Fabrication of Rocket and Payload Bay Area

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Abstract

Rocket design, specifications, and payloads are being constructed at the Payload Applied Technology Operations (PATO) lab using state-of-the-art materials, manufacturing and 3D printing techniques. The rocket will be used as a platform to launch and test different payloads. By using ANSYS static structural analysis, the preliminary results simulate the maximum acceleration loads that the payload will experience during the main parachute deployment. Through this analysis, the resulting maximum acceleration load the payload would experience was determined to be 310 m/s^2 (12,174 in/s^2). The design for the coupler tubes and nose cone have been finalized and are ready to be fabricated as represented in Figure 3 and Figure 4.

Objectives

1. Utilize state-of-the-art materials, software and techniques for design, development and fabrication as shown in Figure 1 and Figure 2
2. The design and fabrication of the payload bay area was optimized to have four TubeSats and two Nanolabs
3. Build, test and investigate payload for desirable results and safety compliance

Figure 1:Sanding of motor tube

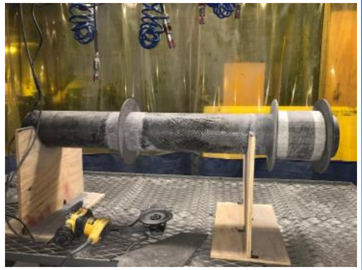

Figure 2: Centering rings placement

Construction

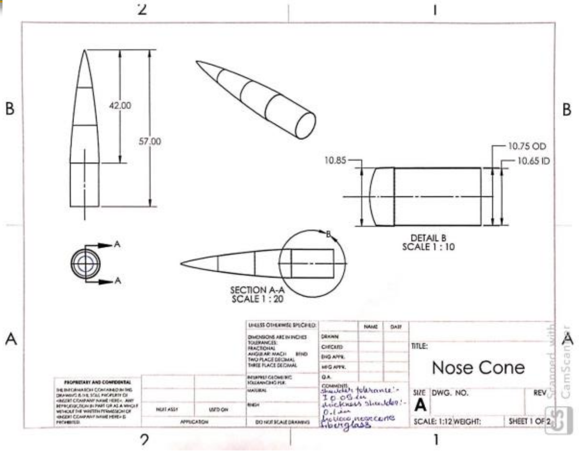

Figure 3:Nose cone design

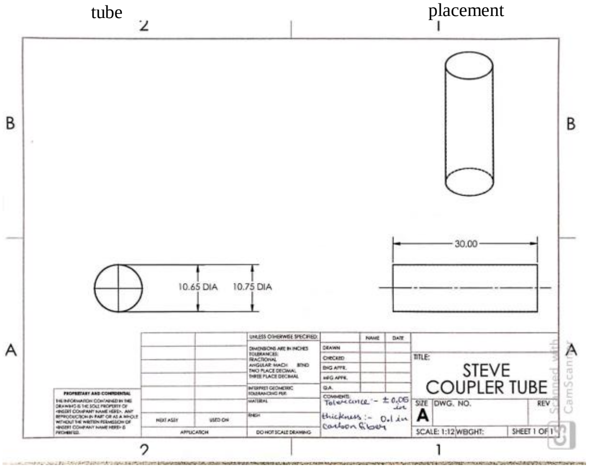

Figure 4: Coupler tube design

Methodology

1. CAD design with CATIA for specifications of the nose cone, motor tube, and payload bay area
2. 3D Printing and CNC machining for fabrication for payload
3. Custom avionics identification and assembly
4. Rocket fin analysis using AeroFinSIm software
5. Preparation of operating procedures and checklists
6. ANSYS software used for structural analysis for payload as shown in Figure 5-9

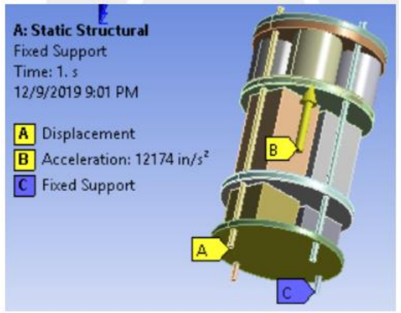

Figure 5: ANSYS model with boundary condition

Timeline

Design and Analysis	→	Composite Fabrication	→	Assembly	→	Testing	→	Flight
January 2019 - March 2019		April 2019 - December 2020		January 2021		January 2021		March 2021

Preliminary Results

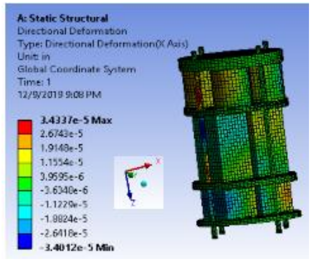

Figure 6: Deformation in the x-direction

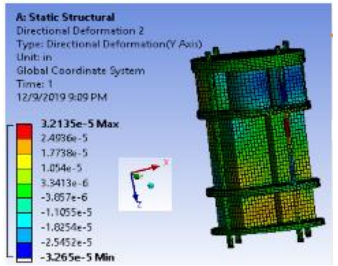

Figure 7: Deformation in the y-direction

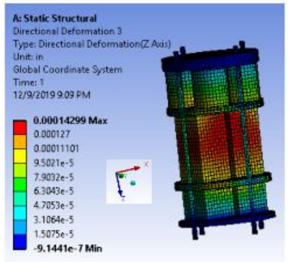

Figure 8: Deformation in the z-direction

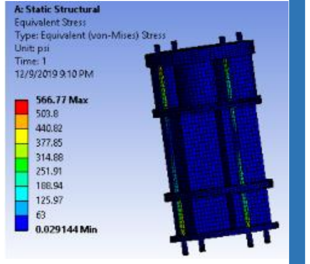

Figure 9: Equivalent Von-Mises Stress.

Acknowledgements

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