HANGAR 9®

Fly First Class™

F-22 Raptor ARF

ASSEMBLY MANUAL

Specifications

Wingspan (with droops and tip extensions)	52 in (1320.8 mm)
Wingspan (without droops and tip extensions)	47.9 in (1216.66 mm)
Length	50.3 in (1277.62 mm)
Wing Area (with droops and tip extensions)	731 sq in (47.16 sq dm)
Wing Area (without droops and tip extensions)	675 sq in (43.55 sq dm)
Weight	7.0–7.5 lb (3.18–3.40 kg)

LOCKHEED MARTIN

Table of Contents

Introduction

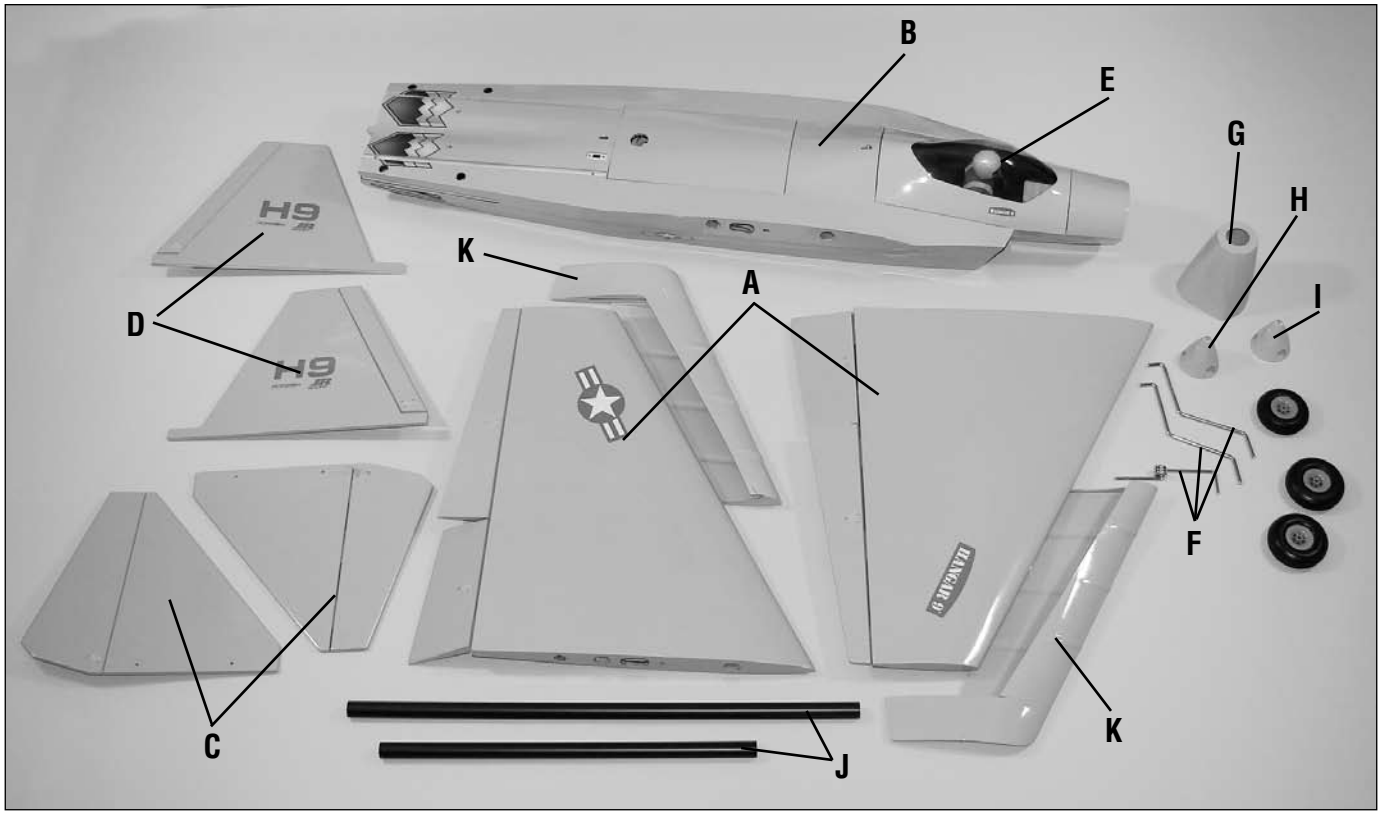
Sophisticated sensors, unmatched close-in dogfighting skills and undetectable at long range. The F-22 Raptor™, the U.S. Air Force's newest aircraft, is the most advanced stealth fighter in aviation technology. With the F-22 Raptor ARF, beginners can learn to fly on a trainer that looks exciting. This revolutionary trainer sports red plastic NACA droops and wing tip extensions that attach to the outer edge of the wing to provide extra stability. Once you've mastered the basics, remove the droops and change the settings on the flap system to move up to the next level and enjoy sport aerobatics. Progress from learning to fly to performing simple aerobatics with Hangar 9's F-22 Raptor ARF.

The F-22 Raptor ARF is part of Hangar 9's complete line of top-quality aircraft and accessories. Our Ready-To-Fly (RTF), Almost-Ready-to-Fly (ARF), Progressive Trainer System (PTS™) and Plug-N-Play® (PNP®) trainer, performance and scale airplanes are engineered and crafted to exacting standards and feature the finest components and materials, such as our exclusive UltraCote® covering. Just as important, with every Hangar 9® product, you'll get the service and technical support you need to succeed.

Contents of Kit

Replacement Parts

A.	HAN4386	Wing Set – Grey
B.	HAN4387	Fuselage – Grey
C.	HAN4388	Stabilizer Set w/Elevator (2) – Grey
D.	HAN4389	Fin Set w/Rudders (2) – Grey
E.	HAN4391	Clear Canopy – Grey
F.	HAN3832	Landing Gear Set
G.	HAN4397	ARF Cowl (Uncut) – Grey
H.	HAN3834	2-blade spinner – Grey
I.	HAN3835	3-blade spinner – Grey
J.	HAN3838	Wing Tube Set
K.	HAN4399	NACA Droops – Grey



UltraCote® Covering Colors

- Light Gray HANU882

Required Items

- Fuel (10%–15% nitro content)
- Glow Plug Igniter with Charger (HAN7101)
- Manual Fuel Pump (HAN118)

or

- Start-Up Field Pack (HANSTART)
- Glow Plug Wrench (HAN2510)
- Glow Plug (HAN3001/3006)

Optional Parts and Accessories

- Fieldmate Prebuilt Field Box (HAN117)
- Metered Glow Driver w/Ni-Cd and Charger (HAN7101)
- Manual Fuel Pump (HAN118)
- Aluminum Transmitter Case for Single Tx (HAN124)
- Long Reach Glow Plug Wrench (HAN2510)
- Transmitter Stand (HAN2525)
- Hangar 9 Straw Hat (HANP303)
- Sealing Iron Sock (HAN141)
- Covering Glove (HAN150)
- Mosfet Power Panel (HAN106)
- PowerPro 12V Starter (HAN161)
- Double Vision Fast Field Charger (HAN114)
- Digital Variable Load Voltmeter (HAN171)
- 2-Cycle Sport Glow Plug (HAN3001)
- Angle Pro Throw/Incidence Meter (HAN192)
- Sealing Iron (HAN101)
- Heat Gun (HAN100)
- Trainer Power System Propeller (EVOE100P)

Required Tools and Adhesives

- Felt-tipped pen
- Pliers
- Threadlock (PAAPT42)
- Drill
- 12-minute epoxy
- Razor saw
- Rubbing alcohol
- Z-bend pliers
- Ruler
- Rotary tool w/sanding drum
- Adjustable wrench
- Side cutters
- Medium sandpaper
- Paper towels
- Hobby knife
- Phillips screwdriver (small)
- Masking tape
- Medium CA
- Hobby scissors
- String
- Drill bit: 1/16-inch (1.5mm), 5/64-inch (2mm), 1/8-inch (3mm)

Radio and Power Systems Requirements

- 4-channel radio system (minimum) w/receiver
- ST47 Servo (JSP20050) (5) or equivalent
- 6-inch Servo Lead Extension (JRPA095) (2)
- Long Servo Arm (JRPA212) (2)
- Y-Harness (JSP98020)
- Receiver Battery (JSP91010)
- Receiver (JSP30060)
- Switch Harness (JSP98010)

Optional/Additional Radio Equipment for Flap Installation

- 5-channel radio system (minimum) w/receiver
- Long Servo Arm (JRPA212) (2)
- ST47 Servo (JSP20050)
- ST47 Reverse Servo (JSP20050R)
- Y-Harness (JSP98020)

Recommended JR®, JR SPORT™ or Spektrum® Systems

- XP9303
- XP7202
- XP6102
- SX600
- DX7


SX600


Spektrum DX7


JR XP9303


Evolution .52NX
EVOE0520


JR XP6102

Recommended Power Systems

- .46–.52 2-cycle engines

  Recommended: Evolution® .52 NX (EVOE0520)

Warranty Period

Exclusive Warranty- Horizon Hobby, Inc., (Horizon) warranties that the Products purchased (the "Product") will be free from defects in materials and workmanship at the date of purchase by the Purchaser.

Limited Warranty

(a) This warranty is limited to the original Purchaser ("Purchaser") and is not transferable. REPAIR OR REPLACEMENT AS PROVIDED UNDER THIS WARRANTY IS THE EXCLUSIVE REMEDY OF THE PURCHASER. This warranty covers only those Products purchased from an authorized Horizon dealer. Third party transactions are not covered by this warranty. Proof of purchase is required for warranty claims. Further, Horizon reserves the right to change or modify this warranty without notice and disclaims all other warranties, express or implied.

(b) Limitations- HORIZON MAKES NO WARRANTY OR REPRESENTATION, EXPRESS OR IMPLIED, ABOUT NON-INFRINGEMENT, MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE OF THE PRODUCT. THE PURCHASER ACKNOWLEDGES THAT THEY ALONE HAVE DETERMINED THAT THE PRODUCT WILL SUITABLY MEET THE REQUIREMENTS OF THE PURCHASER'S INTENDED USE.

(c) Purchaser Remedy- Horizon's sole obligation hereunder shall be that Horizon will, at its option, (i) repair or (ii) replace, any Product determined by Horizon to be defective. In the event of a defect, these are the Purchaser's exclusive remedies. Horizon reserves the right to inspect any and all equipment involved in a warranty claim. Repair or replacement decisions are at the sole discretion of Horizon. This warranty does not cover cosmetic damage or damage due to acts of God, accident, misuse, abuse, negligence, commercial use, or modification of or to any part of the Product. This warranty does not cover damage due to improper installation, operation, maintenance, or attempted repair by anyone other than Horizon. Return of any goods by Purchaser must be approved in writing by Horizon before shipment.

Damage Limits

HORIZON SHALL NOT BE LIABLE FOR SPECIAL, INDIRECT OR CONSEQUENTIAL DAMAGES, LOSS OF PROFITS OR PRODUCTION OR COMMERCIAL LOSS IN ANY WAY CONNECTED WITH THE PRODUCT, WHETHER SUCH CLAIM IS BASED IN CONTRACT, WARRANTY, NEGLIGENCE, OR STRICT LIABILITY. Further, in no event shall the liability of Horizon exceed the individual price of the Product on which liability is asserted. As Horizon has no control over use, setup, final assembly, modification or misuse, no liability shall be assumed nor accepted for any resulting damage 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 this Product, you are advised to return this Product immediately in new and unused condition to the place of purchase.

Law: These Terms are governed by Illinois law (without regard to conflict of law principals).

Safety Precautions

This is a sophisticated hobby Product and not a toy. It must be operated with caution and common sense and requires some basic mechanical ability. Failure to operate this Product in a safe and responsible manner could result in injury or damage to the Product or other property. This Product is not intended for use by children without direct adult supervision. The Product manual contains instructions for safety, operation and maintenance. It is essential to read and follow all the instructions and warnings in the manual, prior to assembly, setup or use, in order to operate correctly and avoid damage or injury.

Questions, Assistance, and Repairs

Your local hobby store and/or place of purchase cannot provide warranty support or repair. Once assembly, setup or use of the Product has been started, you must contact Horizon directly. This will enable Horizon to better answer your questions and service you in the event that you may need any assistance. For questions or assistance, please direct your email to productsupport@horizonhobby.com, or call 877.504.0233 toll free to speak to a service technician.

Inspection or Repairs

If this Product needs to be inspected or repaired, please call for a Return Merchandise Authorization (RMA). Pack the Product securely using a shipping carton. Please note that original boxes may be included, but are not designed to withstand the rigors of shipping without additional protection. Ship via a carrier that provides tracking and insurance for lost or damaged parcels, as **Horizon is not responsible for merchandise until it arrives and is accepted at our facility**. A Service Repair Request is available at www.horizonhobby.com on the "Support" tab. If you do not have internet access, please include a letter with your complete name, street address, email address and phone number where you can be reached during business days, your RMA number, a list of the included items, method of payment for any non-warranty expenses and a brief summary of the problem. Your original sales receipt must also be included for warranty consideration. Be sure your name, address, and RMA number are clearly written on the outside of the shipping carton.

Warranty Inspection and Repairs

To receive warranty service, you must include your original sales receipt verifying the proof-of-purchase date. Provided warranty conditions have been met, your Product will be repaired or replaced free of charge. Repair or replacement decisions are at the sole discretion of Horizon Hobby.

Non-Warranty Repairs

Should your repair not be covered by warranty the repair will be completed and payment will be required without notification or estimate of the expense unless the expense exceeds 50% of the retail purchase cost. By submitting the item for repair you are agreeing to payment of the repair without notification. Repair estimates are available upon request. You must include this request with your repair. Non-warranty repair estimates will be billed a minimum of ½ hour of labor. In addition you will be billed for return freight. Please advise us of your preferred method of payment. Horizon accepts money orders and cashiers checks, as well as Visa, MasterCard, American Express, and Discover cards. If you choose to pay by credit card, please include your credit card number and expiration date. Any repair left unpaid or unclaimed after 90 days will be considered abandoned and will be disposed of accordingly. **Please note: non-warranty repair is only available on electronics and model engines**.

Electronics and engines requiring inspection or repair should be shipped to the following address:

Horizon Service Center
4105 Fieldstone Road
Champaign, Illinois 61822

All other Products requiring warranty inspection or repair should be shipped to the following address:

Horizon Product Support
4105 Fieldstone Road
Champaign, Illinois 61822

Please call 877-504-0233 with any questions or concerns regarding this product or warranty.

Safety, Precautions, and Warnings

This model is controlled by a radio signal that is subject to interference from many sources outside your control. This interference can cause momentary loss of control so it is advisable to always keep a safe distance in all directions around your model, as this margin will help to avoid collisions or injury.

- Always operate your model in an open area away from cars, traffic, or people.
- Avoid operating your model in the street where injury or damage can occur.
- Never operate the model into the street or populated areas for any reason.
- Never operate your model with low transmitter batteries.
- Carefully follow the directions and warnings for this and any optional support equipment (chargers, rechargeable battery packs, etc.) that you use.
- Keep all chemicals, small parts and anything electrical out of the reach of children.
- Moisture causes damage to electronics. Avoid water exposure to all equipment not specifically designed and protected for this purpose.

Before Starting Assembly

Before beginning the assembly of the F-22 Raptor ARF, remove each part from its bag for inspection. Closely inspect the fuselage, wing panels, rudder, and stabilizer for damage. If you find any damaged or missing parts, contact the place of purchase.

If you find any wrinkles in the covering, use a heat gun or sealing iron to remove them. Use caution while working around areas where the colors overlap to prevent separating the colors.

HAN101 – Sealing Iron

HAN141 – Sealing Iron Sock

HAN100 – Heat Gun

HAN150 – Covering Glove

Using the Manual

This manual is divided into sections to help make assembly easier to understand, and to provide breaks between each major section. In addition, check boxes have been placed next to each step to keep track of each step completed. Steps with a single box (☐) are performed once, while steps with two boxes (☐ ☐) indicate that the step will require repeating, such as for a right or left wing panel, two servos, etc. Remember to take your time and follow the directions.

