WICHITA STATE UNIVERSITY

An Overview of Small Aircraft Design at Wichita State University

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October 15, 2013

Introduction

- WSU students have designed, built, tested, and flown over fifty (50) small and unique aircraft in the last five years:
  - Span 1-12 ft.
  - Weight 1-50 lbs.
- This presentation will review:
  - Recent academic and research experiences
  - Future plans and opportunities

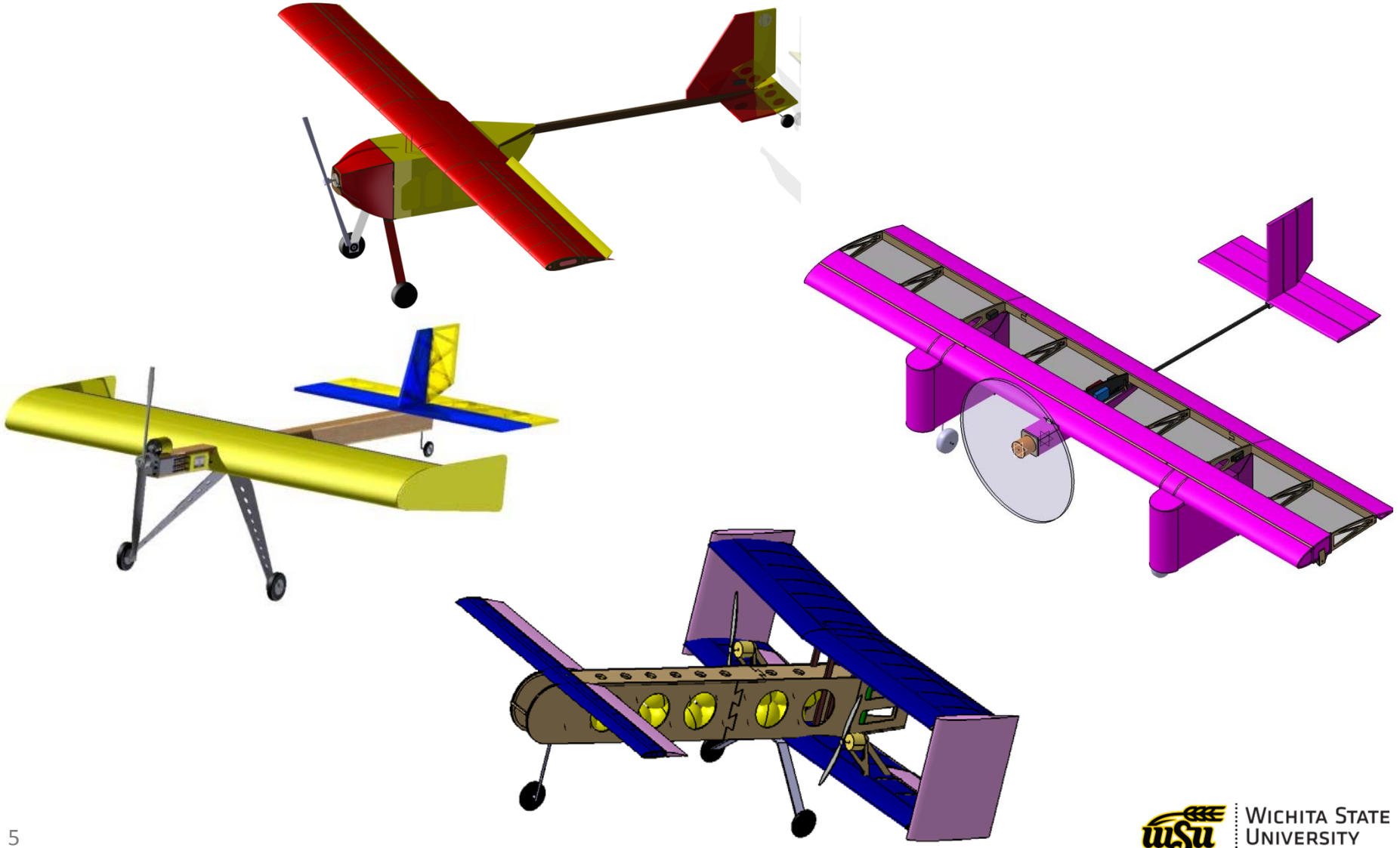
Academics

- Most of the aircraft are designed in the undergraduate capstone senior design course
- Some significant class goals include:
  - Going beyond conceptual design
    - Design; build; test; fly; & demonstrate!
  - Gain experience building and learning how to design-to-build
  - Provide opportunities to test and to reflect on the outcomes
  - Enhance other important skills
  - Address student, faculty, and industry interests (passions)

