



FIRST INTERIM REVIEW

Andrew Bell

Joshua Fromm

Scott Lowery

Spencer Riggs

Barrett Sleeper

Michelle Tamayo

Jonathan Todd

Oleg Usmanov



Agenda



- Project Objectives
- Resolution of Issues
- Design Summary
- Testing Plan
- Current Issues
- Schedule Status
- Budget Status



Project Objectives



- Design, build and fly competitive aircraft
- Carry high-volume payloads for RECUV
 - Phased array antenna
 - Cameras
- Departmental vertical integration
 - Teach design process to undergrads
 - Graduate advisers



Resolution of Issues



- No requests for action
- Balsa Wood Strength
 - Tensile tests will back up researched numbers
- GPS Position Fix
 - Telemetry system powered on separate battery from propulsion, initialized during pre-flight
- Underclassmen Assistance
 - Extracurricular, being utilized for competition portion of project



Design Summary

Avionics



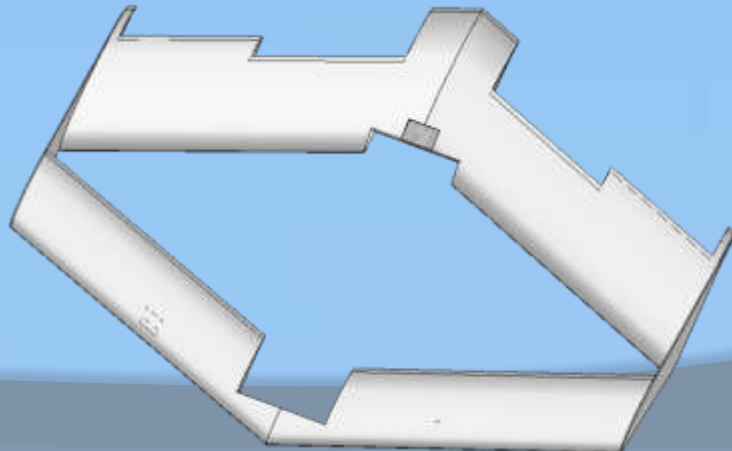
- Eagle Tree Seagull Pro
 - 2 optical RPM brushless motor sensors
 - Propulsion battery voltage and current flow
 - 4 servo response sensors
 - Motor temperature
 - Battery temperature
 - GPS position
 - Airspeed
 - Dynamic and static pressure sensors
 - G force
- Real time data storage and transmission

Design Summary Structures



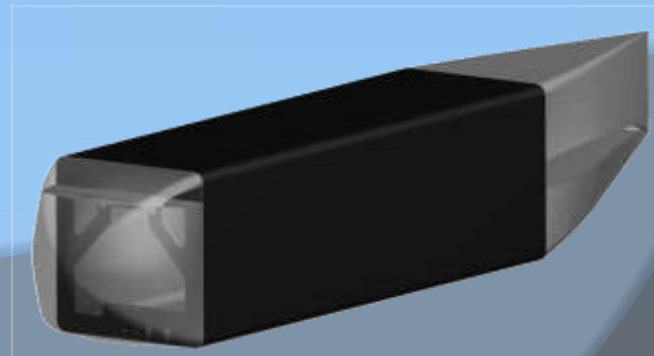
Wing

- Balsa skins
 - Front: 3/64 in
 - Rear: 1/32 in
- Foam cores
 - 1 lb/ft³ EPS foam
- Vertical joiners
 - Balsa: 1/8 in



Fuselage

- Composite sandwich shell
 - Fiberglass: 1.4 oz/sq yd
 - Balsa: 1/16 in
- Balsa bulkheads
 - Front: 1/8 in
 - Rear: 3/32 in
- Nose/ Tail Cones
 - 1.3 lb/ft³ EPP foam





