

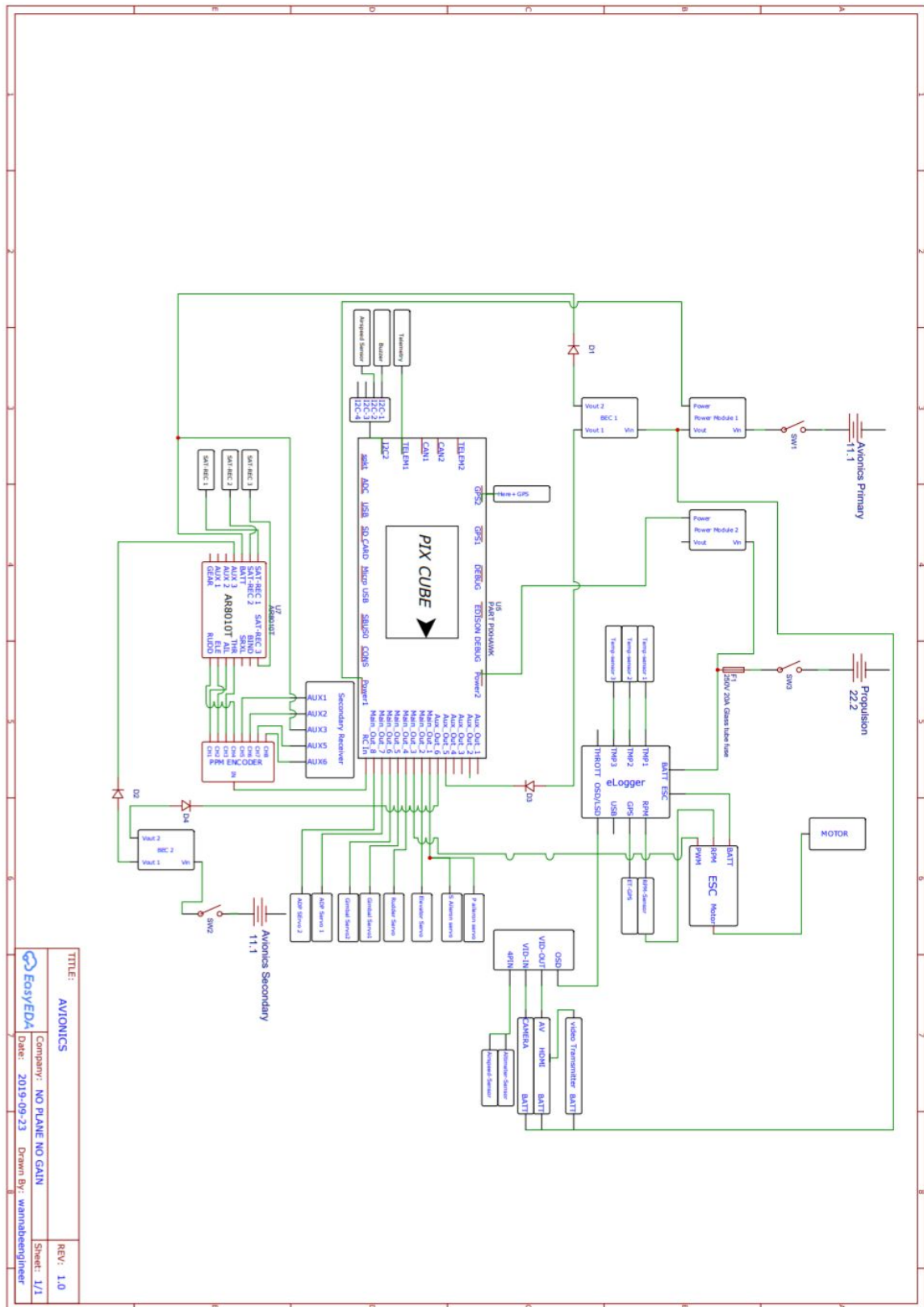
Manufacturing Plan: Subsystems and Avionics Integration

No Plane No Gain

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Block Diagram of Subsystem and Avionics



TITLE: AVIONICS		REV: 1.0
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Date: 2019-09-23		Drawn By: wannabeengineer

