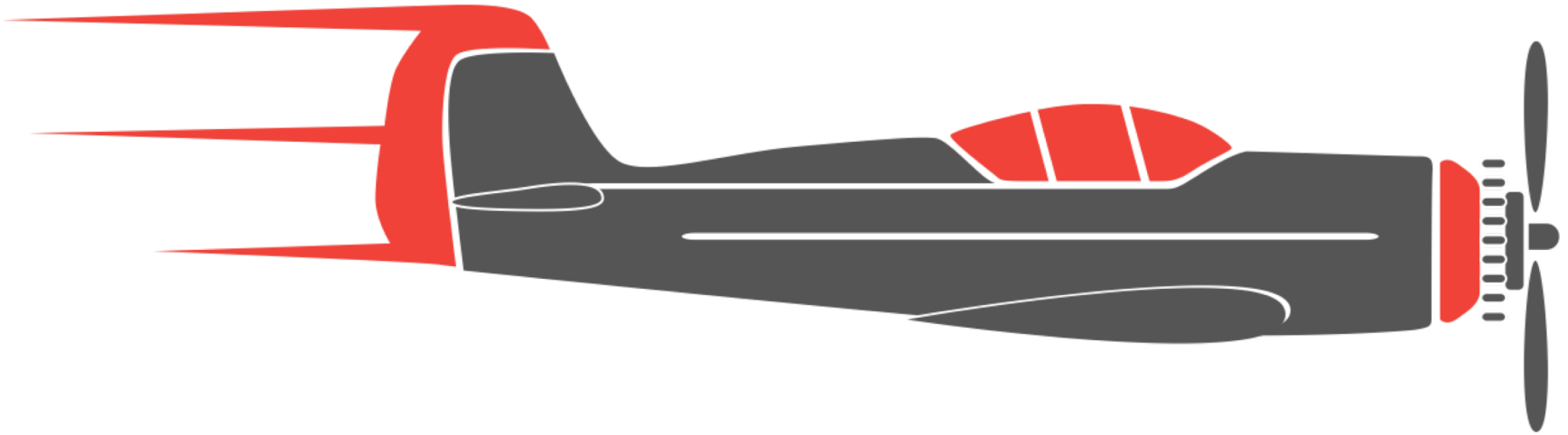


Team 508
SAE Aero Design: Geometric Integration
EML 4552C

Team Members

Jacob Pifer
Project Manager
Manufacturing Engineer

Lauren Chin
Lift & Control Surfaces Engineer
Meeting Coordinator
CAD Engineer

Joseph Figari
Fuselage and Payload Engineer
Financial Coordinator
CAD Engineer

Sponsors

Florida Space Grand Consortium
Financial Sponsor

Seminole RC Club
Equipment Provider

Shayne McConomy, PhD
Faculty Sponsor

Jacob Pifer

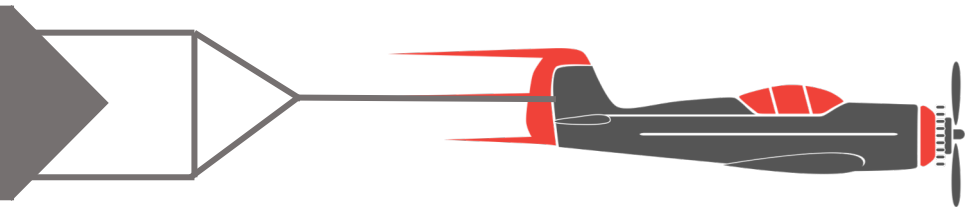
Advisors

Simone Hruda, PhD
Faculty Advisor

Eric Adams
Fablab Supervisor

Jacob Pifer

Project Objective

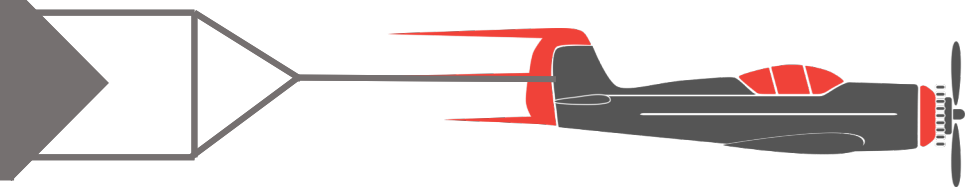


- The objective of this project is to design and manufacture a 3D printed remote control airplane within the rules of the SAE Aero Design Competition

- It will be able to take off, complete the needed flight path, and land while carrying the required cargo

Jacob Pifer

Project Brief Summary

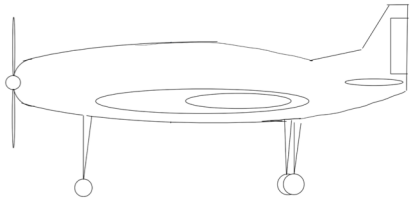


- The plane will not be flown at the competition in March
- Team is still a part of the competition
- Plane will still be built within competition rules
- Test flight will be done in Tallahassee
- If necessary and time permits, design changes will be made and a second flight will take place

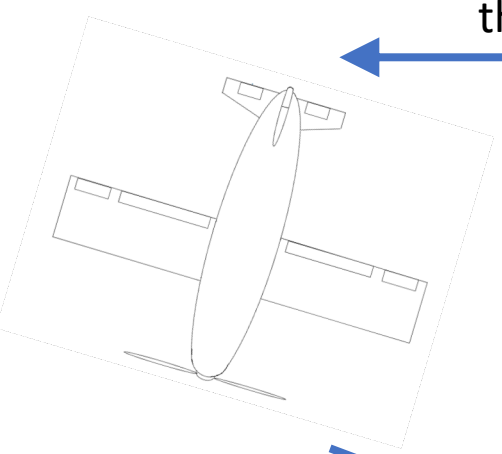
Jacob Pifer

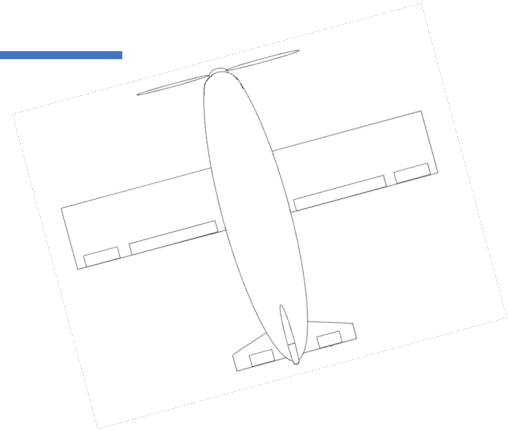
Project Brief Summary

Travel 400 ft past runway then turn back

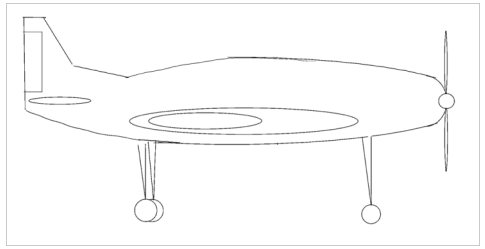


Turn back towards runway





Align with runway then land



Fly 400 ft

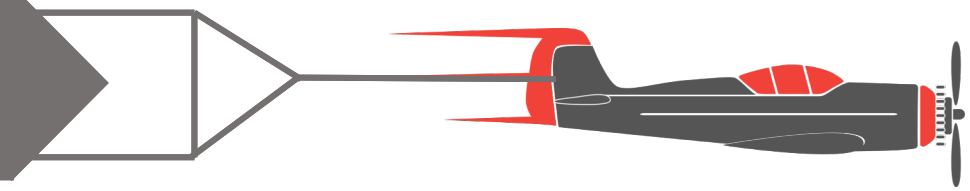
Jacob Pifer

Material Selection

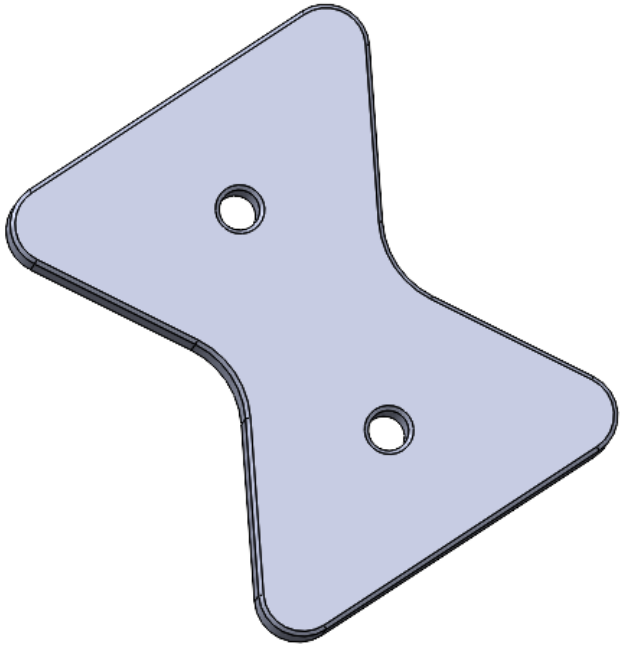
- House of Quality found weight to be most important design factor
- Two possible filaments could be used within budget and competition rules
  - PLA
  - LW-PLA
- Torsion and bending tests done to compare strengths
- Tests found PLA to be stronger but due to weight advantage LW-PLA was chosen

