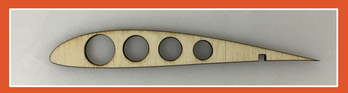
Design/Build/Fly: Aerodynamics & Structures

Key Customer Requirements:

-Aircraft must provide adequate lift to complete all missions.
-Aircraft must be statically stable in flight.
-Aircraft must sustain landing and aerodynamic loads.
-Aircraft must be design to look elegant while maintaining ease of manufacturing and integration.

Aerodynamics Design:

-Conventional aircraft configuration for stability and mission score optimization.
-Airfoil selection (SD7062) for desired lift and low drag at steady level flight.



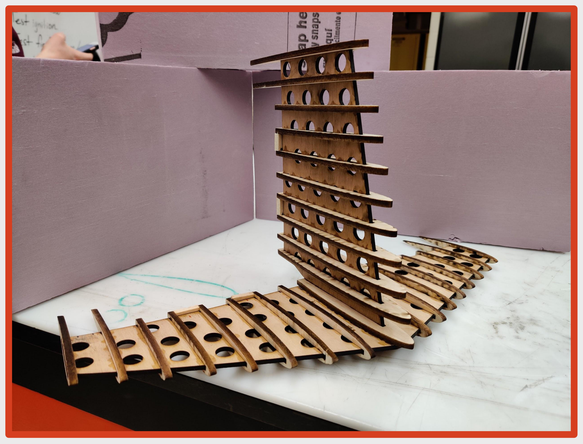
-Wingspan and aspect ratio selected for adequate lift at take-off and cruise conditions.
-Empennage symmetrical airfoil for stability and reduced drag.

Structural Design

-Wing: Carbon fiber main spar and Balsa wood ribs wrapped in mylar.
-Fuselage: Fiberglass with Divinycell foam reinforcements.
-Empennage: Balsa and mylar construction for low weight and adequate strength.

Oregon State University

Max Speed	60 mph
Empty Weight	7 lbs
Max Payload Weight	5 lbs
Wingspan	5 ft
Aspect Ratio	10
Horizontal Stabilizer Span	16.5 in
Vertical stabilizer Span	8 in



Structural Testing

- Wing tip test was conducted on the wing to measure the wing deflection and test structural integrity.
- Wing loading test was done on the wing to validate structural reliability under 120 lbs of distributed loads representing aerodynamic loads.

Project Outcome

- Successful in all 4 competition missions.
- Successfully met customer requirements.
- Successful deployment and release of 10 foot banner.
- Successful mission with 12 passenger payload.

TEAM MEMBERS
Edgar Jimenez
Ajay Mohan
Jehad Aljasem

TECHNICAL ADVISORS
Dr. Roberto Albertani
Dr. Nancy Squires

PROJECT SPONSORS

NATIONAL SPACE GRANT COLLEGE AND FELLOWSHIP PROGRAM
NASA

OSU AIAA

KDE Direct

GLOBAL FORMULA RACING
GFR
DHBW RAVENSBURG | OREGON STATE UNIVERSITY

OREGON STATE UNIVERSITY
VIII
DESIGN BUILD FLY
2019-2020

Design/Build/Fly: Propulsion

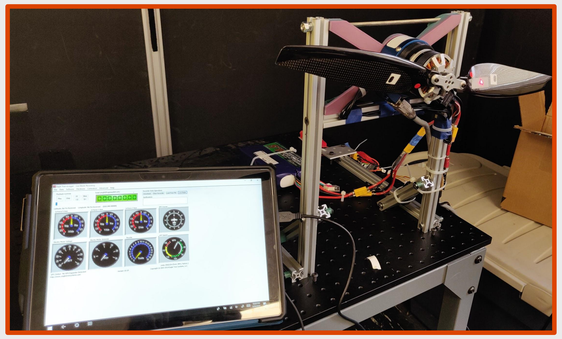
Key Customer Requirements:
The aircraft had to comply with three engineering requirements to have a competition worthy aircraft.

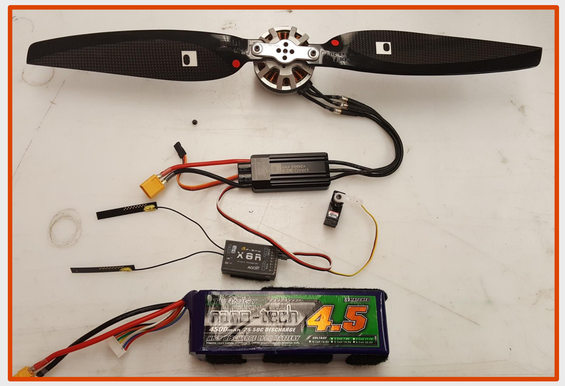
- High Thrust to Weight Ratio
- High Thrust Efficiency
- Aircraft Must Meet Endurance Requirements

Design Selected:
- Single Tractor Propeller
  - Most efficient and lightest
- 6S 4500 mAh Lithium-Polymer Battery

Matlab Analysis:
- Manufacturer thrust data
- Analyzes multiple propeller and voltage configurations

Recommendations:
- Implement thrust testing equipment for in flight data acquisition.
- Future competitions may not allow series connections. Ensure batteries are competition legal.





