Volume

1

APPLIED AERONAUTICS

The Albatross UAV

UAV Kit Build Manual

APPLIED AERONAUTICS, LLC

Albatross UAV Build Manual

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Section

2

Section 2: MOTOR

IMPORTANT: Inside the motor box you will find motor bullet connectors and heat shrink. These will be used later on in the build process. Please put them to the side for safe keeping.

2.0: MANUFACTURERS NOTES

- The motor is mounted inside the fuselage with only the motor shaft sticking out the rear of the fuselage. This allows for a high level of aerodynamic efficiency.
- No exit port for motor heat is needed under normal operating conditions
- The motor is screwed in from the outside of the fuselage via M4 x 10 mm countersunk screws.
- *NOTE: The screws included inside your motor box are too short and not to be used.*

2.1: INSTALLATION INSTRUCTIONS

1. Open the motor box and remove the motor mounting bracket. It is a large metal bracket in the shape of an X.
2. Center the bracket on the outside of the motor firewall at the back of the fuselage.
3. Align the center hole of the mounting bracket with the center of the motor firewall.
4. Drill the hole for the motor retaining nut (the center hole) using a 9/16” drill bit.
    a. *NOTE: Start with a smaller drill bit and increase the size incrementally.*
5. Align the four countersunk holes on the mounting bracket evenly on the motor firewall.
    a. *NOTE Orientation should be in either a “+” orientation or an “X” orientation of the holes.*

    b. Each hole should either be located TOP, BOTTOM, LEFT and RIGHT (+) or TOP LEFT, TOP RIGHT, BOTTOM RIGHT and BOTTOM LEFT (“X”).
    c. *NOTE: This is critical for thrust angle offsets later on.*
6. Mark each of the four hole locations.
7. Drill only one of the four holes using a 4mm drill bit. **Do not drill all four at once.**
8. Place an M4 screw through the recently made hole and adapter. This will ensure the adapter does not move.
9. Drill the second hole and add another screw.
10. Repeat this process until all four holes are drilled.
11. Re-drill the holes with a countersunk drill bit to ensure that the M4 screws sit flush
12. Place the motor inside the fuselage and align it with the four motor screw holes. They should line up correctly.
13. Screw one of the M4 screws in until it catches the motor thread.
    a. *NOTE: Do not tighten the screw.*
14. Repeat this process with the remaining three screws.
15. Once all screws are attached, tighten them from opposing sides (i.e., top then bottom, left then right).
    a. *NOTE: The objective is to attach the motor evenly and to ensure the motor shaft is perpendicular to the outside of the fuselage firewall.*
16. Check that the motor shaft retaining nut does not rub when rotating during operation.
    a. *NOTE: If needed a small washer can be used between the motor and the inside of the firewall to adjust the thrust angle of the motor.*
17. There should be no vibration or lateral movement.
18. After ensuring proper alignment, remove each screw one at a time and apply Red Loctite.
19. Reinsert the screws one at a time.
20. Complete a final check of the motor area to ensure the screws are flush and tight, the motor shaft is straight, and the retaining nut and motor casing are clear of obstruction.
21. The motor is now installed.

Section

3

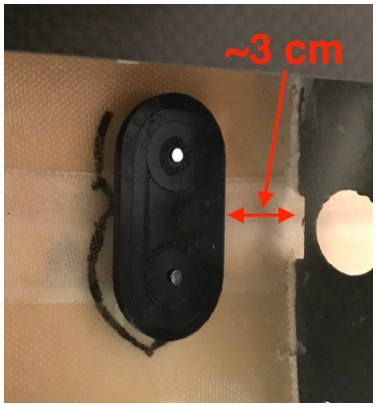
Section 3: LIDAR

3.0: MANUFACTURERS NOTES

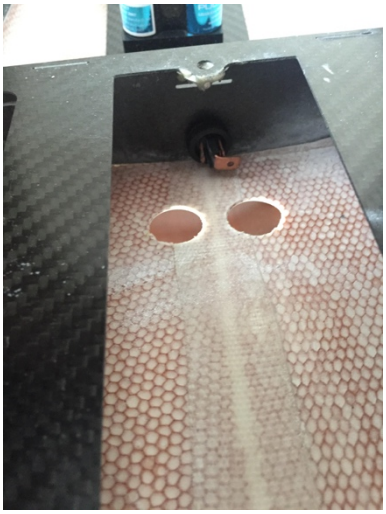
- The process for mounting your LIDAR will depend on the unit you purchased (standard vs. long range). Please follow the corresponding instructions below.

3.1: INSTALLATION INSTRUCTIONS – SHORT RANGE LIDAR

1. Unscrew and remove the rectangular carbon fiber tray from the back of the fuselage.
2. Place the Lidar inside the fuselage with the lenses facing down, approximately 3cm (1.18”) from the front edge of vertical carbon fiber brace.
    a. *NOTE: The piece pictured is a 3D printed stencil. The files are available on our file servers.*
3. Once aligned, trace the outside of the lens area with a marker.
4. Draw a straight line through each circle.
5. Make a small pen mark at each intersection.
    a. *NOTE: This mark represents the center of each lens.*
6. *IMPORTANT:* The interior of the fuselage contains an extra layer of composite-based tape over bottom seam. This leads to a slight increase in elevation, giving your trace the appearance of being closer together than the actual dimensions of the Lidar.
7. Make a stencil on a piece of paper of the lens area of the Lidar.
8. Mark the same lens center hole intersections on the stencil
9. Put the paper stencil aside for now
10. Use a push pin and make a small hole at the trace intersection that is on the most level part of the interior of the fuselage.
    a. *NOTE: Be sure to pierce all the way through the skin of the fuselage.*
11. Flip the fuselage upside down (bottom facing up).
12. Place and center the paper stencil over the small pinhole. Place a pushpin through the existing hole on the paper stencil into the hole already made in the fuselage.



    a. *NOTE: Use the stencil to keep orientation constricted this will ensure that the orientation is perpendicular with the longitudinal axis of the fuselage.*
13. Make a second small hole with the push pin and pierce the skin of the fuselage from the outside.
    a. *NOTE: The two small holes that represent the center area of the Lidar lenses.*
    b. Check this prior to proceeding by putting the Lidar back into the fuselage and checking the horizontal alignment.
    c. Both holes should be in line with each other.
14. Remove the Lidar unit and flip the fuselage back upside down (bottom facing up).
15. Place painters tape over the area where the two small holes are.
    a. *NOTE: This will help to reduce pain chipping when cutting into the fuselage.*
16. Cut two 19mm holes for the lenses using the center pin holes as the guide pilot hole.
    a. *NOTE: We recommend doing so with a diamond coated circular hole saw.*
    b. *NOTE: This type of hole saw will "walk" or move if not used with a drill press. Extreme caution should be taken.*
17. Check to ensure the Lidar lenses fit correctly.
18. Flip the fuselage back to its upright position with the newly cut holes facing down.
19. Place two layers of 3M permanent tape over the top, flat area of the Lidar.
    a. *NOTE: The wiring port on the Lidar must be facing the rear of the fuselage.*
20. Place the Lidar over the holes, taking caution not to move the fuselage abruptly.
21. Place the removable carbon shelf back into its permanent location taking caution to ensure that the thumb screw hole is aligned correctly.
22. Reach under the fuselage to press the Lidar gently onto the tray. The tape will stick without very much force.
    a. *NOTE: Do not scratch the lenses of the Lidar.*
23. Remove the carbon fiber tray carefully.
24. Press the Lidar firmly onto the tray.
25. Insert the tray with the newly mounted Lidar back into its permanent location.
26. Check the orientation of the holes.
27. If satisfied with the hole orientation, remove the tray and make sure the sensor is pressed firmly in place.



