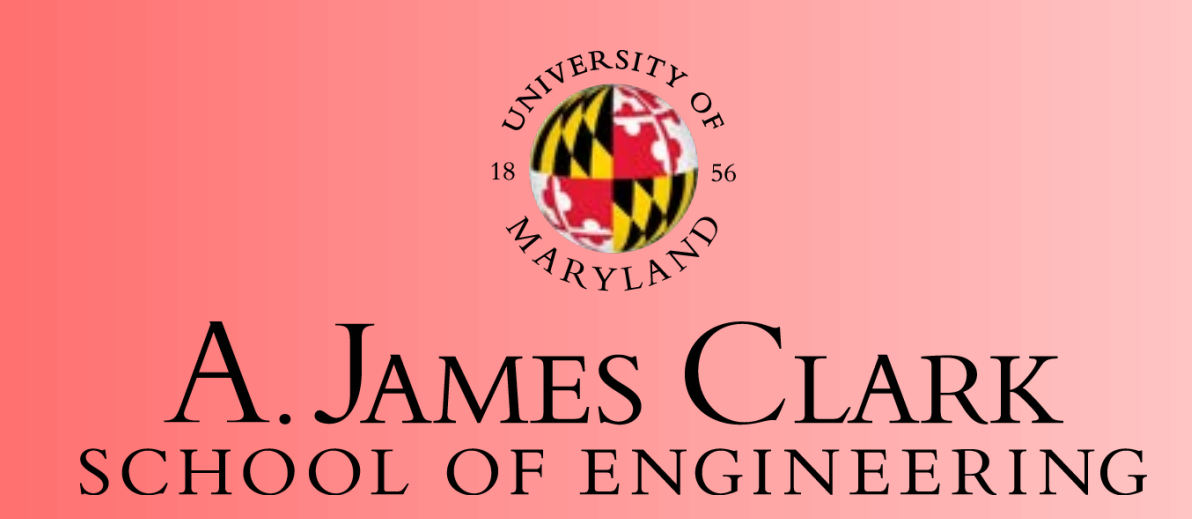




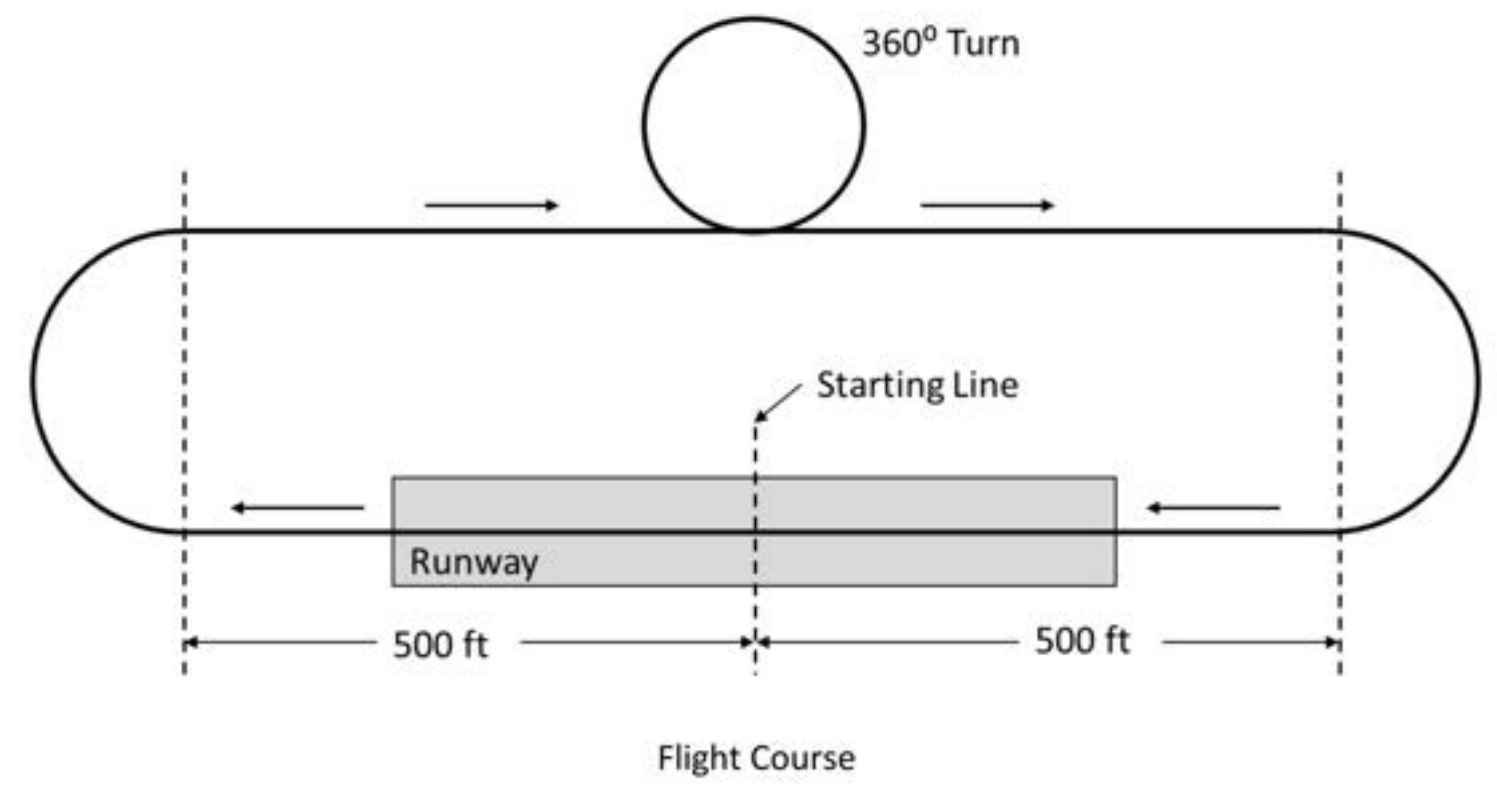
DESIGN, BUILD, FLY AT UMD

AERO7

Allen, Coffman, Grill, Halawani, Hevesy, Khamari, McGowan, Mehta, Miller, Russell, Short, Tian, Vedrin, Vegunta, Vogel, Webb, Zeng-Mariotti

