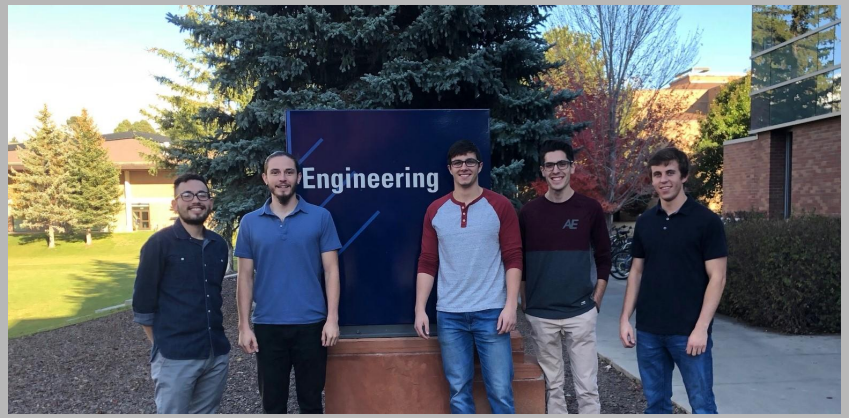
SAE Aero Regular Class



James Seganti (Project Manager)
Caleb Hatcher (Budget Liaison)
Braden Weiler (Documentation Manager)
Angel Montiel (Website Developer)
Damian Lumm (Client Contact)

