Instruction Manual

ARF

RAVEN 180

JASE "the ACE" Russia

FLEX INNOVATIONS™

BEFORE CONTINUING WITH THIS INSTRUCTION MANUAL OR THE ASSEMBLY OF YOUR AIRCRAFT, PLEASE VISIT OUR WEBSITE FOR THE LATEST PRODUCT UPDATES, FEATURE CHANGES AND MANUAL ADDENDUMS FOR THIS PRODUCT.

https://www.flexinnovations.com/product/raven-180cc

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INTRODUCTION

Formulated and flown by Wayne Handley at airshows across the United States throughout the 1990s, the full-scale Raven is a one-of-a-kind aircraft that elevated the standard for aerobatic performance and ingenuity. Bringing this pioneering spirit to the giant scale RC arena, the Flex Innovations Raven 180 expands what is capable with a 40% class aircraft. Designed by Jase “The Ace” Dussia, the Raven showcases a distinguished scale appearance while containing cutting edge aerodynamics. The Raven 180 marks a new range of flight capabilities! Not only does it integrate the floaty low/slow 3D stability of a traditional 40% aircraft and crisp/consistent IMAC performance and presentation, but it offers the XA capabilities previously only seen in the 35% size making it an exceptional choice for a truly ‘Do It All’ airframe.

The Raven has been designed around the all-new Desert Aircraft 180cc twin cylinder engine, while being developed and tested for a wide range of engines of 150-200cc size in both twin and four-cylinder applications. Both twin cylinder and four-cylinder setups can be installed without any modifications required. Featuring the Flex Innovations Speed-Lock system all around, field assembly is a breeze. ARF assembly raises the bar for giant scale aircraft with pre-hinged and sealed control surfaces, pre-installed and painted control horns, installed cockpit/dash, and much more! The Raven 180 showcases a uniquely gorgeous livery designed by Clint Sweet of CS Designs.

Specifications:

Wingspan:	113 in. (2870mm)
Length:	110 in. (2794mm)
Estimated Weight:	37 lb. (16.8kg) with DA-180 & stock mufflers
Engine Size:	150-222cc, 2 or 4 cylinder
Servos:	600 oz/in minimum, 2-3 per aileron, 1-2 per elevator, 2 for the rudder
Channels:	11+

Required Equipment:

Radio Equipment & Servos:

Transmitter:	11+ channels
Receiver:	11+ channels, high-voltage capable
Receiver Battery:	(2) 2S 4000mAh 15C+ LiPos (FPZBR40002S15 recommended)
Recommended Servos:	(8-12) Minimum 600 oz-in (43.2 kg-cm) for control surfaces & (1) standard servo for throttle. (MKS HBL3850 recommended)

Servo Arms:

Aileron:	(4-6) 1 ½-inch Clamping Servo Arm (MKS-2015-10 MKS X8 Aluminum Servo Arm, 2-inch used at the 1 ½-inch position recommended)
Elevator:	(2-4) 2-inch Clamping Servo Arm (MKS-2015-10 MKS X8 Aluminum Servo Arm, 2-inch recommended)
Rudder:	(2) 2-inch Clamping Servo Arm (Push-Pull Rudder) (MKS-2015-10 MKS X8 Aluminum Servo Arm, 2-inch recommended)

Servo Extensions:

Wing Harness:	(2) MPX Triple Servo Wire Harness FPZA1067 or (2) MPX Double Servo Wire Harness FPZA1066 or
Extensions:	(2) 18-inch (460 mm) FPZ1046 (4) 24-inch (610 mm) FPZA1047 (2) 36-inch (920 mm) FPZ1048 (4) 48-inch (1200 mm) FPZ1049
Servo Extension Safety Clips:	Flex Servo Connector Safety Clips FPZA1040

Spinner:

Spinner:	5.5-inch (140 mm) Flex Innovations 5.5-Inch Carbon Fiber, Edge Style Spinner (FPM2522 or FPMA1037 recommended)

Gas Engine Setup

Engine:	150-222cc Two-Stroke Gasoline Engine Desert Aircraft DA-180
Exhaust:	Follow your engine manufacturer's recommendation, as well as local noise restrictions in your area. Desert Aircraft Stock Muffler Set, MTW Re3, etc.
Propeller:	30-34" depending on engine application and personal preference. Prop choice may vary by density altitude. Follow your engine manufacturers recommendations.
Engine Standoffs:	Provided motor box extension for two cylinder. 4-cylinder will vary based on engine application
Ignition Regulator:	Follow your engine manufacturer's recommendation
Ignition Battery	Follow the manufacturer's voltage requirements. Potenza 2S 4000mAh 15C+ Li-Po (FPZBR40002S15) recommended
Fuel Dot:	McFueler Fuel Dot (FPMA1049)

Optional Equipment:

FPZAURA12PRO	Aura 12 Professional
FPMA1040	50oz Lightweight Fuel/Smoke Tank (for smoke)
DP1000	Dualsky DP1000 Brushless Smoke Pump
FPM2514	Flex Innovations Premium Wing and Tail Bag Set – Raven 180
FPM2525	Protection Pack – Raven 180
FPMA1056	180cc Complete Smoke System Pack
FPM2516	Raven 180 Pilot Figure Orange

Ultracote®/Oracover® Colors:

Orange Scheme:

Ultracote®	**Oracover®**
Midnight Blue (HANU885)	Dark Blue (21-052)
Sky Blue (HANU875)	Sky Blue (21-053)
Orange (HANU877)	Orange (21-060)
White (HANU870)	Whtie (21-010)

USING THIS MANUAL

The manual is divided into sections to make the assembly of the airplane easier to follow.

Note: The squares "☐" next to each step that can be checked off to help you keep track of the steps that have been completed.

ATTENTION

Read the ENTIRE instruction manual to become familiar with the features and assembly of the product before starting assembly. Failure to assemble or operate the product correctly can result in damage to the product, personal property and cause serious or fatal injury.

All instructions, warranties and other collateral documents are subject to change at the sole discretion of Flex Innovations, LLC. For up-to-date product literature, please visit our website at www.flexinnovations.com and navigate to the product page for this product.

WARNING

This is NOT a toy. This product is not intended for use by children under 14 years of age without direct adult supervision.

IMPORTANT INFORMATION REGARDING WARRANTY

Please read our Warranty and Liability section before building this product. If you as the purchaser or user are not prepared to accept the liability associated with the use of this product, you are advised to return this product immediately in new and unused condition, in the original packaging material, to the place of purchase.

SAFETY WARNINGS AND PRECAUTIONS

Protect yourself and others by following these basic safety guidelines.

1. This manual contains instructions for safety, operation, and maintenance. It is essential to read and follow all the instructions in the manual, prior to assembly, setup, or use, in order to operate correctly and avoid damage or serious injury.
2. In some cases, the written instructions may differ slightly from the photos. In those instances, the written instructions should be considered correct.
3. This model is not a toy, rather it is a sophisticated remote control hobby product and must be operated with caution and common sense. Failure to operate this product in a safe and responsible manner could result in injury, or damage to the product, or other property.
4. This model must be assembled according to these instructions. Do not alter or modify the model outside of these instructions provided by Flex Innovations, LLC, as doing so may render it unsafe and/or unflyable. You must take time to build straight, true, and strong. It is your responsibility to ensure the air worthiness of this product.
5. Use only compatible, appropriate components for the final assembly of this model. Ensure that the radio system is in functional condition, that the engine is appropriately sized for the model and that all other components are appropriate for use in this model as specified in this instruction manual. All components must be installed correctly so that they operate correctly both on the ground and in the air.
6. Inspect and check the operation of the model and all its components before every flight.
7. If you are not an experienced pilot, or have not flown a high-performance model before, it is recommended that you seek assistance from an experienced pilot in your R/C club for your

first flights. If you're not a member of a club, the Academy of Model Aeronautics (AMA) has information about clubs in your area whose membership includes experienced pilots.

8. Keep the propeller area clear from such items as loose clothing, jewelry, long hair, or tools, as they can become entangled. Keep your hands and body parts away from the propeller as injury can occur.

SPECIAL LANGUAGE DEFINITIONS

The following terms are used throughout the product literature to indicate various levels of potential harm when operating the product.

NOTICE:	Procedures, which if not properly followed, create a possibility of physical property damage AND a liable or no possibility of injury.
CAUTION:	Procedures, which if not properly followed, create a probability of physical property damage AND a possibility of serious injury.
WARNING:	Procedures, which if not properly followed, create the probability of property damage, collateral damage and serious injury OR create a high probability of serious injury.

IMPORTANT BEFORE ASSEMBLY

Carefully unpack your aircraft and inspect the parts. Review the manual and gather the required tools and supplies.

- Remove all parts from their plastic bags, inventory all items and closely examine all the major airframe components for damage. If any items are missing or you find damaged components, do not proceed. Please contact customer support.
- Your aircraft has experienced many changes in temperature, density, etc. Throughout its transit from the factory, warehouse, and finally to your location. It is expected that some areas of covering will show wrinkles
- Use a covering iron with a covering sock on high heat to tighten the covering as necessary, paying special attention to the leading edges of the flying surfaces, hinge lines and stabilizer and wing saddle areas. Apply slight pressure over sheeted areas to thoroughly bond the covering to the wood. Use caution around seams to prevent inadvertently pulling them loose.
    - **Pro-Tip:** You can use a “Seal-It Pen” or clear nail polish to permanently seal any sharp edges or corners of covering that may come loose in flight.
- Use thin CA to go over any important glue joints, such as the motor box, firewall, servo mounting rails and any other pre-assembled joints that may see high stress during flight.
- Gather all the required components such as motor and radio equipment that will be used to equip the airplane. Create a new radio program in your transmitter and bind this model program to the receiver that will be used in the airplane
- To prepare for flight, it is recommended that you use the combination of an iron and heat gun to ensure all seams are sealed. Be sure to operate with safe heat settings on your iron while using an iron cover or paper towel. When using a heat gun, do not concentrate on one area for an extended period, rather distribute the heat
- Glass cleaner and paper towels work well to clean your airframe. For an additional shine, spray wax is an option.
- It is a good idea to have some isopropyl alcohol on hand throughout assembly. This can be used to help clean residual adhesives.

AIRFRAME ASSEMBLY

CONTROL HORN INSTALLATION

Required for this section

Components

- Aileron Control Horns (2 sets of 2)
- Aileron Control Horn Bases (2)
- Elevator Control Horns (2 sets of 2)
- Elevator Control Horn Bases (2)

Tools

Hobby Knife with a #11 blade

Adhesives/Building Materials

- Isopropyl Alcohol
- 30-minute Epoxy
- Paper Towels
- Toothpicks
- Mixing Cups
- Mixing Sticks (something to mix epoxy with)

Note: The Raven 180 features pre-installed and painted control horns for the ailerons, elevators, and rudder.
If running three servos per wing, the center horns will need to be installed.
Additionally, if running two servos per elevator, the outboard horns will need to be installed

☐ 1. Scuff each control horn with medium grit sandpaper where it enters the control surface. Use a paper towel and isopropyl alcohol to clean up the control horn after it has been scuffed.

☐ 2. Slide the control horns through the square control horn base, and test fit them in their corresponding slots. Note that the holes in the control horn base are offset. This is so that the base does not extend over the hinge line. Adjust the holes in the control surfaces to fit the control horns if needed.

☐ 3. Apply epoxy to the control horn slots and control horn and insert the control horn into its corresponding slots. Double check the rudder control horn to ensure it is straight and seated properly. Use a paper towel and isopropyl alcohol to clean up any excess epoxy. Set the rudder aside and let the epoxy fully cure.

Jase's Pro Tips:

Use a ball link and the corresponding hardware to keep the two parts of each control horn aligned while the epoxy cures.

MAIN LANDING GEAR INSTALLATION

Required for this section

Components

- Fuselage Assembly
- Landing Gear
- Wheel Pants (L & R)
- Main Wheel (2)
- M6x25 Socket Head Cap Screw (4)
- M6 Flat Washer (8)
- M3x15 Socket Head Cap Screw (4)
- M3 Flat Washer (4)
- Landing Gear Axle (2)
- M5 Wheel Collar (4)

Tools

- 1.5mm Hex Driver
- 2.5mm Hex Driver
- 5mm Hex Driver
- 7mm Wrench
- 10mm Wrench
- 12mm Wrench
- Felt-Tipped Pen

Adhesives/Building Materials

- Blue Thread Lock
- Red Thread Lock
- Rubber Adhesive (e.g. GOOP)

Landing Gear Installation

The landing gear is secured using four M6x25 bolts that thread from the bottom of the airplane into the blind nuts pre-installed in the fuselage.

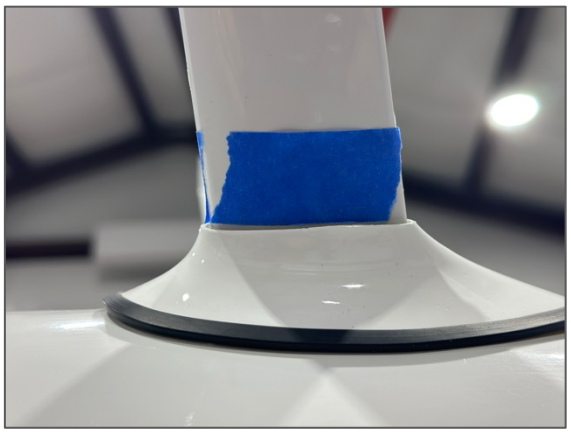
☐ 1. Place the landing gear on the fuselage so that it sweeps forward and the wheels are closer to the nose of the airplane. Note: the landing gear should have a slight forward sweep when installed.

☐ 2. Using red thread lock, install the M6x25 socket head cap bolts with an M6 washer through each one of the holes in the landing gear and through the corresponding landing gear mounting hole in the fuselage. Tighten the screws using a 5mm hex driver loosely. Do not fully tighten until all four M6 screws are in place.

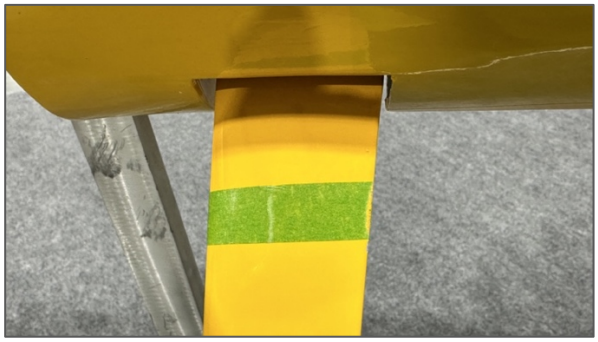
Landing Gear Cuff Installation

The landing gear cuffs are glued to the landing gear itself, and not the fuselage. This allows for easy removal of the landing gear.