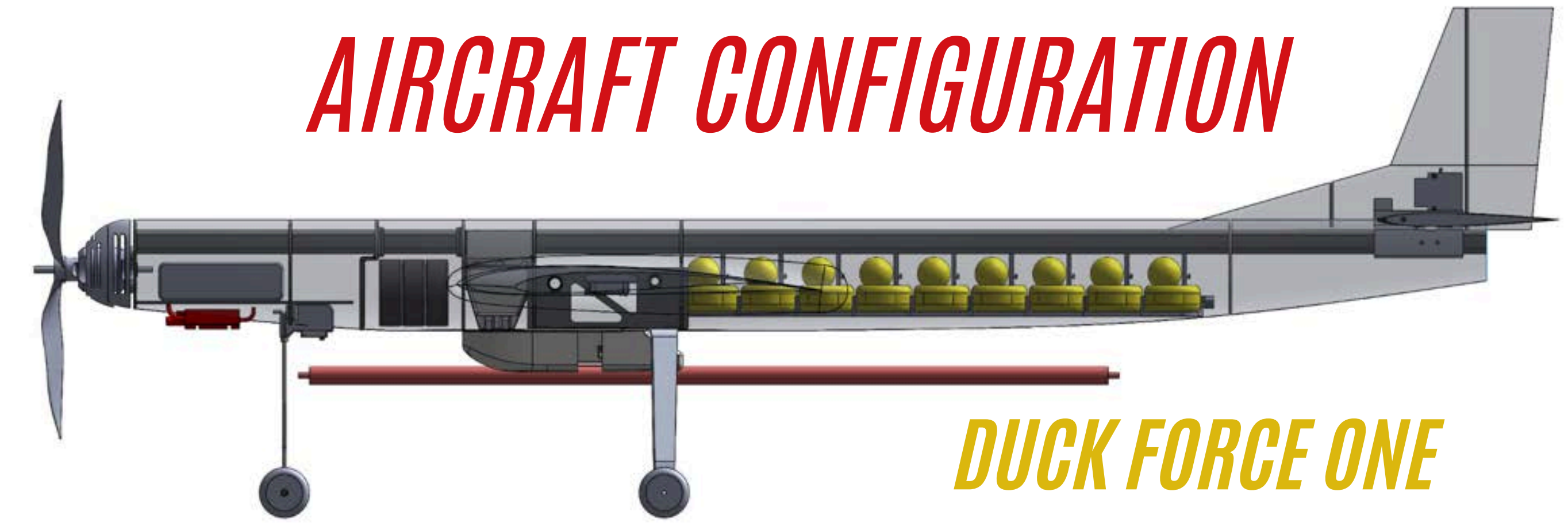


PROBLEM DEFINITION



- M1** No Payload
Fly 3 Laps
- M2** Passengers and Cargo
More Payload/Laps = More Points
- M3** Stow, deploy, tow, and release banner
Banner Size and Laps Earns Points
- GND** Load Payload and Switch Configurations as fast as possible