28. The Lidar unit is now installed.

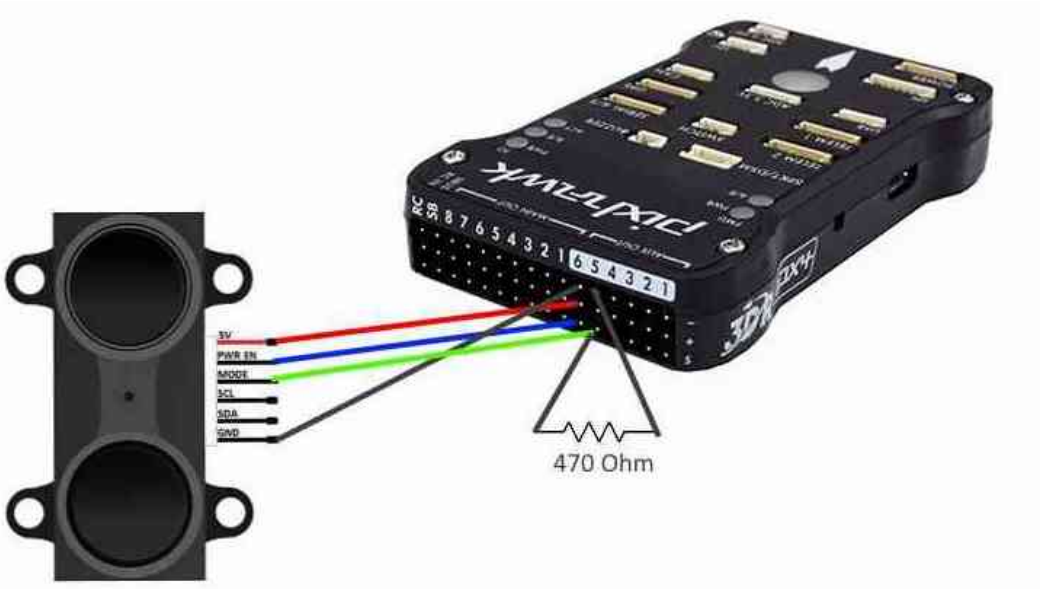
3.2: INSTRUCTIONS – SHORT RANGE LIDAR WIRING

LIDAR-Lite Pin	Pixhawk Pin
1	AUX Channel 6 - V+
2	AUX Channel 6 - Signal
3	AUX Channel 5 - Signal
4	(not used)
5	(not used)
6	AUX Channel 6 - Ground

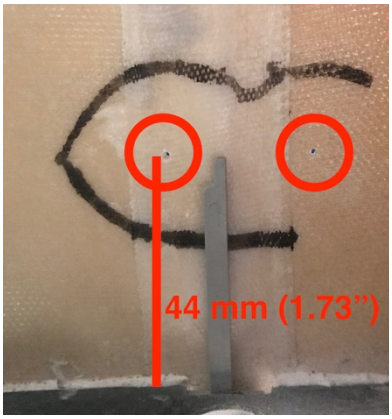
*****NOTE: This unit is only recommended to be used as a serial device and not as a digital i2c device due to interference it can cause.***

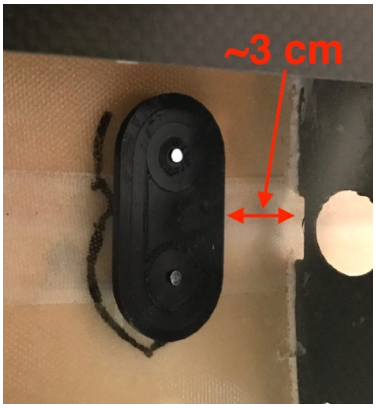
1. Install a 470 Ohm resistor between Pin 3 and the Pixhawk AUX Channel 5 ground pin.
    a. *NOTE: A resistor is needed because it allows the Lidar to receive continuous acquisition measurements.*
2. Solder or crimp servo leads according the following table and images.
    a. *NOTE: BEC power needs to be provided to the servo rail when using this Lidar as it receives power from the servo rail.*
3. The Lidar wiring is now complete.

3.3:



3.3: INSTALLATION INSTRUCTIONS – LONG RANGE LIDAR



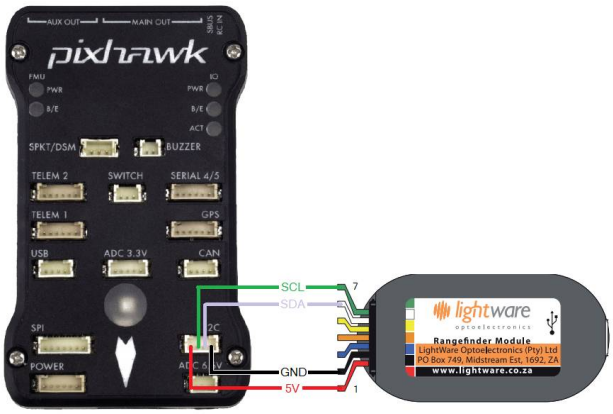


1. Unscrew and remove the rectangular carbon fiber tray.
2. Place the Lidar inside the fuselage with the lenses facing down, approximately 3cm (1.18”) from the front edge of vertical carbon fiber brace (see photo).
    a. *NOTE: This Lidar should be slightly left of center (see photo).*
    b. *NOTE: The piece pictured is a 3D printed stencil. The files are available on our file servers.*
3. Trace the bottom of the Lidar.
    a. *NOTE: The widest part of the unit is slightly above the bottom. Do not trace this lip that makes up the widest part. Trace the true bottom of the unit.*
4. Draw a straight line through each circle.
5. Make a small pen mark at each intersection.
    a. *NOTE: This mark represents the center of each lens*.
    b. This mark should be 44mm (1.73”) from the same front edge of vertical carbon fiber brace. See photo.
6. Remove the Lidar and flip the fuselage upside down.
7. Cover the general area where the Lidar will be positioned with painter’s tape.
8. *IMPORTANT: SKIP TO THE SECTION 3.4 IF USING THE 3D PRINTED MODEL*
9. Make a stencil on a piece of paper of the bottom area of the Lidar.
10. Mark the same lens center hole intersections on the stencil.
11. Place a pin in each hole to hold the stencil.
12. Draw around the stencil on the tape.
13. Flip the fuselage back so it is sitting normally.
14. Cut around the inside of the drawn area with a sharp X-Acto knife.
15. Check the sizing of the hole.
16. Refine the hole cutout from the outside of the fuselage if needed.
17. Insert the Lidar through the hole until it is firmly in place with its widest part (the lip) preventing it from moving further through the hole.
    a. *NOTE: The cable port must be on the right side of the fuselage.*
18. Add a small bead of hot-glue to the outside of the Lidar lip to affix it to the fuselage. See photo.
19. Add more hot glue to the inside area of the Lidar to mount it permanently to the fuselage.

3.4: INSTALLATION WITH 3D PRINTED MODEL

1. If using the 3D printed model, the holes are already populated.
2. Follow the same steps as above except that this is simplified by:
    a. Trace the outside of the model inside the fuselage.
    b. Mark the hole location at 44mm from the vertical carbon fiber brace with a small nail.
        i. Use the side that is raised up facing downwards to alleviate any elevation issues.
3. Flip the fuselage upside down.
4. Place painters tape over the general cut area.
5. Place each nail back through the model and into the existing holes made in the fuselage.
6. Use erasable marker to outline the printed model.
7. Remove the printed model.
8. Cut out the traced area around the inside of the trace line.
9. Insert the Lidar through the hole until it is firmly in place with its widest part (the lip) preventing it from moving further through the hole.
    a. NOTE: The cable port must should be on the right side of the fuselage.
10. Add a small bead of hot-glue to the outside of the Lidar lip to affix it to the fuselage. See photo.
11. Add more hot glue to the inside area of the Lidar to affix it permanently to the fuselage.