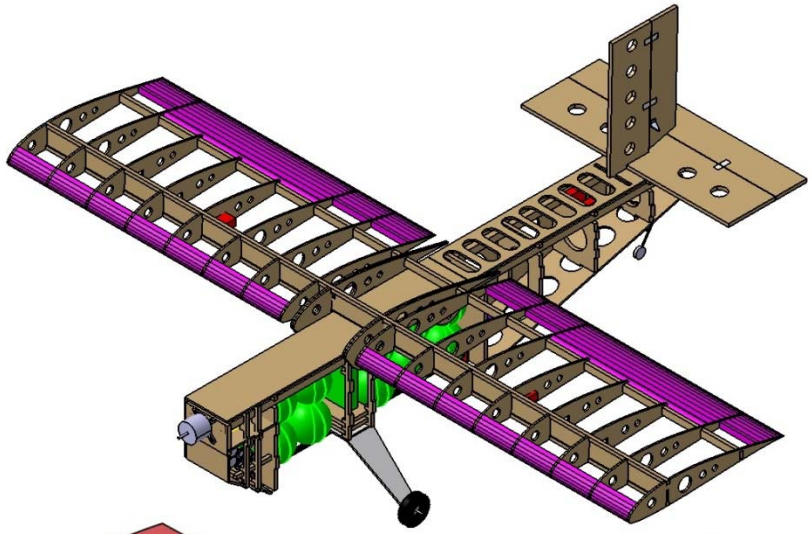
Academic Examples

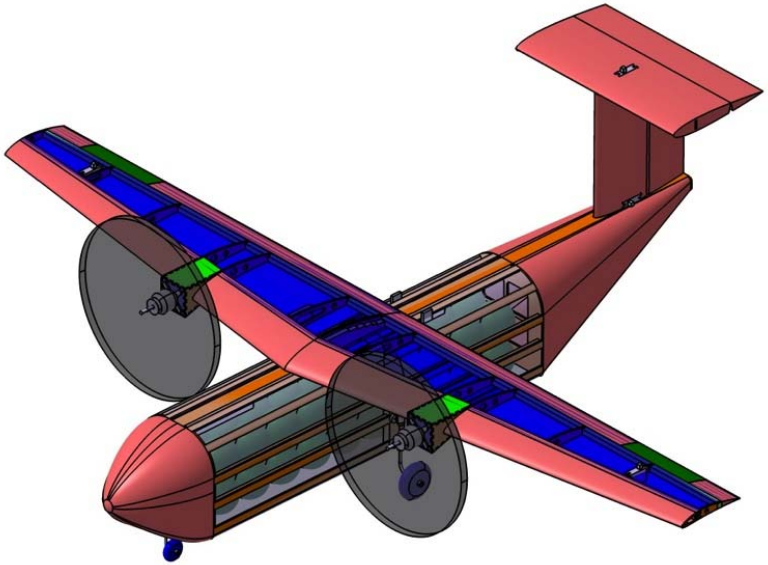
- Expanded activities:
  - Bronze Propeller Competition
    - A competition open to WSU students, WSU alumni, and high school students
  - AIAA DBF
  - A new sophomore-level design class
  - Other spin-offs (rockets!)

