



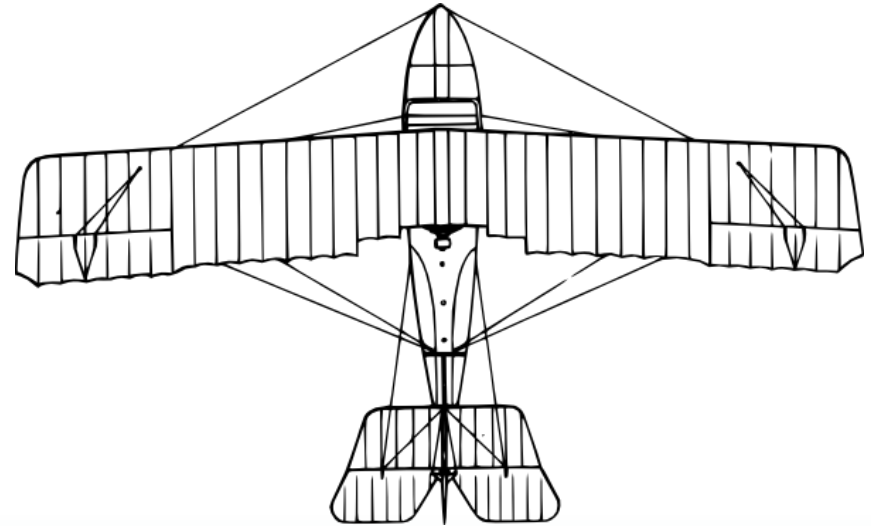
The Wright Stuff

Progress Report
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Agenda

- Competition Overview
- Final Concept
- Analysis
 - Spar Design
 - Static Thrust Testing
 - Takeoff
- Construction Progress
- Financial Overview
- Project Timeline



Competition Overview

- **Customer**
 - Society of Automotive Engineers (SAE)
- **Project**
 - Aero Design West Competition
 - Self-motivated, self-funded project
 - Test of individual and group capabilities

Problem Statement

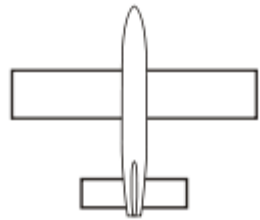
- **Needs Identification**
 - Current remote controlled aircraft do not carry sufficient payload
- **Goal**
 - Introduce precision manufacturing techniques into RC aircraft design

Design Constraints

- **Mission Objectives**
 - Flight Demonstrations
- **Design Limitations**
- **Test Environment**
 - Phoenix, AZ
 - Equivalent atmospheric conditions



