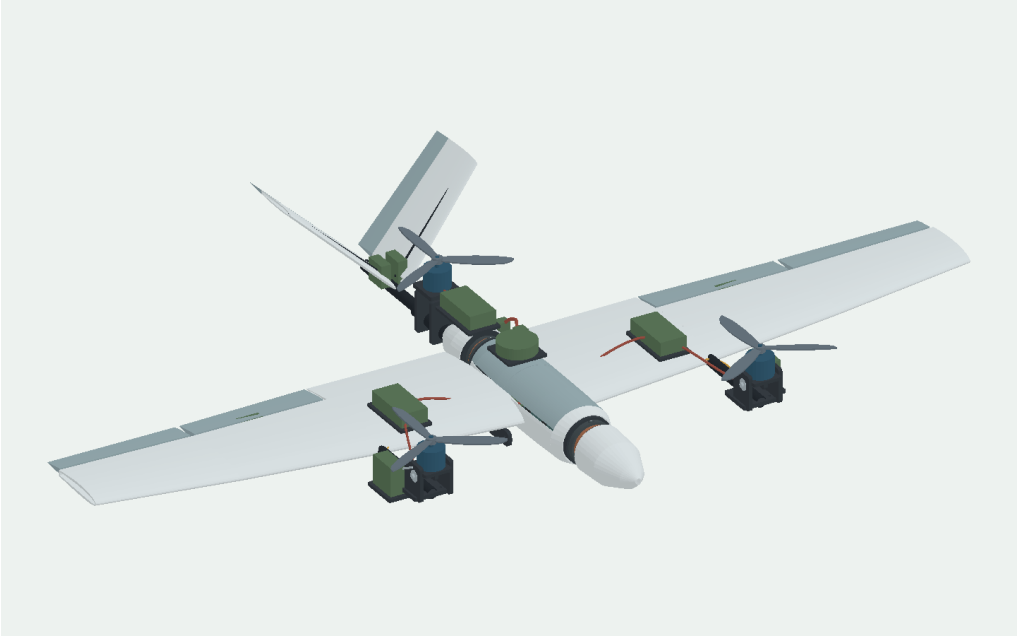
FLIGHTHUB / REVISION 0.2.1 / KIT EDITION 1

Raven Switchwing

A front-tilt tricopter with a removable aft keel and a revised center battery bay. The forward hatch gives access to a shorter XT60 candidate pack while the aft deck stays seated.



Assembled view from the revision-matched CAD.

In this guide

01 Print and measure the fit coupons

02 Dry-fit the nose, center and aft modules

03 Service the installed aft keel and collar

04 Fit the load-bearing frame and tail

05 Assemble the front tilt nacelles

06 Mount electronics and route the harness

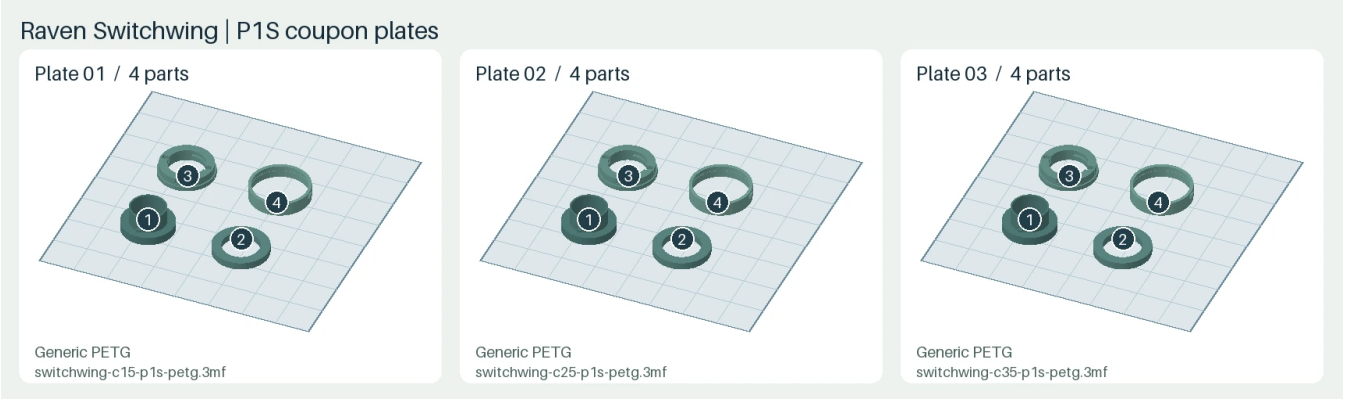
07 Verify controls, power and failsafe with props off

08 Measure each propulsion branch on a guarded rig

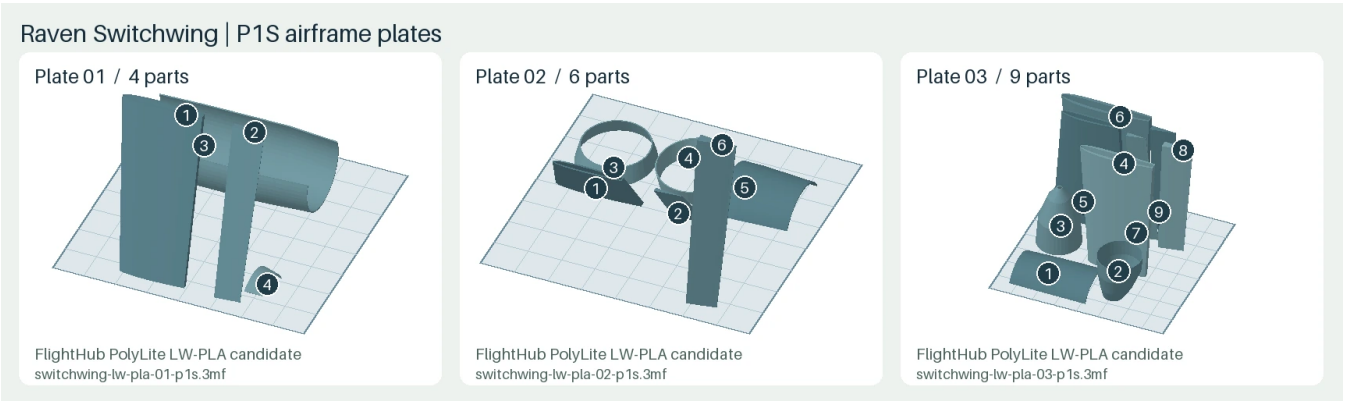
09 Review balance, hover and transition evidence