Academic Examples

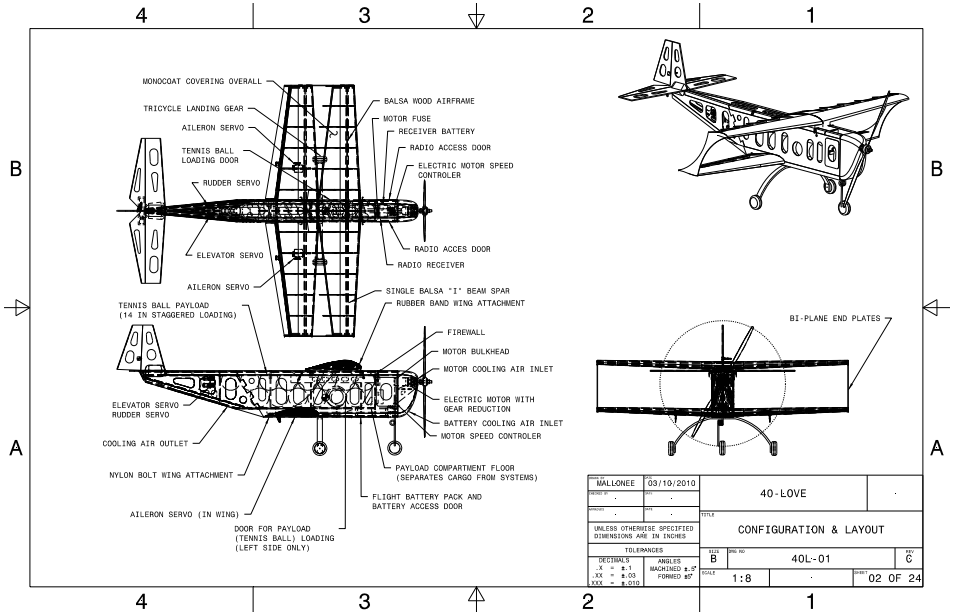


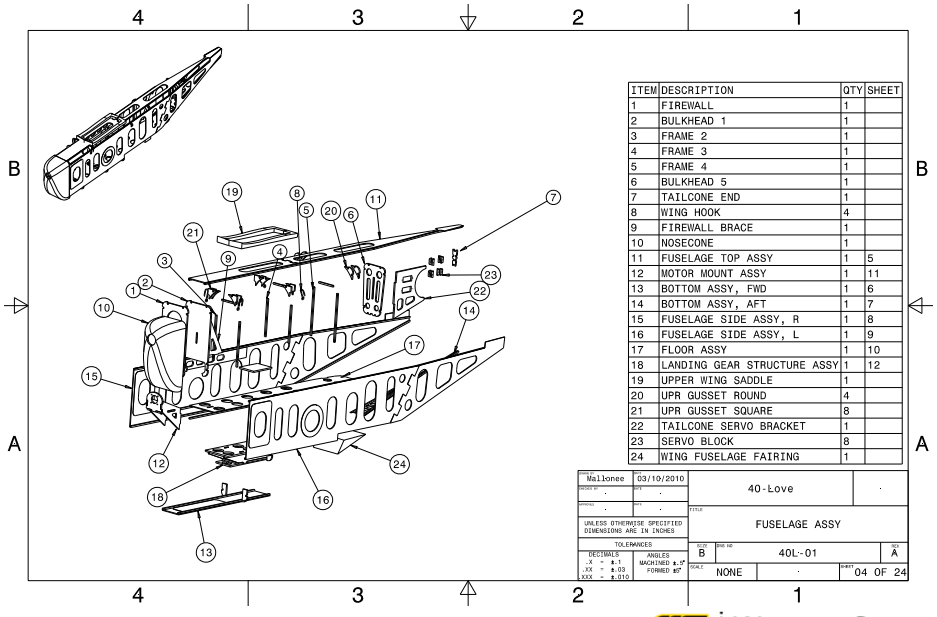
Academic Examples





Academic Examples





ITEM	DESCRIPTION	QTY	SHEET
1	FIREWALL	1	
2	BULKHEAD 1	1	
3	FRAME 2	1	
4	FRAME 3	1	
5	FRAME 4	1	
6	BULKHEAD 5	1	
7	TAILCONE END	1	
8	WING HOOK	4	
9	FIREWALL BRACE	1	
10	NOSECONE	1	
11	FUSELAGE TOP ASSY	1	5
12	MOTOR MOUNT ASSY	1	11
13	BOTTOM ASSY, FWD	1	6
14	BOTTOM ASSY, AFT	1	7
15	FUSELAGE SIDE ASSY, R	1	8
16	FUSELAGE SIDE ASSY, L	1	9
17	FLOOR ASSY	1	10
18	LANDING GEAR STRUCTURE ASSY	1	12
19	UPPER WING SADDLE	1	
20	UPR GUSSET ROUND	4	
21	UPR GUSSET SQUARE	8	
22	TAILCONE SERVO BRACKET	1	
23	SERVO BLOCK	8	
24	WING FUSELAGE FAIRING	1	

Mallonee 03/10/2010
UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
TOLERANCES
DECIMALS .X = ±.1 .XX = ±.03 .XXX = ±.010
ANGLES MACHINED ±.5° FORMED ±1°
40-Love
FUSELAGE ASSY
SIZE B
DRG NO 40L-01
REV A
SCALE NONE
SHEET 04 OF 24

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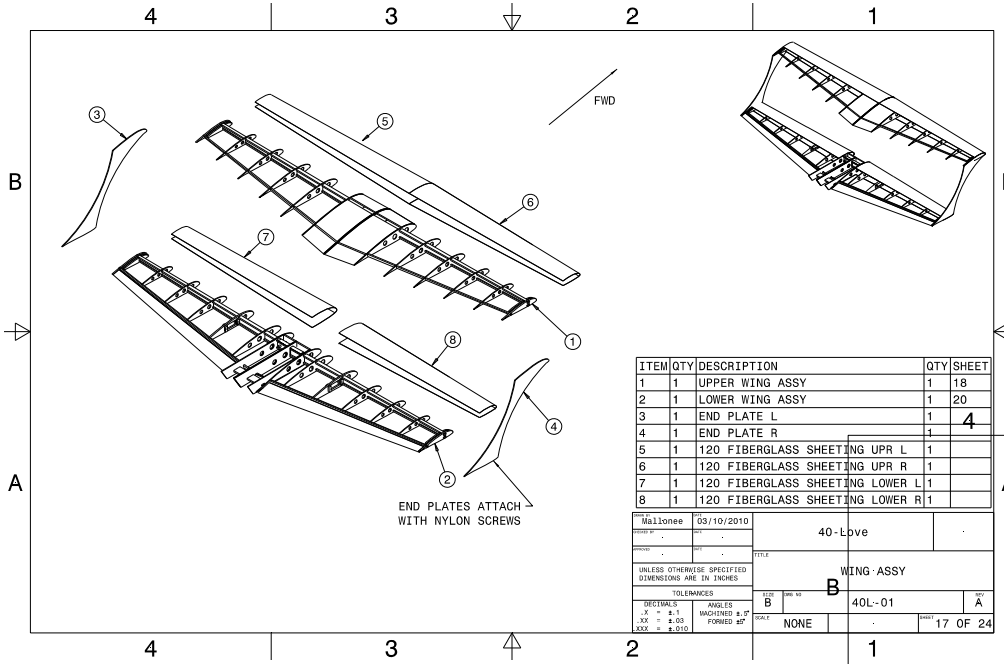
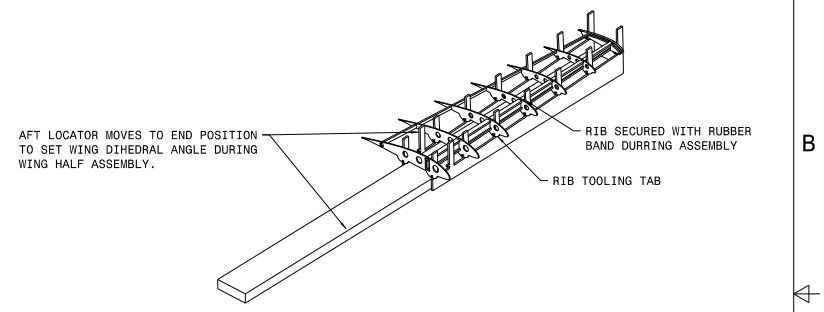
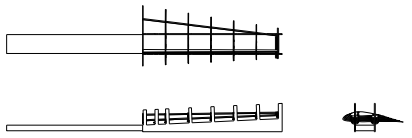
Academic Examples



