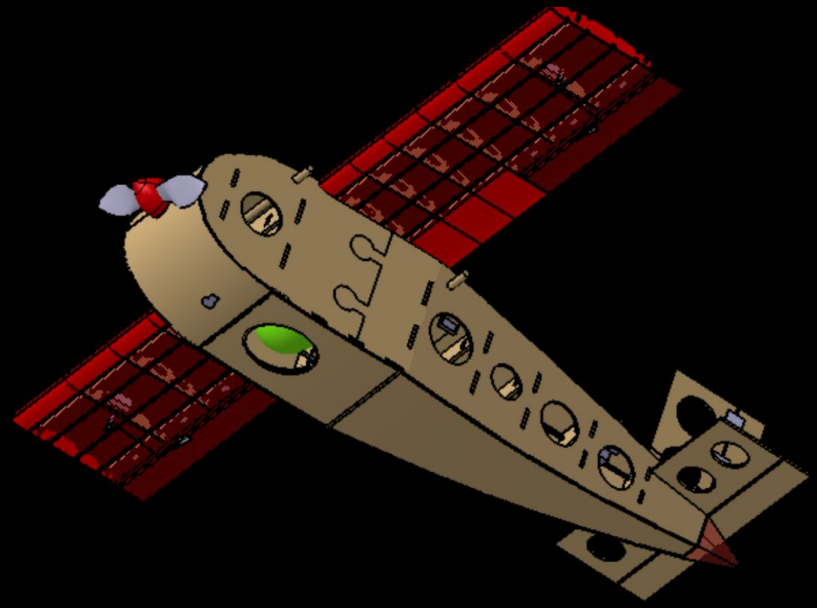
BOEING

Team 15: Kamikaze



Jerry Yang	Stability & Control
Sungjun Park	Structures
Estevan Hernandez	Propulsion
Pierre Fabela	Aerodynamics

WSU

Open-House

Mission Review

- Design and build a small electric avion
- Extract and assemble the plane from the storage box and go through the structural test
- Launch the aircraft by hand
- Drop the payload autonomously into the target zone after the 2nd lap
- Loiter for 3 more laps for a total of 5 laps
- Belly land successfully

Competition Goals

- Design an effective and weight-efficient aircraft that can deliver the payload quickly and precisely
- Design the aircraft while adhering to rigorous engineering principles
- Win the Bronze Propeller Competition

MISSION REQUIREMENTS AND CONSTRAINTS

Stability & Control

- Stable laterally and longitudinally
- Trimmable over the entire CL range even during crosswind situations

Propulsion

- Takeoff: Ensured we had enough thrust for short takeoff during handlaunch
- Mission Time: Analyzed various propellers for the best motor pairing offering optimized performance at our desired cruise speed to obtain a good mission score

Structures

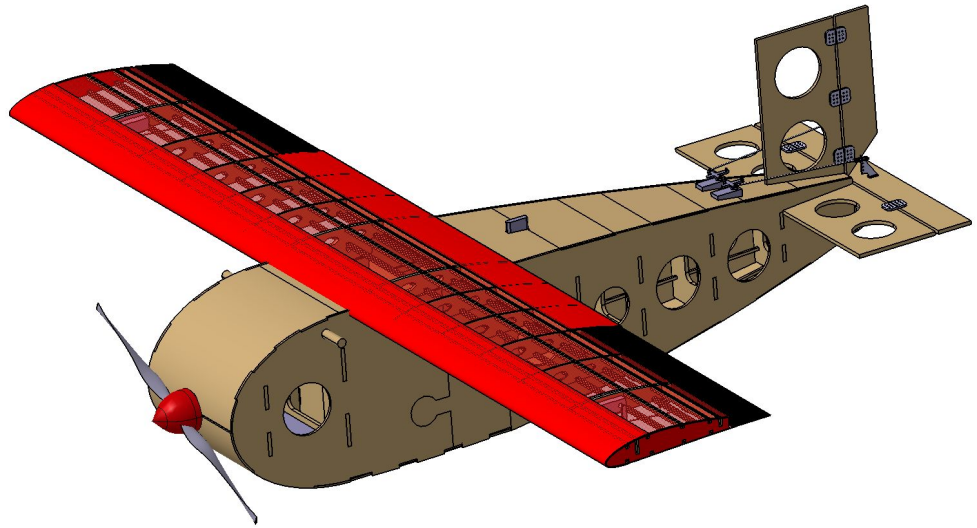
- Wing: Add a significant amount of lift without structural failure
- Fuselage: Strong shear and bending resistance capability
- Strong Wing-to-Fuselage junction to withstand any impacts upon landing