Jacob Pifer

Assembling Methods: Bow Ties

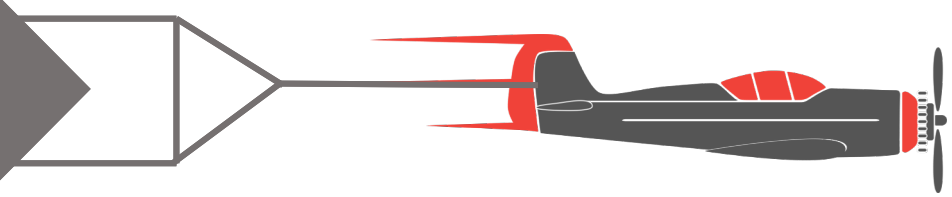


- Bowties will be used to connect parts of the fuselage
- Typically three bowties per connection point
  - Only one needed to connect the tail sections
  - One screw can be used to secure a bowtie

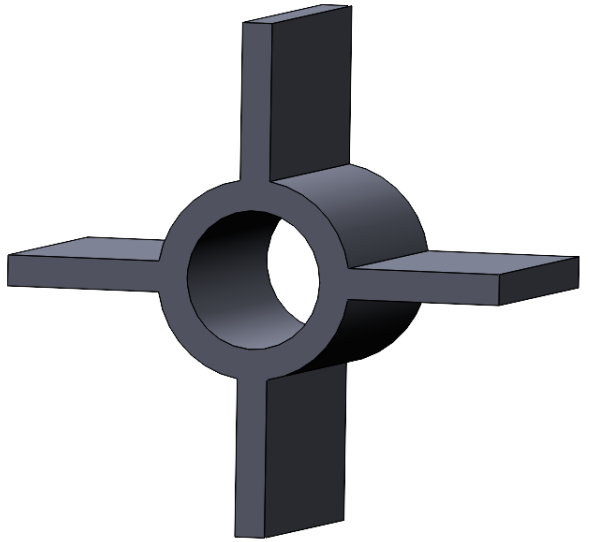


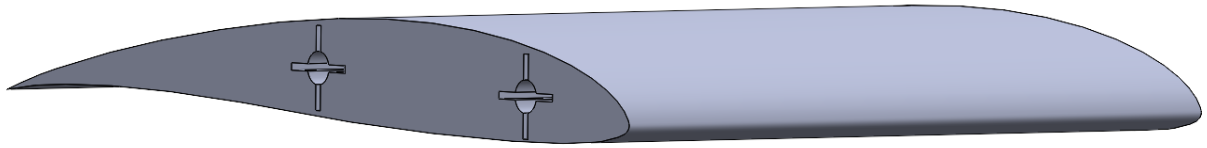
Lauren Chin

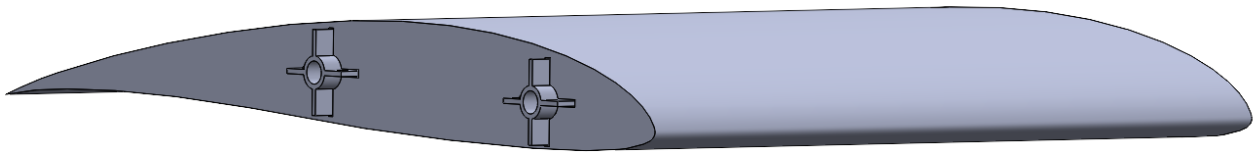
Assembling Methods: Spars



- Plane uses spars to assemble the wings
- Each wing set has two spars
- Small crosses are also used to help lock the wings together
- Ends of the spars are threaded so screws can be used to secure the parts

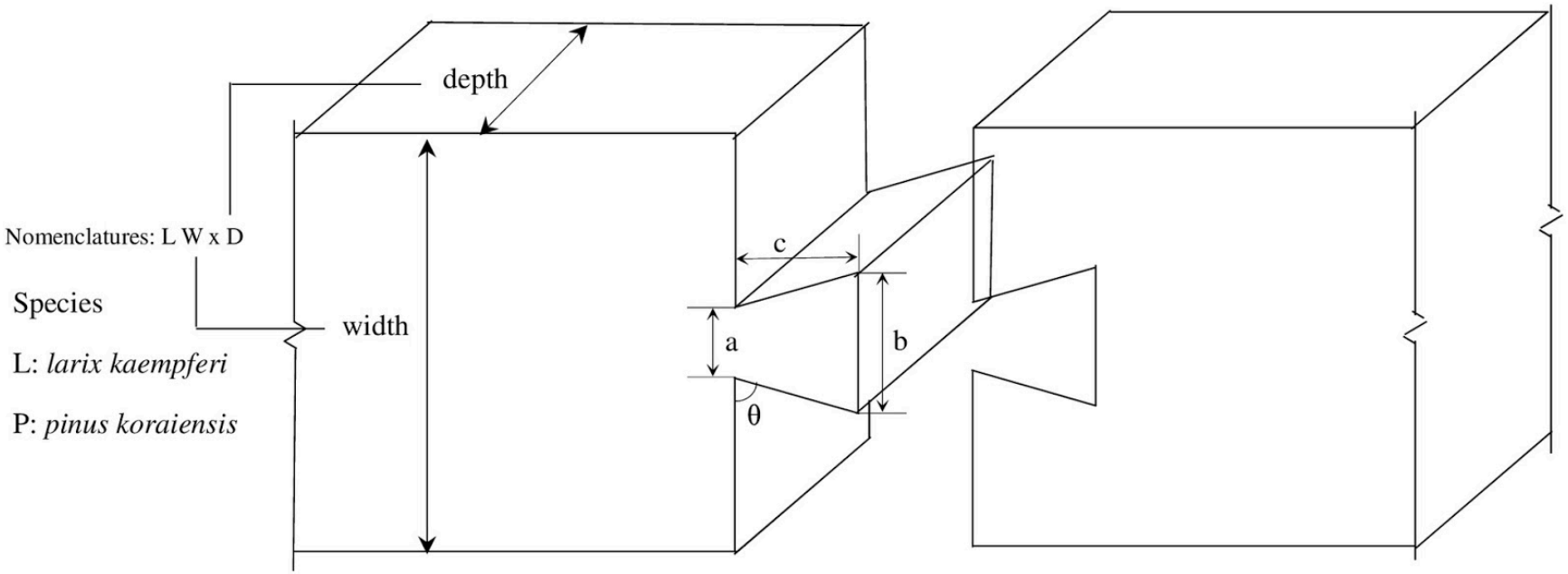






Lauren Chin

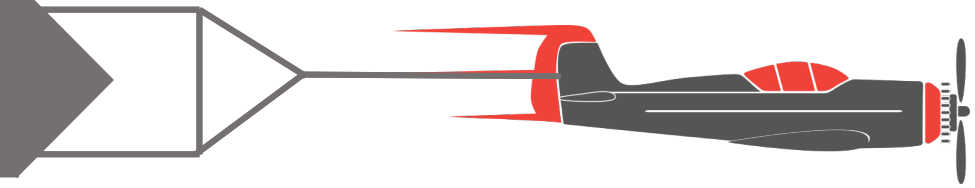
Assembling Methods: Woodworking

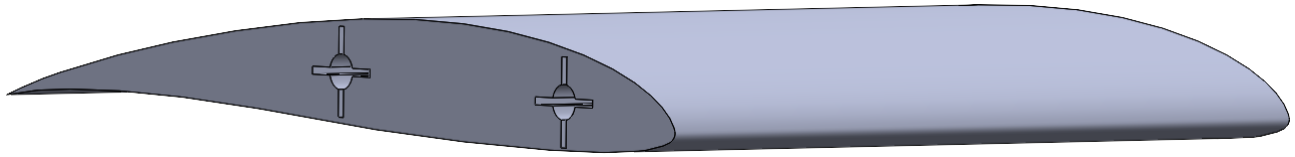


- The Dove Tail Connection
  - Consists of a male and female part
  - Prevents movement perpendicular to the connection
  - Prevents rotational movement

