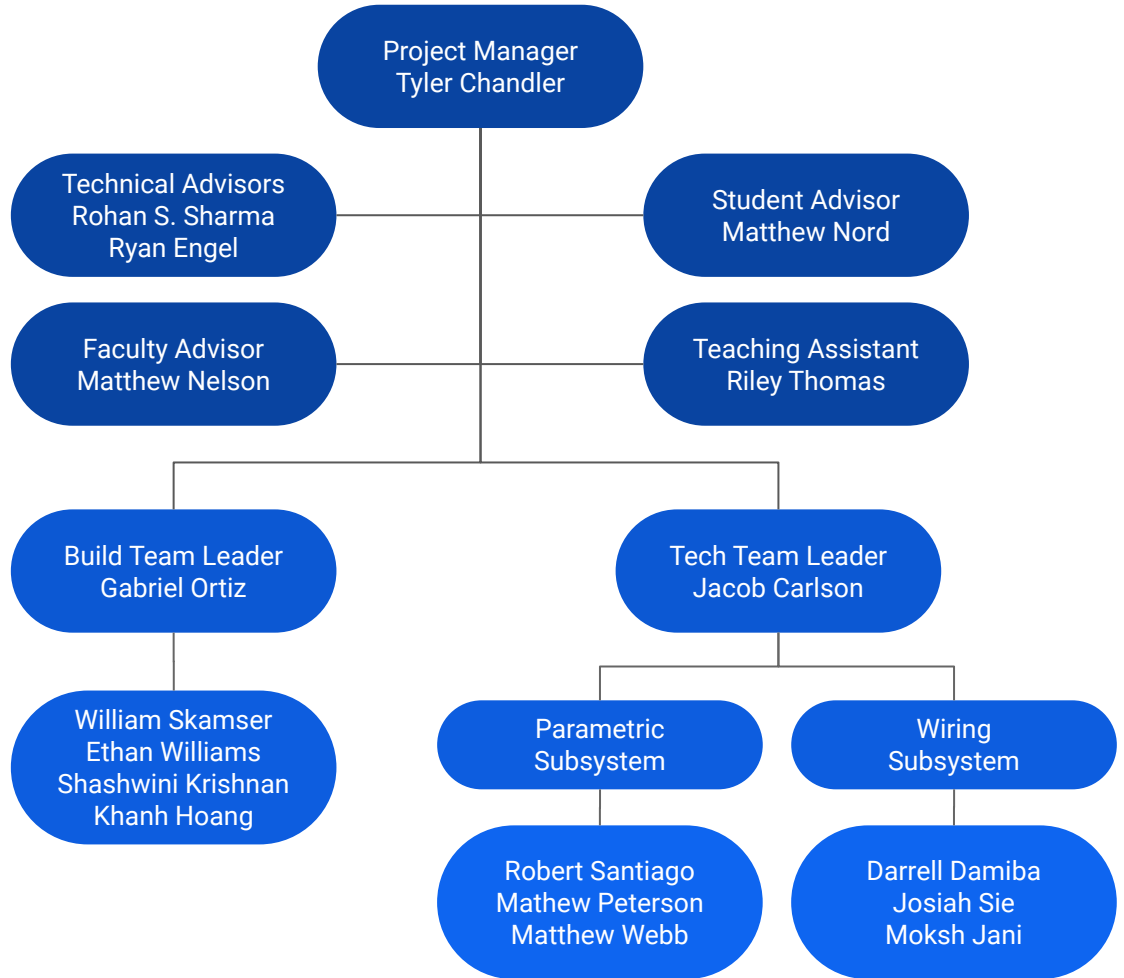# Boeing Experimental Flight

Final Presentation

The Team

Project Goals

Spring 2021

To conceptualize, design, and engineer a testbed aircraft from the ground up capable of data collection and semi-autonomous flight.

Fall 2021

To optimize the testbed aircraft and to design and engineer a control variable build utilizing the testbed for direct comparison to commercial aircraft.

(Revision) To construct and test a RC aircraft based off of the Boeing 737 MAX and collect data for future references.

What went right?

Tech Team

- Redesigned empennage
  - Created replacement parts and designed new flaps
- Parametrics finished first portion of MATLAB code
- Had everyone obtain composites training
- Assembled new control craft
  - Set up Pichawks for new craft
    - Began process of teaching more members about how the electronics/pichawks works

Build Team

- The team's transition to YouTrack went smoothly
  - Logging time and assignments
- Team members research skills grew immensely
  - Learned the importance of documentation and to save multiple copies of important documents
    - CyBox
- Team members excelled with SolidWorks
  - Grew from being able to do small assignments to be able to complete complex designs
- Redesigned landing gear
  - Created a whole new design of a landing gear in SolidWorks
- All team members became certified in composites training
  - The team was able to apply that knowledge to some different parts of the craft
- The team assembled new control craft
  - Documentation for immaculate
   - User manual for craft had everything documented, even CAD drawings of almost every part
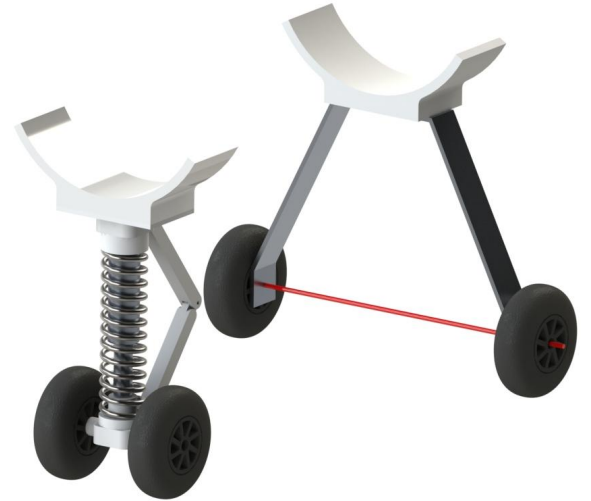
What went wrong?