Print setup

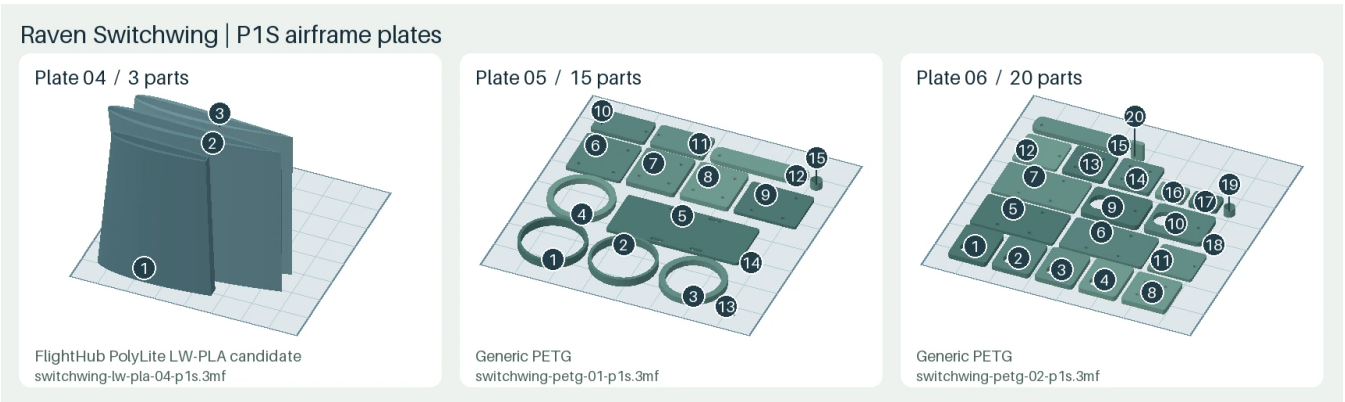
Bambu Lab P1S with a 0.4 mm nozzle. Start with the saved 0.15, 0.25 and 0.35 mm clearance coupon projects. The coupon profiles use Generic PETG on textured PEI at 0.20 mm layers, four walls and 30% gyroid. The 6 editable airframe plates were checked with Bambu Studio 02.09.01.70. Verify material, bed, supports and orientation on your own printer. Record the physical print, fit, retention, mass and balance before applying power.



Raven Switchwing coupon plates 01-03. Saved print orientations on the P1S bed.



Raven Switchwing airframe plates 01-03. Saved print orientations on the P1S bed.



Raven Switchwing airframe plates 04-06. Saved print orientations on the P1S bed.

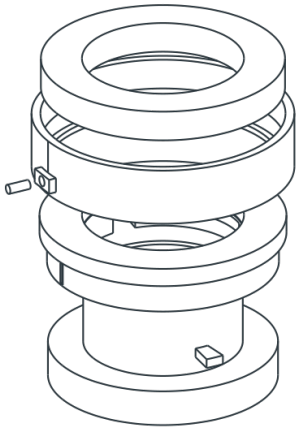
01 Print and measure the fit coupons

Why this matters

The bayonet interfaces need measurable alignment, deliberate release and independent keeper engagement.

Where to look

Find the collar, spigot and catch parts on the exact P1S coupon projects. Read support settings before printing.



Inherited coupon solids with identical installed source links. This is a fit sample.

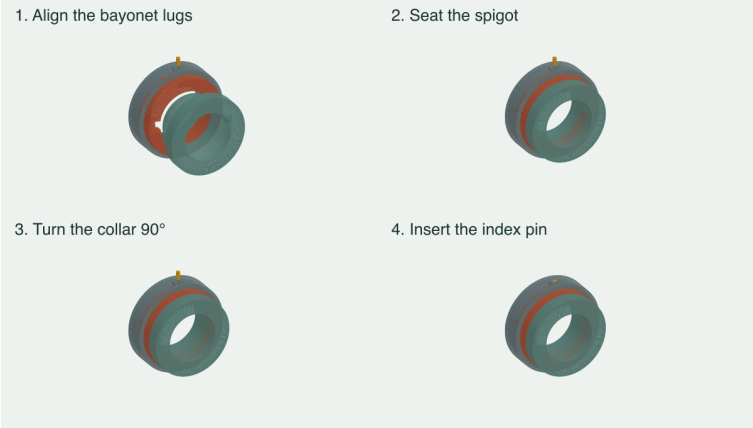
1. Print the collar, key and catch coupons on the P1S with a 0.4 mm nozzle in the exact candidate material and orientation.

2. Record the profile, material lot, measured gap, edge step, play and insertion effort. Keep the coupon ID paired with each result.

3. Check that the secondary catch engages only at the visible lock mark and releases deliberately. Compare fit before and after repeated cycles.

Before you continue

Record seating, quarter-turn feel, lock-mark alignment and keeper engagement for each clearance before choosing a fit.



Use the isolated coupon to check the latch sequence before trying it on the full airframe.