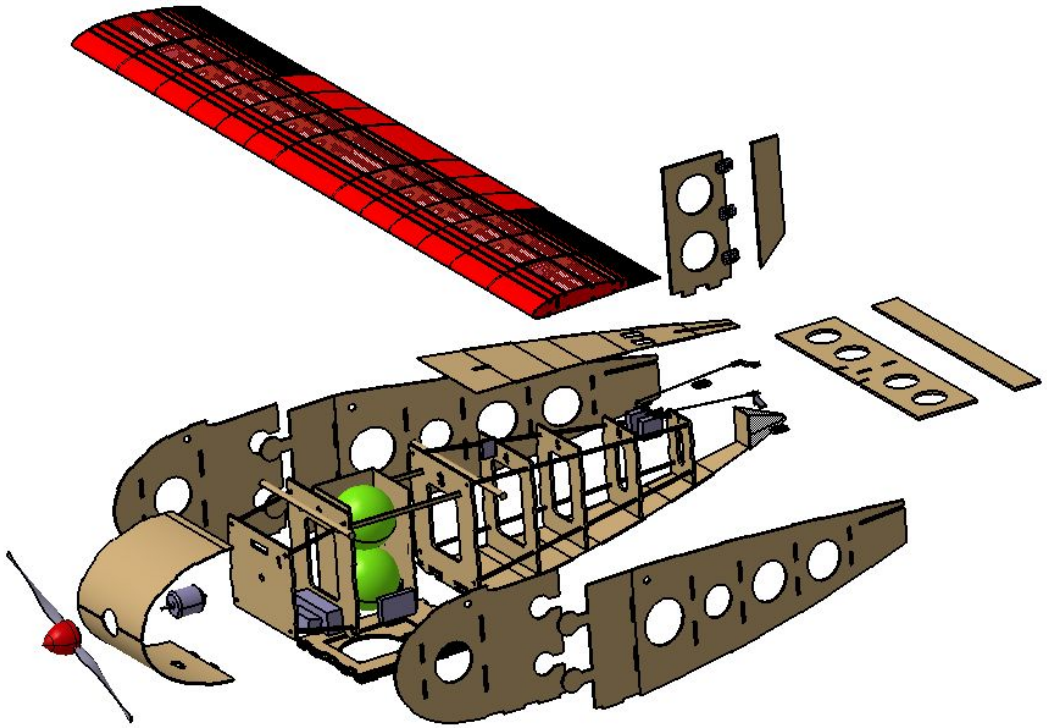
Aerodynamics

- Streamlined fuselage to prevent flow separation
- Minimized parasite drag
- Optimal lift to competitively complete the mission