Design Summary

Propulsion

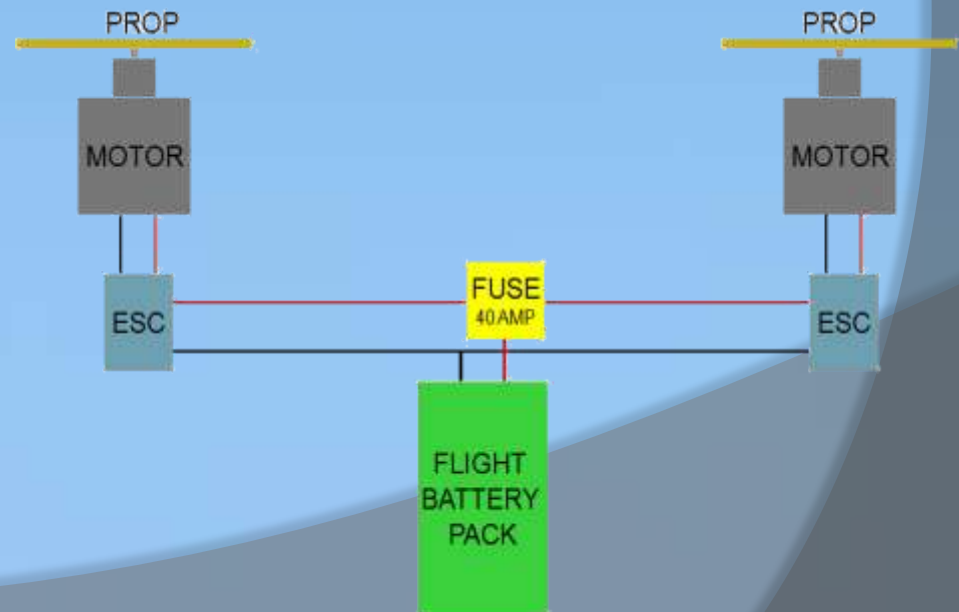


Motors

- Neu 1107 /2Y brushless motor
 - Twin motor configuration
 - Wing mounted
- Single fuse: 40 Amp
- Two 45 A speed controllers
- 14 gauge wire
- Propeller
 - Empty: APC 17 x 9
 - Loaded: APC 15 x 8

Batteries

- IB1400 NiMH
- Empty: 8 cells
- Loaded: 15 cells





Design Summary

Aerodynamics



	Forward Wing	Aft Wing	Vertical Tail
Span	5 ft	5 ft	0.83 ft
Chord	8 in	15 in	8 in
Area	3.33 ft ²	6.25 ft ²	0.56 ft ²
Sweep	20 deg	-21 deg	0 deg
Geometric Incidence	-1.3 deg	-1.3 deg	0 deg
Dihedral	0 deg	0 deg	90 deg

- Vertical Tail Redesign
 - Added taper to improve appearance
 - Same aerodynamics as original tail
- Elevator Redesign
 - Flight test showed aircraft is overly sensitive in pitch
 - Elevator chord decreased by 25% to 3.75 inches, not yet tested



Design Summary

Missions & Fuselage

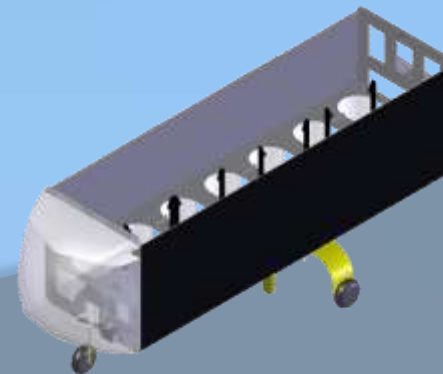


Missions

- Changes to rules regarding passenger payload
 - Collar location and length now unbounded
- Current restraint system inadequate for certain payload locations and sizes
 - Prototyping of 4 new designs in progress
 - No current selection

Fuselage

- Dimensions
 - 28" long x 8.5" wide x 9" tall
- Removable top hatch for payload loading
- Fiberglass and balsa sandwich construction





Testing Plan Overview

- 14 Required Tests
 - Verify project goals from PDD
 - Basic tests: wing span, takeoff distance, etc.
 - 31 Primary Tests
 - Verify design models
 - Static thrust, power budget, and stall speed
 - 22 Secondary Tests
 - Optimize design for competition
 - Time and resource dependent
 - Battery cell voltage drop curve, dynamic lateral stability identification
- Each test has an assigned number and is documented in test plan
 - All flight tests have test card checklists

	Task	Response
Rudder	Full Left	
	Full Right	
Elevator	1/4 Up	
	1/4 Down	
Ailerons	1/3 Left	
	1/3 Right	
	2/3 Left	
	2/3 Right	
	Full Left	
	Full Right	



Critical Testing

- Aerodynamics
 - Taxi (low/high speed)
 - Low speed flight
 - High speed flight
 - Stall speed
 - Short period mode
- Propulsion
 - Static / dynamic thrust
 - Take off distance
 - Power budget
 - Fuse opening time
- Structures
 - Material tensile strength
 - Static wing loading
 - Vibration
- Payloads
 - Restraint system
 - Loading time
- Avionics
 - Sensor calibration
 - Power budget
 - Servo torque



