ESRA 30K ROCKET: STRUCTURES & INTEGRATION

Project Summary

The Structures & Integration subteam manufactures the rocket's structural components and integrates all components into the final rocket.

Components

- **Nosecone:** The nosecone is the tip of the rocket composed of aramid and fiberglass.
- **Bulkheads:** The bulkheads enclose the various sections of the rocket and provide structural integrity. These components are made of G10 fiberglass laminate.
- **Upper and Lower Bodytubes:** The bodytubes are composed of fiberglass and hold a majority of the rocket's components.
- **Boat Tail:** The boat tail improves the aerodynamics of the rocket.
- **Couplers:** The couplers hold the separable pieces of the rocket together and keep the rocket from bending where the pieces join.
- **Fins:** The fins provide in flight stability and are made of G10 fiberglass, Nomex honeycomb core, and carbon fiber.
- **Payload Rails:** The payload is enclosed in the nosecone and is slid in and out using mounting rails made of fiberglass.
- **Avionics Bay (Av-Bay):** The Av-Bay houses all electrical components and tracking data.

Oregon State University

ESRA's goal is to design, manufacture, and compete with a rocket to reach 30,000 feet with a student researched and developed solid propellant motor and scientific payload. The Structures & Integration team is responsible for all structural components of the rocket, as well as integrating every component into the rocket before launch.

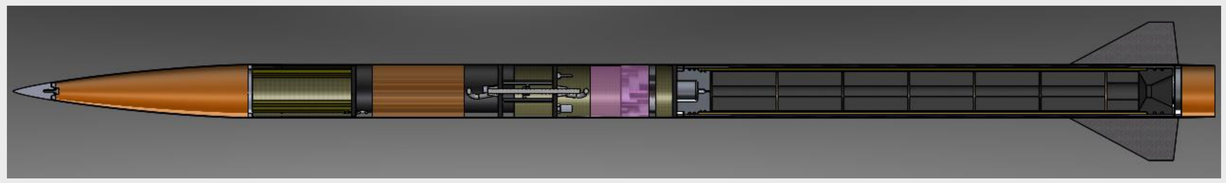
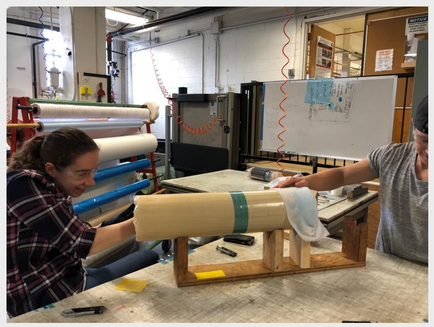


Figure 1: Section view of the CAD model of our final design



Figures 2: Manufacturing the nose cone joint tube

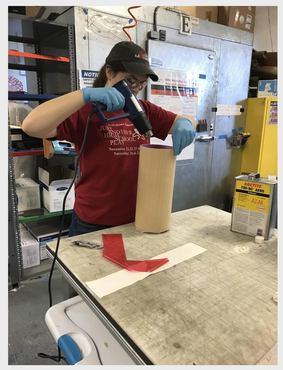


Figure 3: Heating up film adhesive for the joint tube

Figure 4: Attaching the nosecone tip for integration tests

Manufacturing

Most components created required an extensive composite layup process (figures 2 and 3). The nosecone used a female mold and pre-impregnated fiberglass and aramid to create a nosecone profile that reduces drag.

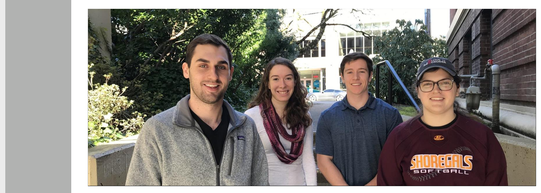
The fins were created using a composite sandwich that consists of G10 fiberglass laminate, honeycomb core and uni-directional carbon fiber. These dimensions were found using simulations run by our Aerodynamics and Recovery team. The fins were then attached using a "tip to tip" layup process that requires laying carbon fiber across both the fins and the body tube. This adheres them securely to the lower body tube.

Testing

Structural components of the rocket were tested to pass a safety factor check of 2 or greater. Most components were tested under varying loading conditions on an Instron machine (figure 5).

The values measured were used to calculate and find the corresponding safety factor to ensure the part is safe for launch.

FIgure 5: Conducting a bend test on a fin with the instron.



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PROJECT SPONSOR
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PROJECT STATUS

- Manufactured and tested bulkheads, coupler, lower body tube and fins
- Tested integration of payload, avionics and motor on the ground (figure 4 and 6)
- Preparing for test flight at the end of June

Figure 6: Attaching the nosecone during integration tests