2021-22 NDSU AIAA Design/Build/Fly Student Competition

Isnala Nanjin Roan Eagle

Tyler Lickfelt

Charles Hickman

Alex Kunkel

Mentors: Yildrim Bora Suzen and Yan Zhang

AIAA Design/Build/Fly

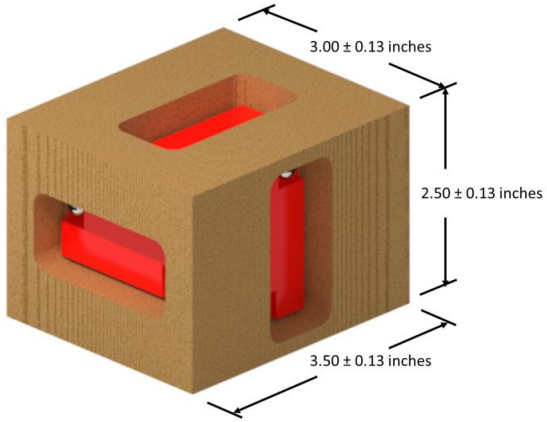
American Institute of Astronautics and Aeronautics (AIAA) Design/Build/Fly Competition

Objective: Design, Manufacture, Test, and Fly an RC aircraft

This year's competition will be April 21-24 in Wichita, KS.

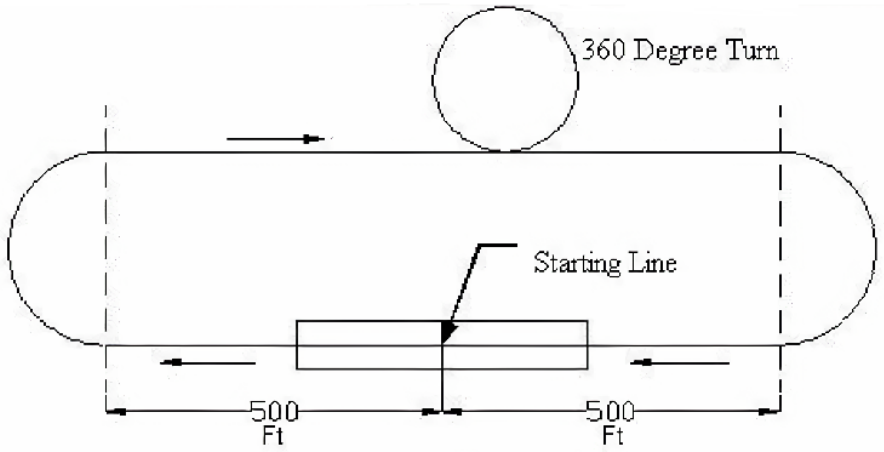
Competition Requirements

- Design, build, and test an aircraft to deliver vaccination components.
  - Carry payload (Syringes; As much as possible)
  - Deliver vaccine vial packages without tripping shock sensors
  - Must meet a specified time for each mission
  - Takeoff in 25 feet
- Must construct design report to be scored
- Need a 1:3 ratio of underclassmen
  - NDSU AIAA Chapter



Mission Requirements

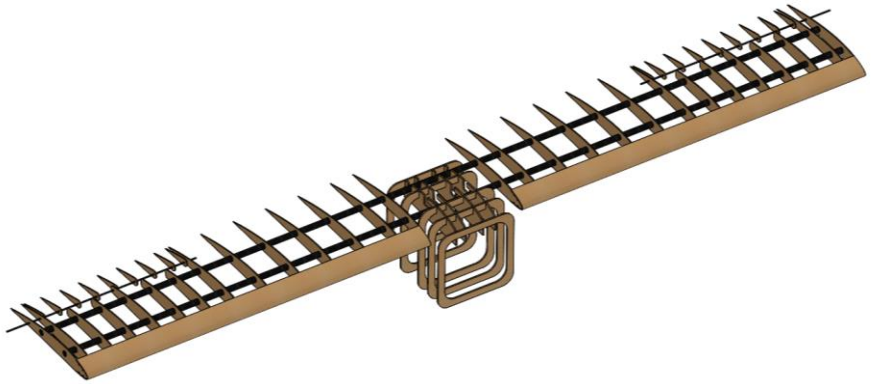
Mission	Scoring Criteria
Flight Mission 1	Without a payload, must complete 3 laps within five minutes.
Flight Mission 2	Must carry a minimum of 10 syringes with same lap and time constraints as mission one.
Flight Mission 3	Carrying a minimum of one vaccine vial package, aircraft must deliver payload after a flight lap until all packages have been delivered or flight time of 10 minutes has surpassed.
Ground Mission	With the aircraft stationary, a ground crew member must run the starting line, load the syringe payload then run back all while being timed. This must also be done for the vaccine vial package payload.