Short Period Mode Test



- Purpose
 - Determine frequency and damping ratio of short period
- Measurements
 - Airspeed, altitude, AOA, GPS, G-loading, weather conditions
- Procedure
 - Establish steady level flight at 100 ft AGL
 - Excite short period mode
 - Record data
- Equipment
 - Test aircraft
 - Telemetry system
 - Laptop
 - Pilot
 - 2 test engineers
- Location
 - Boulder Model Airfield
- Environmental Conditions
 - Temp > 45 F
 - Wind < 10 knots, steady
 - Good visibility



Static Wing Loading



- Purpose
 - Determine wing loading behavior, ultimate strength, failure mode
- Measurements
 - Applied load, wing deflection
- Procedure
 - Verify wing meets build-to specs
 - Secure wing at root per boundary condition
 - Apply load corresponding to lift distribution
- Equipment
 - Wing test stand
 - Wing half
 - Weights
 - Wing loading straps
 - Conduit members
 - Tip deflection measurement tool
 - 3 test engineers
- Location
 - RECUV lab





Dynamic Thrust Test



- Purpose
 - Determine thrust produced in the presence of ram air
- Measurements
 - Airspeed, thrust load, current
- Procedure
 - Install test stand in aircraft stability wind chamber
 - Run propulsion system at 20 amps
 - Turn on wind tunnel and increase to full speed over 30 seconds
 - Record data
 - Repeat at 30 and 40 amps
- Equipment
 - Motor test stand
 - Aircraft stability wind chamber
 - Test stand adapter
 - LiPo battery pack
 - Laptop with DAQ card
 - LabVIEW software
 - DPR (digital power recorder)
 - 4 test engineers
- Location
 - Senior projects lab