Lauren Chin

Canard Assembly





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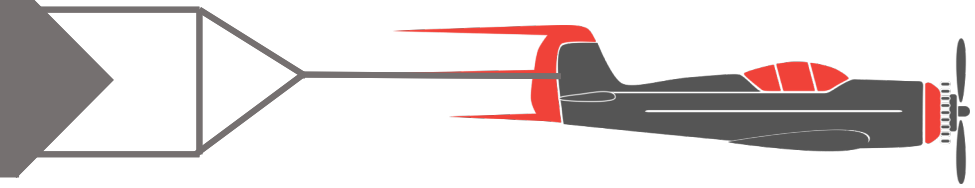
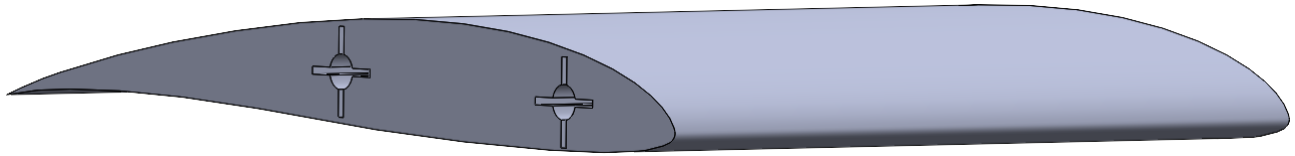
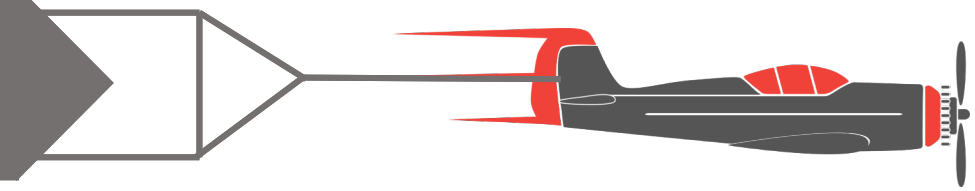
Canard Assembly

