TEAM 12 – WHEAT WORKZ

BRONZE PROPELLER

RYAN LYNCH, DARIN PARKER, RUBEN REYES, ALEX ZADOROZHNYY

TEAM INTRODUCTION

- Members:

Ryan Lynch – From Olathe, KS. Design engineer and stress engineer experience

Darin Parker – Arkansas Native, Systems engineering and CFD experience

Ruben Reyes –From Dodge City, KS. Experience in fighter manufacturing and teardown

Alex Zadorozhnyy – From Odessa, Ukraine. Experience in CATIA and reverse engineering

TEAM CONTACT INFORMATION

- Ryan Lynch – Structures Lead – RyanJLynch7@gmail.com
- Darin Parker – Stability and Control Lead - dxparker@shockers.wichita.edu
- Ruben Reyes – Propulsion Lead – rxreyes3@shockers.wichita.edu
- Alex Zadorozhnyy – Aerodynamics Lead – zadorozhnyy.oleksiy97@gmail.com

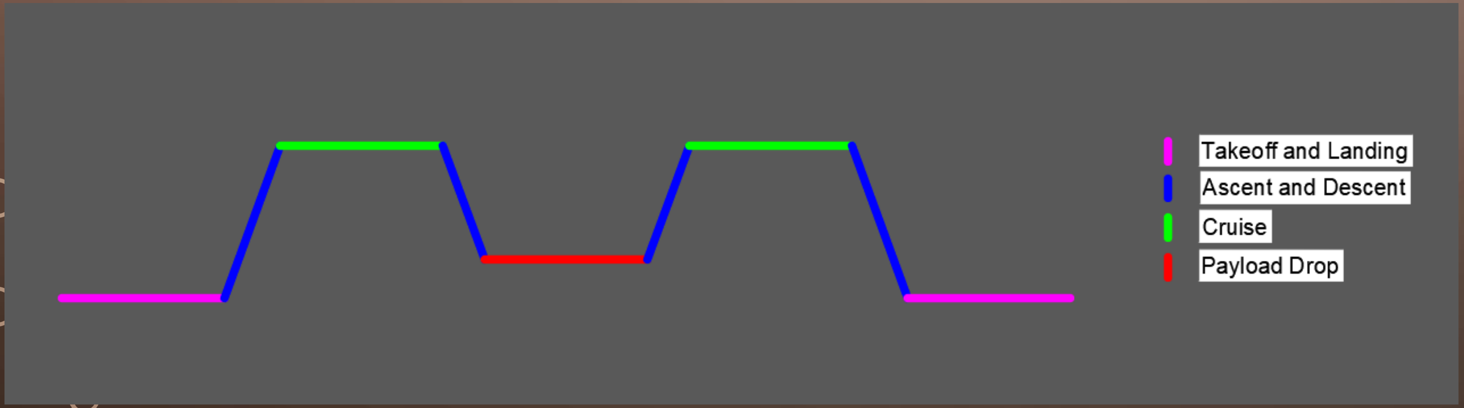
AIRCRAFT, MISSION AND CAPABILITIES

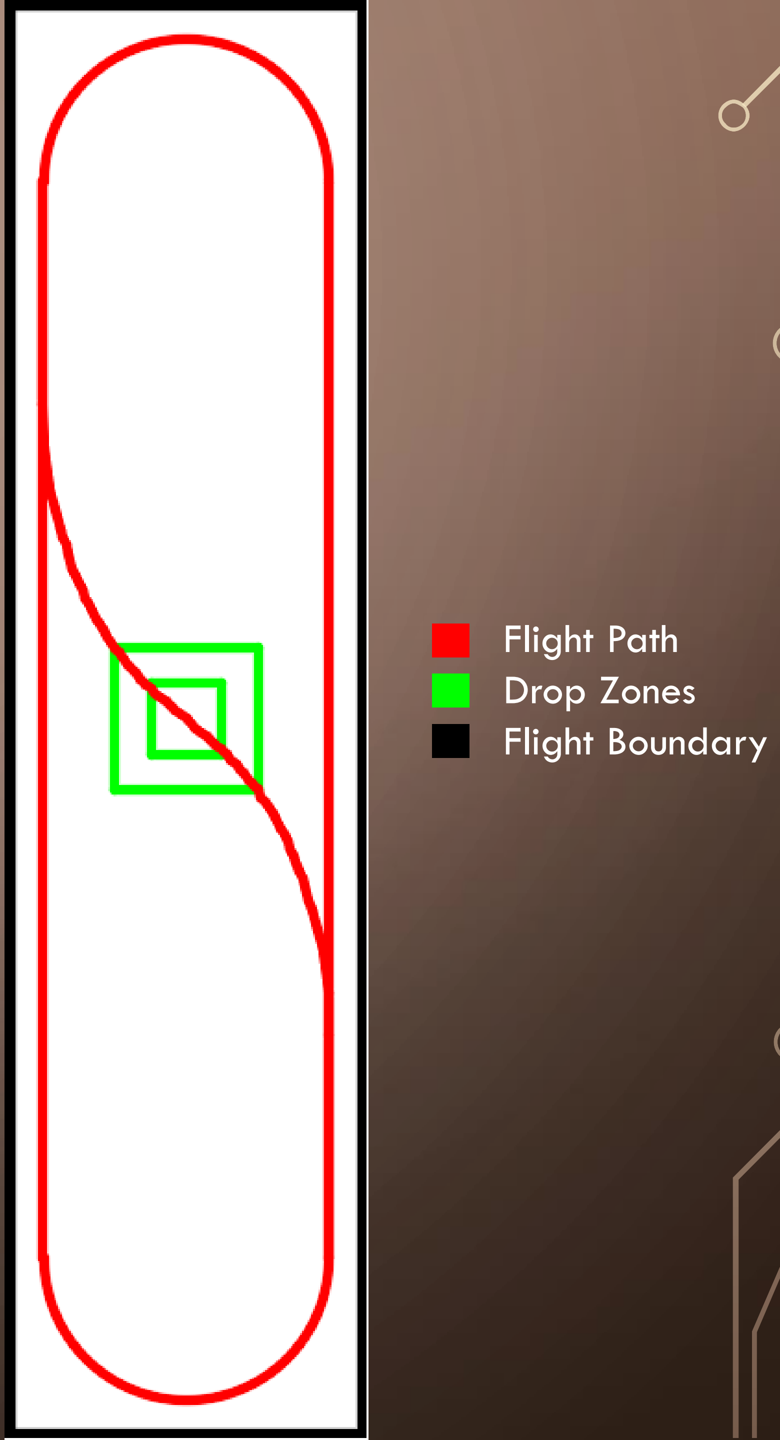
The Fast Emergency Aircraft Response (FEAR) is a storable semi-autonomous emergency supply aircraft that is capable of delivering six emergency supply capsules (modeled with tennis balls) from hand launch to belly landing in a target time of 60 seconds.