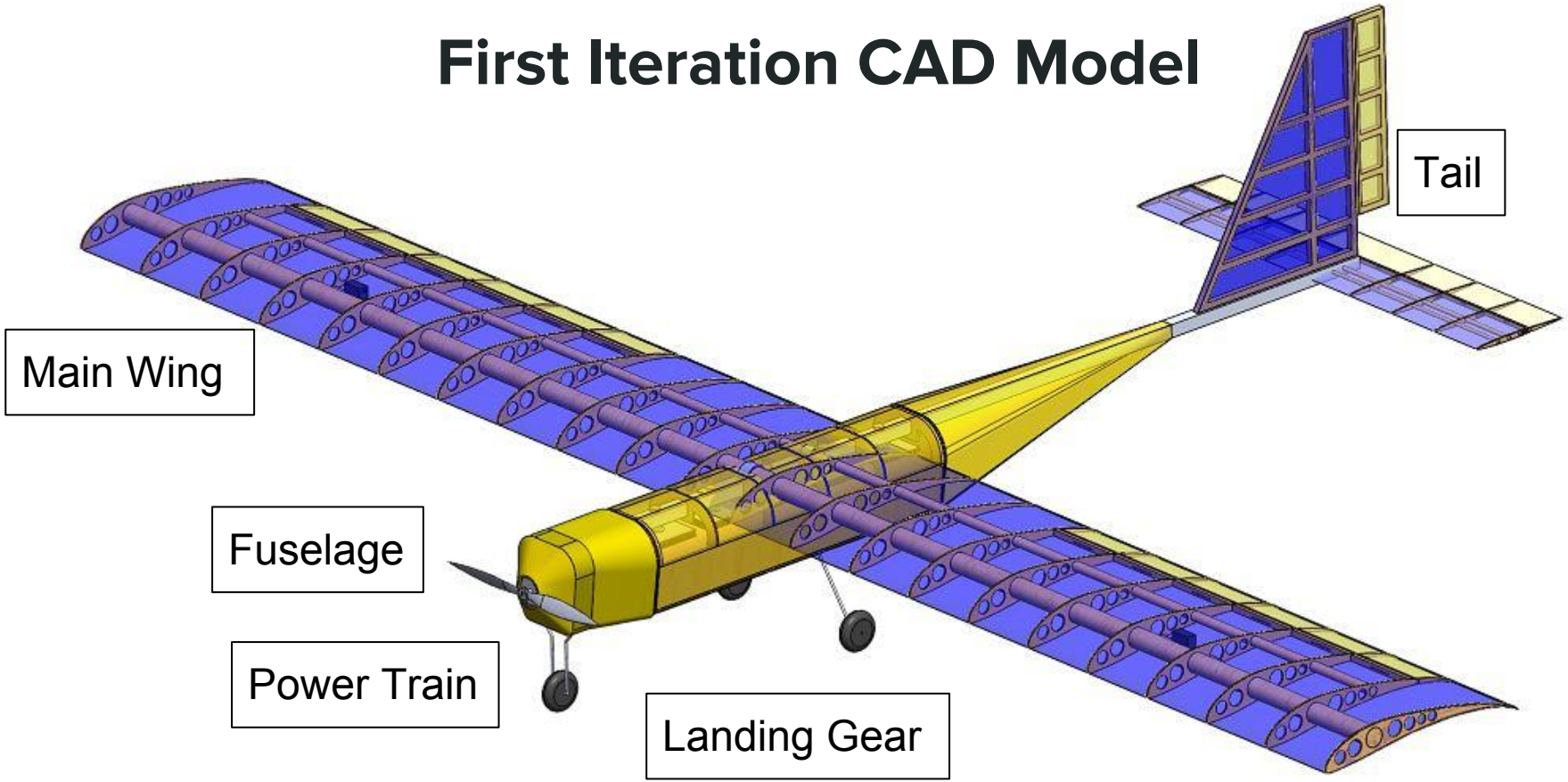
Project Description

- The purpose of this team is to design and manufacture an RC aircraft to compete in the SAE West Region competition.
- Fixed wing regular class
- All electric aircraft and has to carry payload
- Stakeholders: John Tester, Sarah Oman, Northern Arizona University, Flagstaff Flyers, ASNAU
- Represent NAU in a positive manner

Design Description

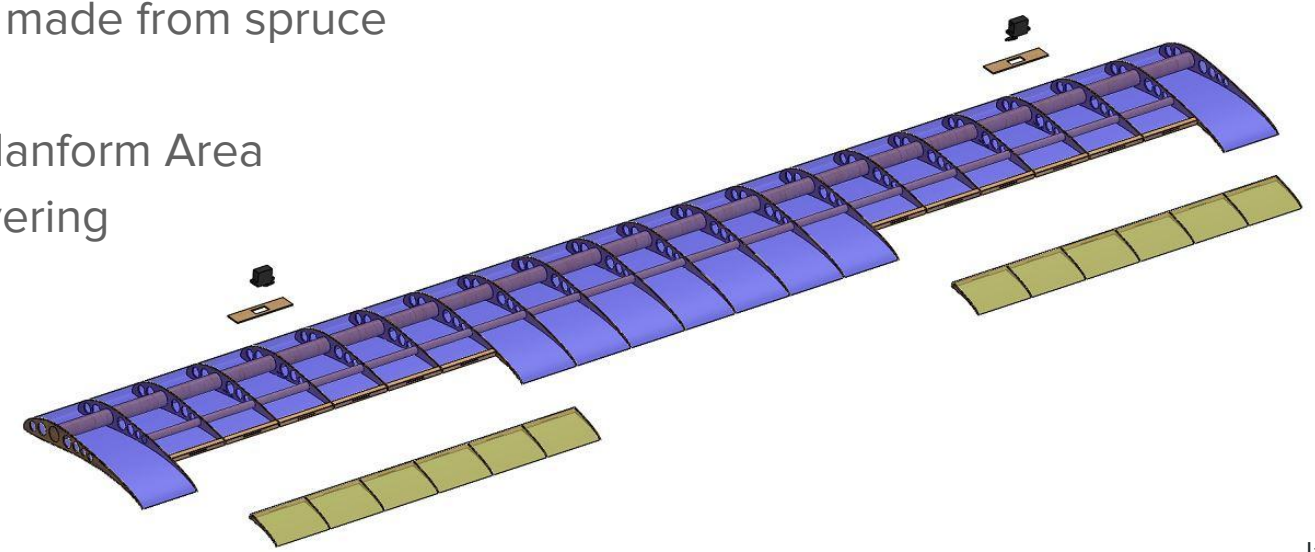
- **Wings:** Rectangular wing with Selig 1223 airfoil
- **Fuselage:** Rounded rectangular tapered body
- **Propeller/Powertrain:** Single two-blade propeller and brushless electric motor
- **Landing Gear:** Tricycle wire landing gear
- **Tail:** GOE 443 Symmetric Airfoil