Section 1: Aileron Servo Installation

Items Required

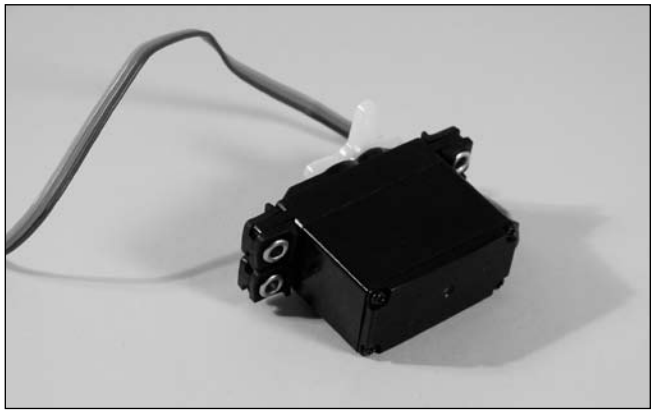
- Wing (left and right)
- #2 x 3/8-inch screw (8)
- Aileron servo hatch (left and right)
- Wire pushrod keeper (2)
- Clevis w/retainer (2)
- Pushrod wire, 4 $^{3}/_{4}$-inch (121mm) (2)
- 3/8 x 3/4 x 3/4-inch (9.5 x 19 x 19mm) servo mounting block (4)

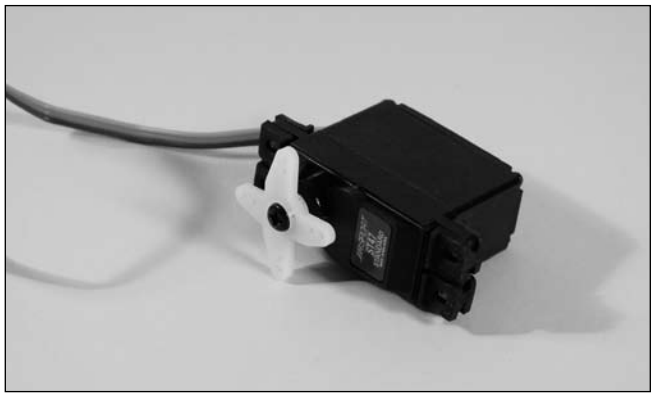
Tools Required

- 12-minute epoxy
- Drill
- Side cutters
- Felt-tipped pen
- Hobby knife
- String
- Servo extension, 6-inch (152mm) (2)
- Drill bit: 1/16-inch (1.5mm) 5/64-inch (2mm)
- Phillips screwdriver (small)
- Long Servo Arm (JRPA212) (2)

☐ ☐ Step 1

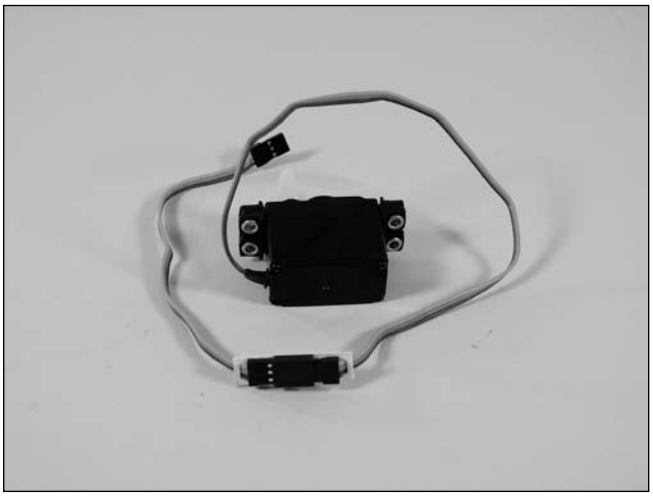
Install the recommended servo hardware (grommets and eyelets) supplied with the servo. Use the instructions provided with your servos or radio system that detail the installation of the grommets and eyelets.





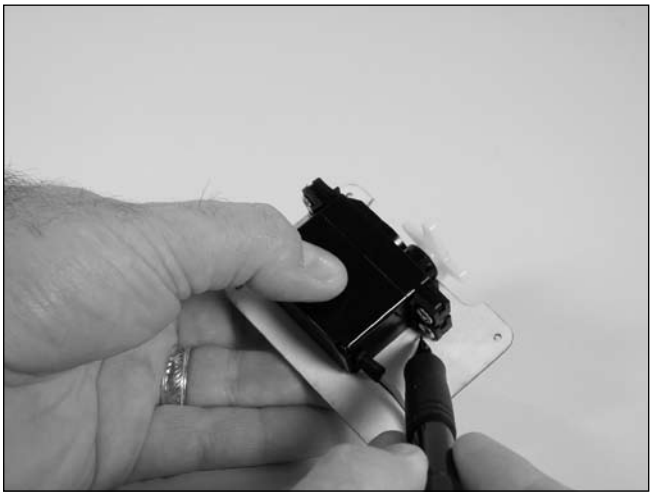
☐ ☐ Step 2

Attach a 6-inch (152mm) servo extension to the servo lead. Use either string or a commercially available connector to prevent the two from unplugging during flight.



☐ ☐ Step 3

Position the servo onto the hatch so the servo arm is centered in the notch. Once satisfied, mark the location for the servo mounting blocks using a felt-tipped pen.

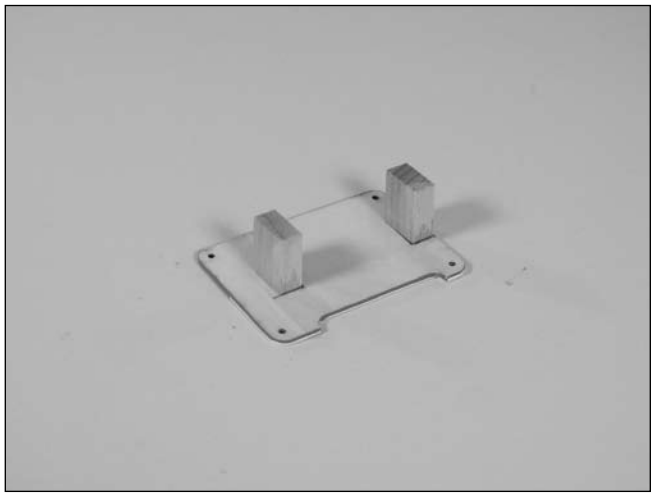


Note: Check to make sure your servo does not hang off one end of the servo hatch. If so, reposition the servo. Having the servo fully on the hatch is more important than having the servo arm centered.

Section 1: Aileron Servo Installation

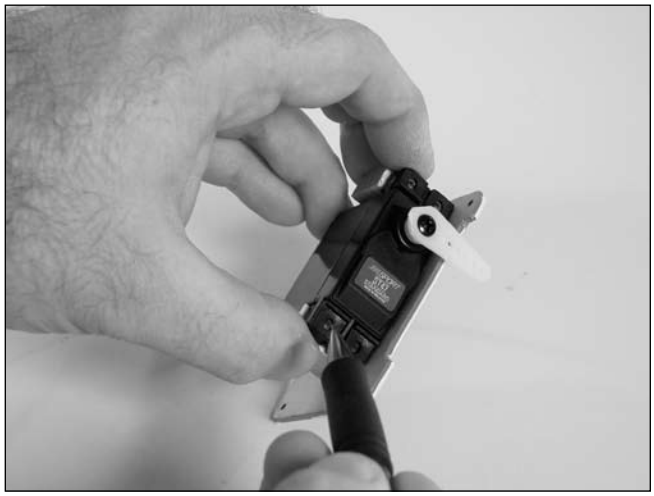
☐ ☐ Step 4

Locate two 3/8 x 3/4 x 3/4-inch (9.5 x 19 x 19mm) servo mounting blocks. Use 12-minute epoxy to glue the blocks to the hatch. Let the epoxy fully cure before proceeding to the next step.



☐ ☐ Step 5

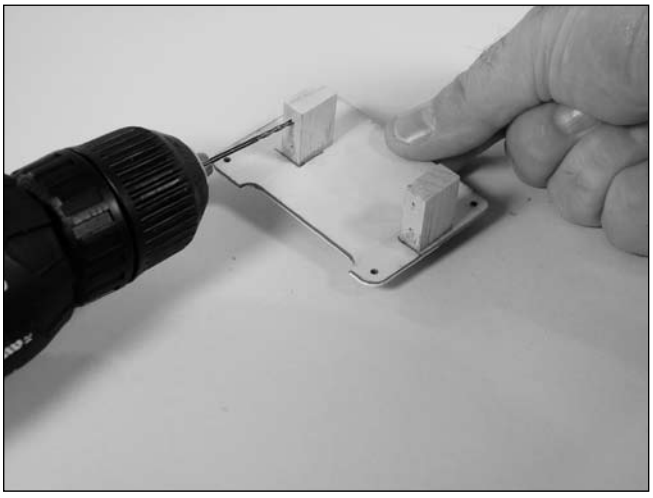
Remove the standard servo arm on the servo and replace it with a long servo arm. Place the aileron servo between the mounting blocks and use a felt-tipped pen to mark the location of the four servo mounting screws. Note the servo must not touch the hatch in order to isolate engine vibration.



Note: Before mounting the aileron servo, make sure the servo arm is installed correctly on the servo. This is done by moving the servo from each end point to determine the center position of the servo. With the radio off, secure the servo arm in the center position. Check the operation of the servo to determine if the two end positions of the arm are equal. If not, reposition the arm as necessary.

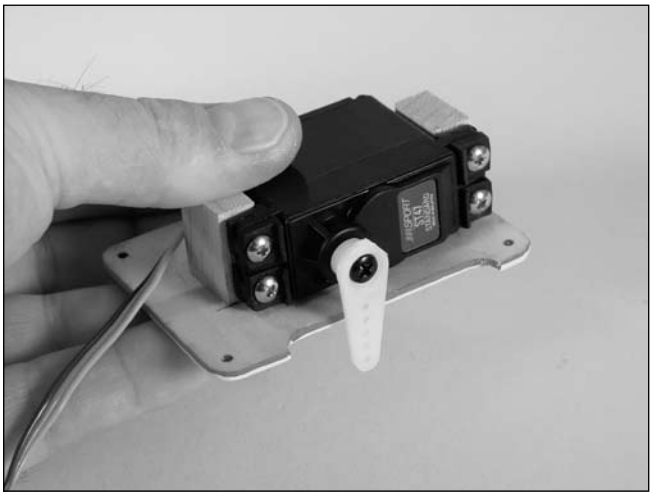
☐ ☐ Step 6

Remove the servo and use a 1/16-inch (1.5mm) drill bit to pre-drill the holes for the servo mounting screws marked in the previous step.



☐ ☐ Step 7

Use the screws supplied with the servo to mount it to the servo mounting blocks.

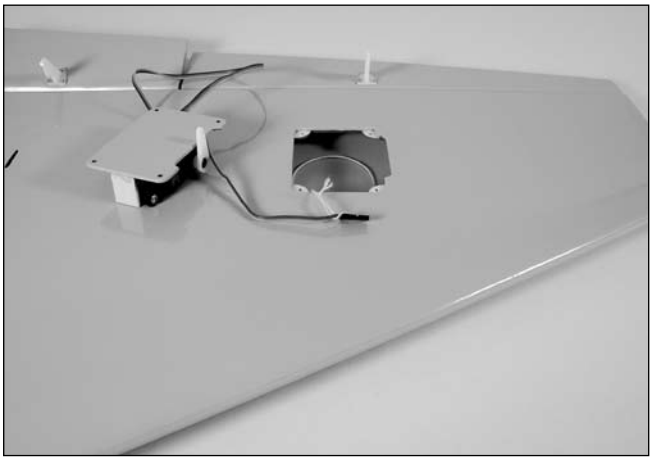


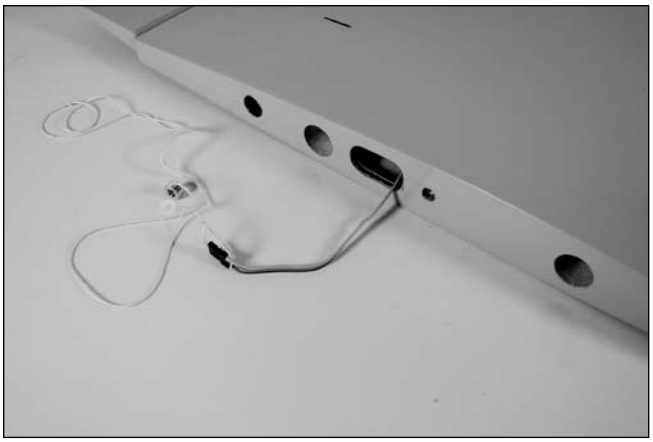
☐ ☐ Step 8

Tie one of the wheel collars to a 24-inch (600mm) length of string. Guide the wheel collar (and string) into the opening closest to the main spar inside the wing. The wheel collar and string will exit the oval hole at the root of the wing.

☐ ☐ Step 9

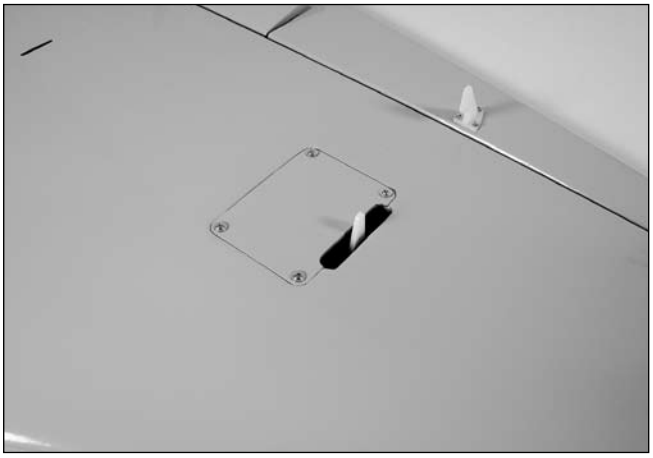
Tie the string to the servo extension for the aileron servo. Carefully pull the string and extension through the wing.





☐ ☐ Step 10

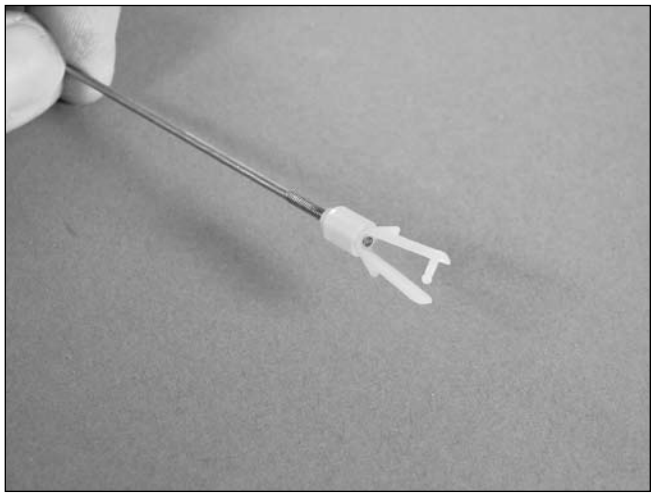
Attach the aileron servo cover using four #2 x 3/8-inch sheet metal screws and a Phillips screwdriver.



Section 1: Aileron Servo Installation

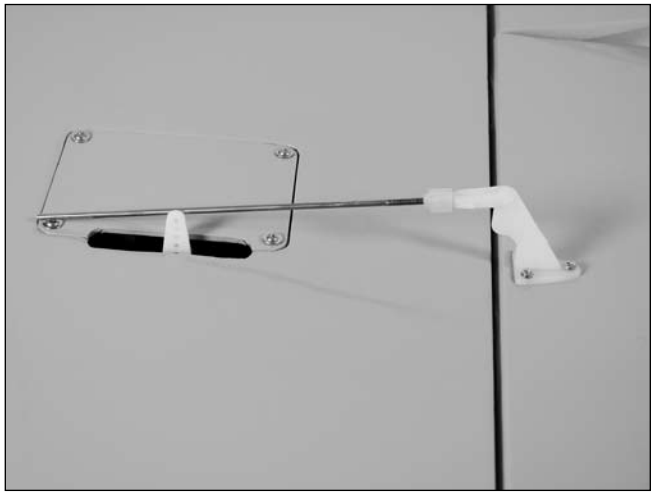
☐ ☐ Step 11

Locate a 4 $^{3}/_{4}$-inch (121mm) pushrod wire, clevis and clevis retainer. Slide the retainer onto the small end of the clevis. Thread the clevis onto the linkage wire until the wire is barely visible between the forks of the clevis.



