzle with a 2.0 mm diameter orifice.





In this test, I used a 12V DC lithium polymer battery and a delay timer. The graph on the right is the ball valve opening for 0.5, 0.6, 0.7, 0.8, and 1.0 second at a pressure of 140 psig. The delay timer can be set using an LED display to close a relay for 0.5 sec, 0.6 sec, ...etc. When the relay closes, the ball valve opens and it stops opening at the indicated delay time.

The flow rate is shown in the legend on the right. With this spray nozzle, the maximum flow rate is ~ 30 ml/sec. It takes ~ 3.0 seconds for the ball valve to completely open. As such, I can add three more spray nozzles to the circuit.

The ignition flow rate for the current Class I rocket motor is around 21 ml/sec at 140 psig. From the graph, it appears this flow rate will occur with a timer delay of around 0.65 seconds.

Next month, I plan to replace the plastic solenoid valve with the stainless steel ball valve and run some instrumented testing using the Class I rocket motor. All test parameters will be the same. The only difference is the opening valve.