AIRCRAFT CONFIGURATION

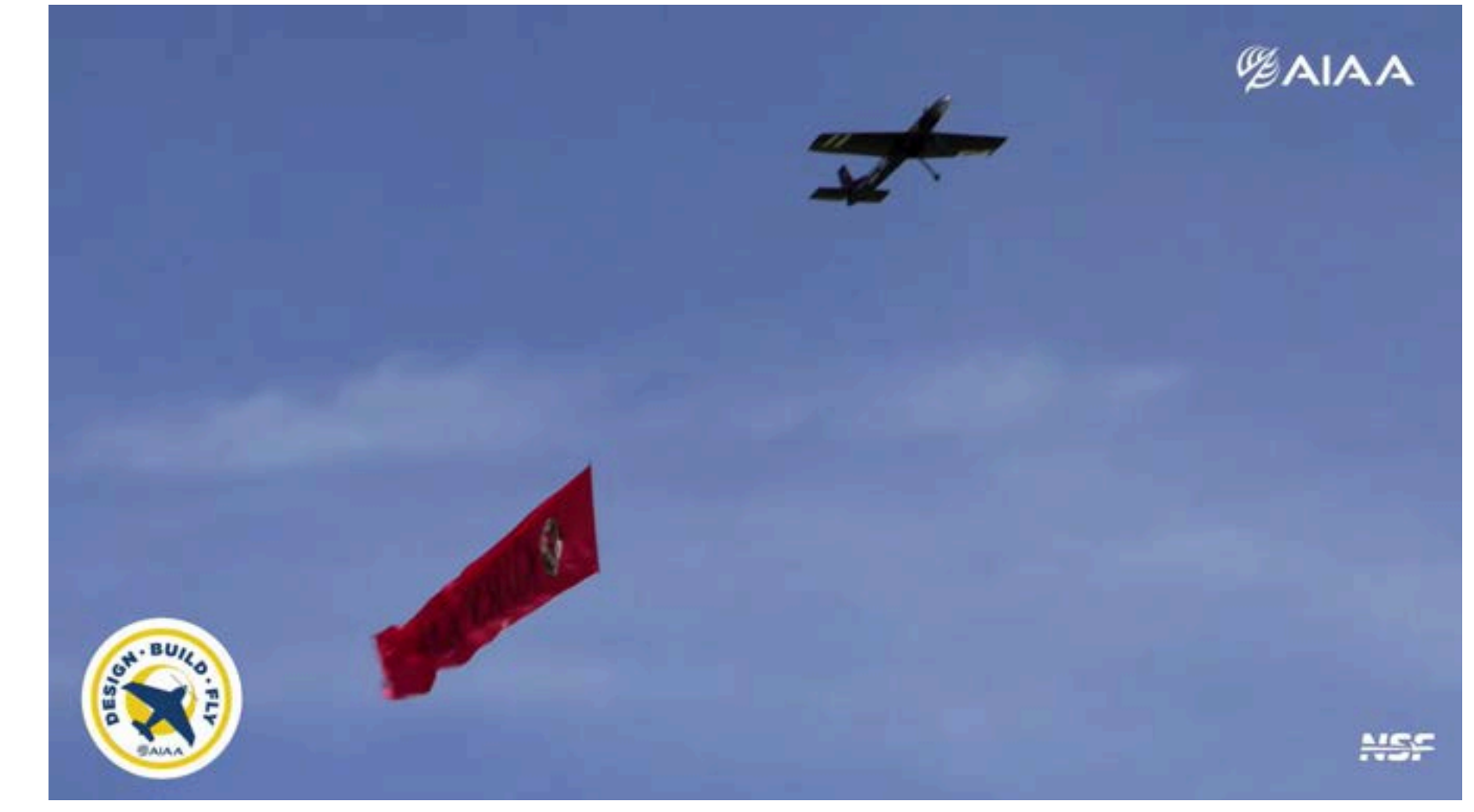


Wing		Avionics	
Airfoil	S2062	Receiver	TBS Crossfire Diversity Nano
Span, <i>b</i>	59.5 in	Servos	KST X10-710 V8.0
Planform Area, <i>S</i>	734.4 in ²	HV Battery Model	GAONENG GNB 8S 3300 mAh
MAC	13.6	HV Battery Voltage	29.6V (8S)
Aspect Ratio, <i>AR</i>	4.375	HV Battery Weight	1.21 lbs
Taper Ratio	0.7	LV Battery Model	POVWAY 1500mah
Incidence Angle	1 deg	LV Battery Voltage	11.1V (3S)
Washout	2 deg	LV Battery Weight	0.2 lbs
Empennage		ESC	Hobbywing Skywalker 120A V2
Airfoil	NACA 0008	Motor	
Vertical Span	10 in	Model	PROPDRIVE v2
Vertical Chord	8 in	Size	5060
Vertical Tail Taper Ratio	0.6	kV	380
Vertical Tail Arm	41 in	No-load Current	0.38 Amps
Horizontal Span	11 in	Internal Resistance	22 mh
Horizontal Chord	8 in	Power Rating	2665 W
Horizontal Tail Taper Ratio	0.9	Weight	0.97 lbs (438g)
Horizontal Tail Arm	42.5 in	Propeller	
Fuselage		Manufacturer	APC
Overall Length	69 in	Mission 1	16x10E
Maximum Width	59 in	Mission 2	16x10E
Maximum Height	23 in	Mission 3	17x8E