3.5 INSTRUCTIONS: LONG RANGE LIDAR WIRING



This unit is set up to be used as a digital i2c device. Please wire according to the photo. Splicing the i2c will need to occur or alternatively an i2c splitter may be used.

Section

4

Section 4: AIRSPEED SENSOR

4.0: MANUFACTURERS NOTES – PITOT TUBE

- The pitot tube of the airspeed sensor is installed at the front of the fuselage on the horizontal centerline, slightly above the center vertical axis of the plane's nose.
- More specifically, it is installed 1/8" (3mm) above the top of the interior shelving. Doing so allows for easy access to recess the pitot tube when the unit is not in use.

4.1: INSTALLATION INSTRUCTIONS – PITOT TUBE

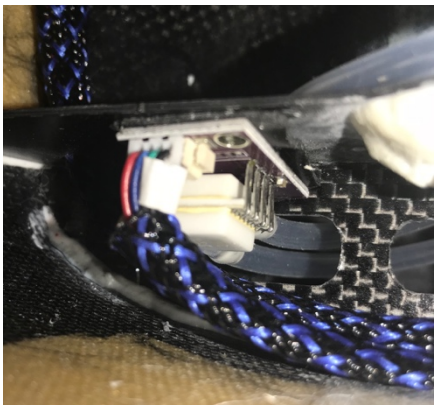
1. Use a flashlight and shine it on the inside of the fuselage.
    a. *NOTE: This will assist you in seeing through the skin of the fuselage in order to draw and drill an adequate hole for the pitot tube.*
2. Assess the nose of the fuselage from the outside to ascertain the location at which the shelving meets the skin at the furthest forward point.
3. Mark this area lightly with a pencil.
4. Look at the nose from the inside of the fuselage and place your finger on pencil mark you just made.
5. Ensure that this location will give you adequate clearance for a hole to be drilled and for your pitot tube to be installed.
6. If satisfied, take painters tape and cover the location you intend to drill through to avoid chipping the paint.
7. Make a hole through the pencil mark with a small push pin.
    a. *NOTE: You will have a difficult time getting completely through the skin if the area has epoxy on the interior joint. Do not try to force it, just make an initial mark.*
8. Slowly drill a 1-2mm pilot hole, drilling 45˚ off of vertical.
    a. *NOTE: This equates to approximately 90˚ (or straight up) from the drilling surface.*
9. Check the location again from the inside of the fuselage.

10. Using the existing hole as a guide hole, drill a 1-2mm hole through the existing hole, parallel to the longitudinal axis of the fuselage.
    a. *NOTE: This should be right above the internal carbon shelving. Be sure to use sharp drill bits as this area is thick composite and reinforced with carbon fiber.*
    b. *NOTE: Take caution of any carbon fiber dust and use a wet towel as needed for suppression.*
11. Drill the hole to a size equal to or slightly smaller than the pitot tube. Approximately 4.00 - 4.10mm.
12. Insert the pitot tube being careful not to bend it, and making sure to cover the small holes close to the front, and the single hole at the very front.
13. Check the pitot tube's fit.
    a. *NOTE: It should be firm but still have enough room to be pushed back into the fuselage when not in use.*
14. Remove the pitot tube entirely and set it aside.
15. If the pitot tube is not snug or wobbles, do the following:
    a. Open the box the motor came in
    b. Remove the rectangular 3-4mm (1/8") thick piece of dense black foam.
    c. Cut a triangle out of the foam that contours roughly to the front of the fuselage.
    d. Place the foam inside the fuselage and check that it fits the area where you drilled a hole for the pitot tube.
    e. Correct the foam shape if needed.
    f. Remove the foam and add several beads of hot glue to the bottom.
    g. Position the foam on top of the shelving at the nose of the fuselage and press it into place.
    h. Once the hot-glue is cured carefully reinsert the pitot tube.
16. The pitot tube should now be secure when inserted without moving.
17. Once complete, recess the tube into the plane in order to protect it from accidental damage during the remainder of your build.

SECTION 4.2: MANUFACTURERS NOTES – AIRSPEED SENSOR

- The airspeed sensor consists of a small electronic board with two protruding plastic ports. The supplied rubber tubing is connected from each of these ports to the pitot tube itself.

SECTION 4.3: INSTALLATION INSTRUCTIONS – AIRSPEED SENSOR



1. Place the sensor upside down at the front of the fuselage. It is to be positioned next to the nose wheel servo.
    a. *NOTE: Do not mount the sensor yet.*
2. Attach the rubber tubing to the sensor and pitot tube.
    a. *NOTE: This is to be done before mounting the sensor.*
3. To do so, connect the tubing to each port and route it through the side opening at the bottom of the shelving strut to ensure adequate clearance to reach the pitot tube adapter when fully extended while also ensuring that it does not kink or break when the pitot tube is recessed and stays out of the way of the nose wheel arm that will be mounted in this area. See Photo
4. Attach the sensor to the bottom of the panel via 3M permanent tape. Take caution to cover any exposed solder tabs if not using them as Carbon Fiber is conductive.
5. Connect the pitot tube port that extends directly out of the back of the pitot tube to the top connector on the sensor.
    a. *NOTE: That is the connector that is furthest away from the electrical PCB board.*
6. Connect the angled pitot tube port to the connector closest to the electrical PCB board.

SECTION 4.4: WIRING INSTRUCTIONS – AIRSPEED SENSOR

1. The airspeed sensor does not follow the standard pinout convention most commonly seen on i2c devices; rather it's backward. Please pay particular attention to the labels on the bottom of the sensor. They are correct.
2. Create a cable of adequate length from the Lidar location to the airspeed sensor location (the Lidar will be in close proximity to your autopilot).
    a. *NOTE: Given the length of the wire, we recommend using twisted wires with the small connector and wire soldered to the end of the twisted wire on both ends, instead of crimping new connector leads*
3. There are solder pads on the bottom of the airspeed sensor if you would like to solder the wires directly to the sensor.

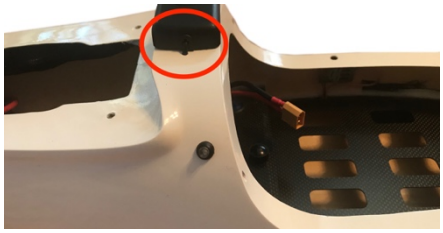
4. Once the cabling is complete, the wiring is finished.
5. *NOTE: If you crack the paint or incorrectly drill your pitot tube hole in this section, this can be remedied by applying widely available, malleable materials such as liquefied plastic.*

Section 5: GPS

SECTION 5.0: MANUFACTURERS NOTES

- The GPS is to be installed inside the fuselage directly in front of the area where the center wing is seated into the fuselage lip.
- We provide you with an external GPS antenna that is placed on the exterior of the fuselage. If you elect to use another GPS, caution needs to be taken with antenna placement as there is often carbon fiber present inside the fuselage and it is not RF transparent. If you mount your antenna on the inside of the fuselage, please be sure to check reception before securing it in place.

