

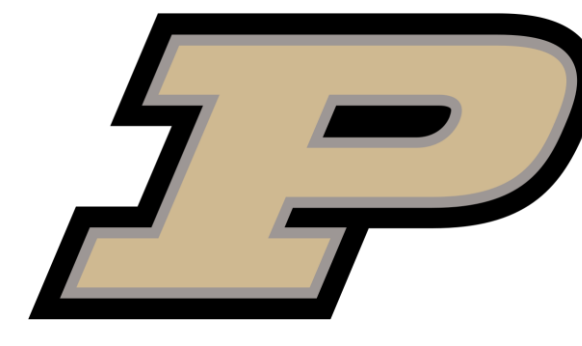
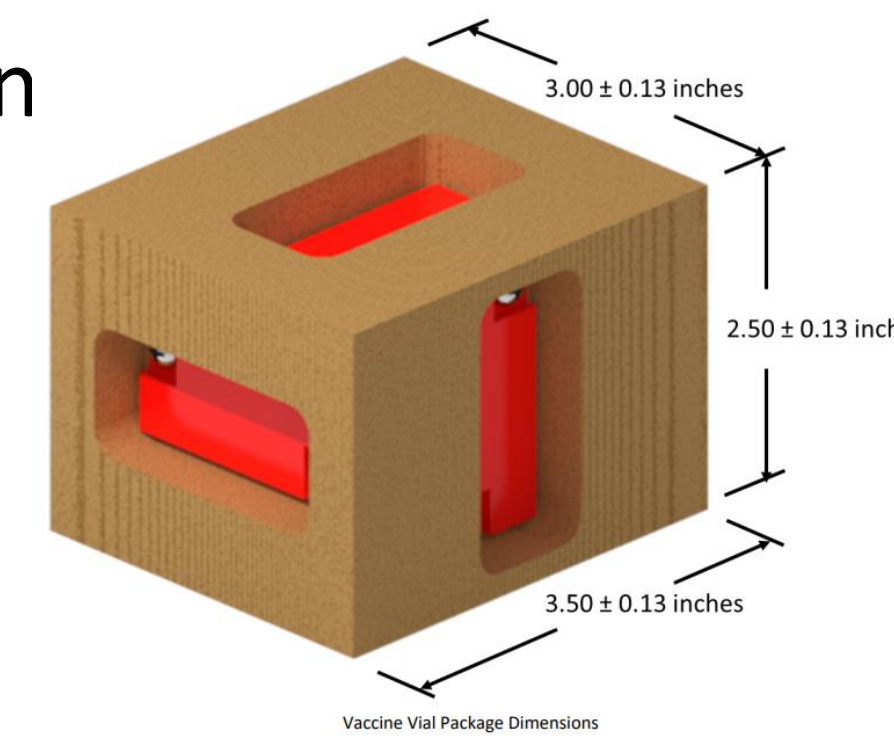
## Abstract

The purpose of the project is to design, manufacturing, and test an RC aircraft to compete in the 2021-22 AIAA Design/Build/Fly (DBF) competition. The theme of the competition this year is a Humanitarian Mission, with the objective of carrying and delivering syringes and environmentally sensitive vaccine vial packages.