FINAL DESIGN



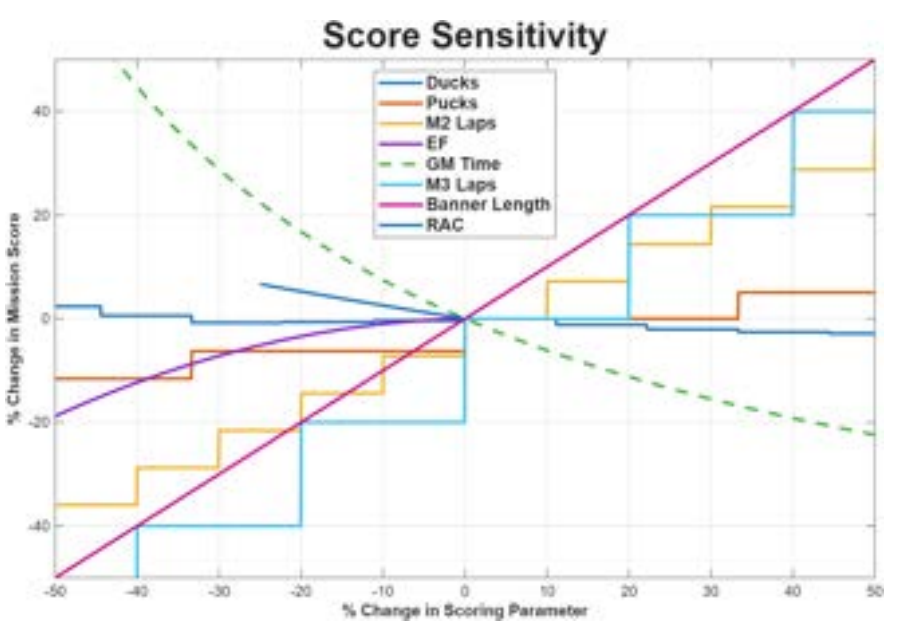
4/4 MISSIONS COMPLETE, 3 DUCKS AND 1 PUCK, 169"X 34" BANNER



BEST UMD FINISH (T)
12th
OUT OF 100+ INTERNATIONAL TEAMS

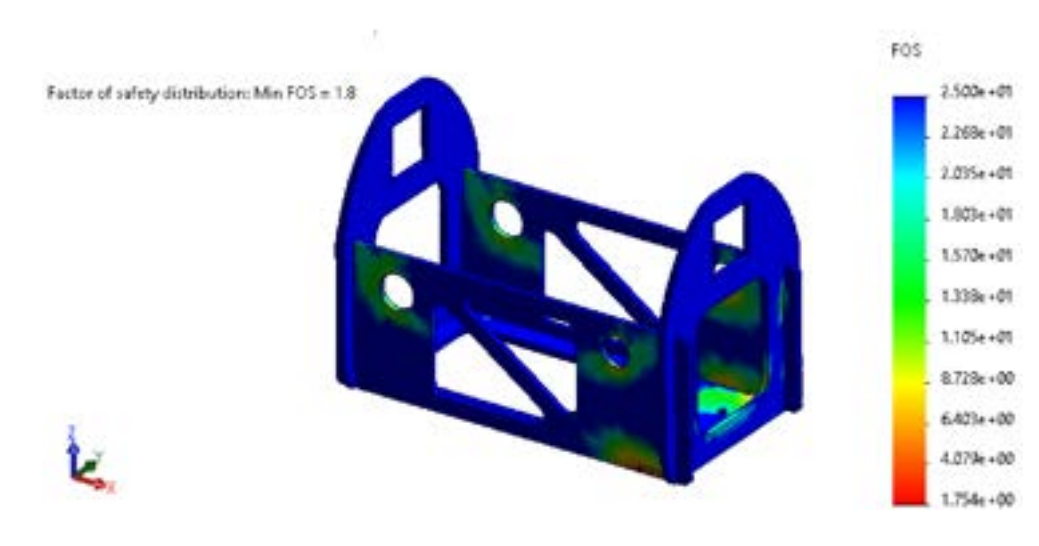