SECTION 5.1: INSTALLATION INSTRUCTIONS



1. Mark the area the external antenna will be placed on top of the fuselage. See photo.
2. Cut the GPS antenna cable to approximately 15cm (6”).
3. Drill a small 3-4mm hole for the GPS cable to fit through.
4. Solder a new connector (an SMA Male connector is provided) to the GPS cable.
    a. Alternatively, the GPS cable can be directly soldered to the solder pads of the GPS unit.
    b. If utilizing the SMA male connector on the GPS cable, an SMA female connector (supplied), needs to be soldered onto the GPS. See photo.
5. Attach the external GPS with 3M permanent tape to the top of the fuselage as depicted.
    a. *NOTE: Take caution in the location of the antenna to make sure adequate clearance is provided on both the side where the canopy mounts, as well as the center wing sits.*

6. Route the GPS module wiring from the top cavity of the fuselage to the underside of the removable shelving unit along the side of the fuselage and down through one of the precut holes in the carbon shelving (See photo).
    a. *NOTE: This area will also house any other cables between the top cavity area and autopilot.*
    b. Ensure the cable used is long enough to reach the Lidar with a bit of slack. The autopilot will be mounted nearby later on.
7. If you elect to use a redundant secondary GPS, it is to be installed in any suitable area by replicating the above instructions. The second GPS will plug into the Serial 4/5 port on the Pixhawk.

SECTION 5.2: GPS WIRING

- The GPS unit should be wired in the following manner. Note that an external magnetometer (compass) is present on the GPS unit so an extra two wires will need to be run to the i2c port of the Pixhawk.

Pixhawk Pin	Signal
1	VCC (5v)
2	TX (Out)
3	RX (In)
4	N/A
5	N/A
6	Ground

GPS Pin	Signal
1	Ground
2	SDA (Magnetometer) – I2C
3	SCL (Magnetometer) – I2C
4	TX – Connect to Pixhawk RX
5	RX – Connect to Pixhawk TX
6	VCC (5v)

Section 6: SPEAKER

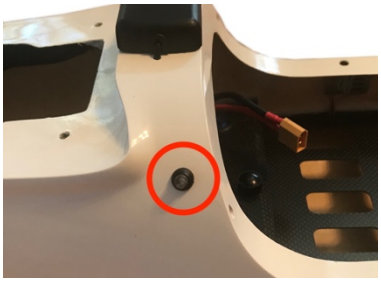
SECTION 6.0: MANUFACTURERS NOTES

- The speaker unit is installed on the side of the fuselage, close to the cable routing for the GPS and button.

SECTION 6.1: INSTALLATION INSTRUCTIONS

1. Hot glue the speaker to the right-hand side of the interior of the fuselage, close to the cabling for the GPS.
2. Solder 2 wire splices into the speaker cabling to lengthen the wires. By doing so you will be able to route them through the predrilled holes and close to where the Lidar is installed.
3. Once lengths are confirmed, this wire plugs into the Pixhawk directly.

Section 7: ARMING BUTTON



SECTION 7.0: MANUFACTURERS NOTES

- The arming button is installed on the right upper side of the fuselage. Approximately, the area between where the canopy is fitted and the small hump on the right side of fuselage lip. See photo.

SECTION 7.0: INSTALLATION INSTRUCTIONS

1. Drill an 8 mm hole in the desired location.
2. Check that the fit is snug and the button does not move.
3. Cut the 3 wires coming out of the button, but take note of which wire location goes where and their color.
4. This wiring should be routed with the speaker and GPS wiring through the predrilled holes.
5. The button is now installed.

Section 8: USB EXTENSION

8.0: MANUFACTURERS NOTES

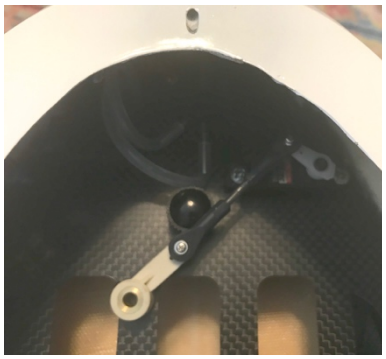
- The USB extension port/led combination board is installed in the center of the cargo bay of the Albatross, attached to the underside lip that supports the removable cargo bay tray.
- Doing so allows for access to the autopilot without having to remove the Pixhawk itself. It also serves as an additional light indicator.

8.1 INSTALLATION INSTRUCTIONS

1. Use the supplied eight pin cable to attach the USB extension board to the Pixhawk.
2. If the cable is not long enough, you will need to splice in and solder an extension for all eight wires.
3. Mount the USB board with hot glue as shown in the photo.
4. Route the cables through the large round hole at the bottom of the vertical former in the fuselage and attach them to the Pixhawk at the ports labeled USB and i2c.
    a. *NOTE: An i2c splitter board or manual wire splice will likely need to be used.*
5. The USB Extension board is now installed.

Section 9: NOSE SERVO

9.0 MANUFACTURERES NOTES



- The nose gear servo is installed in the precut slot in the front of the fuselage. See photo.

9.1 INSTALLATION INSTRUCTIONS

1. Remove an HS-5085 servo from its' packaging and attach the servo horn.
2. Place the servo into the cutout slot with the servo gear on the right-hand side of the fuselage and the servo horn facing the front of the Albatross.
3. Drill a 6mm (1/4") hole into the top of the fuselage lip directly over the screw location of the right side of the servo mounting area.
    a. Doing so makes it easier for you to secure the servo into the tray.
4. Secure the servo to the carbon tray with two #6 or M4 wood screws.
    a. The screws must not exceed 10mm (0.4").
    b. NOTE: The screws provided with your servo are not large enough to hold the servo in place. Please set them aside or discard them.
5. Once affixed, attach a servo wire extension lead and run it from the servo, along the side of the fuselage to the autopilot. A hole has been predrilled to provide access through the side of the vertical carbon bracing. See photo.
6. Set the servo to neutral with your remote control or servo tester and adjust the offset during final setup of the landing gear as well as the servo linkage.
7. Your servo is installed.