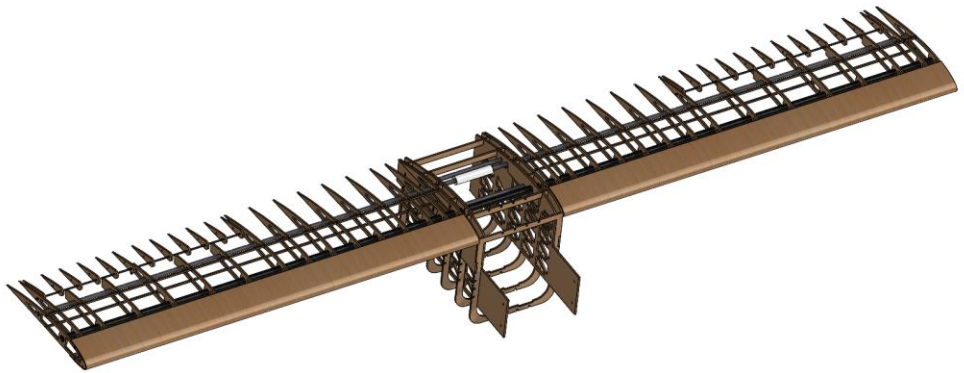


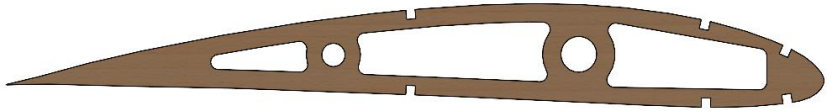
Concept Selection

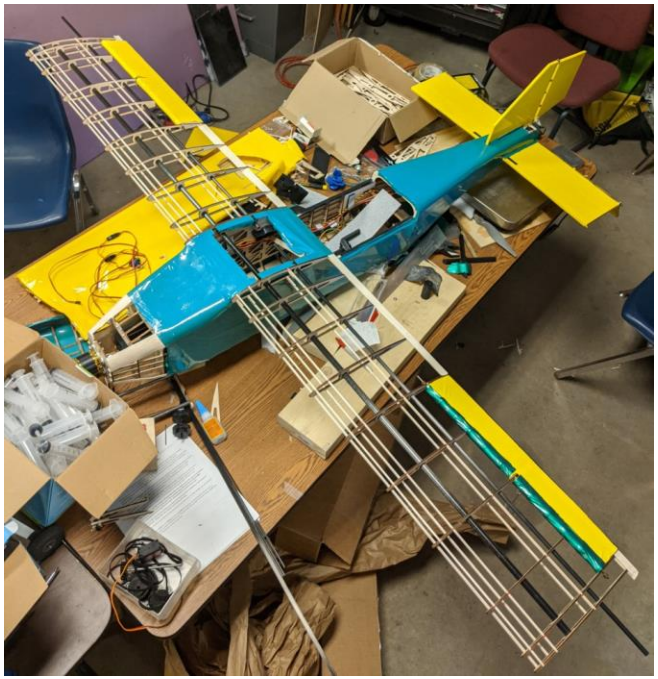
- Concept selection matrices generated for:
  - Wing Configuration
  - Wing Shape
  - Airfoil Selection
  - Flap Style
  - Motor Setup
  - Loading Setup
  - Dropoff Setup
  - Motor
  - Battery
- Mission requirements and aerodynamic parameters factored in choices