Final Concept



Constant Chord



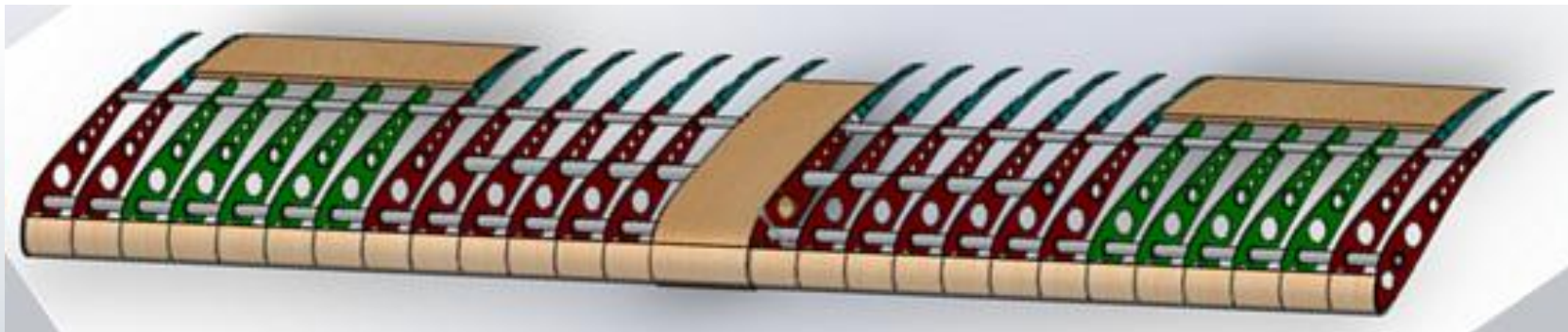
Single High Wings



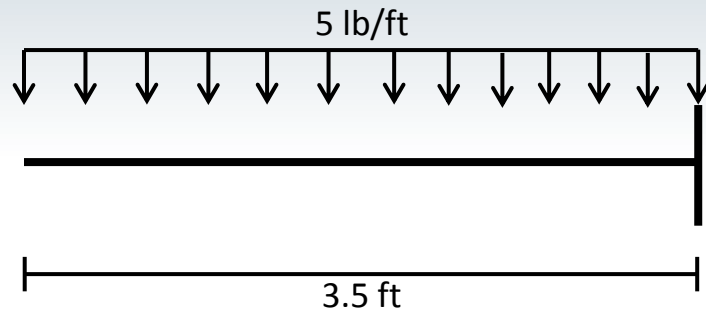
Normal Tail

Final Concept

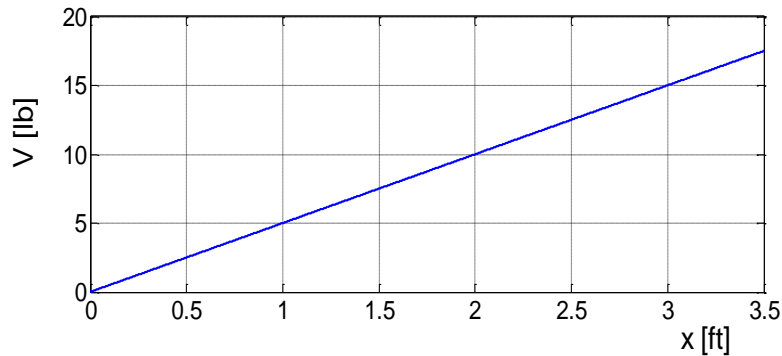
- **Spars**
 - Hollow aluminum tubing
 - Solid wood extensions
- **Ribs**
 - 3D printing with ABS polymer



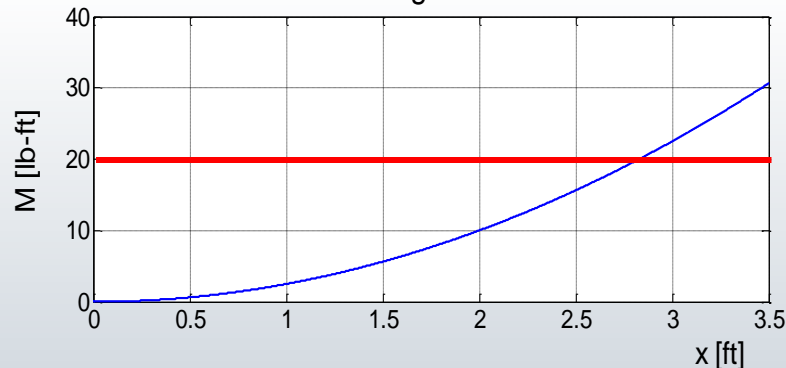
Spar Design



Shear Force



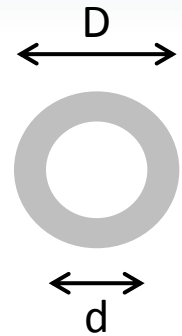
Bending Moment



$$FS = \frac{S_y}{\sigma}$$

$$\sigma = \frac{Mc}{I}$$

$$I = \frac{\pi}{64} (D^4 - d^4)$$



Spar	Front	Rear	Middle
Length (ft)	7	7	1.5
OD (in)	1/2	3/8	5/8
Min FS	1.7	1.5	3.7

Static Thrust Testing

- Four propellers tested

Prop Size	RPM	Thrust (N)
11X7	11,400	24.5
12X7	10,000	23.2
13X4	10,500	32.4
14X4	9,300	36.3

- Selected:
 - 13 x 4
 - Maximum Thrust: 7.3 lb
 - Within preferred RPM range for engine



Motor Break-In



Static Thrust Test Stand

Takeoff

- 1D dynamics problem
- Inputs:
 - Airfoil characteristics
 - Plane mass
 - Static thrust
- Output:
 - Distance to desired velocity

