

Forest Fire Detecting UAV - The Fireflyer

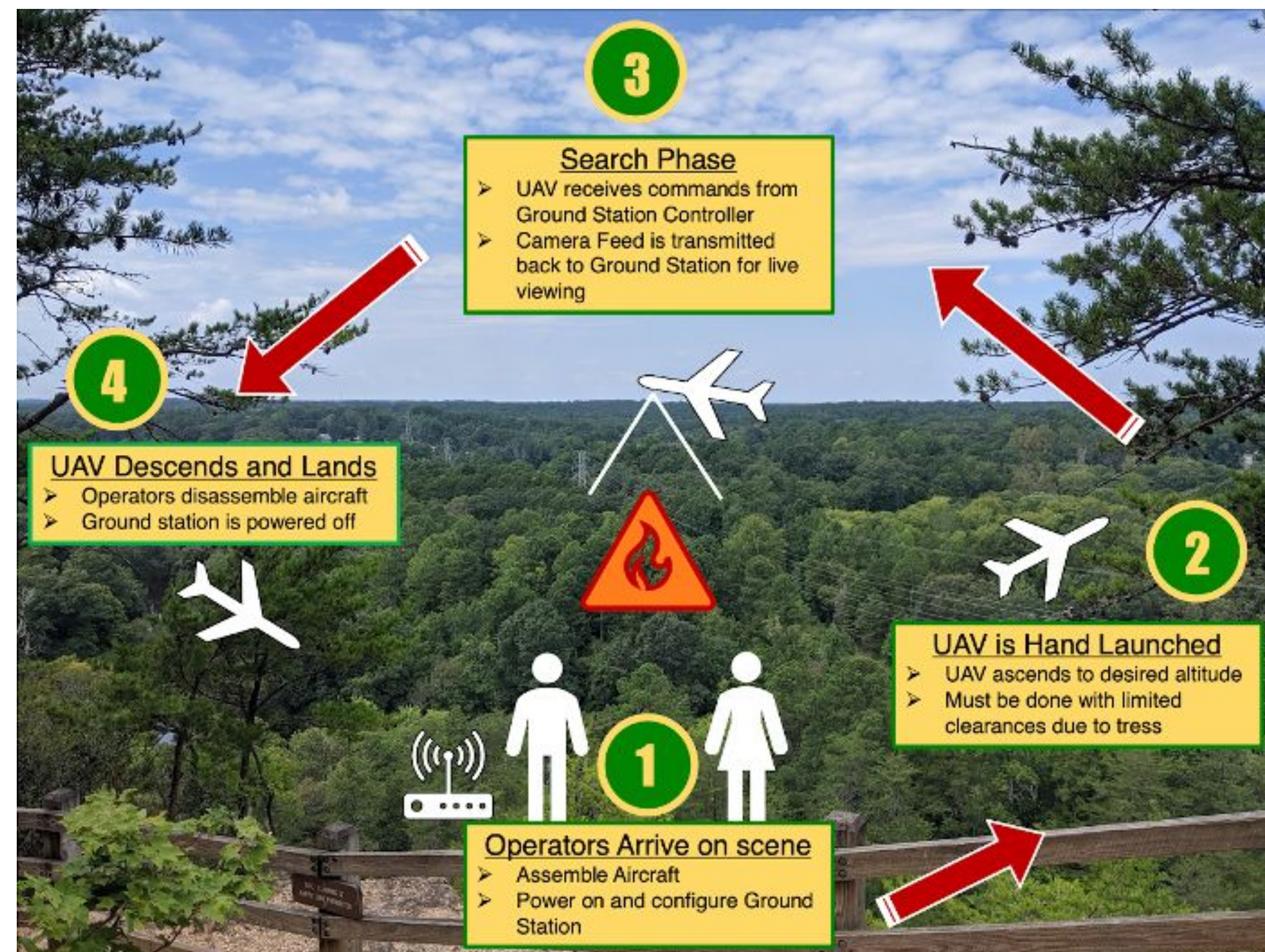
Aerospace Engineering Capstone Senior Design 2020 - 2021

