AIAA Design Build Fly – Vaccine Team

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Mission Statement

The objective for the entire team this year is to build a remotely controlled electric aircraft capable of carrying syringes and vaccine vial packages with fixed dimensions, and to deploy the packages without triggering the 25G shock sensors on each axial, accomplishing the mission requirements.

Missions

There are 3 different Flight Mission Sequences

- Tests our aircraft's flying capabilities by requiring it to fly three laps in five minutes without a payload
- The same as the first but with the vaccine syringes on board
- Deployment of the vaccine vial packages

Ground Mission: Tests our ability to load the entire payload into the aircraft and safely deliver it without setting off the shock sensors

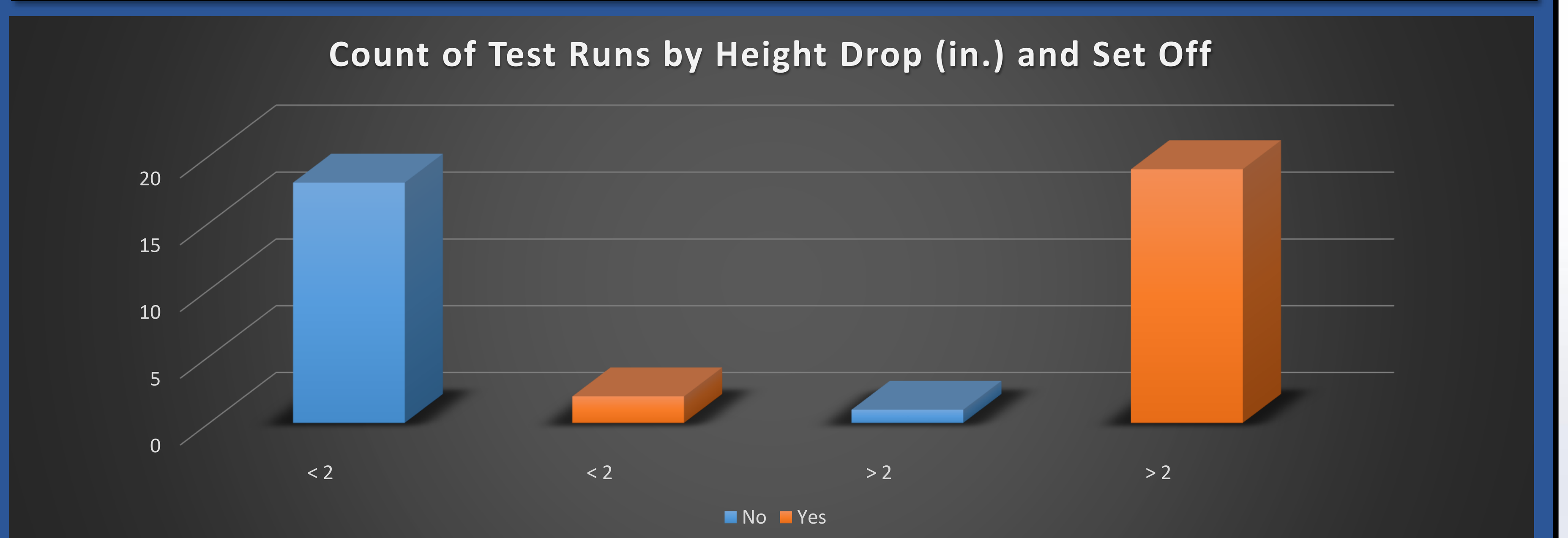


Figure 2: Preliminary Testing of 5G sensors, which have been recently changed to 25G sensors

Analysis

Fuselage

- The fuselage is four feet long to leave room for a nose, tail, and fairing in our maximum length of eight feet. We may have to length the main section of the fuselage depending on how the syringes will be packed into the fuselage.

Drop Mechanism

- We found that a drop of greater than 2 in. would trigger 5G sensors. We developed a design that can deploy one package at a time safely and smoothly. This led to a design of a conveyor belt with a ramp of rollers. Changes may occur depending on the sensitivity of new changes of the competition for 25G sensors.

The AIAA Design, Build, Fly competition is a nationwide competition which will take place between April 21-24, 2022, in Wichita Kansas. We have faculty advisors including Professor Jacqueline Huynh and graduate students available to aid us including Colin Sledge and Nathan Yeung to provide insight and direction for the different components of the project. The team also includes members that were previously involved in the project that we learn from. Our UCI ICU DBF team qualified for the competition, where our proposal placed 15th of the 110 colleges accepted, and 127 of the colleges that applied.

Vaccine Team

We focus on Mission 2 & 3. We are responsible for both the drop mechanism and the fuselage of the aircraft.