Component Description

1. Pixhawk Cube: autopilot unit that computes the required PWM input for servos using an array of external and internal sensors
2. Here+ V2 Rover: provides high precision heading, positioning, and speed information by using a u-blox M8 GNSS module
3. eLogger V4: logs all available sensor data and can be used to analyze and plot mission data after flight.
4. GPS Expander Module: uses WAAS and EGNOS to provide positioning within 8.2ft and speed with 0.1 m/s accuracy
5. Altimeter Microsensor V4: calculates the altitude with a resolution of +/- 1 ft using the barometric pressure and built-in temperature compensation
6. Airspeed Microsensor V3: calculates airspeed using pitot tube and pressure sensor
7. Temp Sensor: outputs temperature in voltage by using a thermistor
8. Brushless RPM Sensor: obtains motor RPM by from pulses between motor and ESC
9. Runcam 5: lightweight action camera that captures HD video in 4:3 ratio that can be stretched to 16:9
10. Herelink HD Video Transmission System: transmits the video captured onboard to the ground station receiver
11. AR8010T Receiver: receives control data from pilot's transmitter and sends them to PPM encoder
12. AR636 Receiver: receives control data from camera and ADP operator transmitter and sends them to PPM encoder
13. DSMX Remote Receiver: provides a redundancy factor to mitigate the risks of lost signals
14. Hitec HS-485HB: maneuvers the plane by deflecting the aileron surfaces.
15. MKS HV6130: maneuvers the plane by deflecting the horizontal and vertical stabilizer surfaces.
16. Hitec HS-5055MG: controls the ADP drop system rotor and hatch mechanism
17. RangeVideo SIR12MG: rotates the camera in 2 degrees of freedom in order to counteract bank angles
18. Power Module: powers Pixhawk and measures voltage/amperage
19. Voltage Regulator (BEC): controls voltage output from batteries to power avionics
20. Primary Power Switch: allows for power on/off without the need for battery removal

- 21. Secondary Power Switch: turns on the avionics subsystem and related electronics.
- 22. Propulsion Switch and Arming Plug: ensures that the propulsion system isn't accidentally turned on.
- 23. OSD Pro: provides a first-person view (FPV) live-feed with eagletree sensor data encoded onto it from the aircraft to a ground station monitor.
- 24. Propulsion Battery: provides power to the motor
- 25. Avionics Primary Battery: the primary source of power for the avionics
- 26. Avionics Secondary Battery: the secondary source of power for the avionics

Subsystem Integration Plan

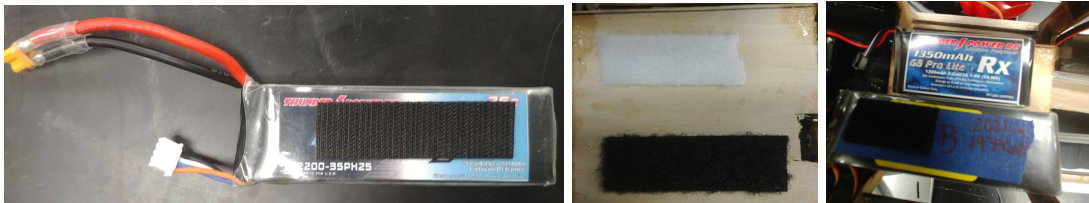
1. Propulsion Battery

- a. Four propulsion batteries (TP4500-3SHV) are connected with a two series two parallel setup using two series connector and one parallel connector. The batteries are located directly behind the firewall, standing vertically. A portion of the fuselage floor is cut out to allow for the batteries to stand vertically on the undercarriage of the fuselage. See location B in the fuselage diagram.



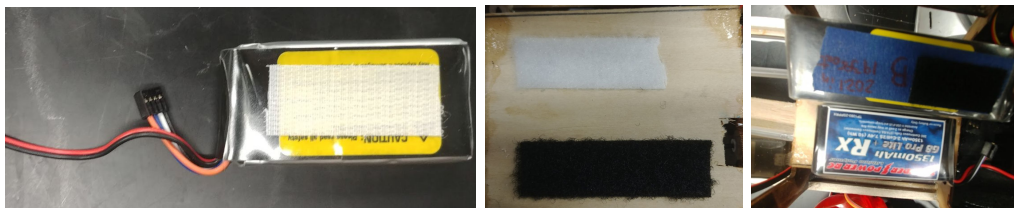
2. Avionics Primary

- a. The battery (TP2200-3SPX25) is velcroed onto the mid bay shelf located 22.5" behind the firewall. The avionics primary is on the right side of the shelf, with its terminals pointing towards the nose of the fuselage. See location F in the fuselage diagram. The battery is connected to the primary switch and the primary power module as shown in the Block Diagram.