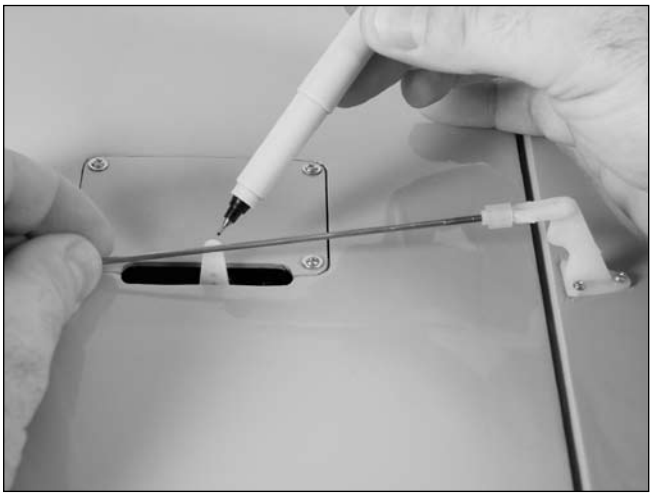
☐ ☐ Step 12

Snap the clevis to the hole on the control horn that is the farthest from the aileron as shown.



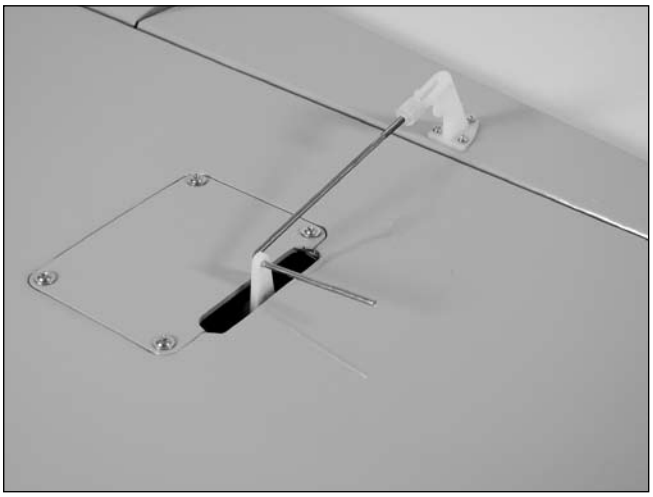
☐ ☐ Step 13

Double-check, using the radio system, that the aileron servo is centered. With the aileron in the neutral position, use a felt-tipped pen to mark the pushrod wire where it crosses the outside hole of the servo arm.



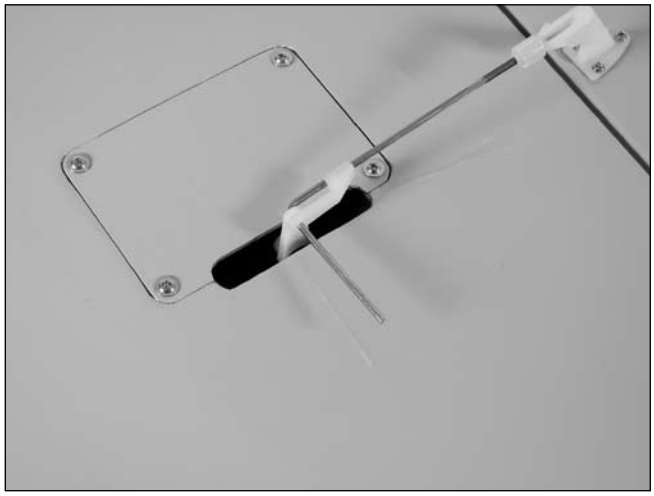
☐ ☐ Step 14

Make a 90-degree bend in the pushrod wire where the mark was made in the previous step. Use a 5/64-inch (2mm) drill bit to enlarge the outer hole of the servo arm. Slide the pushrod wire through the hole in the servo arm.



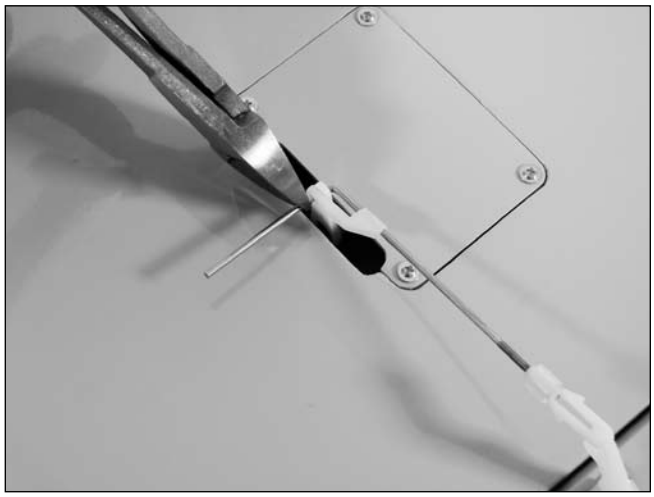
☐ ☐ Step 15

Slide the wire pushrod keeper onto the pushrod wire. The keeper will then pivot around and snap onto the pushrod wire to keep it attached to the servo arm.



☐ ☐ Step 16

Use side cutters to remove any excess pushrod wire beyond the wire pushrod keeper. Leave at least 1/16-inch (1.5mm) of wire extending beyond the keeper to prevent any vibrations from allowing the keeper to slip over the wire and fall off.



☐ ☐ Step 17

Check the operation of the aileron using the radio system. You may need to adjust the length of the linkage to make sure the aileron is fully centered.

☐ Step 18

Repeat Steps 1 through 17 for the remaining aileron servo.

Section 2: Fixed Flap Installation

Items Required

- Wing (left and right)
- Clevis w/retainer (2)
- Pushrod wire, 4 3/4-inch (121mm) (2)
- Linkage stay (2)

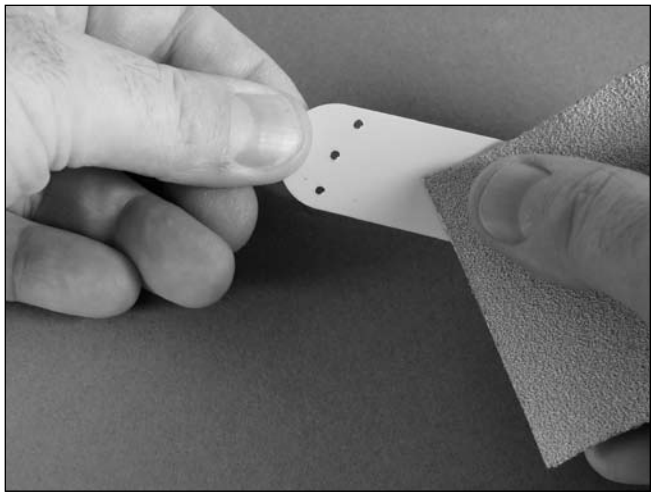
Tools Required

- 12-minute epoxy
- Pliers
- Paper towel
- Masking tape
- Felt-tipped pen
- Medium sandpaper
- Rubbing alcohol
- Z-bend pliers

The F-22 Raptor can either be built using fixed flaps or operating flaps. The following covers the installation of fixed flaps and how to position them depending on your flying skills. Information on setting the position of the flap linkage is coverd on Page 17, "*Setting the position of the fixed flaps*."

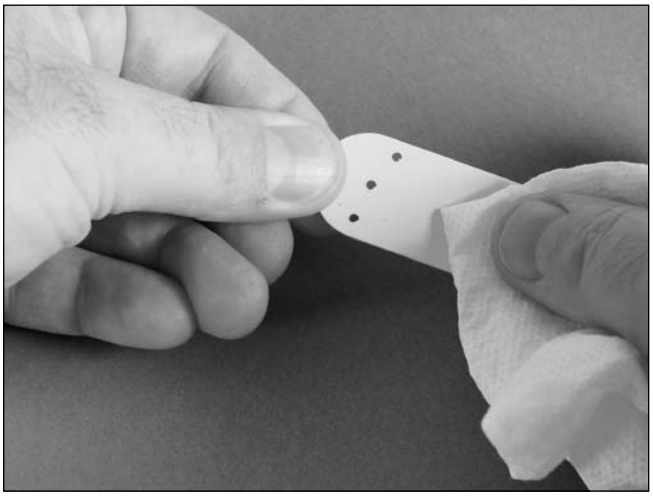
☐ ☐ Step 1

Use medium grit sandpaper to roughen both sides of the flap stay.



☐ ☐ Step 2

Use a paper towel and rubbing alcohol to remove any grit or oils from the flap stay.

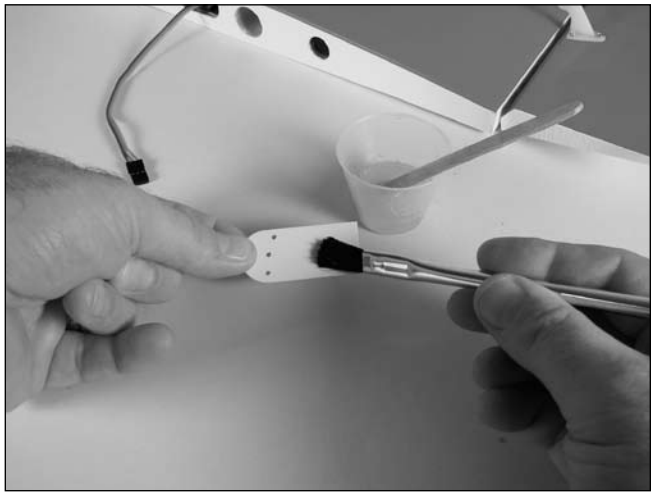


☐ ☐ Step 3

Test fit the flap stay in position in the wing. Note the position of the holes in the stay. The hole closest to the wing faces towards the leading edge of the wing. The hole farthest from the wing faces the flap.

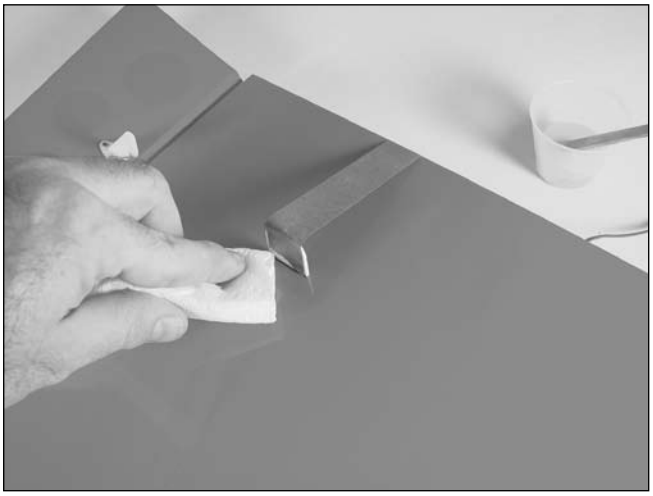
☐ ☐ Step 4

Mix a small amount of 12-minute epoxy. Apply epoxy to the portion of the flap stay that is inserted into the wing. Also apply epoxy inside the slot in the wing.



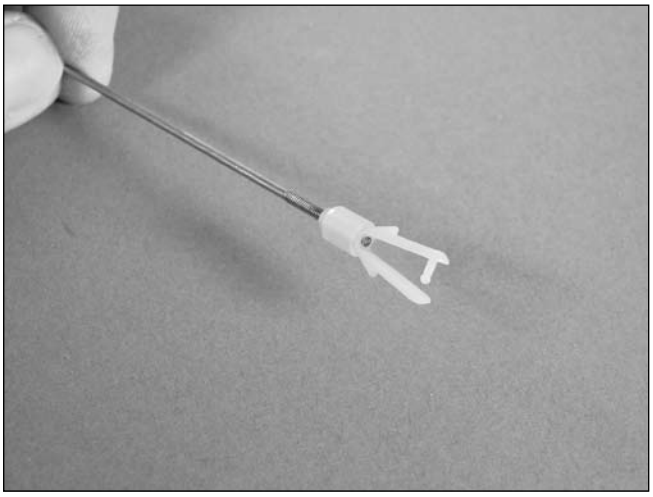
☐ ☐ Step 5

Use a piece of masking tape to hold the flap stay in position while the epoxy cures. Remove any excess epoxy using a paper towel and rubbing alcohol.



☐ ☐ Step 6

Locate a 4 $^{3}/_{4}$-inch (121mm) pushrod wire, clevis and clevis retainer. Slide the retainer onto the small end of the clevis. Thread the clevis onto the linkage wire until the wire is barely visible between the forks of the clevis.



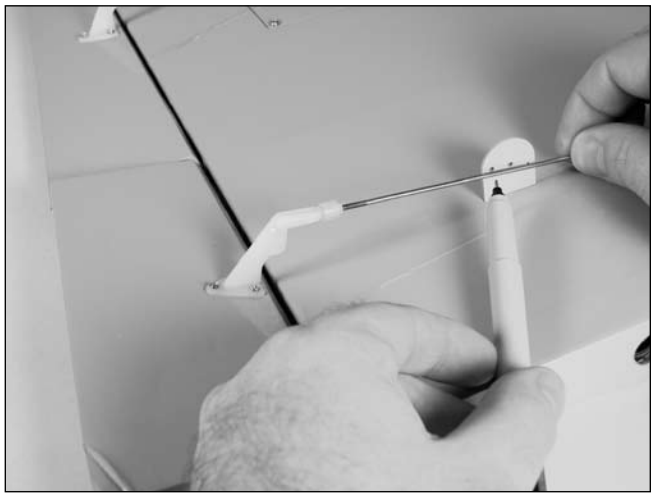
Section 2: Fixed Flap Installation

☐ ☐ Step 7

Snap the clevis to the hole on the control horn that is the farthest from the flap as shown.

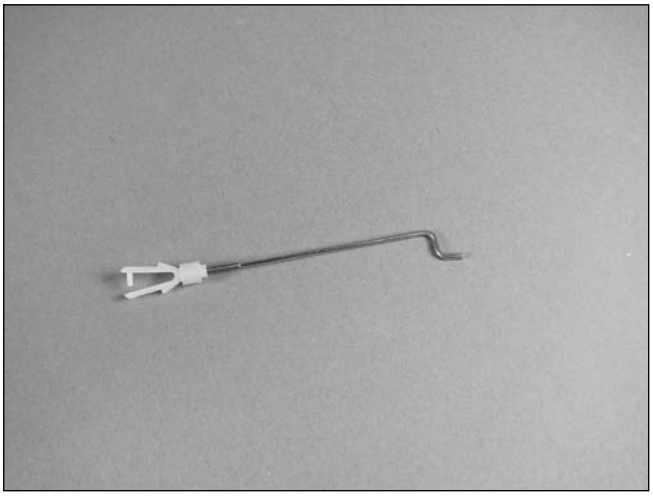
☐ ☐ Step 8

With the flap in the neutral position, use a felt-tipped pen to mark the pushrod wire where it crosses the first hole of the flap stay.



☐ ☐ Step 9

Remove the clevis from the flap control horn. Use pliers to make a Z-bend in the linkage at the mark made in the previous step.

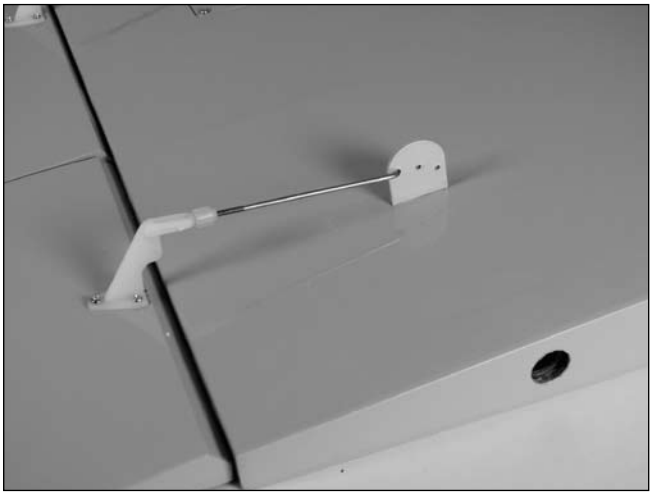


Hint: You can practice making the Z-bend using the very end of the wire. Just make sure not to make your test bend too close to the mark.