ITEM	QTY	DESCRIPTION	QTY	SHEET
1	1	UPPER WING ASSY	1	18
2	1	LOWER WING ASSY	1	20
3	1	END PLATE L	1	
4	1	END PLATE R	1	
5	1	120 FIBERGLASS SHEETING UPR L	1	
6	1	120 FIBERGLASS SHEETING UPR R	1	
7	1	120 FIBERGLASS SHEETING LOWER L	1	
8	1	120 FIBERGLASS SHEETING LOWER R	1	

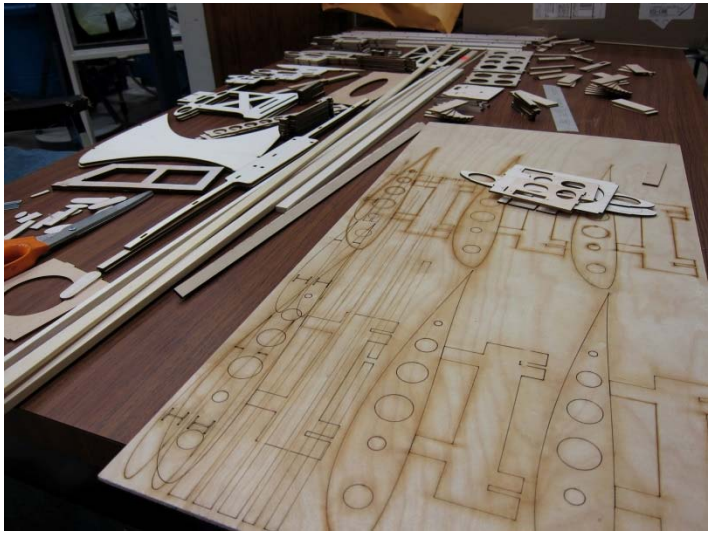
DRAWN BY: Mallonee	DATE: 03/10/2010	40-Love
UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES		TITLE: WING ASSY
TOLERANCES: DECIMALS .X = ±.1, .XX = ±.03, .XXX = ±.010; ANGLES MACHINED ±.5° FORMED ±5°		SIZE: B; DWG NO: 40L-01; REV: A; SCALE: NONE; SHEET: 17 OF 24

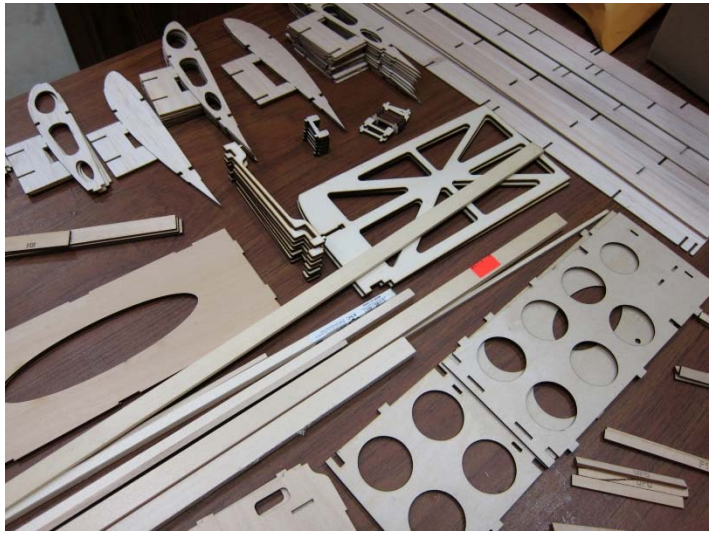


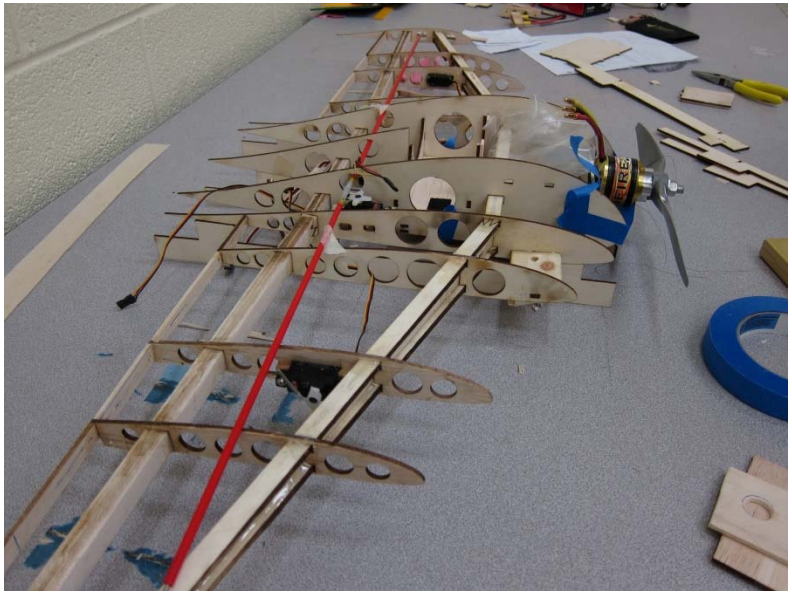


DRAWN BY: Mallonee	DATE: 03/10/2010	40-Love
UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES		TITLE: UPPER LEFT WING HALF IN WING ASSEMBLY JIG
TOLERANCES: DECIMALS .X = ±.1, .XX = ±.03, .XXX = ±.010; ANGLES MACHINED ±.5° FORMED ±5°		SIZE: B; DWG NO: 40L-01; REV: A; SCALE: NONE; SHEET: 23 OF 24