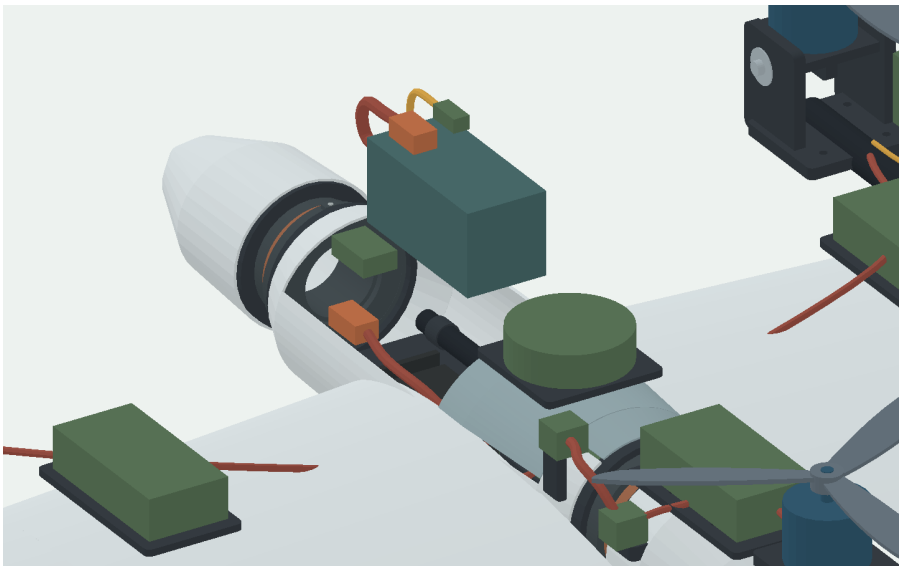
02 Dry-fit the nose, center and aft modules

Why this matters

The module shoulders, center rails and battery installation share a tight center frame.

Where to look

Follow the wing-spar carry-throughs above the pack tray. Identify the removable forward hatch, fixed aft deck, straps and connector access.


Revision 0.2.1 battery service pose with the aft deck and wing spars seated.

1. Seat the keyed nose spigot on the hard stop, rotate the collar to its lock position and install its positive lock pin. Start with the isolated coupon to measure seating and insertion effort before attempting the exact assembled airframe.

2. Inspect both seams for even seating, cracking, unexpected movement and wires entering the collar path. The aft keel retention pin and the original collar lock pin both need independent retention.

3. Dry-fit the two 175 mm center rails and the four battery-tray rail seats. Bond the seats to the tray edges and keep the nominal Ø9.3 mm seat bores clear. Confirm actual strap-slot access, pack clearance and fit of the repositioned servo regulator before power.

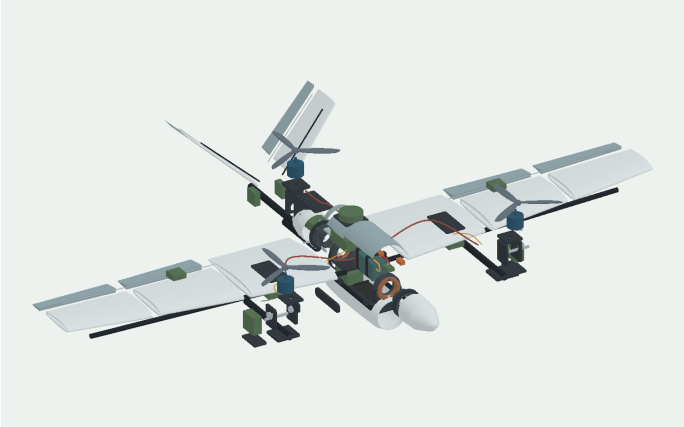
4. Keep the fixed aft deck seated and lift the forward hatch 30 mm in the modeled access pose. Start with an inert 77 × 37 × 38 mm fit gauge. Measure the delivered pack, leads and plugs before using the actual pack.

5. Dry-fit both straps at CAD X181 and X218 mm. The modeled slots accept straps up to 10 mm wide. Confirm actual strap grip, soft end pads and positive axial restraint with both wing spars fitted.

6. Disconnect and park the XT60 and balance leads before releasing both straps. Lift the pack and its leads straight up. The CAD check uses 72 mm of travel. Check access, strain relief and harness clearance on the physical assembly.

Before you continue

Measure delivered pack and connector clearance through the full access path, then check positive restraint with both spars fitted.



Exact 0.2.1 scene meshes with service parts separated for identification.

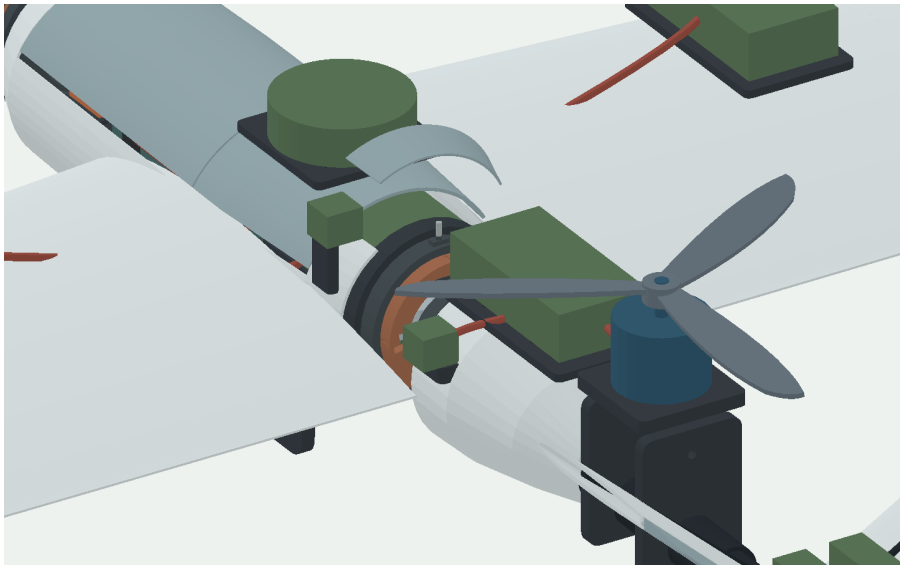
03 Service the installed aft keel and collar

Why this matters

The separate metal keel and original collar each need positive retention. Service access requires both releases in the modeled order.

