FRANK ALVAREZ

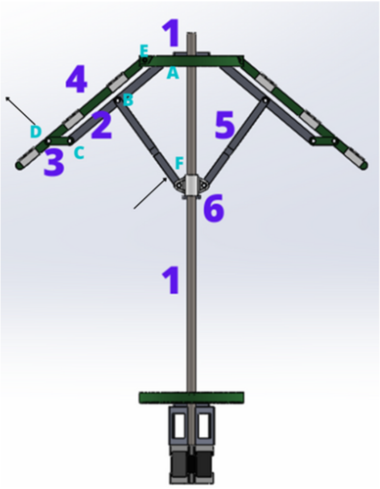
MECHANICAL ENGINEER GRADUATE FROM THE UNIVERSITY OF SOUTH FLORIDA

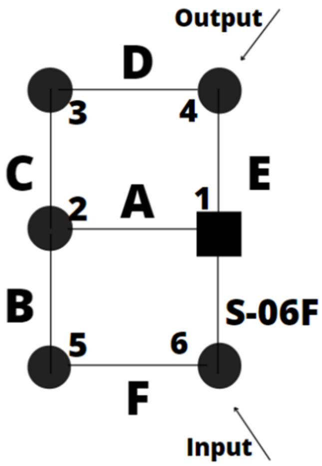
Frank.Alvarez.1121@gmail.com

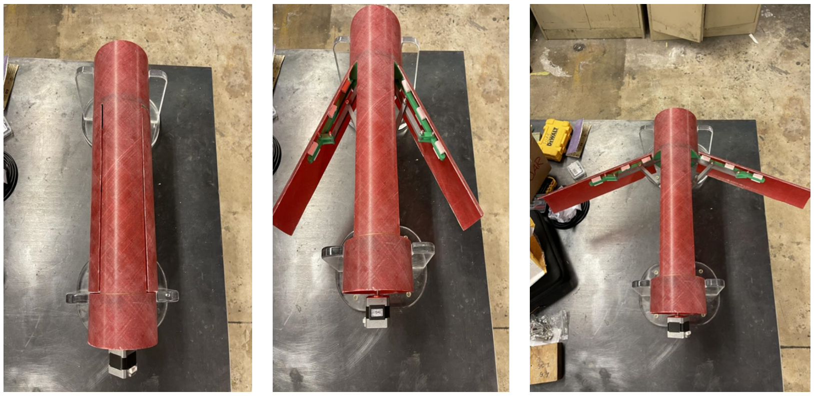
www.linkedin.com/in/frankalvarez mechanicalengineer

(941)404-9919

DEPLOYABLE FIN MECHANISM







What?

- Design and fabricate a **one-degree-of freedom** mechanism that deploys fins through a servo motor that is controlled via a switch and an **Arduino** board

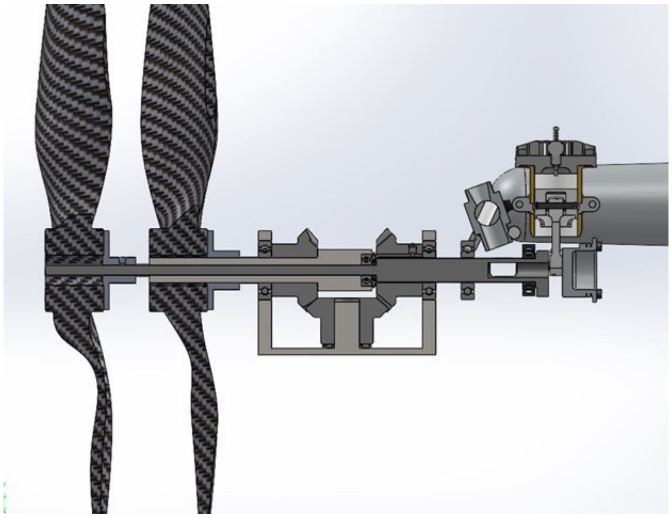
How?

- Used **SolidWorks** to design this
- Constructed through **3D Printing** tolerance parts and off the shelf threaded rod, servo and screws.

Results

- Using the **change point** for the mechanism as the locked position, the maximum output angle of the fins were **66.81 degrees**.

CONTRA-ROTATING PROPELLER AND GEARBOX



What?

- Design of contra-rotating propeller and gearbox system for RC plane.
- **Analyze** the effect of material selection with respect to the life cycle of the motor through **Sodaberg** and **Goodman** failure anaylsis

How?

- Designed on **SolidWorks**
- Selection of parts were done through McMaster-Carr to assure that this product could be constructed if budget permitted.