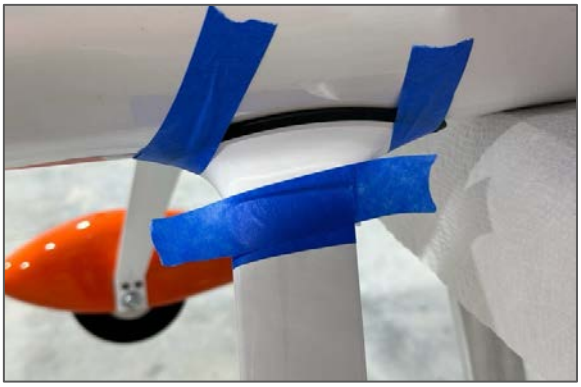
☐ 1. Slide the gear cuff up into place against the fuselage. Apply a piece of masking tape at the bottom edge of the cuff on each side of the landing gear.

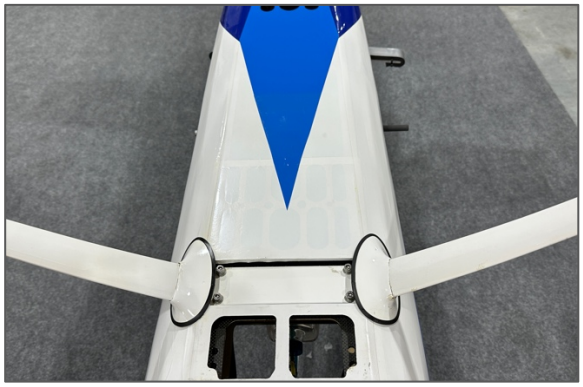


☐ 2. Slide the cuff back down and apply a bead of adhesive on each side of gear based on where you marked the bottom of the cuff. We recommend a rubberized adhesive such as GOOP.



☐ 3. Slide the gear cuff back up into place. Tape over the bottom of cuff to ensure no residual adhesive runs down the landing gear. Also tape the top of the cuff to the fuselage to keep it in place while the adhesive sets.





☐ 4. Keep airframe upright and allow the adhesive to cure for 24 hours (if using GOOP).

Wheel, Axle, and Wheel Pant Installation

The wheel, axle, and wheel pants feature a wheel pant saver system which will increase the longevity of the wheel pants when flying off grass runways for example.

☐ 1. Mount the axle to the landing gear by using the provided washer and locknut, use red thread lock on these nuts. Notice the flat spot on the end of the axle. To properly use the wheel pant savers, make sure this is facing towards the bottom of the airplane.

☐ 2. Put the wheel in place by sliding it over the axle. A collar will likely need to be installed to keep the wheel in place laterally.

☐ 3. Locate the long cylindrical collar. This will be applied using the provided set screw facing towards the bottom of the airplane.

☐ 4. Put the wheel pant in place and notice how the cylindrical collar sits inside the fiberglass housing in the wheel pant mold. Begin threading in the bolts. Use blue thread lock.

- [ ] 5. Apply the exterior wheel pant saver bolt from the outside of the wheel pant into the threaded portion of the cylindrical collar.
- [ ] 6. Tighten the wheel pants for flight.

RUDDER AND TAILWHEEL INSTALLATION

Required for this section

Components

- Fuselage
- Rudder
- Rudder Hinge Wire
- Tail Gear Assembly
- Steering Ball Link (1)
- Socket Head Cap Screws (3)
- M3 Washers (3)

Tools

- Flat Head Screwdriver
- 2.5mm Hex Driver
- Hobby knife

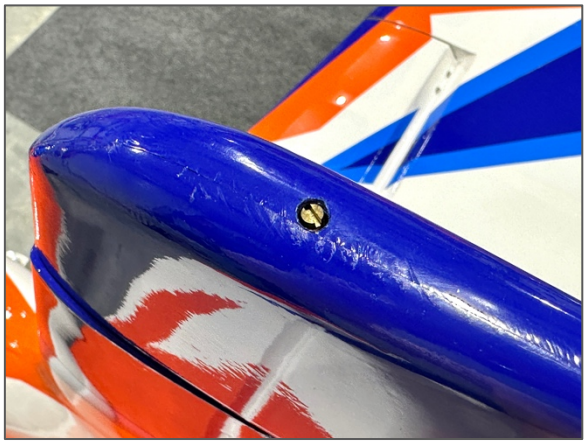
Adhesives/Building Materials

- Blue Thread Lock

Rudder Installation

The rudder is removable using a wire sliding through the hinges from the top. The wire is threaded at the top and is tightened by using a flat head screwdriver.

☐ 1. Install the rudder by making sure the slots in the hinges are aligned. Also be sure, the bottom of the rudder lines up with the bottom of the fuselage.



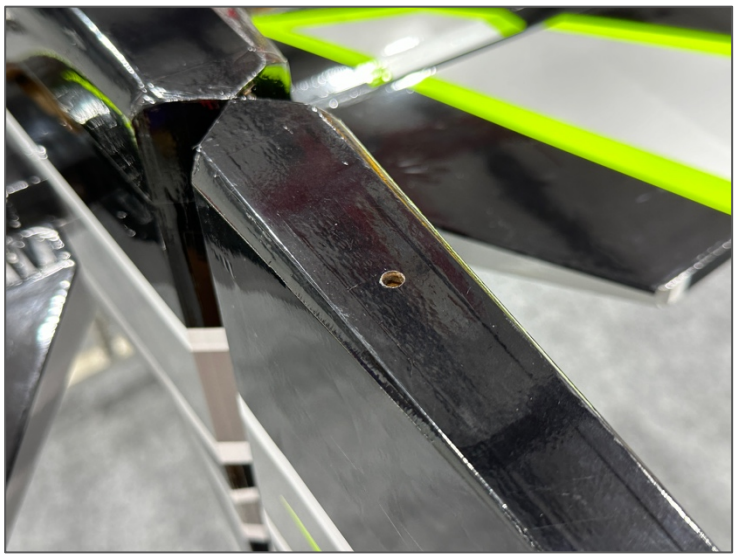
☐ 2. Run the wire through the top of the rudder through the hinges.

☐ 3. Be sure to not overtighten the threaded hinge wire, this will allow for easy removal.

Tailwheel Installation

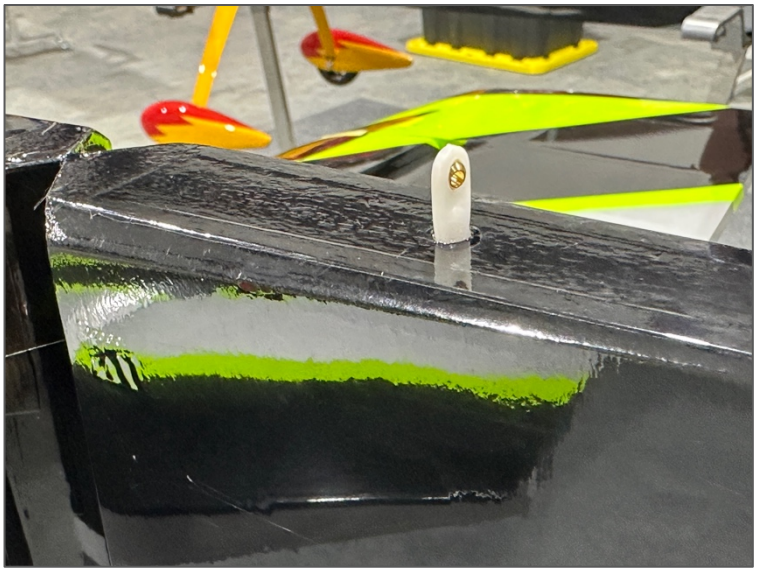
The tailwheel is mounted using three bolts along with a ball link.

☐ 1. Locate the hole in the bottom of the rudder that will accept the ball link for the steering arm. It is about 3-3/8 inches (85mm) aft of the rudder hinge line. Use a hobby knife with a #11 blade to remove the covering from the hole.



☐ 2. Scuff the cylindrical part of the ball link with a medium grit sandpaper. Clean the ball link with isopropyl alcohol and a paper towel to remove any leftover plastic particles.

☐ 3. Once clean and dry, apply adhesive and glue the steering ball link into the hole, keeping it square to the bottom of the rudder and perpendicular to the wire steering arm. Apply adhesive around the ball link for added strength.



☐ 4. Once the adhesive is cured, slide the wire steering arm through the ball link and bolt the tail wheel mount in place using the supplied bolts and blue thread lock.

☐ 5. You can trim the steering wire leaving some overhang. Ensure that the steering wire stays on track within the ball link throughout the rudders full range of motion.

AILERON SERVO AND LINKAGE INSTALLATION

Required for this section

Components

- Main Wing Panels (2)
- Aileron Linkage (4-6)
- Aileron Servos (4-6)
- Aileron Servo Arms 1.5" (4-6)
- Tip Aileron Servo Extensions (2)
- Center Aileron Servo Extensions (2, optional)
- Ball Links (8-12)
- M3x20 Socket Head Cap Screw (4-6)
- M3x15 Socket Head Cap Screw (4-6)
- M3 Washer (24-36)
- M3 Lock Nut (8-12)
- M3 Conical Spacer (4-6)

Tools

- 2.5mm Hex Driver
- 5.5mm Nut Driver
- #1 Phillips Screwdriver
- Hobby knife

Adhesives/Building Materials

- Thin CA
- Blue Thread Lock
- Heat shrink tubing, dental floss or servo safety clips

The Raven 180 has an option to use two or three servos per wing. For faster, XA style flying, three high torque servos are recommended per wing.

☐ 1. If you are using the center servo, remove the covering from the servo mount using a hobby knife with a sharp blade.

☐ 2. Use a #1 Phillips screwdriver to thread a servo mounting screw into each of the pre-cut holes in the servo mounting rails in the wing. Remove the screw and apply a small amount of thin CA to each of the holes to harden the threads cut by the screw. Do not use CA accelerator. Let the CA fully cure before moving forward.

☐ 3. Assemble your servo grommets per your servo manufacturer's instructions.

Jase's Pro Tip:

Many servo grommet brass eyelets will fit over most hex drivers. Slide all the eyelets over the hex driver, flared end first. Use the hex driver to push the eyelets into the servo grommets one right after the other for easier installation.

☐ 4. Secure a servo extension to each of the two tip and center aileron servos. Use servo connector safety clips (FPZA1040), heat shrink or dental floss to secure the extension.

☐ 5. Insert the aileron servo into the servo bay with the output shaft towards the **trailing edge** of the wing. Be sure to route the servo lead out of the wing before mounting the servo. There is string routed through the wing to assist you in pulling the tip aileron servo extension through the wing. Mount the servo to the wing using the servo mounting screws provided with your servos.

☐ 6. Using an aileron pushrod, assemble the aileron linkages so that the total length from center of ball to center of ball is approximately 3 inches (75mm). Final length will be adjusted when centering the control surface. Note that one end of each aileron linkage

has left-hand threads, while the other end has right hand threads, this will allow for adjusting the linkage length without removing either end of the linkage.

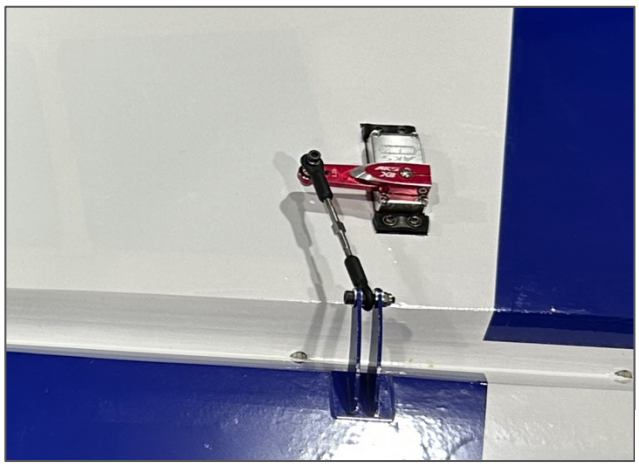
Jase's Pro Tip:

Use a set of digital calipers to measure the length of threads exposed on each end of the linkage. This allows you to ensure that the ball links are equally threaded onto each end of the linkage.

☐ 7. Attach the linkage to the servo arm. The correct hole location is 1 ½ inches (38mm) from center. If using the recommended 1 ½ inch servo arm, this is the hole at the end of the servo arm. The order of hardware components, starting from the top of the servo is as follows:

- M3x20 socket head cap screw
- M3 washer
- Ball Linkage
- Conical Spacer (narrow, pointed side towards the ball link)
- Servo Arm
- M3 washer
- M3 locknut

☐ 8. Use your radio system power on the servos to center them. Install your aileron servo arm onto the servo as close to parallel with the hinge line as possible. Apply blue thread lock to the servo arm output shaft screw and fully tighten the screw. If your servo arms have clamping screws, apply blue thread lock, and secure them in place as well. Once complete, use sub-trim to fine tune the center position of the servo to be perfectly parallel to the hinge line.

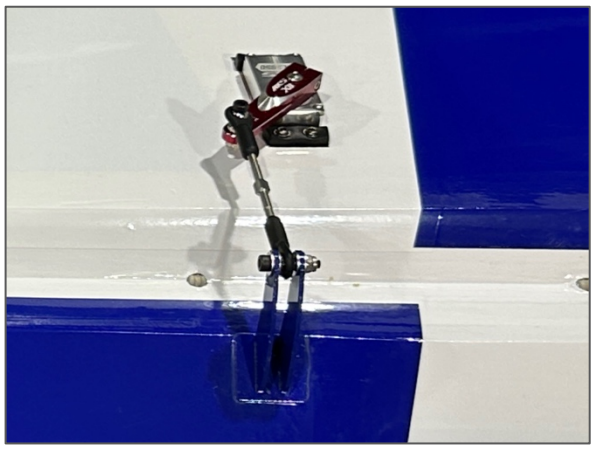


☐ 9. With the radio powered-on and the servo arm parallel to the hinge line, connect the root aileron servo linkage to the control horn with the hardware in the following order:

- M3x15 Socket Head Cap Screw
- M3 Washer
- Control Horn (Side 1)
- M3 Washer
- Ball Link
- M3 Washer
- Control Horn (Side 2)

- M3 Washer
- M3 Lock Nut

☐ 10. Center the aileron by lengthening or shortening the linkage as needed.



