## Executive Summary

This month, I did three test using the same scaling parameters. Although, the performance results are not as consistent as I'd like, the initial thrust is ~ 20 N at ignition and climbs to ~ 25 N toward the end of the burn. Twenty Newtons at ignition may be enough for aerodynamic control of the rocket glider as it leaves the rail guide. As such, it is my intention to launch the Mk I Viper next month.

## Technical Stuff

This month, I did three test using the same scaling parameters for consistency and reliability. Figure 1, 2, and 3 below show the pressure and thrust for each test. Please note that on the 02/15 test, I did not get the thrust data. I estimated the thrust using an average thrust coefficient (~ 0.93) from the next two test.

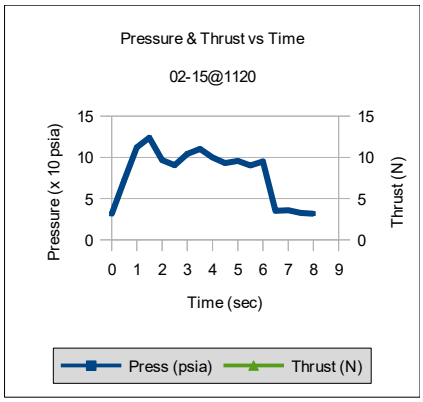

Figure 1

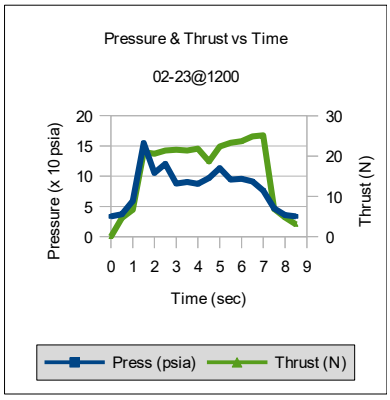

Figure 2

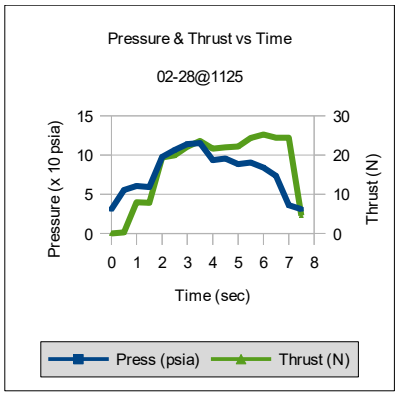

Figure 3

Table I below shows the scaling parameters I used and table II shows the performance results. The characteristic velocity and efficiency is not as reported in the Jan EOM report. I've been using the pressure gauge on my air tank to calibrate the pressure sensor. I re-calibrated my pressure sensor using the pressure gauge on the $CO_2$ tank. Apparently, there is a big difference between the two gauges. Who would have thought?

Table I
Scaling Parameters

| Noz Orifice (mm) | $V_{dot}$ (ml/sec) @140 psig | L (cm) | ISF (gm/cm$^2$/sec) | $d_{eq}$ (cm) | L/D | $d_t$ (mm) |
|---|---|---|---|---|---|---|
| | | | | | | |
| 1.5 | 20.84 | 13.5 | 0.21 | 1.52 | 8.9 | 6.0 |

Note: $V_{dot}$ is the initial flow rate at valve opening, L is the length of the fuel core, ISF is the initial surface flux of the oxidizer at valve opening, $d_{eq}$ is the equivalent inner port diameter of the fuel core (found by dividing the open surface area at the inlet by pi, taking the square root and multiplying by two), L/D is the length to diameter ratio of the fuel core, and $d_t$ is the initial throat diameter at ignition.

Table II
Performance Results

| Date of Test | $t_{ig}$ (sec) | $t_b$ (sec) | c* (m/s) | $c^*_{eff}$ | O/F | Thrust (N) |
|---|---|---|---|---|---|---|
| 02/15/23 | 0.7 | 6 | 1447 | 0.9 | 6.7 | ~ 23.4 |
| 02/23/23 | 1 | 5.9 | 1438 | 0.9 | 3.6 | 22.1 |
| 02/28/23 | 1.3 | 5.3 | 1287 | 0.8 | 4.8 | 22.6 |

Note: $t_{ig}$ is the time from opening the valve to ignition, $t_b$ is the time from ignition to shutdown, c* is the characteristic velocity, $c^*_{eff}$ is the experimental c* divided by the theoretical c*, and O/F is the oxidizer to fuel ratio.

From table II, it appears that ignition does occur reliably but it is not consistent in time to ignition. Also, with the exception of thrust, the remaining performance results are not as consistent as I'd like. However, with reference to Figure 2 and 3 above, the initial thrust is ~ 20 N at ignition and climbs to ~ 25 N toward the end of the burn. Twenty Newtons at ignition may be enough for aerodynamic control of the rocket glider as it leaves the rail guide. As such, it is my intention to launch the Mk I Viper next month.