



Concept Generation

FCAAP: AIAA Design Build Fly

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FCAAP

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Project Overview

OBJECTIVES:

- Design and build an electrically powered RC aircraft
- Complete 3 flight missions directed by the AIAA Design/Build/Fly competition
- Create a precise written report documenting the process (scored along with flight missions)

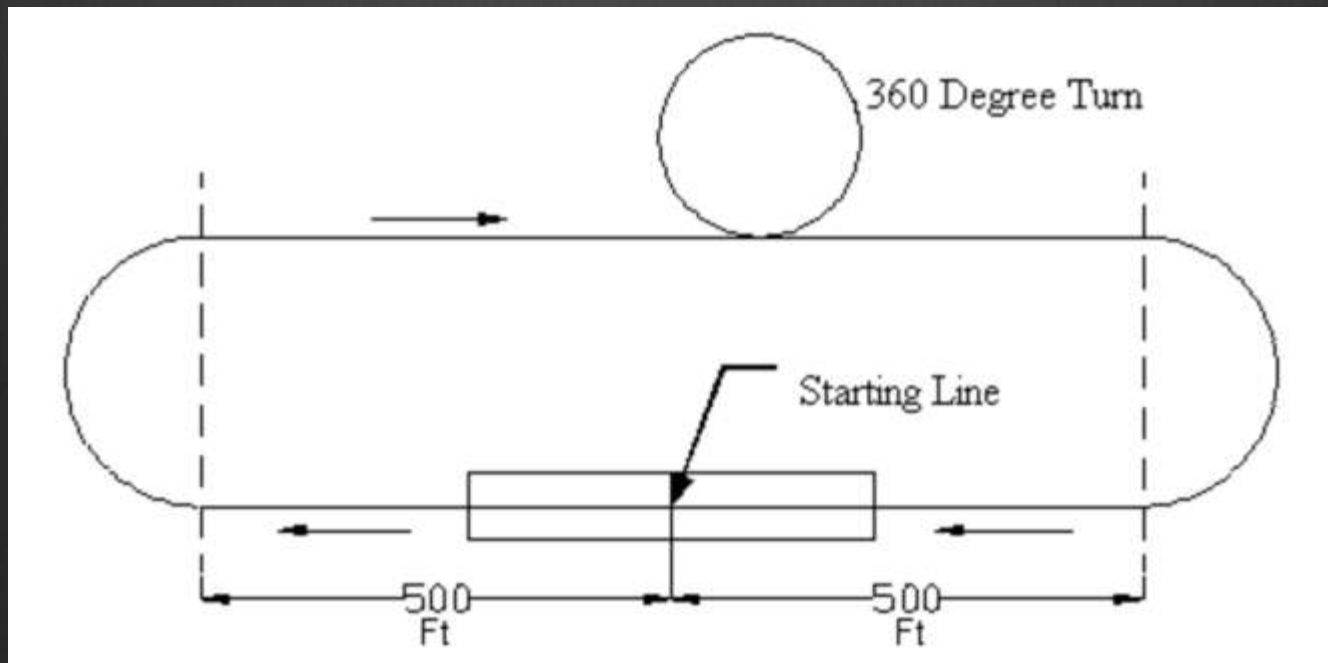




Mission Objectives

Mission 1:

- Take-off within the prescribed area.
- Maximum number of complete laps within a 4 minute flight time
- Mission score $M1 = 2 * (N_Laps_Flown / Max_N_Laps_Flown)$





Mission Objectives

Mission 2:

- Take-off within the prescribed area.
- 3 Lap internal-stores flight.
- Mission score $M2 = 4 * (N_Store_Flown / Max_N_Store_Flown)$





Mission Objectives

Mission 3:

- Take-off within the prescribed area.
- 3 lap mixed-stores (internal & external) flight.
- Mission score $M3 = 6 * (\text{Fastest_Time_Flown} / \text{Fastest Team_Time_Flown})$