With FEAR's detachable wings and empennage, it has the ability to be stored in an 11x7x36 in. box allowing for easy storage and handling.

FLIGHT PROFILE

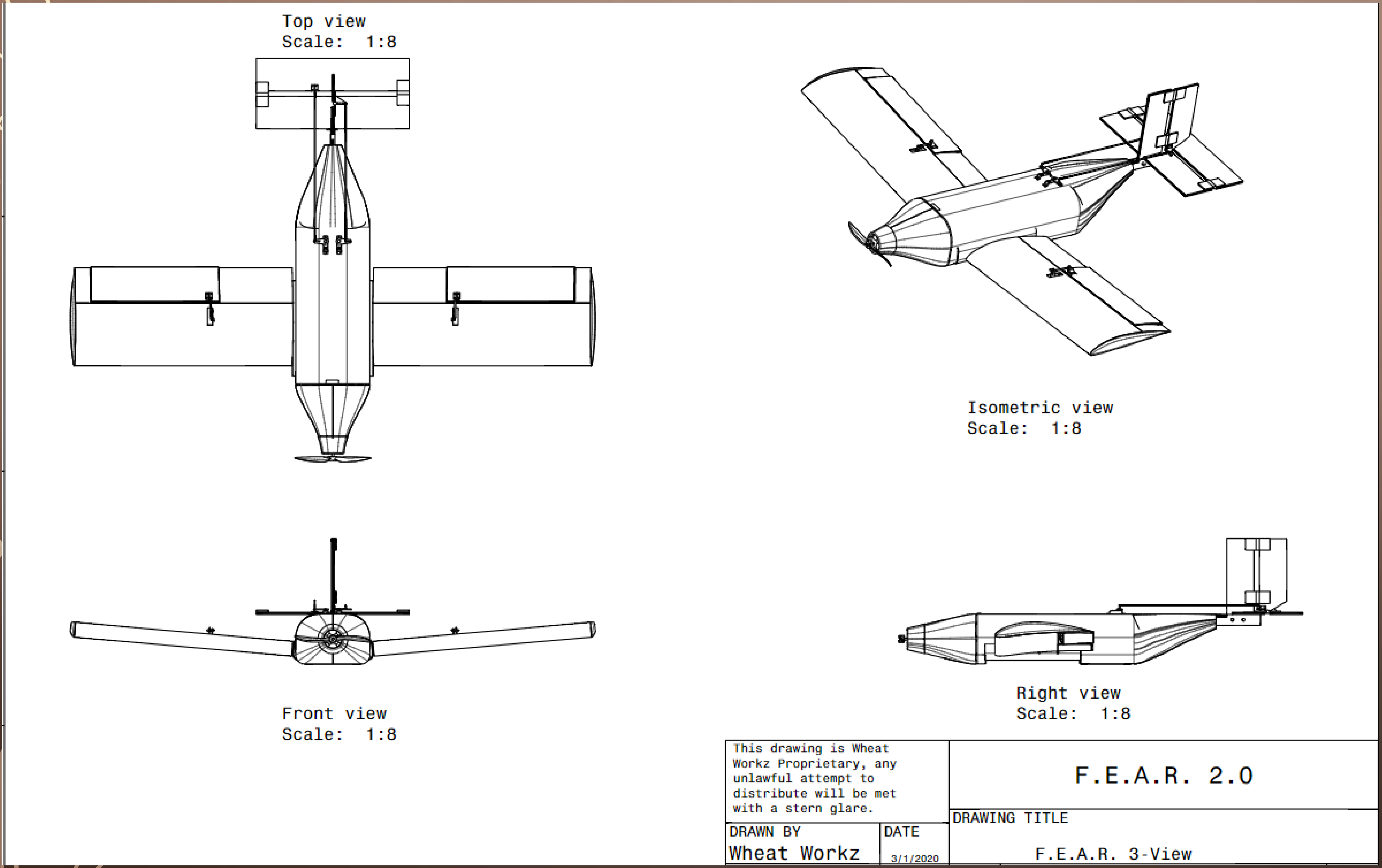
- The flight course consists of a 400 ft x 100 ft area
- 5 laps must be flown
- Payload must be dropped on target after 2nd lap
- Turns 300 ft apart