Wing





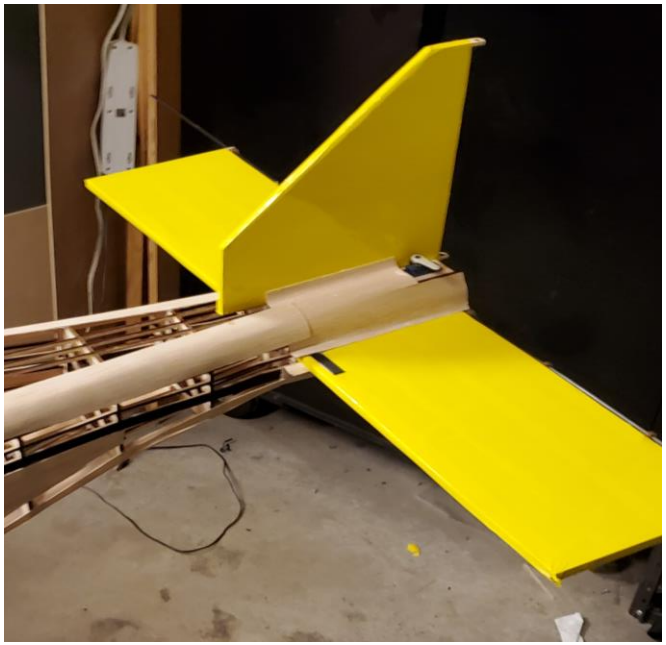


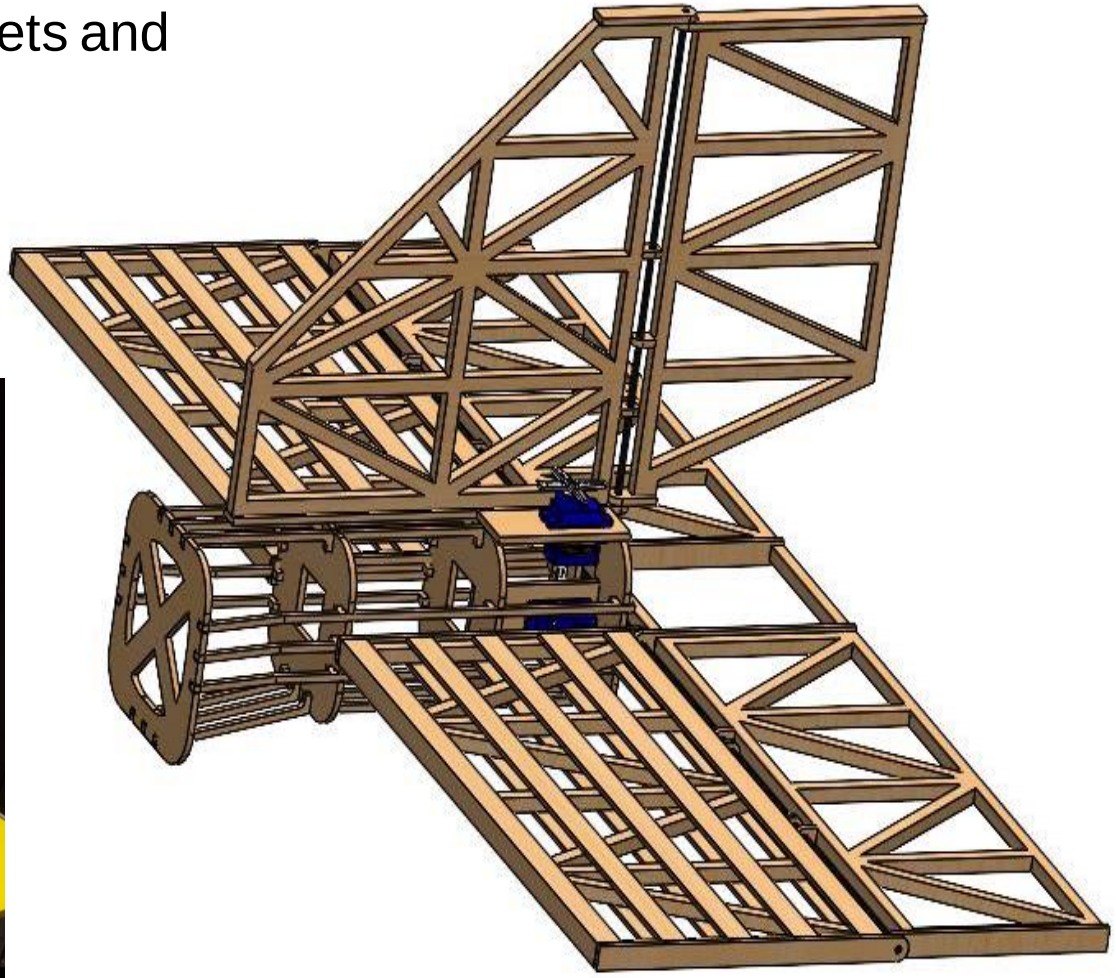


Span – 66 in
Chord – 11.1 in
NACA 4412 Airfoil
Wing Area – 762 in²
Coefficient of Lift – 0.4
Angle of Attack – 5°