Academic Examples







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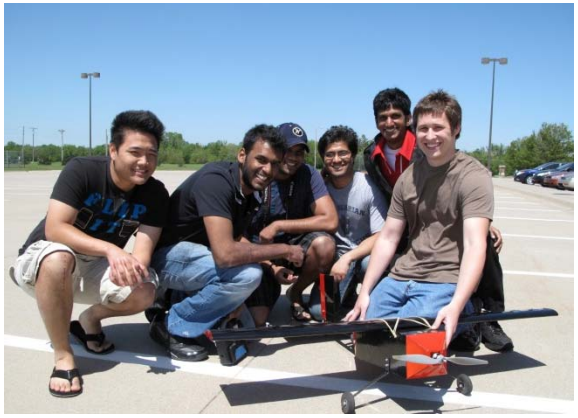

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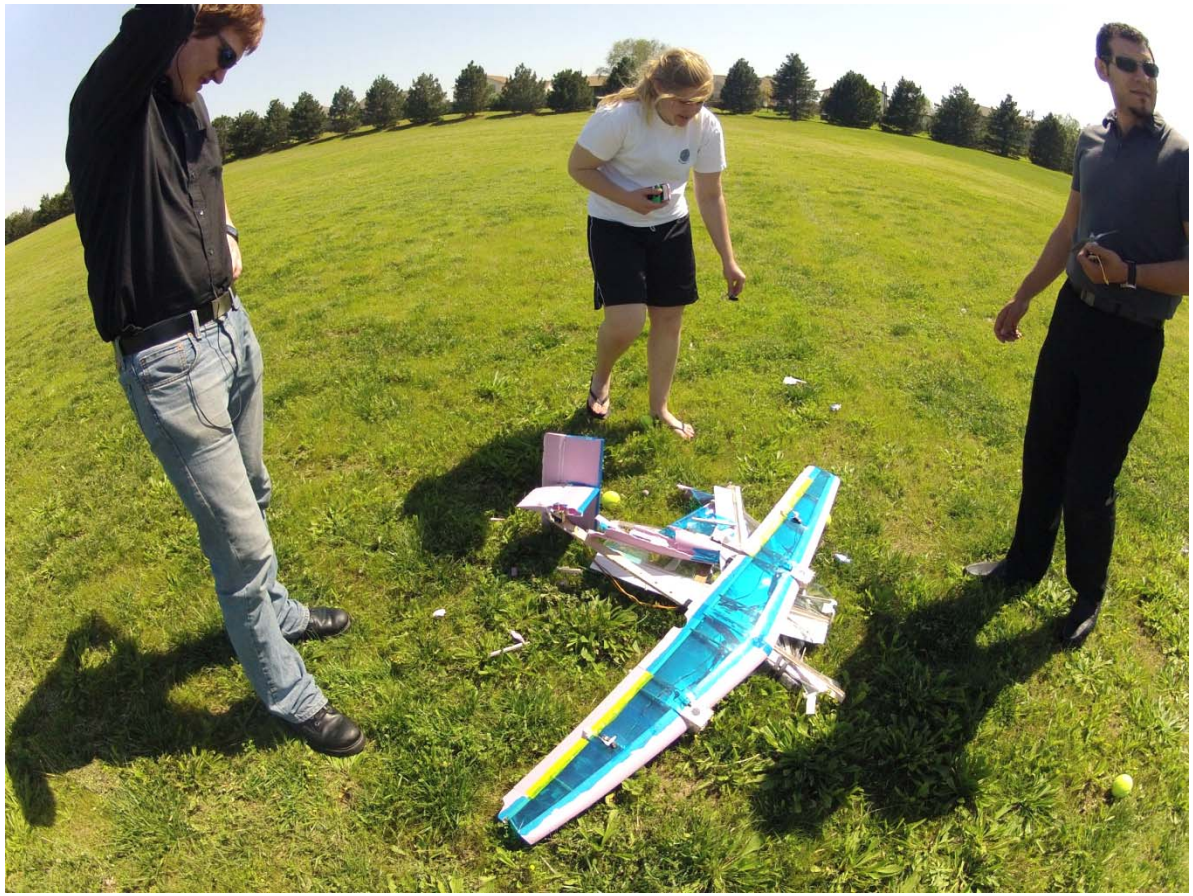