Note: Special pliers for making Z-bends are available and make the task of creating these bends much easier.

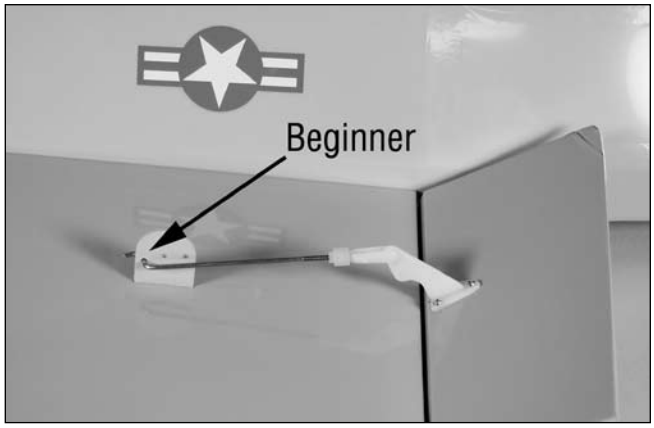
☐ ☐ Step 10

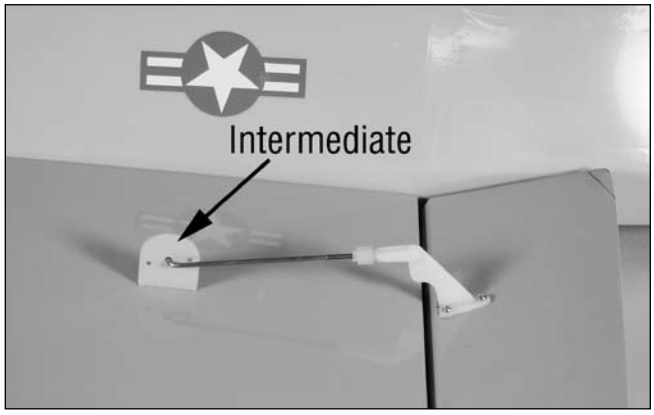
Insert the Z-bend into the hole in the flap stay and snap the clevis back into position. Thread the clevis in or out as necessary to fine-tune the neutral position of the flap.

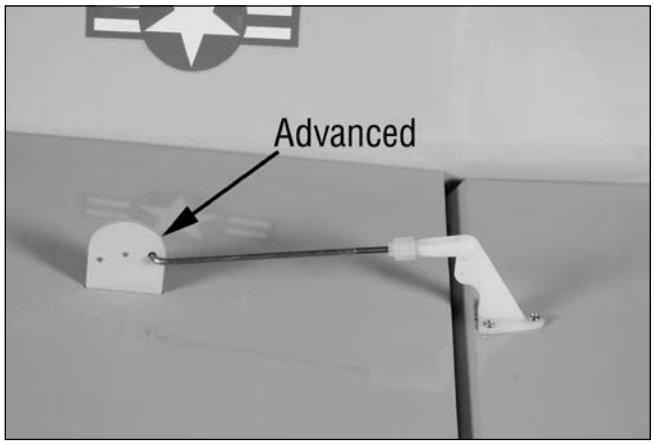


Setting the position of the fixed flaps

The linkage stay provides three positions for the flaps, depending on your flying skills. The photos below show the position for basic, intermediate and advanced flap positions. Choose the appropriate position for the flaps based on your current flying skills. If you are just starting to fly your F-22 Raptor, use the beginner position. If you are an experienced pro, use the advanced position.





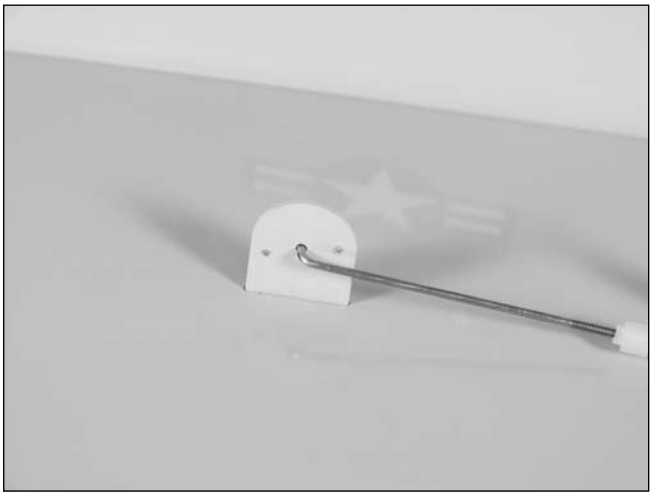


☐ ☐ Step 11

Disconnect the flap linkage from the flap control horns. Remove the linkage from the linkage stay.

☐ ☐ Step 12

Move the linkage into the new position in the flap linkage stay.



Section 2: Fixed Flap Installation

☐ ☐ Step 13

Reconnect the clevises and check that the flaps are in neutral, which is level with the wing center section. Check both the right and left flaps.

☐ Step 14

Repeat Steps 1 through 13 to install the remaining flap stay and linkage.

Section 3: Flap Servo Installation

You can take your F-22 Raptor ARF even a step further and add functional flaps. Simply remove the covering over the flap servo openings in the wing panels, secure the servos to the flap servo hatches, and secure the hatches to the wing. Basically, the same procedure as installing the aileron servos. Hook up the linkage to the servo following the directions and you have a scale F-22 Raptor complete with functioning landing flaps.

Note: Using two standard rotation servos and a standard Y-harness for the flap servos will result in them moving in opposite directions instead of the same direction. There are three options available that will result in the flaps operating correctly.

Option 1: Use two JR SPORT ST47 (JSP20050) servos and two 6-inch Servo Extensions (JSP98020) if your radio has programmable mixing. You will need to use two separate channels and use your radio to mix them together electronically for this option to work.

Option 2: Use two JR SPORT ST47 (JSP20050) servos, two 6-inch extensions and a JR® MatchBox™ or a 6" standard reversing Y-harness (EXRA320) to link the two flap servos to operate properly.

Option 3: Use a JR SPORT™ ST47 (JSP20050) standard servo and JR SPORT ST47 (JSP20050R) reverse servo and a standard Y-harness.

Items Required

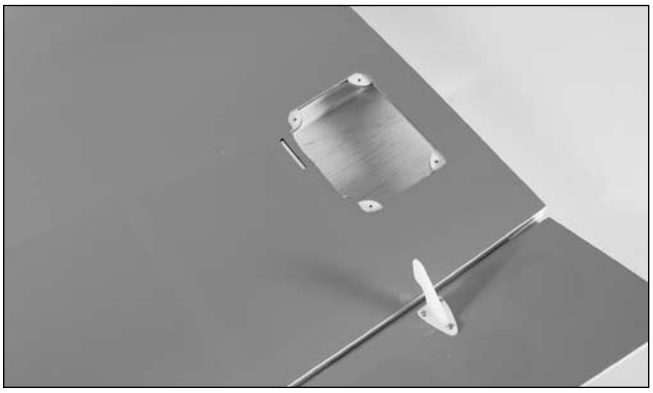
- Wing (left and right)
- #2 x 3/8-inch screw (8)
- Flap servo hatch (left and right)
- 3/8 x 3/4 x 3/4-inch (9.5 x 19 x 19mm) servo mounting block (4)
- Pushrod wire, 4 $^{3}/_{4}$-inch (121mm) (2)

Tools Required

- 12-minute epoxy
- Drill bit: 1/16-inch (1.5mm)
- Y-Harness (JSP98020)
- Phillips screwdriver (small)
- Razor saw
- Long Servo Arm (JRPA212) (2)
- Felt-tipped pen
- Drill
- Hobby knife

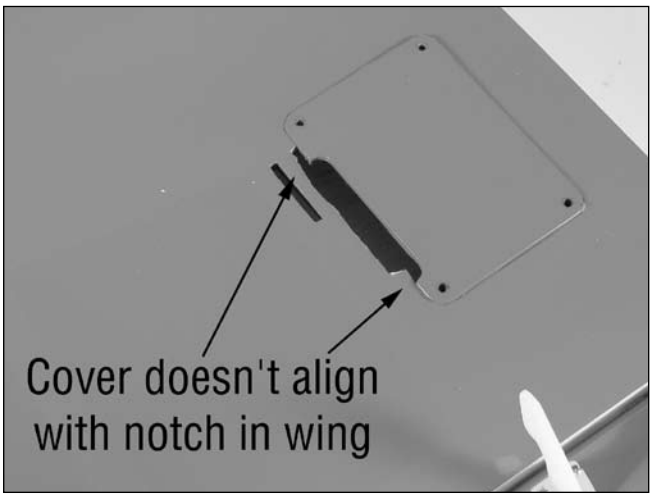
☐ ☐ Step 1

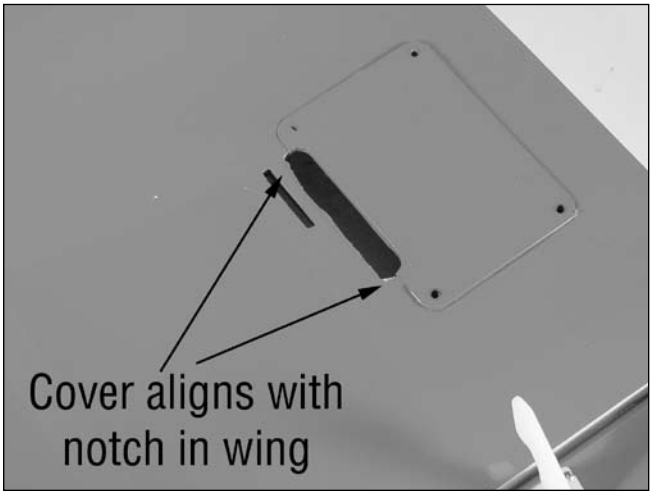
Remove the covering from the servo opening in the bottom of the wing using a hobby knife. Use a trim iron to seal the edges of the UltraCote® covering into the opening.



☐ ☐ Step 2

Select the correct servo hatch by checking the alignment for the servo arm on the plate with the one on the wing.

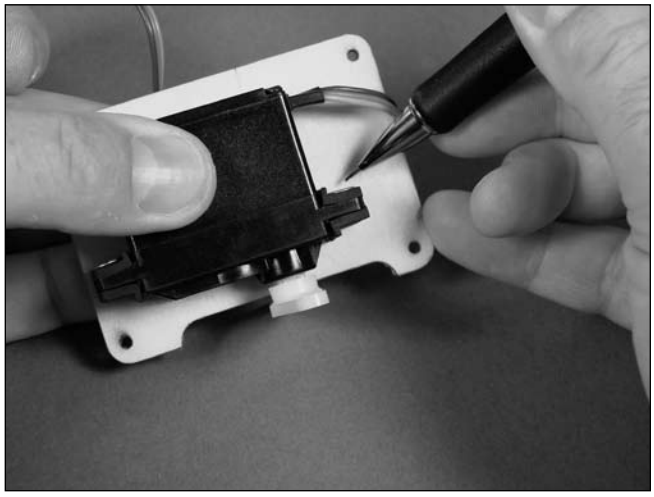




Section 3: Flap Servo Installation

☐ ☐ Step 3

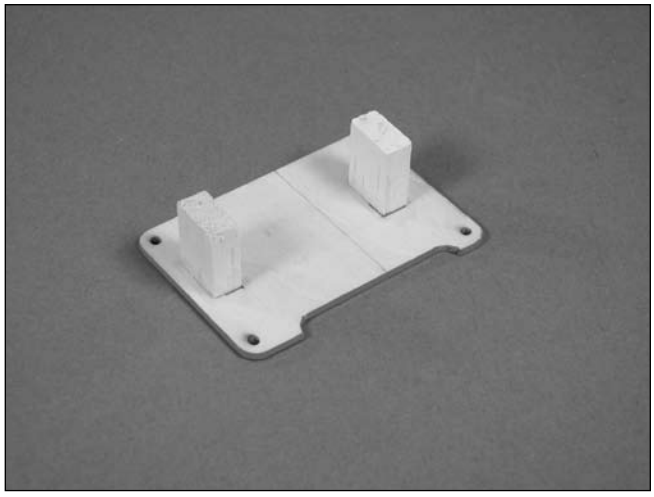
Install the recommended servo hardware (grommets and eyelets) supplied with the servo. Temporarily install a long half servo arm (JRPA212) onto the servo and position the servo onto the hatch so the servo arm is centered in the notch. Once satisfied, mark the location for the servo mounting blocks using a felt-tipped pen.



Note: Check to make sure your servo does not hang off one end of the servo hatch. If so, reposition the servo. Having the servo fully on the hatch is more important than having the servo arm centered.

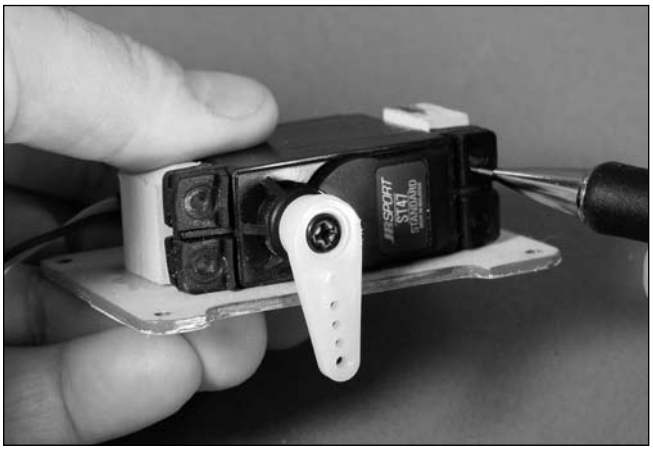
☐ ☐ Step 4

Locate two 3/8 x 3/4 x 3/4-inch (9.5 x 19 x 19mm) servo mounting blocks. Use 12-minute epoxy to glue the blocks to the hatch. Let the epoxy fully cure before proceeding to the next step.



☐ ☐ Step 5

Place the flap servo between the mounting blocks and use a felt-tipped pen to mark the location of the four servo mounting screws. Note that the servo must not touch the hatch in order to isolate engine vibration.



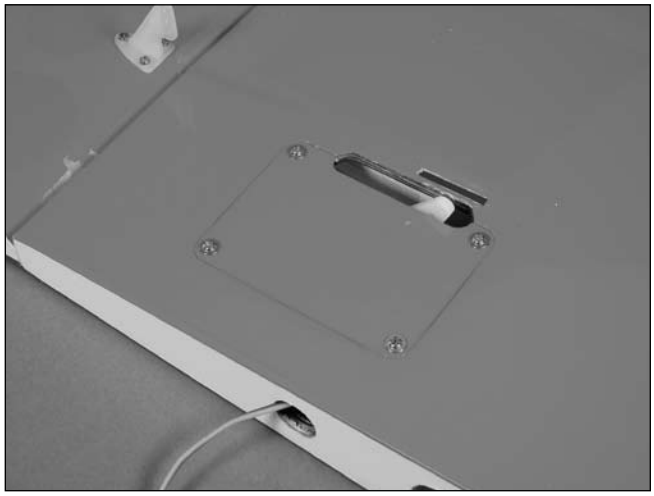
Note: Before mounting the flap servo, make sure the servo arm is installed correctly on the servo. This is done by moving the servo from each end point to determine the center position of the servo. With the radio off, secure the servo arm in the center position. Check the operation of the servo to determine if the two end positions of the arm are equal. If not, reposition the arm as necessary.

☐ ☐ Step 6

Remove the servo and use a 1/16-inch (1.5mm) drill bit to pre-drill the holes for the servo mounting screws marked in the previous step. Use the screws supplied with the servo to mount it to the servo mounting blocks.

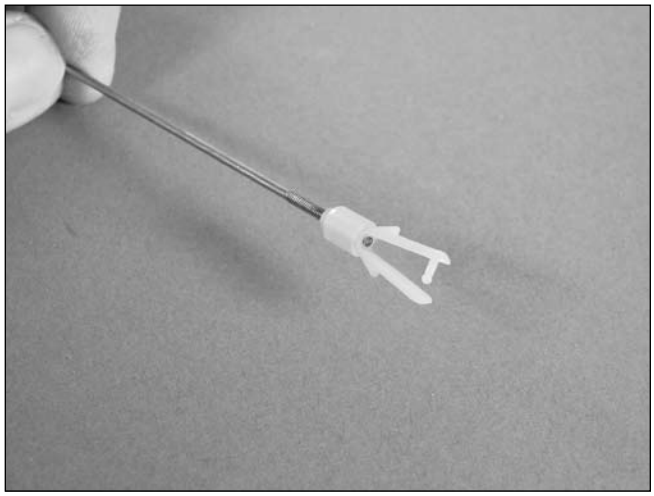
☐ ☐ Step 7

Pass the servo lead through the flap opening and out the end of the wing. Secure the hatch using four #2 x 3/8-inch sheet metal screws.



