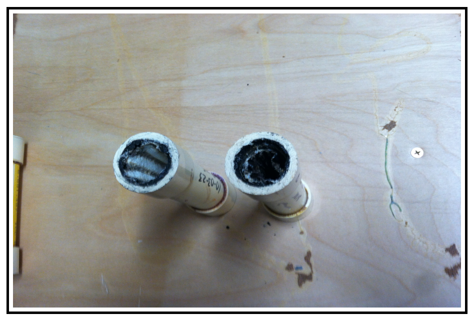
## Executive Summary

This month, I had one launch of the MkI Viper rocket glider. The Viper cleared the rail guide at ~ 3.6 m/sec and reached an altitude of ~ 100 feet while arcing over and heading east. The Viper exhausted all of the unstabilized HTP oxidizer in this launch before crashing into the ground, a first for Fisher Space Systems, LLC. Analysis of the spent fuel core showed an almost complete burn of available PLA/$KMnO_4$. I plan a series of test to determine what effect HTP stabilizers play in the combustion efficiency of PLA.

## Technical Stuff

This month, I had one launch of the MkI Viper rocket glider. The launch used PLA fuel cores that were infused with $KMnO_4$ at the original concentration of 50 gm/L. This was the $5^{th}$ infusion at this concentration. The PLA/$KMnO_4$ fuel core had been stored in a dry bag since 05/14/25. Also, I used 50 ml of unstabilized HTP at ~ 85% concentration and 2 ml of ethanol (O/F = 25) for the oxidizer. Ignition occurred in less than one second.

In this launch, the Viper cleared the rail guide at ~ 3.6 m/sec (video). Recall, calculations showed that a minimum velocity of ~ 4.0 m/sec was needed for aerodynamic control. During the launch, I had the flaps down and right rudder to counter the Viper's tendency to pitch up and yaw to port. As can be seen in the video, the Viper went straight up and began to rotate. I did not counter with flaps or rudder. It appeared the Viper made it to ~ 100 feet while arcing over and heading east. The Viper exhausted all of the oxidizer in this launch before crashing into the ground, a first for Fisher Space Systems, LLC. The Viper hit the ground at full speed. As such, it has to be completely rebuilt.



The physical analysis of the spent fuel cores introduced a new variable, stabilized vs unstabilized HTP. As shown in the picture, the fuel core on the left shows a nice even burn with PLA/$KMnO_4$ remaining in the housing. This particular rocket engine used 62.5 ml of ~ 85% stabilized HTP plus 2.5 ml of ethanol. The engine burned ~ 6.0 sec. The O/F ratio was ~ 3.3.

The fuel core on the right used 50 ml of ~ 85% unstabilized HTP and 2 ml of ethanol. This engine burned for ~ 6.0 sec as well. It shows a more complete burn even with a lower volume of oxidizer. The O/F ratio was ~ 1.5.

In retrospect, this makes sense. I start the distillation with ~ 35% stabilized hydrogen peroxide. The stabilizers do not boil off. The stabilizer remains in the distilled hydrogen peroxide which now is at a higher concentration. At the end of the distillation, I have ~ 350 ml of ~ 85% highly stabilized HTP and ~ 150 ml of ~ 25% of unstabilized hydrogen peroxide. I surmise that the stabilizer takes energy away from the reaction. The burn is not as efficient as it could be. However, the stabilizer becomes part of the exhaust and may or may not effect the thrust. Is it good or bad, an advantage or disadvantage? I need to do more instrumented testing.

Next month, I plan to continue launch operations with the MkI Viper. I have a rebuilt Mk I Viper. I plan to repeat the launch and learn to fly the Viper. I started a new solution of $KMnO_4$ at 40 gm/L initial concentration and have infused six PLA fuel cores with $KMnO_4$. I plan to start the stabilized vs unstabilized HTP testing. The O/F ratio is calculated using the mass flow rate of oxidizer vs the mass flow rate of fuel. As such, an O/F ratio of 1.5 means the mass of HTP is close to the mass of PLA/$KMnO_4$ and should result in a very compact flight vehicle design.