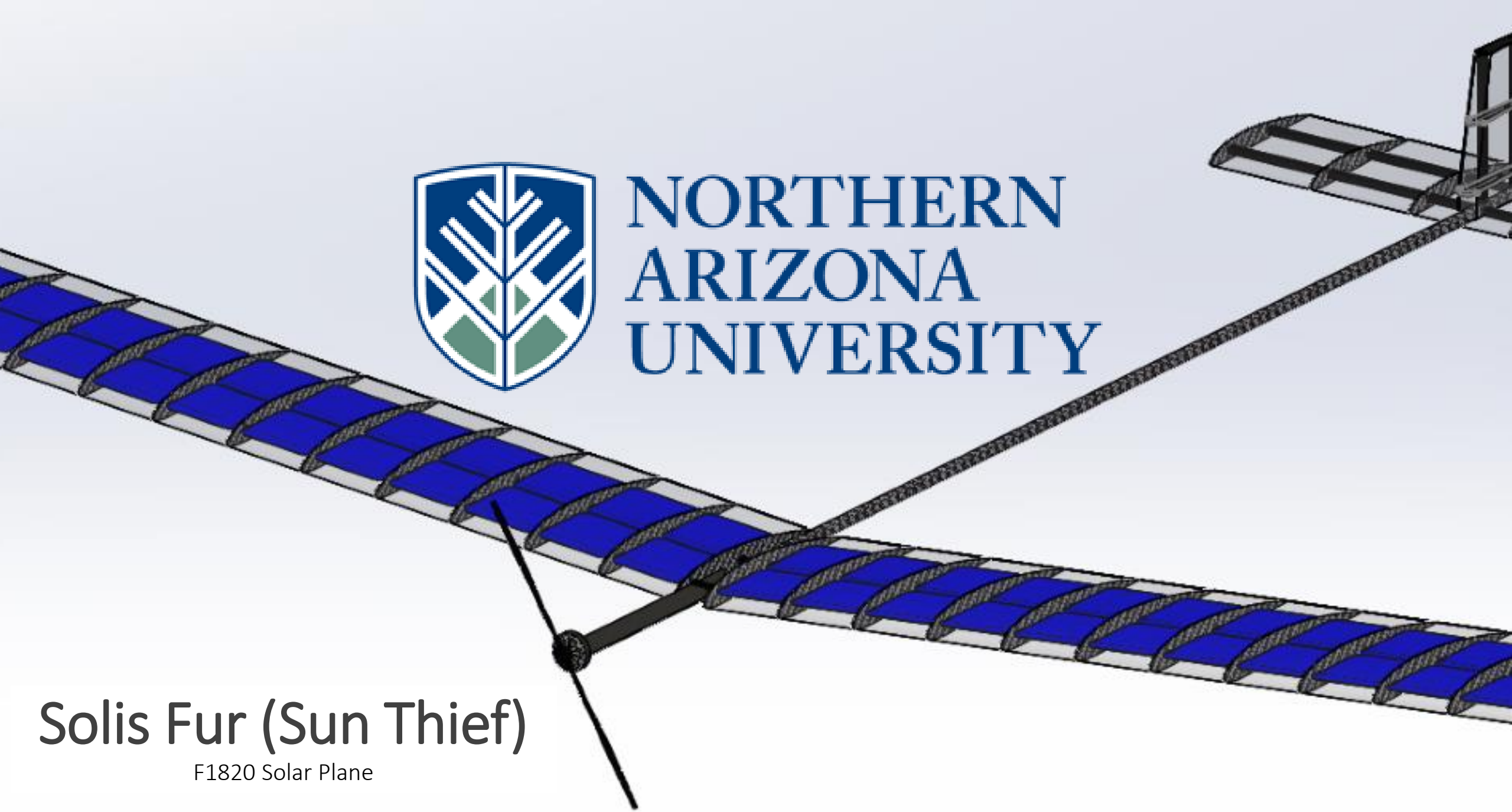
NORTHERN ARIZONA UNIVERSITY



Solis Fur (Sun Thief)

F1820 Solar Plane

The Team

Brandon Beaudoin
(Project Manager)

Michael Broyles
(Website Designer)

