

The Wright Stuff

Progress Report January 2013 Aaron Lostutter Adam Nelessen Brandon Perez Zev Vallance Jacob Vincent



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



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



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

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

$$V^{2} = V_{o}^{2} + 2a(x - x_{o})$$

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

Summary of Takeoff Characteristics										
Static Thrust	(lb)	7								
Static mirust	(N)	32								
Dlana Waight	(lb)	40								
	(N)	18								
Plane	(ft/s^2)	6								
Acceleration	(m/s^2)	2								
Desired Valasity	(ft/s)	48								
Desired velocity	(m/s)	15								
Distance	(ft)	194								
Distance	(m)	59								



Construction Progress







Construction Progress









Construction Progress





Financial Overview

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





Project Timeline

Task Name 🚽 👻	Start 🚽	Finish 🚽	Ja	n 6, ':	13	st w	an 20, s т	'13 M	Fe	b 3, т	'13 S	W	Feb 1	17, '13 T	M	Mai	r 3, '13 T S	3 W	Mar	17, '13 T	B M	Ma	r 31, ' T	13 S M	Ap	r 14,	'13 M	Apr	r 28,
Prototype 1 Construction Phase	Tue 1/8/13	Thu 2/21/13											0	<u>ן</u>										<u> </u>					-
Servo Analysis	Mon 1/28/13	Wed 1/30/13																											
Wings and Fuselage Complete	Sat 2/2/13	Sat 2/2/13							\$ 3	2/2																			
Flaperons/ Rudder Complete	Sat 2/9/13	Sat 2/9/13									\$ 2	2/9																	
Cowling Design	Sat 2/9/13	Mon 2/11/13									[]																		
Tail Complete	Sat 2/9/13	Sat 2/9/13									2	2/9																	
Engine Installation	Sat 2/16/13	Sat 2/16/13										<	2/:	16															
Flight test (Phoenix)	Thu 2/21/13	Sun 2/24/13											I	C 3															
Order Materials for Protoype 2	Thu 2/21/13	Mon 2/25/13											1	כ	1														
Prototype 2 Construction Phase	Sun 2/24/13	Fri 3/1/13												C]														
Design Revision	Mon 2/25/13	Sun 3/3/13												C															
Flight Test Review	Mon 2/25/13	Tue 2/26/13												C	1														
SAE Report Compilation	Mon 2/18/13	Mon 3/4/13											C			2													
SAE Final Report Due (11:59PM)	Mon 3/4/13	Mon 3/4/13															3/4												
Design Rebuild	Tue 3/5/13	Thu 4/11/13														C													
SAE Competition	Thu 4/11/13	Sun 4/14/13																						C	2				
Progress Report Presentation	Tue 1/29/13	Tue 1/29/13							1/29																				
Progress Report Due	Fri 2/1/13	Fri 2/1/13							\$ 2	/1																			
Midpoint Review Presentation	Tue 2/26/13	Tue 2/26/13													¢ 2,	/26													
Midpoint Review Report Due	Fri 3/1/13	Fri 3/1/13													<	3/1	L												
Hardware Review 1	Tue 3/12/13	Tue 3/12/13																4 3	/12										
Hardware Review 2	Tue 4/9/13	Tue 4/9/13																						\	4/9				
Walk Through Presentations	Tue 4/16/13	Tue 4/16/13																							•	\$ 4/	16		
Final Report due	Fri 4/19/13	Fri 4/19/13																									4/19		
Poster Due	Tue 4/23/13	Tue 4/23/13																										4/23	
Final Presentations	Fri 4/26/13	Fri 4/26/13																										4/	26

Questions?