Tailfin

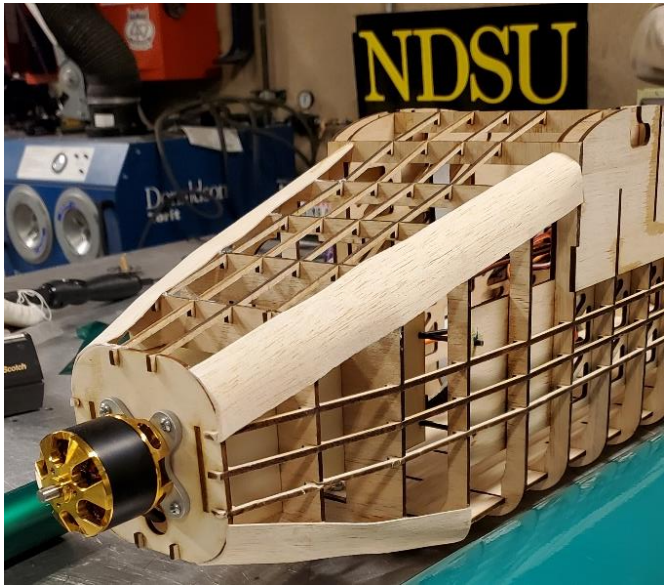
- 1/8th inch cross sectional dowels
- Covered with balsa sheets and panels
- 25-inch Elevator Span
- 8-inch Rudder Span