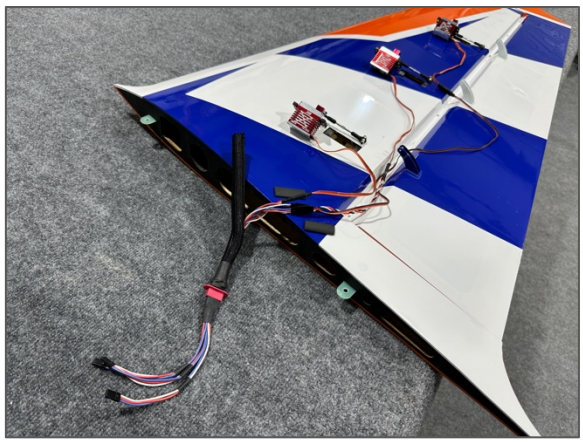
Note: The angle of the linkage when centered is correct. As the servo arm rotates and the control surface deflects, the linkage will straighten.

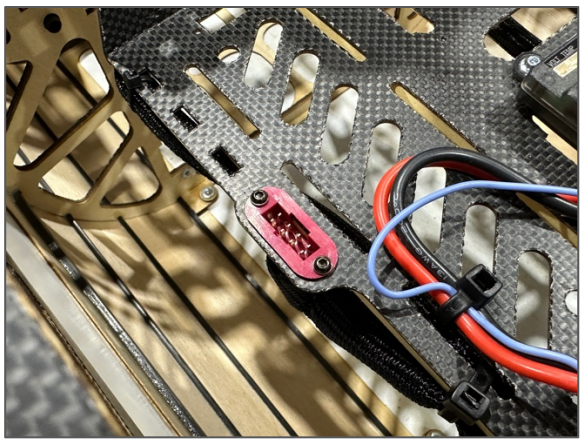
☐ 11. Once the root aileron servo is connected, set your end points in both directions so that the ailerons travel 39 degrees up and 39 degrees down, at the root of the aileron, when set to high rates. Once complete, center the tip servo, and adjust the linkage so that there is no binding with the tip root at neutral. Deflect the servos to maximum and adjust the tip servo end points to match the root servo in both directions. Once satisfied with the matching of the servos, attach the linkage to the control horn using the same order of components used previously.

Jase's Pro Tip:

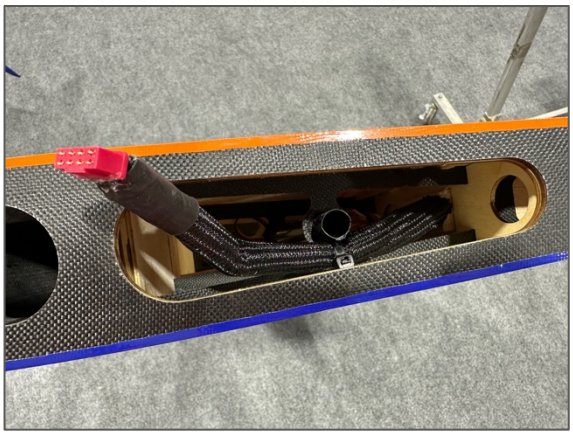
When matching the tip and optional center servo to the root servo, don't connect the linkages to the control horns of the servos. Instead, place the ball link in the control horn, and use a bolt, or hex driver with a 3mm shafts, to check the alignment of the holes in the control horns and the holes in the ball links. If they slide easily through the holes, they are aligned. If not, you still need to adjust the servo travel.

☐ 12. For the wing servos, the Tripple or Dual Servo MPX Connectors (FPZA1067 or FPZA1066) are an easy way to route all servos to the receiver. The fuselage has a slot specially designed to mount the MPX connector.





☐ 13. Be sure the leads of the connector are secured within the wing to help prevent them from coming unplugged.



☐ 14. Repeat for the other wing.

ELEVATOR SERVO AND LINKAGE INSTALLATION

Required for this section

Components

- Left and Right Horizontal Stabilizers (2)
- Elevator Servos (2-4)
- Elevator Servo Arm 2" (2-4)
- M3x20 Socket Head Cap Screw (2-4)
- M3x15 Socket Head Cap Screw (2-4)
- M3 Washer (12-24)
- M3 Lock Nut (4-8)
- M3 Conical Spacers (2-4)

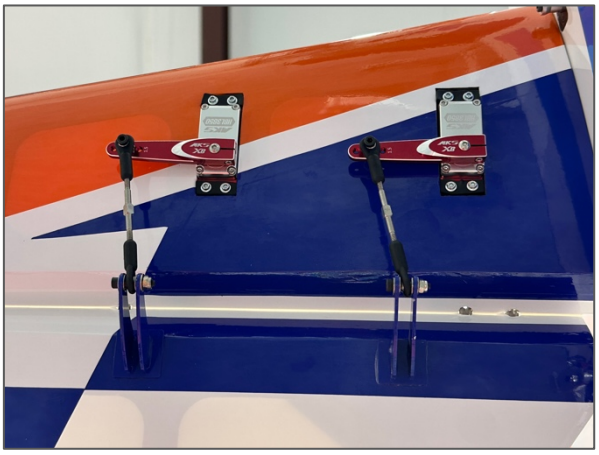
Tools

- 2.5mm Hex Driver
- 5.5mm Nut Driver
- #1 Phillips Screwdriver
- Hobby knife

Adhesives/Building Materials

- Thin CA
- Blue Thread Lock
- Heat shrink tubing, dental floss or servo safety clips

The Raven 180 has an option to use one or two servos per horizontal stabilizer. For faster, XA style flying, two high torque servos are recommended per horizontal stabilizer.



☐ 1. If you are using the outside servo, remove the covering from the servo mount using a hobby knife with a sharp blade.

☐ 2. Use a #1 Phillips screwdriver to thread a servo mounting screw into each of the holes in the servo mounting rails in the horizontal stabilizer. Remove the screw and apply a small amount of thin CA to each of the holes to harden the threads cut by the screw. Do not use kicker, allow the CA to fully cure before moving forward.

☐ 3. Assemble your servo grommets per your servo manufacturer's instructions.

☐ 4. Insert the elevator servos into the mounting locations with the output shafts towards the trailing-edge of the stab. Mount the servos to the stab using the mounting screws provided with your servos.

☐ 5. Power on your radio system to center the servos. Install a 2-inch (51mm) servo arm onto the servo as close to perpendicular with the servos' cases as possible. Apply a small amount of blue thread lock to the servo arm screws and secure them in place. If your servo arms have clamping screws, apply blue thread lock to these screws and secure them in place. Use sub-trim to set the servo arms perfectly perpendicular before installing the elevator linkages.

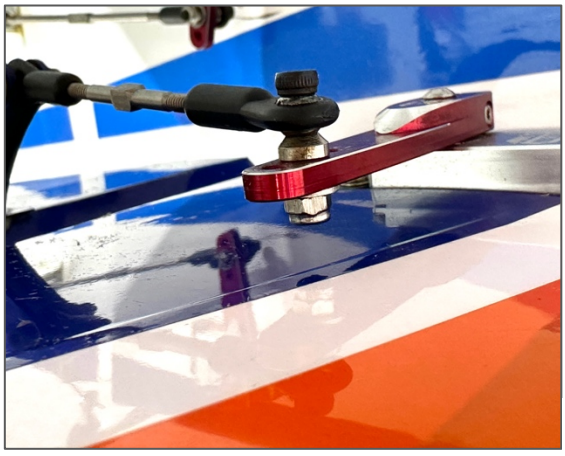
☐ 6. Using an elevator pushrod, assemble the elevator linkages and ball links so that the total length from center of ball to center of ball is approximately 3 in (75mm). Final length will be adjusted when centering the control surface. Note that both ends of the elevator linkages have opposite direction threads.

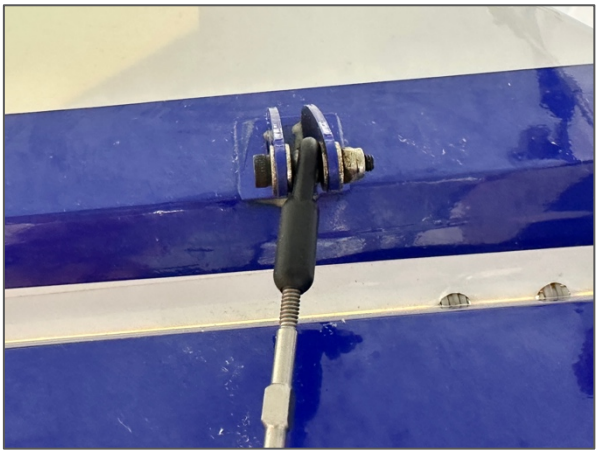
☐ 7. Starting with the root servos, attach the linkage to the servo arm. The correct hole location is 1-¾ to 2-inches (44.5 to 50.8mm) from the center of the servo. If you are using the recommended servo arm this is the hole at the end of the servo extension arm. The order of hardware components, starting from the top of the servo is as follows:

- M3x20 socket head cap screw
- M3 washer
- Ball Linkage
- Conical Spacer (narrow, pointed side towards the ball link)
- Servo Arm
- M3 washer
- M3 locknut

☐ 8. Attach the linkage to the control horn. The order of hardware components, starting from the tip of the stabilizer is as follows:

- M3x15 socket head cap screw
- M3 washer
- Control Horn #1
- M3 washer
- Ball Linkage
- M3 washer
- Control Horn #2
- M3 washer
- M3 locknut





☐ 9. With the radio powered on and the servo arm centered perpendicular to the servo case, adjust the linkage length so that the control surface is centered.

Quique Pro Tip:

- For elevator centering, it is best to install the stabilizers onto the fuselage and stand approximately 10 feet (3m) behind the aircraft while sighting the two elevator halves. Using

this method, you can best align the most important part of the control surface, the wider section, rather than referencing something less important, like the elevator counterbalance.

- [ ] 10. If you are using two servos per horizontal stabilizer install the second linkage now. Follow the instructions provided with the Aileron Servo Setup to ensure that the servos and linkages are matched properly.

- [ ] 11. Repeat for the other horizontal stabilizer.

RUDDER SERVO AND LINKAGE INSTALLATION

Required for this section

Components

- Fuselage Assembly
- Rudder Servo
- Rudder Servo Arm 2" (2)
- Rudder Servo Extensions (2)
- Elevator Servo Extensions (2-4)
- M3x20 Socket Head Cap Screw (2)
- M3x15 Socket Head Cap Screw (2)
- M3 Washer (12)
- M3 Lock Nut (4)
- M3 Conical Spacer (2)

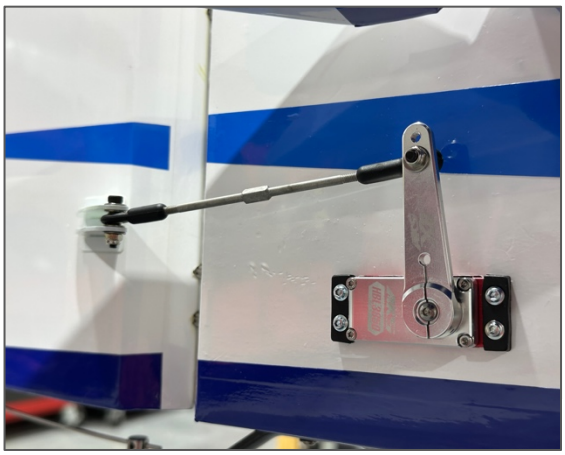
Tools

- 2.5mm Hex Driver
- 5.5mm Nut Driver
- #1 Phillips Screwdriver

Adhesives/Building Materials

- Thin CA
- Blue Thread Lock
- Heat shrink tubing, dental floss or servo safety clips

The Raven 180 is designed to run two rudder servos, both in a push-pull configuration. There is one servo on each side of the fuselage connected to the rudder via pushrods like the ones used on the ailerons and the elevator. When the installation is complete it should look like the pictures shown below.



☐ 1. Use a #1 Phillips screwdriver to thread a servo mounting screw into each of the holes in the servo mounting rails in the fuselage. Remove the screw and apply a small amount of thin CA to each of the holes to harden the threads cut by the screw. Do not use kicker, allow the CA to fully cure before moving forward.

☐ 2. Assemble your servo grommets per your servo manufacturer's instructions.

☐ 3. Secure a servo extension to each one of the rudder servos. Use servo connector safety clips (FPZA1040), heat shrink tubing or dental floss to secure the extensions.

☐ 4. Feed the rudder servo extensions and the two elevator servo extensions through the tube in the fuselage that is provided for this purpose. Secure the extensions to prevent excessive movement during flight.

☐ 5. Insert one of the rudder servos into the mounting location, with the output shaft towards the front of the fuselage. Mount the servo to the fuselage using the mounting screws provided with your servo.

☐ 6. Power on your radio system to center the servo. Install a 2-inch (51mm) servo arm onto the servo, pointing up, as close to perpendicular with the servo's case as possible. Apply a small amount of blue thread lock to the servo arm screw and secure it in place. If your servo arm has clamping screws, apply blue thread lock to these screws and secure them in place.

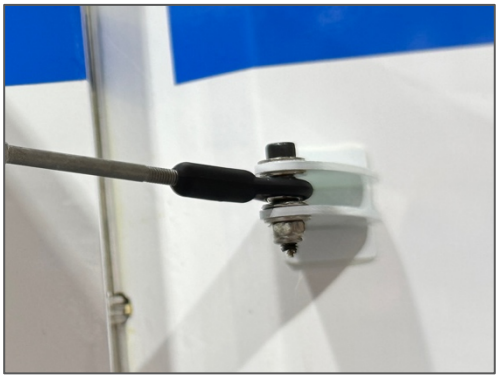
☐ 7. Using a rudder pushrod, assemble the rudder linkages and ball links so that the total length from center of ball to center of ball is approximately 4 ⅜ in (110mm). Final lengths will be adjusted when centering the control surface. Note that both ends of the rudder linkages have opposite direction threads.

☐ 8. Attach the linkage to the servo arm. The correct hole location is 2-inches (50.8mm) from the center of the servo. If you are using the recommended servo arm this is the hole at the end of the servo extension arm. The order of hardware components, starting from the top of the servo is as follows:

- M3x20 socket head cap screw
- M3 washer
- Ball Linkage
- Servo Arm
- M3 washer
- M3 locknut

☐ 9. Attach the linkage to the control horn. The order of hardware components is as follows:

- M3x15 socket head cap screw
- M3 washer
- Control Horn #1
- M3 washer
- Ball Linkage
- M3 washer
- Control Horn #2
- M3 washer
- M3 locknut



☐ 10. With the radio powered on and the servo arm centered perpendicular to the servo case, adjust the linkage length so that the rudder is centered.

☐ 11. After installation is complete, repeat for the servo on the other side. Match the travel of both the servos as you did with the ailerons and elevators.