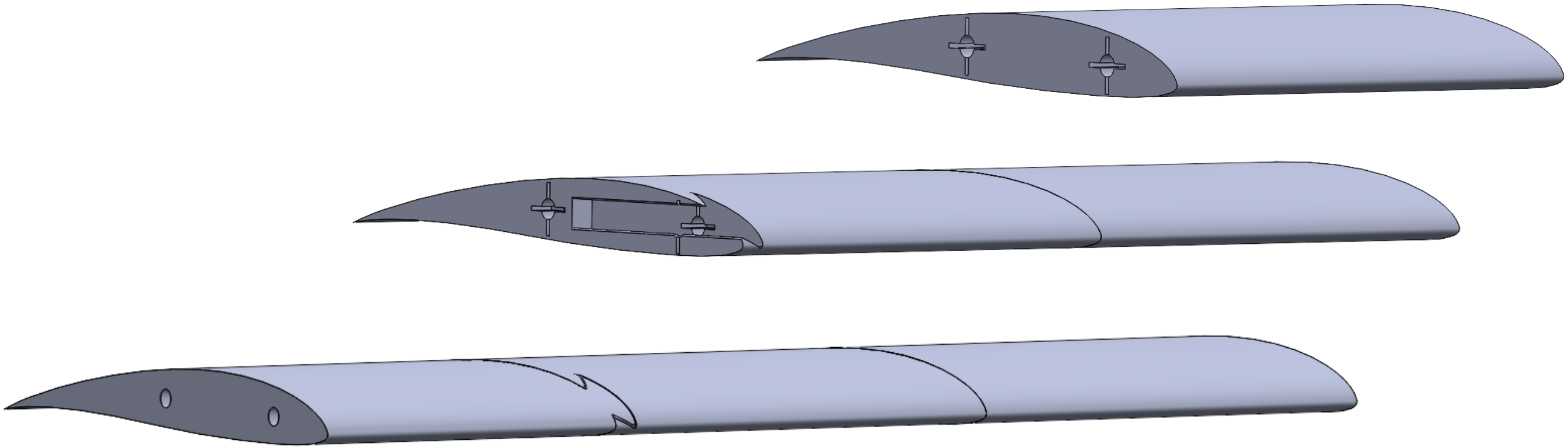




Lauren Chin

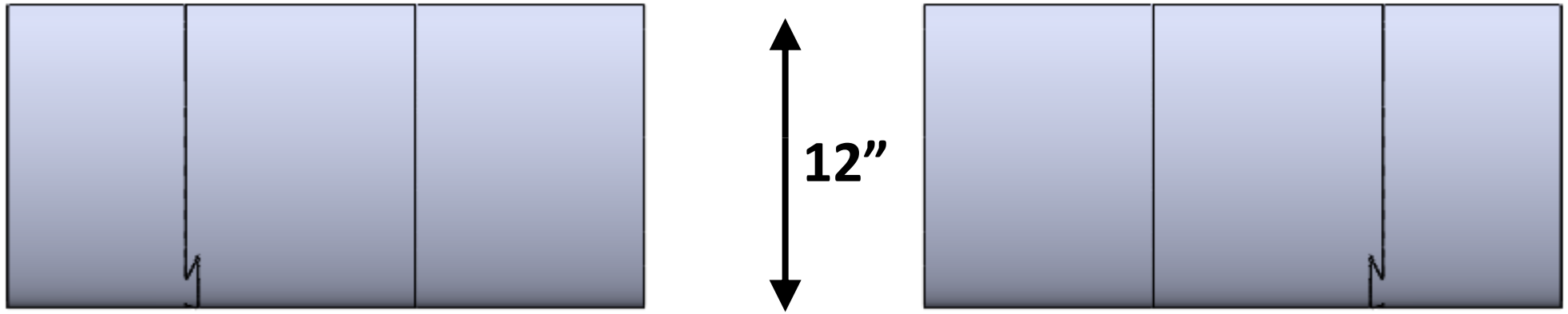
Canard Assembly





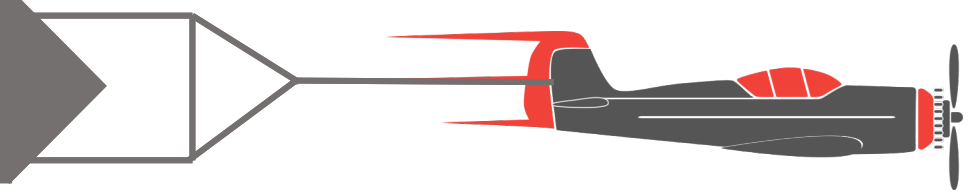
Lauren Chin

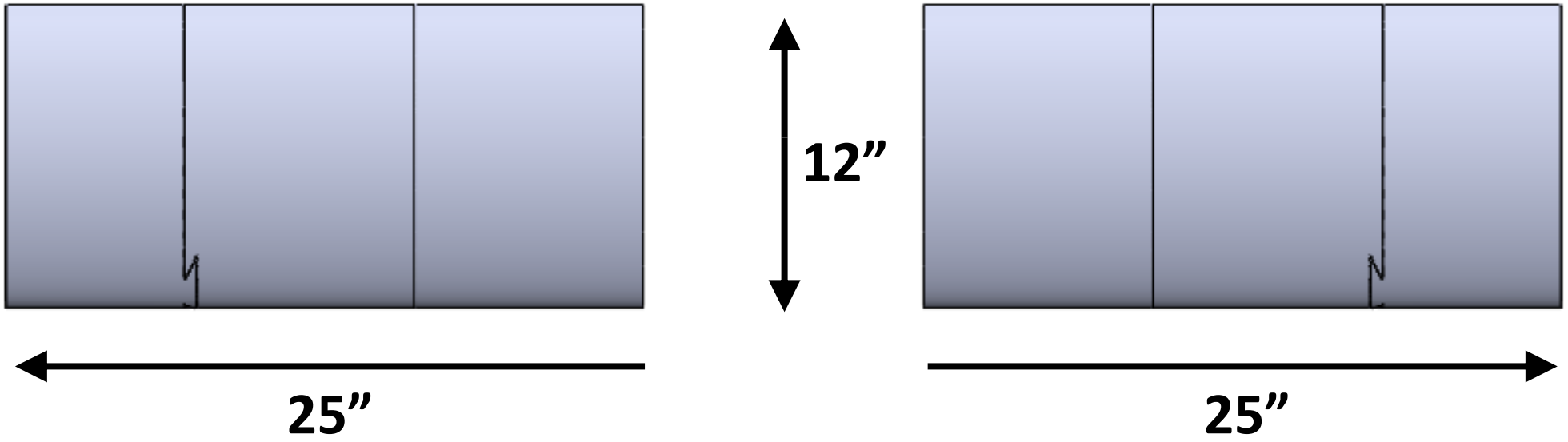
Canard Dimensions



Lauren Chin

Canard Dimensions





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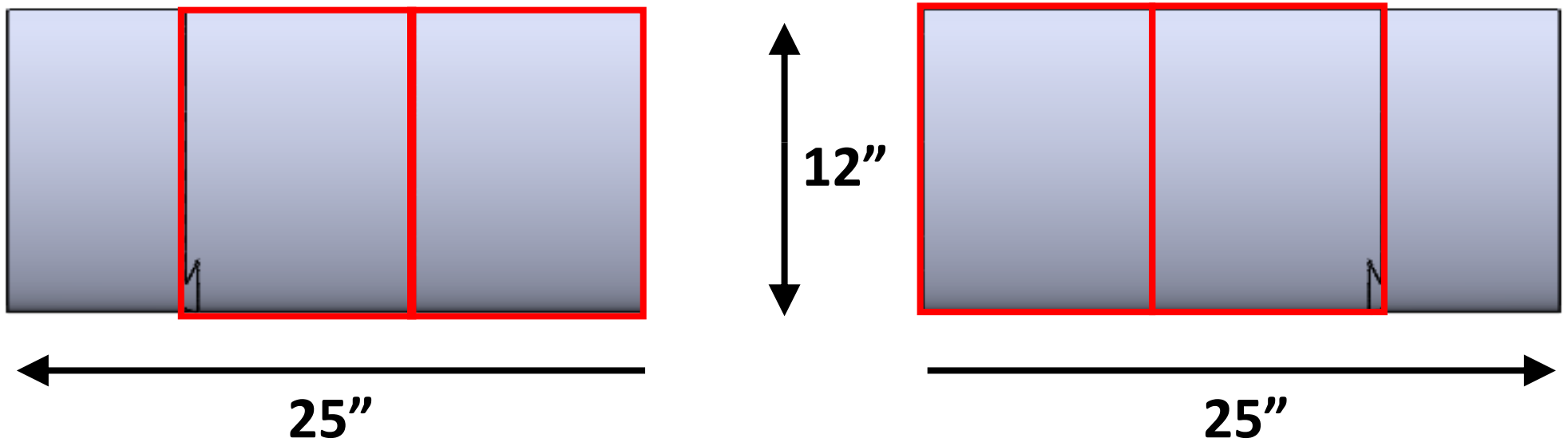
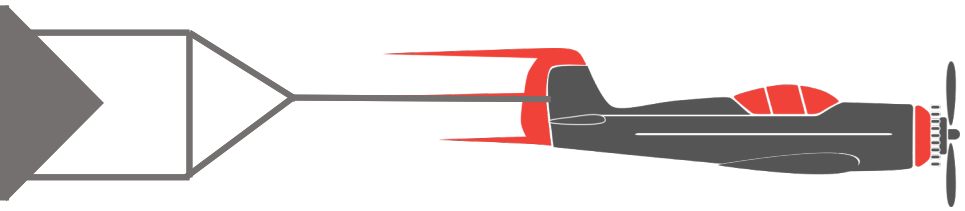
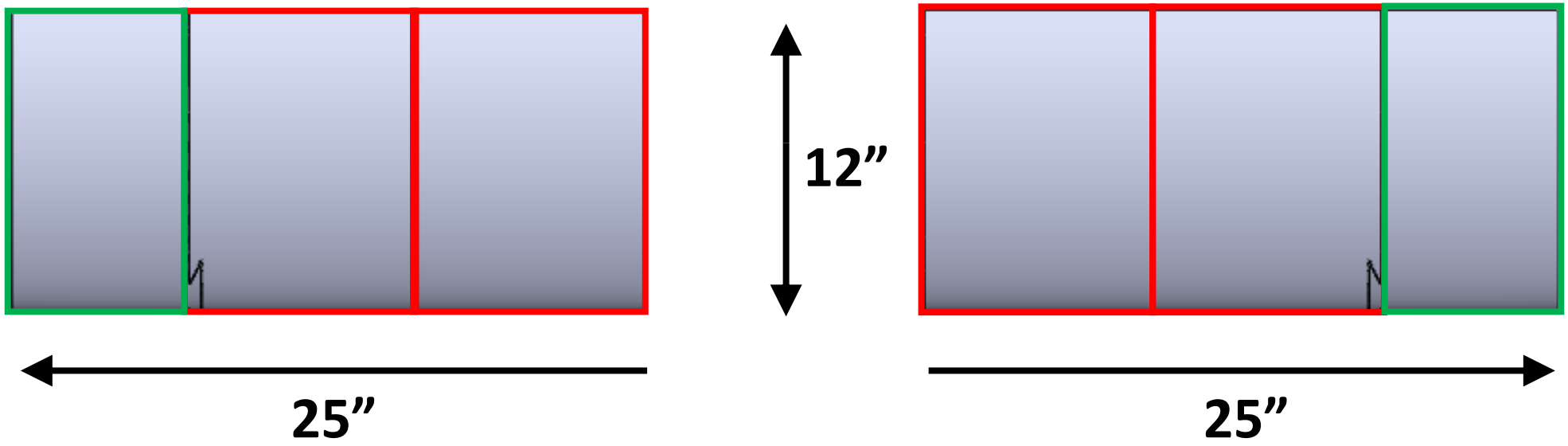
Canard Dimensions



Lauren Chin

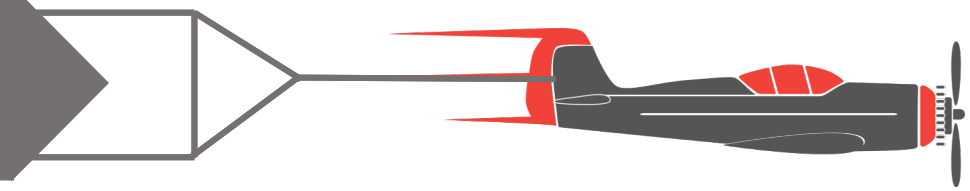
Canard Dimensions





Lauren Chin

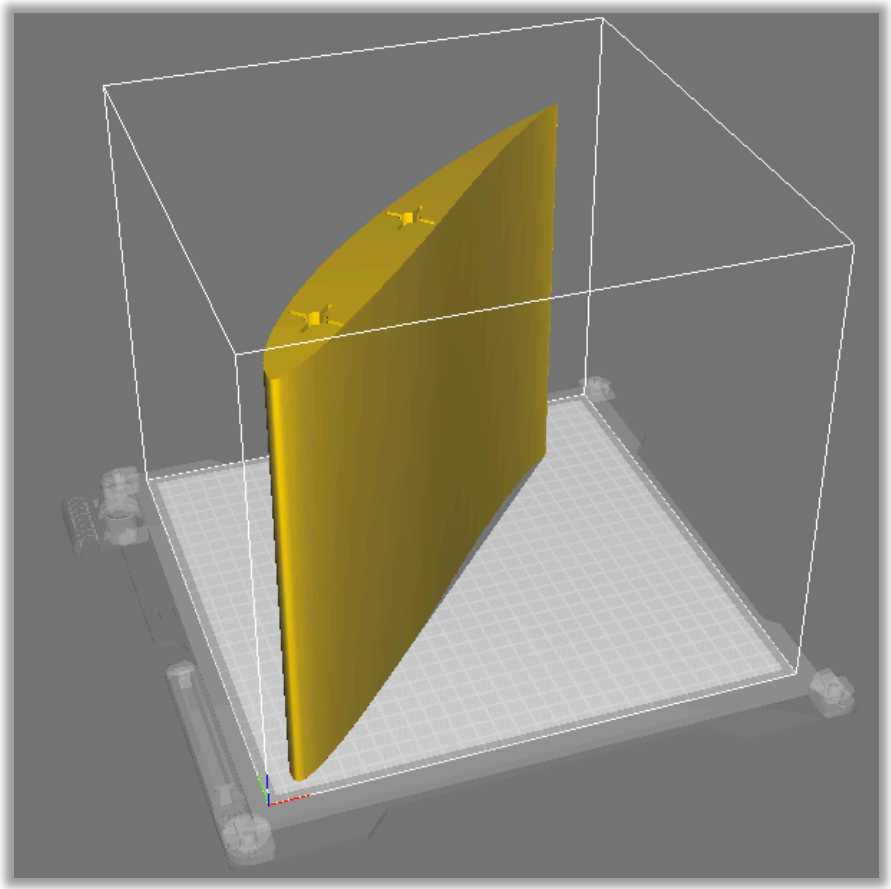
Printers



- Lulzbot TAZ printers are the main printers used
  - Design Lab has two and the Innovation Hub has one
- Any PLA parts will be printed at the Innovation Hub
  - Small parts that DREMEL printers can make
- Cura-lulzbot used to queue prints
  - Helps in estimating print time, material used, and needed printing orientations