Where to look

Open Installed joint service and locate the aft cover, disconnectable jumper, keel pin and collar lock.



Exact successor service-review scene at the aft withdrawal pose. Physical clearance and retention still need measurement.

1. Remove the propellers and disconnect the flight battery. Lift the dedicated aft keel service cover straight up and remove it. The modeled access pose raises it 24 mm. Confirm actual tool access and isolate every branch before touching the service harness.

2. Unplug and remove the aft service jumper at the fixed and moving connector ends. Restrain each remaining harness section on its own module. Check actual wire bends and clearance through both motion paths.

3. Withdraw the separate Ø3 mm aft keel retention pin at X329. The nominal CAD service pose raises it 15 mm. Then withdraw the original collar lock pin 6 mm, rotate the collar 90 degrees and slide the complete aft module straight aft along the nominal 18 mm CAD path. Stop if the printed assembly binds.

4. Reassemble in reverse order. Verify hard-stop seating and both independent keepers before reconnecting the jumper. Verify actual pin grip, connector polarity, pinout and strain relief before refitting the cover or powering up.

Before you continue

Verify physical pin grip and travel, keep both harness branches restrained, and confirm both keepers before reconnecting the jumper.

04 Fit the load-bearing frame and tail

Why this matters

The carbon stock, keel and tailored fittings carry loads from the wing and tail back into the center structure.

Where to look

Use the exploded view to locate the center rails, rear stock bridge, wing supports and V-tail attachments.

1. Fit the main spar, wing carriers, tail supports and skids to the reinforced frame. Record fastener engagement and fit at each hardpoint.

2. Fit the rear fixed lift motor mount to the structural frame and inspect the tail clearance using an inert propeller sweep template.

3. Fit the two ailerons and two ruddervators. Check hinge retention, linkage access and measured free travel.

Before you continue
Review metal fitting material and fastening, carbon engagement, fastener grip and control travel before loading the structure.

05 Assemble the front tilt nacelles

Why this matters
The two front tilt stations need compatible axial retention and matched travel.

Where to look
Identify each metal pivot, flanged bearing, actuator link and travel stop in the front nacelles.

1. Fit each supported metal pivot, motor plate, actuator link and positive axial retainer. Confirm the bearing and shaft fits against actual hardware samples.

2. With the battery disconnected, use a 177.8 mm inert sweep template to check both front clearances through the full physical range, including beyond vertical.

3. With propellers removed, measure the left and right travel, stop clearance, backlash and actuator mismatch. Review loaded authority before choosing servo endpoints.

Before you continue
Measure both endpoints, stop clearance, backlash and actuator mismatch with propellers off.

06 Mount electronics and route the harness

Why this matters
Independent servo and propulsion supplies need defined isolation and access at the removable rear harness.

Where to look
Trace the controller, three ESCs, dedicated servo supply and fixed/moving jumper ends in the wiring worksheet.

Matek H743-WING V3

Candidate outputs and wiring branches

Port · function	Driven item
S1 · 33 · PWM	Motor 1 · starboard front
S2 · 34 · PWM	Motor 2 · port front
S3 · 36 · PWM	Motor 4 · aft fixed
S7 · 75 · PWM	Port front tilt
S8 · 76 · PWM	Starboard front tilt
S9 · 4 · PWM	Port aileron
S10 · 4 · PWM	Starboard aileron
S11 · 79 · PWM	Port ruddervator
S12 · 80 · PWM	Starboard ruddervator

Power and peripherals

4S Tattu pack and XT60 → protected distribution → three ESC branches

Separate pack branches → FC supply and dedicated 5.5 V servo regulator

Full CRSF UART and separate GPS UART

I²C → compass · DroneCAN → airspeed candidate

See the guide worksheet for endpoints and supply isolation. Verify with propellers removed.

Revision-matched worksheet. Check exact pinouts and confirm the hardware with propellers removed.

1. Mount the flight controller, receiver, air data, three ESCs and dedicated servo regulator where cooling and service access can be inspected.

2. S1 Motor 1 · starboard front (PWM, function 33) · S2 Motor 2 · port front (PWM, function 34) · S3 Motor 4 · aft fixed (PWM, function 36)

3. S7 Port front tilt (PWM, function 75) · S8 Starboard front tilt (PWM, function 76) · S9 Port aileron (PWM, function 4)

4. S10 Starboard aileron (PWM, function 4) · S11 Port ruddervator (PWM, function 79) · S12 Starboard ruddervator (PWM, function 80)

5. Use the independent servo supply and common signal ground. Isolate its positive rail from the FC and the ESC BECs. Keep the main propulsion current on a separate rated distribution harness.

Before you continue

Inspect connector pinout, strain relief, separate rated paths and cooling access before applying power.

07 Verify controls, power and failsafe with props off

Why this matters

Control and power checks establish direction, shutdown and rail behavior before propulsion testing.

Where to look

Use the exact controller output map and confirm front tilt travel separately from wing and tail control travel.

1. Check polarity, connector locks, wiring strain relief and rail voltage before enabling any ESC. Check that simultaneous servo movement leaves the FC powered and responsive.

2. Verify motor assignment and direction, combined V-tail mixing, tilt synchronization, arm and disarm, and response to signal loss or low voltage.

3. Record board firmware, radio settings, motor map, control travel and the configuration used for the test. Review mode and abort behavior with the propellers removed.

Before you continue
Record firmware, motor map, radio failsafe, rail behavior and ground abort behavior with propellers removed.

08 Measure each propulsion branch on a guarded rig

Why this matters
Separate measurements are needed before approving the pack, connector and integrated electrical load.