First Iteration CAD Model



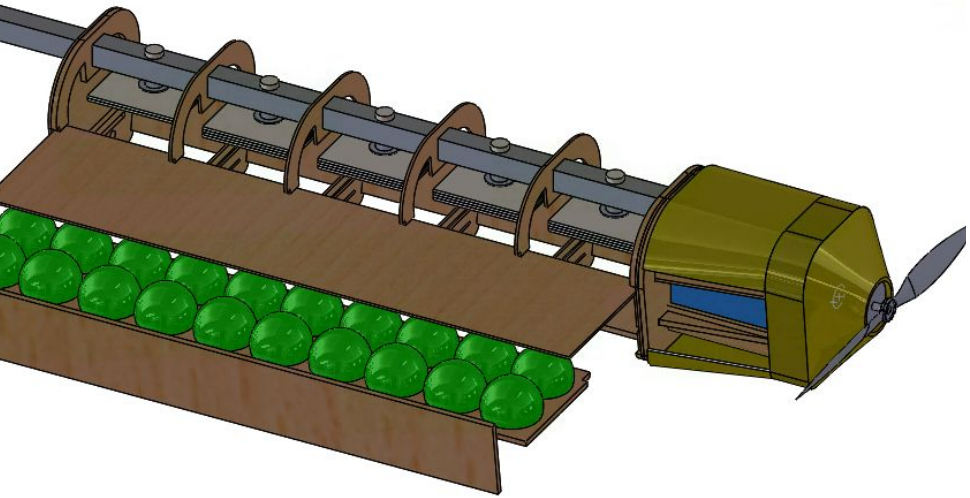
Wing Design

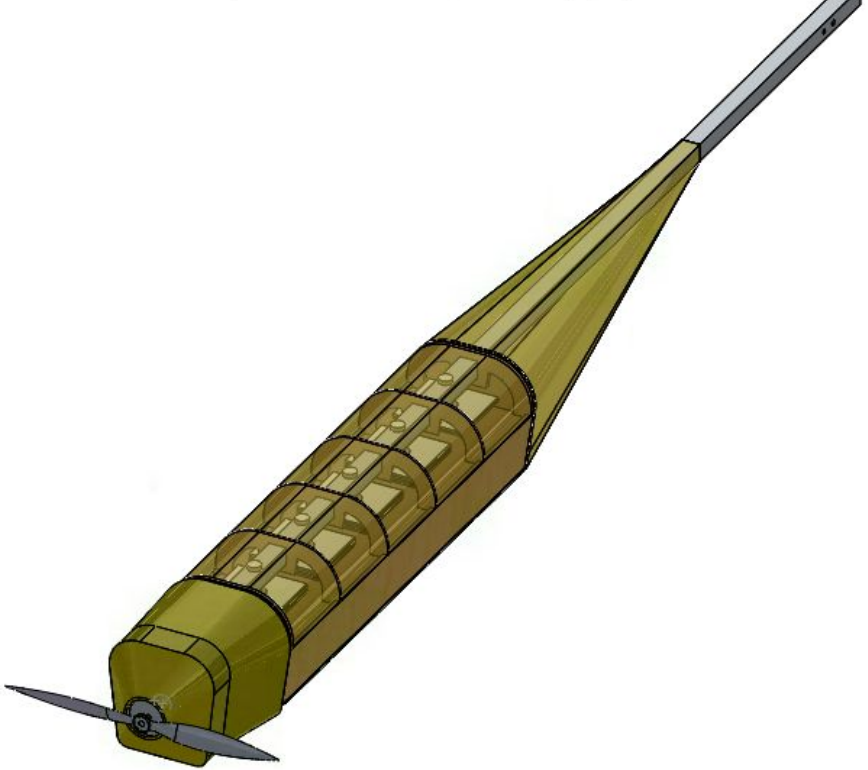
- Aspect Ratio: 7.33
- Wingspan: 11 feet
- Ribs made from Balsa Wood
- 2 Spar design made from spruce or Pine Wood
- Rectangular Planform Area
- Monokote covering
- Two Ailerons
- Wing mounted Servos
- Fiber pivot system



Fuselage Design

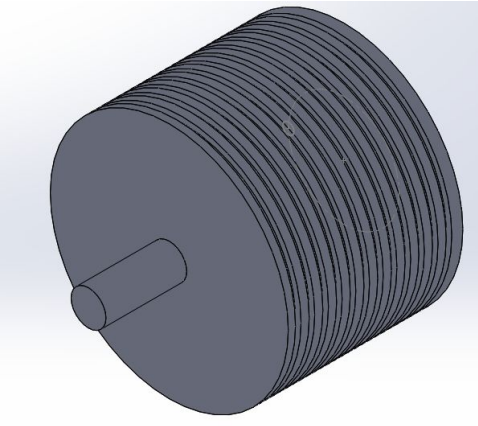
- Quickly load/unload payload from side
- Maximize payload
- Minimize weight
- Minimize drag