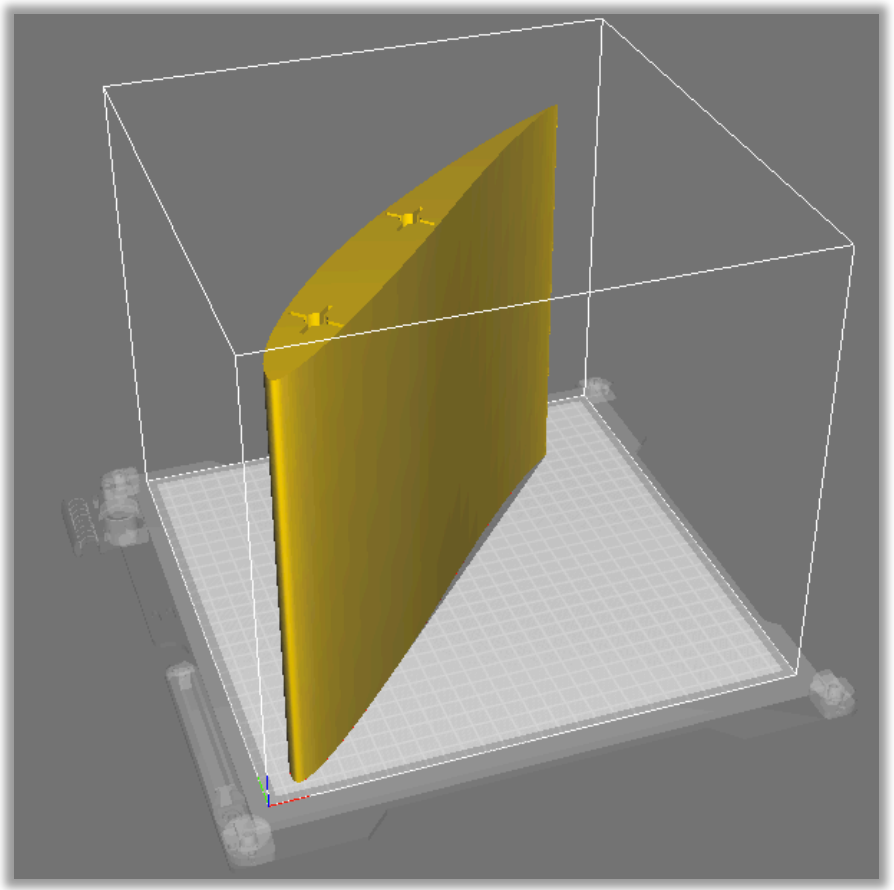
Jacob Pifer

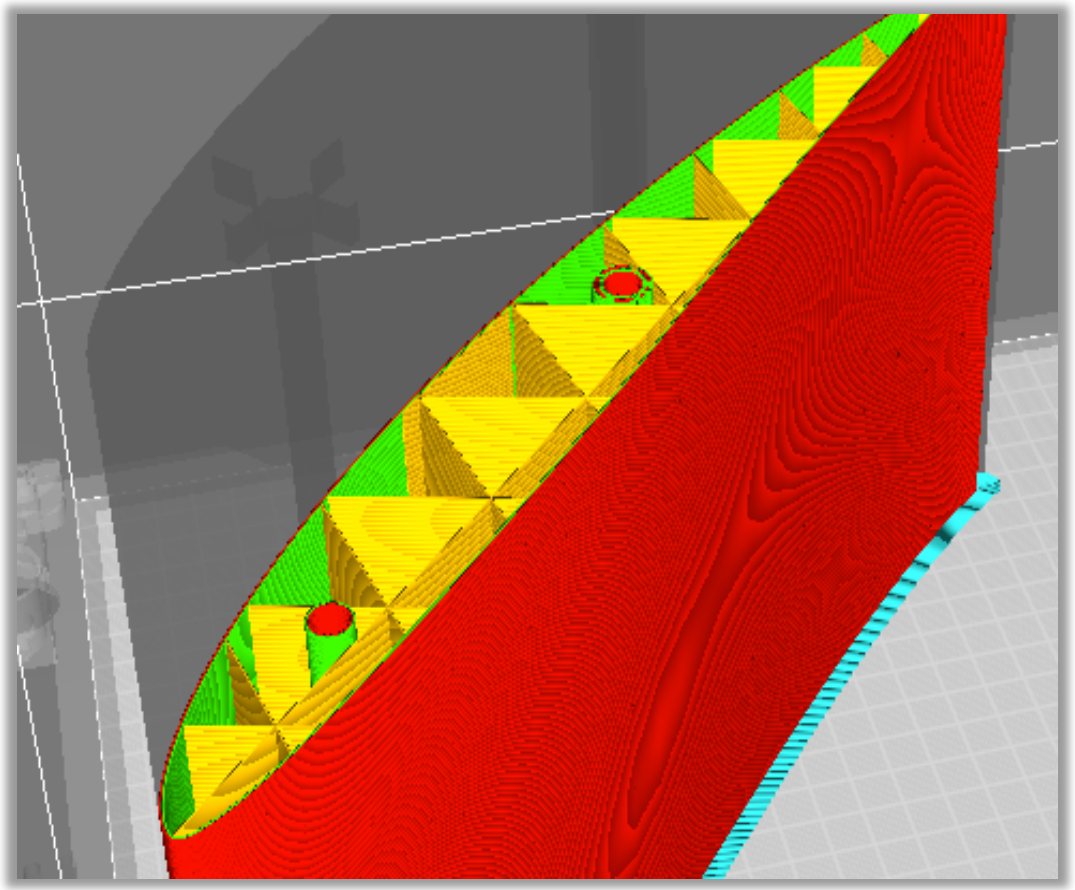
Printing Parts



Jacob Pifer

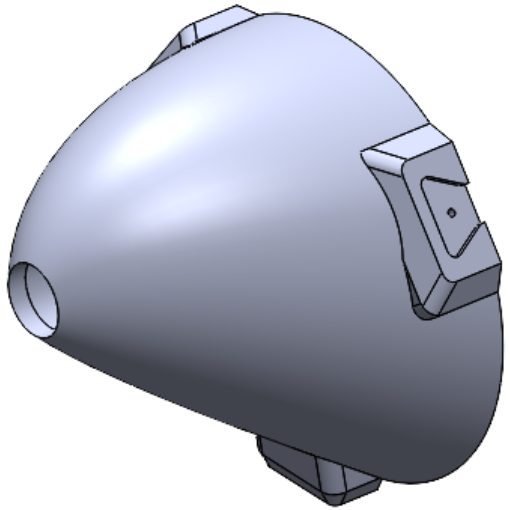
Printing Parts





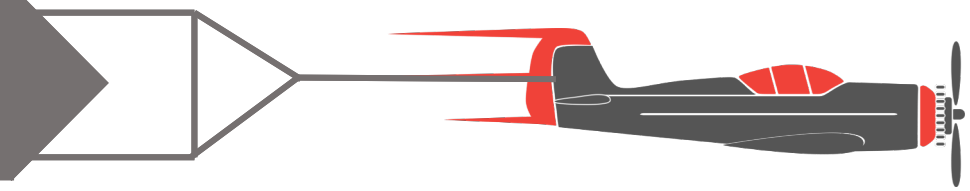
Jacob Pifer

In the Works



Lauren Chin

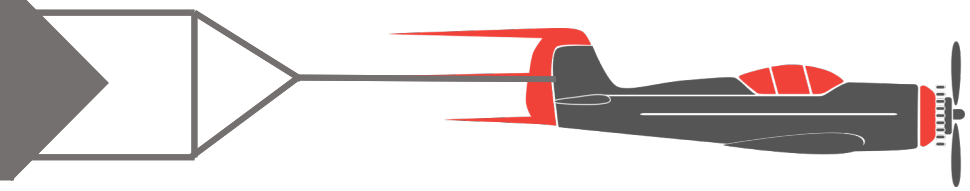
Future Work



- Design ways to secure the electronics inside the fuselage
- Build the landing gear
- Make remaining project orders
- Continue 3D printing the parts
- Set a date and fill out needed paperwork for the test flight with Seminole RC

Jacob Pifer

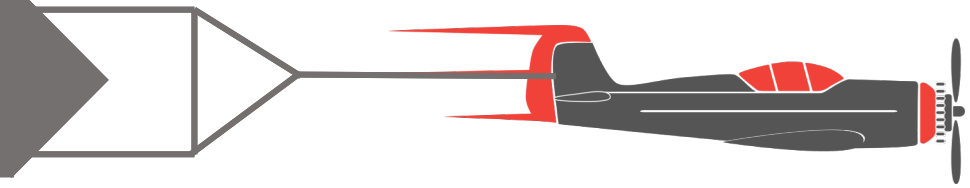
Key Takeaways



- Even though the teams aren't going to Lakeland, there will still be a test flight
- The plane is still being built within competition rules
- LW-PLA is here and printing has begun
- All parts must be made with printing in mind

Jacob Pifer

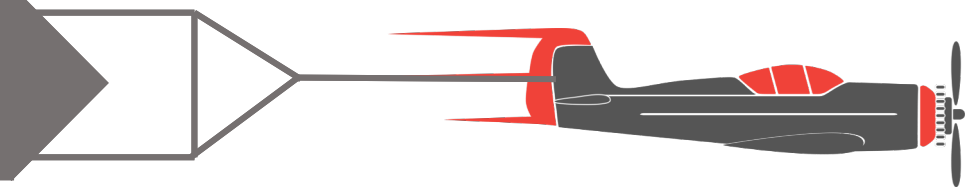
References



- 2021 Collegiate Series SAE Design Rulebook (2021). *SAE Aero Design.* *https://www.saeaerodesign.com/cdsweb/gen/DocumentResources.aspx*

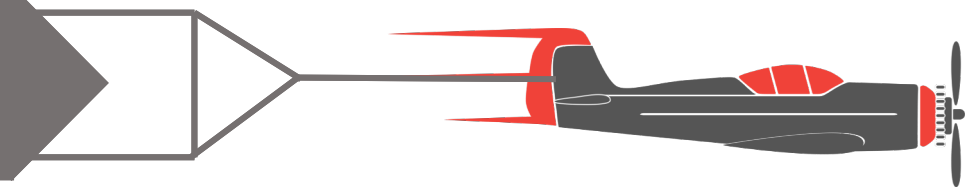
- Aguirre, N., Evans, L.,… Silver, Z. (2020). T513: SAE Aero Design Operations Manual. *Team 513: SAE Aero Design East Competition,* 47-56.