Where to look
Use the guarded stand and remote isolation to measure each front and aft propulsion branch with the selected components.

1. Have an experienced operator review the stand, current protection, guard, exclusion area and remote isolation before fitting a propeller.

2. Test one exact motor, propeller and ESC branch at a time. Record thrust, current, voltage, RPM, temperature and vibration.

3. Review current, wiring and cooling before planning any combined powered check. Stop for structural movement, abnormal vibration, overheating, desynchronization or brownout.

Before you continue
Review measured current, thermal behavior and voltage sag against the exact pack, wiring and connector ratings.

09 Review balance, hover and transition evidence

Why this matters
The measured center of gravity must be reviewed for both the hover thrust triangle and wing-borne balance.

Where to look
Use the secured pack location and record both front nacelle positions, rear motor location and flight control configuration.

1. Weigh the exact complete assembly and measure its balance with the installed battery. Review projected CG within the hover thrust triangle and the separate fixed-wing balance range.

2. Review mechanical retention, thrust reserve, yaw authority and loaded pivot travel before authorizing a controlled hover or landing trial.

3. Set airspeed, transition and abort thresholds from Switchwing measurements. Record both directions of transition and keep the flight hold until the exact build passes review.

Before you continue
Confirm the required physical and supervised test evidence before approving hover, landing or transition.

Wiring worksheet

Matek H743-WING V3

Port and starboard are defined looking forward from behind the aircraft.

S3 is the chosen output for the fixed aft Motor 4. The motor number is distinct from the board output number.

S4-S6 share the S3 timer group. Match output rates within a timer group and keep the servo supply separate from the FC and ESC positives.

Confirm the full CRSF UART and firmware configuration before wiring. For the standard MatekH743 target, UART6 requires BRD_ALT_CONFIG=1 and SERIAL7_PROTOCOL=23.

The aft route has a removable service jumper. Disconnect the pack, remove propellers and unplug the jumper before withdrawing either aft retainer. Verify the actual connector ratings and pinout.

The jumper's fit envelopes reserve separate connector space for the aft ESC power and for the signal, signal-ground and external servo-supply conductors. The route meshes show shared corridors. Verify the individual lead paths from the moving connector to the aft ESC and both ruddervator servos.

The candidate pack and harness are shown disconnected in their access poses. Confirm actual mate access, wire lengths and routing, insulation and strain relief before assembly.

Output	Signal	Function	Endpoint	Driven item
S1	PWM	33	Starboard front ESC signal input	Motor 1 · starboard front
S2	PWM	34	Port front ESC signal input	Motor 2 · port front
S3	PWM	36	Aft fixed ESC signal input	Motor 4 · aft fixed
S7	PWM	75	Port front tilt servo	Port front tilt
S8	PWM	76	Starboard front tilt servo	Starboard front tilt
S9	PWM	4	Port aileron servo	Port aileron
S10	PWM	4	Starboard aileron servo	Starboard aileron
S11	PWM	79	Port ruddervator servo	Port ruddervator
S12	PWM	80	Starboard ruddervator servo	Starboard ruddervator

Power, motor phases and peripheral links

Link	From	To	Connection notes
Power	4S Tattu FunFly pack / XT60	Protected propulsion distribution	Fit and qualify the exact XT60 pair, strain relief, rated protection and power distribution for measured load. Keep propulsion current off flight-controller traces.
Power	Protected propulsion distribution	Starboard front ESC VBAT	Keep propulsion current off FC power traces. Isolate ESC BEC positive.
Power	Protected propulsion distribution	Port front ESC VBAT	Keep propulsion current off FC power traces. Isolate ESC BEC positive.
Power	Protected propulsion distribution	Aft fixed ESC VBAT	Keep propulsion current off FC power traces. Isolate ESC BEC positive.
Power	Protected pack branch	FC supply input	Keep controller supply separate from the propulsion harness current path.
Power	Protected pack branch	Castle CC BEC Pro input	Independent nominal 5.5 V servo supply. Keep FC servo positive and all ESC BEC positives isolated.
Power	External 5.5 V servo breakout	Port front tilt servo	Use both Castle output leads as documented and maintain a common signal ground.
Power	External 5.5 V servo breakout	Starboard front tilt servo	Use both Castle output leads as documented and maintain a common signal ground.
Power	External 5.5 V servo breakout	Port aileron servo	Use both Castle output leads as documented and maintain a common signal ground.
Power	External 5.5 V servo breakout	Starboard aileron servo	Use both Castle output leads as documented and maintain a common signal ground.

Link	From	To	Connection notes
Power	External 5.5 V servo breakout	Port ruddervator servo	Use both Castle output leads as documented and maintain a common signal ground.
Power	External 5.5 V servo breakout	Starboard ruddervator servo	Use both Castle output leads as documented and maintain a common signal ground.
Phase	Starboard front ESC motor outputs	Starboard front lift motor	Three phases. Confirm motor order and direction with all propellers removed.
Phase	Port front ESC motor outputs	Port front lift motor	Three phases. Confirm motor order and direction with all propellers removed.
Phase	Aft fixed ESC motor outputs	Aft fixed lift motor	Three phases. Confirm motor order and direction with all propellers removed.
Signal	Full UART for CRSF	CRSF receiver	Cross TX/RX and verify supply and common ground. Check the selected full UART and exact firmware mapping.
Signal	Separate GPS UART	GNSS	Cross TX/RX and verify 4.7-5.2 V. The standard GPS1 UART is USART2 / SERIAL3.
Signal	I²C	GNSS module compass	Match SDA/SCL and ground. Confirm the physical accessory pinout.
Signal	DroneCAN	Airspeed sensor candidate	Confirm termination, supply and device ID. The sensor is absent from the scene.
Power	Fixed-side aft service connector	Moving-side aft service connector	Removable aft ESC supply and return. Verify the actual connector rating, polarity and pinout.
Signal	Fixed-side aft signal connector location	Moving-side aft signal connector location	Candidate disconnect for S3 aft ESC PWM, S11/S12 ruddervator PWM, common signal ground and the separately regulated servo supply. Confirm pin count, isolation and ratings on the hardware.
Signal	Pack 5-pin JST-XHR balance plug	Parked at the pack during installation	Use the exact approved balance charger and verify lead access. Secure the balance plug before fitting the hatch.