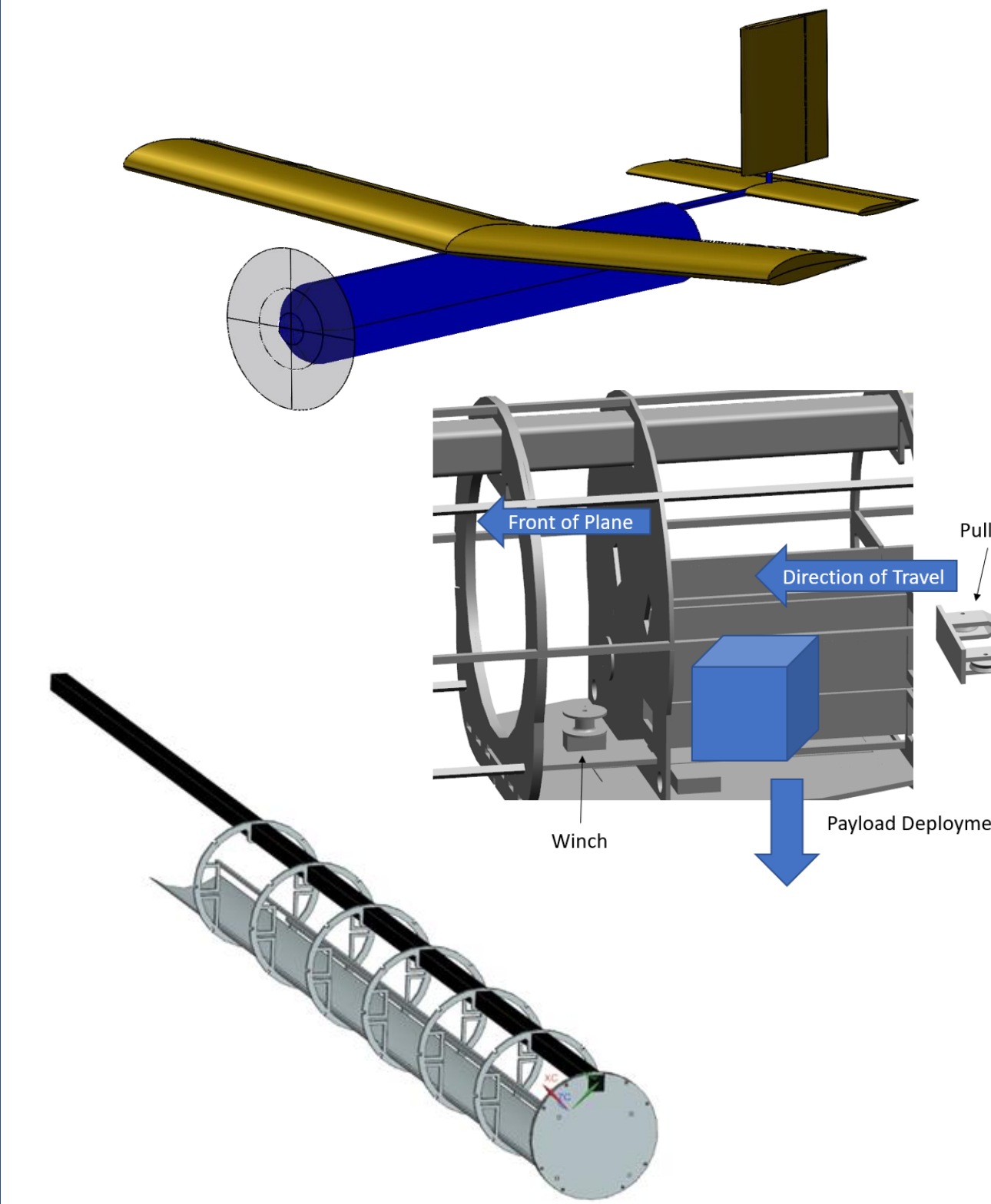
“Project Thunderstorm” was constructed from Balsa Wood, Plywood, Carbon Fiber, and Foam. The final plane had a wingspan of 7.6 ft, chord of 1.26 ft, tip to tail length of 7.7 ft, 9-inch diameter fuselage, and empty weight of 13.6 lbs.

## Customer Needs and Requirements

- Place in the top half of the competition
- Beat all other Indiana Teams
- Maximum Dimension of 8 ft
- Maximum Takeoff Distance of 25 ft
- Carry at least 10 syringes
- Carry at least 1 payload
- Package Acceleration Sensor cannot exceed 25 G's