- Fuselage holds the vaccine syringes and the drop mechanism
- Drop mechanism will be releasing the vaccine vial packages smoothly and safely

Fuselage

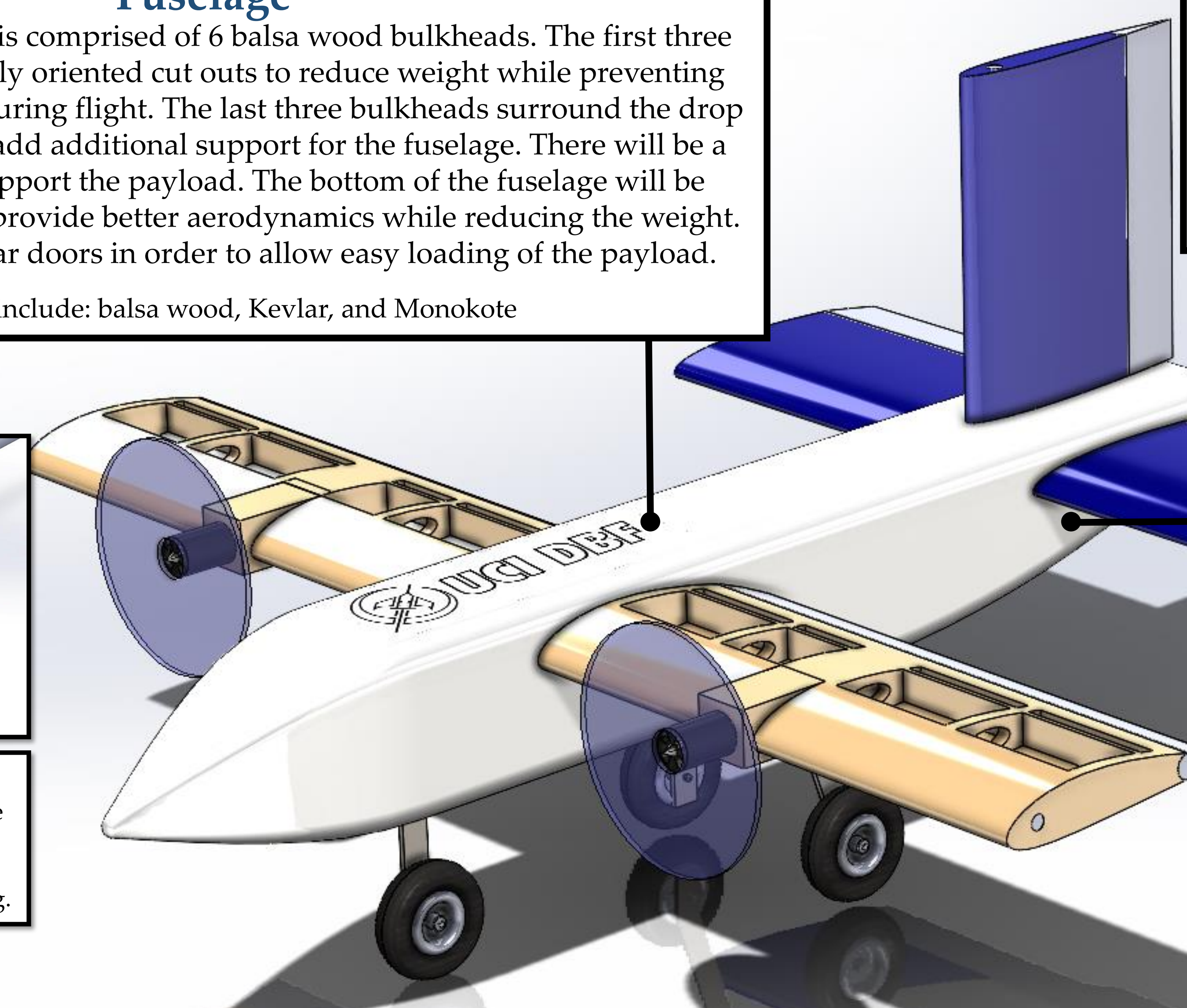
The fuselage's structure is comprised of 6 balsa wood bulkheads. The first three bulkheads have vertically oriented cut outs to reduce weight while preventing shifting of the syringes during flight. The last three bulkheads surround the drop mechanism and aim to add additional support for the fuselage. There will be a balsa wood floor to support the payload. The bottom of the fuselage will be covered in monokote to provide better aerodynamics while reducing the weight. The top will have Kevlar doors in order to allow easy loading of the payload.

Materials include: balsa wood, Kevlar, and Monokote

Drop Mechanism

Current design is a conveyor belt contained by a shell that will safely hold up to 6 of the vaccine vial packages and a ramp that will cautiously deploy each package. This will be powered by a servomotor

Materials include: a servo motor, grip pads, sandpaper, and balsa wood



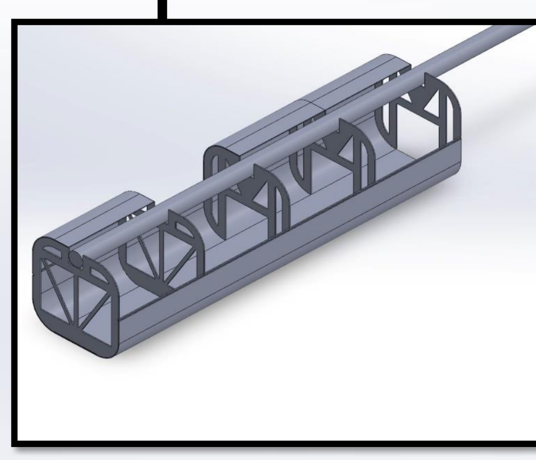


Figure 3: CAD image of the fuselage structure, planned to be made from BALSA wood. The doors on the front of the model were removed for easier viewing.