Checks to record

Record physical print dimensions, both hard-stop seats, fit through the complete aft path, and positive engagement of the collar and aft keel retention pins.

Measure the delivered Tattu pack and verify hatch access, plug mating, end pads and strap retention. Qualify the exact XT60 pair and harness for measured current, voltage sag and temperature before testing combined loads.

Record connector identity, polarity, isolation, strain relief and clearance through the complete service sequence.

Measure loaded tilt and tail control travel, full motor clearance, ESC and servo current, temperature, balance, range and failsafe.

Record guarded propulsion, hover, both transition directions and landing separately after bench approval.

Print inventory

File	Material	Qty	Envelope (mm)
parts/airframe/nose-shell.stl	LW-PLA candidate	1	63.0 × 65.0 × 92.0
parts/airframe/center-shell-front-ring.stl	LW-PLA candidate	1	72.0 × 81.0 × 16.0

File	Material	Qty	Envelope (mm)
parts/airframe/center-shell-rear-ring.stl	LW-PLA candidate	1	64.1 × 78.0 × 17.0
parts/airframe/center-shell.stl	LW-PLA candidate	1	181.0 × 85.9 × 51.5
parts/airframe/center-hatch.stl	LW-PLA candidate	1	112.0 × 76.2 × 21.2
parts/airframe/aft-shell.stl	LW-PLA candidate	1	63.0 × 66.0 × 72.0
parts/airframe/nose-spigot-saddle.stl	PETG candidate	1	61.0 × 61.0 × 6.0
parts/airframe/nose-receiver-saddle.stl	PETG candidate	1	62.0 × 62.0 × 8.0
parts/airframe/aft-spigot-saddle.stl	PETG candidate	1	61.0 × 61.0 × 6.0
parts/airframe/aft-receiver-saddle.stl	PETG candidate	1	62.0 × 62.0 × 8.0
parts/airframe/battery-tray.stl	PETG candidate	1	125.0 × 52.0 × 3.0
parts/airframe/avionics-deck.stl	PETG candidate	1	59.6 × 45.0 × 3.0
parts/airframe/gnss-deck.stl	PETG candidate	1	52.0 × 52.0 × 3.0
parts/airframe/aft-esc-deck.stl	PETG candidate	1	79.0 × 43.0 × 3.0
parts/airframe/port-wing-1.stl	LW-PLA candidate	1	196.0 × 23.7 × 184.0
parts/airframe/port-wing-2.stl	LW-PLA candidate	1	130.9 × 24.1 × 180.0
parts/airframe/port-aileron-2.stl	LW-PLA candidate	1	46.7 × 14.3 × 174.0
parts/airframe/port-wing-3.stl	LW-PLA candidate	1	108.5 × 25.4 × 185.0
parts/airframe/port-aileron-3.stl	LW-PLA candidate	1	41.8 × 17.2 × 179.0
parts/airframe/port-esc-deck.stl	PETG candidate	1	79.0 × 43.0 × 3.0
parts/airframe/port-nacelle-foot.stl	PETG candidate	1	46.0 × 51.0 × 5.0
parts/airframe/port-tilt-bearing-1.stl	PETG candidate	1	36.0 × 45.0 × 5.0
parts/airframe/port-tilt-bearing-2.stl	PETG candidate	1	36.0 × 45.0 × 5.0
parts/airframe/port-tilt-motor-plate.stl	PETG candidate	1	39.0 × 38.0 × 4.0
parts/airframe/port-tilt-trunnion.stl	PETG candidate	1	27.0 × 19.0 × 5.0
parts/airframe/port-tilt-servo-tray.stl	PETG candidate	1	51.0 × 29.0 × 4.0
parts/airframe/port-vtail.stl	LW-PLA candidate	1	108.4 × 117.4 × 117.0
parts/airframe/port-ruddervator.stl	LW-PLA candidate	1	51.6 × 113.3 × 117.0
parts/airframe/port-aileron-tray.stl	PETG candidate	1	42.0 × 38.0 × 3.0
parts/airframe/port-skid.stl	PETG candidate	1	90.0 × 19.0 × 5.0
parts/airframe/starboard-wing-1.stl	LW-PLA candidate	1	196.0 × 23.7 × 184.0
parts/airframe/starboard-wing-2.stl	LW-PLA candidate	1	130.9 × 24.1 × 180.0
parts/airframe/starboard-aileron-2.stl	LW-PLA candidate	1	46.7 × 14.3 × 174.0
parts/airframe/starboard-wing-3.stl	LW-PLA candidate	1	108.5 × 25.4 × 185.0
parts/airframe/starboard-aileron-3.stl	LW-PLA candidate	1	41.8 × 17.2 × 179.0
parts/airframe/starboard-esc-deck.stl	PETG candidate	1	79.0 × 43.0 × 3.0
parts/airframe/starboard-nacelle-foot.stl	PETG candidate	1	46.0 × 51.0 × 5.0
parts/airframe/starboard-tilt-bearing-1.stl	PETG candidate	1	36.0 × 45.0 × 5.0
parts/airframe/starboard-tilt-bearing-2.stl	PETG candidate	1	36.0 × 45.0 × 5.0
parts/airframe/starboard-tilt-motor-plate.stl	PETG candidate	1	39.0 × 38.0 × 4.0
parts/airframe/starboard-tilt-trunnion.stl	PETG candidate	1	27.0 × 19.0 × 5.0

