At the beginning of this year I built the first version of the MkI Viper. The MkI Viper is a vertical takeoff and horizontal landing rocket glider. The Viper is powered by a hybrid rocket motor. The oxidizer is concentrated hydrogen peroxide (HTP) and the fuel is poly-lactic acid (PLA) infused with potassium permanganate ($KMnO_4$). Infusing PLA with $KMnO_4$ makes the fuel catalytic with the HTP. There is no need for a separate ignitor.

I printed out PLA molds and fiberglassed the MkI Viper fuselage. I printed out PLA vertical and horizontal stabilizers mounting the servos in the fin. I assembled the entire rocket glider using an inert rocket engine. I attached the paraglider to the frame using six lines and attached two lines to wing tips. I installed the electronics, batteries, and nose cone. The final mass was ~ 1.2 kg. This left 300 gm for the HTP oxidizer and PLA/$KMnO_4$ fuel (ref, Jan-Apr end of month reports).

Also this year, I demonstrated the first launch of the MkI Viper. The total launch mass was ~ 1.4 kg with a propellant mass of ~ 93 gm. Ignition and liftoff was less than 1.0 sec. Unfortunately, the Viper pitched down, did a few flips, and crashed. It was clear that the thrust vector was above the center of mass. As such, the torque at the center of mass caused the Viper to pitch down (ref, May and Jun end of month reports).

In Aug, I calculated the center of mass to be ~ 3.4 cm above the reference line. I rearranged some of the masses and lowered the thrust vector of the MkI Viper to ~ 3.5 cm. On launch, the Viper pitched up instead of down. The Viper did a few flips but not as bad as previous launches. I believed I was getting a better handle on CM/thrust vector issue. But, there was still some work to do here (ref, Jul and Aug end of month report).

Finally, this year, I replaced the PLA fins with styrofoam fins tripling the surface area of the controlling surfaces without increasing the mass of the MkI Viper. This will give me more control at launch (ref, Nov end of month report).

Next year, I plan to continue my work on the MkI Viper. I plan to launch to maximum altitude, deploy the glider, control the decent, and glide to a walk away landing (i.e. it doesn't have to be perfect).