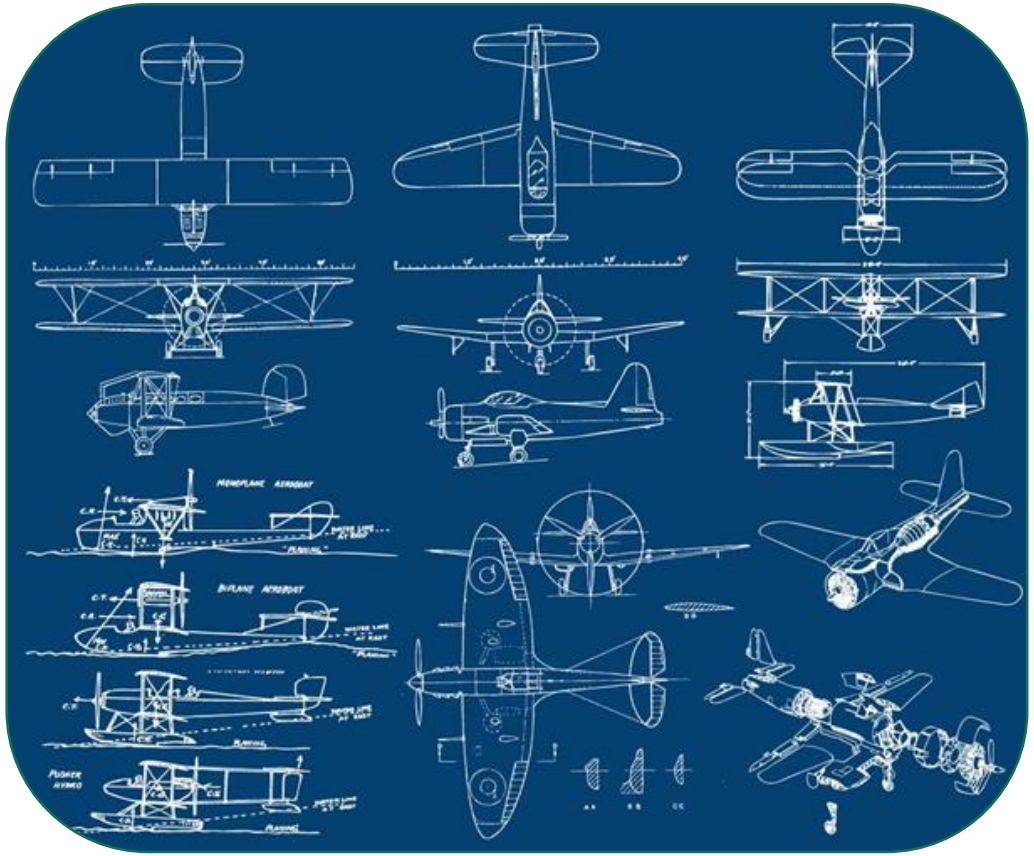
Nathan Zufelt
(Budget Manager)

Ethan Smith
(Client Contact)

Jonathan Hernandez
(Documentation Manager)

Project Concept

Explore the use of engineering principles to design and build a solar powered RC aircraft capable of sustaining indefinite flight while the sun is out.



Plane Schematic [8]

Project Sponsor / Customer

David Trevas, PhD

- Provided customer requirements.
- Crucial inputter in design requirements.