3. Avionics Secondary

- a. The battery (TP1350-2SPX25) is velcroed onto the mid bay shelf located 22.5" behind the firewall. The avionics secondary is on the left side of the shelf, next to the avionics primary. See location F in the fuselage diagram. The terminals are pointing towards the nose of the fuselage. The battery is connected to the secondary switch and the secondary power module as shown in Block Diagram.

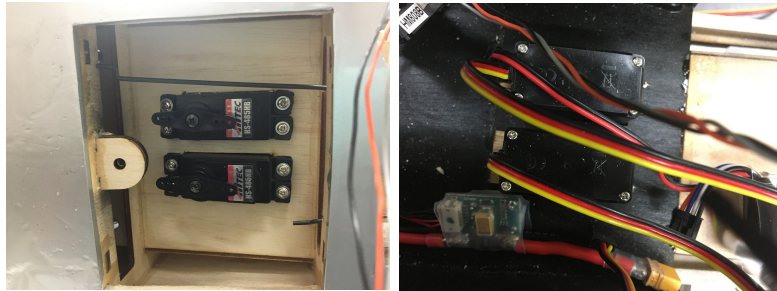


4. Pixhawk

- a. Four m2.5 8mm screws will be unscrewed from the sides of the pixhawk and used to mount the pixhawk to a forward bay shelf. The Pixhawk is located directly at the center of gravity (c.g.) of the aircraft, and will be raised above the fuselage floor to allow space for the ADP structure. All pixhawk connections are made according to the block diagram. See location C in the fuselage diagram.

5. Horizontal Stabilizer Servo (Hitec HS-485HB)

- a. The horizontal stabilizer servo is mounted into the servo housing using 4 wooden screws provided so that the servo top points toward the ground and its output faces the nose. They are located 17.75" behind the fuselage firewall. See location E in the fuselage diagram.



6. Vertical Stabilizer Servo (Hitec HS-485HB)

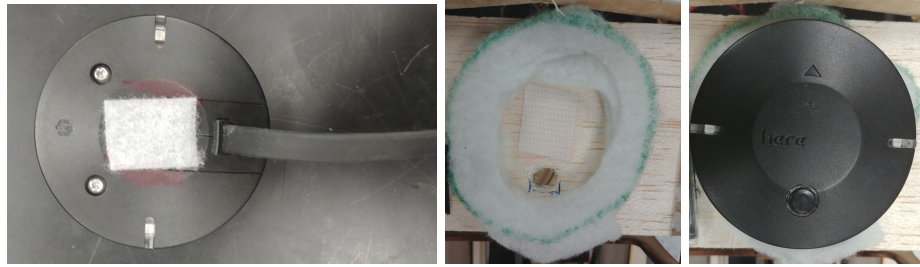
- a. The vertical stabilizer servo is mounted into the servo housing using 4 wooden screws provided so that the servo top points toward the ground and its output faces the nose. They are located 17.75" behind the fuselage firewall. See location E in the fuselage diagram.

7. Aileron Servos (MKS HV6130)

- a. The aileron servos will be located inside the wing, with one servo in each wing. They will be attached to the avionics mounting shelf in the wing by three plywood blocks, each a different height according to the screw heights on the servo.

8. Here+ V2 Rover

- a. The Here+ V2 Rover is attached the top mid bay shelf located directly behind the fuselage wing mount. This shelf is 21.25" behind the fuselage firewall. The Here+ V2 Rover is positioned so that its arrow is pointing towards the nose of the fuselage. See location J in the fuselage diagram.