3-View Drawing

F.E.A.R. - 1
Team 12 - Wheat Workz
3 - View and Isometric



Layout Drawing

F.E.A.R. - 1
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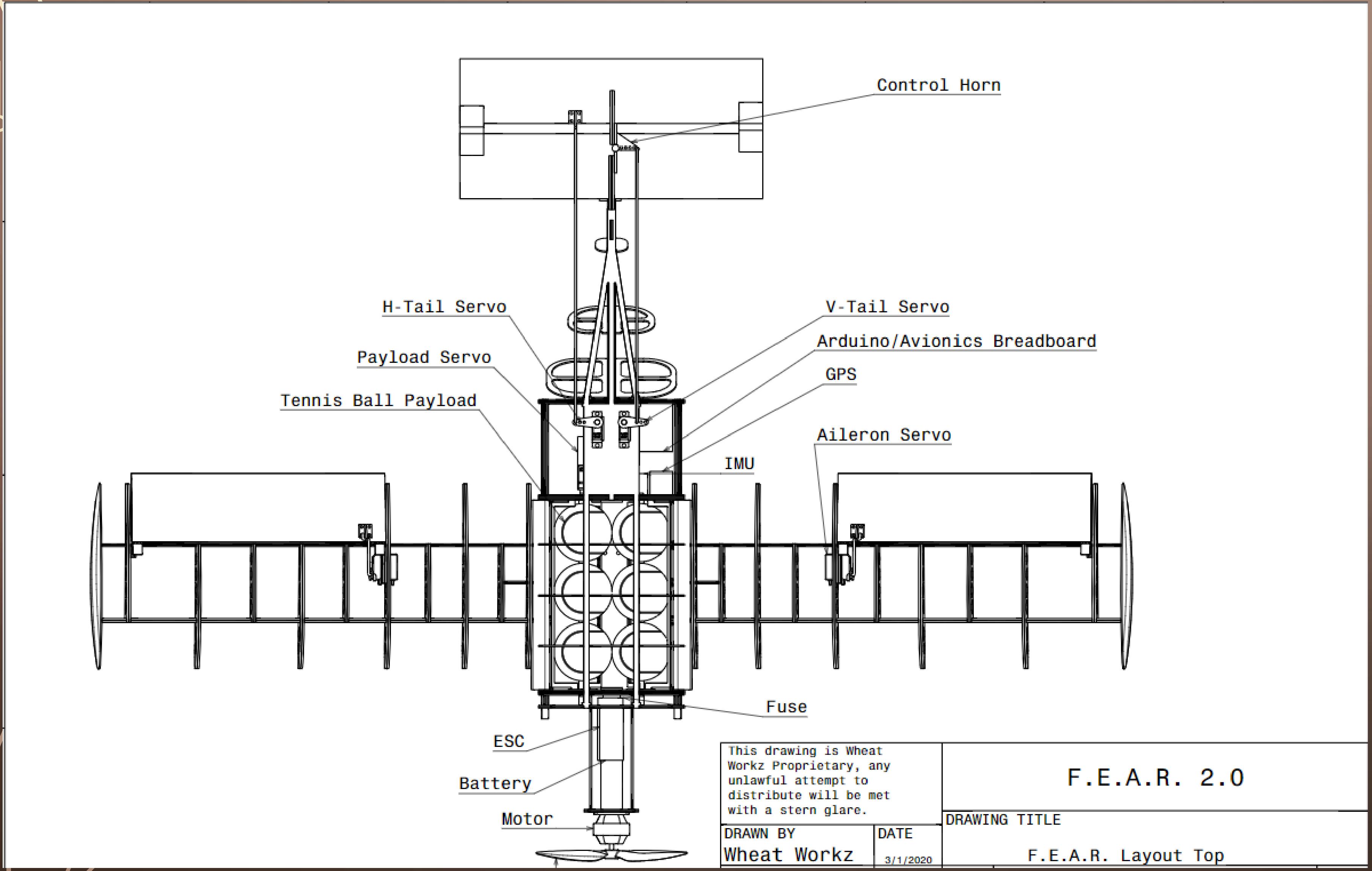
Top View Layout