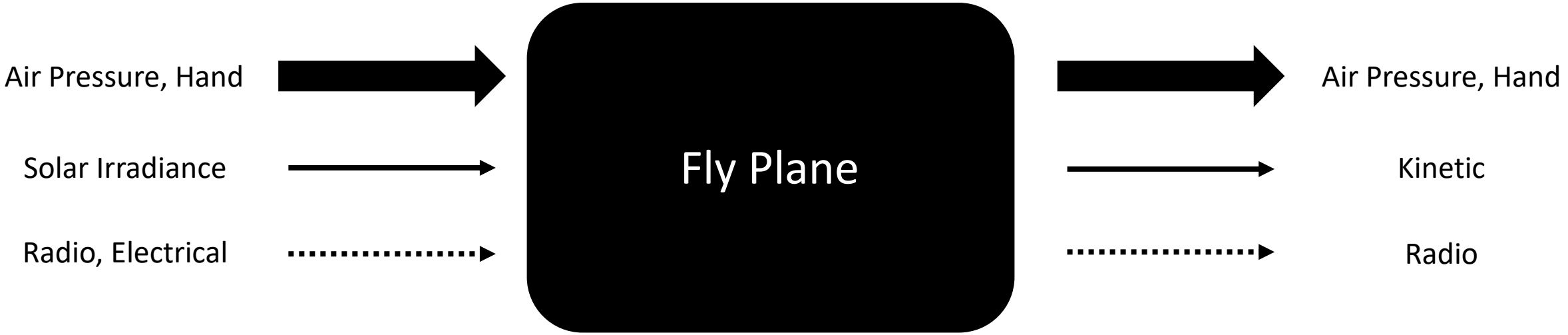
Sponsors

- Novakinetics AeroSystems
- Prometheus Solar
- Flagstaff Flyers

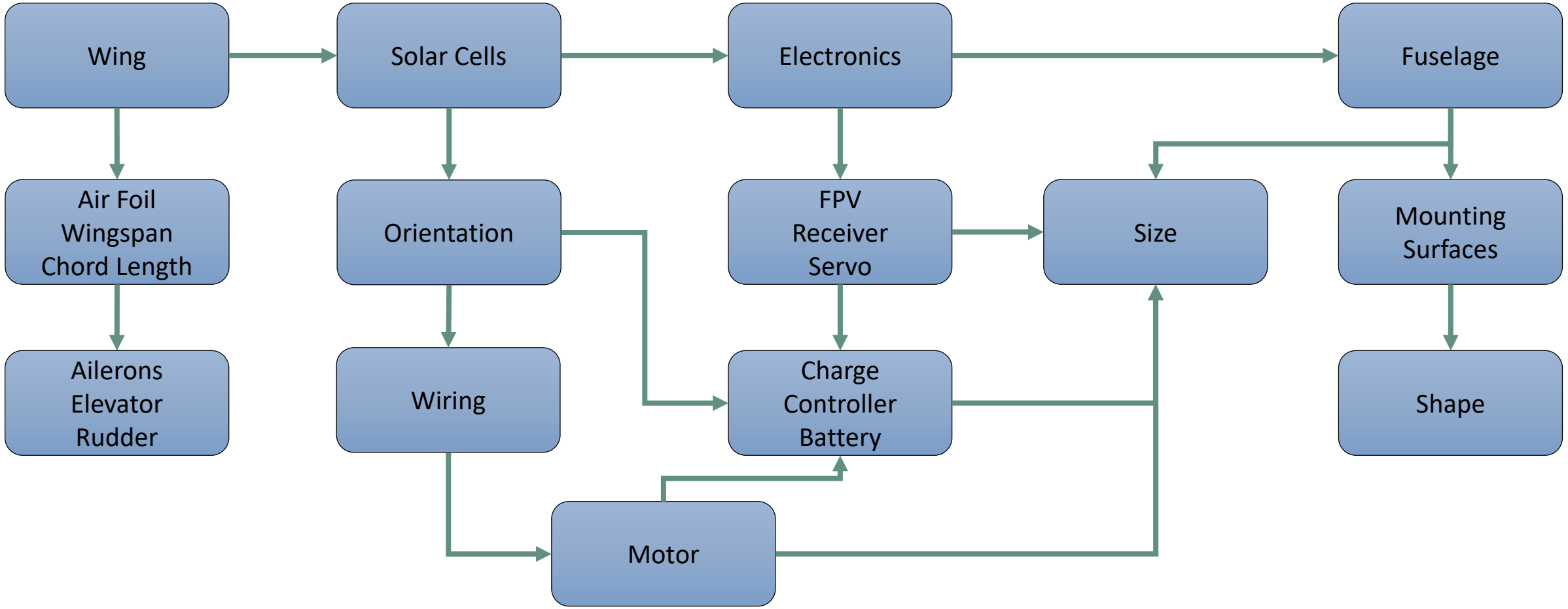
Why is this important?

- Teaches students to use engineering principles in a real life application.
- Allows the use of renewable energy to power an RC plane.

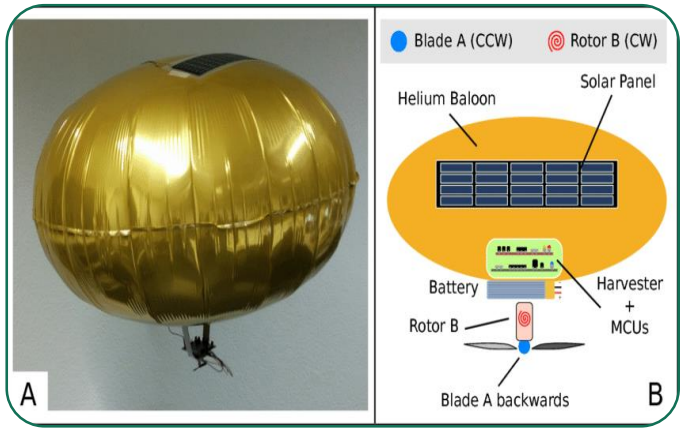
Black Box Model



Decomposition Model

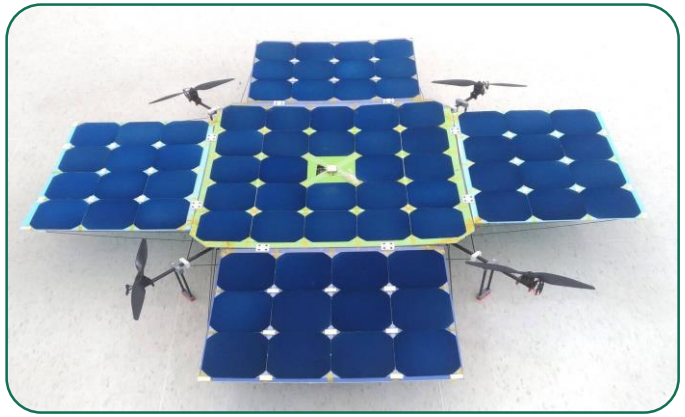


Aircraft Selection



Solar Blimp

Advantages:	Disadvantages:
Positive Buoyancy	Control
Simplified Electronics	Surface Area (Power)



Solar Quadcopter

Advantages:	Disadvantages:
Vertical Takeoff	Surface Area
Maneuverability	Complex Design