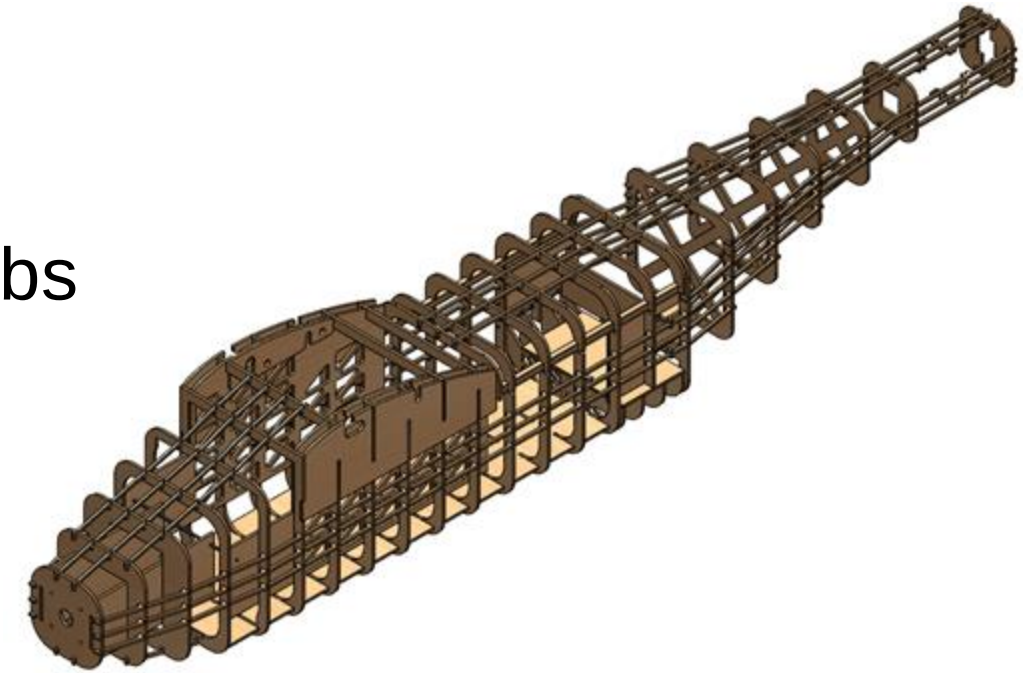


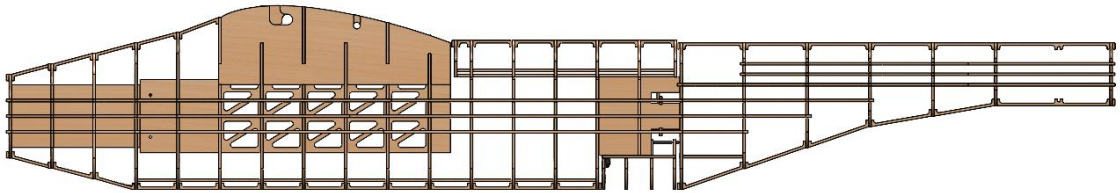


Fuselage

- Size – 7x7 in
- Removable top
- Composed of balsa ribs and sheets

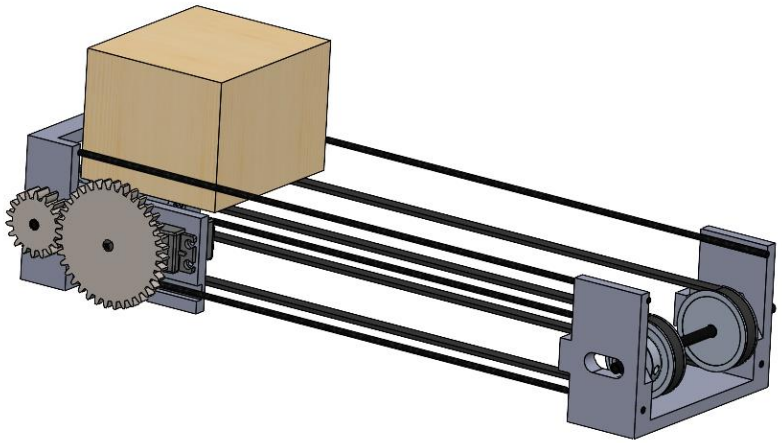


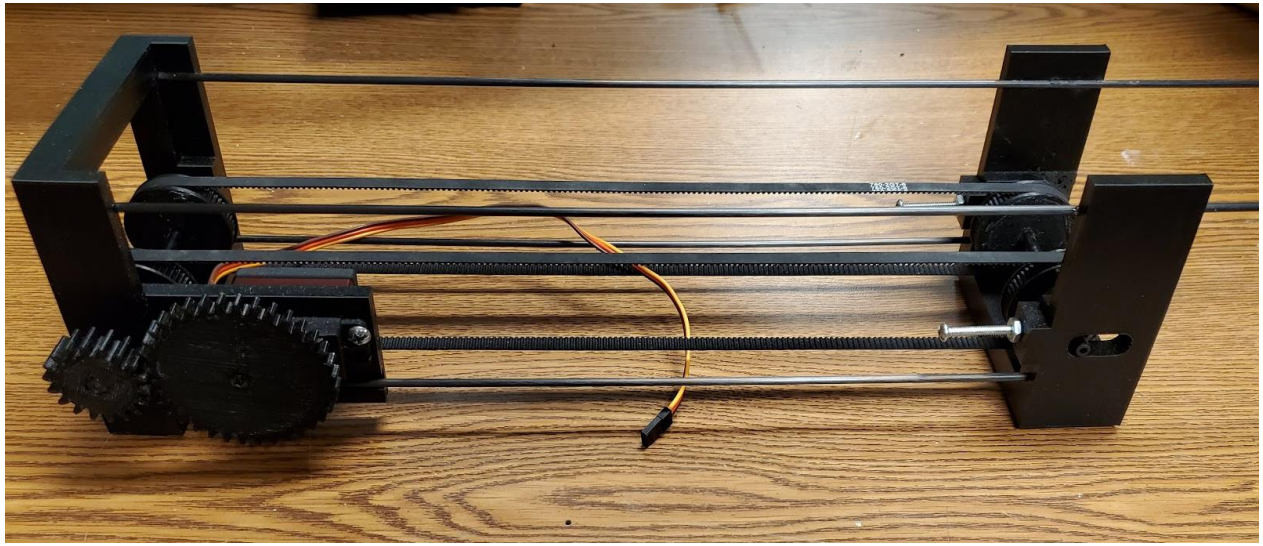




Conveyor Belt

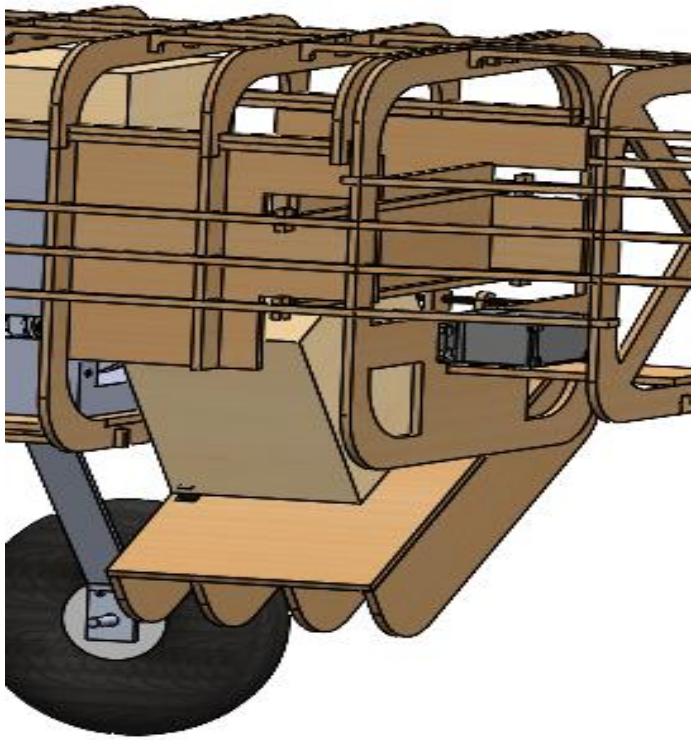