DESIGN CALCULATIONS & ANALYSIS

Mission Systems

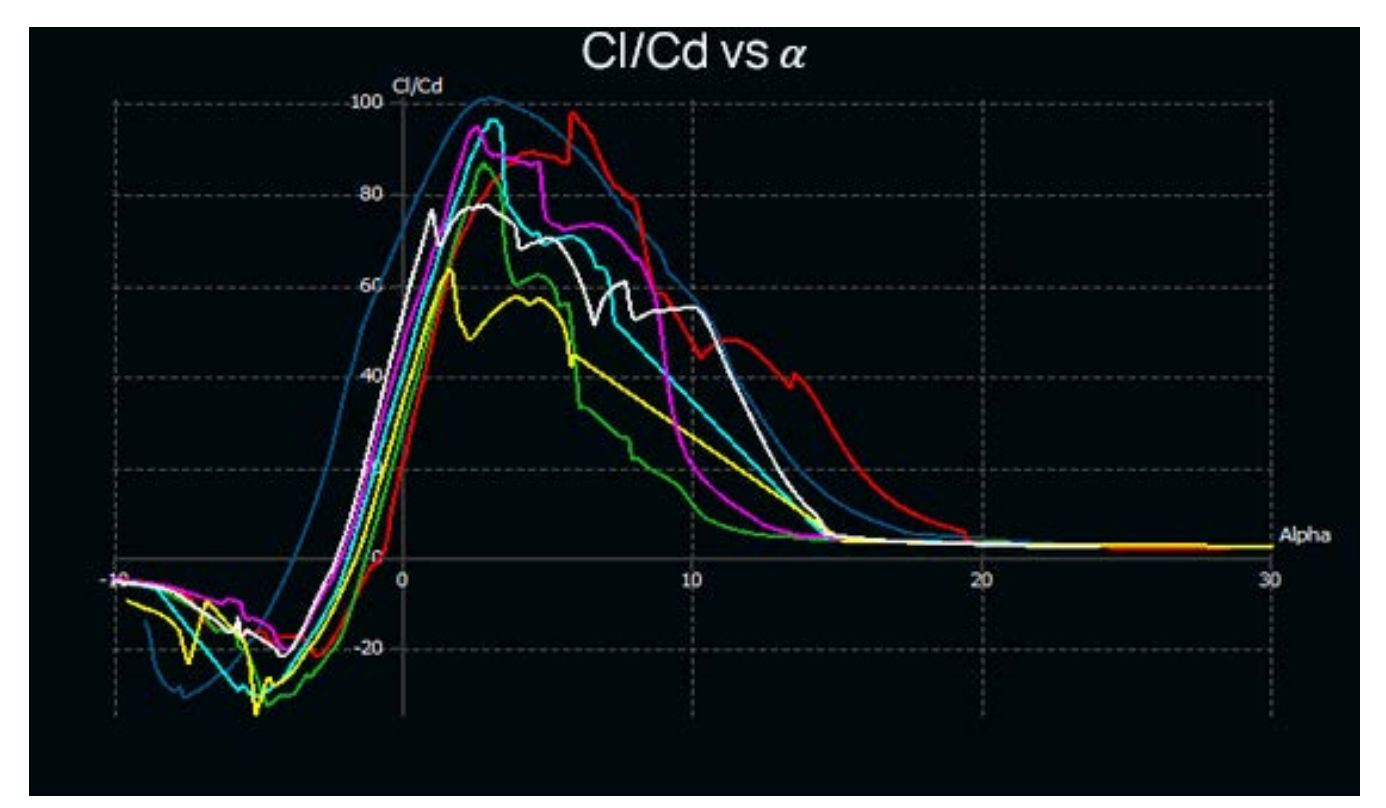


Optimization led to producing a fast, maneuverable aircraft capable of towing a large banner while minimizing Ground Mission time.