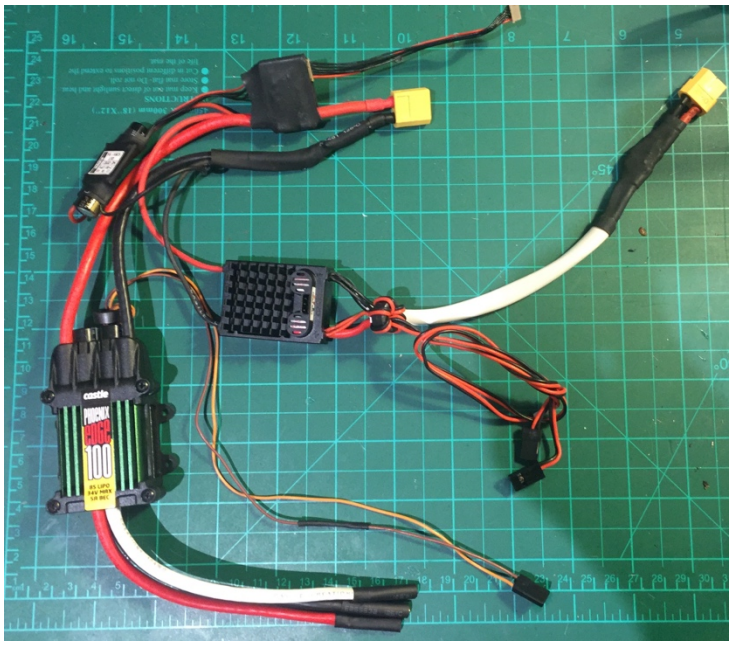
Section 10: ESC

10.0 MANUFACTUERES NOTES

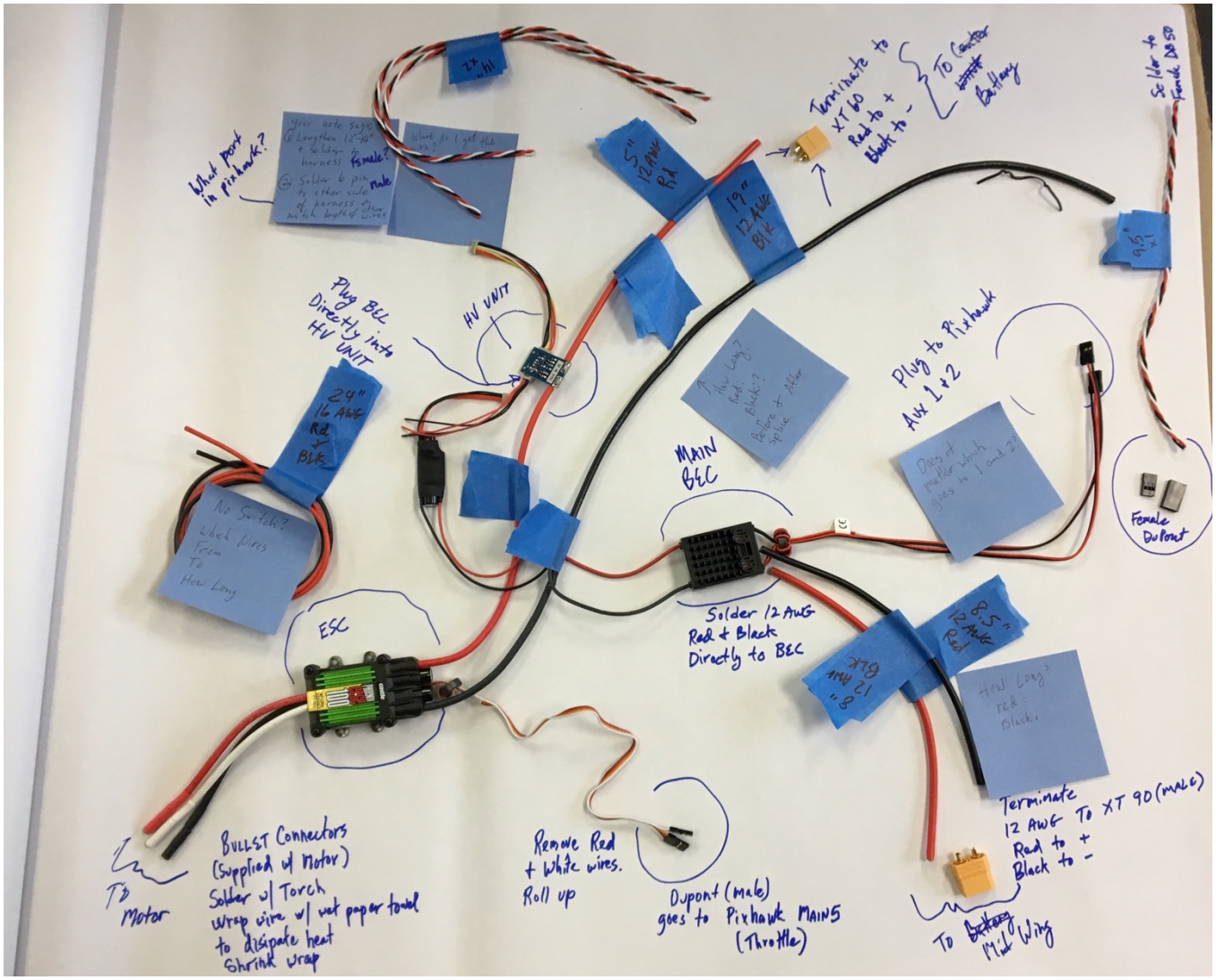
- The ESC is installed at the rear of the fuselage. It is mounted with several layers of 3M permanent tape.

10.1 INSTALLATION INSTRUCTIONS

1. Solder bullet connectors to the three motor leads.
    a. *NOTE: Correctly sized connectors are supplied in the motor box as well as heat shrink to cover them.*
    b. *NOTE: The wire gauge of the ESC does not fit easily into the connectors provided. While the wires are pre-tinned for soldering, it is challenging to heat them up enough and insert them into the bullet connectors. The quickest way to accomplish this is to cut just the end of each wire off to remove the pre-tinned section and re-strip the wire before soldering them into the bullet connector.*
2. Assure a strong solder bond is formed.
    a. *NOTE: Putting the individual bullet connectors into a metal vice will assist with this.*
3. Attach the red and black heavy gauge main wiring to the BEC, redundant flight controller BEC and power sensing module. Then terminate with a male XT60 battery connector. See photo.
    a. *NOTE: When building this part of the system, we add several wire splice areas to be able to remove or add components as needed or access additional power by wiring in, a 2/3 position snap wire splice.*
4. Put two layers of 3M permanent tape on the bottom of the ESC. If need be, remove the plastic screw mounting holes on the side of the ESC.
5. Affix the ESC firmly to the back of the fuselage using 3M permanent mounting tape.



6. Connect the servo wire to the Pixhawk.
   a. *NOTE: Remove the red wire from the ESC to the autopilot. Because an external BEC is used, the internal BEC within the ESC cannot be utilized.*
7. The ESC is installed.



Section

11

Section 11: POWER MONITOR

11.0: MANUFACTUERES NOTES

- The power monitor sensor is used to determine current and voltage in real-time and report it back to the autopilot and pilot during flight. It assists in identifying consumption rates and monitors battery voltage to provide insight into battery levels and the level of the battery that has been discharged.

11.1: INSTALLATION INSTRUCTIONS

1. Solder the positive lead of an XT60 male plug to the 12 AWG red wire on the end that has the 6 position port on the unit.
2. Solder the negative location on the XT60 to a black 12 AWG 300mm (12”) wire
3. Solder the opposing side of the unit in series with the Albatross’s ESC, BEC, backup BEC and any other wires or devices wanting to have their current and voltage measured.
    - *NOTE: Anything soldered in here will have whatever voltage is provided by the batteries.*
    - *See the photos from the ESC section for detailed wiring drawings.*
4. Plug a 6 pin conductor plug from the Power Module to the Pixhawk at the port named Power.
5. The specific unit’s test data can be entered into the autopilot software for an accurate representation of voltage and consumption.
6. The Power Monitor is now installed.