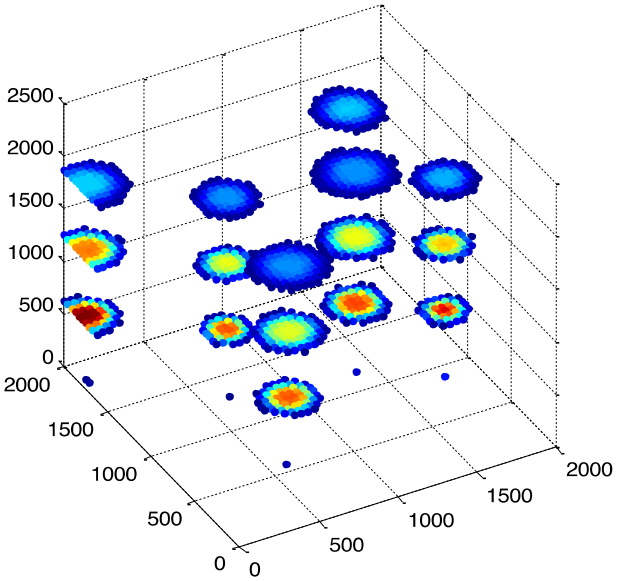
Academic Examples

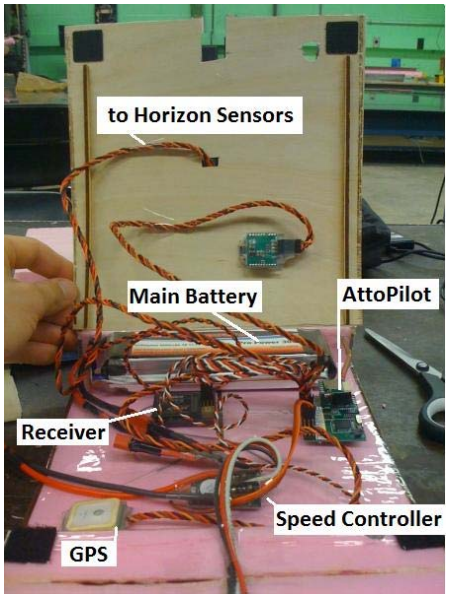
Academic Examples

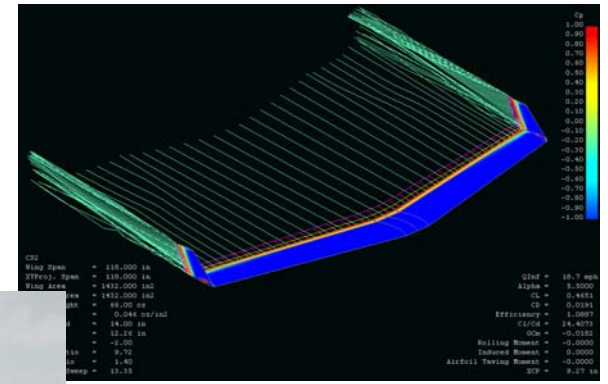
Research

- My recent or current activities include:
  - Autonomous cooperative soaring
  - Course and curriculum development (autonomous aircraft)
  - Low Reynolds Number propeller testing, analysis, and design
  - Other assorted (skewed-hinge, flat plate wings, etc.)

Research Examples







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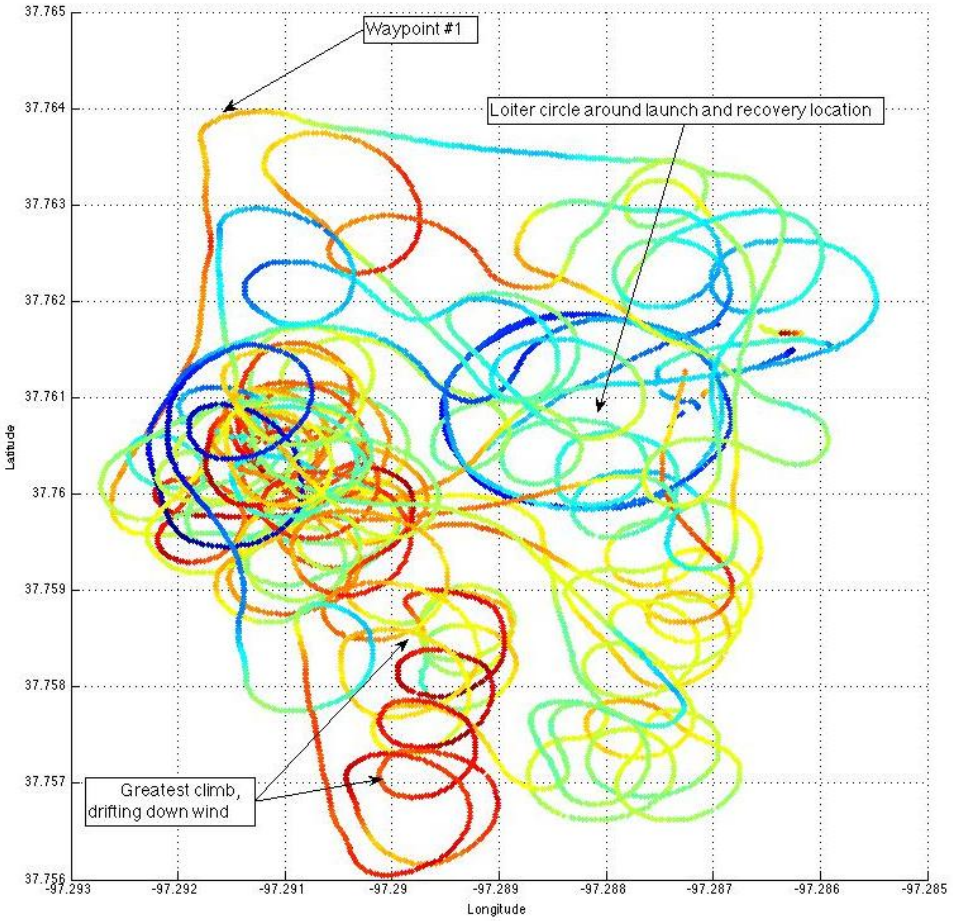