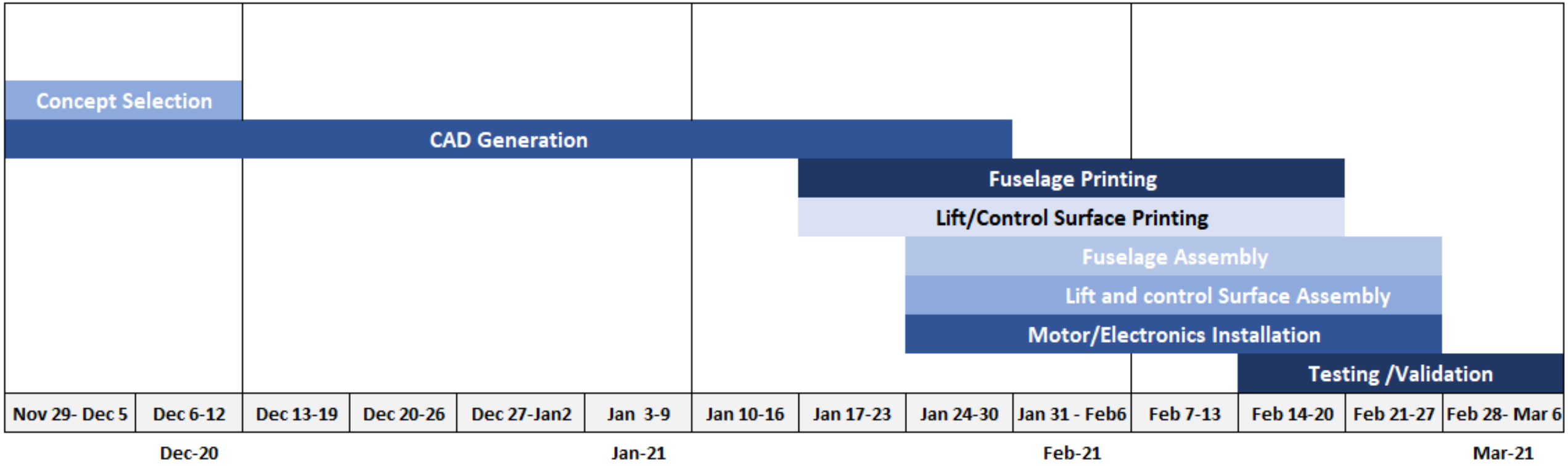
Fall Semester Timeline



Preliminary Research												
		Concept Generation										
						Concept Selection						
Aug 30- Sept 5	Sept 6-12	Sept 13 - 19	Sept 20-26	Sept 27- Oct 3	Oct 4-10	Oct 11- 17	Oct 18-24	Oct 25-31	Nov 1-7	Nov 8-14	Nov 18-21	Nov 22 -28
	Sep-20				Oct-20				Nov-20			