Section

12

Section 12: BEC

12.0: MANUFACTUERES NOTES

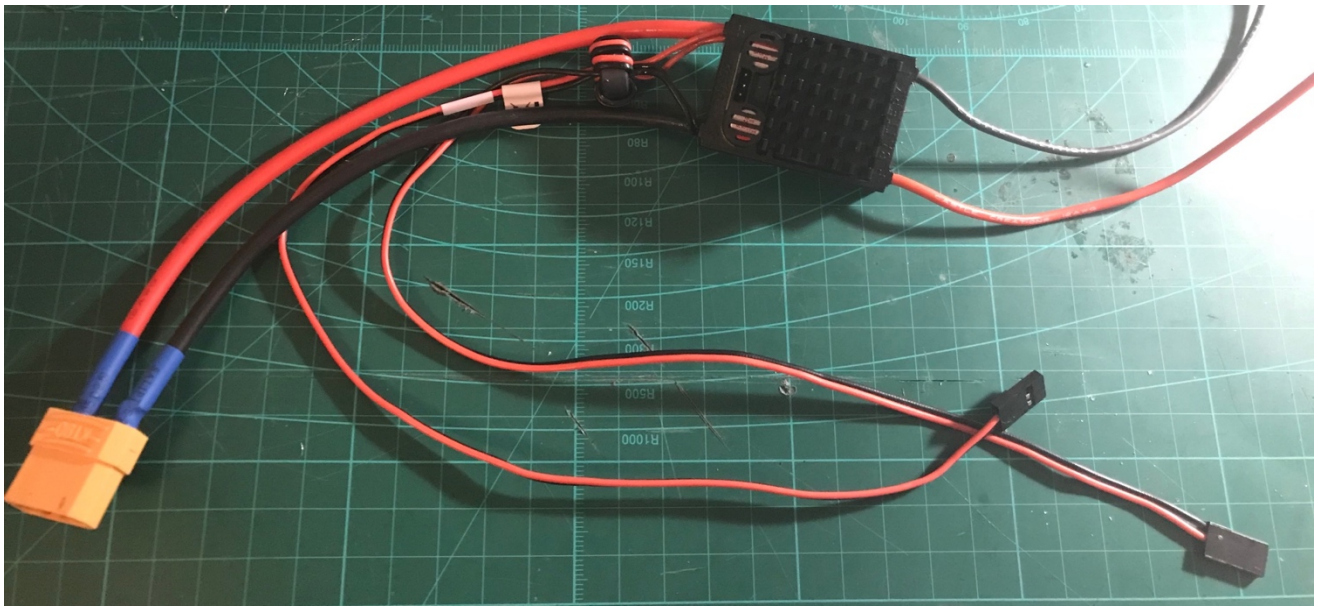
- The Castle Creations BEC PRO is used to provide power to the servos, radio and telemetry link, as well as serve as an additional power source for the autopilot. This unit has an adjustable voltage out, but doing so will require an alternate BEC to be used for the Pixhawk because raising the voltage will make the Pixhawk inoperable.

12.1: INSTALLATION INSTRUCTIONS

1. Add 200mm (8”) of 16 AWG red and black silicone wire to the soldered location between the ESC and battery line.
    a. *NOTE: A snap-fit crimp for changeable access to the BEC can be added here for easy removal.*
2. The BEC comes with two servo style male plugs for power. These plug into the Pixhawk auxiliary ports for power. You will need to add an additional 150mm-200mm (6-8”) of 14 AWG to the wire terminals.
3. Open the Case of the BEC (with nothing plugged into it)
4. Solder one red and one black 6-8” (15cm – 20cm) 14 AWG wires to the terminals where the existing output cabling is soldered.
    a. *NOTE: Do not remove the original wiring, it is needed to power the Pixhawk.*
5. Terminate the opposite side of the 14 AWG wires with a female XT90 plug. This size plug ensures the battery is not accidentally connected to this plug’s mate in the wing.
6. Cut a space at the bottom of the BEC casing where the wiring is placed, to make room for the 14 AWG wires.
    a. *NOTE: A heated element can assist in cutting this area.*
7. Take the two servo leads and route them down underneath the shelving. They will be plugged into AUX 3 and AUX 4 of

the Pixhawk for power later on and the XT90 plug will be used to supply 5V power to all powered devices in the wings.

8. Mount the BEC on the side of the fuselage with 3M permanent tape towards the rear of the fuselage, close to the ESC.
9. The BEC is now installed.



Section

13

Section 13: CENTER WING

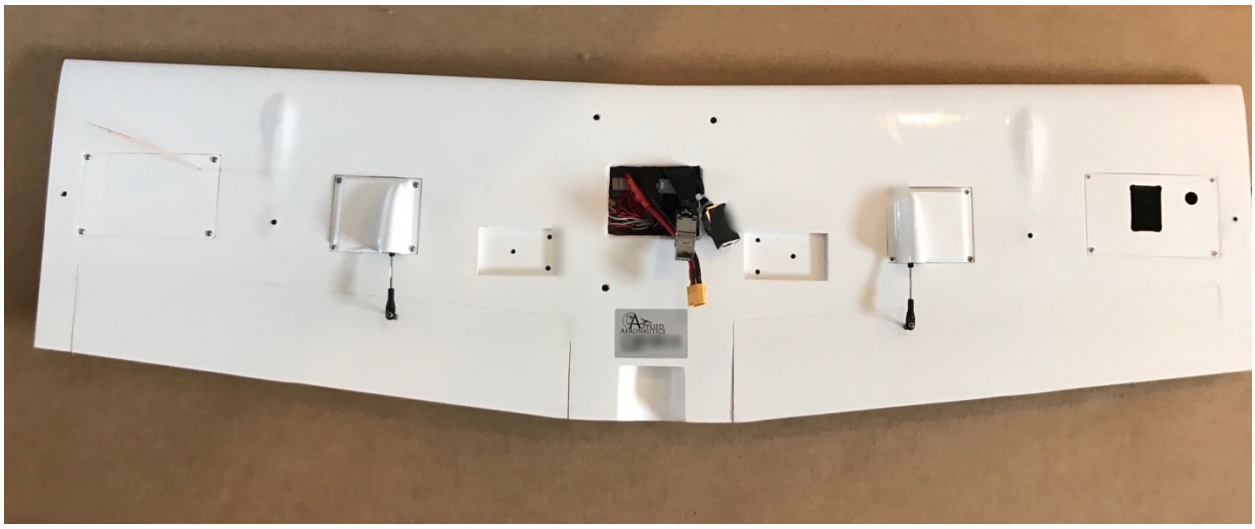
13.0: MANUFACTURERS NOTES

- Please make a note of the following 22 AWG twisted servo wire lengths required to build out your center wing
    - Flaps – 18” (46cm)
    - Ailerons – 29.5” (75cm)
    - Compartment Bays - 29.5” (75cm)
    - Tail - 30” (76cm)
    - Tail booms to tail - 35” (89cm)
- The center wing is best built by using a series of unified connectors to join the wing based components to the fuselage and then the autopilot. That said, this manual will explain how to wire each component individually and connect them without a unified connector to the autopilot.
- A centralized power connector is used to provide power to all systems and servos.

13.1: INSTALLATION INSTRUCTIONS

1. Run wire through the in-wing channeling to each of the extremities of the plane:
    a. Flaps
    b. Ailerons
    c. Tails
    d. Component Bays
2. Run three twisted wires to each flap and tail area.
    a. *NOTE: When trying to run wiring through the channeling, it is much easier to feed a single 16 AWG wire through first and solder the tip of the wire to the twisted wires being pulled through. This proves even more useful when installing five twisted wires at one time.*
3. Run:
    a. Five twisted wires to each compartment bay.
    b. Three wires for each aileron servo

    c. Two wires for the telemetry receive and transmit
    d. Two wires for the radio PPM signal and RSSI
4. Terminate all signal wires with a female servo plug on the center wing side but only crimp the white signal wires.
    a. Label each signal wire with their respective locations.
5. Terminate the servo wires in each component location (exclude the two extra wires in each compartment bay at this time) with female servo connectors.
    a. All three wires – white, red and black should be terminated.
6. Terminate the remaining four wires (two extras in each compartment bay) with male servo leads if utilizing a long-range setup.
7. Splice an additional two wires in each compartment way from each aileron servo wiring (red and black) to provide power for the telemetry and radio receiver.
    a. If using a long-range setup, then both the radio and telemetry module area should be terminated with male servo plugs.
    b. If using a short-range setup, then the radio receiver location should still be terminated with a male servo header, but the telemetry location needs to be spliced with the appropriate DF13/Molex plug.
8. Solder all power and ground cables together in the center area of the wing.
9. Solder the power bundle of cable to the positive location on the XT90 male plug and the ground wire bundle to the negative/ground location on the XT90 pin of the plug.