GAS POWER SETUP

FUEL TANK INSTALLATION

Required for this section

Components

- Fuselage Assembly
- Fuel Tank
- Fuel Line
- Fuel Filler

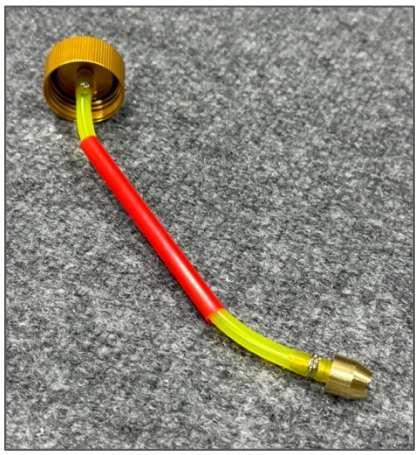
Tools

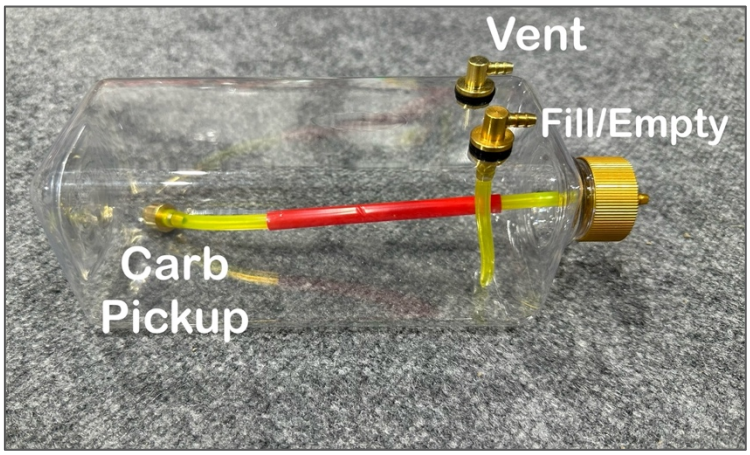
- Pliers

Adhesives/Building Materials

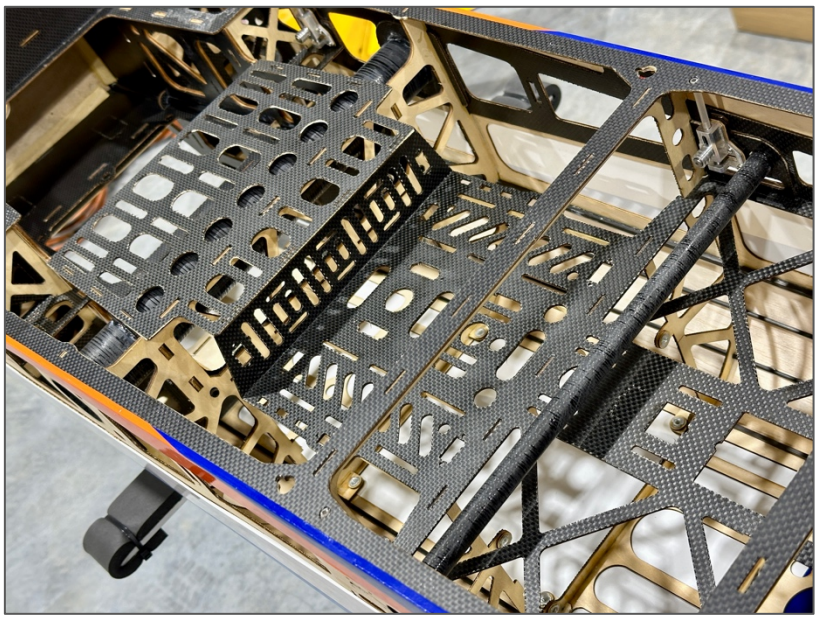
- Hook and Loop Strap (2)
- Adhesive-Back Hook and Loop Tape
- Cable Ties

The Flex Innovations 50oz Lightweight Fuel Tank is included with your Raven 180.

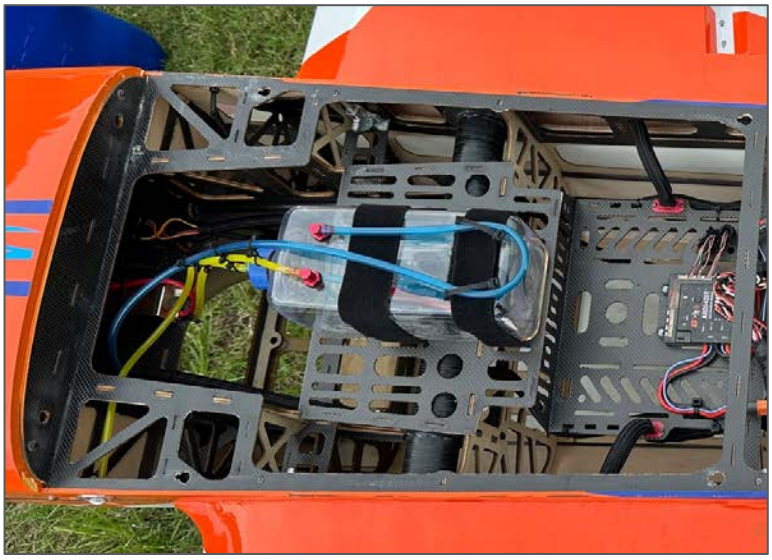




☐ 1. Assemble your fuel tank. Before installing the fuel tank check all fittings are properly installed and that the clunk line inside the tank is appropriately sized. Adjust as necessary. We recommend using a straw around the pickup line inside the tank as shown above, this will prevent the line from wrapping around itself during flight.



☐ 2. As shown in the picture on the previous page, the fuel tank tray has plenty of room for your fuel tank. If you are using a single tank, you can place the fuel tank in the middle of the tray, If you plan on using a smoke system, two of the 50oz Lightweight Fuel/Smoke tanks (FPMA1040) should be used, installed side by side. One is included in your kit. Both tanks should be center over the wing tube in order to be closer to the airplane's CG.

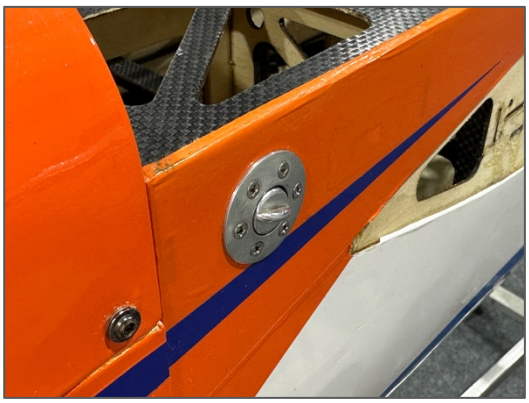


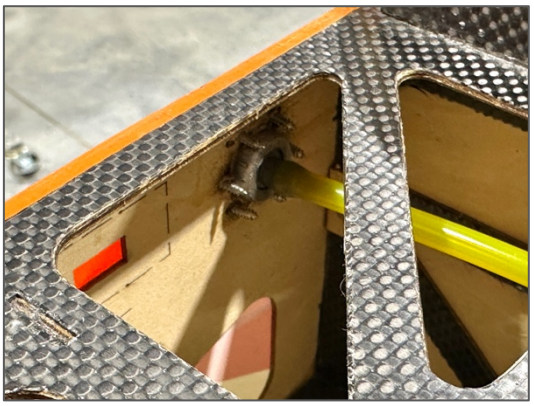
☐ 3. To mount the tank(s), apply adhesive-backed hook and loop tape to the bottom of your tank(s) and to the fuel tank tray. Place the tank(s) in their location and secure them with two hook and loop straps. These straps should be snug but not overly tight, as the fuel tanks are very lightweight and can be easily crushed. The hook and loop tape on the bottom of the tank(s) will prevent the tank from moving fore and aft, and the hook and loop straps will prevent the tank from pulling away from the tray.

Jase's Pro Tip:

Wrap the vent line(s) around the top of the fuel tank(s) all the way to the back and then return to the front of the tank(s) to prevent siphoning.
Tie wire is a good way to keep all fuel line connections secure. You can also use a small ring of Tygon tubing as a clamp.

☐ 4. After the tank is in position, route and trim your fuel lines appropriately. Your clunk line should go to the carburetor or throttle body. The fill line should go to your fuel dot or filling system. We recommend the McFueler Fuel Dot (FPMA1049).





☐ 5. The vent line shrould warp around the tank and should then exit the bottom of the fuselage. After the vent line exits the fuselage. A piece of metal tubing coming from the bottom of the airplane can be used for vent. Or the vent line can be run through the bottom of the fuselage and secured with a zip tie. Don't overtighten the cable tie, as air and fuel will need to vent from this line. Be sure to keep your fuel line away from components that get hot (like your exhaust or cylinder heads) and route it in such a way that it will not bounce around or chafe on any of the interior structure of the fuselage.

ENGINE INSTALLATION

Required for this section

Components

- Fuselage Assembly
- Engine
- ¼-20 x 1-inch Socket Head Cap Screw (8 DA-180)
- ¼-20 x 2-inch Socket Head Cap Screw (4 DA-200)
- ¼-inch Flat Washer (4-8)
- ¼-inch Fender Washers(4)
- ¼-inch Lock Nuts(4)
- 30mm – 35mm Engine Standoffs (4 DA-200)

Tools

- Drill
- ⅛-inch (3mm) Drill Bit
- ¼-inch (6.5mm) Drill Bit
- ¼-inch Hex Driver

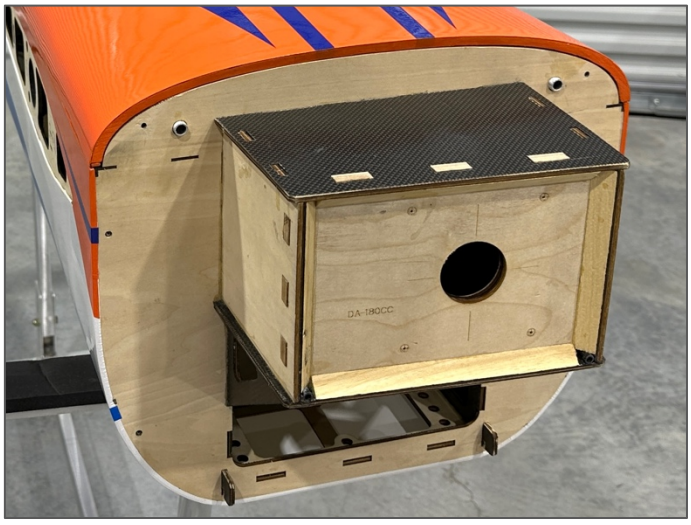
Adhesives/Building Materials

- Blue Thread Lock
- Red Thread Lock
- Thin CA

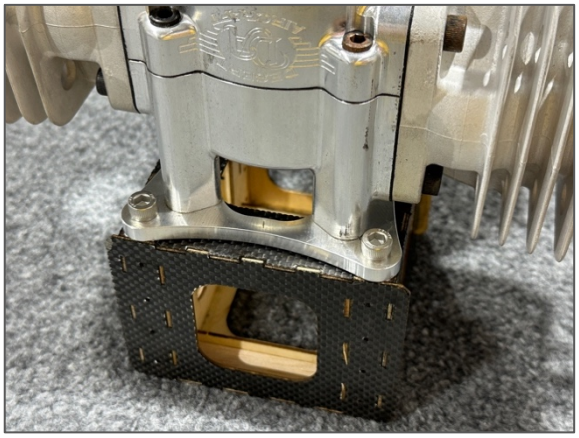
Mount the Engine, DA-180 Two-cylinder

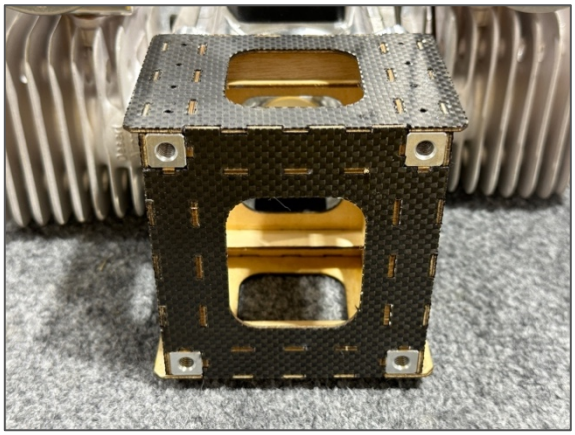
The Raven 180 features a motor box extension to allow for use of both four cylinder and two-cylinder engines without any modifications. The firewall itself is positioned for a four-cylinder engine such as the DA-200. The motor box extension allows for the use of a two-cylinder engine such as the DA-180.

☐ 1. The engine mounting location for the DA-180 is laser-etched into the firewall for your convenience. If using a different engine with a different mounting pattern, the "+" represents the engine crankshaft. Use a ⅛-inch drill bit and drill to create a pilot hole in the center of the four bolt hole etchings in the firewall. Use a ¼-inch drill bit to enlarge these holes to the appropriate size.

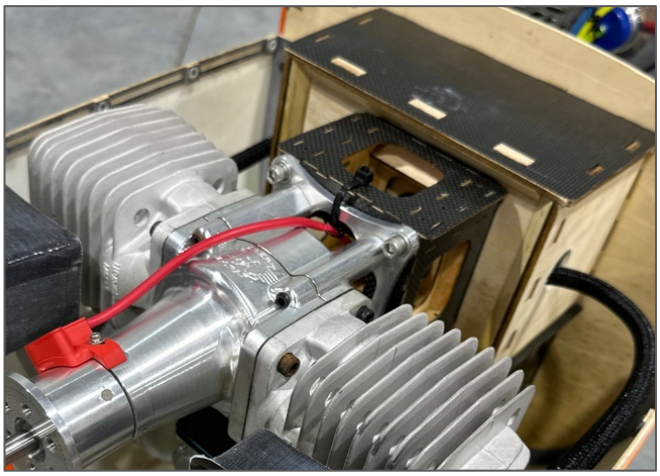


☐ 2. Mount the engine (without the exhaust) to the motor box using (4) ¼-20 x 1-inch socket head cap screws and (4) ¼-inch flat washers, use red thread locker on these bolts.





☐ 3. From the back of the firewall, mount the motor box using (4) ¼-20 x 1-inch socket head cap screws and (4) ¼-inch flat washers, use red thread locker on these bolts.



Mount the Engine, DA-200 Four-cylinder

When using a DA-200 four-cylinder engine you will not need the motor box, it will mount directly to the firewall.

Note: When using the DA-200 you will have to move your receiver packs around to achieve the proper CG for your Raven 180. It is highly beneficial to use 4 elevator servos in this configuration as it will make it a lot easier to achieve the desired CG.