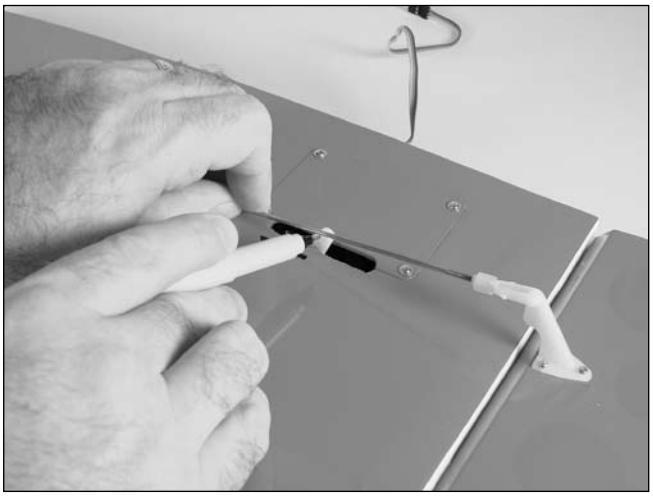
☐ ☐ Step 8

Locate a 4 $^{3}/_{4}$-inch (121mm) pushrod wire, clevis and clevis retainer. Slide the retainer onto the small end of the clevis. Thread the clevis onto the linkage wire until the wire is barely visible between the forks of the clevis.



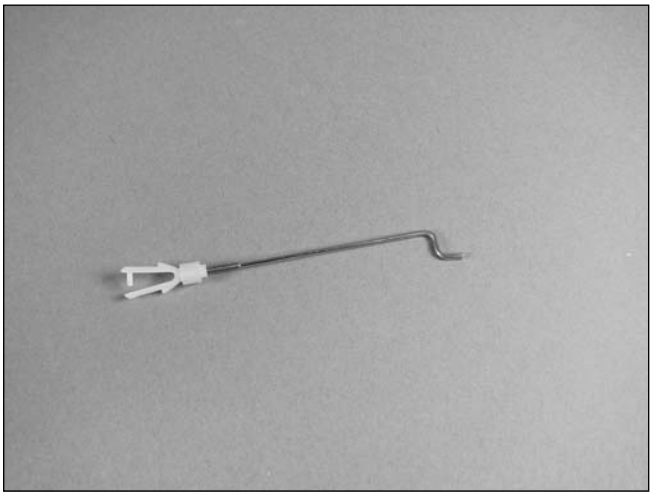
☐ ☐ Step 9

With the flap in the neutral position, adjust the servo to the full "up" position with your transmitter. Use a felt-tipped pen to mark the pushrod wire where it crosses the servo arm.



☐ ☐ Step 10

Remove the clevis from the flap control horn. Use pliers to make a Z-bend in the linkage at the mark made in the previous step.



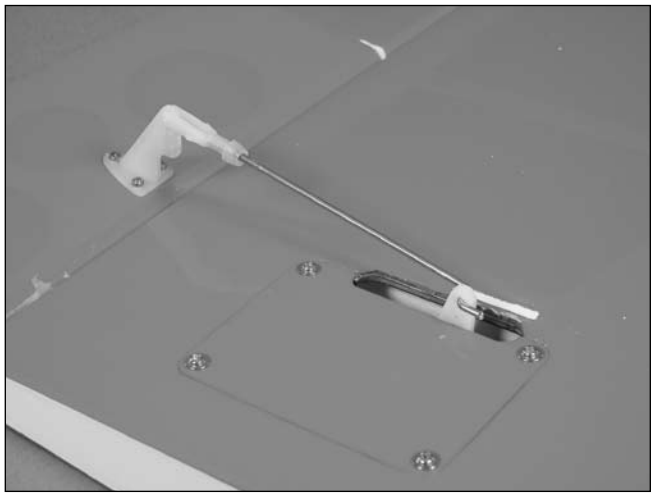
Hint: You can practice making the Z-bend using the very end of the wire. Just make sure not to make your test bend too close to the mark.

Note: Special pliers for making Z-bends are available and make the task of creating these bends much easier.

Section 3: Flap Servo Installation

☐ ☐ Step 11

Install the flap linkage and check the operation of the flap using the radio system. You may need to adjust the length of the linkage when the flap is in the “up” position to make sure it is fully centered.



☐ Step 12

Repeat Steps 1 though 11 for the remaining flap servo.

Section 4: Engine Installation

Items Required

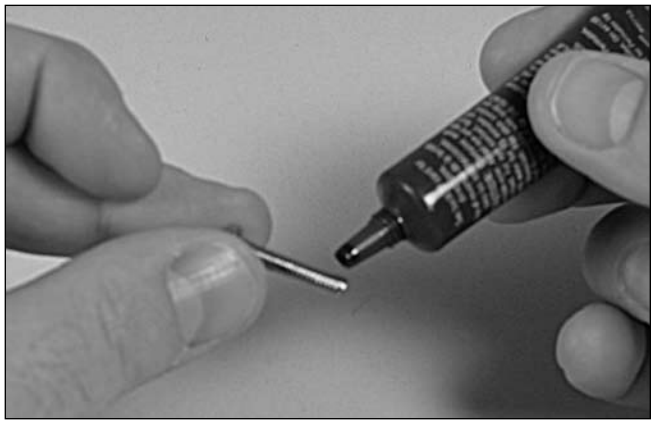
- 8-32 x 3/4-inch machine screw (4)
- 8-32 x 1-inch machine screw (4)
- Assembled fuel tank
- Plywood fuel tank brace
- 8-32 lock nut (4)
- Engine mount
- Engine mount plate (2)
- Clevis w/retainer
- Linkage wire, 22 $^{7}/_{8}$-inch (581mm)

Tools Required

- Phillips screwdriver
- Threadlock
- Medium CA

☐ Step 1

Locate four 8-32 x 3/4-inch machine screws. Apply two drops of threadlock to each of the screws.

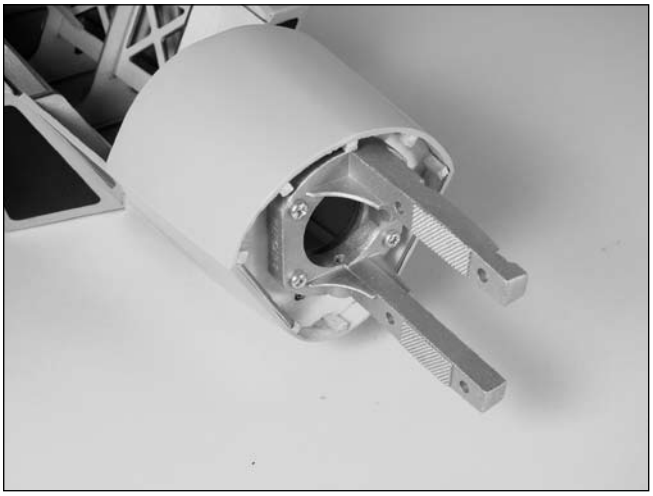


☐ Step 2

Slide the cockpit lever rearward and lift the cockpit from the fuselage.

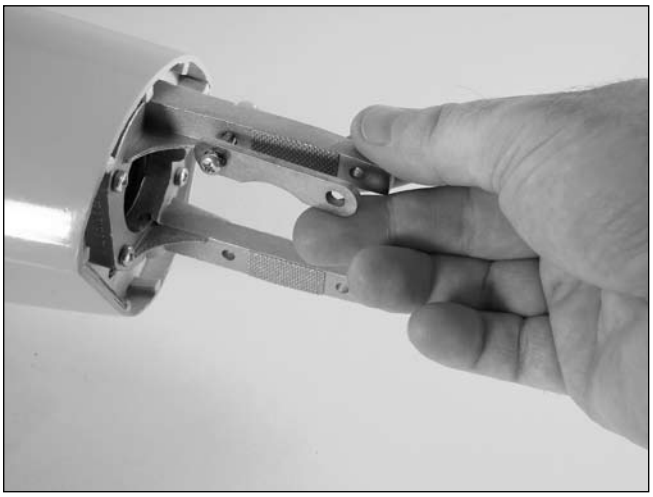
☐ Step 3

Attach the engine mount to the firewall using the 8-32 x 3/4-inch machine screws. Note the direction of the mount in relationship to the fuselage.



☐ ☐ Step 4

Locate an 8-32 x 1-inch machine screw, 8-32 locknut and one of the engine mount plates. Pass the screw through the plate then through the engine mount. Thread the 8-32 lock nut on the screw a few turns by hand so the plate will remain attached to the mount.



Note: The engine mount plate has texture on one side. This texture will face towards the engine mount lugs.

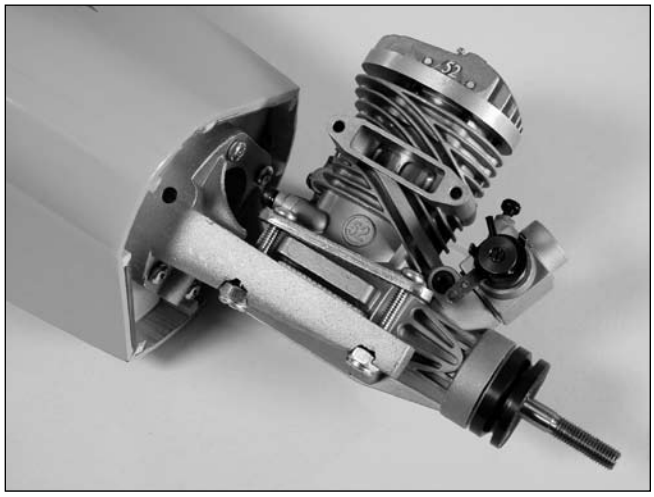
Section 4: Engine Installation

☐ ☐ Step 5

Locate a second 8-32 x 1-inch machine screw and 8-32 locknut. Position the engine so it is between the engine mount and engine mount plate. Slide the second 8-32 x 3/4-inch machine screw through the plate and mount. Thread the 8-32 lock nut on the screw.

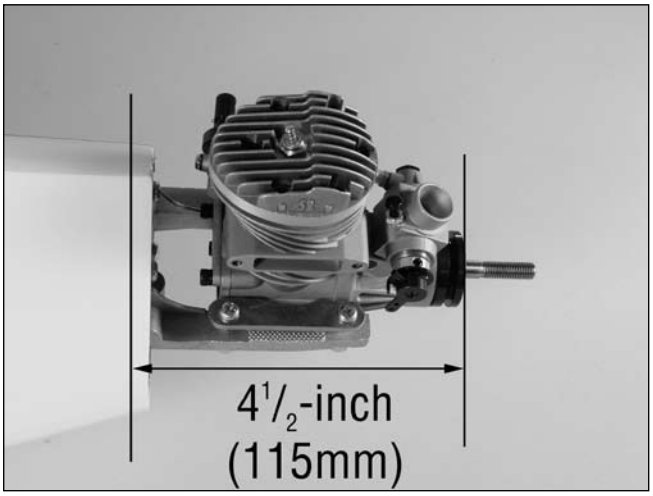
☐ Step 6

Repeat Steps 4 and 5 to place the remaining engine mount plate in position.



☐ Step 7

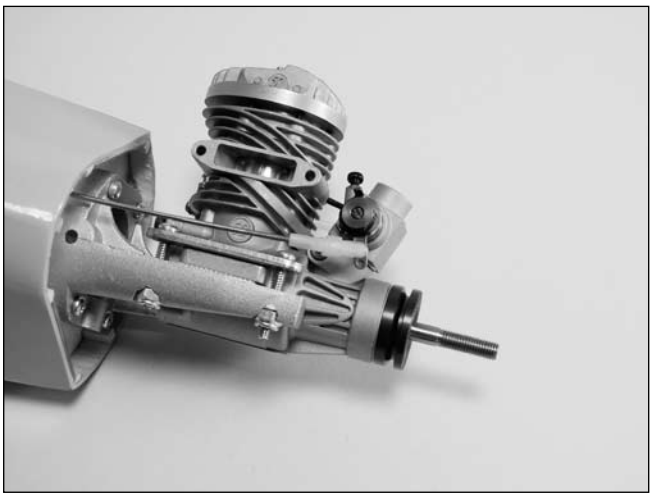
While the engine is still free to move on the mount, position the engine so the drive washer is 4 $^{1}/_{2}$-inch (115mm) forward of the firewall.



Note: The firewall is not visible in the photo. Make sure to measure from the firewall and not the front of the fuselage.

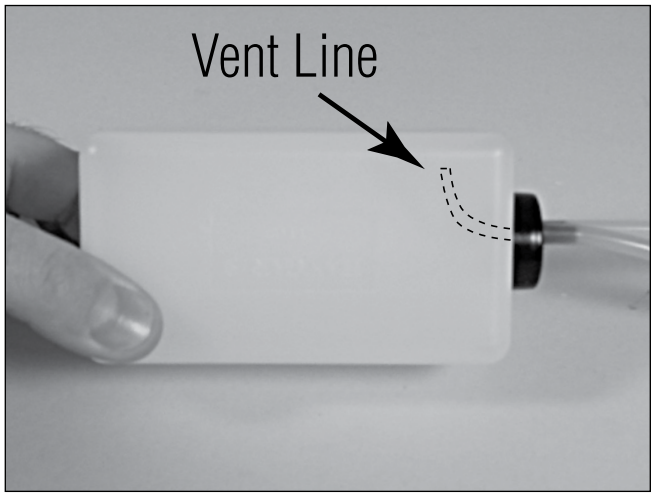
☐ Step 8

Slide a clevis retainer onto a nylon clevis. Thread the clevis on the 22 $^{7}/_{8}$-inch (581mm) linkage wire. Slide the linkage wire through the tube in the firewall. Snap the clevis on the throttle arm of the carburetor.



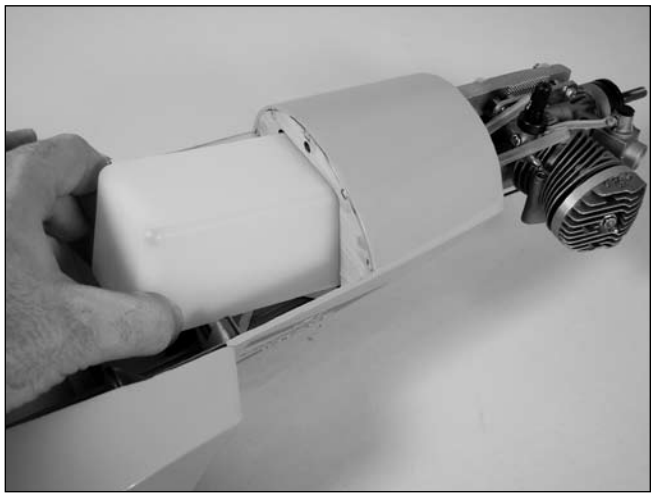
☐ **Step 9**

Hold the fuel tank up to the light and look to determine the direction of the vent line. The vent will be facing up toward the top of the fuel tank (top of the fuselage) when the tank is installed. If not, the engine will not run properly.



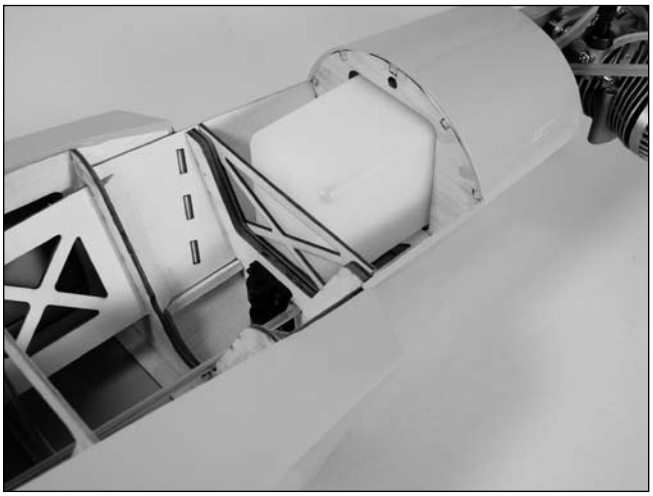
☐ **Step 10**

Slide the fuel tank into the fuselage. Guide the fuel tubes through the hole in the firewall. Slide the tank forward until it rests against the back of the firewall and the fuel tank floor.