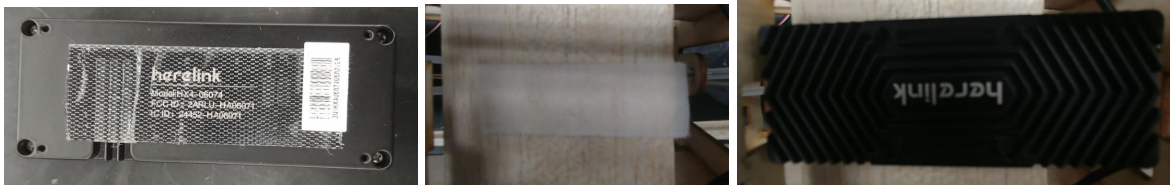


9. Pitot tube based airspeed sensor

- a. The Airspeed sensor is located on the right wing on top of the avionics shelf. It is secured to the wing with velcro. The sensor is connected to the pitot tube with tightening rings. The metal tubing of the pitot is extruding on the leading edge of the wing through a hole made in the sheeting and monokote. This allows for the measurement spots of the pitot to be on the exterior of the aircraft.

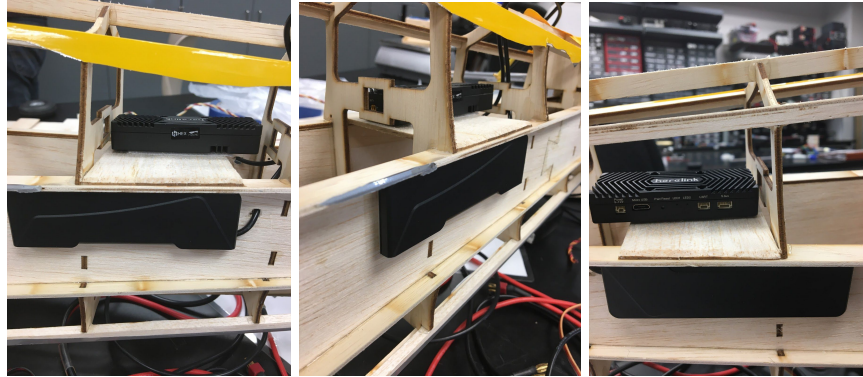
10. Herelink Video Transmitter

- a. The video transmitter is attached to the center of the aft bay shelf with velcro. It is placed flat side down, with its hdmi output facing the tail. See location H in the fuselage diagram.



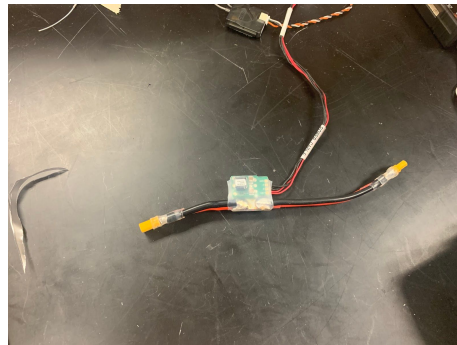
11. Herelink Antennas

- a. The Herelink antennas are located below the Herelink video transmitter, flush with the fuselage wall on each side. They are attached by 3M adhesive, and located 31.5" from the fuselage firewall. See location H in the fuselage diagram.



12. Power Module 1

- a. The first power module is located on the right side of the aircraft. It is flush with the right wall of the fuselage, and flush with the floor of the fuselage. It is on the right of the servo housing, and in directly in front of the primary avionics battery. It is attached to the floor and wall of the fuselage by velcro. The power module is connected to the primary avionics battery and the BEC 1.



13. Power Module 2

- a. The second power module is connected to the left side of the aircraft, flush with the wall. It is located below the Pixhawk shelf. It is connected to the aircraft wall with velcro. The power module is directly in front of the Eagle Tree OSD.

14. Power BEC 1

- a. The power BEC 1 is located directly in front of the Power Module 1. The bottom of the BEC is attached to the right wall of the fuselage, and it is also flush with the fuselage floor. It is connected to both the wall and the floor with velcro. The BEC 1 connected to the Power Module 1.

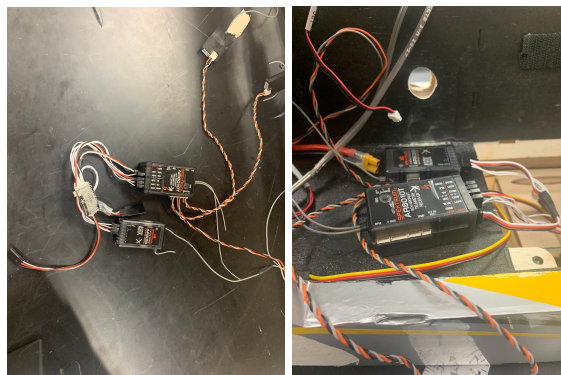


15. Power BEC 2

- a. The Power BEC 2 is positioned in front of the secondary avionics battery. The bottom of the BEC is attached to the left side of the wall, and the right side of the BEC is flush with the floor of the fuselage. It is attached to the wall and the floor with velcro.