Section

14

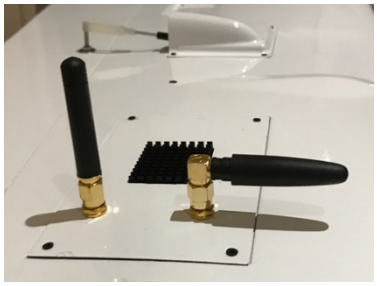
Section 14: TELEMETRY MODULE

NOTE: Installation instructions will vary based on whether or not you purchased a long range kit. Please use the appropriate instructions below.

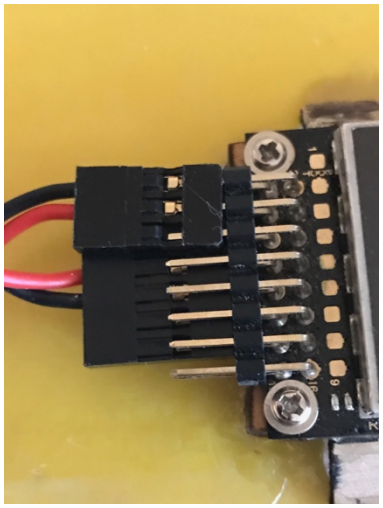
14.0: MANUFACTURERS NOTES – LONG RANGE

- The telemetry module is installed inside the left compartment bay of the main wing. To complete this installation, you will need four wires: two for power and ground, as well as receive and transmit lines. These should have been routed during the wiring of the center wing.

14.1: INSTALLATION INSTRUCTIONS – LONG RANGE



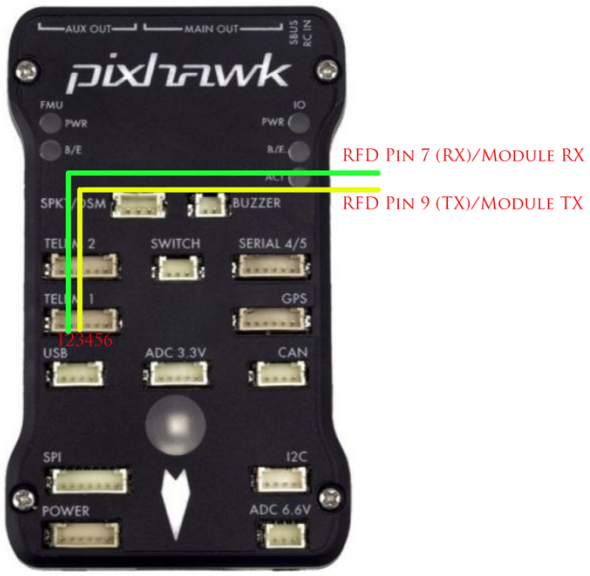
1. Add the power and ground lines by splicing the existing wire present for the servos.
2. Either solder the wire splice into place or use a press fit T-Splice.
    a. *NOTE: This will alleviate the need to solder while still giving a secure connection.*
3. Make sure you added transmit and receive wires and routed them back to the center wing and/or Pixhawk. If not done, do so now.

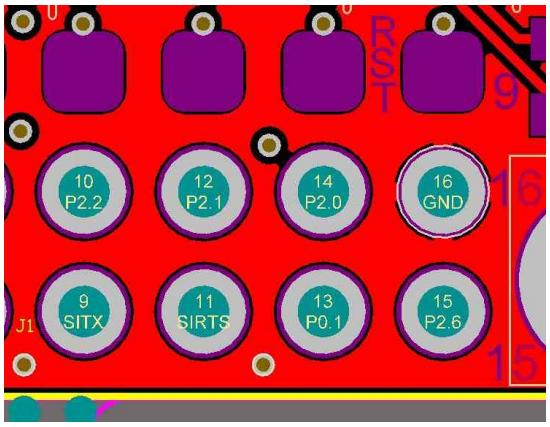


4. Remove the white fiberglass panel from the component bay and cut a hole the size of the telemetry module heatsink.
    a. *NOTE: Make sure to measure where the antennas will extend and wiring will connect before cutting the panel.*
5. Place the telemetry module through the hole with the heatsink facing out of the hole and secure it in place with hot glue.
    a. *NOTE: It is recommended to use RP-SMA extensions here. Affix them permanently to the fiberglass panel for ease of use during storage as well as the installation and removal of the antennas. See photos.*
6. The RFD unit in the plane will need to have the removable jumper removed.
7. The receive and transmit lines are on pins 7 and 9.
8. *IMPORTANT: Do not turn on the modules unless at least one antenna is plugged in. You can plug either the supplied large or small antennas into the unit. Having one pointing downward and another angled 90 degrees is ideal.*
9. The Long Range Telemetry unit is installed.

14.2: WIRING INSTRUCTIONS – LONG RANGE

- The long-range units should be wired according to the following diagram and pinouts. At a minimum, only four wires are needed. Power, Ground, Transit and Receive. This will plug into the Pixhawk at the Telem1 port.





14.3: MANUFACTURERS NOTES – SHORT RANGE

- The short-range telemetry modules are installed similarly to the long-range version.
- The primary difference is that when installing them in the compartment bay, the wiring needs to be spliced from the supplied cable rather than terminated from a servo type connector.
- Please look for the exact pinout of the module you have received and follow the above convention for wiring into your Pixhawk.

14.4: INSTALLATION INSTRUCTIONS – SHORT RANGE

1. Power and ground can be taken from the servo line that was previously installed, but the transmit and receive lines will need to be run back to the center of the main wing, and then to the autopilot.
2. A single RF extension cable should be used to make attaching removing the antenna possible quickly without needing the open the compartment each time.
3. The short-range telemetry unit plugs into the Pixhawk at the Telem 1 port.
4. Orient the short-range receiver antenna with the antenna vertical towards the ground.
5. The Short Range telemetry module is now installed.

Section

15

Section 15: TRANSMITTER / RECEIVER

15.0: MANUFACTURERS NOTES – LONG RANGE TRANSMITTER / RECEIVER

- The long range RC receiver module is installed inside the right compartment bay of the main wing. To complete this installation, you will need 4 wires: two for power and ground, as well as a PPM and RSSI line. These should have been routed during the wiring of the center wing.

15.1: INSTALLATION INSTRUCTIONS – LONG RANGE TRANSMITTER / RECEIVER

1. Power and ground lines need to be added by splicing the existing wires present for the servos.
2. Either solder the wire splices into place or use a press fit T-Splice.
    a. *NOTE: This will alleviate the need to solder but still give a secure connection.*
3. Make sure the two extra wires to the right component bay for PPM and RSSI signals are present. These need to be routed back to the center wing and/or Pixhawk. If not done, do so now.
4. Place the unit in the compartment bay and orient it so there is adequate space to reach the USB port, the SMA antenna port as well as the servo pins.
5. Once satisfied, remove the white fiberglass panel from the component bay and drill a small 2mm (1/16”) hole through the wing skin to place the supplied antenna holder in (a small rigid drinking straw type piece).
6. Ensure the hole is tight enough for this to hold the tube upwards. The same should be done for the downwards facing antenna, this hole should be cut in the removable

fiberglass piece to loo be able to achieve the same vertical orientation.

   a. *NOTE: It often helps to cut the ears or part of the T shape material on the antenna backing to make it fit correctly. Take extreme caution to not cut the antenna itself. Affix the antenna holding piece in place with hot glue.*

7. The Long Range Receiver unit is installed.

15.2: WIRING INSTRUCTIONS – LONG RANGE TRANSMITTER / RECEIVER

1. Wire the ground and power to any ground and power pin location on the receiver, except the RSSI and PPM port.
2. Plug a servo connector in with the correct wiring for RSSI and PPM.
   a. *NOTE: Make sure this corresponds to the notated wiring you made during the center wing wiring installation.*
3. The Long Range Receiver wiring is now complete.