☐ **Step 11**

Test fit the plywood fuel tank brace between the fuel tank and the former. The brace will only fit if the tank is installed properly. Once the brace fit has been checked, use medium CA to glue the brace into position.



Section 5: Cowling Installation

Items Required

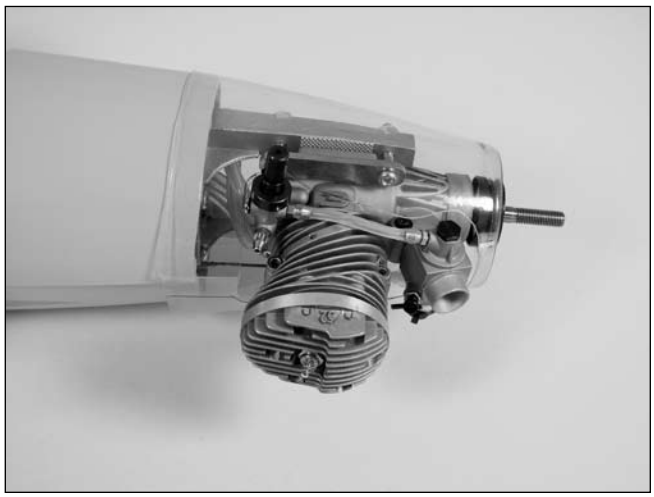
- Spinner w/backplate
- Propeller
- Spinner adapter w/screw
- #2 x 3/8-inch sheet metal screw (4)
- Cowling (painted)
- Cowling (clear)

Tools Required

- Adjustable wrench
- Hex wrench (included in kit)
- Drill
- Rotary tool w/sanding drum
- Masking tape
- Drill bit: 1/16-inch (1.5mm), 1/8-inch (3mm)
- Felt-tipped pen
- Hobby scissors
- Phillips screwdriver

☐ Step 1

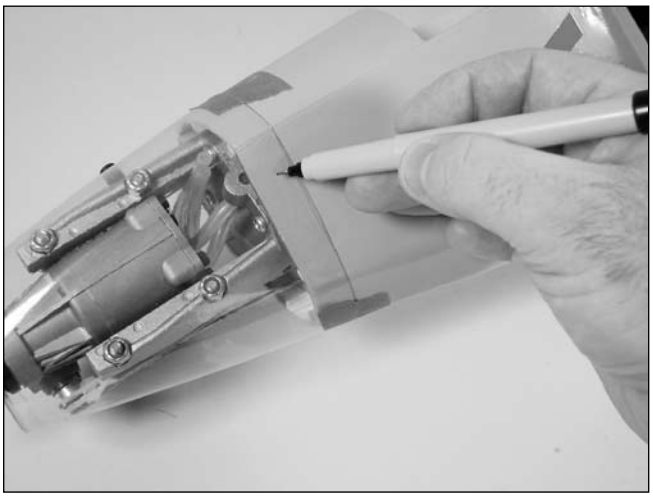
Fit the clear plastic cowling to the front of your aircraft. Trim the cowling to clear the needle valve, carburetor and to provide clearance for the muffler. Take your time when trimming the cowling.



Note: You will need to cut a slot behind the engine head so the cowling can be opened and slid over the engine.

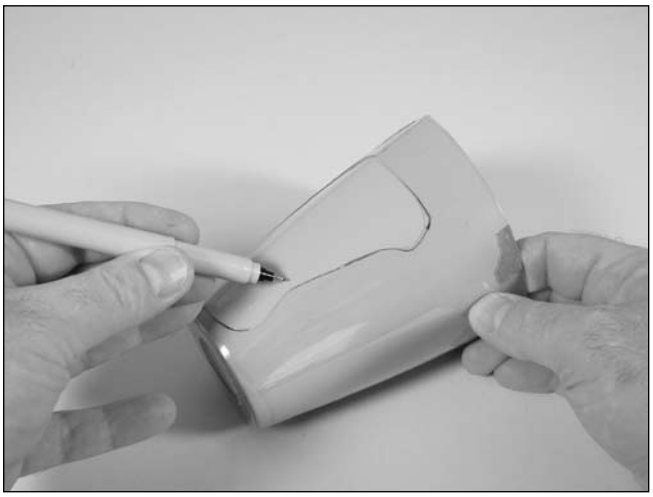
☐ Step 2

Slide the spinner backplate on the crankshaft of the engine. Position the cowling so there is roughly 1/8-inch (3mm) gap between the spinner backplate and cowling. Mark four locations (two on each side) for the cowling mounting screws using a felt-tipped pen.



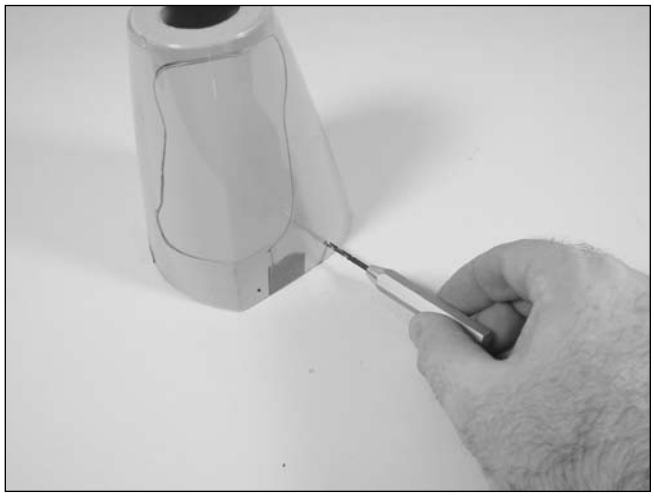
☐ Step 3

Remove the clear cowling from the fuselage. Slide it over the painted cowling and transfer the locations for the cut-outs on the painted cowling.



☐ **Step 4**

Use drill and a 1/8-inch (3mm) drill bit to drill the holes for the cowling mounting screws. Remove the clear cowling and use hobby scissors to trim the painted cowling. Use a rotary tool and sanding drum to clean up any jagged edges. Remember to make the cut behind the engine head (can be seen in Step 5) so the cowling can be opened to fit over the engine.



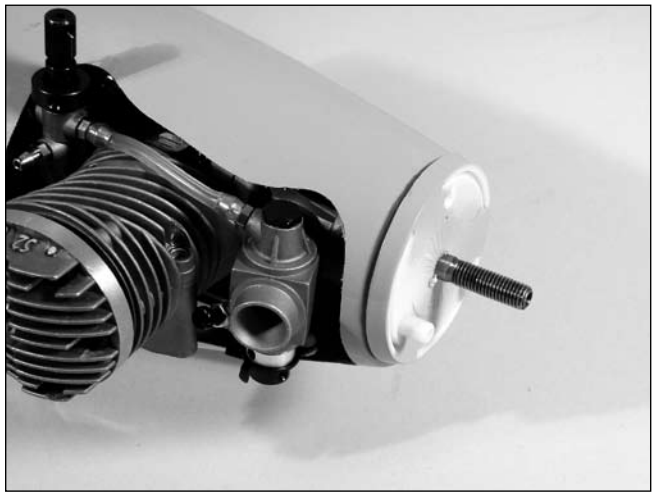
☐ **Step 5**

Slide the cowling in position on the fuselage.

Note: Two spinners have been included with your F-22 Raptor. Use the 3-blade spinner for trainer use and lower flight speeds with the 3-blade Trainer Power System propeller (EVOE100P). The 2-blade spinner is preferred for 2-blade props, sport flying and for higher speeds. Installation of either spinner follows the same procedure.

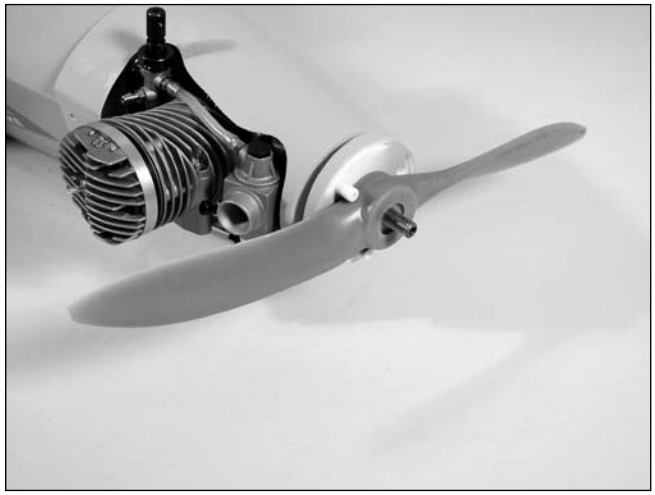
☐ **Step 6**

Slide the spinner backplate onto the engine shaft



☐ **Step 7**

Slide the propeller onto the engine shaft.



Section 5: Cowling Installation

☐ Step 8

Slide the washer onto the engine shaft and then thread the spinner adapter onto the engine shaft. Rotate the propeller clockwise so it is resting against the lugs of the spinner backplate. Finger-tighten the adapter.

Note: You will not use the nut from your engine for this application. Make sure to save the nut somewhere in case you use the engine from your F-22 Raptor in a future project.

☐ Step 9

Use an adjustable wrench to tighten the propeller nut. Make sure the propeller remains against the lugs on the spinner backplate.

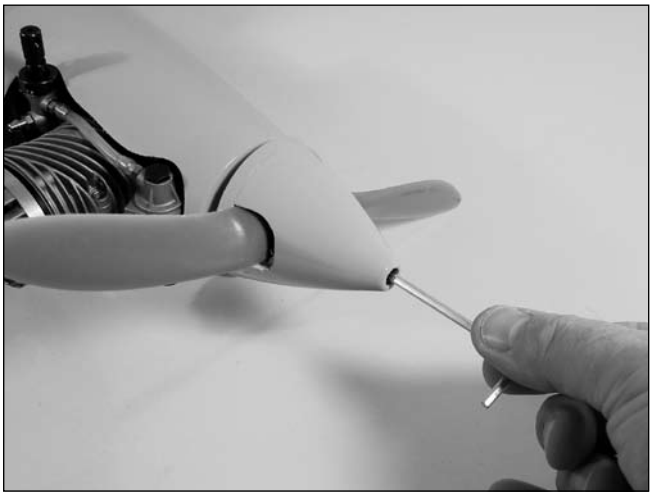
Important: DO NOT use pliers, as the nut will not be tight enough and could come loose.

☐ Step 10

Locate the spinner cone and position it onto the spinner backplate. The cone will key to the backplate with no gap between the backplate and cone.

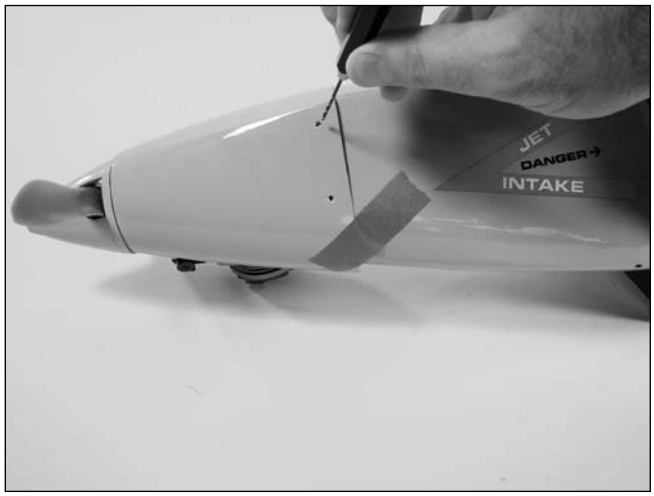
☐ Step 11

Slide the adapter screw through the hole in the end of the spinner and thread it into the adapter. Use the included hex wrench to tighten the screw. Do not over-tighten the screw which could possibly deform the spinner.



☐ Step 12

Position the cowling with a 1/8-inch (3mm) gap between the front of the cowling and spinner backplate. Use a drill and 1/16-inch (1.5mm) drill bit to drill through the holes in the cowling into the fuselage.



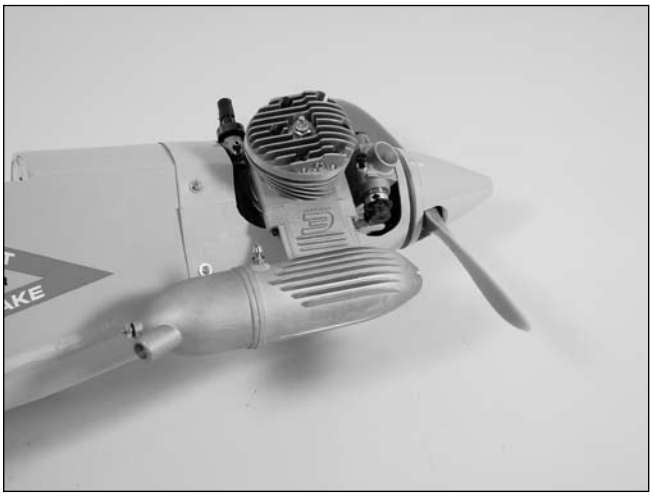
☐ Step 13

Secure the cowling to the fuselage using four #2 x 3/8-inch sheet metal screws and a Phillips screwdriver.

Note: If you find the screws vibrating loose, remove the screws and cowling. Apply a few drops of thin CA into the screw holes to harden the wood around the holes. Allow the CA to cure then install the cowling back onto the fuselage.

☐ Step 14

Install the muffler onto the engine following the instructions provided with your engine. Make sure there is adequate clearance between the cowling and muffler before continuing with assembly.



☐ Step 15

Attach the fuel lines from the fuel tank to the engine and muffler. The line from the vent attaches to the muffler.

Section 6: Landing Gear Installation

Items Required

- Main landing gear (2)
- 2 1/2-inch (63mm) wheel
- 2 3/4-inch (70mm) wheel (2) • Nose landing gear
- 5/32-inch wheel collar (2) • Landing gear strap (4)
- 3/16-inch wheel collar (4) • 4-40 setscrew (6)
- Steering arm
- 3mm x 8mm socket head screw
- Pushrod wire, 29 3/4-inch (755mm)
- #4 x 1/2-inch sheet metal screw (8)
- 3mm x 6mm machine screw
- Brass pushrod connector w/backplate

Tools Required

- Phillips screwdriver • Pliers
- Rotary tool w/sanding drum
- Hex wrench (included in kit)
- Threadlocking compound

☐ Step 1

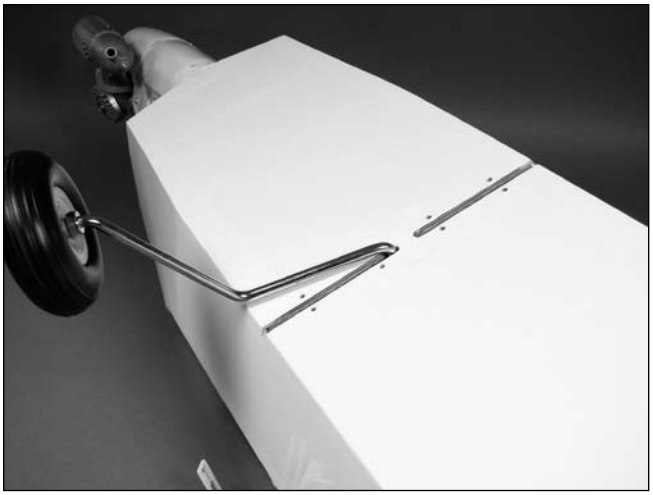
Use a rotary tool and sanding drum to grind a flat onto the bottom of the two main landing gear and on the nose gear where the wheel collar will be placed. There shouldn't be a flat where the wheel is placed. This will help in preventing the wheel collars from vibrating loose in flight.

☐ ☐ Step 2

Slide a 5/32-inch wheel collar onto the main gear, then a 2 3/4-inch (70mm) wheel. Slide a final 5/32-inch wheel collar onto the main gear. Secure the wheel collars using the 3mm setscrews.