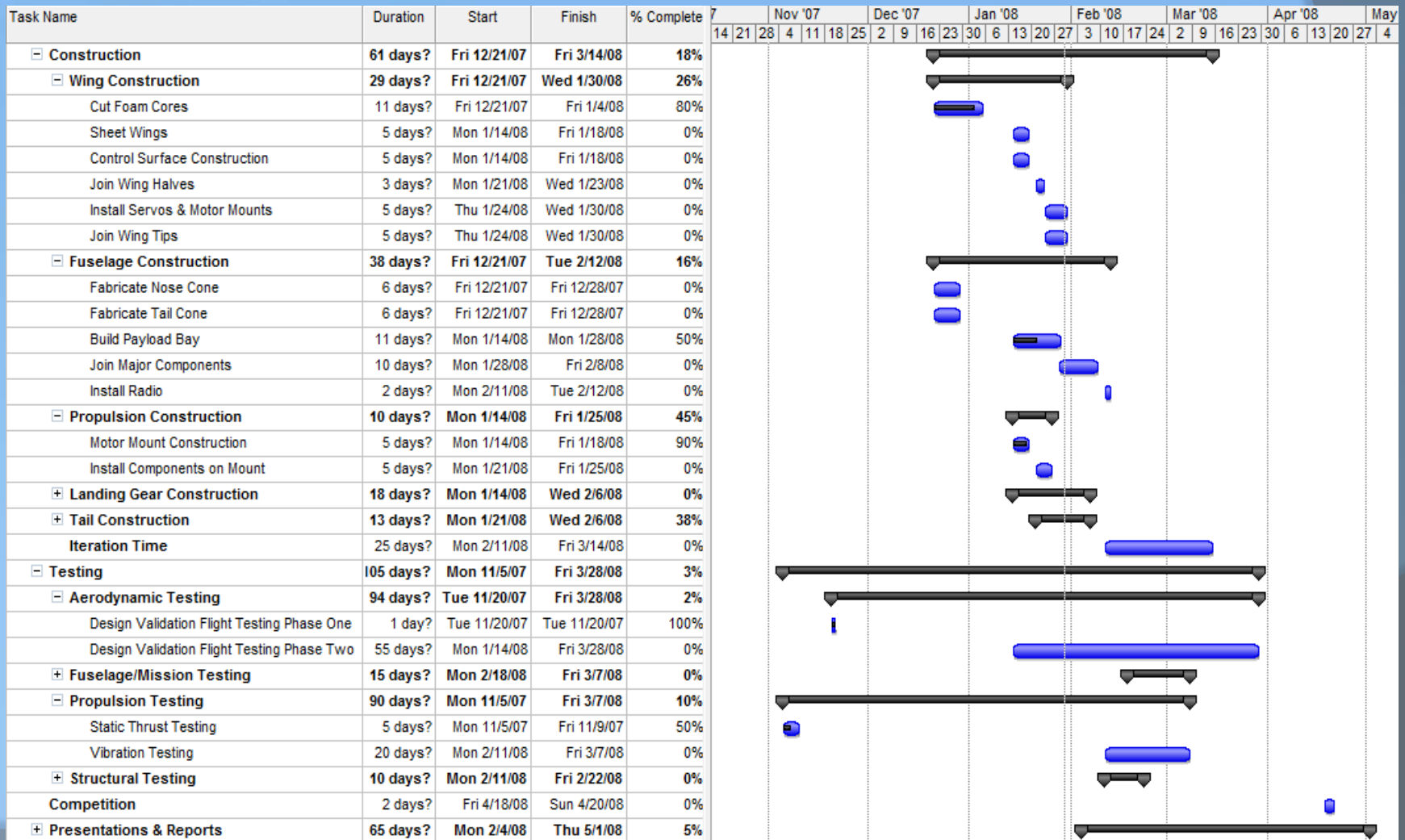


Current Issues

- Radio Interference Issues
 - Radio failed range check
 - Determined to be frequency crystal issue, new crystals ordered
- Materials Delays
 - Materials have been ordered, working on small parts for aircraft until major materials arrive
- Control Derivatives
 - Need help computing derivatives for tailless aircraft
- Landing Gear Drop Testing
 - Cannot use Durning Lab equipment, looking into other options
- In-Flight Thrust Data
 - Need to design mechanism to allow linear translation of motor mount
- Payload Restraint System
 - Rules change



Schedule Status





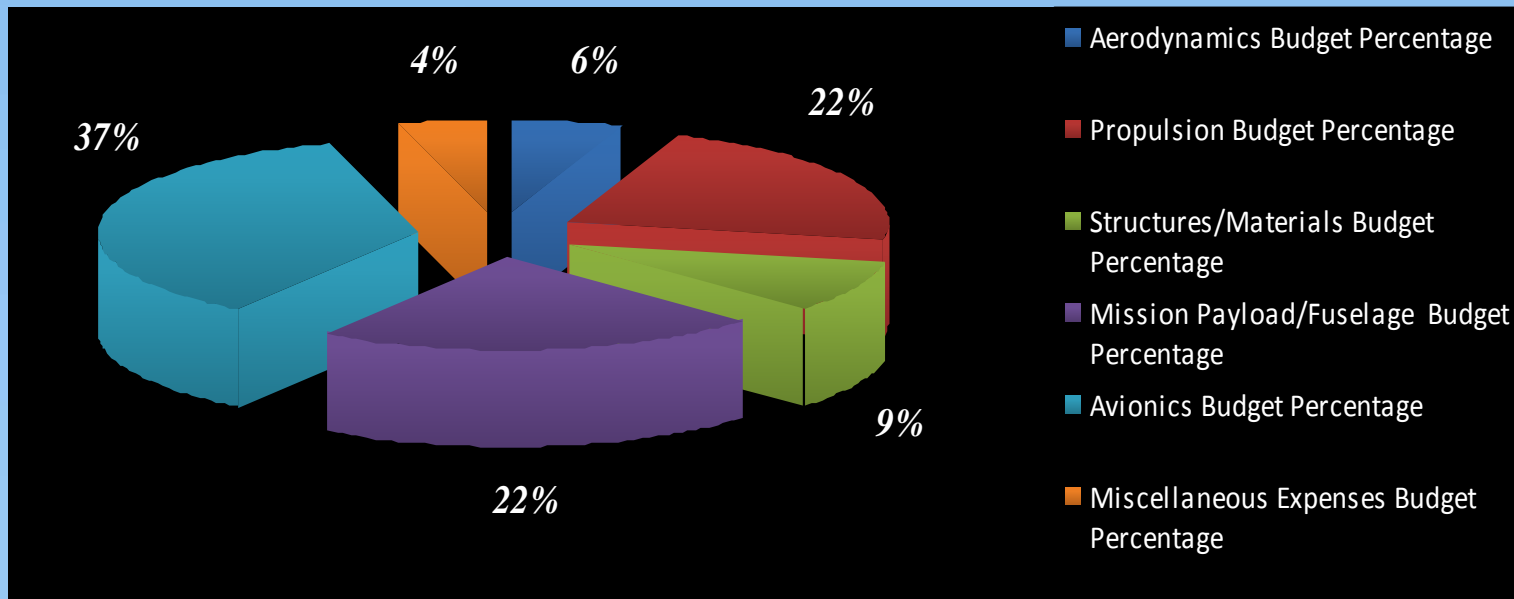
Budget Status

MASTER BUDGET

Sponsorship Total	\$9,000.00
Total Allocated Funds	\$4,450.00
Total Spent Funds	\$1,298.21
Total Available Funds	\$7,701.79

MONETARY SPONSORS

ASEN PAB	\$4,000.00
EEF	\$2,000.00
UROP	\$3,000.00
Total	\$9,000.00





Questions?