- Holds four vaccine packages
- Loads into package drop area
- Carbon fiber rails prevent packages from moving around

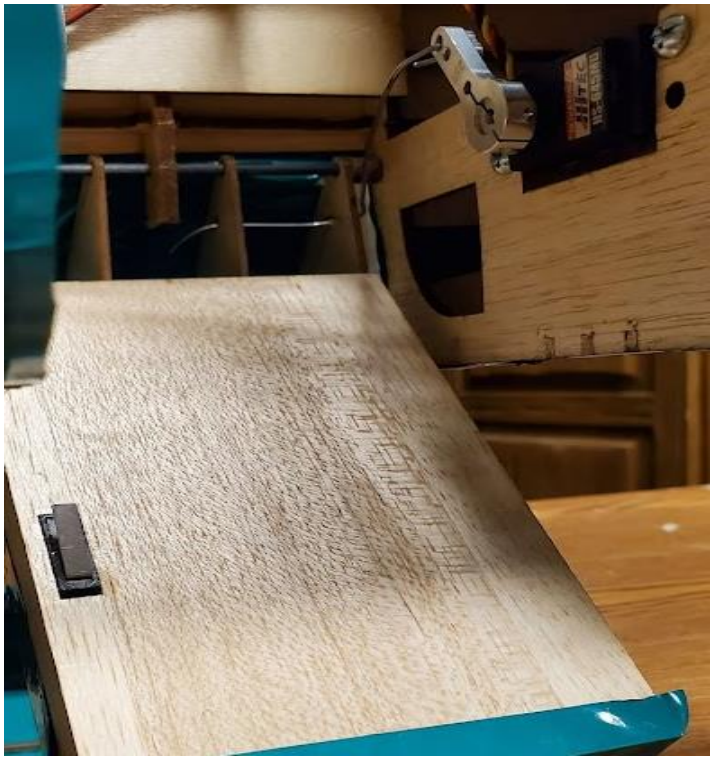




Deployment Mechanism

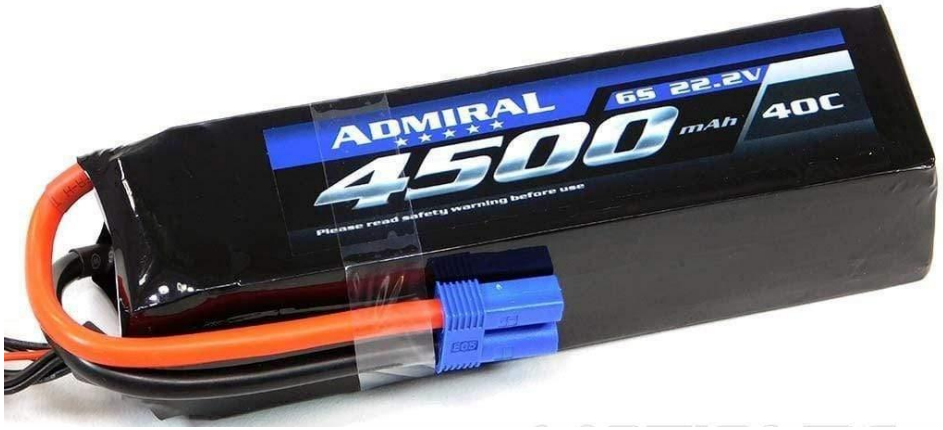
- Side opening ramp
- Servo opens the door
- Meant to limit deployment to one package