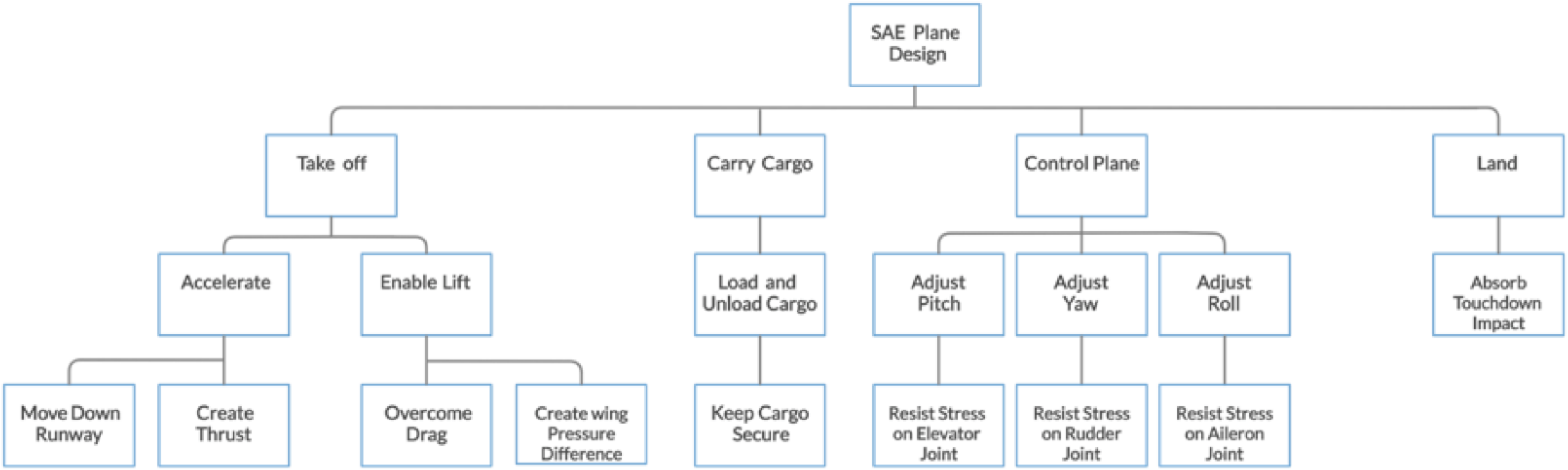
Winter & Spring Semester Timeline



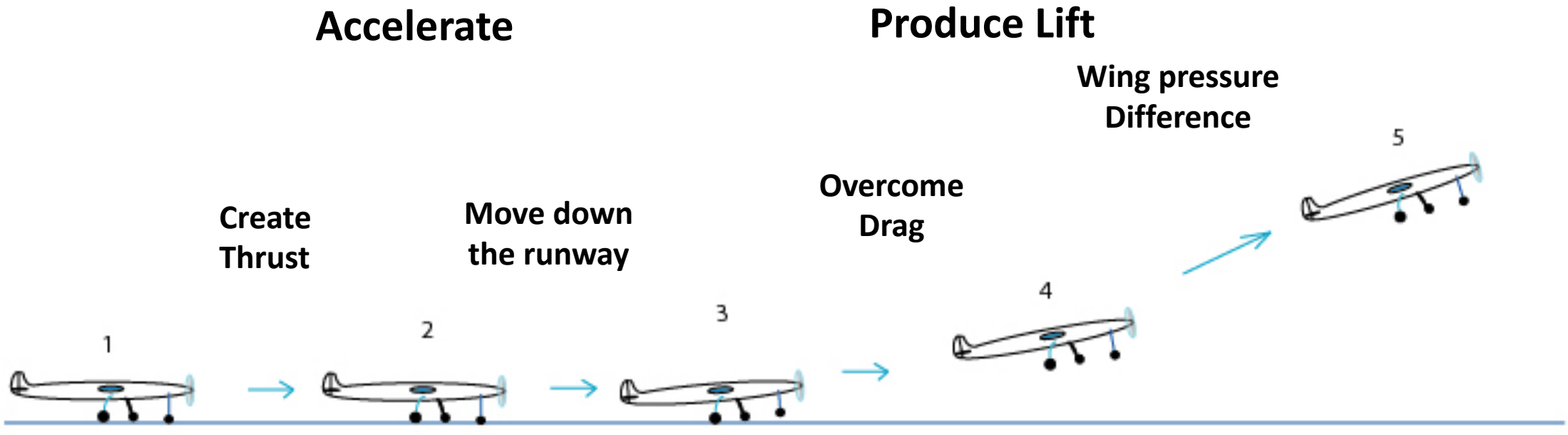


Jacob Pifer

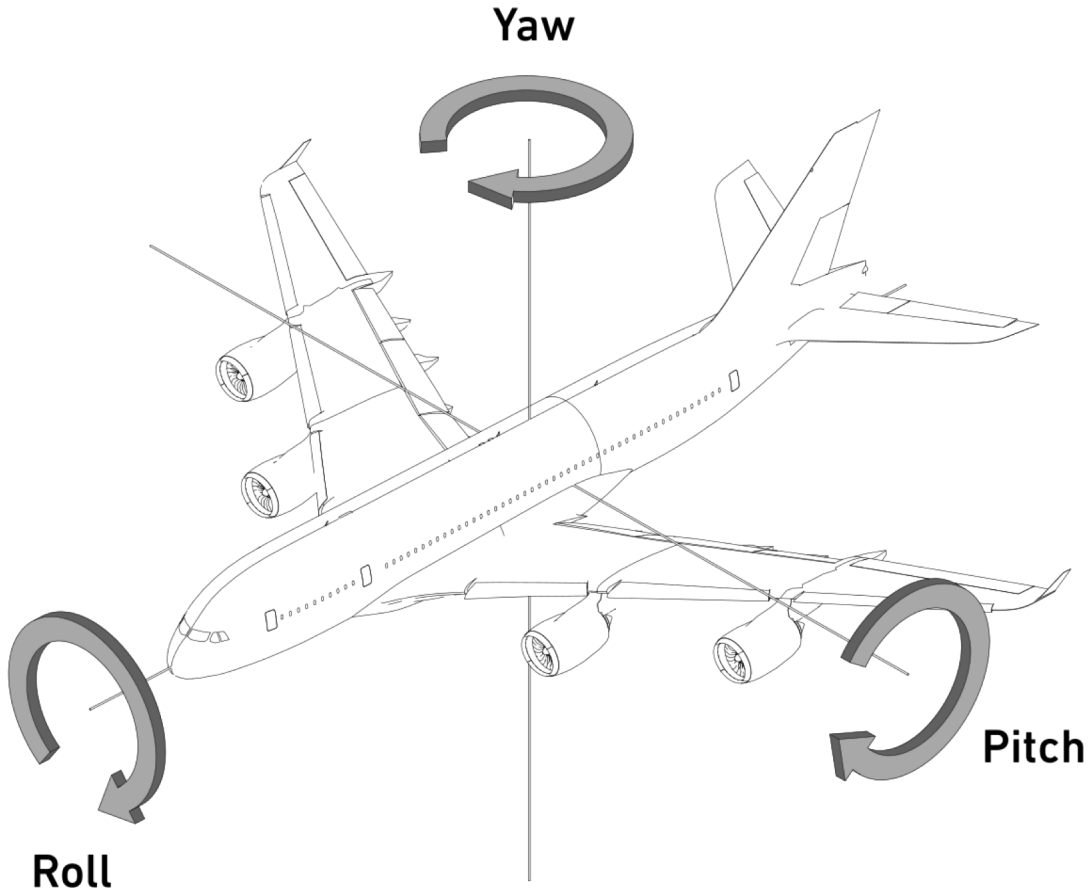
Functional Decomposition



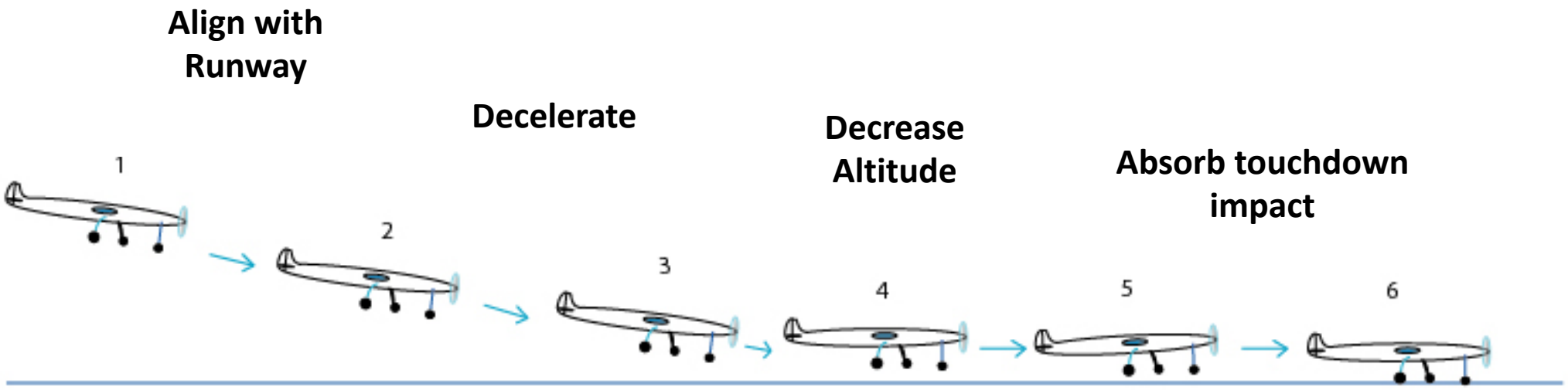
Takeoff

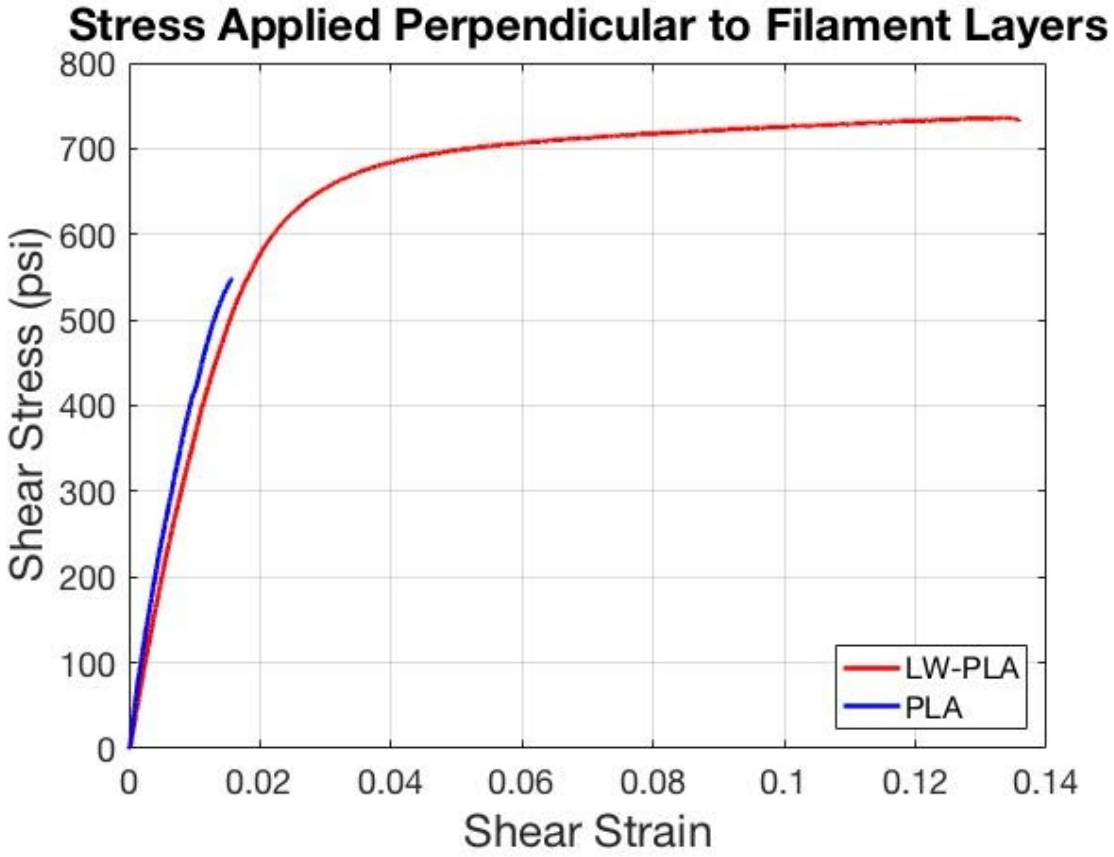

Accelerate
Produce Lift
Wing pressure
Difference
Overcome
Drag
Create
Thrust
Move down
the runway
1
2
3
4
5