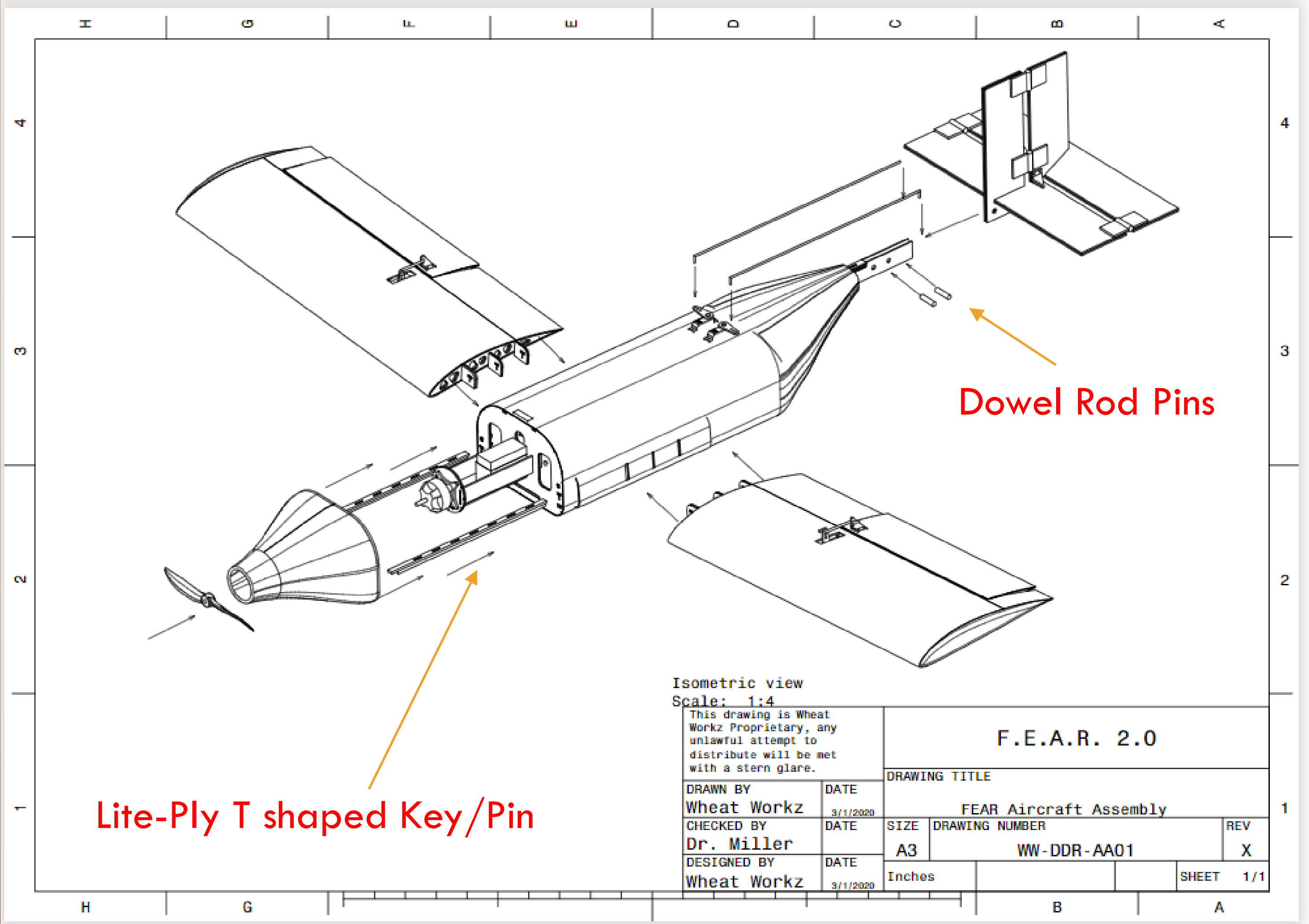
FEAR KEY FEATURES

Wing

- The Wing is Pinned to the fuselage using a Key inserted through the Frame and Wing attach Plates through holes in the spar ends

Tail

- The Tail is Pinned using dowel rods inserted through the tail beam and control surfaces.
- Rubber-bands could have been placed around these rods for extra security



Wing and Tail Connection

FEAR KEY FEATURES

Senors

- GPS module (global positioning)
- IMU (inertial measurement)
- Altimeter (height measurement)