15.3: SOFTWARE SETUP- LONG RANGE TRANSMITTER / RECEIVER

- The long-range receivers need to be altered one time via a Windows computer to transmit 12 channels over the link. Software and a video of how to do this are on the Applied Aeronautics file server.

15.4: MANUFACTURERS NOTES – SHORT RANGE TRANSMITTER / RECEIVER

- The short range RC receiver module is installed nearly the same way as the long-range unit except for the antenna placement. It fits inside the right compartment bay of the main wing. To complete this installation, you will need 4 wires: two for power and ground, as well as a PPM and RSSI line. These should have been routed during the wiring of the center wing.

15.5: INSTALLATION INSTRUCTIONS – SHORT RANGE TRANSMITTER / RECEIVER

1. Power and ground lines need to be added by splicing the existing wires present for the servos.

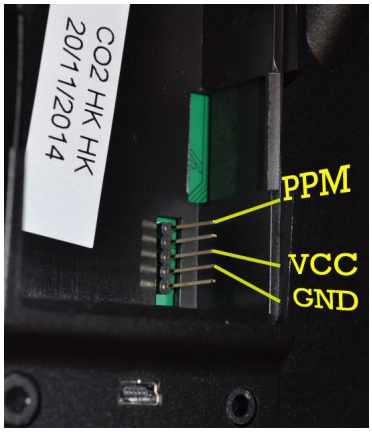
2. Either solder the wire splices into place or use a press fit T-Splice.
    a. *NOTE: This will alleviate the need to solder but still give a secure connection.*
3. Make sure you the two extra wires to the right component bay for PPM and RSSI signals. These need to be routed back to the center wing and/or Pixhawk. If not done, do so now.
4. Place the unit in the compartment bay and orient it so there is adequate space to reach the servo pins.
5. Once satisfied, remove the white fiberglass panel from the component bay and drill a small notch (1-2mm) to place the antenna wiring through.
6. The antennas should point towards the ground in the vertical orientation and one horizontal.
7. Additionally, both antennas can be facing downwards at a 45 degree offset angle, one to the left and one to the right creating a 90-degree separation between the two.
8. The Short Range Receiver unit is installed.

15.6 WIRING INSTRUCTIONS – SHORT RANGE TRANSMITTER / RECEIVER

1. Wire the ground and power to any ground and power pin location on the receiver, except the RSSI and PPM port.
2. Plug 2 servo connectors in with the correct wiring for RSSI and PPM.
    a. *NOTE: Make sure this corresponds to the notated wiring you made during the center wing wiring installation.*

Section 16: TARANIS

16.0: INSTALLATION INSTRUCTIONS



1. A premade file has been prepared for the Taranis RC remote for both the long and short range transmitters. A cross-compatible software application enables adding the settings to your Taranis.
2. It is available in the customer portal on our web server. Please contact us for login details.
3. This file sets the correct modulation type for the long-range transmitter to utilize the external transmitter.
4. It also includes all of the settings for both the short and long controls concerning the channel mapping for the deployment of flaps/crow, mode switching, etc.
5. If using the long-range transmitter, the following wiring should be followed:
    a. Orange wire to PPM
    b. Red wire to VCC
    c. Black wire to GND

Section 17: FRONT LANDING GEAR

17.0: INSTALLATION INSTRUCTIONS

1. Insert the nose wheel into the front axle area of the gear.
    a. *NOTE: We advise using an additional wheel collar on the inner side of the axle to prevent the wheel from rubbing against the vertical shaft of the gear.*
2. Use Red Loctite to secure the collar in place.
3. Make a small groove where the set screw mates with the axle. This can be done using a file.
4. Locate the flat spot at the top of the gear.
5. Make a second flat area on the left side of this area with a metal file.
6. Once the servo gear horn is in place and the nose servo is correctly oriented, measure the distance and make a small linkage between the two horns.
    a. *NOTE: Two ball link joints are best suited for this.*
    b. *NOTE: The best travel in this instance is achieved when the nose horn is zeroed – neutral input from your transmitter – but the horn is offset 15-20 degrees to the right.*
7. Once attached, check the travel with your RC remote.

Section 18: REAR LANDING GEAR

18.0: INSTALLATION INSTRUCTIONS

1. Assemble the wheel axles in the following order from outside in:
    a. Metal black partially threaded bolt.
    b. Axle Collar
    c. Wheel
    d. Nylon Safety nut
        i. See Photo
2. Ensure the wheel axle is secured to the carbon fiber landing gear.
3. Use a small amount of Loctite on the screws but make sure the wheel axles can still be freely spun.
    a. NOTE: If need be, washers can be added.
4. Attach each of the two rear landing gears to the center wing via three screws.
    a. NOTE: They are mounted into the recessed areas that sit on top of the notched metal plating.
5. The rear landing gear is now installed.

Section 19: SERVOS

19.0: MANUFACTURERS NOTES

- All servos used for deflection surfaces (all servos on the Albatross except the nose servo) are installed the same way. The only difference is the flap servos which are mechanically limited to not go in a reverse direction.

19.1: INSTALLATION INSTRUCTIONS

1. Drill a 3mm hole in each of the partially drilled holes on each deflection surface.
2. Put the supplied M3 screw, conical washer, (the deflection surface), flat washer and then retaining nut (in that order) through the deflection surface.
3. Use Loctite on the retaining nut to affix it permanently.
4. Mount the servo to the servo cover by one of the following ways:
    a. Use the 3D printed servo holders available on the Applied Aeronautics server.
        i. This enables you to simply glue the servo holder to the servo cover and screw the servo into the holder. Changing a servo then only takes a moment or altering a physical setting.
    b. Small wooden blocks to screw the servos into.
        i. A similar principle applies, glue the blocks to the servo covers and screw the servos to the blocks.
        ii. Use glue directly on the back of the servo to the servo cover.
        iii. This makes altering and replacement much more difficult but is also effective.
5. Once the servo is mounted, center the aileron and tail servos to their midpoint.
6. Attach the tallest servo horn that will fit in the respective servo cover and measure the distance between the horn hole location and the vertical M3 screw in the deflection surface.
7. Make a linkage between the two locations.

8. Repeat for each servo location.
9. Check that the deflection amount on either side and up and down is matched.
10. Set one flap servo at PWM value (2000, its max), affix the servo horn vertically (perpendicular to the flap itself).
    a. *NOTE:* This reduces the ability for the servo to move upwards and tear the servo or deflection surface out.
11. Repeat this with the opposing side servo but use a PMW value 1000 (minimum)
12. Once complete, measure the distance between the horn hole location and the vertical M3 screw in the deflection surface.
13. Make a linkage between the two locations.
14. Check that the deflection amount on either side is matched.

Section 20: AUTOPILOT

20.0: MANUFACTURERS NOTES

- The autopilot is installed underneath the removable carbon fiber shelving.
- Before mounting the autopilot, it is critical to have completed your LIDAR installation.

20.1 INSTALLATION INSTRUCTIONS

1. Mount the Pixhawk using 3M permanent tape. *NOTE: It is vital to ensure there is enough room available to remove the autopilot so that it is not touching*.
2. When completing your cable routing, please ensure that there is adequate cable length available to remove the Pixhawk.