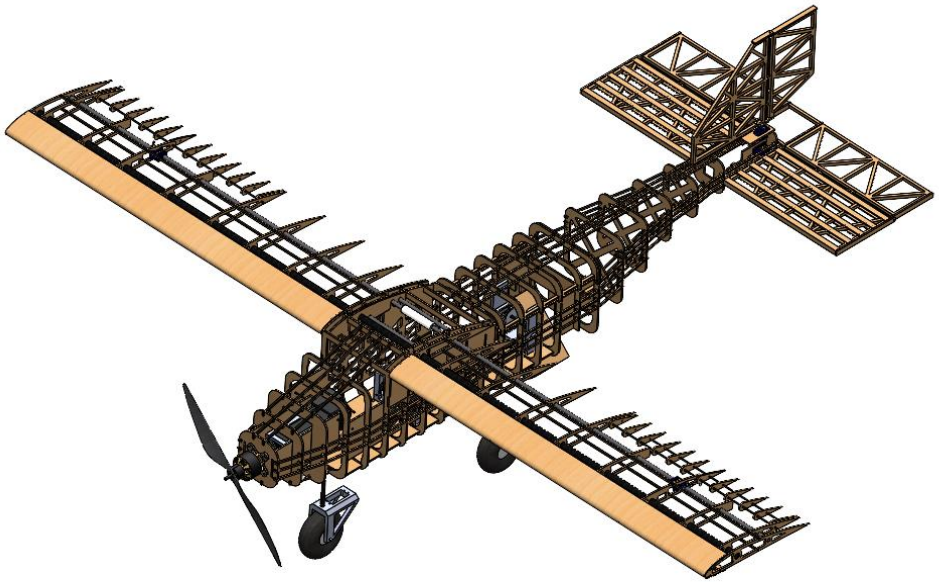
Battery & Motor

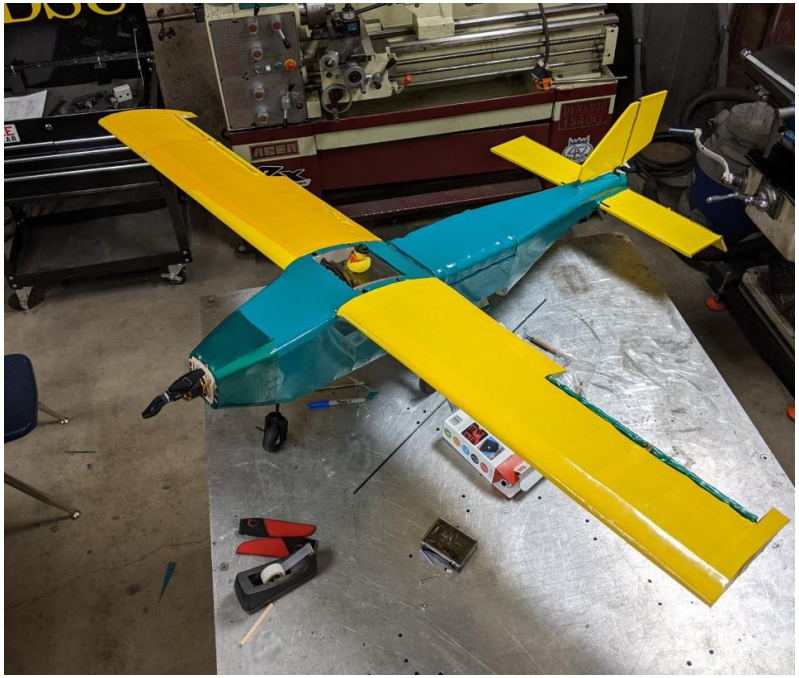
- Competition limits battery size affecting motor size
- Motor: Capable of producing 14 lbs of thrust
- Battery: Maximizes flight time



