To Predict ▶ To Design ▶ To Perform

College of Engineering
Department of Mechanical & Industrial Engineering

ME, ECE, BE Capstone Design Programs

Team #33b: SAE Aero Design Micro Class

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Background

- The Society of Automotive Engineers have hosted Aero Design competitions since 1986 to challenge students to create remote controlled aircraft in innovative ways.
- Competition scoring consists of rounds of flight, design report, and design presentation.

Competition Requirements

Aircraft must:

- Fit in a 6" outer diameter tube whose length affects scoring (shorter length = higher score)
- Carry a payload that fits in a 1.5" x 1.5" x 5" bay
- Weigh less than 10 lbs, including carrying tube and payload
- Be hand-launched

Objectives

- Empty aircraft weight of 0.4 lbs
- Payload fraction of 0.75
- Tube length of 10 in
- Place in the top 3 overall

Concept Evaluation

Attribute	Weight (%)	low wing	mid wing	high wing	flying wing
Weight	25	3	3	3	5
Packability	25	4	3	4	1
Flight Stability	20	3	4	5	2
Lift/Drag ratio	15	3	3	2	5
Hand-launchability	10	2	4	4	2
Manufacturability	5	4	3	4	2
Total	**100**	**3.2**	**3.3**	**3.65**	**2.95**

Manufacturing

- Plane is disassembled in parts to fit in tube
- Laser cutter to cut structural pieces
- 3D printed tail mount and saddle bushings
- Heating gun/ iron to apply Ultracote lite

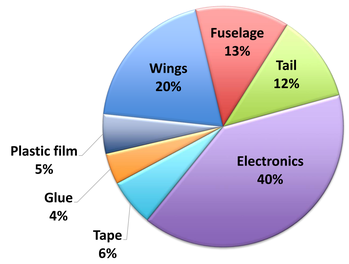
Materials

- Carbon fiber- boom and dowels
- ABS plastic- tail mount and bushings
- Competition balsa- structure
- Plywood- structure
- Ultracote Lite- aircraft skin
- Cyanoacrylate glue- assembly
- A36 steel- payload plates

Aircraft Specifications

Wing Span	30 in
Wing Chord	5.5 in
Boom length	13.45 in
Fuselage Length	7.5 in
Fuselage Height	2.75 in
Tail Span	12.6 in
Overall Length	24 in
Empty Weight	0.47 lbs

Empty Aircraft Weight Build-up



Takeoff Velocity Testing

- Weighted plane launched to test takeoff velocity
- Calculated speed: 19-22 MPH

Structural Testing

- Wing Loading: 2.8 lbs
- Boom-Fuselage Connection: 2.37 lbs
- Tail-Boom Connection: 0.77 lbs

Static Thrust Testing

- APC 7x4 SF generated 0.88 lbs of thrust with a 2S battery pack, meeting manufacturer's specifications

Safety

- Personal Protective Equipment during aircraft launch
- Propeller awareness when motor is live
- Red shunt plug mounted on top of airplane to open circuit

Budget

Competition	$1132.50
Travel Expenses	$2198.65
Raw Materials (wood, film coating, etc.)	$2206.81
Electronics	$1735.82
Total Spent	**$7273.78**
Total Remaining	**$726.22**

Schedule

First Prototype	January 15
Competition-Worthy Aircraft	January 25
SAE Design Report Submission	January 26
Payload Testing	March 9
Competition	March 13-15

Competition Results

Report Score	38.63 (14th)
Presentation Score	39.5 (5th)
Flight Score	75.25 (3rd)
Overall	**156.87 (5th)**

Conclusion

The aircraft was constructed with an empty weight of 0.47 lbs and carried 1.24 lbs of payload, resulting in a payload fraction of 0.73. The aircraft was assembled in less than 3 minutes and fits into a 6" outer diameter, 15.75" long tube. The team placed 5th overall in the competition.

Reference

"2015 Collegiate Design Series: East and West Rules". SAE 2014.

Sponsors: LaSPACE, LSU MIE Department, SolidWorks

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