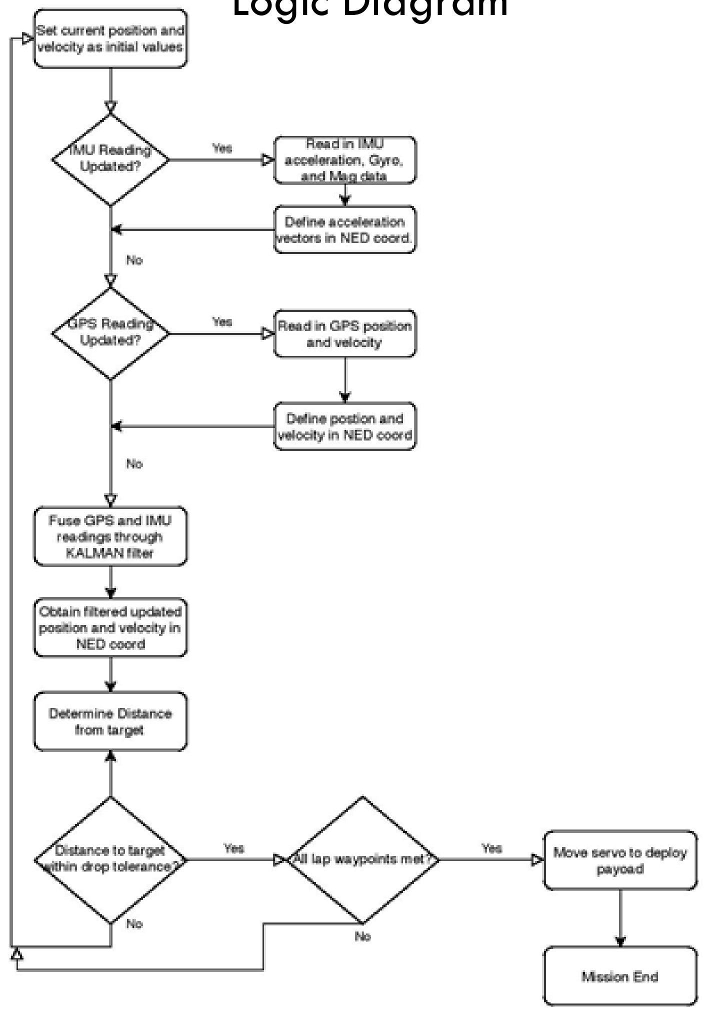
Sensor Fusion

- In order to get an accurate real time position of the aircraft, the readings from each sensor must be fused together
- GPS provides very accurate position but slow updates
- IMU provides fast updates but has drift errors