Solar Delta-Wing Plane

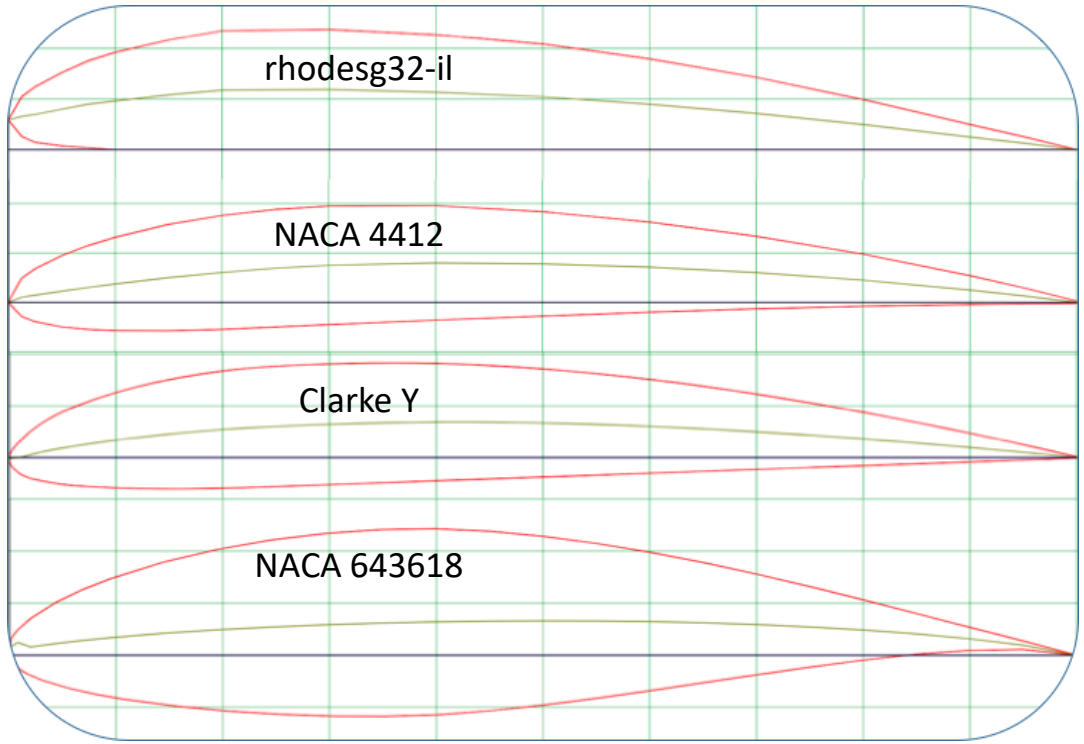
Advantages:	Disadvantages:
Surface Area Manufacturable (Styrofoam)	Increase Drag
	Size Constraints

Aircraft Selection

Glider

Advantages:	Disadvantages:
Low Drag	Low Maneuverability
High Efficiency	Fragile

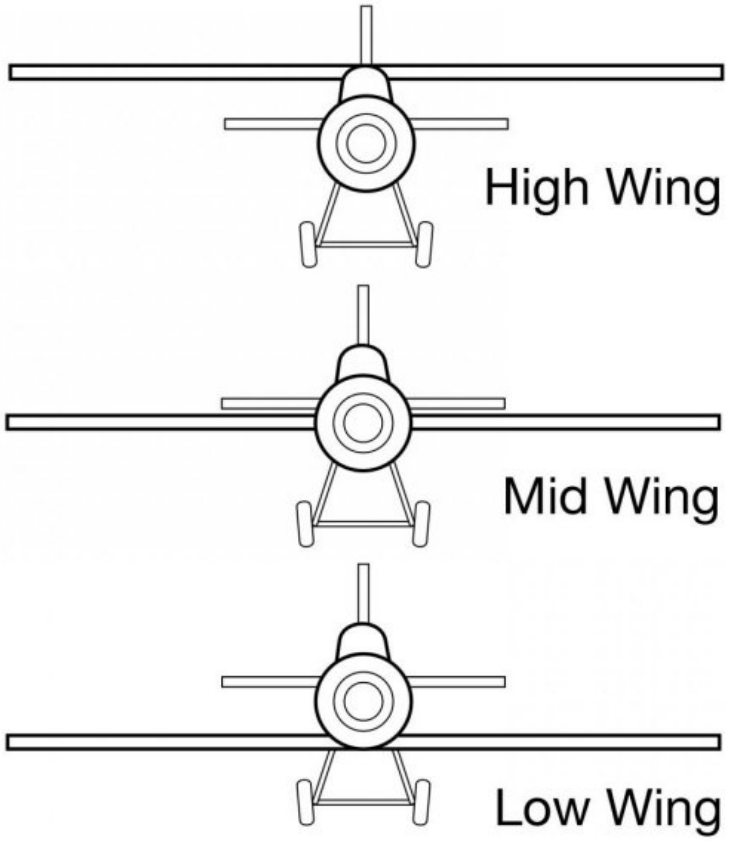
Airfoil Selection



Airfoil Pugh Chart								
Criteria	Weight	4412 (Datum)	rhodesg32-il		Clark Y		NACA 643618	
Max Lift	2	D	-	-2	-	-2	-	-2
Lift $\alpha = 0$	2	D	+	2	-	-2	-	-2
Max Drag (Aerodynamic)	1	D	-	-1	-	-1	-	-1
Induced Drag	1	D	+	1	+	1	+	1
Total Wing Drag	2	D	-	-2	-	-2	-	-2
Ease of manufacturing	2	D	+	2	-	-2	-	-2
Inferred	Sum	0	0	0	-4	-8	-4	-8
	Rank	2	1		3		3	

Reasons for selected weights	
2	Critical to flight
1	Infuential but not critical

Wing Location Selection



Wing Location Pugh Chart						
Criteria	Weight	Mid (Datum)	Upper		Lower	
Weight	2	D	1	2	1	2
Lift	2	D	1	2	1	2
Stall Speed	2	D	1	2	-1	-2
Stability	1	D	1	1	-1	-1
Frontal Area	1	D	-1	-1	1	1
Drag	1	D	0	0	1	1
Pitch Moment	1	D	1	1	-1	-1
Cost	1	D	1	1	1	1
Ease of manufacturing	1	D	1	1	1	1
Versatility	1	D	1	1	1	1
Inferred	Sum	0	7	10	4	5
Does not pertain to project	Rank	3	1		2	