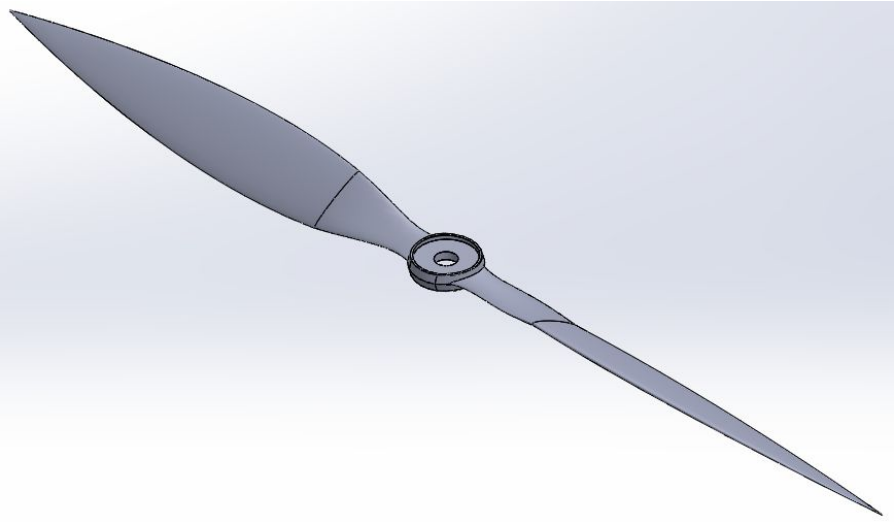




Propeller & Power Train

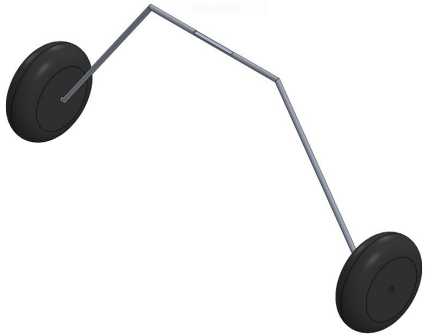
- 16x8 Propeller (16 inch diameter and 8 inch pitch)
- 4625 Brushless Electric motor by NeuMotors
- 1000 Watt Power Limiter
- 4.65 Kg of Rated Thrust output by propeller and motor combo
- 22.2 V 6C 5000mAh Battery