## Concept Selection



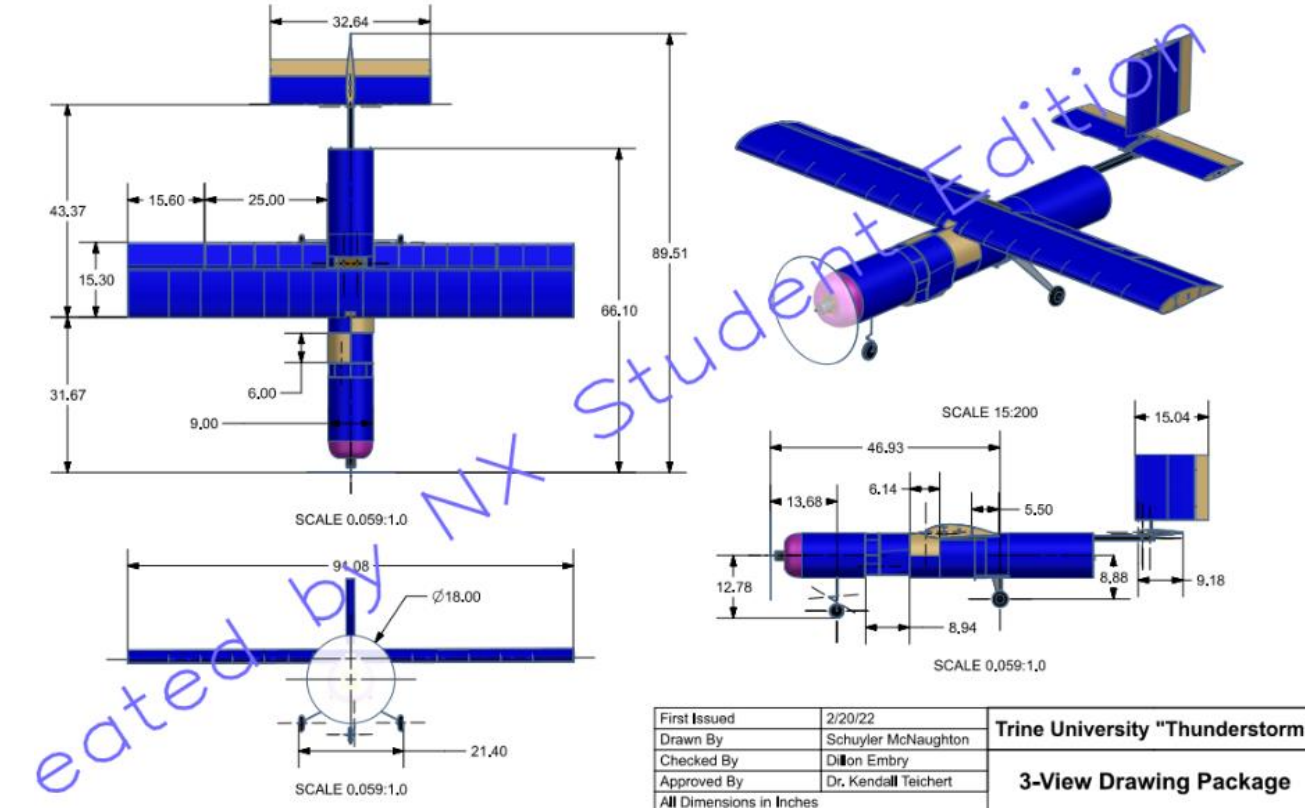
- High Wing
- Dihedral Wing
- NACA 4418 Airfoil
- Conventional Tail
- Winch Package Delivery System
- Rear Door Loading
- 18-inch Propeller
- Sheet Metal Landing Gear

## Design Solution

A code was generated on MATLAB in order to size our aircraft. It would provide us with the aspect ratio, span, and other variables needed.

Ailerons, Flaps, Rudder, and Elevator were sized to grant control authority, provide lift, and pitch the plane as required.

Propeller and motor were chosen to grant enough thrust at takeoff to ensure 25 ft takeoff while also meeting power requirements.