Max Thrust	10.3 lbs
Thrust to Weight	1.40:1
Thrust Efficiency	12.4 lbs/hp
Endurance	13 min

Motor/Propeller

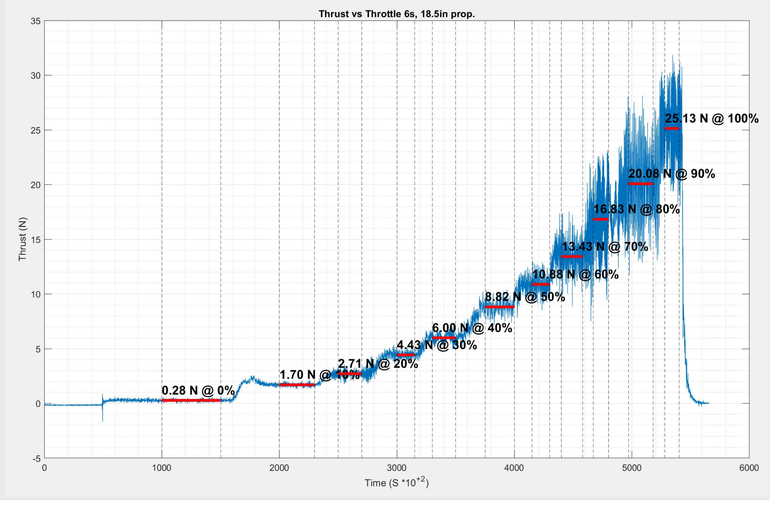
- KDE 5215XF-220kV
  - Combines high thrust with leading efficiency
- 20” x 14” propeller
  - High pitch negates speed penalties
  - Large diameter improves thrust and efficiency

Battery Configuration

- Nickle Cadmium -> Lithium-Polymer
  - ~4x energy density and specific energy increase
- 6S 4500 mAh battery
  - Provides efficient cruise and high thrust
  - Maximizes the 100 Wh limit

Testing

- Static Thrust Testing:
  - Thrust stand upgraded to handle higher thrust
  - Used for battery endurance and thermal testing
- Dynamic Testing
  - Performed on a test vehicle



TEAM MEMBERS
Joshua Walters
Joshua Coplantz
Sam Wiewel

TECHNICAL ADVISORS
Dr. Robert Albertani
Dr. Nancy Squires

PROJECT SPONSORS

NASA COLLEGE AND FELLOWSHIP PROGRAM
NATIONAL SPACE GRANT
OSU AIAA
KDE Direct
GFR GLOBAL FORMULA Rracing
DHBW RAVENSBURG / OREGON STATE UNIVERSITY

Oregon State University

OREGON STATE UNIVERSITY VIII DESIGN BUILD FLY 2019-2020

COLLEGE OF ENGINEERING

Mechanical, Industrial, and Manufacturing Engineering

TEAM NUMBER 1.3

OSU Design-Build-Fly: Payload & Manufacturing

Key Customer Requirements

- Lightweight passenger restraint
- Low drag max length banner
- High payload capacity
- Simple and cost effective manufacturing
- Durable landing gear

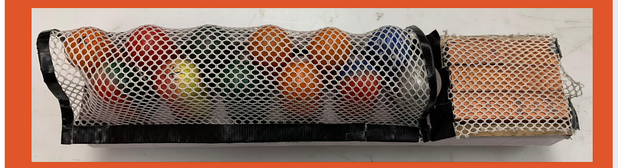
Component Design

-Banner dimensions of 10 ft by 2ft for an aspect ratio of 1:5.

- Two stage single servo release mechanism

- Carbon fiber tail dragger landing gear configuration

- Insulation foam passenger restraint is designed to be light and secure in fuselage.

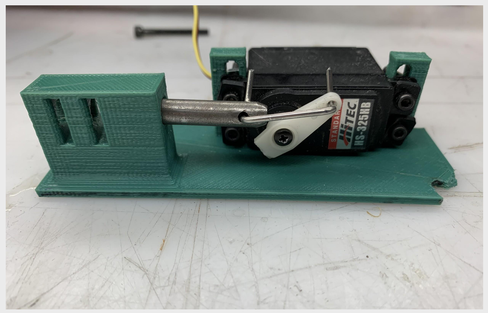


Design Revision

- Drag reducing modifications for the banner
  - Parachutes
  - Tapering edges
- Sheet metal aluminum landing gear
  - Steerable Tail
  - Fixed tail

Oregon State University

Max Passenger Storage	16 Sets
Max Banner Length	10 Feet
Landing Gear Thickness	24 Ply



Implementation and Testing

- Banner drag tests were conducted using a vehicle-mounted load cell for dynamic load drag values.
- Landing gear was mounted to a weighted fixture and dropped to simulate heavy impact when landing.

Composite Manufacturing

- Number of plies and ply orientation is determined by dynamic load analysis
- Molds are manufactured for plies to be laid up on
- Individual plies are cut to profiles and placed on mold for vacuum bagging
- Oven curing to set resin and shape

TEAM MEMBERS

Alejandro Navarro
Kody Panui
Aidan Gillespie
Desmond Aiello

TECHNICAL ADVISORS

Dr. Nancy Squires
Dr. Roberto Albertani

PROJECT SPONSORS

NASA COLLEGE AND NATIONAL SPACE GRANT FELLOWSHIP PROGRAM

OSU AIAA

KDE Direct

GPR GLOBAL FORMULA RACING DREW RAVENSBURG / OREGON STATE UNIVERSITY

OREGON STATE UNIVERSITY VIII DESIGN BUILD FLY 2019-2020