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CONOPS - Concept of Operations

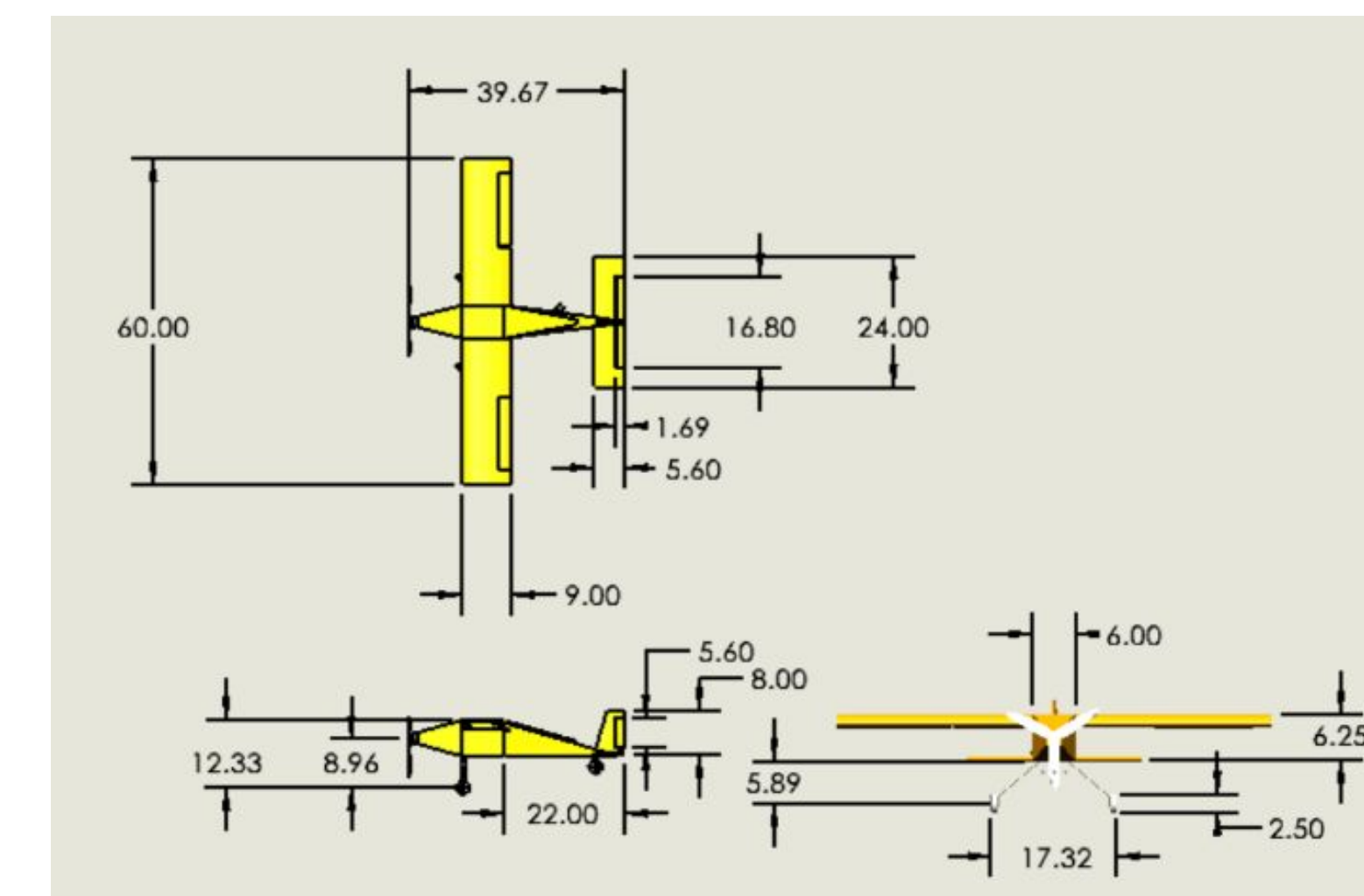
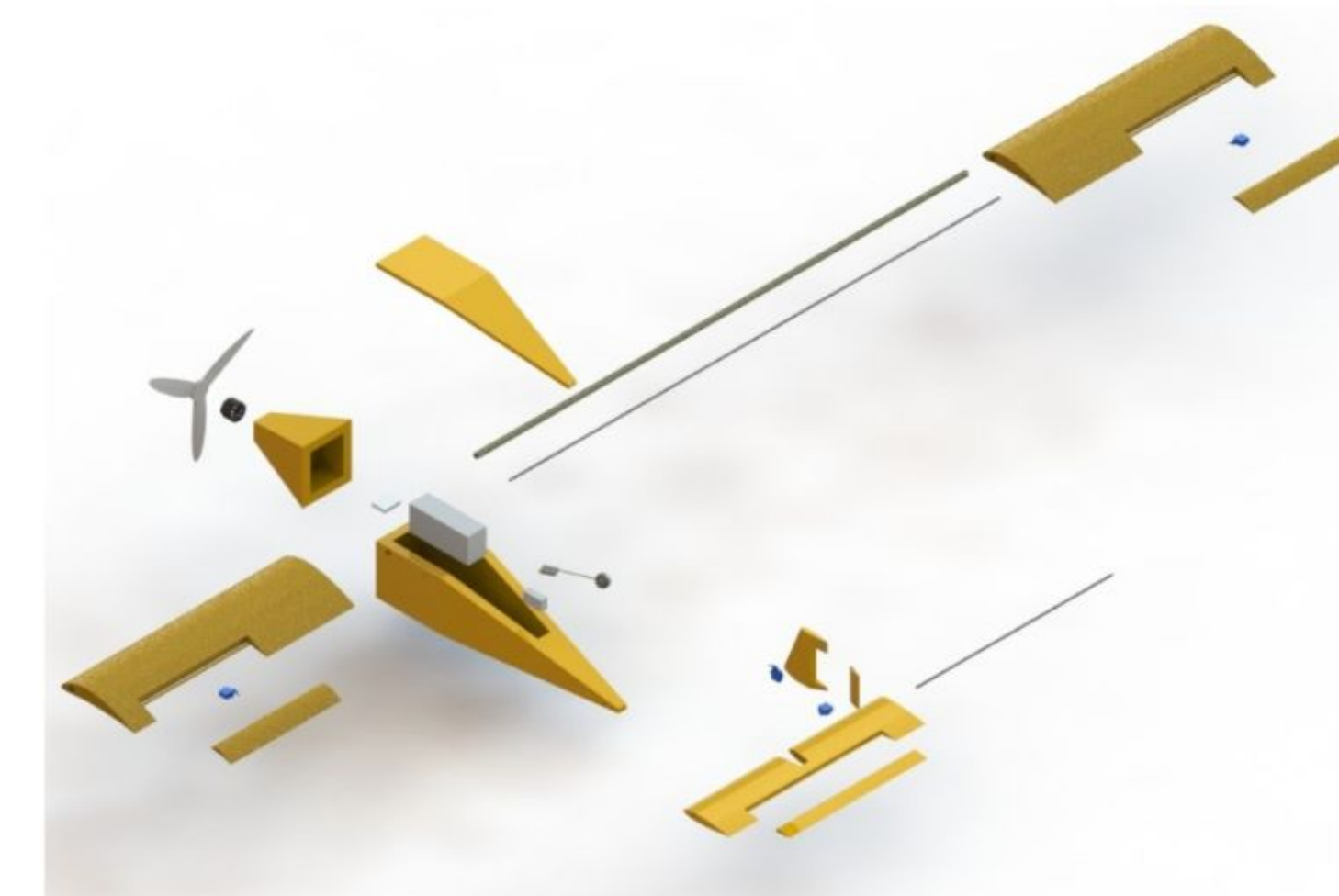
The Forest Service requested a UAV which:

- Weighed less than 20 lbs
- Fits in 5ft X 3ft X 2ft trunk
- Has real time communication with a ground station
- Can be hand launched
- Can be assembled and operated by a max of 2 persons
- Is battery operated



CAD Model

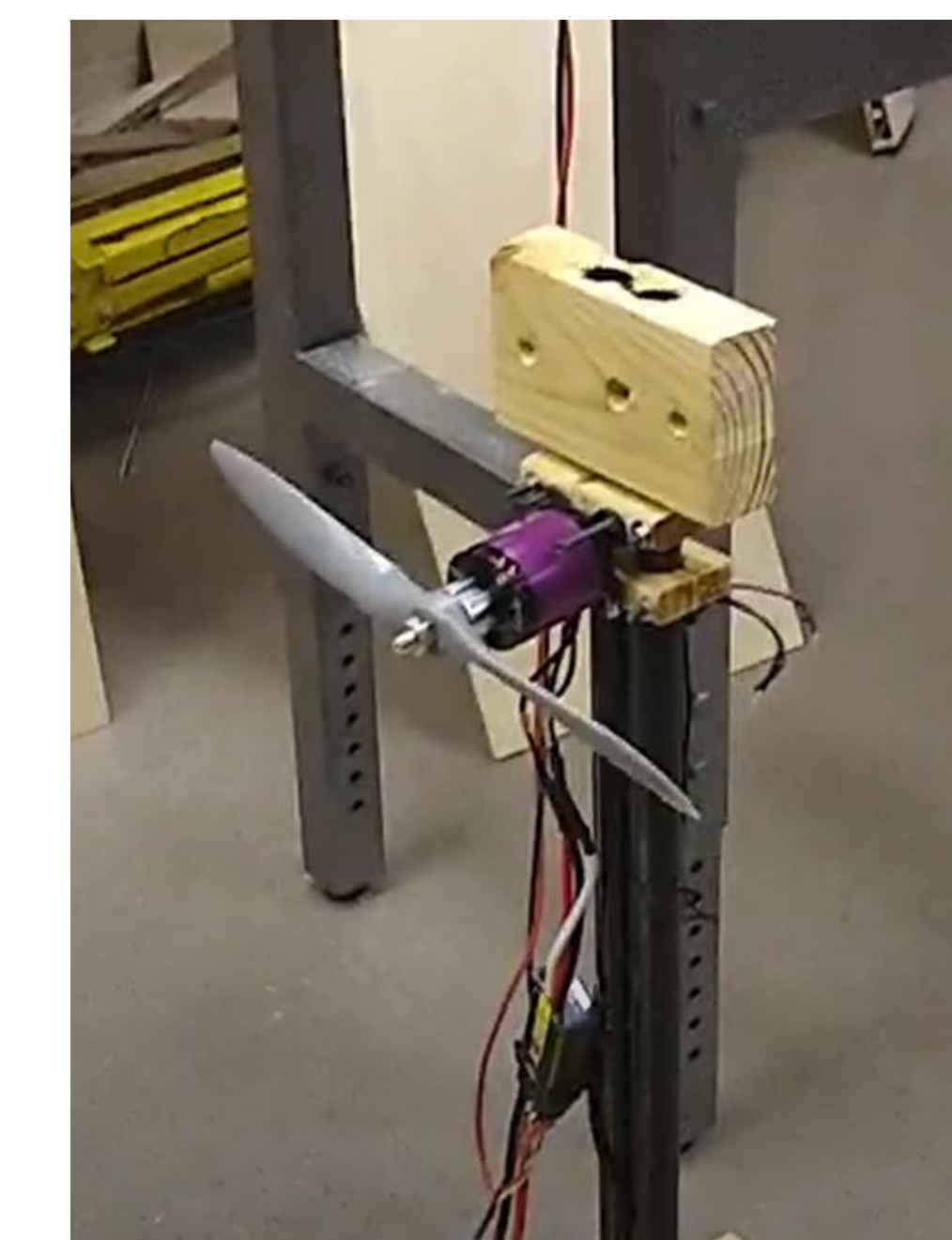
Computer Aided Design (CAD) Models were generated to visualize what the prototype would look like. Dimensions were determined taking into account stability and control variables, desirable lift and drag coefficients, and customer needs. The CAD models also were used to estimate weights of the aircraft based on material density properties.