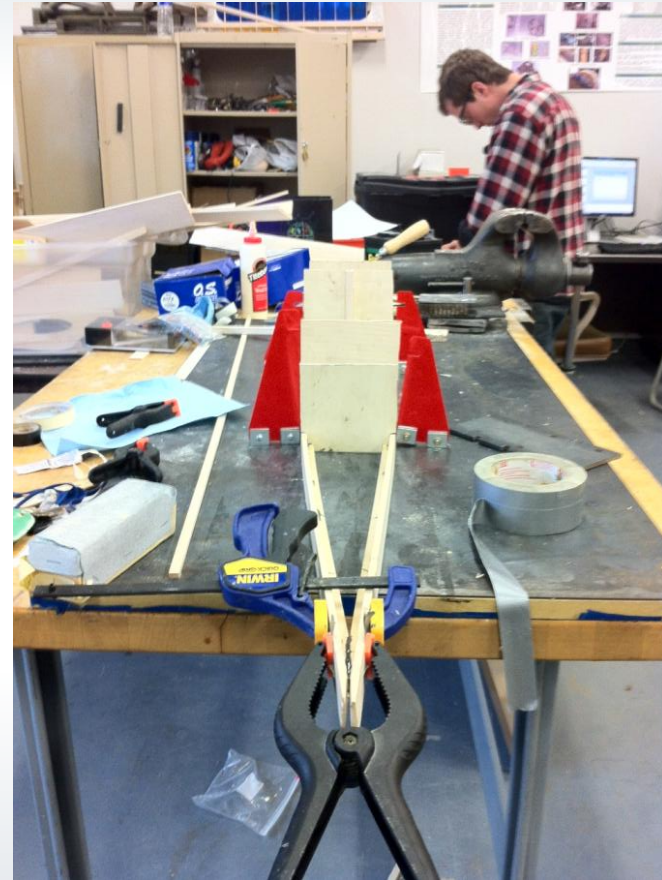
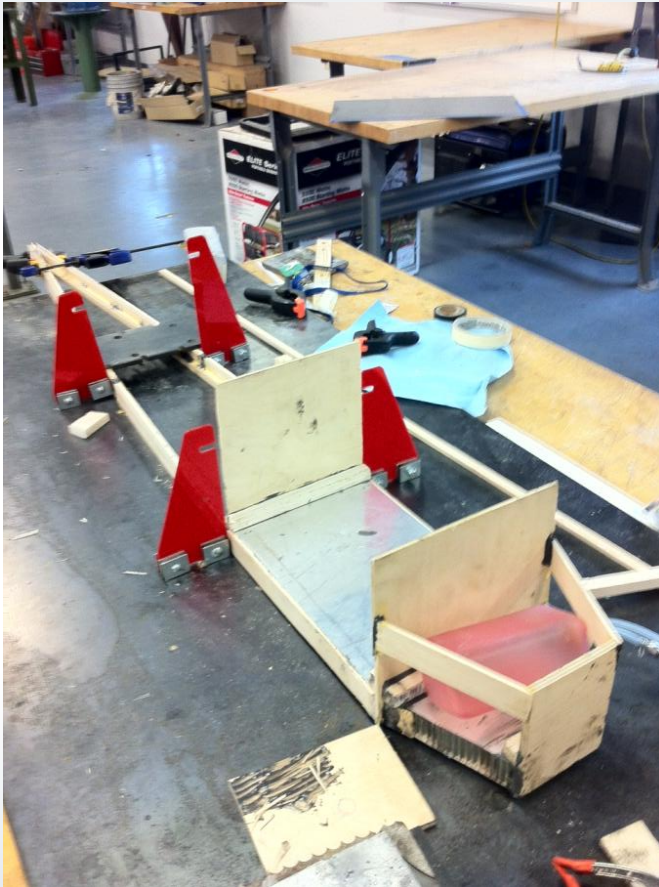