Concept Views

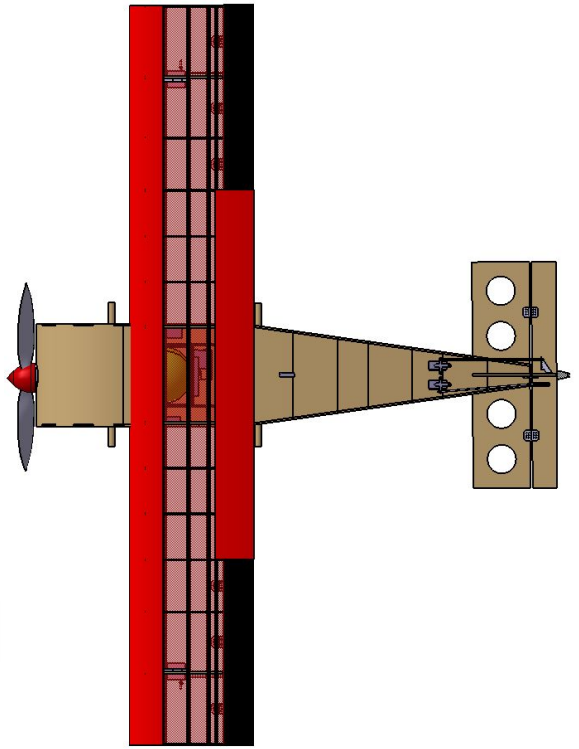
Isometric & Exploded Views

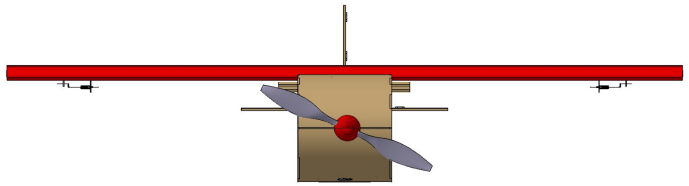


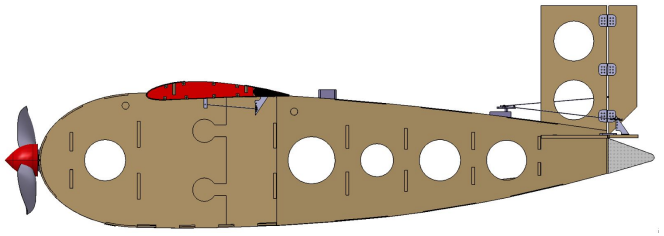


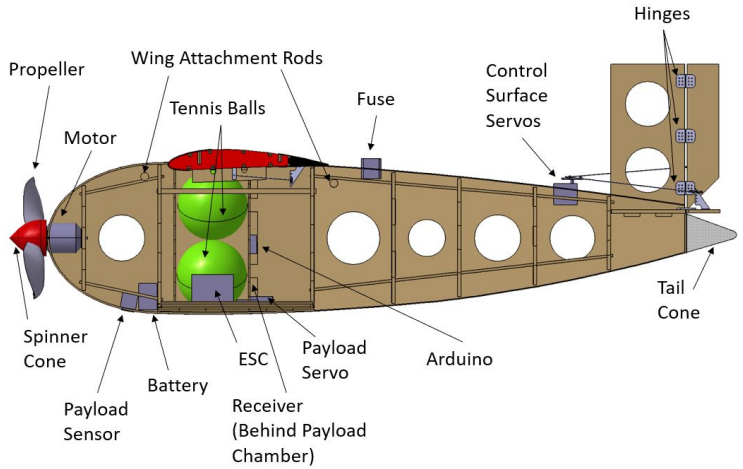
3-View Drawing

Layout Drawing as the Fourth View









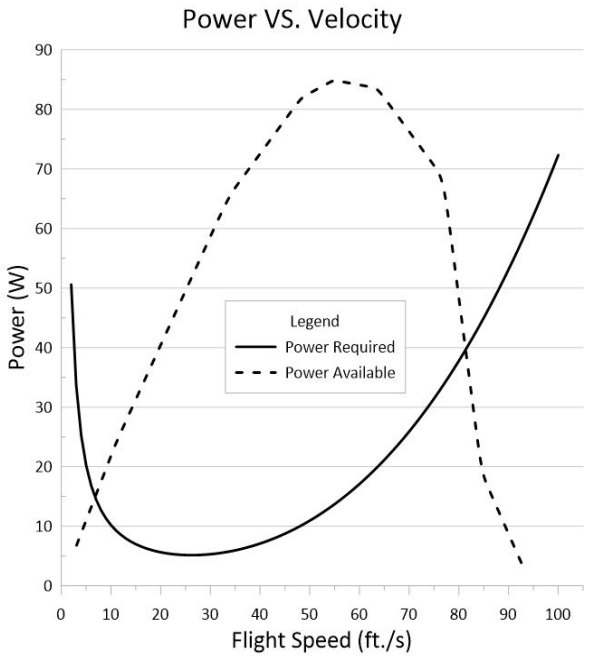
Vehicle Specs

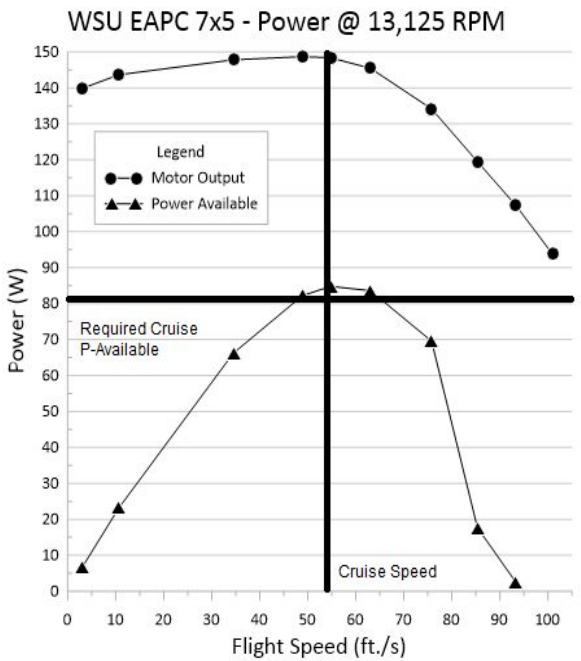
Design Data Table

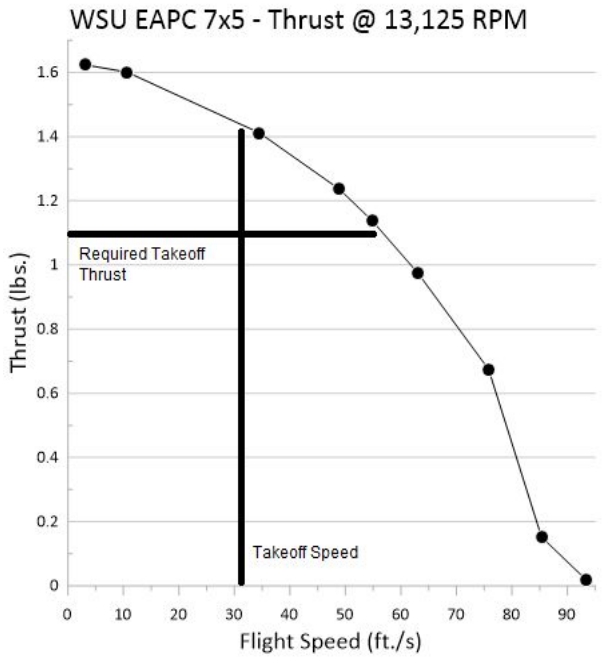
Parameter	Design Prediction	Parameter	Design Prediction
Wing Area	216 sq-inches	Endurance	180 seconds
Wing Span	36 inches	Stall Speed	30 ft/s
$C_{D,0}$	0.036	Max Speed	83 ft/s
$C_{L\,max}$	1.1	Corner Speed (V_c)	63 ft/s
$(L/D)_{max}$	11.7	Minimum Turn Radius	30 ft
Wing Airfoil/s	NACA 4412	Take-off Distance	N/A
Aerodynamic Center Location	7 inches from Nose	Landing Distance	N/A
$C_{M,0}$	0.046	Empty Weight (ready to fly, no payload)	1.24 lb
$C_{M\text{-}alpha}$	-0.03	Maximum Payload	0.26 lb
Static Margin	12 %	CG Location	6.29 inches from the Nose
Required Elevator Deflection for Trim at V_{Cruise}	-5.47deg	Wing Tip Deflection at V_c	0.13 inches
Required Elevator Deflection for Trim at $1.2V_{Stall}$	-7.33 deg	+/- n_{max}	+6.8 g, -2.3 g
Required Elevator Deflection for Trim at Maneuver Point	6.93 deg	Total Vehicle Cost	$500
Max Power Available	85 W	Time to Build	20 hours
Propeller Diameter	7 inches	*Other Critical (list below)*	
Total Propulsion System Weight (motor, battery pack, wires, connectors, fuse, prop, etc.)	0.45 lb	a)Wing Aspect Ratio	6
Battery Pack (nominal volts, # of cells, & mAhr)	11.1 V, 3, 800 mAhr	b)H-Tail Aspect Ratio	2.75
Maximum Current Draw	20 A	c)H-Tail Volume Ratio	0.55