Structures

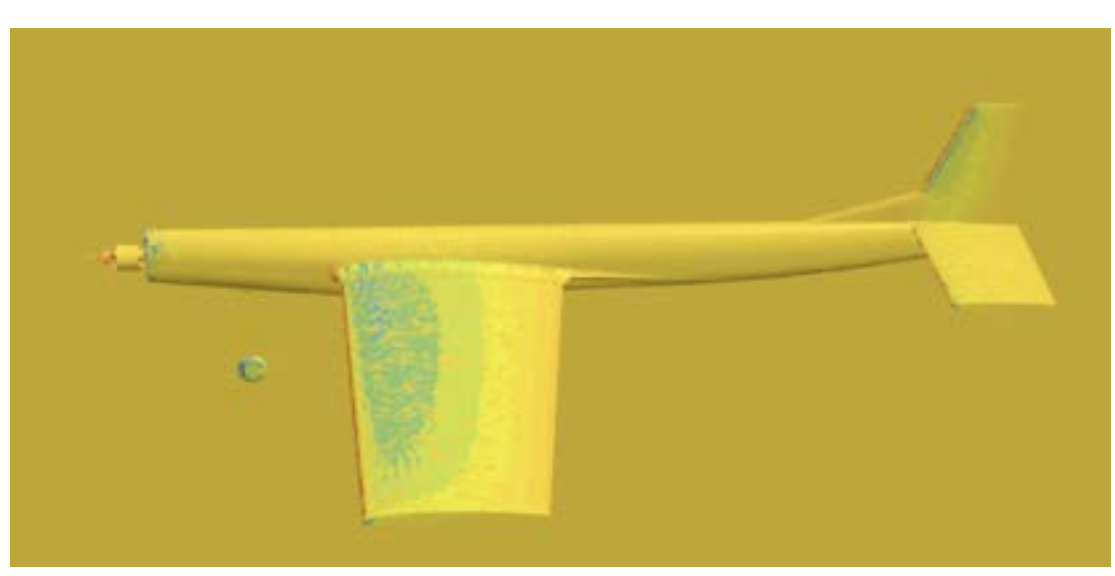


Loads: 7G Lift Load, 5G Landing Load
Composite properties imported into Solidworks FEA and simulations provided