$$V^2 = V_0^2 + 2a(x - x_0)$$

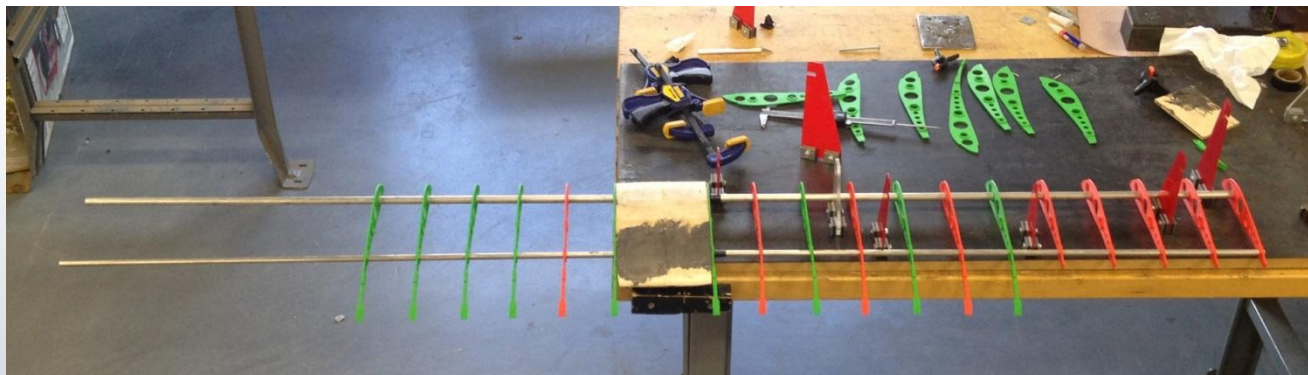
$$x = V^2/2a$$

Summary of Takeoff Characteristics		
Static Thrust	(lb)	7
	(N)	32
Plane Weight	(lb)	40
	(N)	18
Plane Acceleration	(ft/s ²)	6
	(m/s ²)	2
Desired Velocity	(ft/s)	48
	(m/s)	15
Distance	(ft)	194
	(m)	59