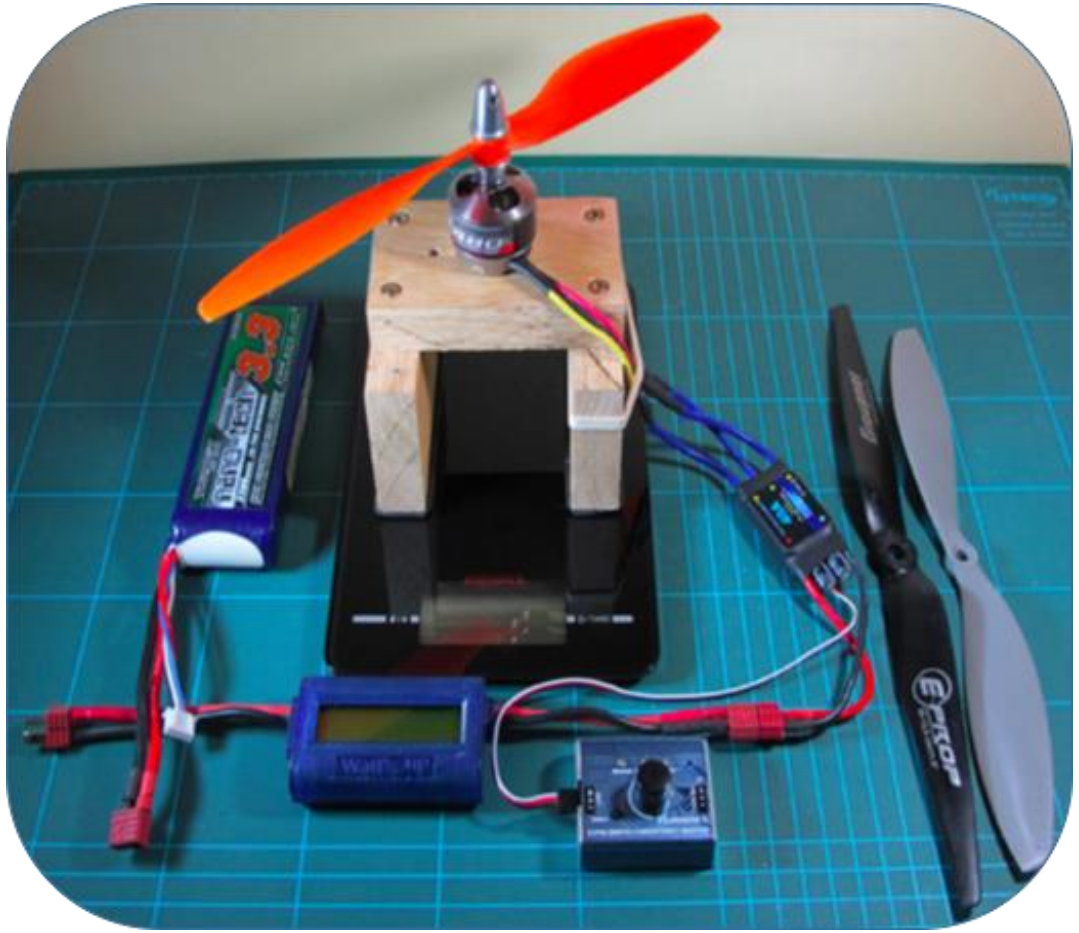
Proposed Testing

Solar Panels:

- Analyze solar ouput
- Helps quantify available power
- Help determine the correct panel orientation

Motors/Propellors:

- Helps determine thrust capabilities
- Helps determine cruise speed
- Optimize propellor : motor size



