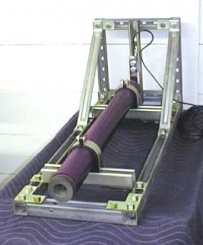
**The Rise of a Suitable Test Stand**

Static test stands are crucial in the process of designing and creating a successful hybrid motor. It provides a physical setup of acquiring data on temperature, pressure, and thrust of the motor during a test. This article covers the setup of our team’s first test stand, the downsides of it, as well as a brief plan for a future test stand.

The first design of our static test stand resembled that of a coffee table. Large planks of wood were nailed together to provide an elevated and flat surface for the rocket motor to be mounted on. The wood was protected with a layer of sheet metal where two lubricated rails were placed. At the end of the rails, a steel L-shaped stopper was placed in order to stop the rocket from dismounting itself from the stand. The stopper was also designed to hold a load cell to obtain thrust values. An additional wooden structure was built to hold the large nitrous tank close to the stand. Although our test stand is fairly easy to fabricate and assemble, there are a few downsides to it.

The test stand, as the name suggests, must be static. Therefore a strong and robust build is crucial in order to withstand the thrust from the rocket motor. The four legs of our wooden structure as well as the high center of mass of the stand does not provide enough stability or strength to withstand very high thrust from a motor. It’s very difficult to bolt down this structure to any surface to ensure that it wont move. Therefore, in order to provide a strong and robust build, the stand can be made out of galvanized steel. Despite its disadvantage that it is hard to drill or cut through, it would provide the strength and weight we need to withstand high thrust. This structure can have an L-shaped framework with an implementation of several triangles to ensure stability. The use of UniStruts could also be used in order to facilitate the process of bolting down the stand to a surface of greater mass. The idea I’m basing myself off of is that made from Aercon Systems seen in figure 1.



***Figure 1****: Static test stand designed by Aerocon Systems*



Another property that the test stand should have is that it should be large enough to cater for a wide variety of rocket motors. The problem with our current test stand is that it is very small; therefore inhibiting our option to later increase the diameter and length of the motor. The future test stand would have to be a little longer and we’d to get various clamp sizes to accommodate different diameters of our rocket engine.

The rocket we are building is a hybrid. This means that aside from the fuel grain, a supply of nitrous oxygen needs to be fed through the chamber in order for the test to occur. Our test stand didn’t provide a supporting structure for a nitrous tank, thus a separate build was needed. This isn’t as practical as having a structure attached to the stand as additional preparation is needed before a test. The additional preparation includes accommodating and locating the build to an appropriate height and location depending on the situation. Therefore, a test stand that integrates a structure and can hold up a nitrous oxide tank upright or at an angle would bring ease to the mounting of all of the components prior to a test as well as it would save us time. Furthermore, a balance can be added below the tank in order to acquire some data on the change in weight of the tank as the test proceeds.

After our first static test, a lot of light was shed on the possible improvements in the construction of our next static test stand. Our future stand will give us the confidence that it will withstand a quantity of thrust greater than the calculated thrust. It will also be robust, easily adjustable, and will take any diameter and length of motor.