16. AR8010T Receiver

- a. The AR8010T Receiver is located on the forward bay shelf, directly behind the Pixhawk. It is attached to the shelf with velcro. The receiver is connected to the Pixhawk. See location C in the fuselage diagram.



17. AR636 Receiver

- a. The AR636 Receiver is located on the forward bay shelf, directly behind the Pixhawk. It is attached to the shelf with velcro. The receiver is connected to the Pixhawk. Pictured above. See location C in the fuselage diagram.

18. DSMX Remote Receivers (3)

- a. One of the DSMX Remote Receivers is positioned near the tail of the airplane. It is on top of a shelf located in the aft bay, and secured to this shelf with velcro. A hole in the bottom of the monokote allows for the receiver antenna to pass through and be taped to the bottom of the fuselage on the exterior. This incision is made with a needle to cut through the monokote.
- b. The other two DSMX receivers are positioned on the wings near the tips on a receiver compartment. There is one receiver in each wing, and it is secured to its respective shelf with velcro. A small hole near the shelf is of each receiver allows for each receiver's antenna to pass through the monokote. This hole, made with a needle piercing the monokote, allows for the receiver's antenna to be taped to the underside of each wing.

19. eLogger V4:

- a. The eLogger V4 is located on the left wall of the fuselage, underneath the Pixhawk shelf and behind the propulsion batteries. It is connected to the Eagle Tree OSD, and is secured to the fuselage wall with velcro.

20. GPS Expander Module

- a. The GPS Expander Module is located on the mid bay shelf where the Here+ V2 Rover lies. It is on the port side of the Here+, and is secured to the shelf with velcro. See location J in the fuselage diagram.



21. Altimeter Microsensor V4:

- a. The Altimeter Microsensor V4 is located in the left wing on the avionics shelf. It is behind the Airspeed Microsensor V3, and is secured to the shelf with velcro.

22. Airspeed Microsensor V3 with pitot tube

- a. The Airspeed Microsensor V3 is located on the left wing on top of the avionics shelf. It is secured to the wing with velcro. The Microsensor is connected to the pitot tube with tightening rings. The metal tubing of the pitot is extruding on the leading edge of the wing through a hole made in the sheeting and monokote. This allows for the measurement spots of the pitot to be on the exterior of the aircraft.

23. Temperature Sensors (3)

- a. The first temperature sensor is placed directly onto the propulsion battery. It is secured to the battery with tape. See location B in the fuselage diagram.
- b. The second temperature sensor is located on the left side of the motor. It is secured to the motor by tape. See location A in the fuselage diagram.
- c. The third temperature sensor is located on the exterior wall of the aircraft. It extrudes from the aircraft from a hole in the right wall of the fuselage, allowing the sensor to pass through. It is secured to the outside of the aircraft with tape.

24. Brushless RPM Sensor

- a. The Brushless RPM sensor is located on the left side of the motor mount. It is secured to the mount with tape. The RPM sensor has two current wires that are soldered to two wires that connect the ESC to the motor. See location A in the fuselage diagram.

25. RangeVideo SIR12MG servos (2)

- a. The RangeVideo SIR12MG servos are two servos located directly above the camera inside the gimbal. See location D in the fuselage diagram.

26. Primary Power Switch

- a. The Primary Power Switch is located on the right side of the avionics batteries on the exterior of the fuselage wall. A small section of the fuselage is cut away to allow for the switch to be accessed from the outside of the fuselage.

27. Secondary Power Switch

- a. The Secondary Power Switch is located to the right of the avionics batteries, on the exterior fuselage wall. A small section of the fuselage wall is cut away to allow for the switch to be accessed from outside the fuselage.

28. Propulsion Switch and Arming Plug

- a. The Propulsion Switch and Arming Plug are located on the left side of the fuselage, below the Pixhawk shelf and directly behind the propulsion battery. The arming plug is attached via screws, and it is connected to the eLogger V4.