☐ 1. The engine mounting location for the DA-200 is the same as for the DA-180 motor box and it is laser-etched into the firewall for your convenience. If using a different engine with a different mounting pattern, the "+" represents the engine crankshaft. Use a ⅛-inch drill bit and drill to create a pilot hole in the center of the four bolt hole etchings in the firewall. Use a ¼-inch drill bit to enlarge these holes to the appropriate size.

☐ 2. Mount the engine (without the exhaust) to the firewall using (4) ¼-20 x 2-inch socket head cap screws, (4) ¼-inch flat washers, (4) 30mm-35mm engine standoffs, (4) ¼-inch fender washers & (4) ¼-inch lock-nuts, use red thread locker on these bolts.

DA-180 & DA-200 Throttle Servo and Linkage Installation

Required for this section

Components

- Fuselage Assembly
- Throttle Servo
- 9-inch (230mm) Servo Extension
- Throttle pushrod
- 2mm Ball Link (2)
- M2x10 Phillips Head Screw (2)
- M2 Flat Washer (4)
- M2 Lock Nut (2)

Tools

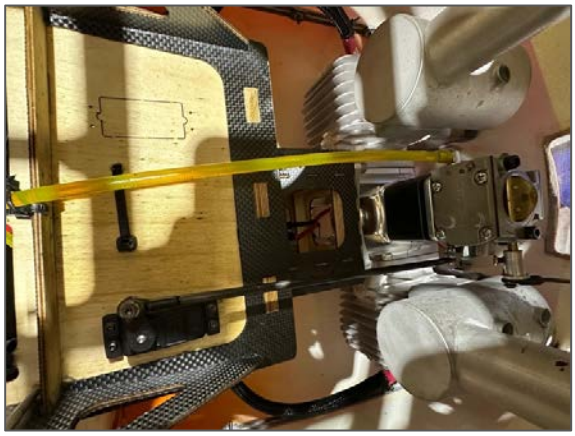
- #1 Phillips Screwdriver
- 2.5mm Hex Driver

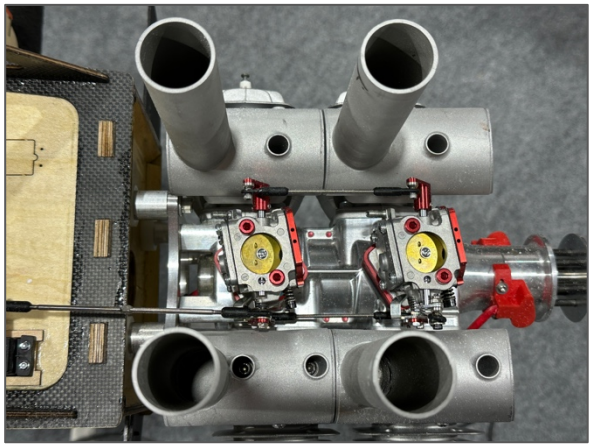
Adhesives/Building Materials

- Thin CA
- Blue Thread Lock
- Heat Shrink, Dental Floss or Safety Clips

The throttle servo is mounted to the bottom of the motor box. Provisions are made for a mounting location on each side of the airframe to match your engine carburetor requirement. Select the appropriate location and cut out the outlined wood section to allow for mounting of your servo..

☐ 1. Thread a servo mounting screw into each of the four mounting screw holes in the motor box. Apply thin CA to each of the holes to harden the threads.





☐ 2. Attach the servo extension to the throttle servo. Use a Servo Connector Safety Clip (FPZA1040), thread or heat shrink tubing to secure the extension in place. Mount the servo with the output shaft towards the rear of the aircraft and route the servo extension appropriately through the aircraft.

☐ 3. Assemble the throttle linkage and install a 1" servo arm. If your arm is longer, use the 1" location on the arm.

☐ 4. Use an M2x10 socket head cap screw, M2 washers, and M2 lock nut to secure the ends of the linkage to the throttle arm on the carburetor and to the servo arm. The order of components is as follows:

- M2x10 Socket Head Cap Screw
- M2 Washer
- Throttle Arm/Servo Arm
- M2 Lock Nut

☐ 5. Adjust the length of the throttle linkage so that both the throttle arm and servo are in the exact center location when your throttle stick is centered. Set your end-points to achieve full range of motion and to avoid binding at either end-point.

Jase's Pro Tips:

- Use the shortest servo arm possible while still getting full throttle arm movement on your engine. Your throttle end points should be around 110-120% when finished with the installation. A faster servo (like the Potenza DS49010HV) with a shorter arm is preferred over a slower servo with a longer arm.
- For the most linear throttle response, adjust the throttle linkage length to balance the end points for your throttle servo. You do NOT want your end points to be mismatched (example: 60/120). Set your end points as close to one another as possible (example: 114/116) for the most linear throttle response.

IGNITION INSTALLATION

Required for this section

Components

- Fuselage Assembly
- Ignition
- Ignition Switch
- Ignition Battery or IBEC
- Regulator (if applicable)
- (4) M2.5 x 8mm Wood Screws
- Motor box access hatch

Tools

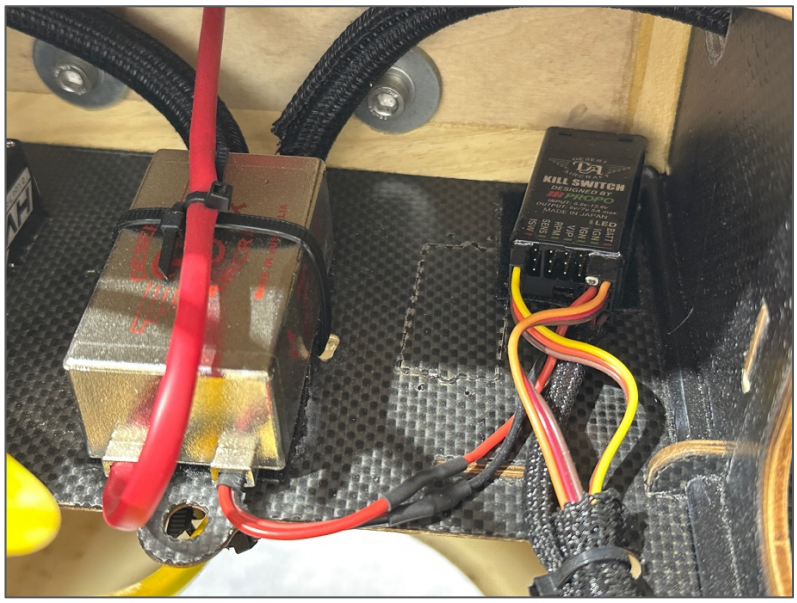
- Hobby Knife w/#11 Blade
- #1 Phillips Screwdriver

Adhesives/Building Materials

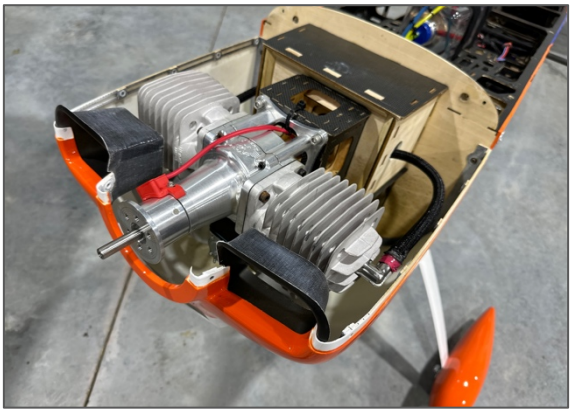
- Hook and Loop Strap (2)
- Adhesive-Back Hook and Loop Tape
- Thin CA

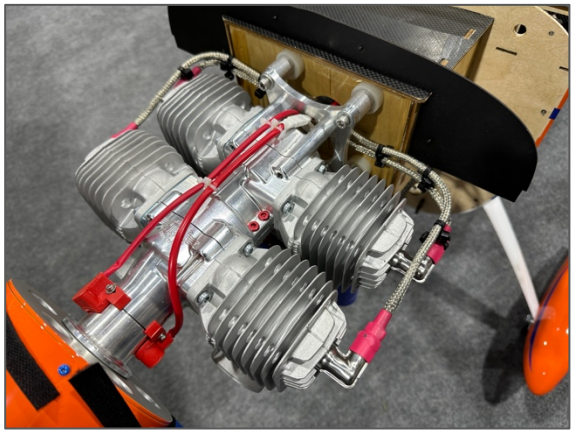
☐ 1. Locate the ignition switch hole towards the nose of the fuselage. Note that there are switch locations on both sides of the fuselage for your preference. Use a hobby knife with a #11 blade to remove the covering from the hole of your choice. Test fit your switch and modify the hole if needed. Secure it in place using the screws included with your switch. If your switch mounting screws thread into metal, be sure to apply blue thread lock. **DO NOT** apply blue thread lock if they thread into plastic.

☐ 2. The ignition can be mounted wherever you prefer. We have found that with the DA-180 & DA-200, the inside of the motor box is our preferred location. There are many ways to install an ignition and we recommend you mount it per your engine manufacturer's recommendations.



☐ 3. If you are using an ignition battery, we recommend using a 2S 4000mAh Li-Po (FPZBR40002S15) placed in the motor box in the provided location next to the ignition module that is accessible from the main hatch. Use adhesive-backed hook and loop tape between the battery and the hatch and secure the battery with a hook and loop strap. For this installation we are showing a battery eliminating ignition switch from Desert Aircraft.





☐ 4. You can route the ignition wires through the holes provided in the side of the motor box or through the central hole to best match your installation. Because of the baffling that will be used for cooling on the DA-200 it is easier to rout the ignition wires out the center of the motor box.

☐ **5.** Secure any permanent connections with heat shrink tubing, dental floss or servo safety clips (FPZA1040). Be sure to secure the wiring so that it will not bounce around in the aircraft. For extra security we recommend that you wrap your ignition wiring, also, be sure to secure the wiring in a way that the wires will not chafe against sharp edges from vibration. A typical ignition setup will be connected as follows:
Ignition Battery → Ignition Switch → Ignition Regulator → Ignition → Engine

Or (if using an IBEC):

Receiver Channel → IBEC → Ignition → Engine

EXHAUST AND COWLING INSTALLATION

Required for this section

Components

- Fuselage Assembly
- Cowling
- Cowling Baffles
- Your Exhaust Choice
- Canister or Pipe Mount
- Exhaust marking template

Tools

- Rotary Tool
- Rotary Tool Sanding Drum
- Rotary Tool Cut-Off Wheel
- Felt-Tipped Pen
- Covering Iron
- 2.5mm Hex Driver

Adhesives/Building Materials

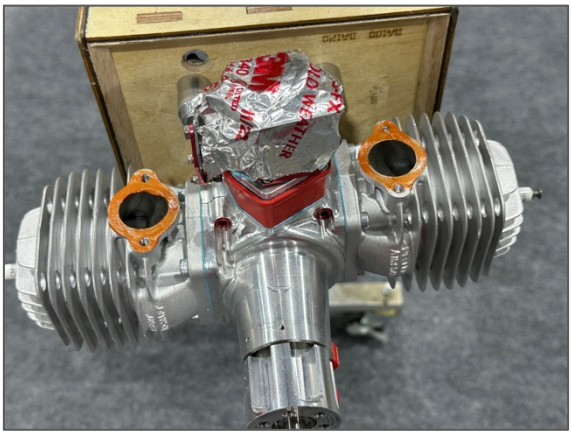
- Thin CA
- CA Accelerator
- Blue Thread Lock
- Red Thread Lock
- 30 Min Epoxy
- Mixing Cups
- Mixing Sticks
- Paper Towels

If you plan to use stock mufflers, please follow the instructions (A) below. If you plan on using a canister exhaust setup, please follow the canister isntallation (B) instructions starting on page 37. Be sure to follow the engine baffling instructions for both setups. Different engines and exhaust setups may require significantly different installations. You will need to decide what is best for your setup.

Muffler Installation (A)

☐ 1A. If using stock mufflers, locate the two bolts for each muffler, lock washers, and the gaskets. We recommend that you temporarly cover the carbureator opening while installing the mufflers and the cowling to prevent any debree from accidentally entering it and harming your engine.

☐ 2A. Apply a moderate layer of RTV silicone (Permatex Ultra Copper recommended) to the muffler port on the engine followed by placing the gasket.



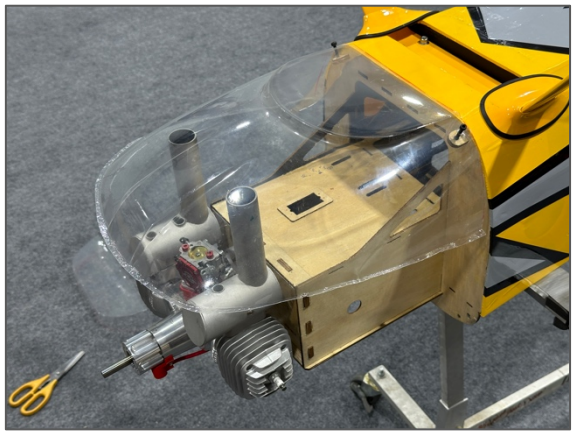
☐ 3A. Apply red thread lock to the muffler bolts and install the mufflers. When using the recommended DA-180 or the DA-200 with the stock mufflers we recommend installing the muflers with the pipe end of the muffler facing the rear of the airplane (pictures can be seen on page 32)

☐ 4A. The Raven 180 features a clear cowling template for simple exhaust hole mapping.

☐ 5A. Pre-fit the template by aligning it to the cowling itself and mark where the cowling bolts align to the template. Cut holes for the bolts and bolt the template to the fuselage.

☐ 6A. Mark where the exhaust needs to be relieved through the template.

☐ 7A. Cut the holes out of the template, and bolt to the cowling itself. The holes can then be cut from the cowling using a Dremel tool. Be sure to cover the carburetor and exhaust ports to prevent fiberglass dust from entering the engine.



☐ 8A. Test fit the cowling and slowly open the exhaust openings until the cowling fits properly. You can then clean the edges of the openings.