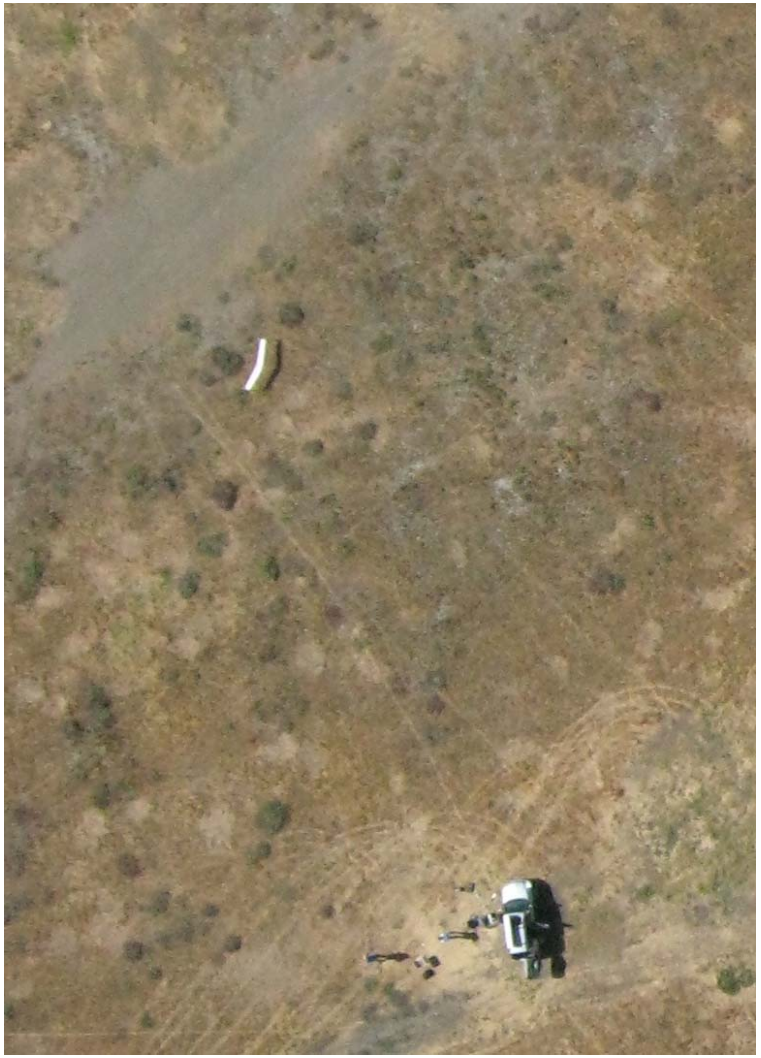

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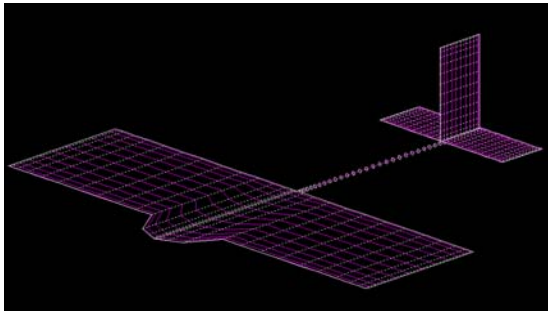