Component Selection

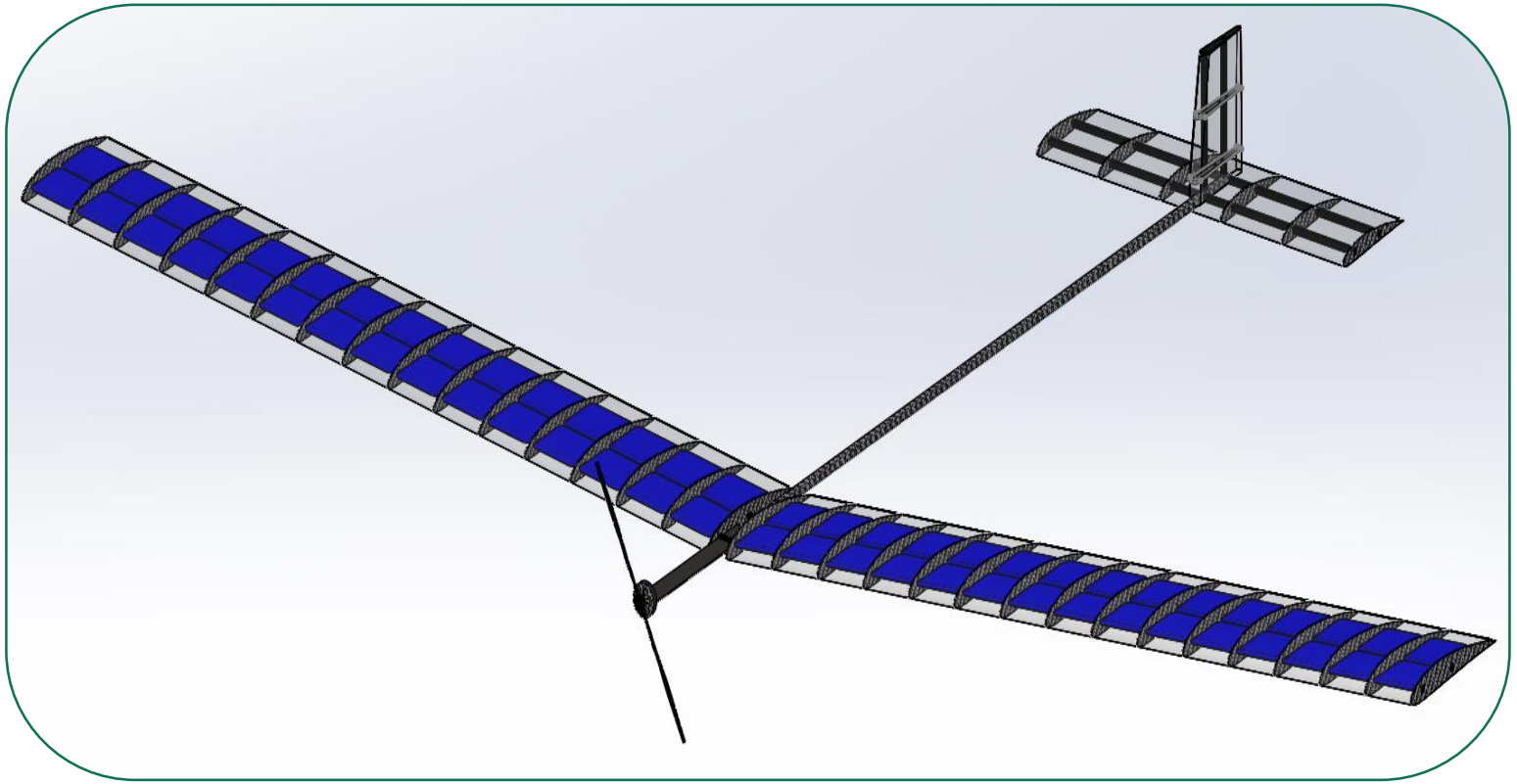
Components:

- Motor
- Prop Size
- Speed Controller
- Electrical Layout

Proposed Design

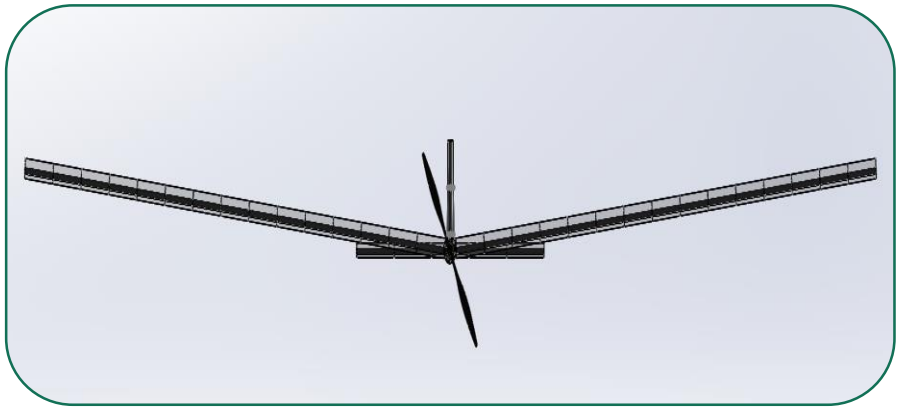
Specifications:

- Wing span: 13.25ft
- Weight: <8lbs
- Number of solar cells: 60
- Flight duration: Indefinite

