

Executive Summary

This month marked the second launch of the MkI Viper. The liftoff mass was ~ 1.45 kg with a propellant mass of ~ 93 gm. Ignition occurred in less than 0.1 seconds and liftoff occurred in ~ 0.3 seconds. I had active control using a transmitter and receiver. The Viper flipped a few times as it cleared the rail guide. I regained control momentarily. However, burn through at the nozzle inlet caused the Viper to spin out of control and crash into the ground. It was an exciting six seconds.

Technical Stuff

This month marked the second launch of the MkI Viper. It was tight. I had to order a new receiver, new RC switches, new Li-Po batteries, print new pieces, and check everything out. On the last launch, the RC switches shorted out. The short drained the batteries and nuked the receiver. Once the batteries completely drained, I could not use the charger to recharge. I had already drained my primary batteries. These were the backups. So, I had to order new ones.

However, while waiting for new batteries, I tried to jump start the dead Li-Po batteries with a 9V battery (in parallel, i.e. + to + and - to -). I held the connection for 10 seconds and it worked. It brought the battery up to 0% charge. Now, the charger would accept the battery and begin recharging. So, tip for the day, if anyone has dead Li-Po batteries, try jump starting them first before throwing them away. Please do this from behind a shield as they may blow up.

Also, at the beginning of the month, I printed a PLA mold for the bottom fuselage (first picture). The mold is in three pieces which are glued together and sanded down. I used three pieces of lightweight fiberglass cloth and fiberglassed the outside of the mold. The final mass was ~ 156 gm. The single piece bottom fuselage replaces three sections I used in the last launch. It is a little more massive but much stiffer than the three separate pieces and simplifies the build. The center picture shows the fully assembled MkI Viper (mass ~ 1380 gm without HTP).



For this second launch, I used 50 ml of HTP and 2 ml of ethanol for the oxidizer. Ignition took less than 0.1 seconds, liftoff in 0.3 seconds, and burn time was about six seconds. The HTP was concentrated to $\sim 91\%$ and the PLA/ K_2MnO_4 fuel core had been stored in a dry bag (zip lock bag with desiccant) for over two months. The liftoff mass was ~ 1.45 kg with a propellant mass of ~ 93 gm.

As seen in the [video](#), when the MkI Viper cleared the rail guide, it began to pitch down. I had active control and tried to correct. It flipped a few times and I regained control. At this point, there was a burn through at the nozzle inlet and the Viper began to spin out of control. The Viper crashed nose down into the ground. The crash broke the forward strut and equipment bay into 20 to 25 pieces (breakable plastic, FAA regulation). Also, the Soda Stream[®] oxidizer tank broke off the mount. It was an exciting six seconds.

Fortunately, the damage wasn't as bad as it looked. The batteries, receiver, and switches survived the crash this time and I was planning on redoing the frame and fuselage anyway. As seen in the video, the pitch down suggest that the center of mass is below the thrust vector. So, I plan on lower the oxidizer tank,

solenoid valve, check valve, and rocket engine to bring the CM and thrust vector more in line. Also, I'm going to fiberglass the inside of the mold using two layers of fiberglass. This will make the bottom fuselage smaller and a little lighter. As such, the frame can be made smaller resulting in a lighter rocket ship. So, stay tuned for next months report.