Results

- A safety factor of **2** was successfully achieved for each part of the system.
- Implemented **DFMA** principles to reduce overall part production cost

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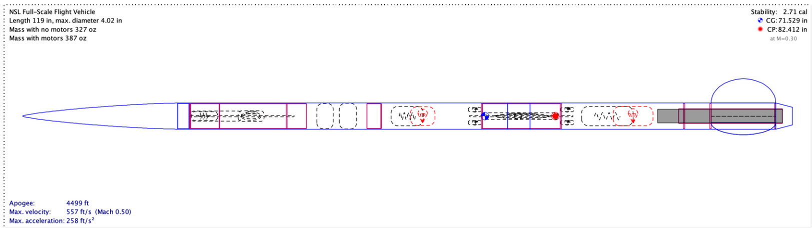
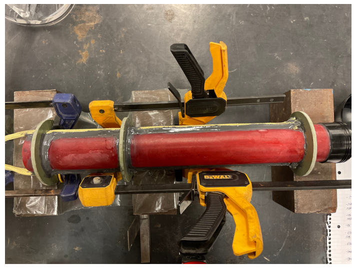
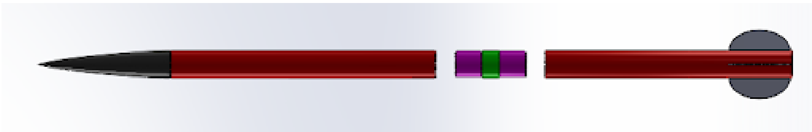
NASA STUDENT LAUNCH FLIGHT VEHICLE







What?

- **Design**, **manufacture**, and **assemble** a reusable solid motor rocket that can transport the payload system to its mission target.

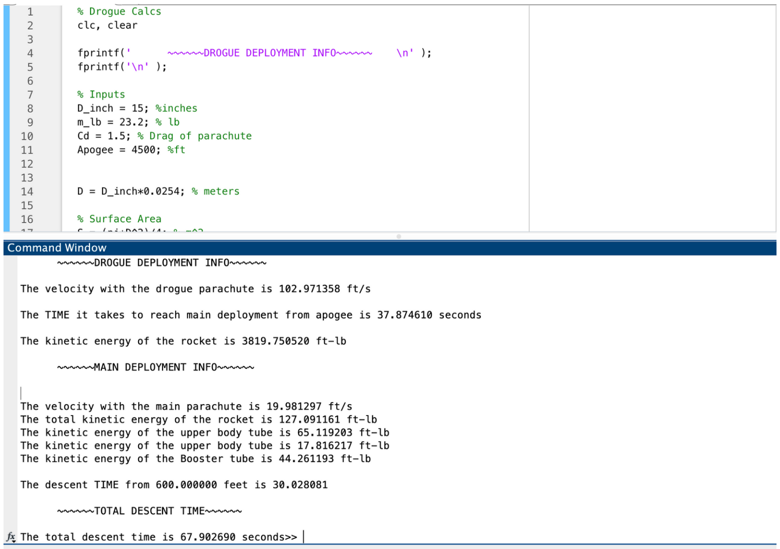
How?

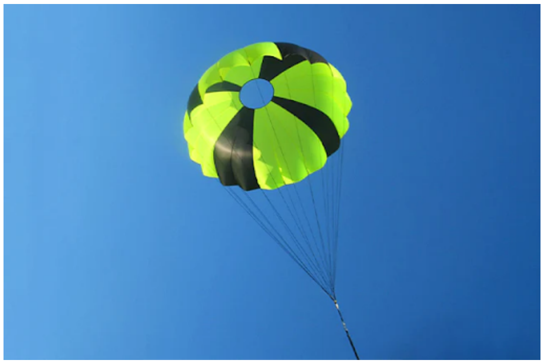
- Rocket Stability software was used to verify and improve design
- **Solidworks** modeling to fit payload and avionics system.
- **CNC machining** and **resin curing** to assemble competition rocket

Results

- Flight ready vehicle to be used in the NASA competition with proper space for the recovery system and payload system.

MATLAB SCRIPT FOR ROCKET RECOVERY SYSTEMS





What?

- Adjustments to rocket weight and desired altitude can change **recovery dynamics**.
- Develop a rapid way of **testing** main and drogue parachute sizes without doing hand calculations.

How?

- The equations that relate a parachute's coefficient of drag, diameter, and velocity were coded using **MATLAB** to find the flight vehicle's **velocity, kinetic energy,** and **descent time**.

Results

- The calculated descent time was on average **2-3%** lower than actual time due to the variation in wind speeds.