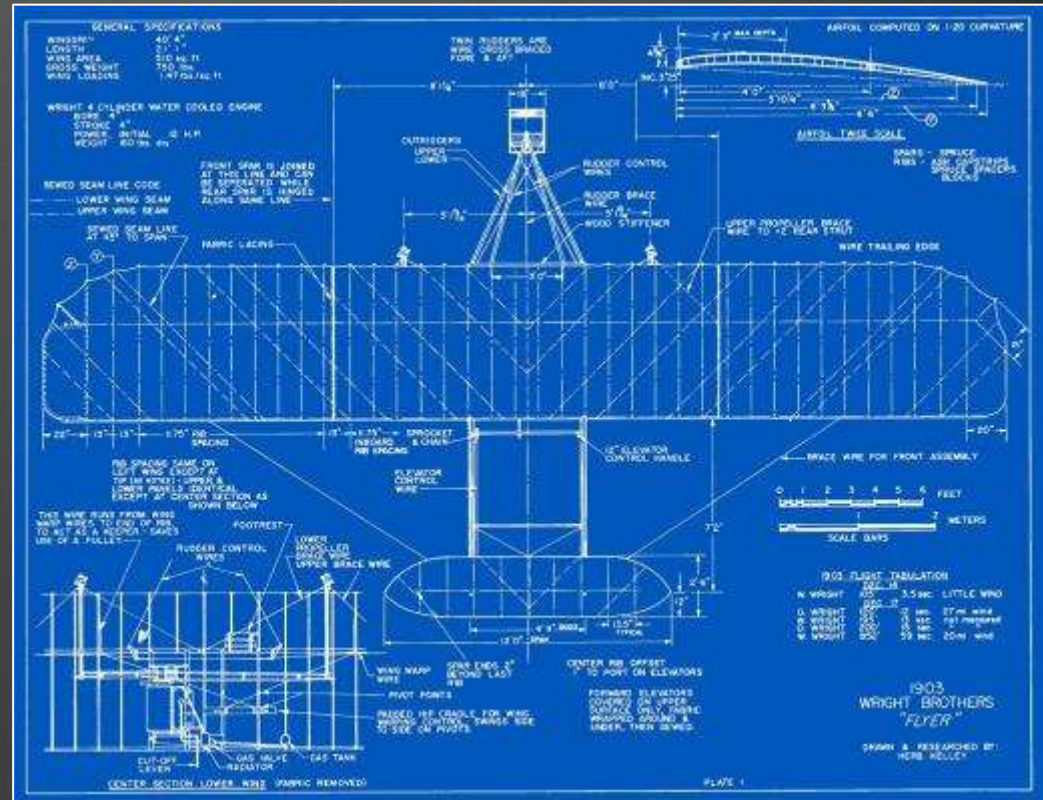




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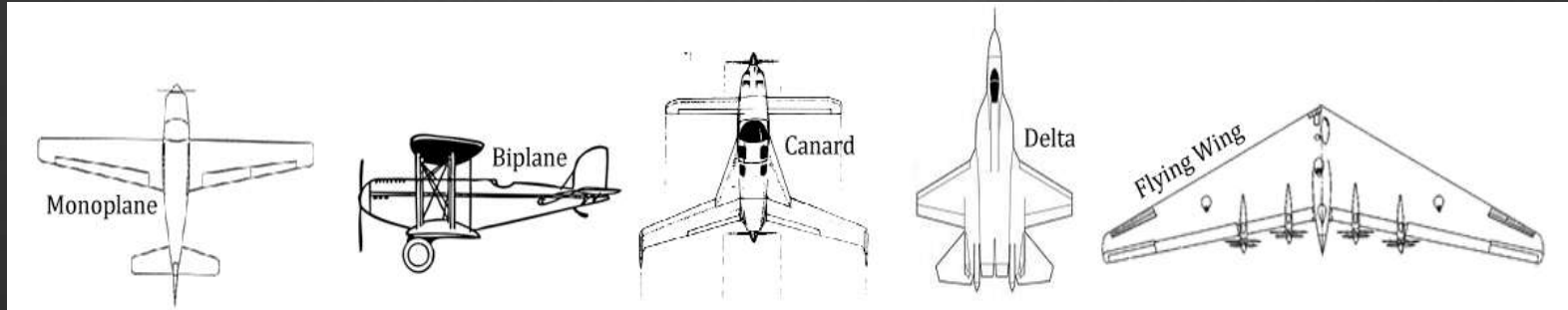
Subsystems:

- Wing
- Fuselage
- Tail
- Engine Configuration





Wing Selection



Monoplane:

- Stable flight characteristics
- Exterior storage capacity
- Light weight

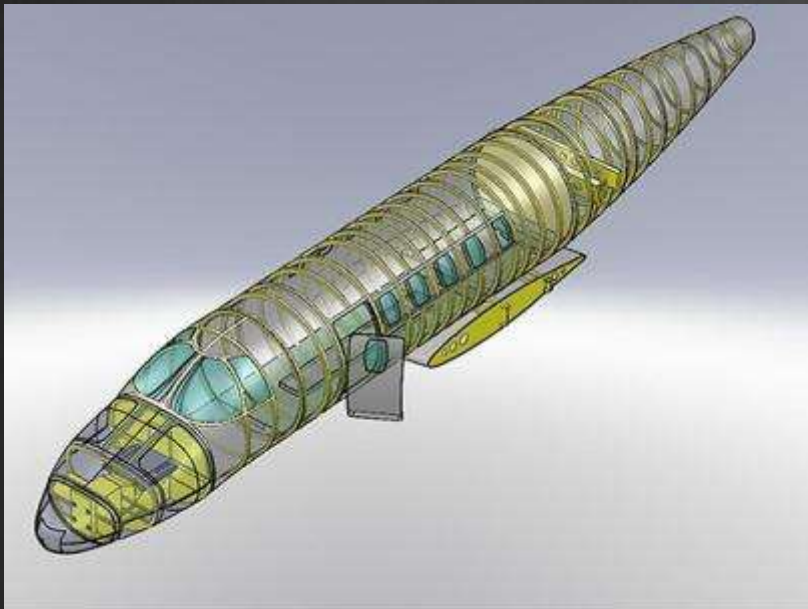




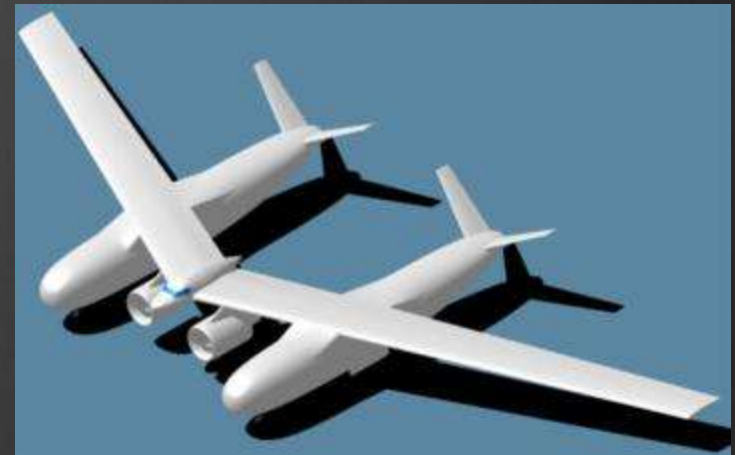
Fuselage Selection

Single Boom:

- Largest interior storage capacity
- Less overall drag and weight



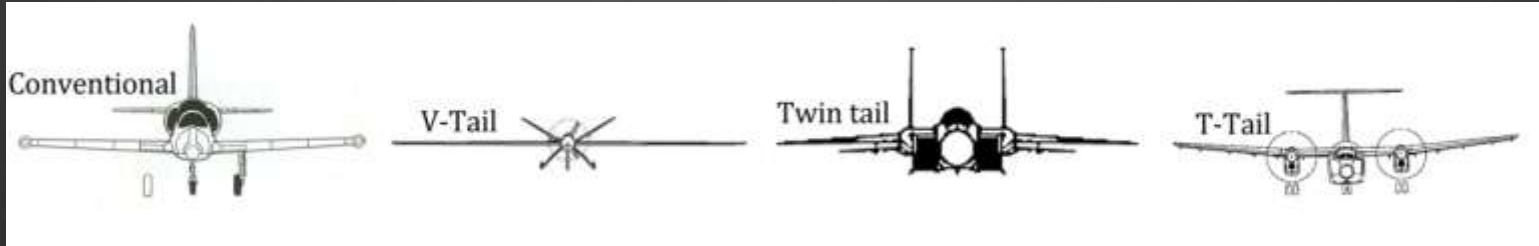
Blended Body:



Double Boom:

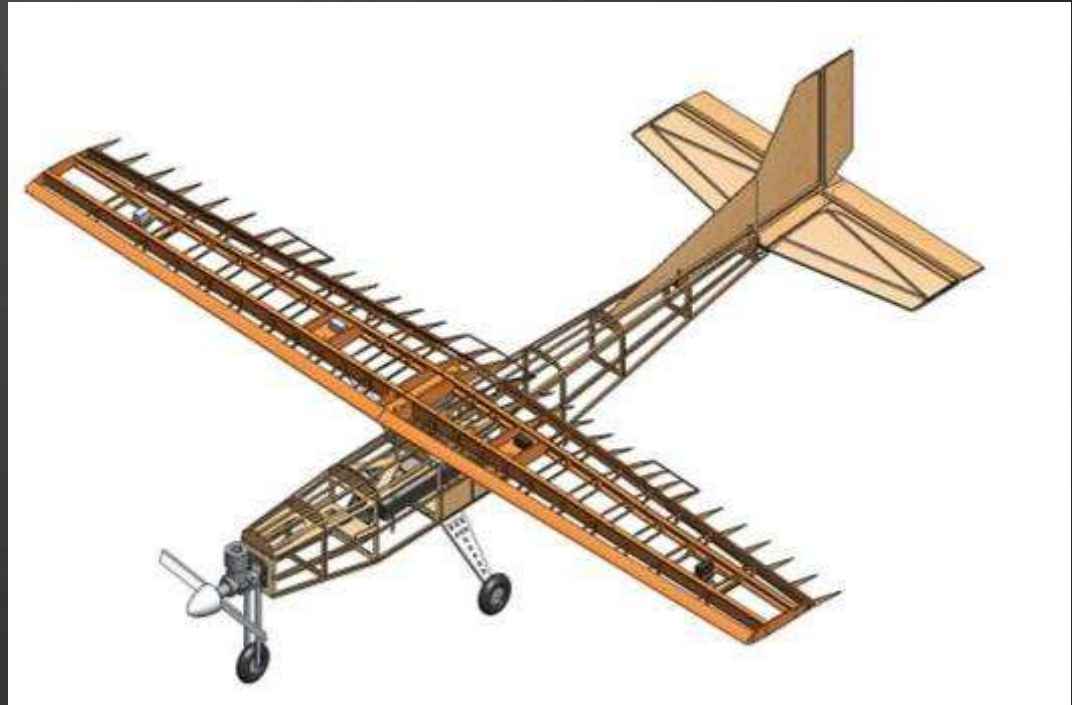


Tail Selection



Conventional Tail:

- Stable Flight Characteristics
- Increased Controllability
- Less Complex

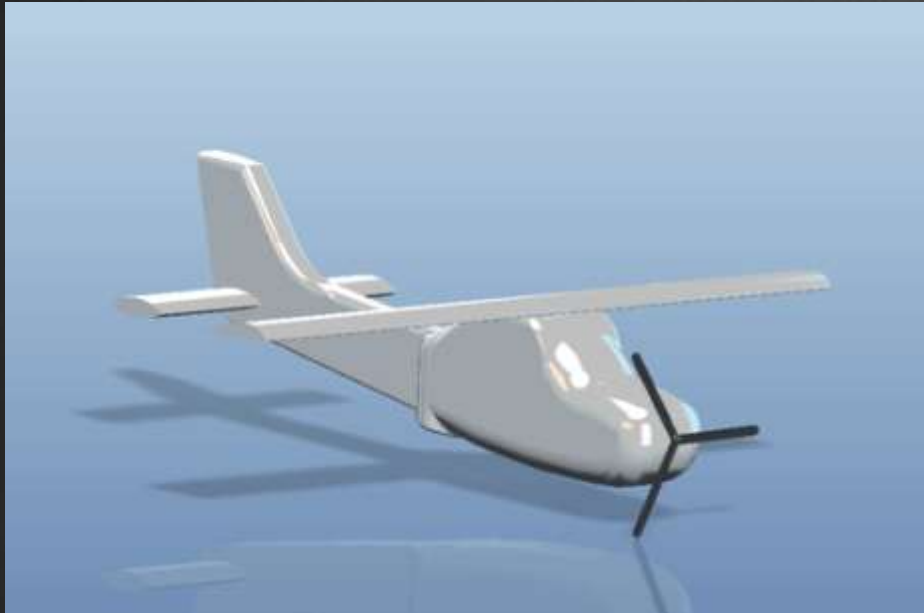




Engine Configuration

Tractor:

- Efficient propulsion
- Increased controllability
- Better performance



Pusher - Puller



Pusher



Ducted Fan

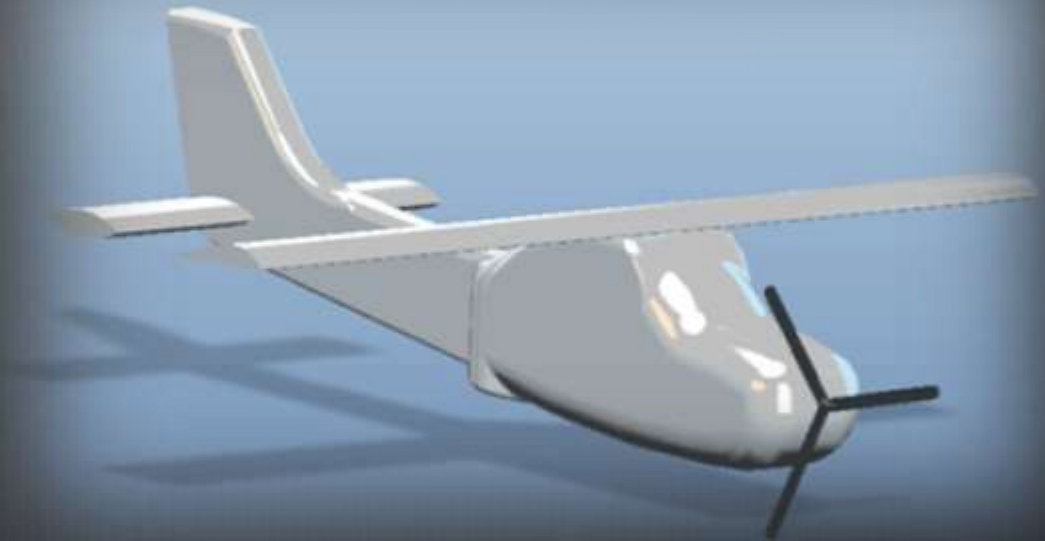




Concept Generation

Final Aircraft Configuration:

- Monowing
- Single Boom Fuselage
- Conventional Tail
- Tractor Configuration





Concept Generation

Questions ?



Cessna Aircraft Company
Raytheon Missile Systems
AIAA Foundation



Resources

Personal Aircraft Drag Reduction. Bruce Carmichael
“ATMOSPHERIC FLIGHT: AERODYNAMIC LIFT”. *NASAQuest*, NASA,
9 February 2012. (accessed September 29, 2012).
<<http://quest.nasa.gov/aero/planetary/atmospheric/aerodynamiclift.html>>.

C., Niculiță, A. Bencze, and I. Cădea. "AIRCRAFT WINGS: PRESENT AND FUTURE". *Bulletin Of The Transilvania University Of Brasov, Series I: Engineering Sciences* 1, no. 50: 41-46. 2008. *Academic Search Complete*, EBSCOhost (accessed September 27, 2012).

Ewans, J.R. “AERODYNAMICS OF THE DELTA”. Accessed from the Flight Global Archive, 11 August 1951. pg. 172-174 (accessed September 28, 2012). <<http://www.flightglobal.com/pdfarchive/view/1951/1951%20-%201545.html>>

Kermode, A.C. FLIGHT WITHOUT FORMULAE. 5th ed. updated by Bill Gunston. *Longman Group UK Limited*, 1989. Print.

Personal Aircraft Drag Reduction. Bruce Carmichael, page 195, Propeller behind tail - pros and cons.

Aircraft Design: A Conceptual Approach. Daniel P. Raymer. AIAA Education Series.

Images

Tail -

<http://blogs.solidworks.com/.a/6a00d83451706569e2014e87f3ac86970d-800wi>

Fuselage - <http://ardz21.blogspot.com/2011/02/year-2025-future-plane-design-concepts.html>

Wing -

<http://www.young eagles.org/photos/gallery.asp?action=viewimage&imageid=608&text=&categoryid=17&box=&shownew=>

Blueprint - [http://www.wright-](http://www.wright-brothers.org/Information_Desk/Help_with_Homework/Wright_Models/Wright_Models.htm)

[brothers.org/Information_Desk/Help_with_Homework/Wright_Models/Wright_Models.htm](http://www.wright-brothers.org/Information_Desk/Help_with_Homework/Wright_Models/Wright_Models.htm)

Rockets - <http://www.estesrockets.com>

Course Outline – AIAA DBF Site

Overview Slide – www.hobby-lobby.com