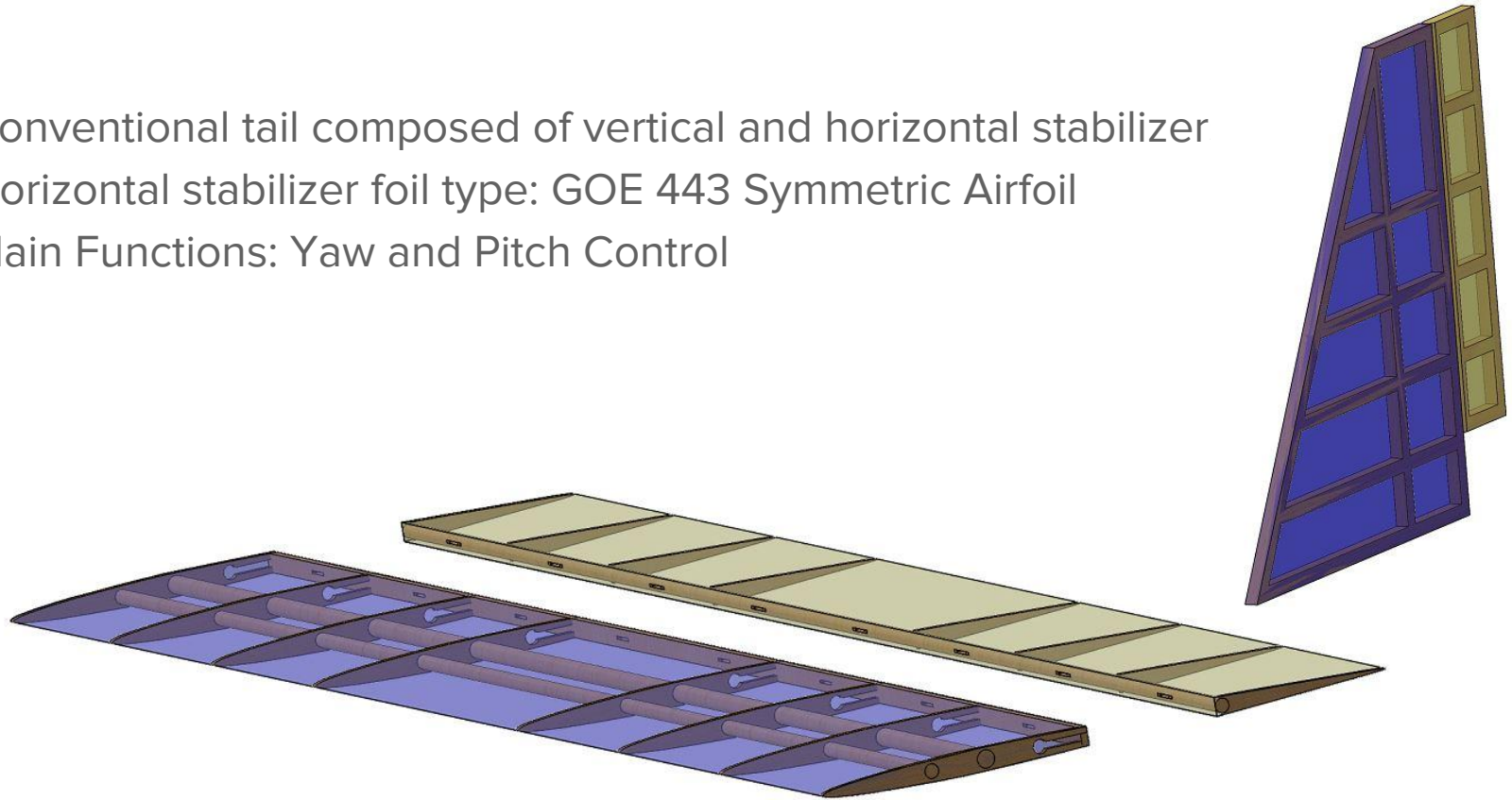
Landing Gear

- Tricycle Configuration- Easier to land
- Wire main wheels
- Nose gear used for steering
- Music Wire

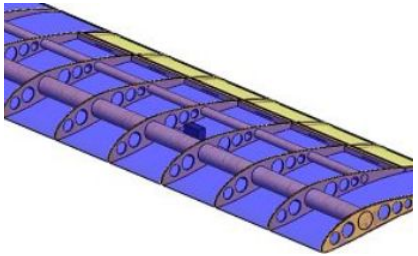


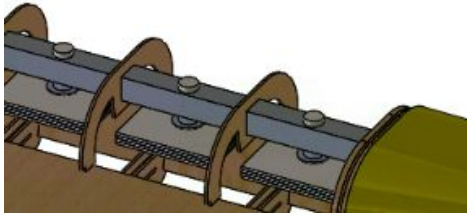
Tail

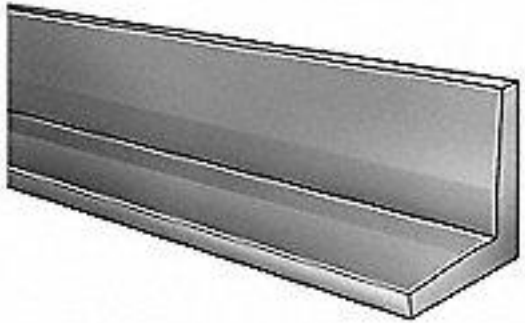
- Conventional tail composed of vertical and horizontal stabilizer
- Horizontal stabilizer foil type: GOE 443 Symmetric Airfoil
- Main Functions: Yaw and Pitch Control



Ideas For Second Iteration







Design Requirements

Customer Requirements:

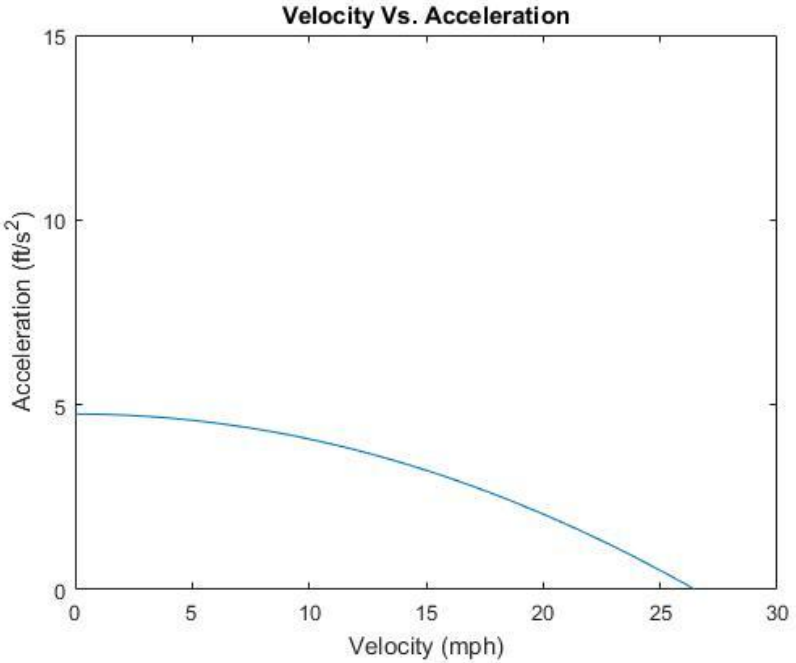
- Original design
- Fixed wing aircraft
- Cargo plane
- Safe
- Electric motor