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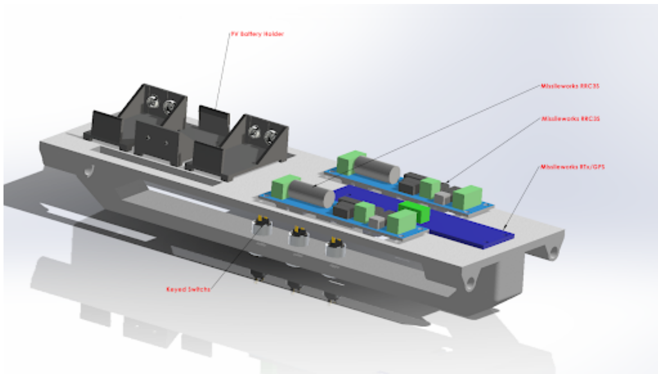
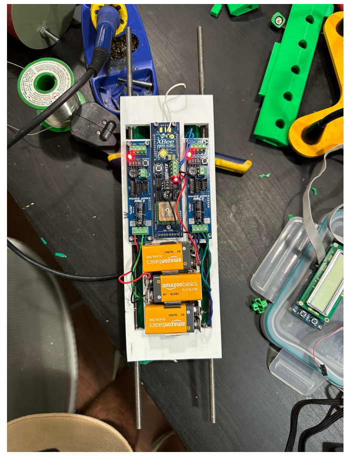
AVIONICS SLED





What?

- **Design** a sled to mount sensitive avionics equipment to withstand the flight time of the rocket.

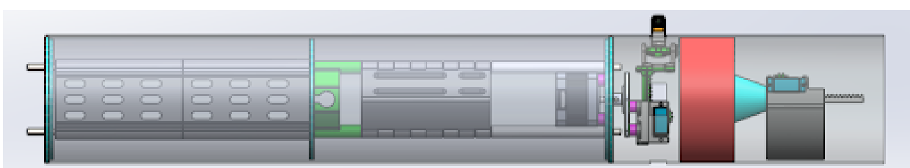
How?

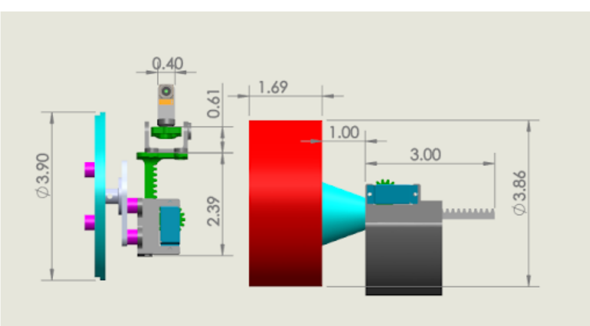
- Used **Solidworks** to design the sled and model avionics electronics
- **3D Printing** of the avionics bay provided a cost effective solution to the manufacturing of the sled.

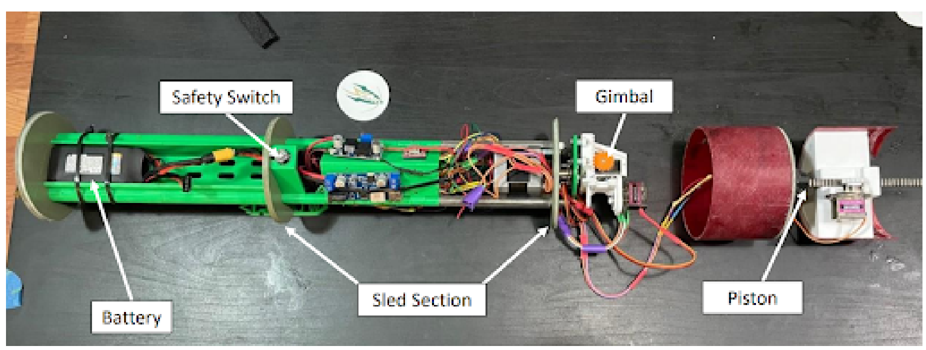
Results

- **Vibration** testing and **flight** testing verified the effectiveness of the sled design. **PLA** plastic was sufficient in withstanding flight stresses in avionics bay.

PAYLOAD SYSTEM







What?

- **NASA** Student Launch payload requirement needed a camera to be able to take 360 degree photos of surface when rocket landed. Payload system was initiated via **RF** commands from **NASA** when landed.

How?

- **Raspberry Pi, accelerometer, stepper motor, servos** and **gears** were used to determine when rocket was landed and to select the proper hole that was closest to z-axis wrt surface.

Results

- Payload system was able to be **tested** on land and at launches. The camera ribbon cable provided too much **tension** for camera gimbal assembly, leading to the photos not being closely aligned with z-axis