Canister Installation (B)

Required for this section

Components

- Fuselage Assembly
- 2-to-1 Exhaust Header
- Canisters
- Exhaust Gaskets (2)
- Canister Mount Plate
- Silicones Tubes

Tools

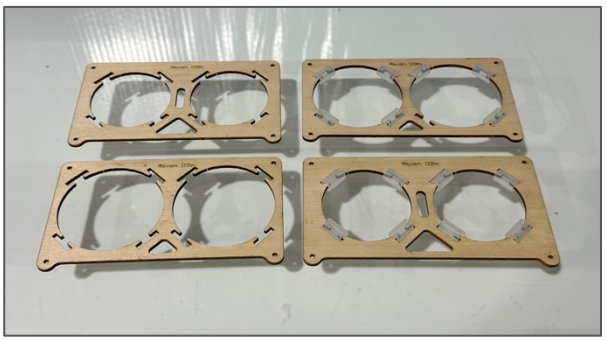
- 4mm Driver
- 2.5mm Hex Driver
- #11 Exacto Knife

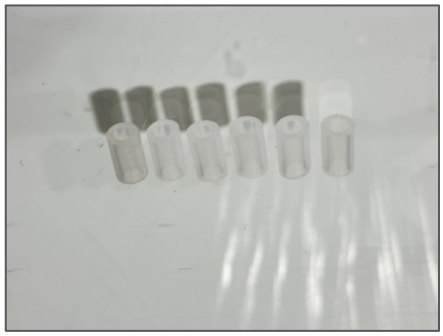
Adhesives/Building Materials

- Red Silicone (RTV)
- Paper Towels

There are several possible engine and exhaust combinations, and all can't be covered in this manual. This section will cover the typical setup as recommended at the beginning of this manual. Exhaust canister mounts are provided for both 65mm and 75mm diameter exhausts.

☐ 1B. Assemble your header and canister or pipe per your exhaust manufacturer's recommendations and select a canister or pipe mount that fits your exhaust. Assemble the silicone tubing into the mount if needed. Included with the Raven 180 is a mount for 75mm diameter exhausts, like the KS 1090 canister. If your exhaust is a different size, you'll need to make one or get one from your exhaust or engine supplier.





☐ 2B. Re-insert your exhaust into the fuselage and slide your canister mount over the exhaust. Decide the location that best suits your mount.

☐ 3B. Mix an adequate amount of epoxy and glue the mount to the former decided upon in the previous step. You can use servo screws to secure the mount in place while the epoxy cures if desired.

Engine Baffling and Cooling Installation

Required for this section

Components

- Fuselage Assembly
- Cowling
- Cowling Baffles
- Cooling Plates
- (4) M2.5 x 8mm Wood Screws

Tools

- Ruler
- Hobby knife

Adhesives/Building Materials

- GOOP or other flexible adhesive
- Thin CA

The Raven180 features pre-molded fiberglass baffling for effective operation and easy installation when using a 2-cylinder engine such as the DA-180.

In addition, for 4-cylinder engines such as the DA-200, an optional baffling kit is available (FPM219 – Four Cylinder Baffling Kit). This baffling system forces air over the top of the engine to the rear cylinders. Hot air is then extinguished through the bottom pressure lip opening.

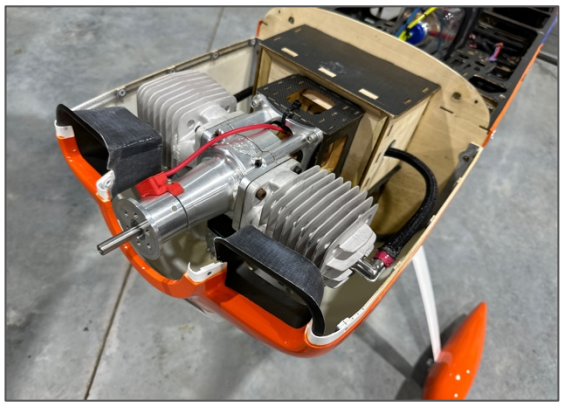
In both cases it is still important to allow plenty of hot air to exit through the fuselage and bottom of the fuselage.

Baffling for 2-cylinder engines

☐ 1. Fit the baffles in place by aligning the shape of each baffle along with the offset of the engine cylinders based on the baffle depth. Tack in place with CA.

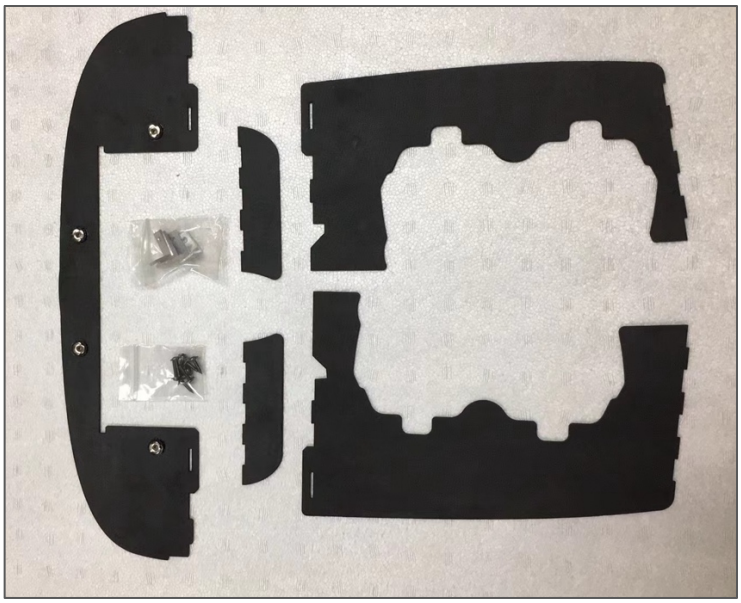
☐ 2. Test fit the cowling with the baffles to make sure fitment is proper. Depending on your engine, you may need to trim the baffles slightly.

☐ 3. Once fitment is confirmed, use GOOP to permanently mount in place.



Baffling for 4-cylinder engines

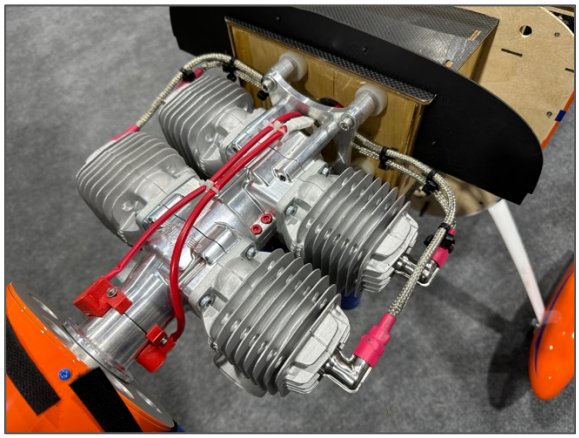
☐ 1. The 4-cylinder baffling kit is designed around the DA-200 engine, if you are using a different engine you may need to adapt it accordingly.

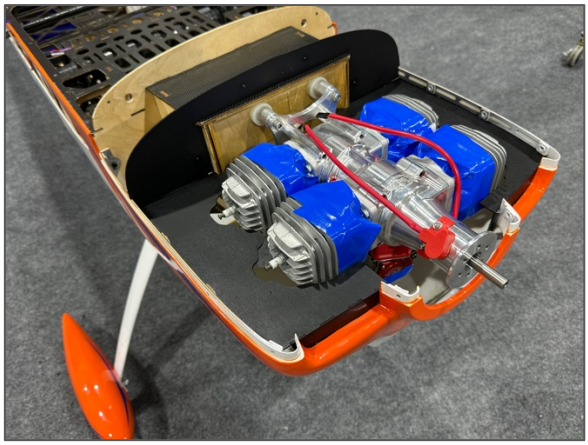


☐ 2. Dry assemble the baffling kit and the bottom cowling into the airplane as shown below, make any adjustments as necessary. When you are happy with the fit tack the side plates and the front lip plates to the cowling using a few spots of thin CA.

☐ 3. Glue together the side plates and the front lip plates and then glue the entire assembly to the bottom cowling using GOOP. Let the glue dry for at least 24 hours.

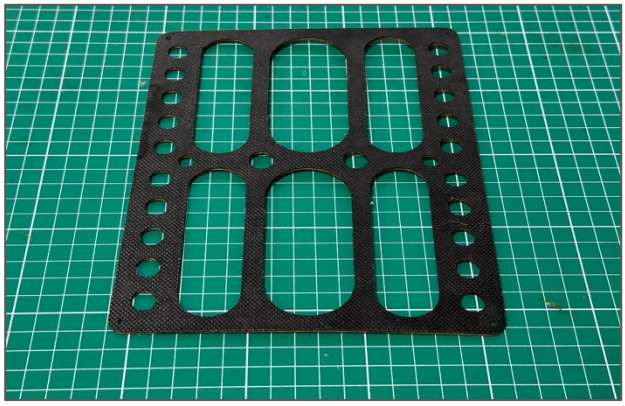
☐ 4. The rear plate of the baffling kit is bolted to the motor box with the L-brackets provided. Once everything lines up correctly insert the screws into the motor box and remove them. Reinforce the holes with thin CA letting it dry without kicker before attaching the back plate to the motor box using the brackets.



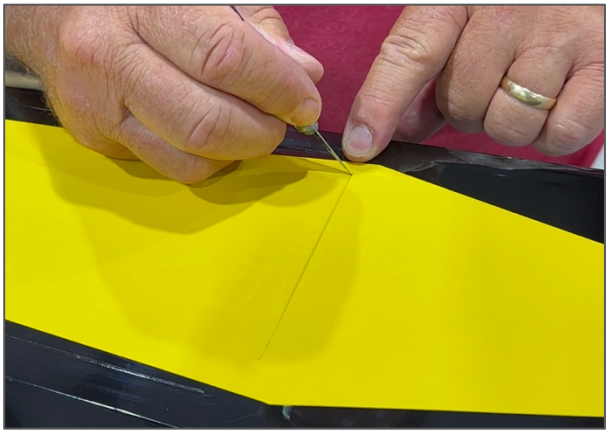


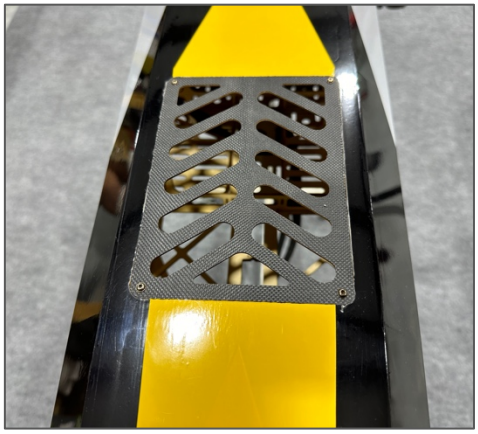
Exhaust port cover installation

☐ 1. The Raven 180 includes a fuselage plate installed on the bottom for can/tuned pipe use and air venting even with a stock muffler setup.



☐ 2. To install this plate, remove the covering where the plate provisions are located. The plate is installed using four wood screws. Be sure to apply thin CA after the openings are threaded to prevent stripping.





☐ 3. The cowling has a pre-cut pressure lip opening for hot air exit. Additionally, there is an opening in the cowl for easy choke access and proper airflow.

COWLING, PROPELLER AND SPINNER FINAL INSTALLATION

Required for this section

Components

- Fuselage Assembly
- Cowling
- Propeller
- Spinner
- (6)M3x20 Flanged Button Head Hex Bolt
- (12) M3X12 Flanged Button Head Hex Bolts

Tools

- M3 Hex Driver
- M2 Hex Driver (Spinner)

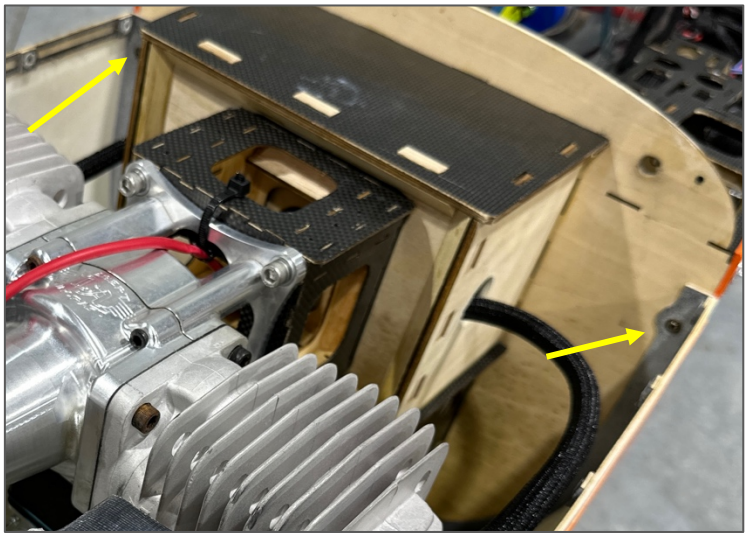
Adhesives/Building Materials

- Blue Thread Lock

The Raven 180 features a two-part cowling. The bottom of the cowling is installed on the fuselage first, then the top is installed to the fuselage and finally they are bolted to each other.

The Raven 180 takes a 5 ½" spinner. Flex offers a matching spinner (FPM2522) for the Raven 180 scheme along with a solid color spinner (FPMA1037).

☐ 1. The bottom cowling is installed with (4) M3x20 flanged button head hex bolts. These are driven into the rear the four blind nuts in the firewall through the rear flange in the cowling two in the sides and two close to the bottom. Apply blue thread Lock to these bolts, use a 3mm hex driver and tighten well.



☐ 2. The Top half of the cowling is then installed from the inside of the fuselage with the main hatch removed and (2) M3x20 flanged button head hex bolts with installed into the holes on the outside top of the firewall (these holes can also bee seen in the picture above). Apply blue thread Lock to these bolts, use a 3mm hex driver and tighten well.

☐ 3. Finally, attach the two cowling halves together with (12) M3X12 flanged button head hex bolts around the perimiter. Apply blue thread Lock to these bolts, use a 3mm hex driver and tighten well.

☐ 4. Drill the spinner and propeller using a drill jig for your engine.

☐ 5. Torque the engine bolts to approximately 95 in/lbs.