File	Material	Qty	Envelope (mm)
parts/airframe/starboard-tilt-servo-tray.stl	PETG candidate	1	51.0 × 29.0 × 4.0
parts/airframe/starboard-vtail.stl	LW-PLA candidate	1	108.4 × 117.4 × 117.0
parts/airframe/starboard-ruddervator.stl	LW-PLA candidate	1	51.6 × 113.3 × 117.0
parts/airframe/starboard-aileron-tray.stl	PETG candidate	1	42.0 × 38.0 × 3.0
parts/airframe/starboard-skid.stl	PETG candidate	1	90.0 × 19.0 × 5.0
parts/airframe/aft-lift-front-bulkhead.stl	PETG candidate	1	55.0 × 39.0 × 5.0
parts/airframe/aft-lift-rear-bulkhead.stl	PETG candidate	1	55.0 × 39.0 × 5.0
parts/airframe/aft-lift-plate.stl	PETG candidate	1	42.0 × 42.0 × 5.0
parts/airframe/aft-keel-service-cover.stl	LW-PLA candidate	1	17.0 × 55.8 × 22.0
parts/airframe/aft-service-fixed-clip.stl	PETG candidate	1	12.0 × 4.5 × 18.0
parts/airframe/aft-service-moving-clip.stl	PETG candidate	1	15.0 × 12.0 × 6.0
parts/airframe/port-battery-tray-seat-146.stl	PETG candidate	1	10.8 × 10.8 × 8.0
parts/airframe/port-battery-tray-seat-247.stl	PETG candidate	1	10.8 × 10.8 × 8.0
parts/airframe/starboard-battery-tray-seat-146.stl	PETG candidate	1	10.8 × 10.8 × 8.0
parts/airframe/starboard-battery-tray-seat-247.stl	PETG candidate	1	10.8 × 10.8 × 8.0
parts/airframe/center-hatch-aft.stl	LW-PLA candidate	1	67.4 × 76.6 × 21.3
parts/coupons/switchwing-c15-spigot.stl	PETG candidate	1	49.0 × 49.0 × 23.5
parts/coupons/switchwing-c15-receiver.stl	PETG candidate	1	52.0 × 52.0 × 6.8
parts/coupons/switchwing-c15-collar.stl	PETG candidate	1	52.7 × 52.7 × 11.0
parts/coupons/switchwing-c15-keeper.stl	PETG candidate	1	57.5 × 56.0 × 12.6
parts/coupons/switchwing-c25-spigot.stl	PETG candidate	1	49.0 × 49.0 × 23.5
parts/coupons/switchwing-c25-receiver.stl	PETG candidate	1	52.0 × 52.0 × 6.8
parts/coupons/switchwing-c25-collar.stl	PETG candidate	1	52.7 × 52.7 × 11.0
parts/coupons/switchwing-c25-keeper.stl	PETG candidate	1	57.5 × 56.0 × 12.6
parts/coupons/switchwing-c35-spigot.stl	PETG candidate	1	49.0 × 49.0 × 23.5
parts/coupons/switchwing-c35-receiver.stl	PETG candidate	1	52.0 × 52.0 × 6.8
parts/coupons/switchwing-c35-collar.stl	PETG candidate	1	52.7 × 52.7 × 11.0
parts/coupons/switchwing-c35-keeper.stl	PETG candidate	1	57.5 × 56.0 × 12.6

Bill of materials

USD listings checked 2026-11-11. Shipping, tax and unpriced items require a separate budget.

Filament estimates cover all saved airframe plates, including supports and brims. Coupon material and measured print consumption are separate.

Printed parts and filament

Item	Qty	Specification
Switchwing quarter-turn fit coupons	1 set	Print the matching collar and catch variants in the intended bulkhead material on a 0.4 mm P1S; log each coupon gap and engagement print first
Fuselage shells and battery hatch	1 assembly	Use the 0.2.1 forward access hatch and fixed aft deck. Confirm seating, clearance and retention with the exact print profiles. prototype CAD
Keyed bulkheads and quarter-turn collars	2 interfaces	Reinforced locating shoulders and removable keyed cam collars; independent captive catch on both seams prototype CAD
Left and right wings and ailerons	1 assembly	Sectional shells with spar seats; hinge and servo hardpoints require coupon and pullout checks prototype CAD
V-tail and ruddervators	1 assembly	Mirrored moving ruddervators and retained hinges; envelope and load review required prototype CAD
Tilt nacelles and rear motor seat	3 assemblies	Two bearing-supported front yokes plus fixed aft lift seat tied to internal frame; printed shells require a separate structural review prototype CAD
Servo and equipment trays plus skids	1 set	Separate adjustable battery tray and mechanical battery straps; ventilated ESC and controller access prototype CAD
Lightweight shell filament	1 lot	Provisional LW-PLA class; exact product and shell profile to be qualified for mass and layer strength material pending Reference $0.0375 per gram. 743.7 g estimate / $27.88. Gray 1.75 mm 0.8 kg spool PA08003. Candidate material. Bambu Studio estimate using the PolyLite LW-PLA candidate profile.
Rigid airframe filament (PETG)	1 lot	Use the saved Generic PETG airframe projects as the process reference. Choose and record the actual PETG spool. The three fit coupon projects have separate material estimates. material candidate Reference $0.0190 per gram. 198.3 g estimate / $3.77. Black 1.75 mm 1 kg spooled PETG HF candidate. Budget uses the Generic PETG slice estimate at the candidate PETG HF spool rate.
Battery-tray rail seats	4	Four PETG candidate rail seats with nominal Ø9.3 mm bores. Bond to the battery-tray edges with the bores clear and review actual alignment, adhesive selection and load retention. Successor bench CAD
Aft service cover and harness strain-relief brackets	1 set	Print one rear cover and two candidate brackets. Check cover retention, actual wire restraints and access to both connector positions. Successor bench CAD