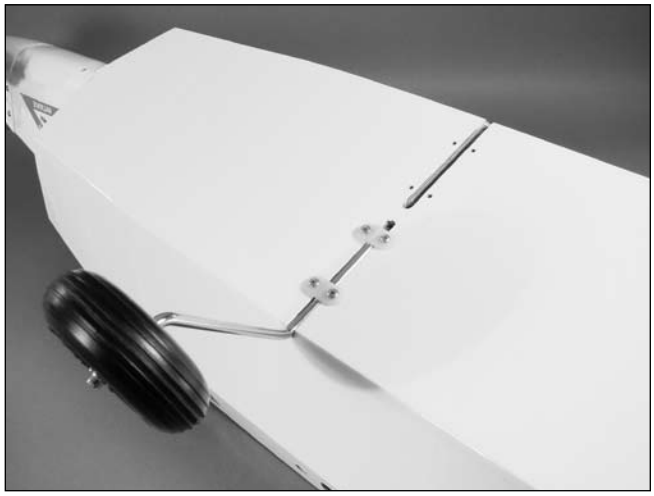
☐ ☐ Step 3

Slide one of the main gears into the hole in the fuselage.



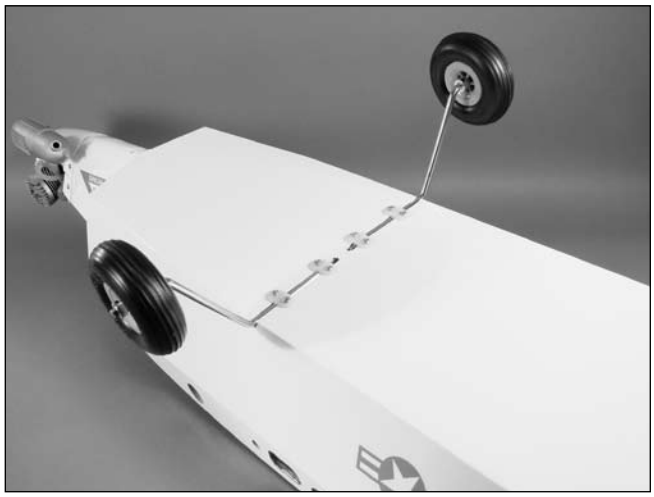
☐ ☐ Step 4

Press the gear into the slot in the fuselage. Use two landing gear straps and four #4 x 1/2-inch sheet metal screws to secure the landing gear to the fuselage.



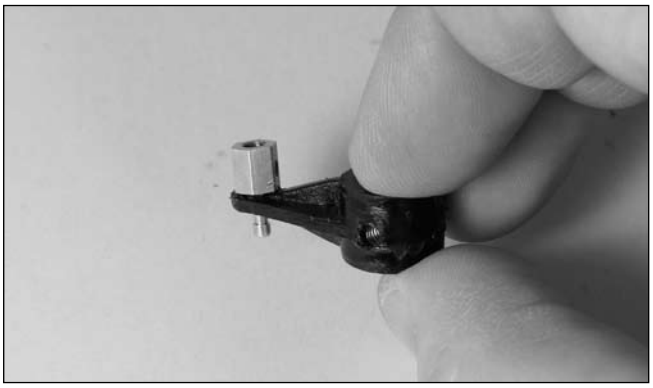
☐ Step 5

Repeat Steps 2 through 4 to install the remaining main landing gear.



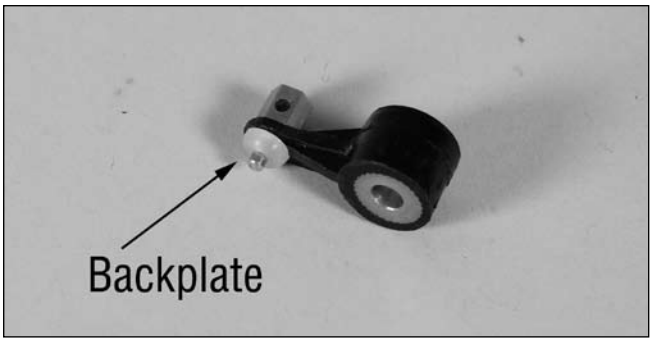
☐ Step 6

Slide the brass pushrod connector in the hole in the nosewheel steering arm. Note the location of the hole in the steering arm for the screw in relationship to the pushrod connector.



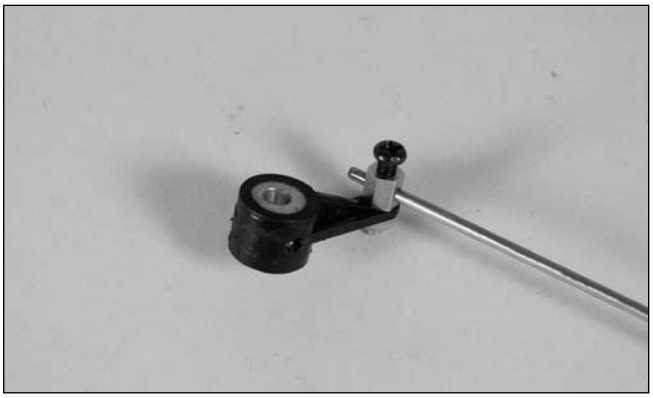
☐ Step 7

Secure the connector by installing the pushrod connector backplate using pliers.



☐ Step 8

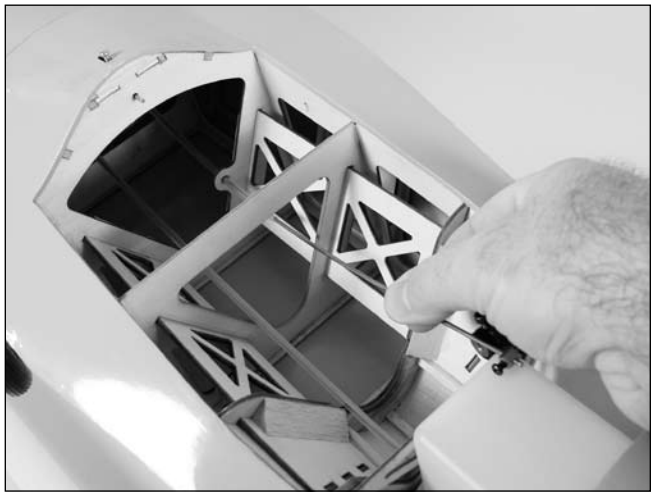
Locate the 29 $^{3}/_{4}$-inch (755mm) pushrod wire. This wire does not have threads on either end. Slide the wire in the connector and secure it using a 3mm x 4mm machine screw. Make sure to use threadlock on the screw.



Section 6: Landing Gear Installation

☐ Step 9

Slide the pushrod wire into the pre-installed pushrod tube inside the fuselage.



☐ Step 10

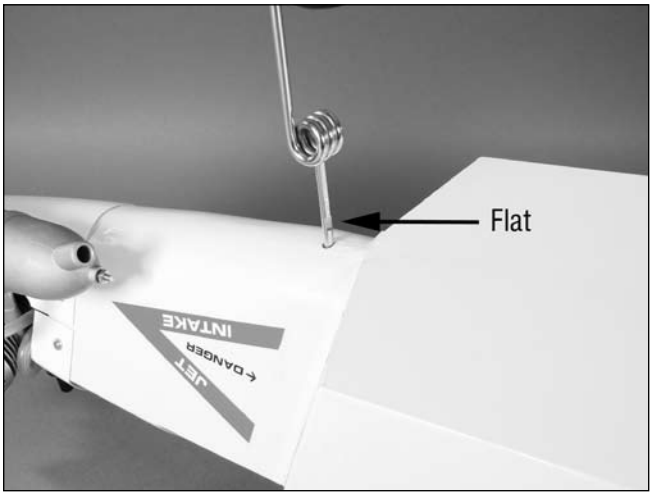
Position the steering arm in the center of the nose gear block inside the fuselage.

☐ Step 11

Repeat Step 2 using two 3/16-inch wheel collars to attach the 2 $^{1}/_{2}$-inch (63mm) wheel to the nose landing gear.

☐ Step 12

Slide the nose gear into position from the bottom of the fuselage. Make sure the notch in the nose gear faces towards the rear of the fuselage.



☐ Step 13

Thread a 3mm x 8mm socket head screw into the steering arm. Use the supplied hex wrench to tighten the screw in the steering arm onto the nose gear wire. The screw must rest on the flat area of the nose gear wire.

Hint: Apply a drop of threadlock to the screw before tightening it onto the nose gear wire.

Section 7: Tail Installation

Items Required

- Vertical stabilizer (left and right)
- Horizontal stabilizer (left and right)
- 4-40 x 3/4-inch hex head screw (4)
- #4 washer (silver) (4)
- 4-40 x 1-inch hex head screw (4)
- #4 washer (black) (4)

Tools Required

- Hex wrench (located in kit)

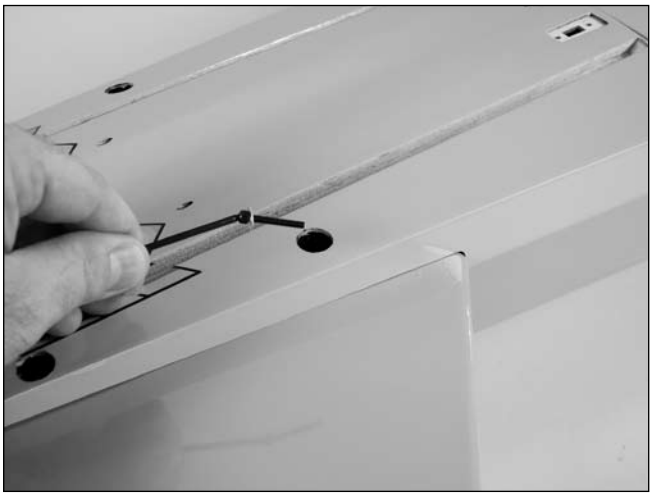
☐ ☐ Step 1

Slide one of the horizontal stabilizers into the slot in the fuselage.

Note: For balance purposes we have deliberately made the tail surfaces of very strong material. The weight of these parts is normal for this airplane.

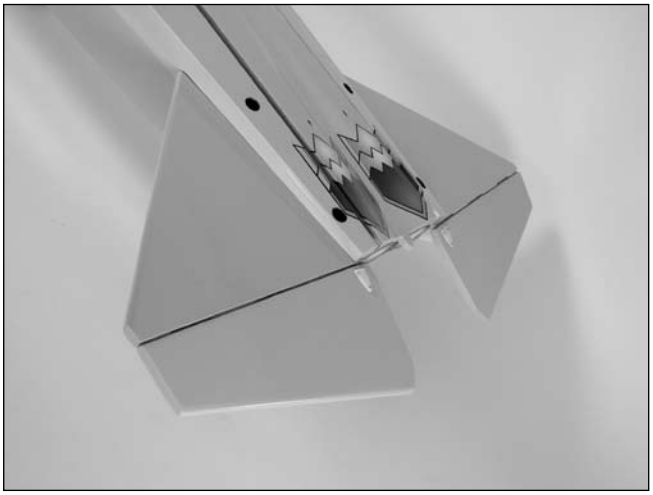
☐ ☐ Step 2

Slide a #4 silver washer onto a 4-40 x 3/4-inch hex head screw, then thread the screw into the fuselage. Use two 4-40 x 3/4-inch screws and two #4 silver washers to secure the horizontal stabilizer into position.



☐ Step 3

Repeat Steps 1 through 2 to secure the remaining horizontal stabilizer to the fuselage.



Section 7: Tail Installation

☐ ☐ Step 4

Slide the vertical stabilizer into the slot in the fuselage. Apply a drop of threadlock to a 4-40 x 1-inch hex head screw. Slide a #4 black washer onto the screw. Use two 4-40 x 1-inch hex head screws and two #4 black washers to secure the vertical stabilizer to the fuselage.

☐ Step 5

Repeat Step 4 to install the remaining vertical stabilizer.

Section 8: Radio Installation

Items Required

- Foam (large and small)
- Hook and loop strap
- Nylon clevis w/retainer (4)
- Long servo arm (2)
- 3/16-inch wheel collar (2)
- 18 $^{3}/_{4}$-inch (476mm) pushrod wire
- 15-inch (381mm) pushrod wire
- 3mm x 10mm machine screw
- 3mm x 4mm machine screw
- Brass pushrod connector w/backplate
- Tie wrap
- Pushrod wire keeper (2)
- Clear tape
- Battery cover

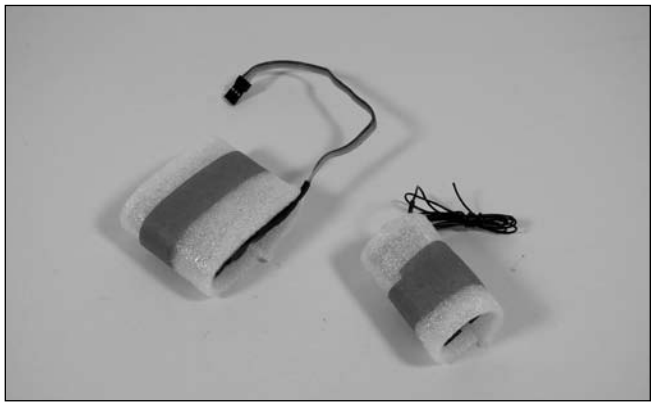
Tools Required

- Phillips screwdriver
- Masking tape
- Side cutters
- Drill
- Drill bit: 5/64-inch (2mm)
- Pliers
- Switch harness
- Threadlock

Important: It is suggested to read through *Section 10: Centering the Control Surfaces* before beginning the radio installation so you are familiar with how to center the control surfaces.

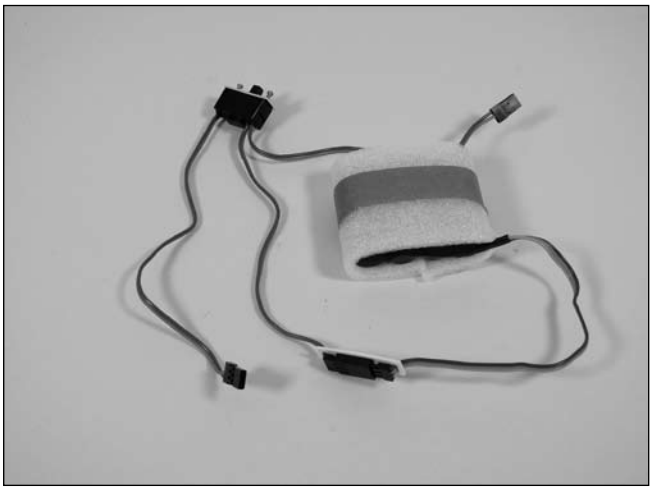
☐ Step 1

Locate the large and small pieces of foam. Wrap the receiver battery using the larger piece and masking tape. Wrap the receiver with the smaller piece of foam and masking tape.



☐ Step 2

Connect the receiver battery to the switch harness. Use a commercially available connector, tape or string to secure the two together to prevent them from coming unplugged inside the fuselage.



☐ Step 3 – Receiver Battery Installation

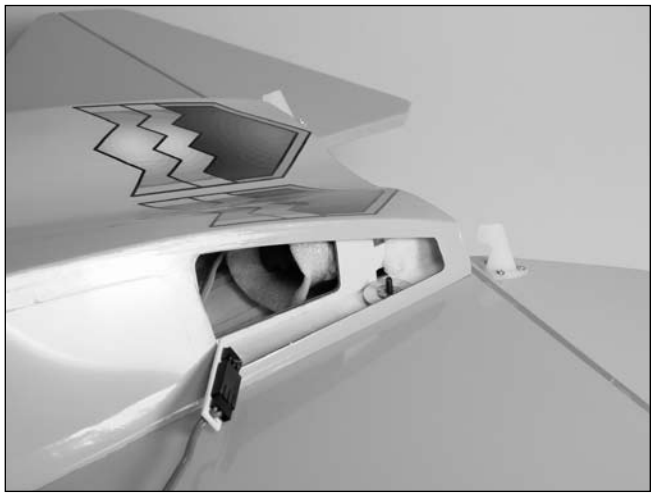
Slide the battery tie wrap through the lower rectangular hole at the rear of the fuse into the fuse then back through the upper hole. Try to have the majority of the tie wrap inside the fuselage.

Note: The tie wrap is used to secure the receiver battery inside the fuselage in the following step.