☐ 6. When applying the spinner, be careful not to overtighten the bolts. Be sure to use the provided spinner bolt washers

RADIO INSTALLATION

Required for this section

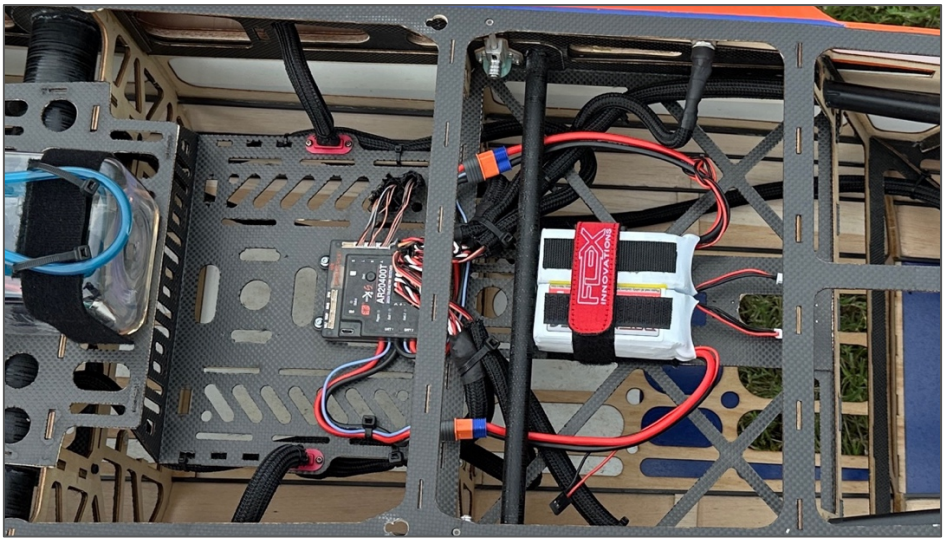
Components

- Fuselage Assembly
- Receiver
- Receiver Switch
- Aura 8 or 12 Professional (Optional)
- Receiver Batteries
- Hook and Loop Straps
- Adhesive-Backed Hook and Loop Tape
- Tie-Wraps

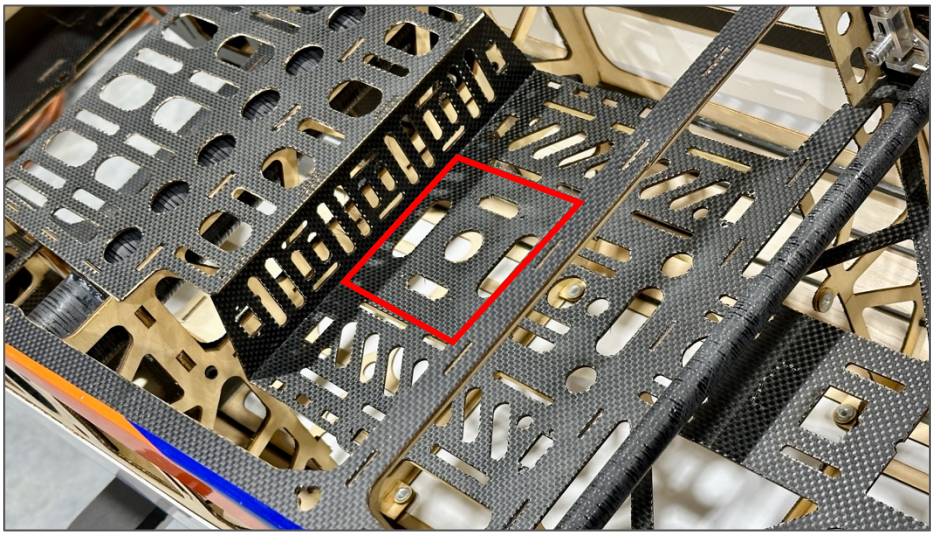
Tools

- #1 Phillips Screwdriver
- Hobby Knife

Adhesives/Building Materials



☐ 1. If you are using the Aura 8 or 12 Professional AFCS, it should be mounted in the center of the fuselage in the location noted in the picture below.



☐ 2. Use a #1 Phillips screwdriver to thread an RX/Aura mounting screws into each of the pre-cut holes in the mounting tray. Remove the screw and apply a small amount of thin CA to each of the holes to harden the threads cut by the screw. Let the CA fully cure before mounting the Aura and securing the (4) screws.

☐ 3. Locate the RX/Aura switch just under the canopy. Note that there are switch locations on both sides of the fuselage for both traditional and power safe switches. Remove the covering from the hole of your choice using a hobby knife with a sharp blade and install your RX switch. Use blue thread lock if your switch uses screws with metal-to-metal contact. DO NOT use thread lock if your screws thread into plastic!

☐ 4. Make all the necessary servo connections. Depending on the center of gravity (see the CG section), install your (2) receiver batteries in one of three mounting locations provided in the Raven 180. They are located as follows:

- Receiver & Rudder Servo Tray
- Just forward of the fuel tank tray along the sides of the motor box
- Inside the motor box on the bottom surface of the motor box
- Of course, batteries can be mounted virtually anywhere you can strap them in.

Use adhesive-backed hook and loop tape and a hook and loop strap to secure each battery in place.

☐ 5. Place your receivers in the appropriate area according to your receiver's instruction manual. Note that the carbon structure in the fuselage can cause issues with signal, so route your antennas appropriately.

FIELD ASSEMBLY

Required for this section

Components

- Fuselage Assembly
- Main Wings (2)
- Anti-rotation Tube
- WingTube
- Stab Tube
- Canopy Hatch

Tools

- None!

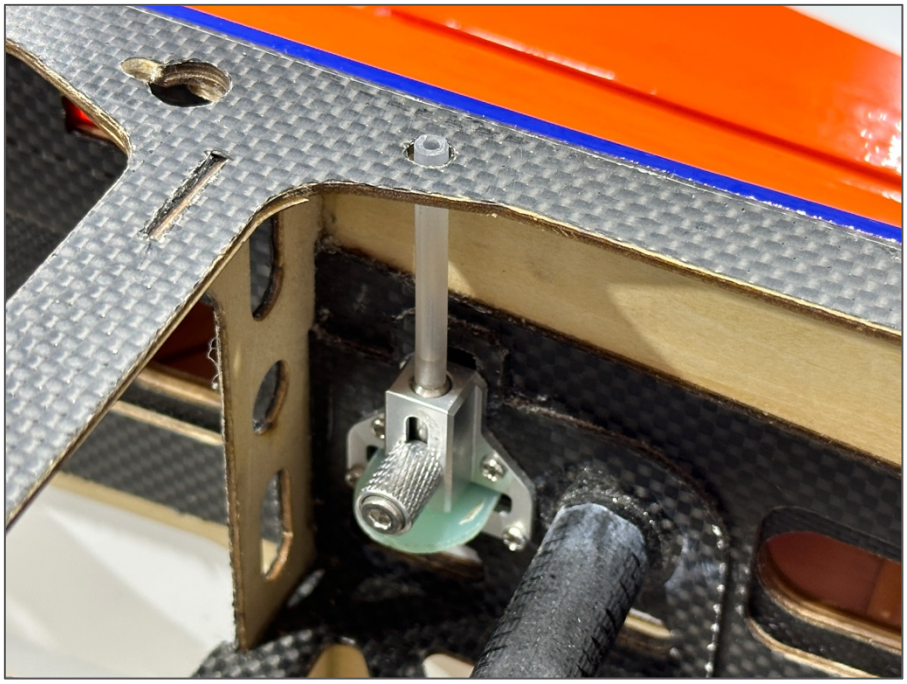
Adhesives/Building Materials

☐ 1. Pull out the Flex Canopy Speed-Lock knob until it bottoms out, then twist it CW or CCW 1/4 turn. You can now release the knob, and it will stay in the unlocked position (canopy open). Do the same to the Flex Canopy Speed-Lock on the other side of the fuselage.

☐ 2. Start by sliding the canopy rearward until the studs in the bottom of the canopy disengage from the keyhole slots in the fuselage. Slowly lift the rear of the canopy until the studs clear the holes, then you can disengage the pins in the front of the canopy that go into the firewall.

☐ 3. Unlock the 4 wing Flex Speed-Locks from both right and left side. To unlock them you need to pull out on the knob and then slide it up until it reaches its limit. Note that the Flex Speed-Lock design has a plastic tube extension on the top that shows the unlock position when the tube is sticking out of the top of the airplane frame.

☐ 4. Slide the main wing tube and the anti-rotation tube into the fuselage so that they are roughly centered left to right. Slide one of the wing panels over the tube, connect the aileron servos to the servo extensions or MPX connector and fully slide the wing against the fuselage until you see no gap between the wing and the fuselage.



☐ 5. Proceed to lock the Flex Speed-Locks by pushing down on the plastic tubes until they are flush with the fuselage, and you hear a “click”. If the plastic tube is not flush with the top of the fuselage, then you know the Flex Speed-Lock is not properly locked. The protruding tube will also prevent the canopy from being installed when the Flex Speed-Locks are not fully locked.
Note: it is not recommended to lock the Flex Speed-Lock by pulling on handle and sliding it down as this does not guarantee that the knob will find the indentation and be in the proper locked position. Pushing on the tube and hearing the “click” is what ensures that it is locked properly.

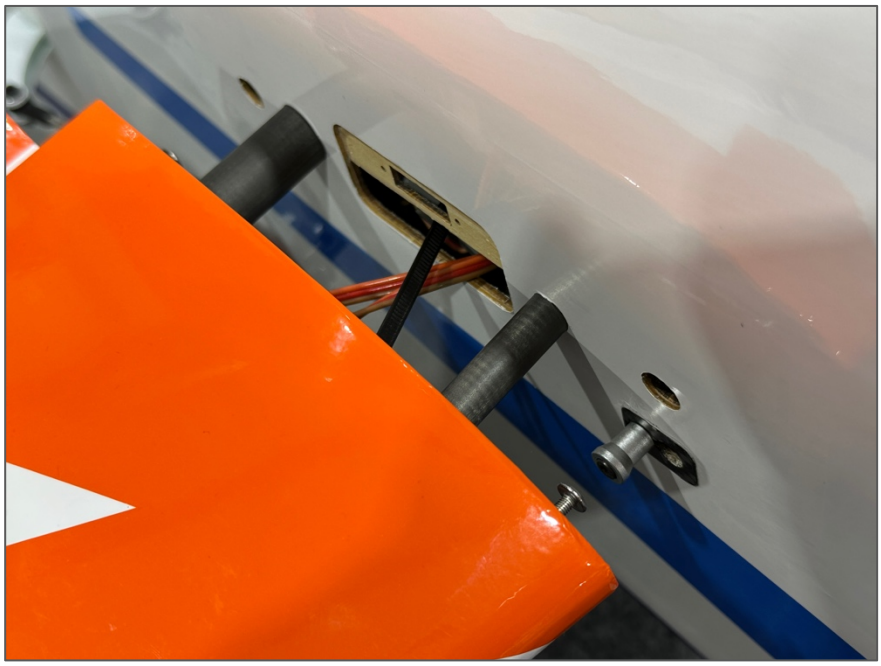
☐ 6. Repeat for the second wing.

Always push down on the plastic tubes until you hear “click” and they sit flush with the fuselage frame.

Make sure you lock all 4 Flex Speed-Locks.

☐ 7. Unlock the horizontal stabilizer Flex Speed-Locks from both right and left side. To unlock them you need to pull out on the knob and then slide it back until it reaches its limit.

☐ 8. Slide the horizontal stabilizer tube into the fuselage so that it is roughly centered left to right. Slide one of the horizontal stabs over the tube, connect the elevator servo(s) to the servo extension(s) and fully slide the horizontal stab against the fuselage until it completely seated in the pocket in the fuselage.



☐ 9. Once the horizontal stab is seated properly lock the Flex Speed-Lock by pushing the knob forward until it settles into position. Pull out on the horizontal stabilizer to ensure that it is properly locked. Repeat these two steps for the horizontal stabilizer on the other side of the fuselage.

☐ 10. Install the canopy hatch back onto the fuselage by first inserting the two front pins in the canopy into the two holes in the firewall. Once the pins are engaged slowly drop the canopy down onto the fuselage as far back as possible so that the studs can enter the key-hole shaped slots in the top of the fuselage. Once the studs are properly engaged you can slide the canopy back forward until it meets the firewall.

☐ 11. One in place, then proceed to lock the canopy. Turn the Flex Canopy Speed-Lock knob ¼ turn CW or CCW and the knob will go in a find lock position. Do the same with the other side. Check that the Flex Speed-Locks are in the locked position by pulling up on the canopy to confirm that it is secure.

DECAL INSTALLATION

Use the drawings provided below for a guide to apply the decals to your model.

- ☐ 1. Thoroughly clean the model to ensure it is free of oil, fingerprints, and dust.
- ☐ 2. Separate the decals, but do not remove the paper backing.
- ☐ 3. Prepare a dishpan or small bucket with a mixture of warm water and liquid dish detergent. The ratio should be approximately one teaspoon per gallon of water.
- ☐ 4. Submerse the decal into the water/soap mixture and gently remove the paper backing. Removing the backing under water prevents fingerprints from being visible on the back side of the decal
- ☐ 5. Apply some water/soap mixture with your palm to the area desired. Once the area is saturated, position the sticker on the airplane. Even though these are not water transfer decals, using wet application methods allows the sticker to be repositioned, reduces bubbles, and eliminates fingerprints and other blemishes from being visible.
- ☐ 6. Hold the decal in place and use a paper towel to gently wipe most of the water away.
- ☐ 7. Use a soft piece of balsa or something similar, to squeegee out the remaining liquid from underneath the decal.
- ☐ 8. Repeat the process until all decals are applied. Do not move, or otherwise touch, the model for at least 24 hours to allow adequate time for the remaining water to evaporate.


180
RAVEN


RAVEN
180


RAVEN

FINAL SETUP AND FLYING NOTES

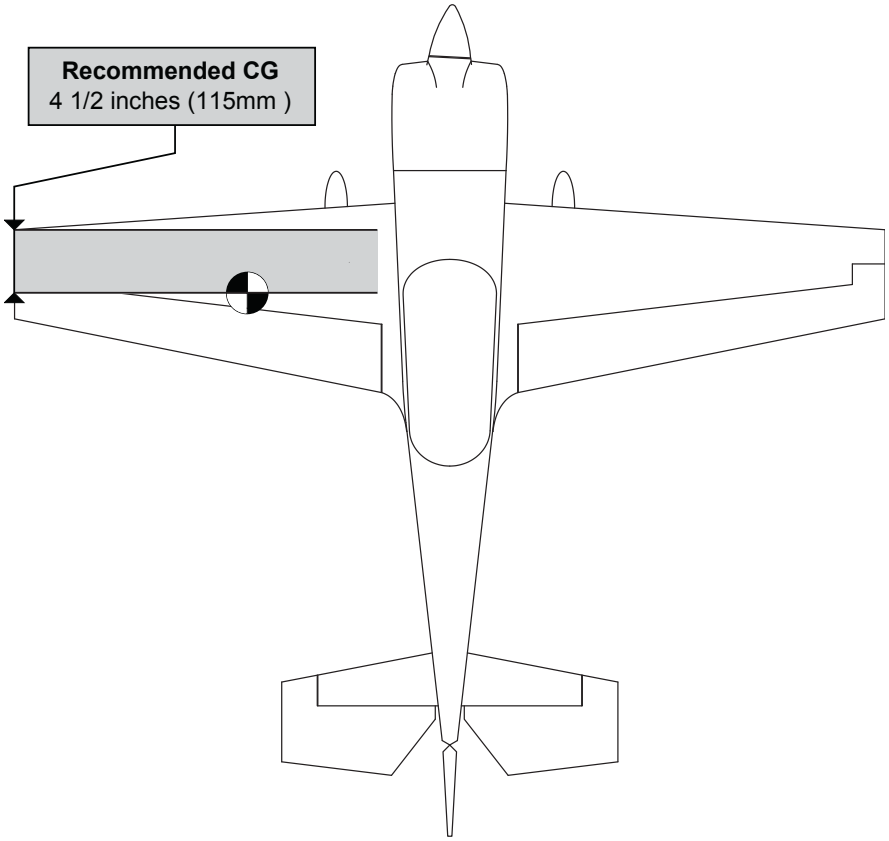
CENTER OF GRAVITY

Setting the center of gravity (CG) is one of the most important steps for success, particularly with a new airplane. The Flex Innovations Raven 180 is a high-performance airplane with large control surface throws, and a very high thrust to weight ratio. These factors combined make the Raven 180 a very enjoyable aircraft to fly, but if the center of gravity is not within an acceptable range, it will make the airplane difficult, if not impossible, to control. To have the most success and enjoyment from your Raven 180, please follow the next few steps very carefully.