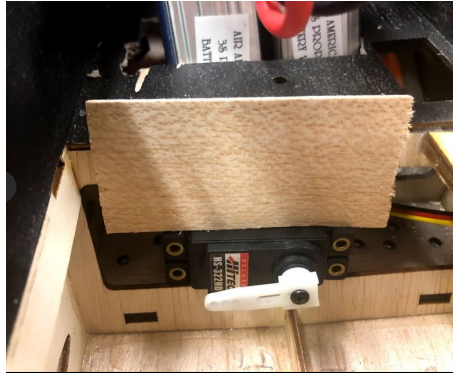
29. Runcam Split 3 Micro

- a. The Runcam split is located inside the gimbal, outside the aircraft. It is encased and attached to the gimbal, and is connected to the two RangeVideo servos. It is

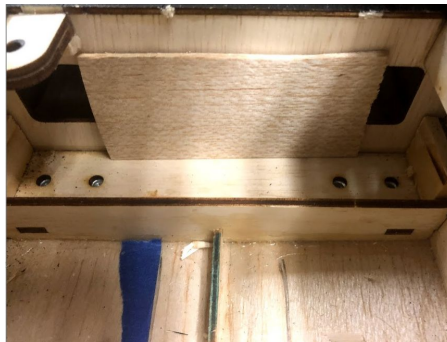
located behind the Pixhawk, beneath the undercarriage of the fuselage. See location D in the fuselage diagram.

30. Hitec HS-5055MG

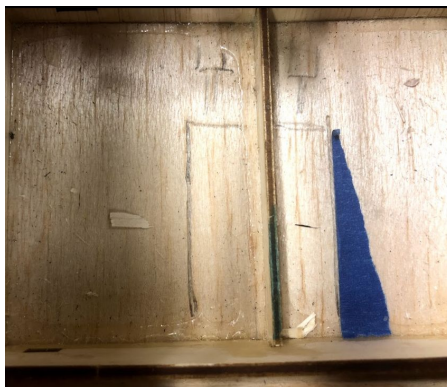
- a. The Hitec servo is located directly forward of the ADP drop system structure, attached horizontally below the fuselage floor.



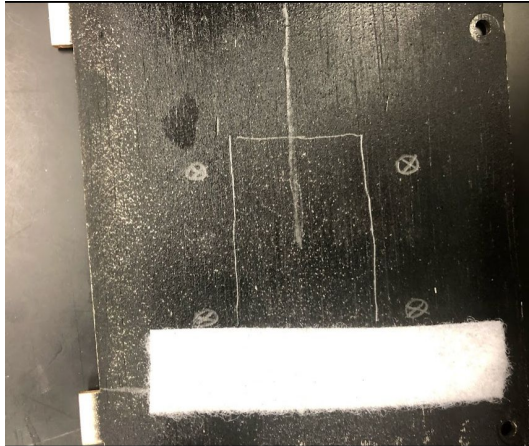
- b. The servo's default arm will be replaced with a circular one and attached to the ADP.
- c. ADP bucket is attached to the servo and the arm is then connected to a bearing mounted into the wall added in to the back of the compartment



- d. Hole is cut into the bottom of the fuselage dimensioned at $2 \frac{3}{16}$ " by $1 \frac{3}{16}$ "