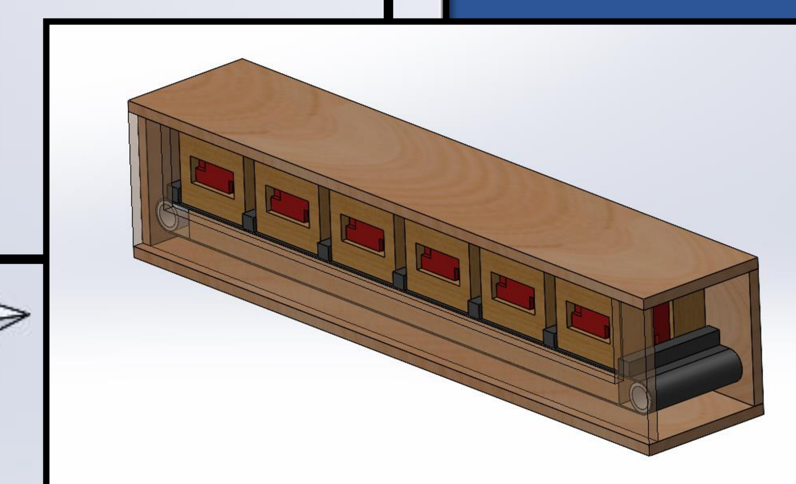


Figure 4: A CAD image of a Balsa Wood Shell containing the conveyor belt system with 6 vaccine vial packages separated by grip pads

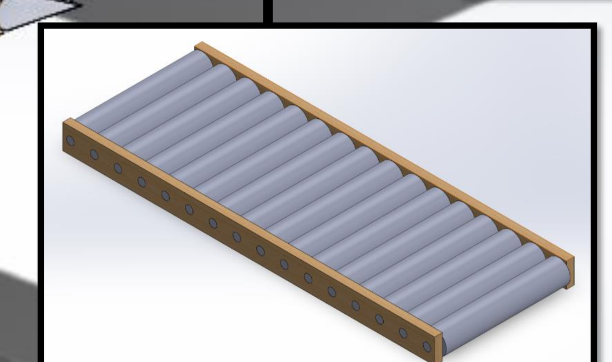


Figure 5: CAD image of the ramp we plan to use to safely deploy each vaccine vial package. Made of BALSA wood and plastic rollers.

Figure 1: Preliminary CAD designs of our aircraft that was used for our team's proposal for the competition

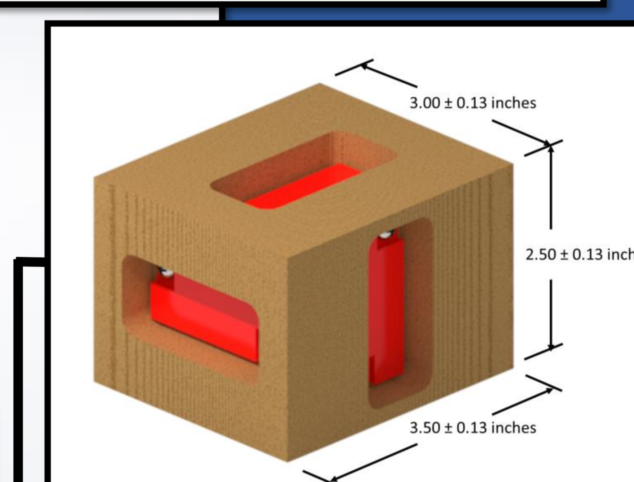


Figure 6: Vaccine vial package with imbedded 25G Shock sensors

https://www.aiaa.org/docs/default-source/uploadedfiles/aiaadbf/dbf-rules-2022.pdf

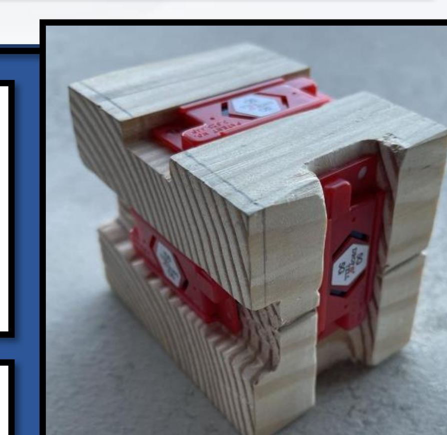


Figure 7: Developed vaccine vial package with imbedded shock sensors for testing

Reference

2021-22 Design, Build, Fly

- https://www.aiaa.org/docs/default-source/uploadedfiles/aiaadbf/dbf-rules-2022.pdf

Preliminary Work

The DBF team initiated working on the scoring analysis for the competition. Our Vaccine sub-team's contribution revolves around both Mission 2 and 3, which we have been designing and testing for the Drop Mechanism and Fuselage. Our team plays an importance to this competition as it is part of both missions.

Future Work

- Continue prototype development phase
- Begin testing new 25G Shock Sensor Sensitivity
- Report our data and analysis to the team

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