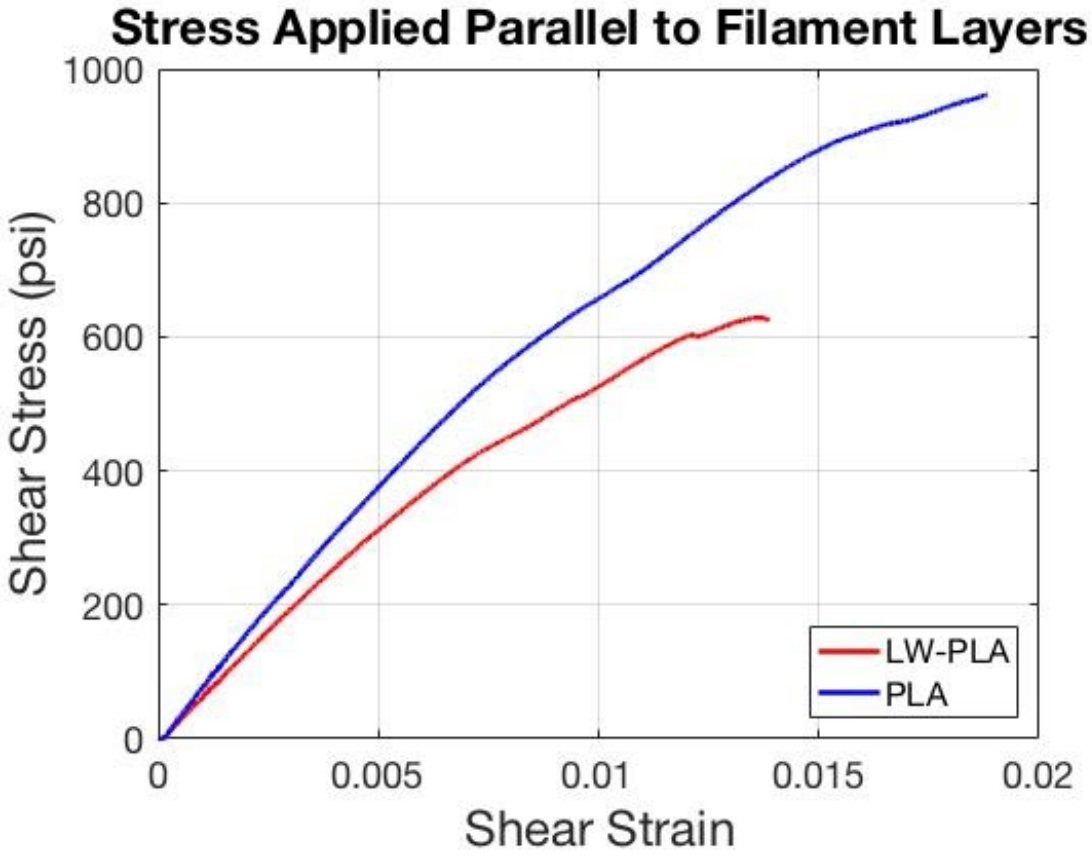
Control Plane



Landing


Align with Runway
Decelerate
Decrease Altitude
Absorb touchdown impact
1
2
3
4
5
6

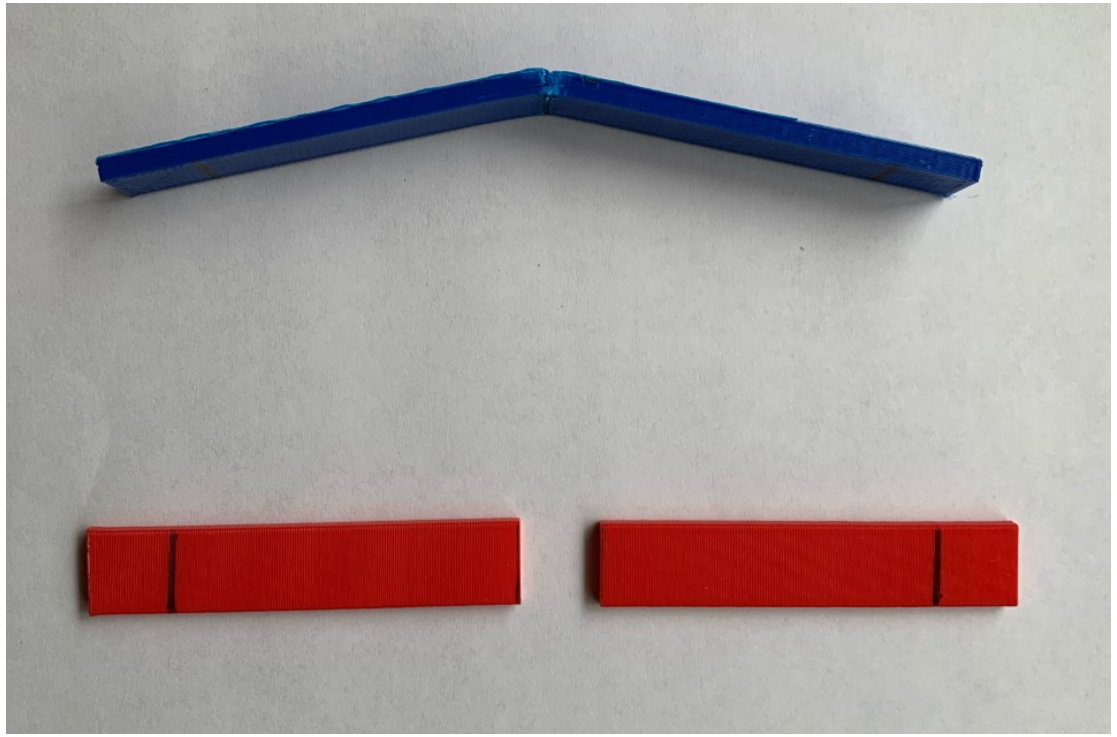




PLA failure stress: 412 psi
LW-PLA failure stress: 552 psi

PLA failure stress: 721 psi
LW-PLA failure stress: 471 psi

PLA



Stress Perpendicular to layering direction: 3,360 psi
Stress Parallel to layering direction: 8,350 psi

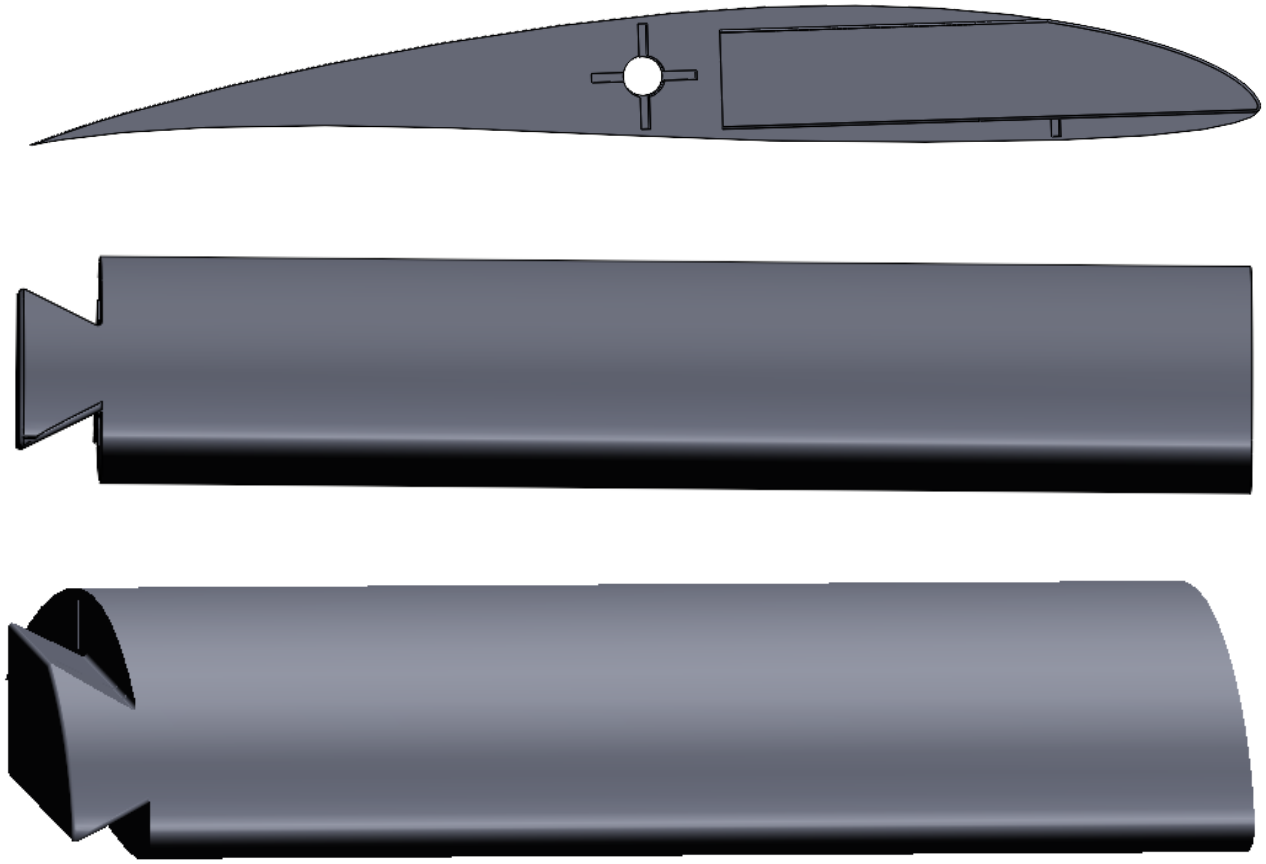
LW-PLA

Stress Perpendicular to layering direction: 3,380 psi
Stress Parallel to layering direction: 6,120 psi

Dove Tail Male Construction

- Dimensions:
  - Minimum thickness: 0.5 inches
  - Maximum thickness: 1 inch
  - Length: 5.25 inches

- Characteristics
  - Follows curvature of the airfoil
  - Edges are rounded



Dove Tail Female Construction

- Dimensions:
  - Minimum opening: 0.5001 inches
  - Maximum thickness: 1.001 inch
  - Length: 5.25 inches

- Characteristics
  - Follows curvature of the airfoil
  - Edges are rounded