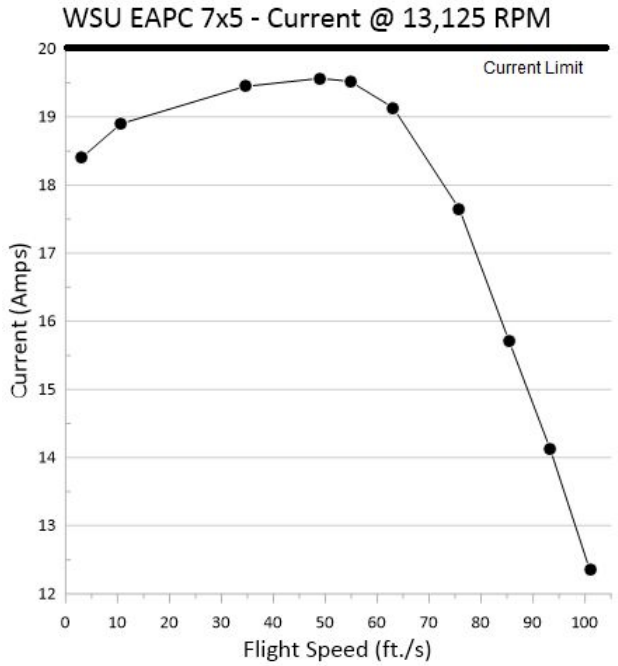
Propulsion

Relevant Plots



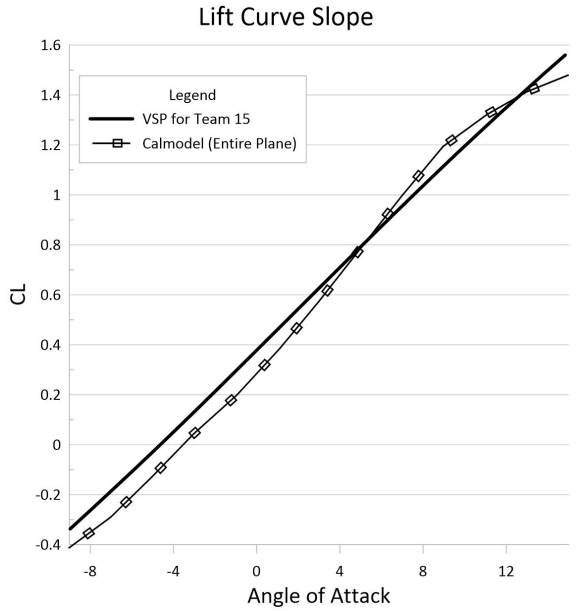


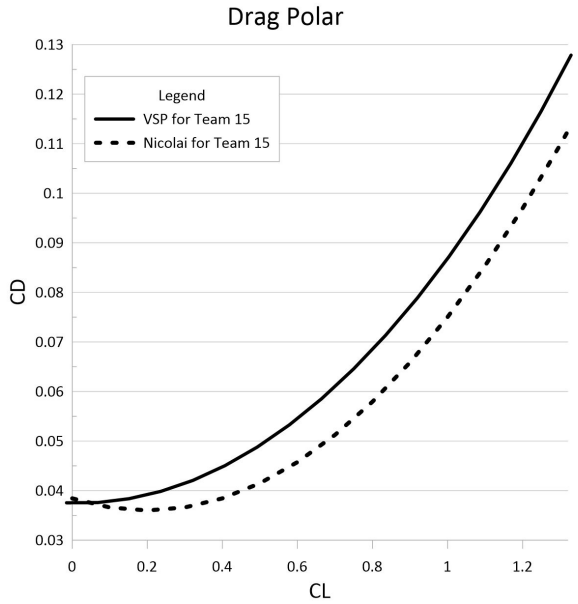


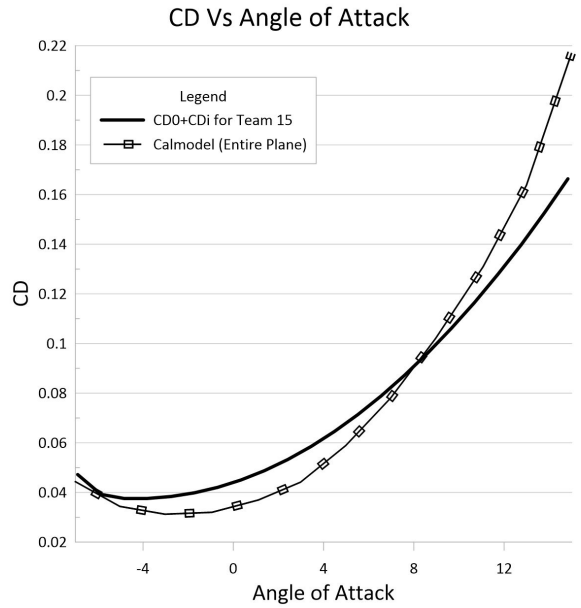


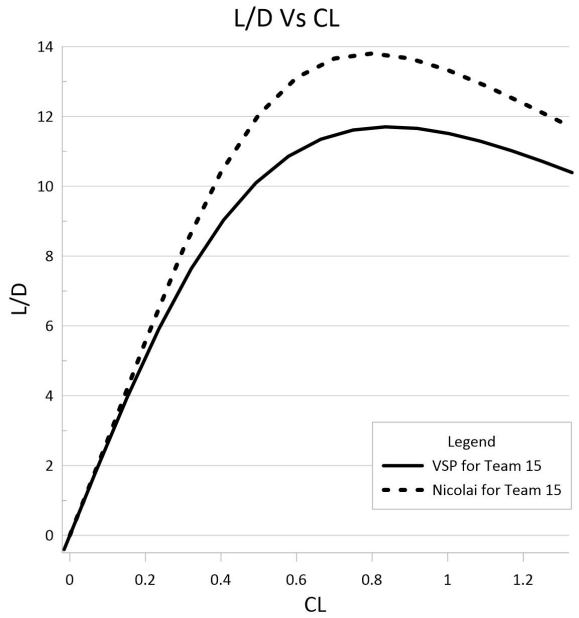
Aerodynamics

Relevant Plots



