

To: Dr. Sarah Oman

From: 19F18 - Northrop Grumman Standoff

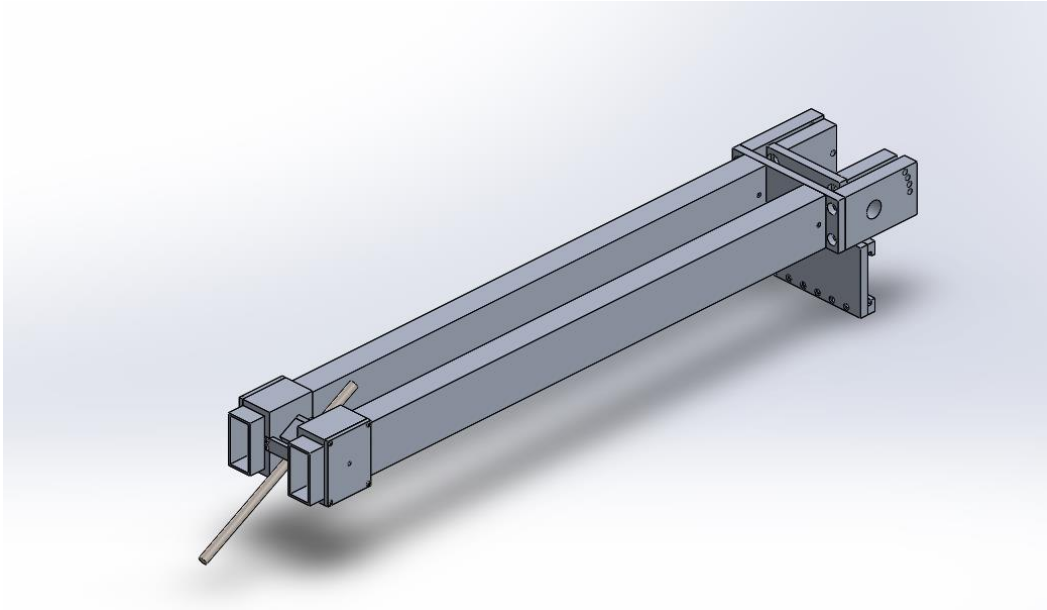
Date: February 7, 2020

Re: Hardware Review 1

---

## 1 INTRODUCTION

Rocket motor integration activities at Northrop Grumman field sites currently bond standoffs, which are threaded mounting devices that are used for avionics electrical components, to rocket motor domes using an adhesive and tape. The standoffs are mounted to metal brackets, which are taped to the motor dome for 24 to 72 hours to allow the adhesive to cure. This method is unreliable and fails roughly 5% of the time causing the brackets to either slip or fall off the motor domes. When the taping fails, an increase in man hours is required which costs more time and money when installing these standoffs. For this reason, Northrop Grumman's Flight Systems Group has requested for a team to design, analyze, and build a prototype universal dome standoff bonding tool that can be mounted to the attach rings of variations of rockets that will hold standoff brackets in place while the adhesive cures. Currently the final design can be seen in Figure 1 as shown below.

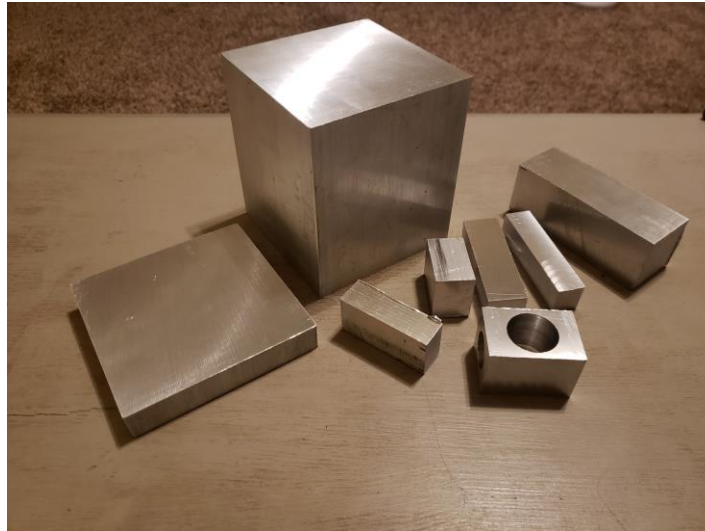


**Figure 1:** Current CAD Model

The final design will need to be manufactured by the Northrop Grumman Capstone team. For this reason, this report will address the progress of the design and future plans for manufacturing and changes.

## 2 CURRENT STATE OF DESIGN

The Northrop Grumman Capstone team has manufactured its design from a 4 in x 4in x 1ft stock of Aluminum 6061. The remaining aluminum available from this stock can be seen in Figure 2 below.



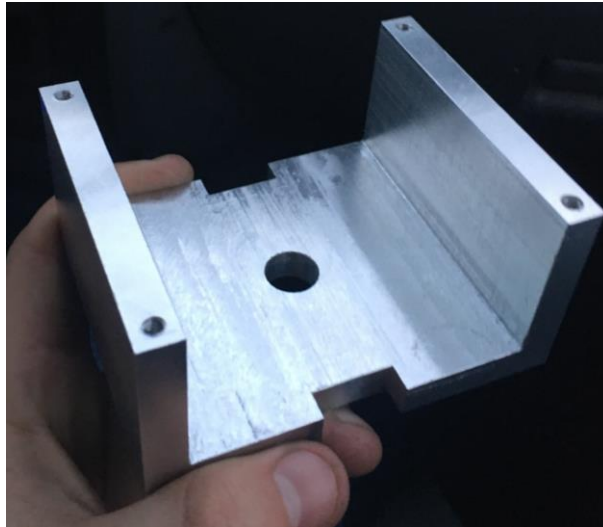
**Figure 2:** Aluminum 6061 Stock

The rail cart has been the main part that has been manufactured and constructed. In the center of the rail cart is a component referred to as the “T-Piece”. This piece connected to the rail holders allows the power screw to angle back and forth. This piece has been manufactured and assembled as seen in Figure 3 below.



**Figure 3:** Power Screw, Nut, and T-Piece

The rail cart will connect to the rails by rail holder components. These components, as seen in Figure 4, connect around the rails in order to hold/slide the rail cart into the correct positioning. The rail holder components will be two separate pieces: a channel and a plate which will screw into the channel pieces.



**Figure 4:** Rail Holder Components

The rail cart will be held together by a front and back plate which will screw into the rail components as seen in Figure 5.



**Figure 5:** Front and Back Plates

The rail holder components and the T-Piece are connected with a circular bar with a washer in the center of the piece, as shown in Figure 6 below.



**Figure 6:** Bar/Washer Connector Piece

### **3 CONCLUSION**

Moving forward with the project, a few action items have been discussed by the capstone team. The top plate which will go above the T-Piece will be constructed on Monday, February 10th. Along with this piece, the second rail holder channel will be constructed sometime during the week of February 10,, screw holes will be made in the side plates and rail holder, and the rails will be purchased to allow the team to assemble the rail cart design. The capstone team has a CDR presentation planned for February 20th to discuss the current state of the design with the client and get feedback on the current assembly. Once this meeting is done, the team will focus on manufacturing the ring clamp component, and finalize the CAD design of the bracket clamp. The bracket clamp has not been finalized as of yet due to the team waiting for the correct dimensions of the standoff spacing on the rocket motor dome.