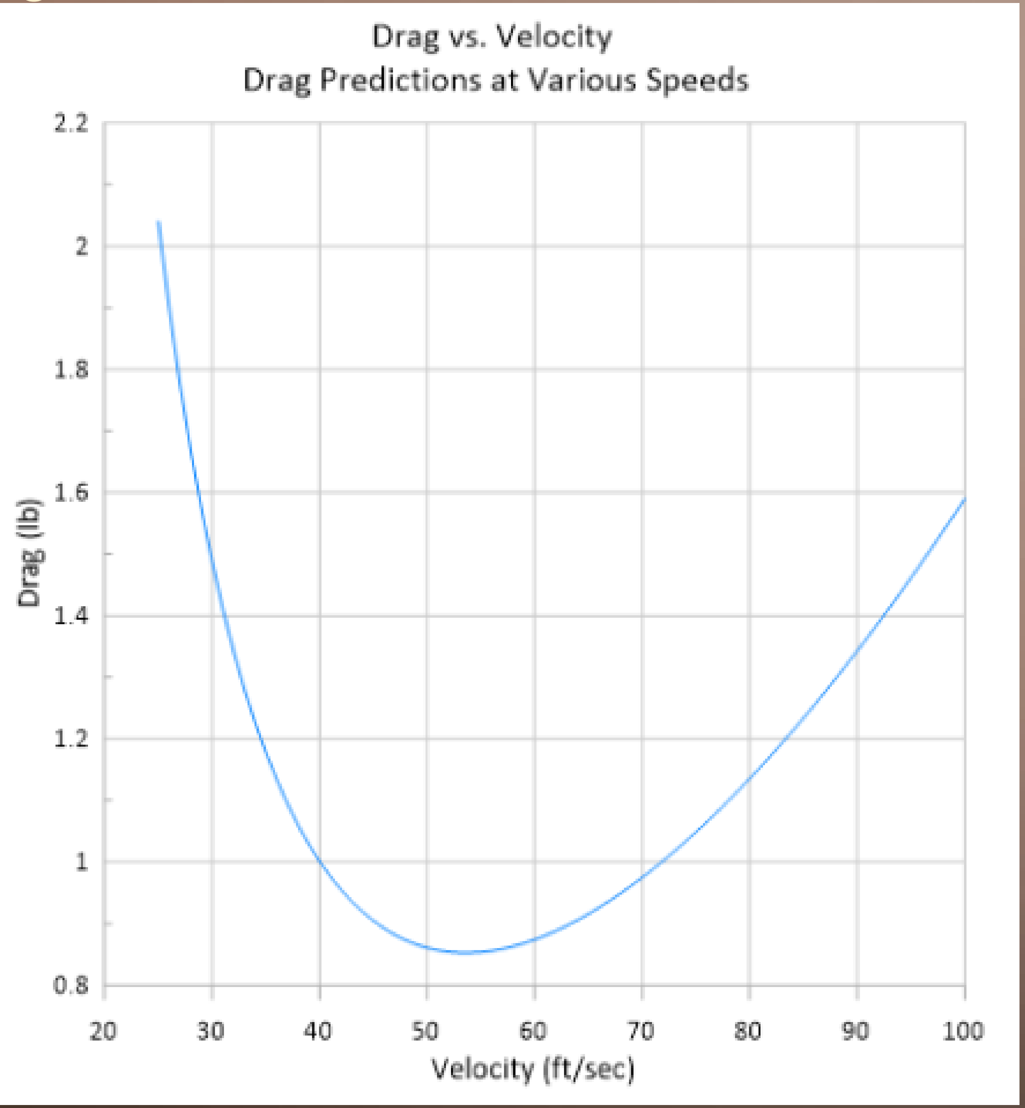
Kalman Filter

- A linear Kalman filter was used to fuse sensor data and reduce noise/drift

Logic Diagram



Avionics

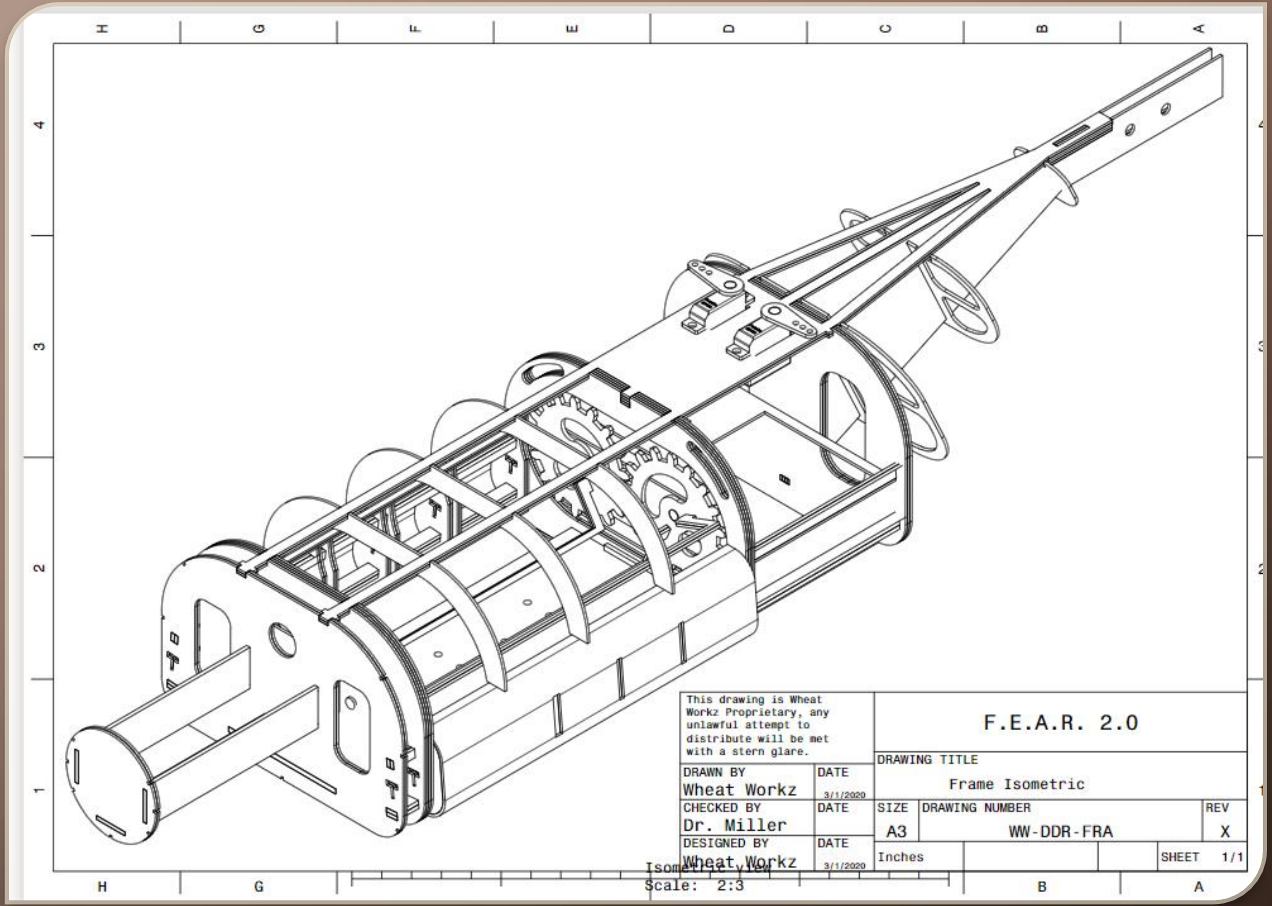


AERODYNAMICS

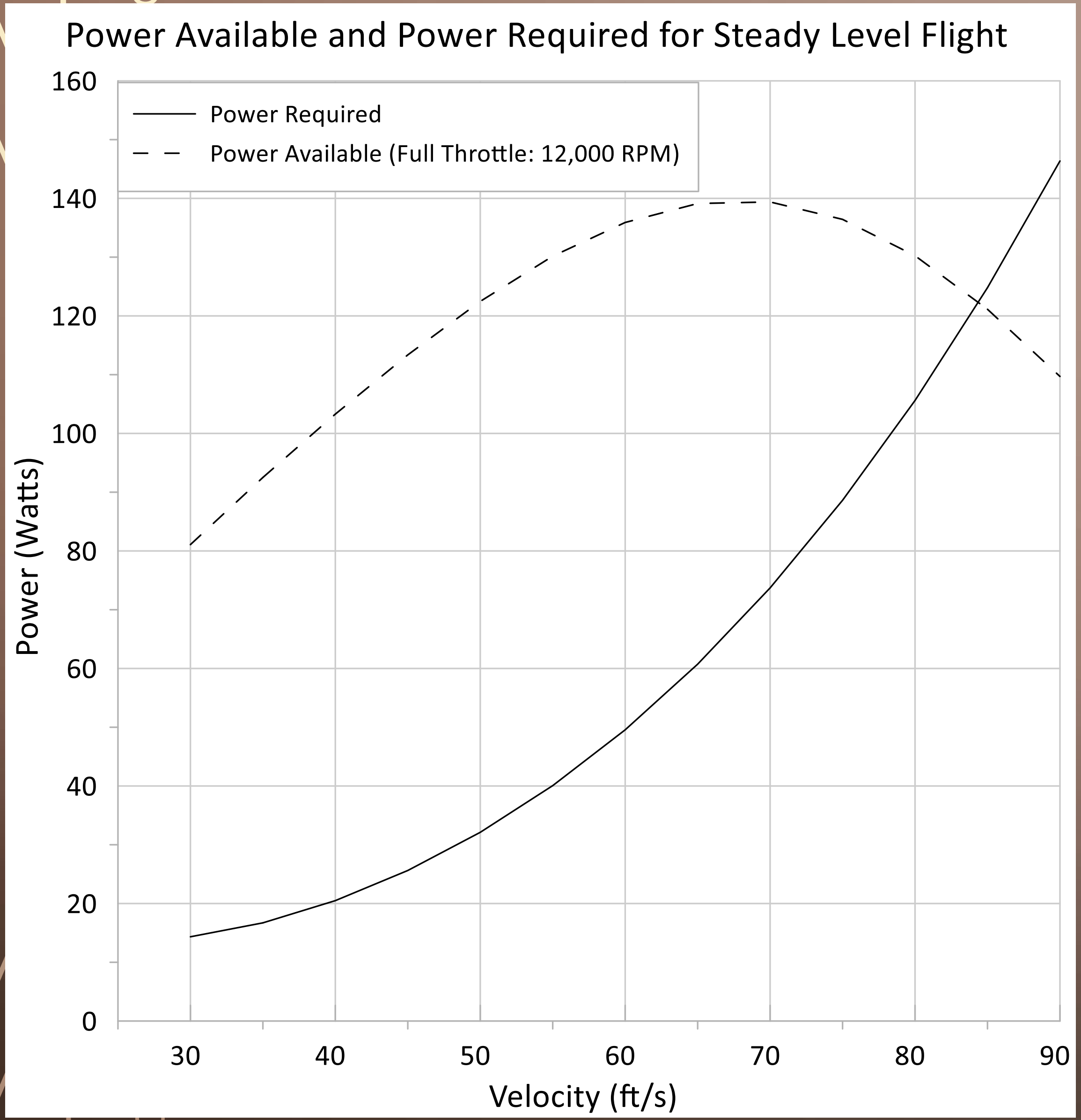
- The nose cone is designed to start from the front engine and transition into the fuselage.
- The fuselage is a semi-oval surface that has a smooth transition into the tail.
- The final airfoil is NACA 6412
  - Selected for its stall speed characteristics and good lift performance.
  - The stall speed is 28ft/sec loading and 22 ft/sec unloaded with a CLmax of 1.05
  - Dihedral of 5 degrees was implemented to help with stability and landing
- Further Aerodynamic analysis where done using VSP using the VSP aero tools

STRUCTURES

- Began with a simple box structure with Balsa spars
  - As the project developed, complex shapes, material changes, and machinability was incorporated
- Semi-monocoque wing with two spars made of Basswood
  - Designed to withstand a 13.75 g turning load
- Drop Mechanism slots into frames to conserve weight and space
- Wing fairing and attachment plates simplify wing installation
- Lite-Ply "Key" used to pin wings to fuselage during field construction