## Manufacturing

### Fuselage



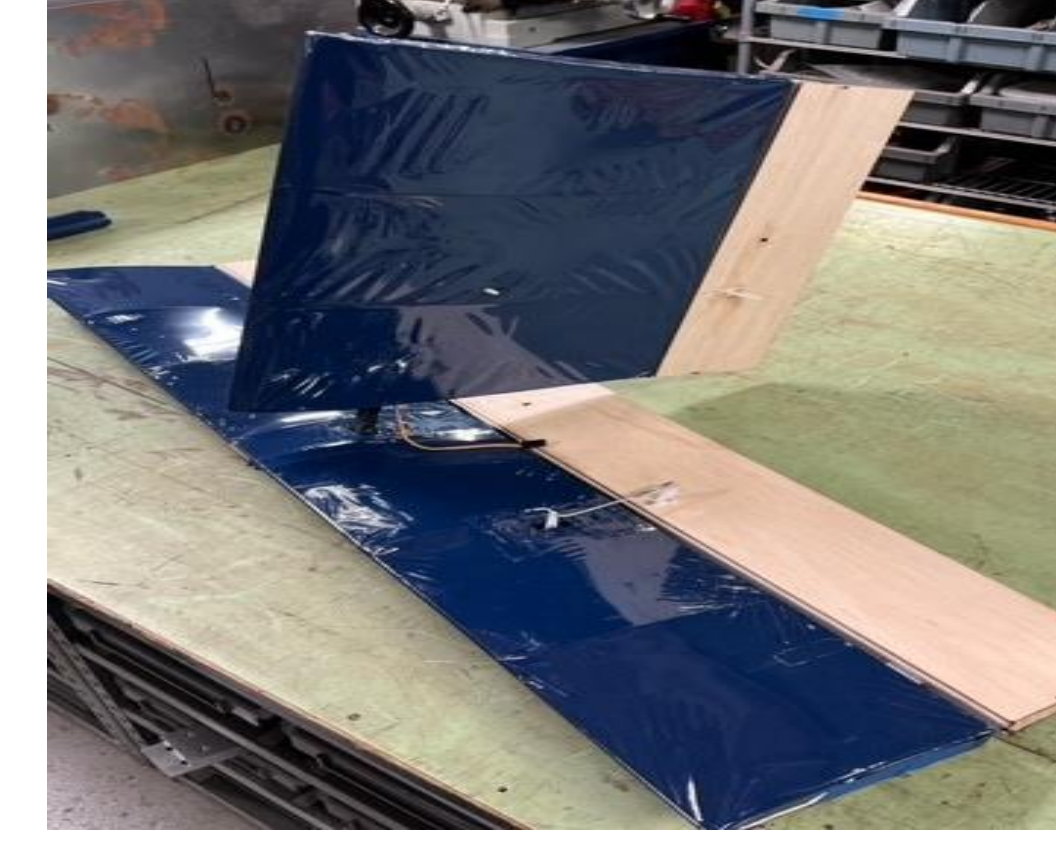
- Laser Cut plywood ribs
- Dry fit to carbon fiber boom
- Assembly payload track

### Wing



- Laser cut plywood I-beam
- Laser cut balsa wood spars
- Leading edge of balsa panel

### Tail



- Laser cut plywood tail connector
- Laser cut balsa wood spars
- Connected spars to carbon fiber rods

### Assembly:



- Tail bolts on carbon fiber boom
- Wing attached with nylon bolt and front pin

## Testing and Validation

### Test 1: Frankenplane

- 25 ft takeoff
- Successful Takeoff

### Test 2: Prototype II

- First Flight
- Successful Cruise
- Implementation of Payload Deployment

### Test 3: Prototype III

- Reduced Weight version of Prototype II

### Test 4: Prototype IV

- Second Successful Flight

### Test 5: Project Thunderstorm

- First Successful Mission Sequence
- Taken to Competition

## Acknowledgments

We would like to give thanks to our advisors Dr. Teichert, Dr. Canino, and Joe Thompson. Our team pushed hard to make the best design for competition, and we wouldn't have gotten as far as we did without their guidance.

A special thanks to our pilots Clay and Clete Schenkel on their donations and advice towards the plane. Without their input, the plane would not have flown at competition.

Additionally, thanks to Trine University, Indiana Space Grant, Univertical, and Hendrickson for providing resources and sponsoring our project.



Prototype I



Prototype II



Prototype III



Project Thunderstorm