sufficient safety factors.
No damage detected under nominal flight conditions.

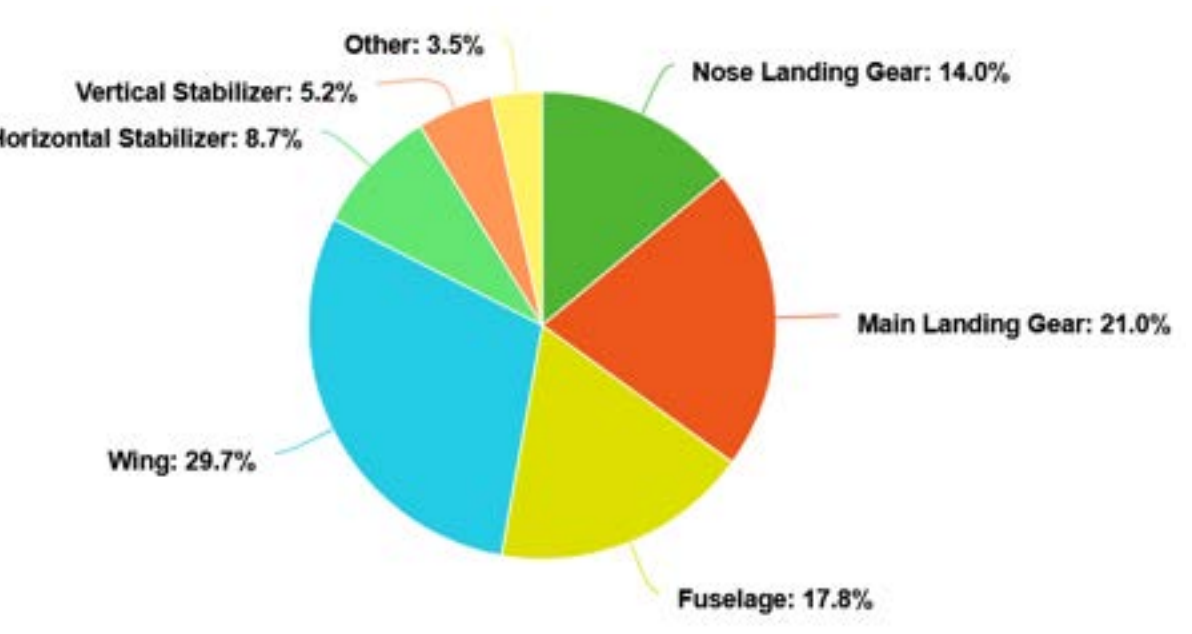
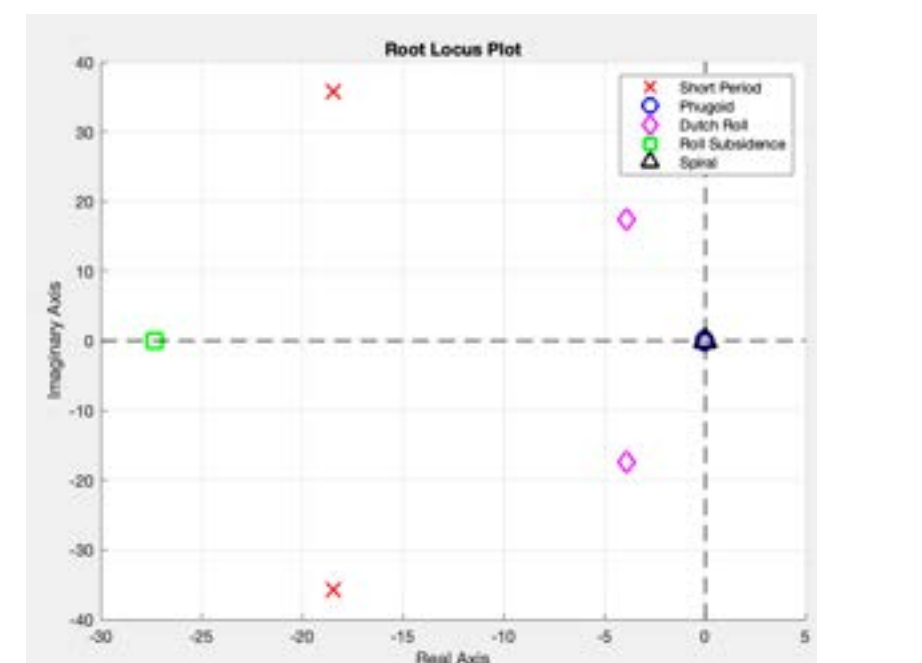