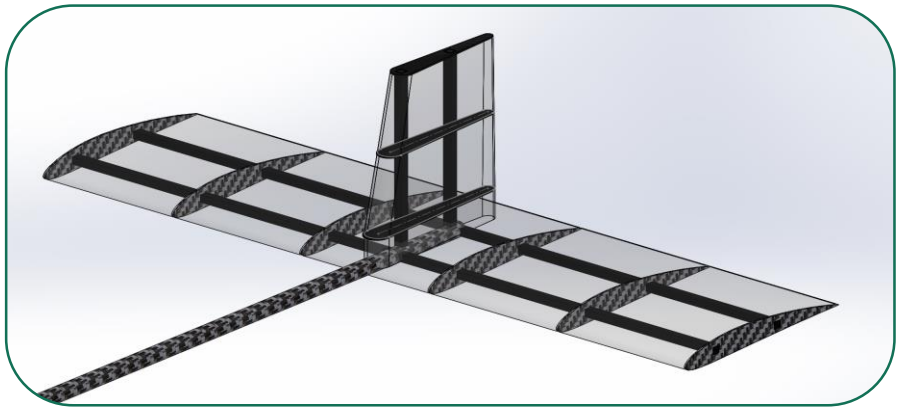


SolidWorks Rendering of Proposed Plane

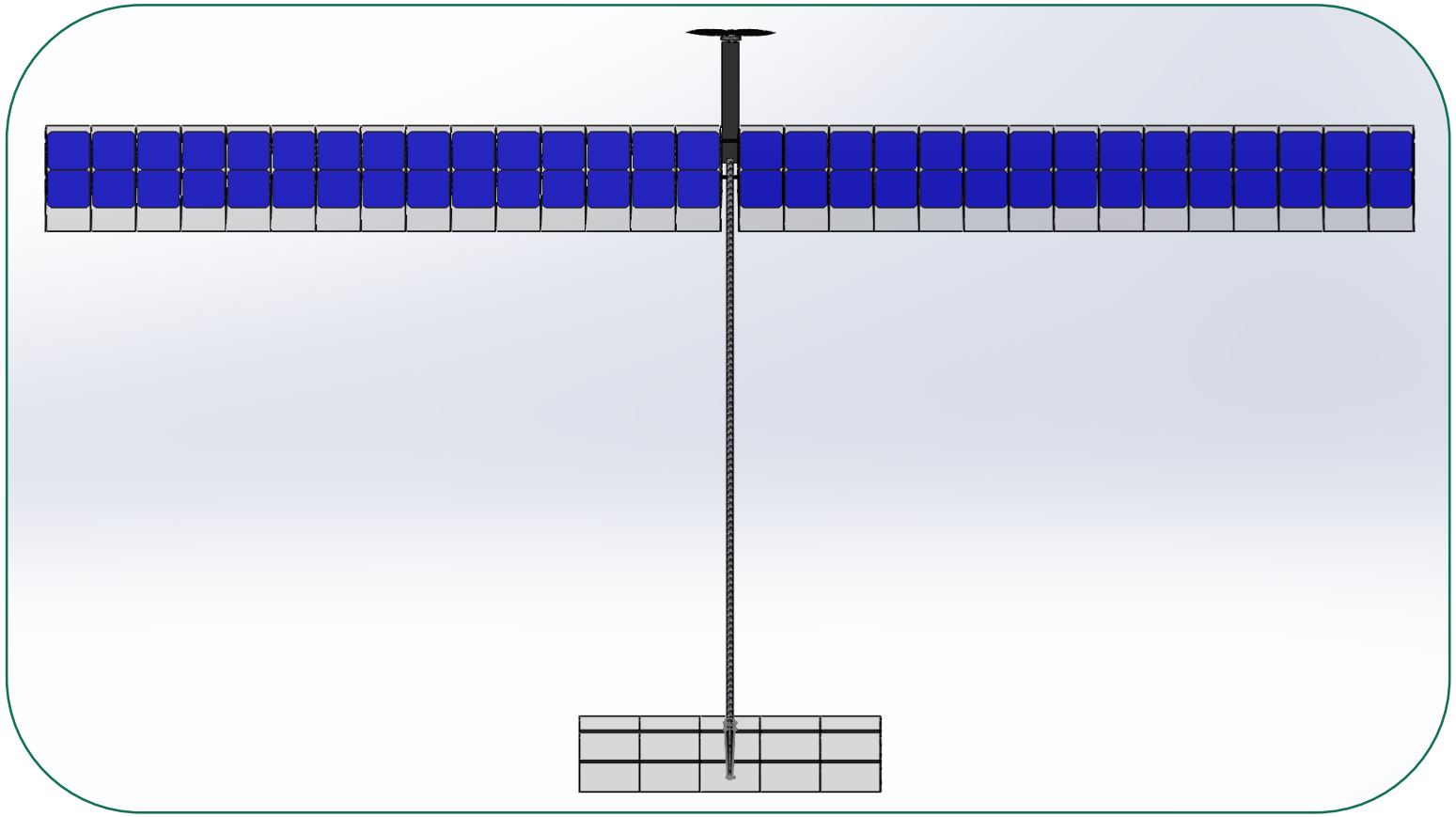
Proposed Design



5 degree Dihedral



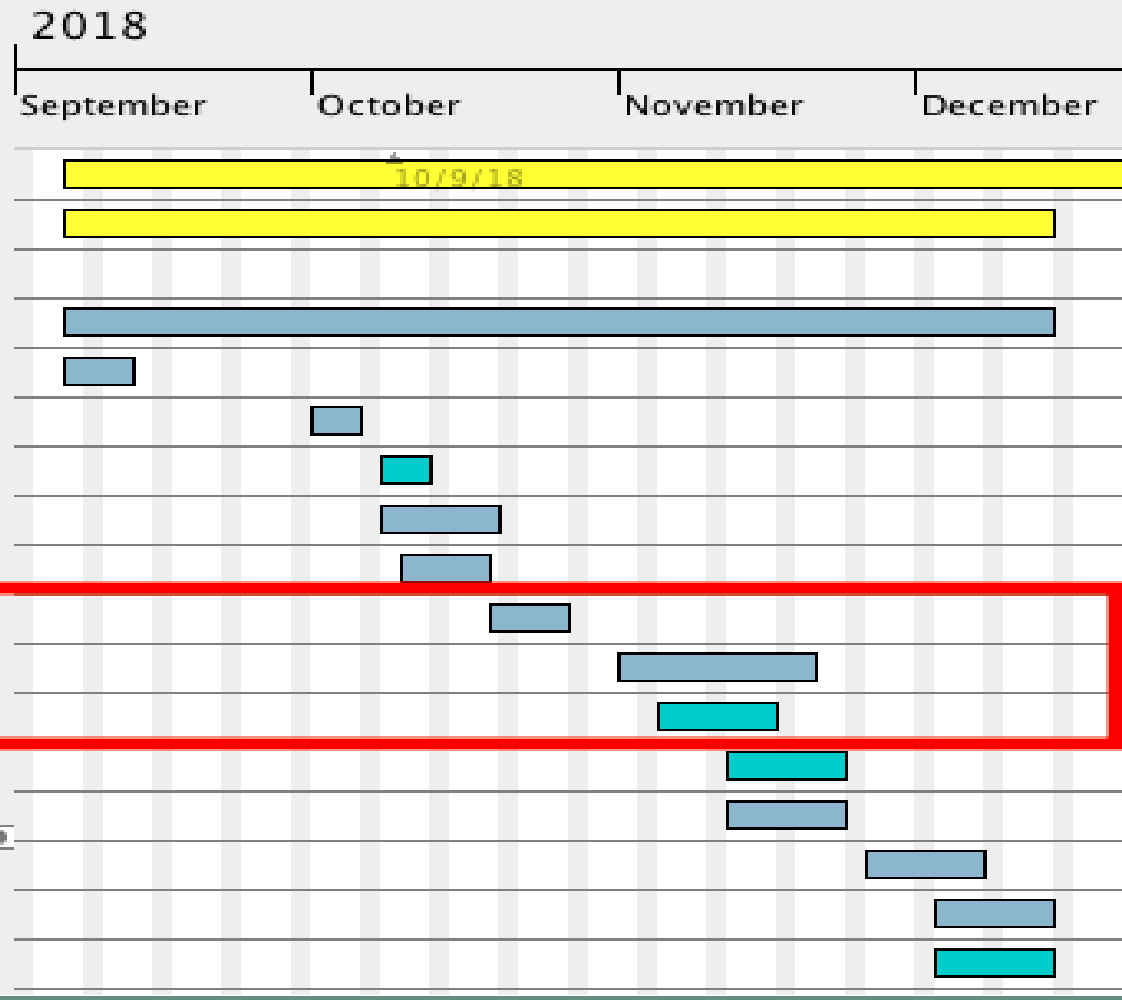
Proposed Tail



Top View

Schedule

Name	Begin date	End date
Research	9/6/18	5/10/19
Design	9/6/18	12/14/18
Build	1/15/19	5/10/19
Meet the TA	9/6/18	12/14/18
Team Charter	9/6/18	9/12/18
Website Check 1	10/1/18	10/5/18
Peer Evaluation 1	10/8/18	10/12/18
Analysis Memo	10/8/18	10/19/18
Website Check 2	10/10/18	10/18/18
Preliminary Report	10/19/18	10/26/18
Test Motors and Panels	11/1/18	11/20/18
Analytical Report	11/5/18	11/16/18
Peer Evaluation 2	11/12/18	11/23/18
Final Report	11/12/18	11/23/18
Prototype, BOM, Cad	11/26/18	12/7/18
Website Check 3	12/3/18	12/14/18
Peer Evaluation 3	12/3/18	12/14/18



Budget

- Total budget - $2500
- Recently purchased
  - Controller - $235
  - Solar Cells - $360
  - Solar cell connectors - $20
- Remaining Budget - $1885

	Price	Quantity	Units	Cost	Price per unit	Weight per unit	Units	Total Weight	Weight (lbs)
Plane Components									
C60 Solar panels	$360.00	1	80	$360.00	$4.50	10	grams	800	1.76