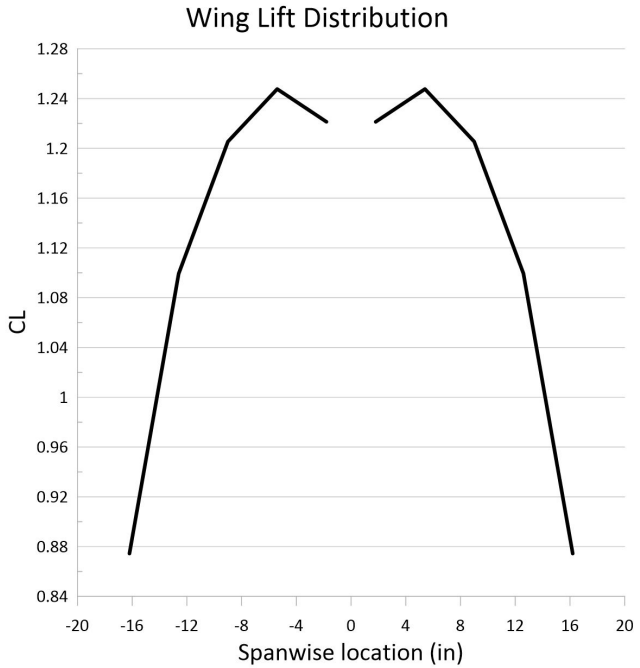


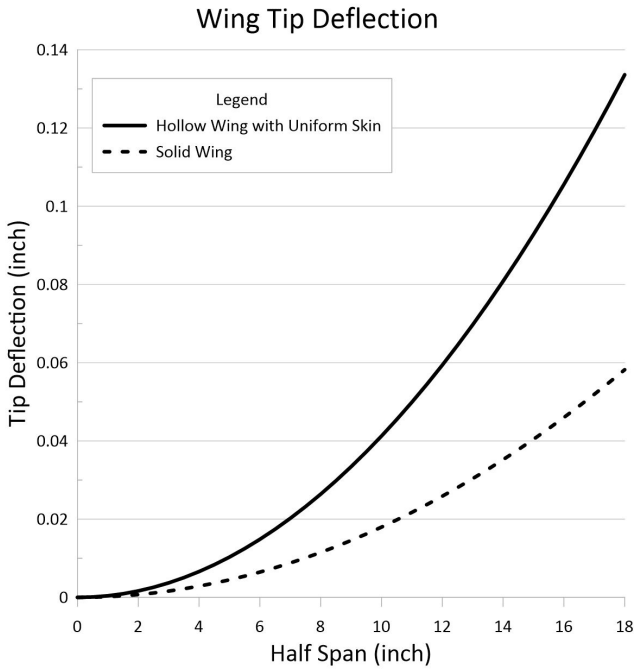




Structures

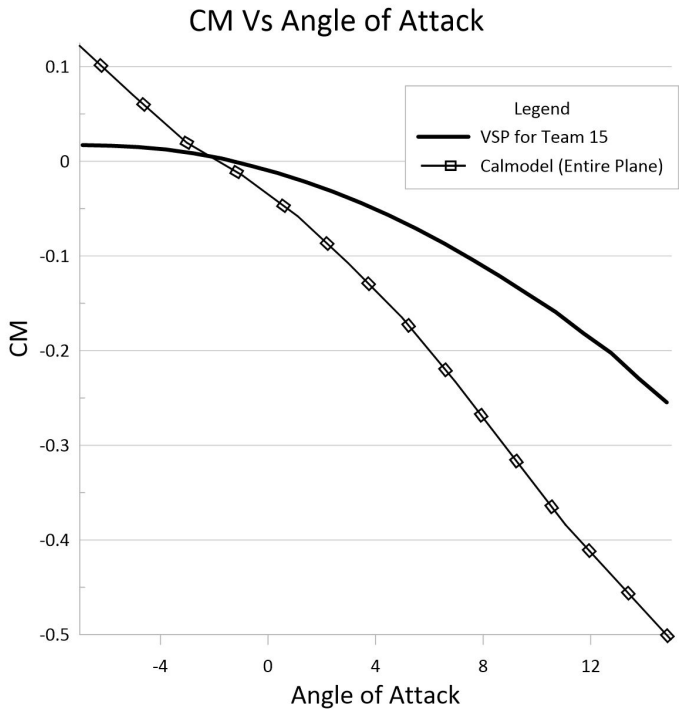
Relevant Plots

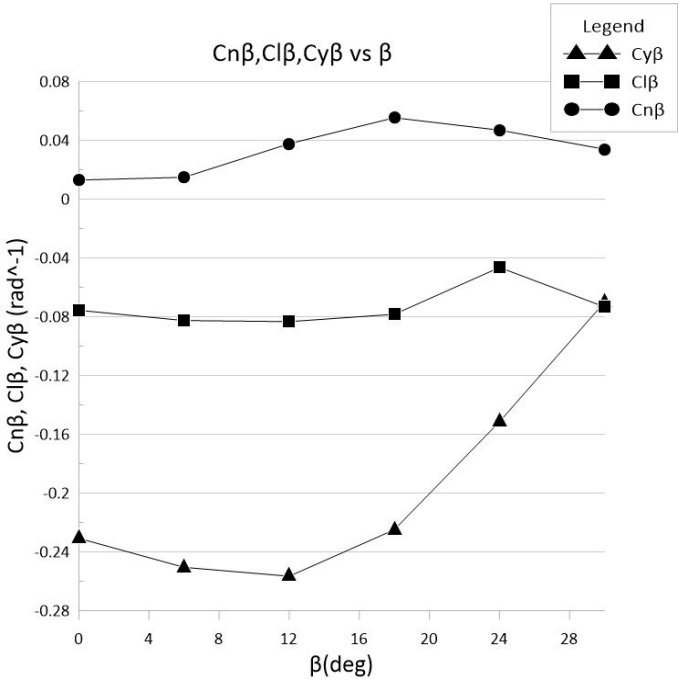


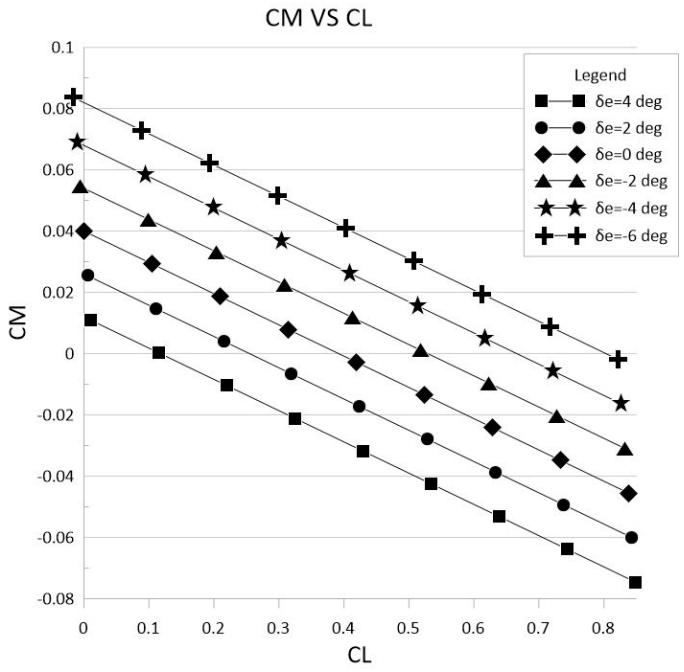


Stability & Control