Management

- Difficulties with Team Coordination and Communication
  - Members had less time to meet due to in-person classes and labs
- Progress met with multiple issues from previous design
- Project revamped mid-semester
  - Resulted in multiple tasks being scratched

Tech Team

- Far too much time spent on repairs from previous semester flight
    - After performing engine testing discovered engines were only outputting 50% of rated thrust
- Other than experience gained, after the switch to control craft most of the previous work done was rendered obsolete
- New airfoil for Truss wing must be selected for next semester
- Coordination challenges (wind tunnel, composites training)

Cl/Cd v Alpha

(S1223 (s1223-il))
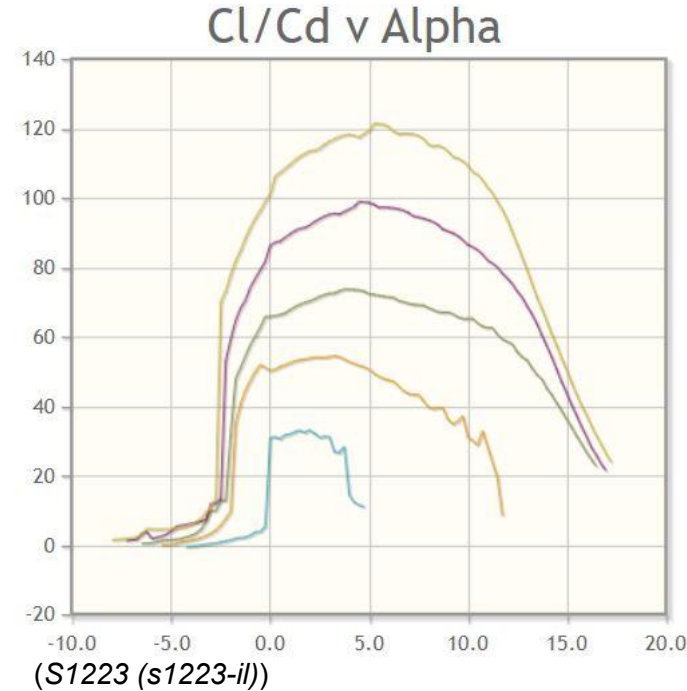
Build Team

- Meeting together as a full sub-team was a challenge
    - Classes, clubs, labs, research, work, etc.
        - Created a GroupMe to help solve this issue
- The team had a good amount of downtime this semester, build-wise
    - The first semester usually is like this; then the second semester is more build heavy
- With the soft reset in place, almost all the build team's work was futile for the time being
    - Landing gear, bay door, hinge, locking mechanism, etc.
        - This is why the build team went very heavy on research

Accomplishments and the Future

Accomplishments

- Ordered and built an RC aircraft
  - Installed Pixhawk
- Optimized current parametric design code
- Gained more experience with aircraft design
- Developed a Documentation LaTeX template for members to easier document work
  - Documented previous research of past members
  - Documented research conducted over past semesters on wing configurations
  - Documented Pixhawk information and how to operate the flight control system
- Multiple members with Pixhawk knowledge who are slated to return next semester

Future Work - Flights

- First Control Flight - Saturday, December 4th, 12:00 PM
    - Central Iowa Aeromodelers
    - Flight Readiness Review with Professor Grager - Thursday, December 2nd, 9:00 AM
- Order second RC aircraft
    - Implement Truss-Braced Wing design for the aircraft
- Explore utilization of the Pixhawk Mission Planner with control aircraft
- Conduct multiple flights in Spring
- Improve collection and calculations of data
- Get members interested in piloting ground training & Part 107 License
    - Six returning members with interest

Future Work - Parametrics & Documentation

- Expand on parametric code
    - Parametric sizing of wings and empennage in relation to the rest of the aircraft
    - Work with Ryan & Rohan to streamline design process
- Expand on documentation methods
    - Four-Square Model mentioned by Ryan Engel
    - Create document with a list of LaTeX commands for new members with less experience
- Compose Truss-Braced Wing Report for Boeing

Spring 2022 Milestones

- Begin parametric sizing component of parametric design
- Remake Truss-Braced Wing for the Freewing AL37 RC aircraft
- Conduct flight test of Truss-Braced Wing
- Improve Pixhawk functionality with Mission Planner or semi-autonomous flight
- Begin writing Truss-Braced Wing Report

References

1. "S1223 (s1223-il)," Airfoil Tools. [Online]. Available: http://airfoiltools.com/airfoil/details?airfoil=s1223-il. [Accessed: 01-Dec-2021].

Questions? Comments?