Before checking the CG of your model please ensure that all the components are installed in your airplane. This means the batteries, servos, linkages, hardware, propeller, spinner, hatches; everything. The airplane must be in ready-to-fly condition (without fuel), otherwise the measurement will not be accurate.

There are several methods for determining center of gravity, from using a CG machine, to using fingers and a friend. Regardless of the method used, ensure that the tests are accurate and repeatable. If there are any inconsistencies between measurements, work to isolate the source of the error(s) making sure that the test can be repeated with the same results.

The location of the center of gravity for the Raven 180 is 4-½-inches (115mm) AFT from the LEADING EDGE of the WING AT THE WING TIP. It is critical that the starting point for your model be at this point. This measurement is determined from many test flights by Jase Dussia.



Jase's Pro Tip:

- The measurement noted is the best CG location for flying the Raven 180, and where all tweaks to the airframe have been made. The aircraft is safe to fly within the range of 4 ⅛-inches (105mm) to 5 ⅛-inches (130mm) when measured from the leading edge of the wing at the wingtip but may not be flying at its optimized location.
- When using the DA-200 you should be able to achieve CG without adding additional weight by moving the receiver batteries around to one of the rearmost provided mounting locations. With this engine configuration it is recommended that you run 4 elevator servos, as it will make it easier to achieve the desired CG.

STARTING CONTROL SURFACE THROWS AND EXPONETIAL

The following throws and exponential have been tested thoroughly during the development of the airplane and have been determined to be the optimal starting point for the Raven 180. As you become more familiar with the airplane, you may tweak the rates and expos to better suit your flying style, but these numbers provide a very good starting point.

NOTE: Throws are measured in degrees. We recommend you download an App on your phone to measure degrees. Since expo directions vary by transmitter manufacturer, all expos listed below are those that make the control feel softer around the stick's center position.

Raven 180 Control Throws and Expos

	Low Rate		High Rate	
	Up	**Down**	**Up**	**Down**
Aileron	20	20	39	39
Elevator	20-30	20-30	60-65	60-65
Rudder	20	20	Maximum Available	Maximum Available
Aileron Expo	20% - 30%	20% - 30%	50% - 55%	50% - 55%
Elevator Expo	20% - 30%	20% - 30%	50% - 55%	50% - 55%
Rudder Expo	20% - 30%	20% - 30%	50% - 55%	50% - 55%

Jase's Pro Tips:

- For high rudder rate, increase the travel until the control horn nearly touches the fuselage, and be sure to match both directions.

RANGE TESTING

Carefully follow the binding and range testing instructions included with your radio equipment. If there are any issues passing the test range, please consult your transmitter and receiver manuals or contact your transmitter and receiver manufacturer to determine the appropriate solution before attempting to fly.

BEFORE FIRST FLIGHT

Before going to the field for your first flight, please go over the finished, fully assembled model at home. The key to a successful first flight is preparation and ensuring that your plane is airworthy.

- ☐ 1. For optimal performance of your model, balance your propeller and spinner. Most propellers are balanced fairly-well out of the package; however, some fine-tuning can make a mediocre propeller perform great. An out-of-balance propeller or spinner can wreak havoc on the electronic components in the airplane, as well as prematurely shorten the life span of the engine, servos or even the model itself. A balanced propeller will be quieter, generate more thrust, produce less vibration, and operate more efficiently than one that is not balanced.
- ☐ 2. Re-check all linkages and connections, including those that may have been assembled by the factory. Ensure pushrods are sufficiently threaded into ball links, ensure that all metal-to-metal connections have thread lock applied and ensure that all control surfaces move freely and in their proper direction.
- ☐ 3. Verify proper functioning, break-in, and operation of your engine choice. Ensure that the fuel-air mixture is correct, and that the engine is producing full power. If you are not familiar with gas engines, ask for the assistance of a more experienced pilot in your area or speak with your engine manufacturer.
- ☐ 4. Secure any loose wiring inside the fuselage or wings in such a way that they do not rub or chafe.
- ☐ 5. Ensure that all batteries (transmitter, receiver, ignition, or flight packs) are fully charged prior to leaving for the flying field.
- ☐ 6. Take a few moments to assemble the airplane away from commotion, talkative onlookers, or any other distractions. Ensure that all connections are properly made and secured, the wing bolts are tight and take a few minutes to plan out your first flight.
- ☐ 7. If your gas engine is new, avoid prolonged full throttle runs and vertical climbs. Limit the first few flights to a short flight time. Start off short, gradually lengthening the flight times as you become comfortable with the performance of your engine. Six minutes is a good time to limit your first flights to. As you become more familiar with the airplane and begin to fly it in a more aggressive manner, monitor the temperature of the engine and adjust the fuel-air mixture according to your engine manufacturer's recommendations.

AMA SAFETY CODE

When flying your aircraft, we recommend following the guidelines set by the Academy of Model Aeronautics (AMA). You can find their Safety handbook as well as more information on the AMA at their website, located at the address below.

https://www.modelaircraft.org/

REPLACEMENT PARTS

FPM2500A	Raven 180 ARF Orange
FPM2501A	Raven 180 Fuselage Orange
FPM2502LA	Raven 180 Left Wing with Horns Installed Orange
FPM2502RA	Raven 180 Right Wing with Horns Installed Orange
FPM2503A	Raven 180 Horizontal Stab and Elevator with Horns Installed Orange
FPM2504A	Raven 180 Rudder with Horns Installed Orange
FPM2505A	Raven 180 Cowling with Template Orange
FPM2506A	Raven 180 Canopy with Cockpit Installed Orange
FPM2507A	Raven 180 Landing Gear (Painted White) for Orange Scheme
FPM2508A	Raven 180 Wheel Pants Orange
FPM2509	Raven 180 Wing Tubes and Stab Tubes
FPM2511	Raven 180 Main Wheels and Axles
FPM2512	Raven 180 Linkage and Control Horn Set
FPM2513	Raven 180 Hardware Set
FPM2515	Raven 180 Decal Set Orange
FPM2517	Raven 180 Landing Gear Cuffs (Painted White) Orange Scheme
FPM2518	Raven 180 Twin Cylinder Fiberglass Baffling
FPM2519	Raven 180 Four Cylinder Baffling Kit
FPM2520	Raven 180 Twin Cylinder Motorbox Extension
FPM2521	Raven 180 Removable Rudder Wire
FPMA1036	Flex 180cc Tailwheel Set with Hardware

OPTIONAL ACCESSORIES

FPM2525	Protection Pack – Raven 180
FPMA1038	Canopy Cover – Raven 180
FPM2514	Premium Wing & Tail Bag Set – Raven 180
FPMA1041	Flex Aircraft Sunshade 180cc Monoplane
FPM2522	5.5" Carbon Spinner (Raven 180 Custom Scheme Orange)
FPMA1037	5.5" Carbon Spinner Orange
DP1000	Dualsky DP1000 Brushless Smoke Pump
FPMA1040	50oz Lightweight Fuel/Smoke Tank
FPZA1036B	Aluminum Servo Arm 2-in Clamping (25T) Grey
MKS-HBL3850	MKS HBL3850 Brushless Servo
FPM2524	Raven 180 Servo Completion Pack
FPM2523	Raven 180 Servo Extension Pack
FPZA1040	Servo Connector Safety Clip
FPZAURA08PRO	Aura 8 Professional AFCS
FPZAURA12PRO	Aura 12 Professional AFCS
FPZBR40002S15	2S 4000MAH 15C LiPo Receiver Pack
FPM2516	Raven 180 Pilot Figure Orange
FPM2519	Raven 180 Four Cylinder Baffling Kit
FPMA1049	McFueler Fuel Dot

LIMITED WARRANTY

Warranty Coverage

Flex Innovations LLC and its authorized resellers ("Flex") warrant to the original purchaser that this product (the "Product") will be free from defects in materials and workmanship at the date of purchase.

Outside of Coverage

The warranty is not transferable and does not cover:

(a) Products with more than 45 days after the purchase date
(b) Damage due to acts of God, accident, misuse, abuse, negligence, commercial use, or due to improper use, installation, operation, or maintenance
(c) Damage to other components or assemblies associated with the use of the Product.
(d) Modification of or to any part of the Product
(e) Product not purchased from an authorized Flex Innovations dealer or distributor.
(f) Product that has been partially, or fully assembled
(g) Shipping damage
(h) Cosmetic damage
(i) Services or labor associated with the repair, use or assembly of the Product.

OTHER THAN THE EXPRESS WARRANTY ABOVE, FLEX MAKES NO OTHER WARRANTY REPRESENTATION, AND HEREBY DISCLAIMS ALL IMPLIED WARRANTIES, INCLUDING, WITHOUT LIMITATION, THE IMPLIED WARRANTIES OF NONINFRINGEMENT, MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE. THE PURCHASER ACKNOWLEDGES THAT THEY ALONE HAVE DETERMINED THAT THE PRODUCT WILL SUITABLY MEET THE REQUIREMENTS OF THE PURCHASER'S INTENDED USE.

Purchaser's Remedy

Flex's sole obligation and purchaser's sole and exclusive remedy shall be that Flex will, at its option, either (i) service, (ii) replace any part of the Product determined by Flex to be defective, or (iii) replace the Product determined by Flex to be defective. Flex reserves the right to inspect all Product(s) involved in a warranty claim. Service or replacement decisions are at the sole discretion of Flex. Proof of purchase is required for all warranty claims. **SERVICE OR REPLACEMENT AS PROVIDED UNDER THIS WARRANTY IS THE PURCHASER'S SOLE AND EXCLUSIVE REMEDY**.

Limitation of Liability

FLEX SHALL NOT BE LIABLE FOR SPECIAL, INDIRECT, INCIDENTAL OR CONSEQUENTIAL DAMAGES, LOSS OF WAY, REGARDLESS OF WHETHER SUCH CLAIM IS BASED IN CONTRACT, WARRANTY, TORT, NEGLIGENCE, STRICT LIABILITY OR ANY OTHER THEORY OF LIABILITY, EVEN IF FLEX HAS BEEN ADVISED OF THE POSSIBILITY OF SUCH DAMAGES.

Further, in no event shall the liability of Flex exceed the individual price of the Product on which liability is asserted. As Flex has no control over use, setup, assembly, modification or misuse, no liability shall be assumed nor accepted for any resulting damage and/or injury. By the act of use, setup or assembly, the user accepts all resulting liability. If you as the purchaser or user are not prepared to accept the liability associated with the use of the Product, purchaser is advised to return the Product immediately in new and unused condition to the place of purchase.

Law

These terms are governed by Florida law (without regard to conflict of law of principals). This warranty gives you specific legal rights, and you may also have other rights which vary from state to state. FLEX RESERVES THE RIGHT TO MODIFY THIS WARRANTY AT ANY TIME WITHOUT NOTICE.

Questions & Assistance

Contact us by:

E-Mail – support@flexinnovations.com

Phone – 1 (866) 310-3539

Inspection or Services

If this Product needs to be inspected or serviced and is compliant in the region you live and use the Product in, please contact your regional Flex authorized reseller. Pack the Product securely using the original shipping carton. Please note that both the inner and outer boxes need to be included. The inner box is not designed to withstand the rigors of shipping without additional protection from the outer shipping carton. Ship via a carrier that provides tracking and insurance for lost or damaged parcels, as Flex is not responsible for merchandise until it arrives and is accepted at our facility.

Warranty Requirements

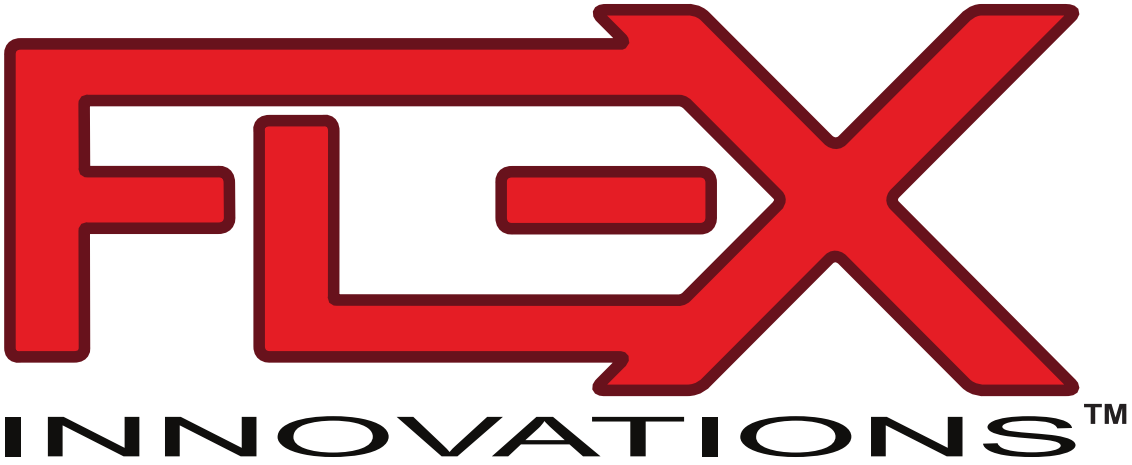
For Warranty consideration, you must include your original sales receipt verifying the proof of purchase date. Provided any warranty conditions have been met, your Product or its defective parts will be replaced or serviced free of charge. Responsibility of shipping charges are as follows:

To Flex from customer, customer is responsible.

To Customer from Flex, Flex is responsible.

Service or replacement decisions are at the sole discretion of Flex.

BUILDING AND FLYING NOTES



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