Sunpower dog bone connector	$9.99	2	100	$19.98	$0.20			0	0.00
Carbon Tail tubing (0.793 x 72in)	$225	1	1	$224.99	$224.99	1.02	lbs	1.02	1.02
Carbon Wing struts (0.38 x 72in)	$70	4	4	$279.96	$69.99	131.5	grams	526	1.16
Carbon Sheets (200x300x2mm)	$20	10	10	$198.60	$19.86	97	grams	970	2.14
Clear UltraCote	$29	3	3	$87.00	$29.00	36.61821	grams	109.85463	0.24
OS 10 motor	$89	1	1	$89.00	$89.00	102	grams	102	0.22
Zeee 3S Lipo Battery 11.1V 50C 5200mAh	$37	1	1	$36.99	$36.99	11.6	oz	11.6	0.73
Place holder (Servos)									
Tunigy Speed Controller	$96	1	1	$96.00	$96.00	60	grams	60	0.13
Place holder (Propeller)									
Place holder (Tail wing?)									
Ground Equipment									
FrSky Taranis X9D Transmitter	$234	1	1	$234.00	$234.00			0	0
FrSky Taranis Compatible Receiver X8R 8-	$35	1	1	$34.50	$34.50			0	0
FrSky X4RSB 3/16CH Telemetry Receiver	$32	1	1	$31.99	$31.99			0	0
Connex ProSight HD Vision Pack	$399	1	1	$399.00	$399.00	66	grams	66	0.15
Zeee 3S Lipo Battery 11.1V 50C 5200mAh	$37	1	1	$36.99	$36.99	11.6	oz	11.6	0.73
			Total	$2,129.00				Total Weight	8.28

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Questions?