Propulsion and onboard electronics

Item	Qty	Specification
EMAX ECO II 2807 1700 KV motor	3	Four M3 mounting points on a 19 × 19 mm square; M5 prop nut; verify supplied screws and shaft engagement sourced candidate Reference $19.49 per motor
HQProp DP7X4X3GR-PC	1 set	Two CW and two CCW per set; use three with handedness verified on the reviewed motor map; 177.8 mm diameter and 5 mm bore sourced candidate Reference $3.59 per 4-pack
Hobbywing FlyFun 60A V5 ESC	3	3-6S LiPo, 60 A continuous vendor rating, 69 × 35 × 18 mm and 73 g each; isolate each ESC BEC output sourced candidate Reference
Tattu FunFly 4S 1550 mAh XT60 LiPo	1	TA-FF15504SP / TAA15504S10X6. Nominal 72 × 35 × 36 mm and 178 ± 20 g. The CAD fit gauge is 77 × 37 × 38 mm. Verify actual fit, balance, voltage sag, integrated current and connector temperature. Candidate pack for revision 0.2.1. Measure the delivered pack and verify the installed electrical load before use. Order $20.59 per battery
Main DC distribution and current sensor	1 set	Separate from FC board power traces; rated pack connector and harness sized from guarded single-branch and integrated measurements release blocked
Castle CC BEC Pro 010-0004-01	1	Separate regulated servo rail programmed to a provisional 5.5 V; qualify loaded ripple and temperature sourced candidate Reference $54.95 per regulator
Matek H743-WING V3	1	ArduPlane MATEKH743 target; segregate FC electronics power from external servo positive rail; record exact board and firmware sourced candidate Reference
Hitec D645MW 36645S	2	Independent left/right tilt actuators, 40.8 × 19.8 × 37.8 mm body, 25T spline; no-load and loaded travel require review sourced candidate Reference $49.99 per servo
Hitec HS-5085MG	4	Two ailerons and two ruddervators, 29.0 × 13.0 × 29.4 mm body and 24T spline; envelope excludes horn/lead travel sourced candidate Reference $48.99 per servo
RadioMaster RP3 V2 ELRS 2.4 GHz receiver	1	Dual antenna serial receiver with CRSF wired to a full UART; separate antennas from carbon and power wiring sourced candidate Reference $19.99 per receiver
Holybro M10 GPS IST8310 6-pin 12042	1	UART GNSS plus I2C compass; repin a documented harness to controller and check supply and orientation sourced candidate Reference

Item	Qty	Specification
Matek ASPD-DLVR airspeed kit	1	Digital differential-pressure sensor and supplied pitot tubing; reserve pitot placement outside rotor wash and verify sensor plumbing sourced candidate Reference
Removable aft service harness and connector pair	1 set	Provide separately rated power and signal connectors at the fixed and moving locations shown by the fit envelopes. Verify polarity, pinout, cable ratings and strain relief for the measured aft branch. Electrical selection and fit pending

Airframe stock and linkages

Item	Qty	Specification
Carbon main spar and central frame stock	1 set	Source straight carbon stock. Use two nominal Ø9 mm OD / Ø7 mm ID × 175 mm center rails at CAD X134-309 and the shortened Ø19 mm OD / Ø16 mm ID aft stock at X384-509. Verify actual tube fits, grade and structural load before use. source pending
Metal tilt shafts and axial retainers	2 sets	Start from the 6 mm nominal shaft witness and select a ground shaft with positive axial retention. Final length and material await bearing and linkage fit. source pending
NMB LF-1360ZZRA5P58L0 flanged pivot bearings	4	Two per nacelle, 6 mm bore, 13 mm body, 5 mm width and 15 mm flange. Fit candidate for a separate retained bearing seat. sourced candidate Reference
Fasteners hinges horns and linkages	1 set	Fit fasteners and thread engagement to actual metal hardpoints. Use metal horns, retained links and verified control hinges. source pending
Metal keel socket, tongue, ties and aft stock bridge	1 set	CAD models an 11 × 5 mm tongue with 17.9 mm nominal engagement, two center rail clamps and diagonal ties, and a rear clamp and stop on the 19 × 16 mm aft tube from X384 to X509. Resolve actual metal grade, fastening, clamp details and structural loads with the exact assembly. Fabrication and load qualification pending

Fasteners and assembly supplies

Item	Qty	Specification
Captive seam catches and collar hardware	2 sets	Mechanical secondary lock and visible position mark per seam; material and rated load TBD source pending
Battery straps pads and connector restraint	1 set	Two independent pack restraints and a positive axial stop. Check the exact tray slot spacing, strap fit, XT60 access and lead bends. source pending
Aft keel retention pin, keeper and tongue fasteners	1 pin set and 2 M3 fasteners	Separate Ø3 mm clevis pin and keeper, plus two M3 fasteners at the moving tongue seat. Check exact grip, axial retention, thread engagement and keeper access on the physical article. Sourced hardware fit pending

Radio and charging gear

Item	Qty	Specification
RadioMaster Boxer ELRS 2.4 GHz radio	1	Select the internal 2.4 GHz ExpressLRS version; region and matching receiver firmware checked before bench use sourced candidate Reference
4S balance charger and charge lead	1 set	Use an approved 4S balance charger and a matching XT60 charge lead. Confirm pack and charger limits with the delivered hardware. bench equipment Reference

Workshop equipment

Item	Qty	Specification
Bambu Lab P1S and calipers	1 set	Stock 0.4 mm nozzle; log printer, slicer, filament lot, orientation and measured dimensions bench equipment Reference
Guarded thrust rig and logging instruments	1 set	Remote power isolation plus thrust load cell and current voltage RPM temperature instrumentation; use separate rigid stand and physical prop guard bench equipment