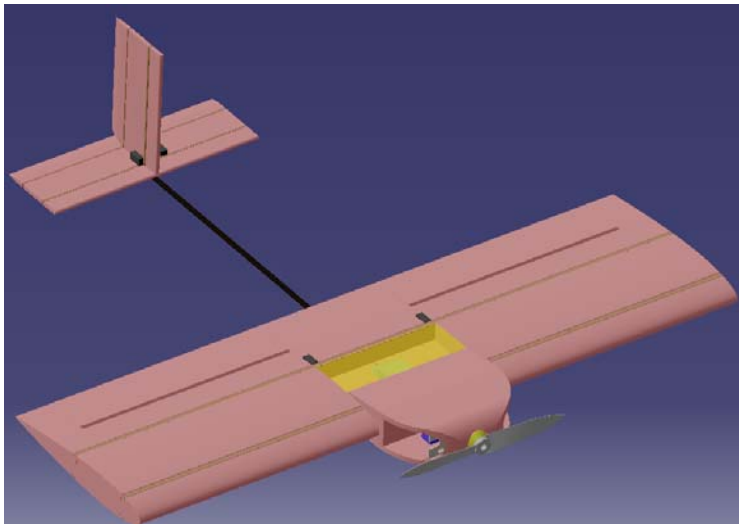

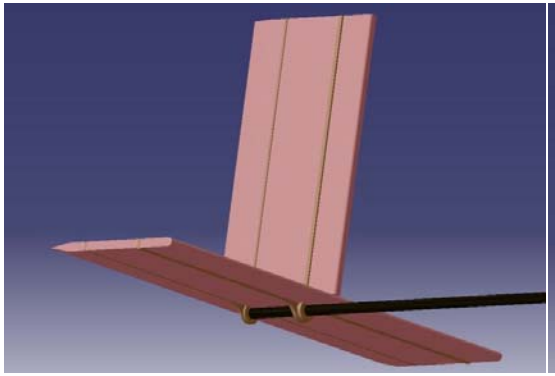

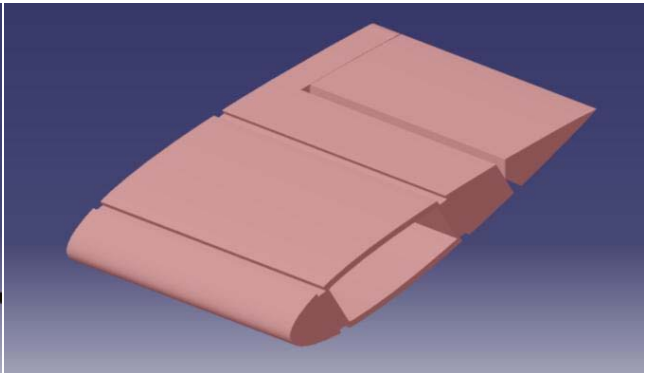

Research Examples

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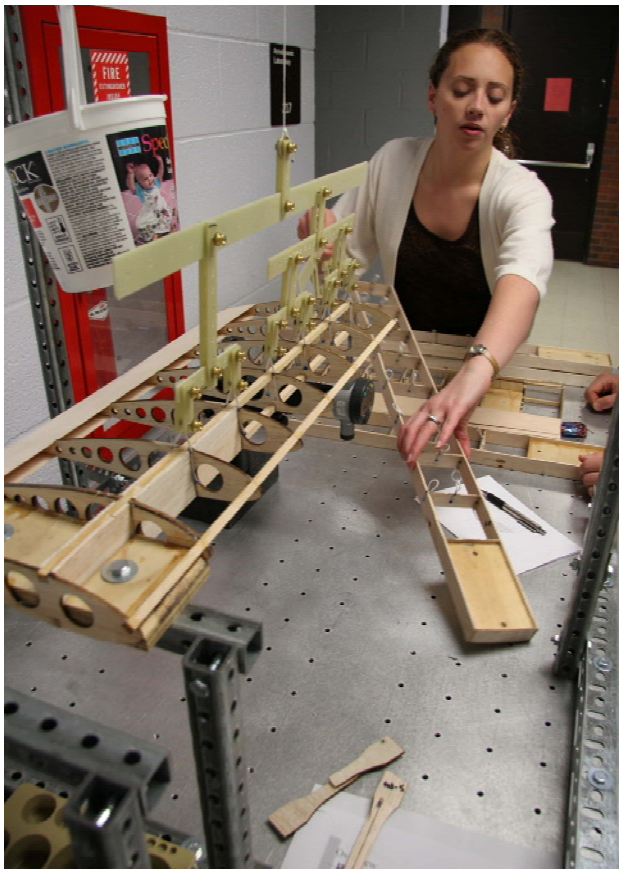
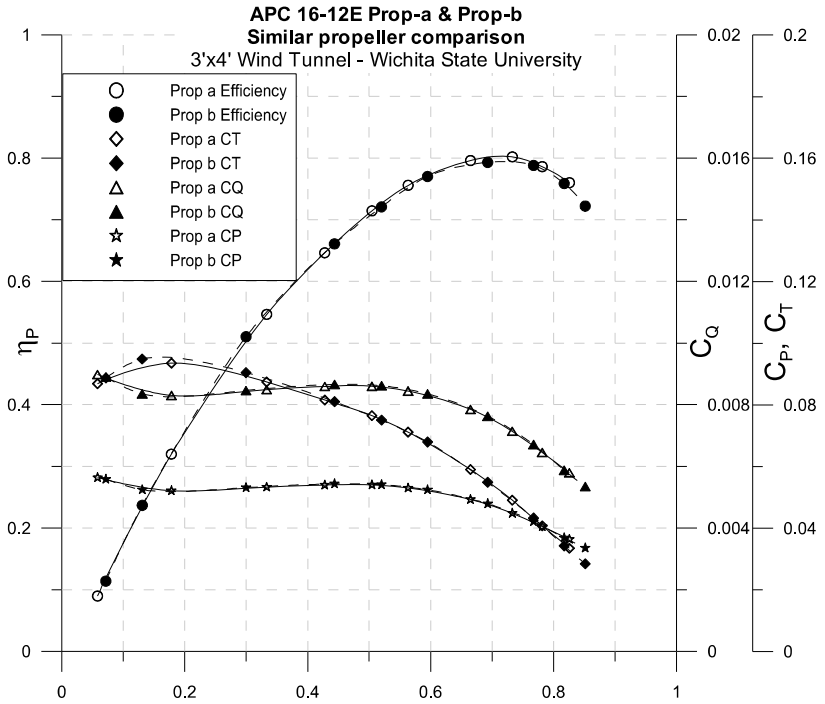
Capabilities

- Classic vehicle design/analysis tools
- Quick build labs:
  - Laser & foam cutters
- Testing:
  - Low speed wind tunnels
  - Propulsion system, propeller, and battery test rigs
  - Material characterization & structural test fixtures
  - Simulation lab
  - Basic in-flight data logging and telemetry systems

Related Capabilities





Plans & Opportunities

- Academics
  - Expand student, hands-on, design and control system experiences
  - Convert to demonstrating fully-autonomous aircraft in the senior design class
- Research
  - Develop a fully characterized baseline research aircraft
  - Morphing aircraft projects
  - New controls concepts development
  - MS & PhD projects
  - Other opportunities & collaboration!

Conclusions

- Students have learned lots through the many hands-on experiences
- Small aircraft prototyping capabilities are substantial and growing
- Research experiences are notable and growing
- There are opportunities for even more work and collaboration!

Contact Information

- Feel free to contact me with questions or ideas:
  - L. Scott Miller, Professor & Chair
  - WSU Aerospace Engineering Department
  - Scott.miller@wichita.edu
  - 316-978-6334

Thanks for your attention!