Design Requirements Continued

Conforming to Requirements:

- Design must be able to take off, fly, land
- Must carry a minimum payload of 6.5 pounds
- Must be able to achieve multiple flights
- Durable and or Repairable

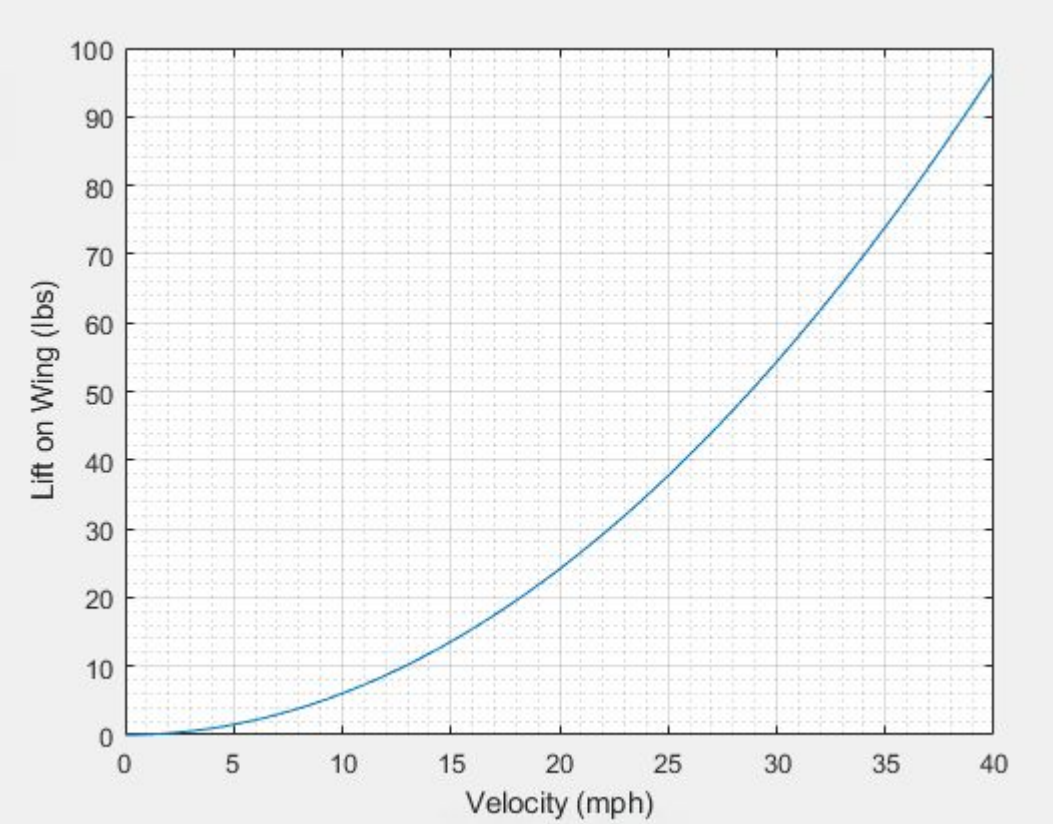
Drag Force and Thrust Analysis



Thrust: 1.628kg

	C_d
Fuselage	0.82
Main Wing	0.116
Horizontal Stabilizer	0.042
Vertical Stabilizer	0.001

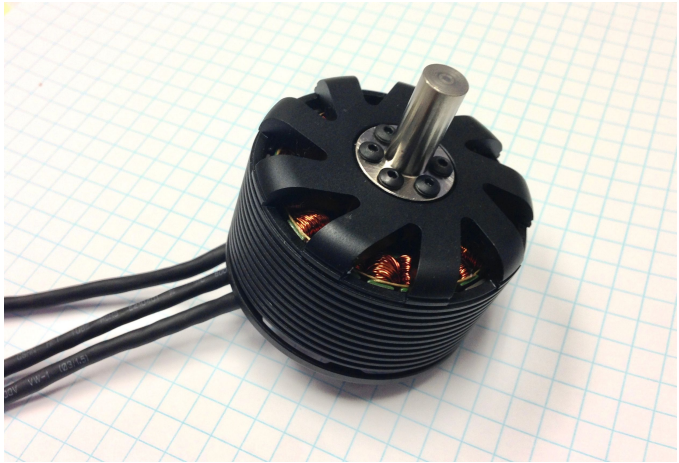
Lift for Estimated Velocity



At current design weight of 24 lbs, velocity needed for takeoff is 20 mph

Motor Analysis

- Velocity needed for level flight: 25.32 ft/s (17.26 mph)
- Velocity needed to takeoff: 30.40 ft/s (20.73 mph)
- Propulsive thrust power needed: 87.96 ft*lb/s
- Motor shaft power: 126.47 ft*lb/s