Full Assembly

- Total length: 57.5 inches
- Wing span: 72 inches
- Total weight with packages: 11.5 pounds
- Electronics located directly under wing

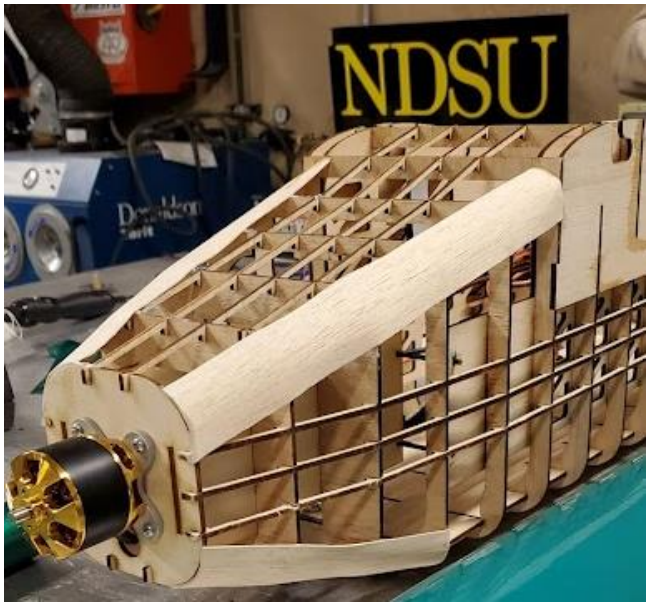


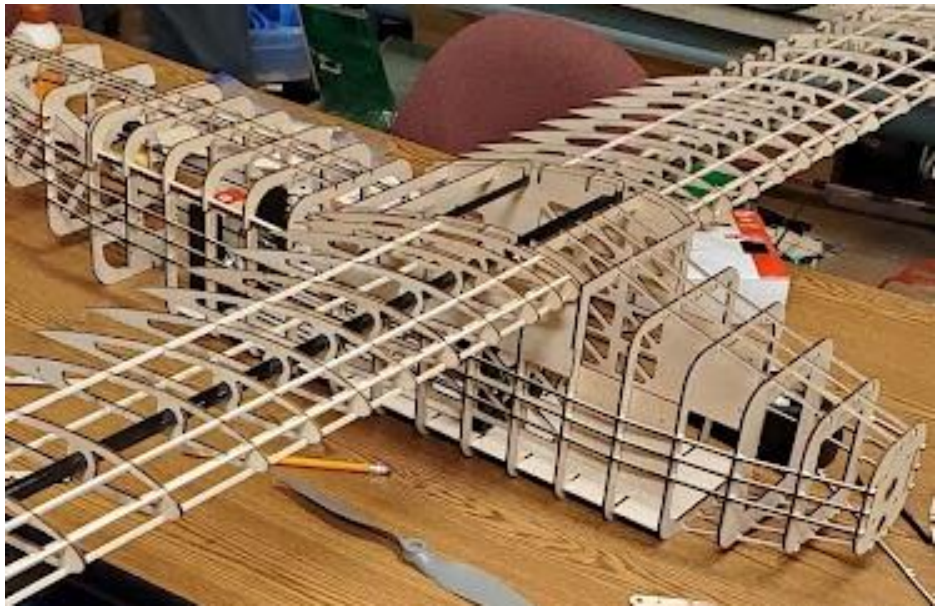


Flight Videos

Future Plans

- Make any necessary revisions
- Continue testing the RC aircraft
- Compete in competition located in Wichita
- Present our project in Senior Design Expo





What Was Learned

- Engineering Design Process
- Manufacturing processes
- Communication skills
- Task Management skills
- Teamwork
- Professionalism

Acknowledgements

- We would like to acknowledge the following:
  - Yildrim Bora Suzen
  - Yan Zhang
  - Valley RC Flyers Club
  - NDSU Mechanical Engineering Dept.
  - North Dakota Space Grant
  - AIAA NDSU Chapter
  - American Institute of Aeronautics and Astronautics

Questions?

NDSU NORTH DAKOTA STATE UNIVERSITY