

ME, ECE, BE Capstone Design Programs



Team #33A: 2015 SAE Aero Design East Regular Class Aircraft

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Background

The Society of Automotive Engineers (SAE) holds a collegiate aircraft design competition every year. The competition scoring is based off of completed flights, design report (50 pts), and oral presentation (50 pts).

The final flight score (FFS) is based on the weight of the payload carried (R_n) for each flight round, max payload prediction bonus (B_n), and the total amount of penalty points (T) deducted.

$$FFS = \sum_1^n R_n - \sum T + B_n(max)$$

Objective

To design, test, and manufacture a radio controlled aircraft within the constraints set forth by SAE which can carry a payload of 25 pounds and place within the top three of the 2015 SAE Aero Design Series East Competition.

Constraints

Dimensions	Length + Width + Height = 175 in
Maximum Combined Weight	55 lbs
Power Limiter	1000 W
Prohibited Materials	Fiber-Reinforced Plastics (FRP), Lead, and Metal Propellers
Battery	6 cell (22.2 V) LiPo, Min 3000 mAh
Take Off	200 ft within 3 minutes
Landing	400 ft controlled landing

Materials

Materials were chosen because of their high strength and low weight.

- Competition Grade Balsa
- Sitka Spruce
- 6061 – T6 Aluminum
- Monokote
- Cyanoacrylic adhesive

References

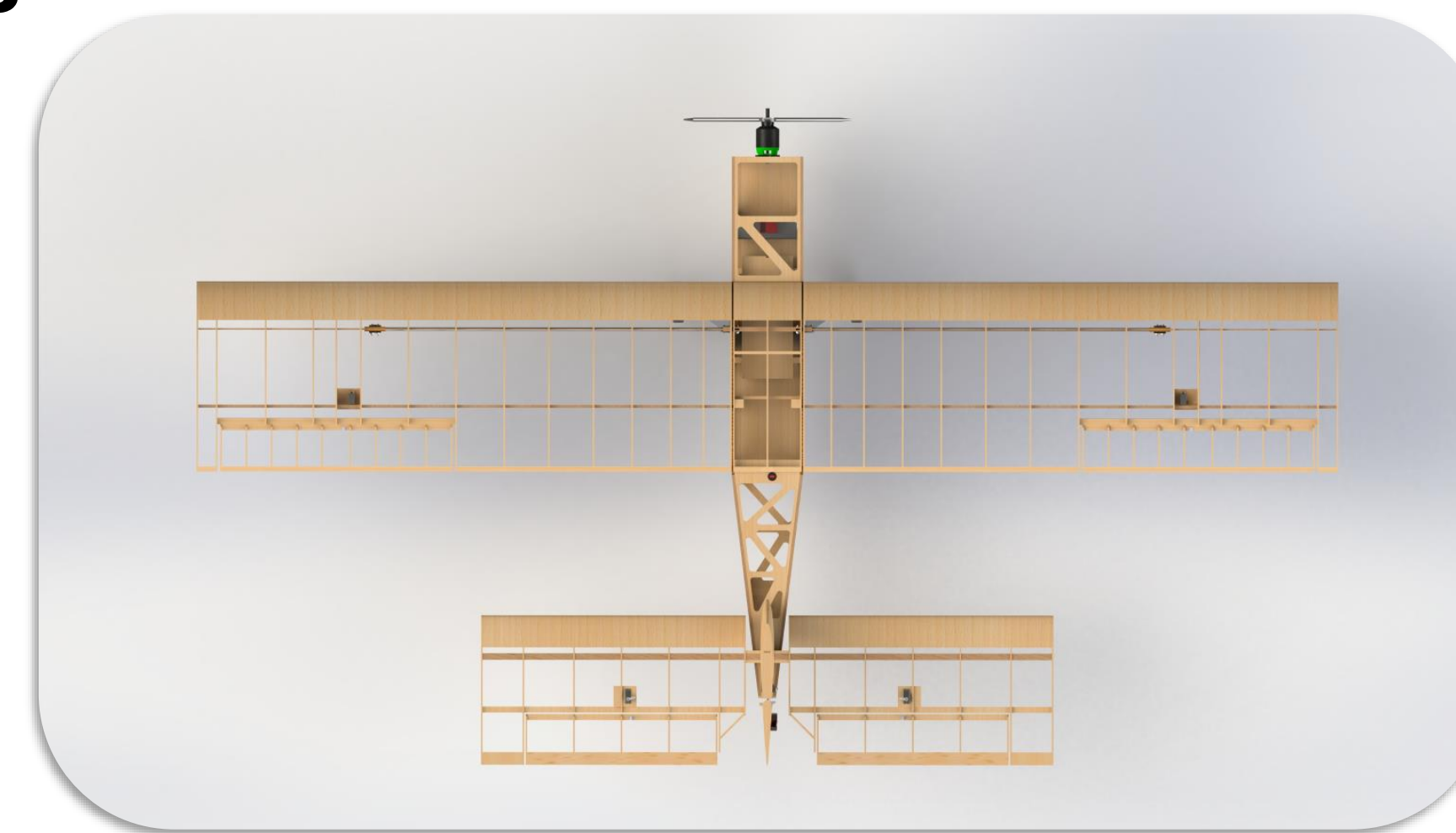
1. Nicolai, Leland M., *Estimating R/C Model Aerodynamics and Performance*. Lockheed Martin Aeronautical Company, June 2009.
2. SAE International. 2015 Collegiate Design Series, SAE Aero Design East and West
3. Corke, Thomas C. *Design of Aircraft*. 2003 Pearson Education, Inc.



Flight Round #2 of SAE Aero East Competition

Plane Specifications

Dimensions	Length = 57 in
	Width = 96 in
	Height = 20 in
Airfoil	Eppler 423
Wing Span	96 in
Chord length	16 in
Aspect Ratio	6
Empty Weight	9.4 lbs
Payload Weight	25 lbs



Competition Results

Design Report	43.37
Oral Presentation	31.93
Total Flight Score	42.86
Total Competition Score	118.16

Finished 8th out of 37 Teams

Schedule

Initial design completed	Nov 28
Begin manufacturing	Dec 14
First aircraft prototype built	Jan 23
Aircraft flight testing	Jan 24 – April 22
Competition	Mar 13-15

Safety

- Shunt plug (breaks the circuit between motor and battery)
- All participants must wear closed toe shoes
- Safety glasses must be worn at flight line
- Spinner or safety nut required
- Must fly within boundaries of course (avoid no-fly zone)

Manufacturing

- Balsa was laser cut in the Design Shop
- Payload was machined to shape
- Landing gear was manufacturing using the CNC machine
- Aircraft assembled using full scale drawings as a guide

Testing

Testing was performed on structural, electronics and the aircraft as a whole during flight testing. Below shows the testing apparatuses of the main spar structural test and propulsion system test.



Budget