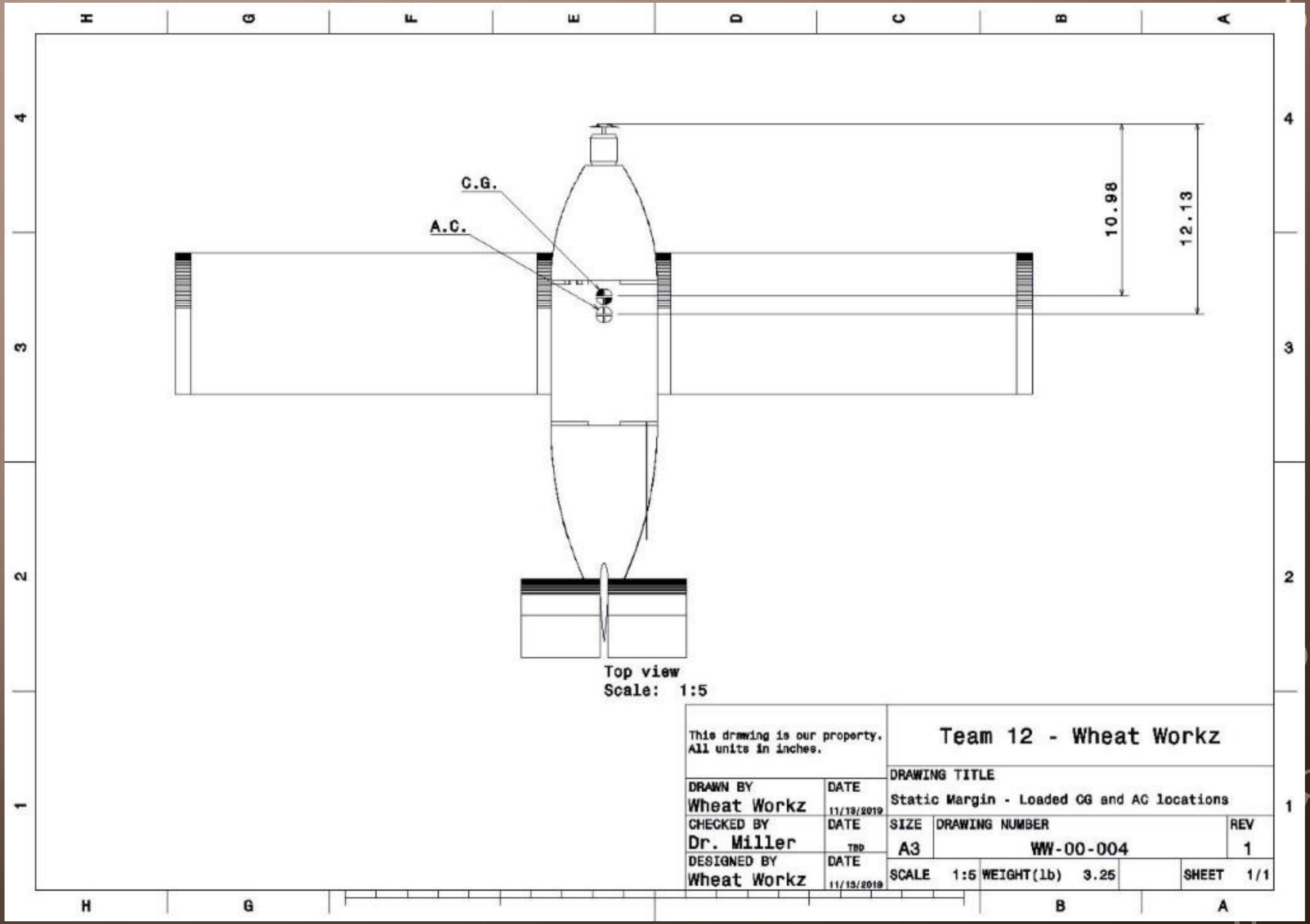
PROPULSION



- Conceptual Design
  - Conceptual Design Primarily focused on estimating a propeller diameter as well as setting a target motor RPM and current draw. Power consumption was estimated and then used to select a battery size and type.
- Preliminary Design
  - Preliminary design matured the propulsion system fully. With the help of propeller data from UIUC, a final size and pitch were selected which complied with the system requirements. A motor was carefully paired with the propeller to ensure current draw would not exceed limits as well as making throttle settings easy to find. Finally, the perfect power pack was chosen on its ability to deliver power to our demanding aircraft competitively and reliably.

STABILITY & CONTROL

- Conventional tail configuration
  - Aerodynamic center established slightly behind quarter chord of wing
- Initial Static Margin of 13%
  - CG calculations for loaded and unloaded configurations
- Tail size increased for better turning
- 50% chord elevator and rudder
- 30% chord ailerons
- Trim calculations up to n-max



AIRCRAFT SPECS

Parameter	Design Prediction
Wingspan	48 in
Wing Chord	9 in
CD,0	0.045
CL max	1.05
(L/D)max	11
Wing Airfoil/s	NACA 6412
K	16%
Max Power Available (at prop)	152 W
Propeller Diameter	8 in
Battery Voltage	14.8 V
Battery Capacity	850 mAh
Endurance	130 seconds
Stall Speed	28.5 ft/s
Max Speed	80 ft/s
Minimum Turn Radius	27 ft
+/- nmax	13.75