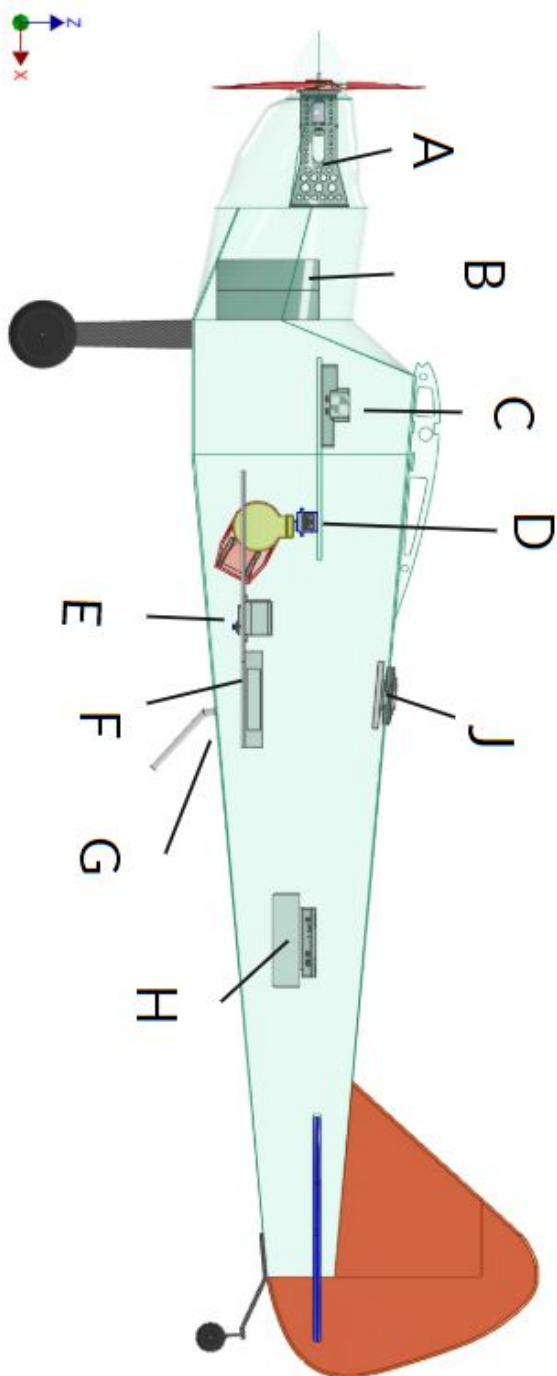
- e. Cut piece is attached with hinges to the frame.
- f. Rubber bands are attached to the frame and the door to keep it closed
- g. ADP chute is attached to platform by cutting the same sized hole as in the fuselage floor and attaching the chute at the 4 marked screw points.





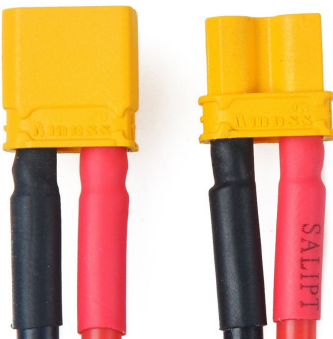

31. Eagle Tree OSD Pro




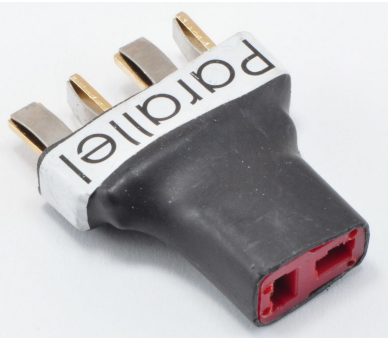
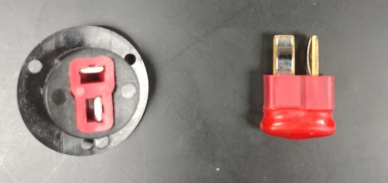
- a. The Eagle Tree OSD is located on the left wall of the fuselage, below the Pixhawk shelf. It is attached to the fuselage interior wall with velcro, and is connected to the arming plug and the Power Module 2.



Fuselage Avionics



Wiring

	Connection name	Purpose	Image
A	Male hdmi to male micro hdmi	Connect av2hdmi output to the av2hdmi input of the video transmitter	
B	3 pin to RCA Male Video cable	Connect the output of the OSD PRO to the RCA video input of the av2hdmi module	
C	Deans Connector male and female	Use for propulsion batteries, their connections to each other, power module 2, eLoggerV4, arming plug	
D	XT 30 Connectors male and female	Used on primary avionics battery, primary avionics switch, power module 1, BEC1, BEC2	
E	JST RCY connectors male and female	Used on the avionics secondary battery, avionics secondary switch,	

F	Futaba J Connector	Used for connections between receivers and PPM encoder	
G	Hitec S connectors	Connecting servos to the pixhawk servo line	
H	Deans Series connector	Connects two batteries in series. positive of first and negative of second are connected. negative of first and positive of second are output.	
I	Deans Parallel Connector	Connects two batteries in parallel.	
J	Armsafe Arming Kit Schumacher	Used to arm the propulsion battery system	

K	Primary Power Switch	Used to arm the Primary avionics battery system	
L	Secondary Power Switch XL601 Switch	Used to arm the secondary avionics battery system	

Pixhawk standard Wiring Set: all are JST to DF13 connectors