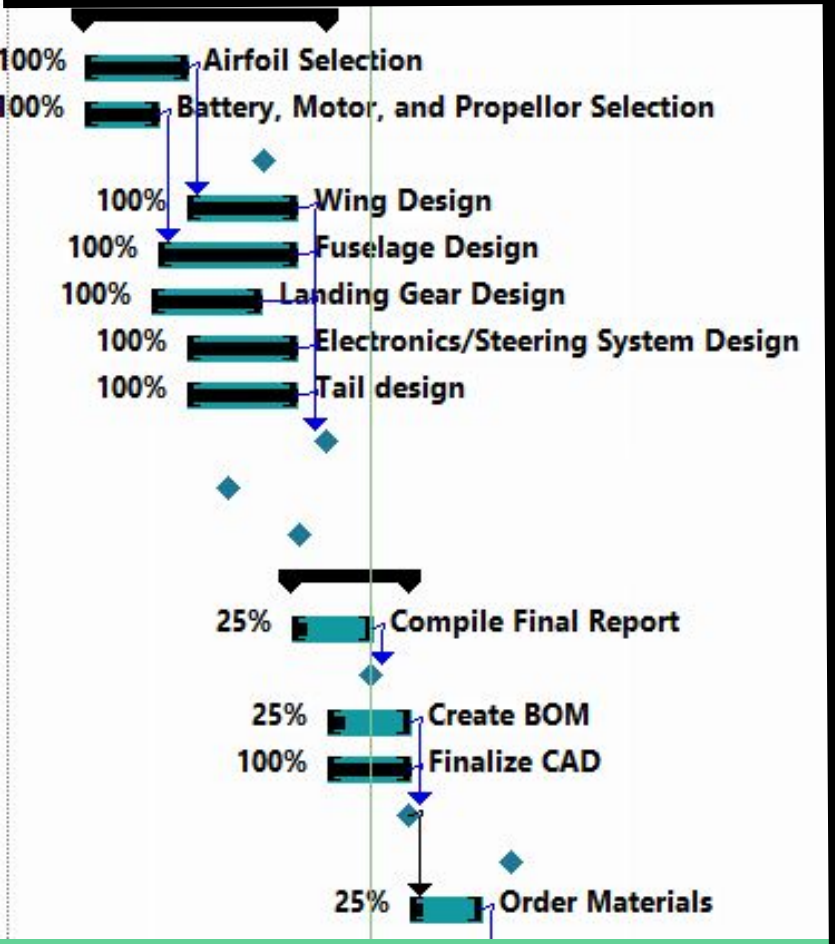


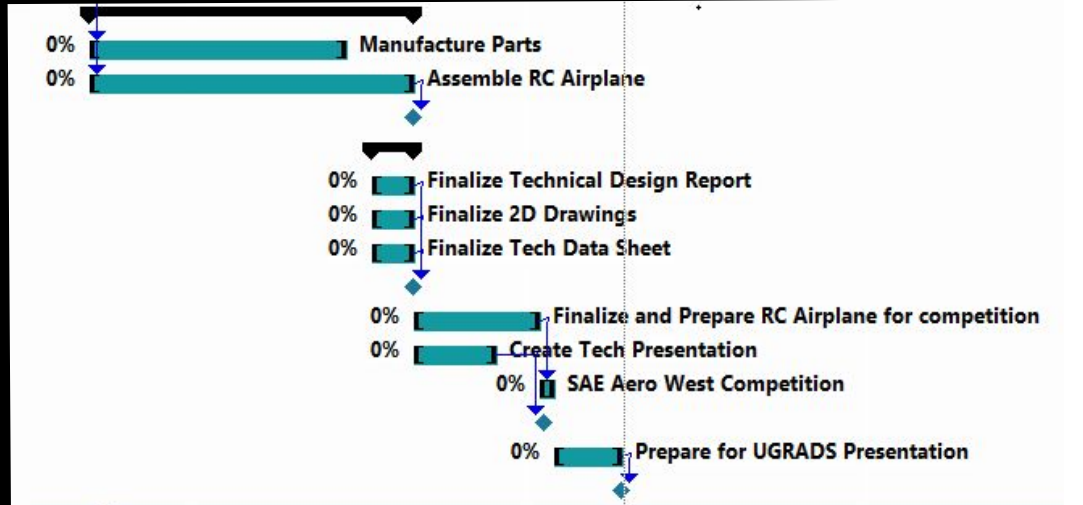
Budget

	Item	Cost	Current source of funding	Status
	Registration	$ 1,050.00	Engineering Department	paid
Insuring Safe Repeatable Flights	AMA Membership	$ 75.00		
	Real Flight controler	$ 90.00	Engineering Department	Requesting
	part/material/manufacturing cost estimaes	$ 1,100.00	Capstone Funding	paid/ finalizing/ requesting
travel estimates	hotel (Airtel Van Nuys)	$ 495.00	NAU SAE club / ASNAU	reserved
	gas	$ 400.00		
	total	**$ 3,210.00**		
	estimated total currently without funding source	**$ 75.00**		