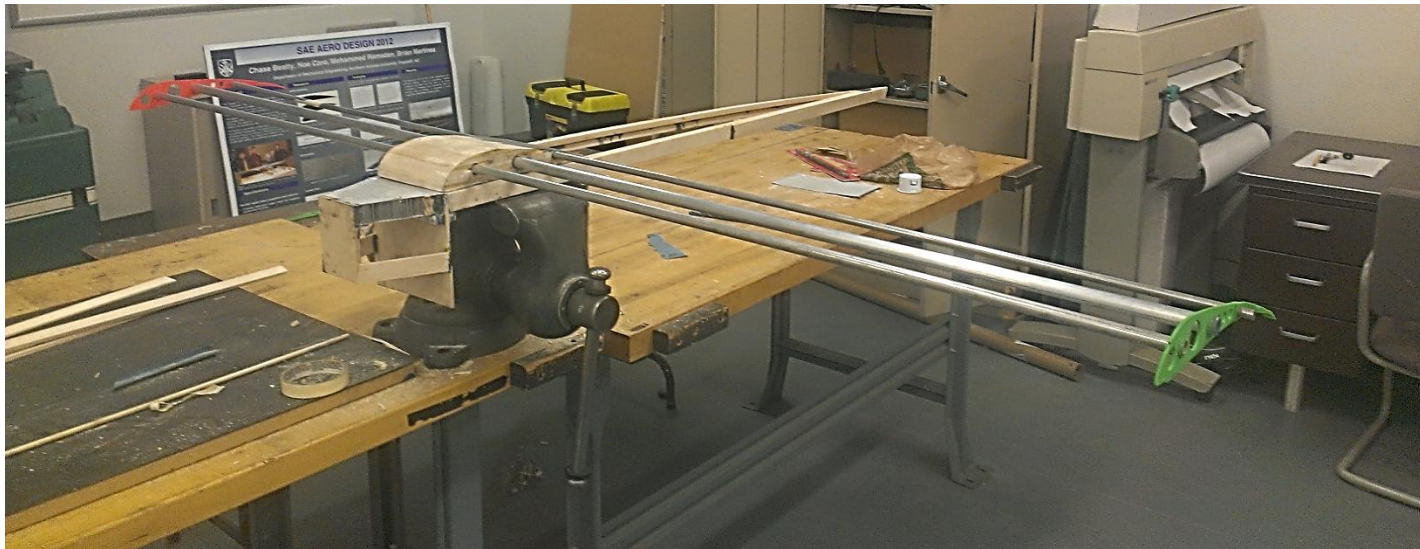
Construction Progress



Construction Progress



Construction Progress

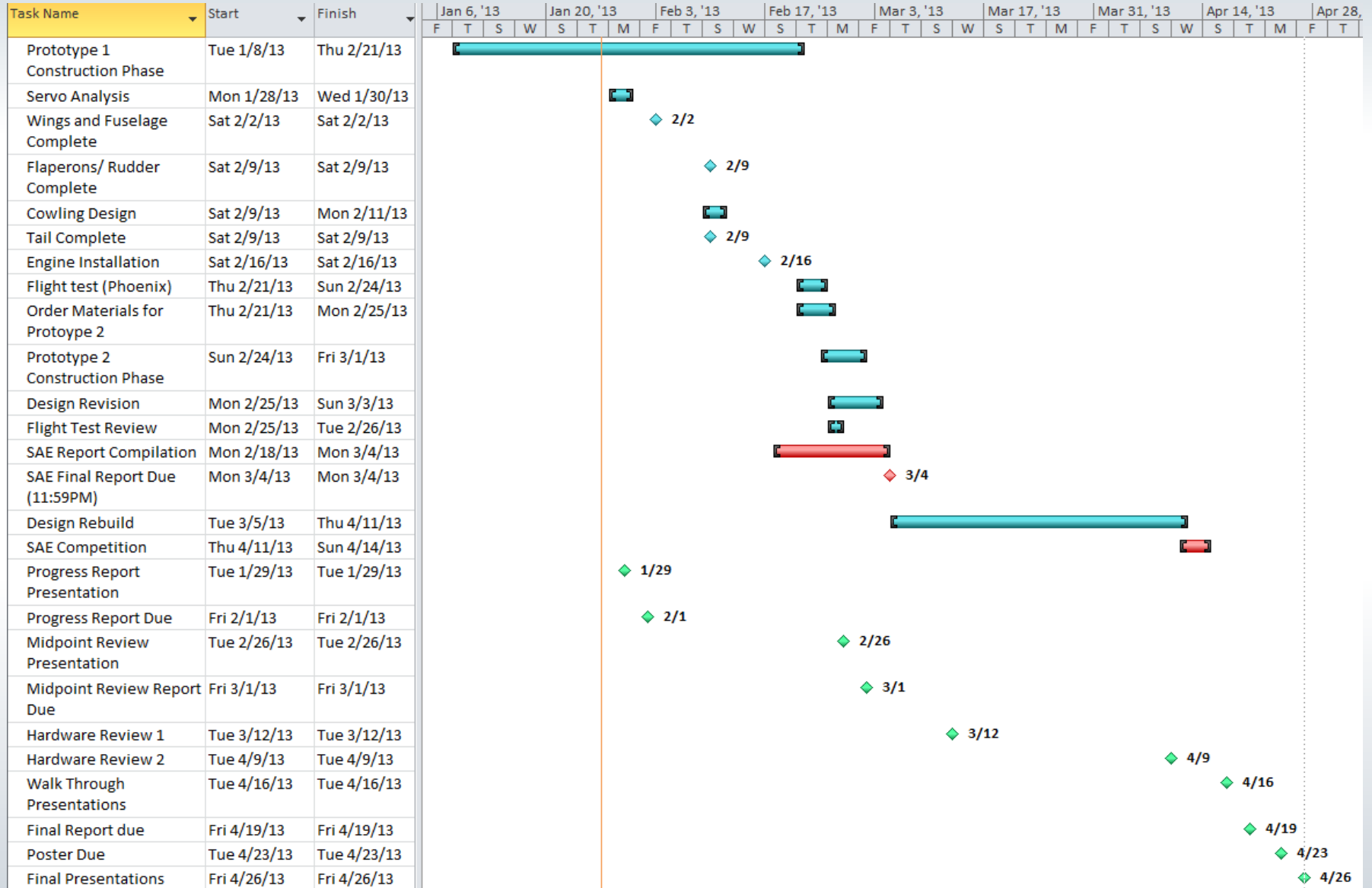


Financial Overview

Building Budget	\$1,835
Travel Budget	\$2,250
Competition Budget	\$870
Total Budget	\$5,000
Expenses	\$2,762
Remaining Budget	\$2,238



Project Timeline



Questions?