Aerodynamics

Airfoil selection, stability analysis, and preliminary design conducted in XFLR5 and AVL



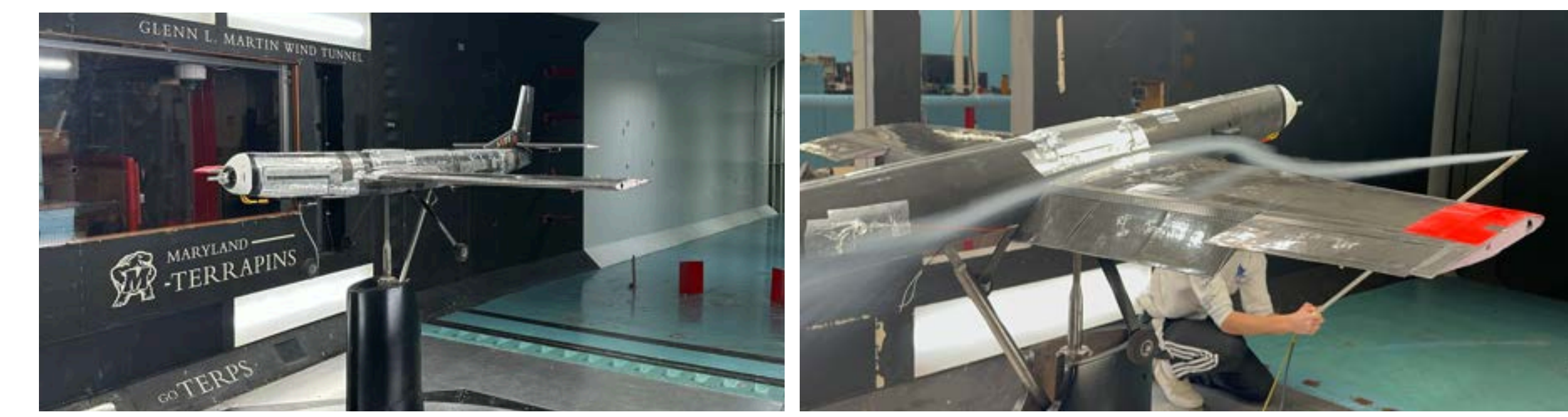
CL, CD of the final aircraft determined through StarCCM+ CFD. Also used for drag reduction studies on wingtips and wheel fairings



Thank you to our sponsors!



PROTOTYPE & TEST RESULTS



Wind Tunnel Test

V1 aircraft was tested in the Glenn L. Martin Wind Tunnel to validate CFD results and obtain CL, CD, and control moment data. Wind tunnel data influenced control surface throw, banner tow flight regime, banner tow design, and landing.



Prototype

Prototype V0 aircraft was built to validate manufacturing methods and evaluate stability and handling qualities of aerodynamic design. Airframe strength deemed acceptable, but longitudinal instabilities were present.