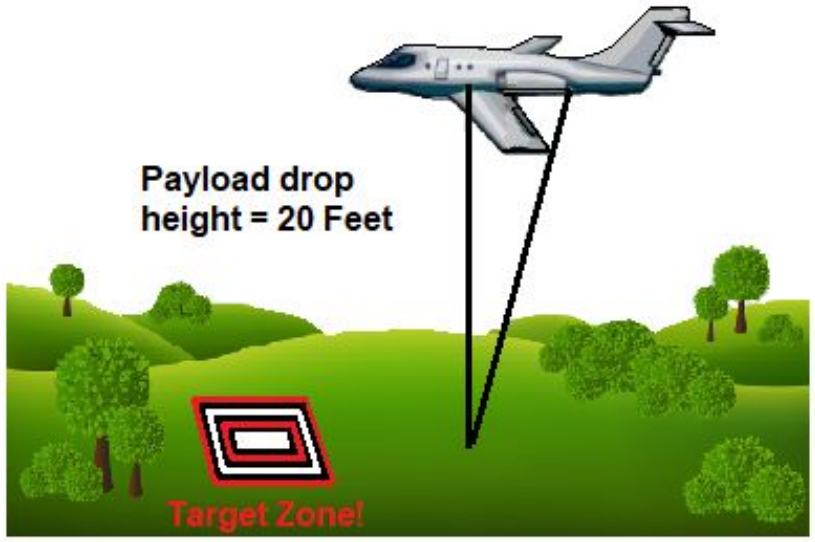
Relevant Plots



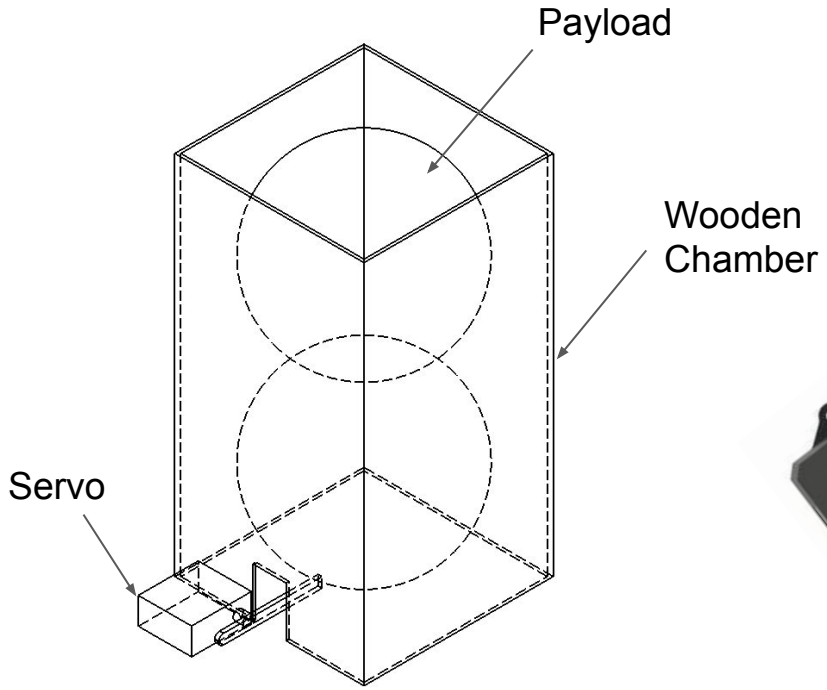




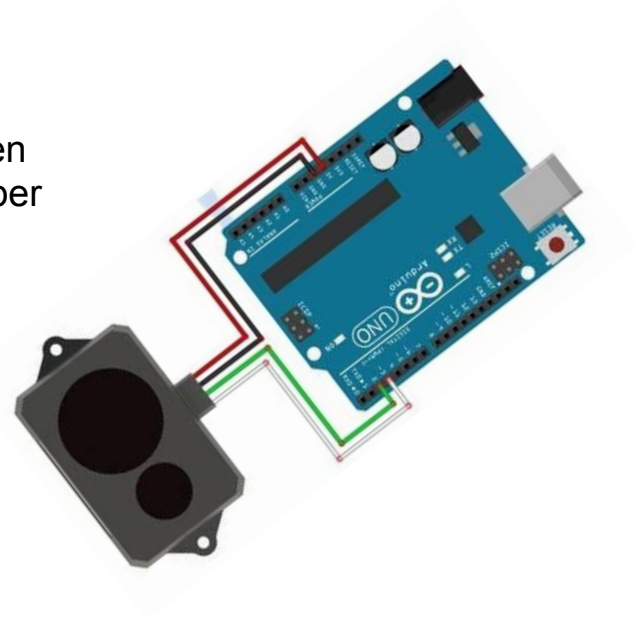
Payload Release System



The Lidar sensor will trigger the servo to release the payload when it senses that the aircraft is lowered to 20 feet above the ground.



Isometric view of payload release mechanism.



Lidar sensor connected to Arduino.

Questions?

Feel free to reach out to us using the contact information provided on the following slide.

Stay Safe!

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