Team Skyjacks								
Part #	Part Name	Qty	Description	Functions	Material	Dimensions	Cost	Link to Cost estimate
1	Selig Airfoil		Rib	Support Wing	Balsa	18x2x.125	$0.50	zon.com/Balsa-Wood-Sheet-36-pack/
2	Power limiter	1	1000W SAE limiter	Required by SAE			$225	motors.cartloom.com/storefront/prod
3	Motor	1	NeuMotors 4625 motor	rotate prop				motors.cartloom.com/storefront/prod
4	ESC	1	Castle Phoenix Edge Lite 100	communicate with remote				motors.cartloom.com/storefront/prod
5	Prop Adapter	1	8mm Prop adapter	connect prop to motor				motors.cartloom.com/storefront/prod
6	Red Arming Plug	1	Maxx Products 6970	Required by SAE			$21.94	81&pd_rd_wg=Z1UMc&pf_rd_i=desk
7	Battery	1	5000mAh 6 cell 22.2v 30C	provide power			$125	one.com/batteries/lipo/6-cell-and-up/
8	Propellers	8	different sizes	provide thrust	plastic, carbon fiber		$50	tps://www.apcprop.com/product/16x
9	Fuselage spar	1	square 1/8" aluminum tubing	increase aircraft strength	aluminum	96x1x1	$19.54	-1-in-x-48-in-Aluminum-Square-Tube
10	Small fuselage ribs	6	fuselage ribs	provide shape	balsa wood	7.15x6.75x1/8	$25	=sr_1_1_sspa/144-3906938-579134
11	Large fuselage ribs	5	fuselage ribs	secure fuselage	plywood	7.15x6.75x1/4	$25	p/1-4-in-x-4-ft-x-8-ft-BC-Sanded-Pin
12	Servos	4	Tactic TSX10 Micro Digital High-Torque MG BB Servo	Move rudder, ailerons, elevator, nose gear		0.9x0.48x1.1	$64.00	TACM02108&P=FR&gclid=EAIaIQobCh
13	Music Wire	4	Flite Test Medium Landing Gear Wire	Support airframe during landing	Aluminum	15.5x0.125	$10.00	r-wire-4-flt-2065/p785011?gclid=EAI
14	Landing Gear Wheels	2	Dubro 3" Smooth Surface Wheels	Support airframe during landing	Rubber	1.10x3.0	$10.96	c&utm_source=google&utm_campaig
15	Wing Main Spar	1	6061 Aluminum Round Tube	Connect wing ribs	Aluminum	144x1.50	$30.36	inum-round-tube?gclid=EAIaIQobCh
16	Wing Secondary Spar	1	6061 Aluminum Round Tube	Connect wing ribs	Aluminum	144x0.75	$42.72	inum-round-tube?gclid=EAIaIQobCh
17	Monokote	2	Top Flite Monokote	Wrap wings, tail, and fuselage	Monokote	300x26	$180.00	tp://www.monokote.com/opaque.ht
18	3D Printed Nose	1	Nose Cone	Hold motor	PLA	7.15x6.75x5	$20.00	https://nau.edu/library/3d-printing/
19	GOE 443 Tail Airfoil	10	Tail Rib	Support Tail	Balsa	5x0.5x0.125	$0.50	zon.com/Balsa-Wood-Sheet-36-pack/
Total Cost Estimate:							$850.52	

Schedule





Airfoil selection and wing design:
Caleb and James

Battery, motor, electronics, and propeller selection:
Damian and Braden

Fuselage design:
Caleb

Landing gear:
Braden

Tail:
Angel and Damian

References

[1] J. D. Anderson, *Fundamentals of aerodynamics*, 6th ed. New York, NY: McGraw-Hill Education, 2017.

[2] Staples, G. (2014). *Propeller Static & Dynamic Thrust Calculation - Part 2 of 2 - How Did I Come Up With This Equation?*. [online] Electricrcaircraftguy.com. Available at: https://www.electricrcaircraftguy.com/2014/04/propeller-static-dynamic-thrust-equation-background.html [Accessed 2 Oct. 2018].

Questions?