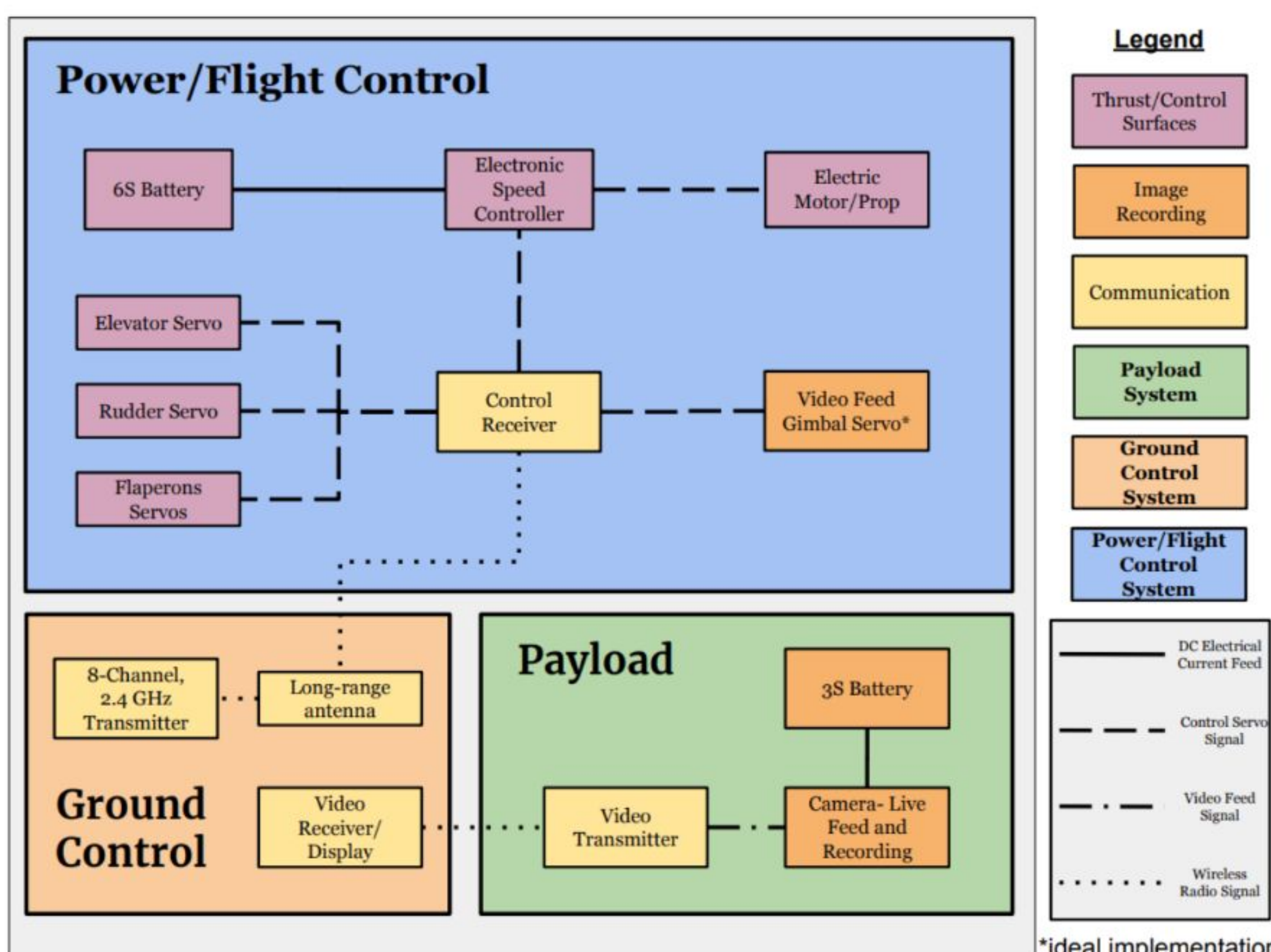
Testing



Pictured are some of the tests performed on the prototype aircraft. The top left picture shows wind tunnel testing of a 3D printed scale model. Results were used to determine the lift and drag coefficients of the prototype. The top right picture shows a wing loading test, performed to ensure the wingbox will not break during flight. The bottom left picture shows static thrust testing of the original motor and propeller to determine the prototype's thrust to power draw relationship. Additional tests included ANSYS and AVL simulations, transmitter and receiver range testing, land gear drop tests, a wing bending test, and a CG location test.

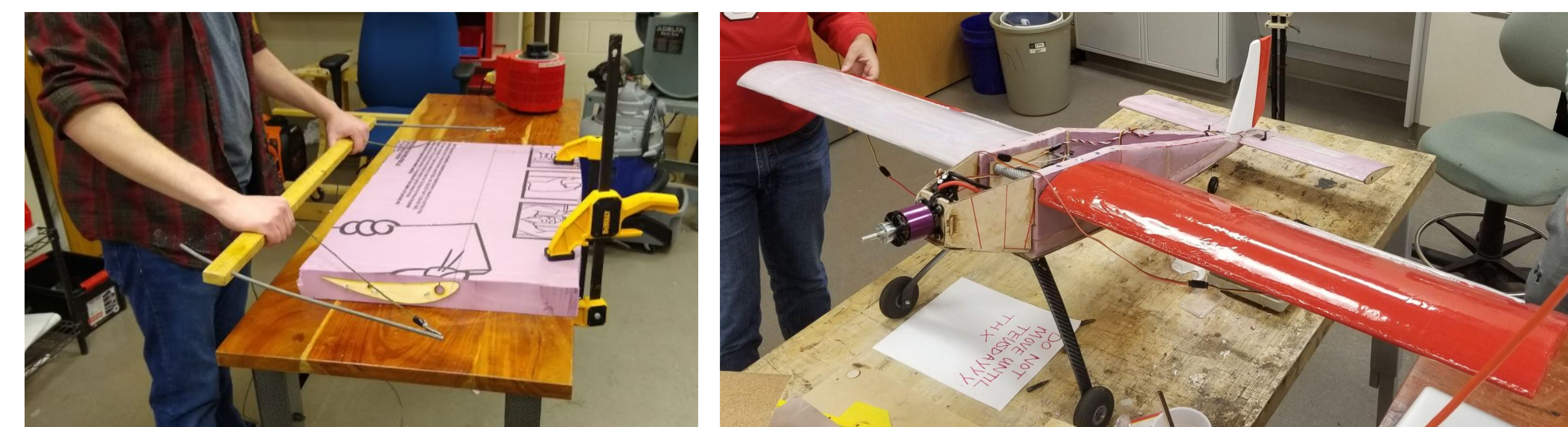


FBD - Functional Block Diagram



Manufacturing

The wings, fuselage and tail of the prototype are made of foam. The foam was cut using a hot wire as shown below. Pieces were affixed together using epoxy. The tops and nose cone were made from wood cut using a bandsaw. Magnets were used to attach the top pieces to the fuselage. The wings were attached with a carbon fiber and aluminum spar, with magnets for extra security at the fuselage.



Prototype

These images show the completed prototype of The Firefly. This prototype crashed during take off on its first test due to poor flight conditions, namely winds gusting from 15 to 25 knots. After a few repairs to the tail, motor mount, and landing gear, the prototype was successfully launched on a less windy day. The prototype flew for three minutes and 24 seconds, transmitting a live video feed to the ground station monitor before landing.