Section 8: Radio Installation

☐ Step 4 – Receiver Battery Installation

Slip the battery into the fuselage and inside the tie wrap. Push the battery as far back in the fuselage as possible. Draw the tie wrap in to secure the receiver battery. Trim the excess tie wrap using side cutters.

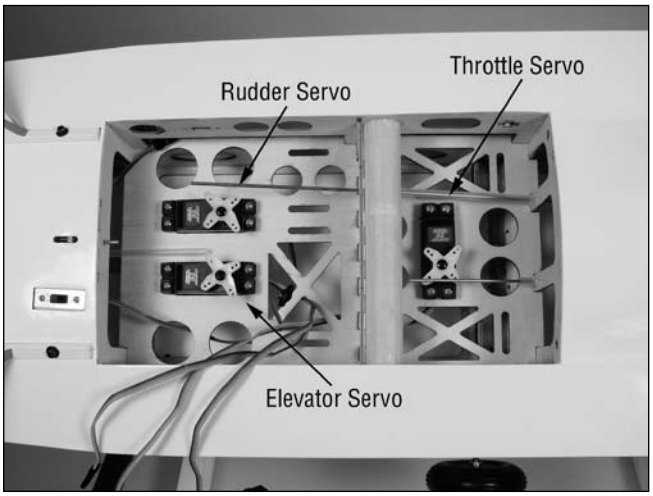


☐ Step 5

Drop the switch harness into the fuselage towards the radio compartment. Use the switch hardware and switch plate to secure the switch in position on the top of the fuselage behind the radio compartment.

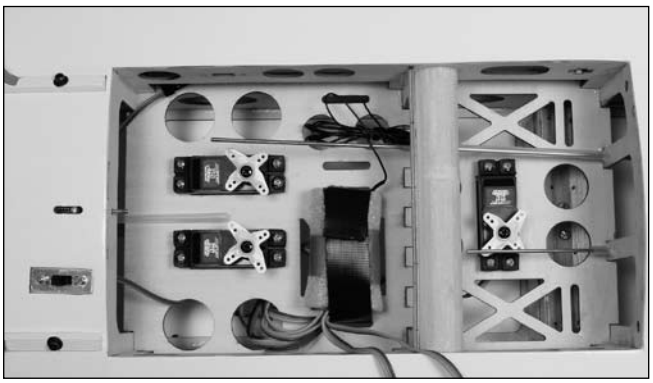
☐ Step 6

Install the grommets and brass eyelets into three servos using the information provided with your radio system or servos. Use the screws provided with the servos to secure them in the fuselage as shown.



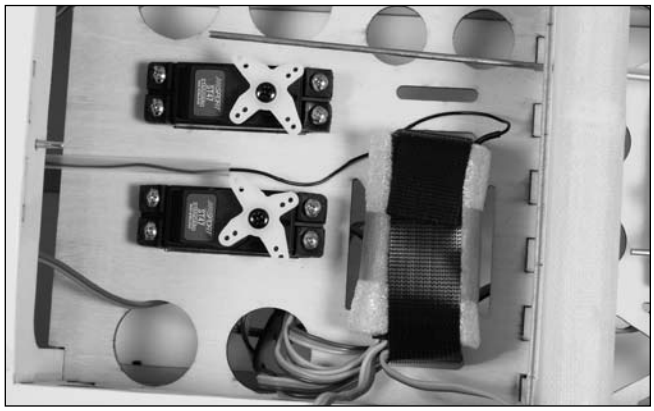
☐ Step 7

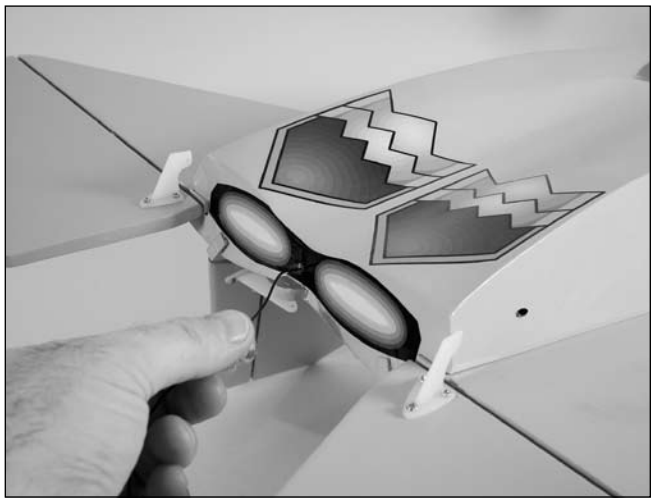
Plug the servos and switch harness into the receiver. Also plug the Y-harness for the ailerons (and a Y-harness for the flaps if you chose to install them) in the receiver at this time as well. Use the hook and loop strap to secure the receiver in the fuselage.



☐ Step 8

Route the receiver antenna wire through the pre-installed tube in the fuselage out to the rear of the fuselage. You will need to use a hobby knife to trim the decal at the rear so the antenna wire can exit the fuselage.





Hint: Make sure the antenna is straight before sliding it into the tube. You may have to try a few times before the antenna wire will slide completely through the tube.

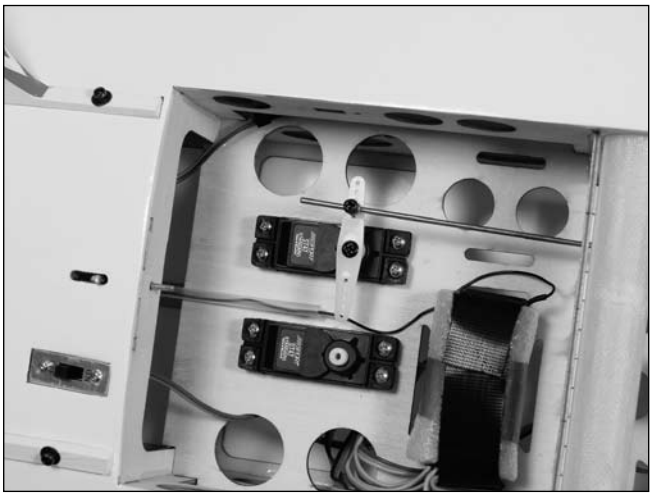
Note: Never cut the antenna wire as this will greatly reduce the range of your radio system.

☐ Step 9

Turn on the transmitter and receiver and check the operation of the servos. Center all the trims and sticks on the transmitter, as well as check to make sure all programming (if using a programmable radio) has been cleared.

☐ Step 10

Secure the brass pushrod connector in the second hole away from the center of the servo arm using the connector backplate. Slide the steering pushrod wire through the connector. Install the servo arm perpendicular to the servo. With the nose wheel parallel to the center line of the fuselage, use a 3mm x 4mm machine screw to secure the steering pushrod wire.



Note: If your F-22 Raptor does not track straight while taxiing, DO NOT use the rudder trim to correct it. Instead, loosen the 3mm x 4mm screw and adjust the position of the pushrod wire. Use the rudder trim for in-flight trimming only.

Section 8: Radio Installation

☐ Step 11

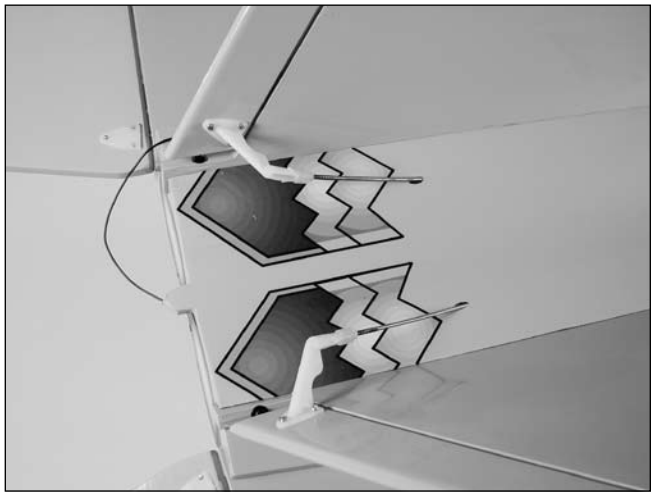
Secure a brass pushrod connector in the throttle servo arm. Pass the throttle pushrod through the connector on the throttle servo arm.

☐ Step 12

Use the radio system to move the throttle servo to the low position. Physically move the throttle linkage to close the carburetor. Tighten the 3mm x 4mm machine screw in the connector to secure the linkage. Use the radio system to make sure the throttle can move freely from closed to fully open. Make any necessary adjustments to the linkage or to the radio to achieve full operation of the carburetor.

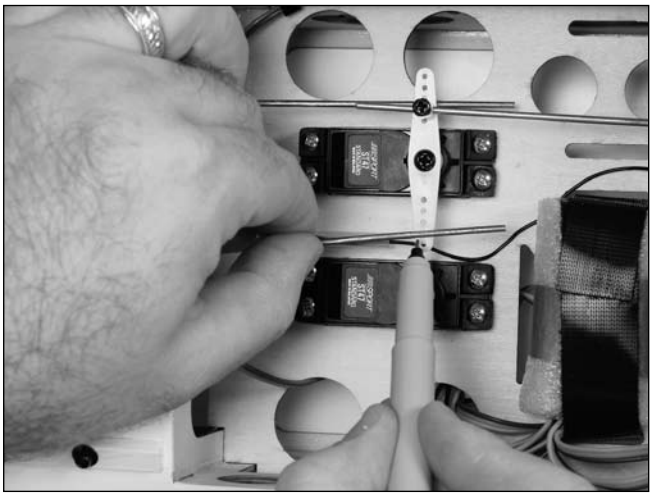
☐ Step 13

Slide a clevis retainer onto a clevis. Thread the clevis onto a 15-inch (381mm) pushrod wire. Slide the wire into the holes in the top of the fuselage near the rudder. Attach the clevis to the outer hole of the rudder control horn. Repeat this to install both rudder linkages.



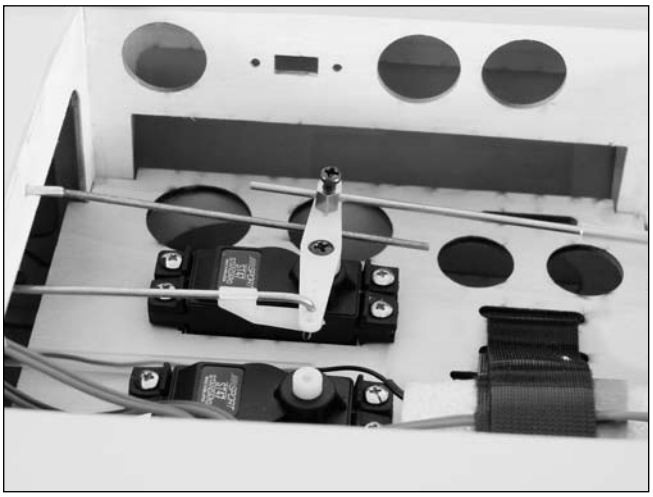
☐ ☐ Step 14

Double-check, using the radio system, that the rudder servo is centered. With the left rudder in the neutral position, use a felt-tipped pen to mark the pushrod wire where it crosses the second hole in on the servo arm.



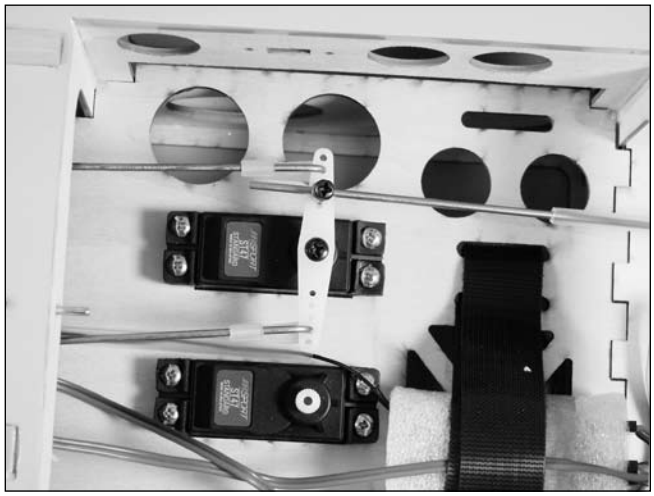
☐ ☐ Step 15

Bend the pushrod wire 90 degrees at the mark. Drill the servo arm using a 5/64-inch (2mm) drill bit and slide the wire into the hole. Secure the wire using a pushrod wire keeper. Trim any excess wire using side cutters.



☐ Step 16

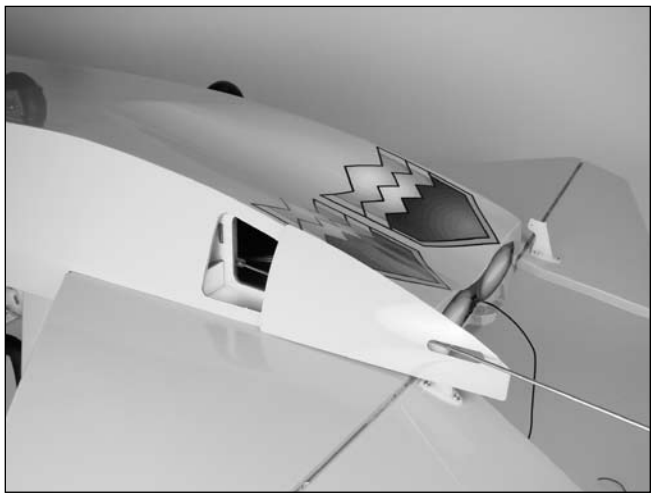
Repeat Steps 14 and 15 to attach the linkage from the left rudder to the rudder servo.



Note: Make sure to connect the right and left rudder pushrods to the servo arm in holes that are the same distance from the center of the servo arm.

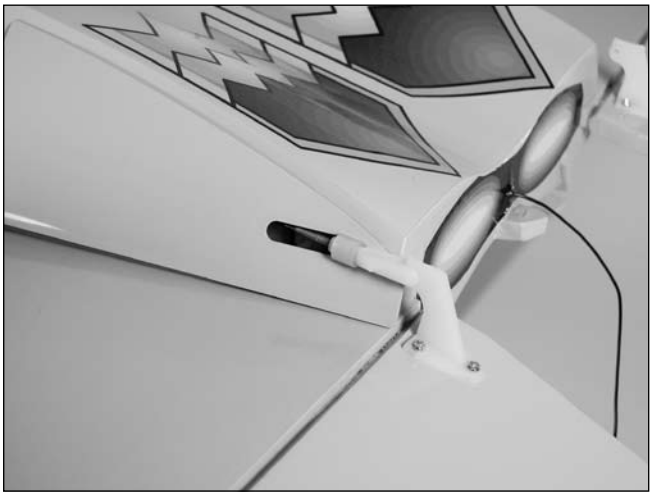
☐ Step 17

Slide a clevis retainer onto a clevis. Thread the clevis onto a 18 $^{3}/_{4}$-inch (476mm) pushrod wire. Slide the wire through the battery cover and into the pre-installed elevator pushrod tube in the fuselage.



☐ Step 18

Attach the clevis to the inside hole of the elevator control horn.



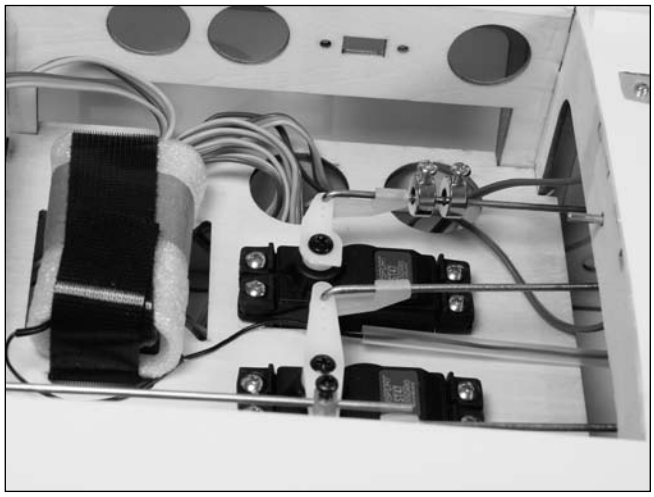
☐ Step 18

Use the included clear tape to secure the battery cover to the fuselage. Position the cover so it won't interfere with the operation of the elevator linkage.

Section 8: Radio Installation

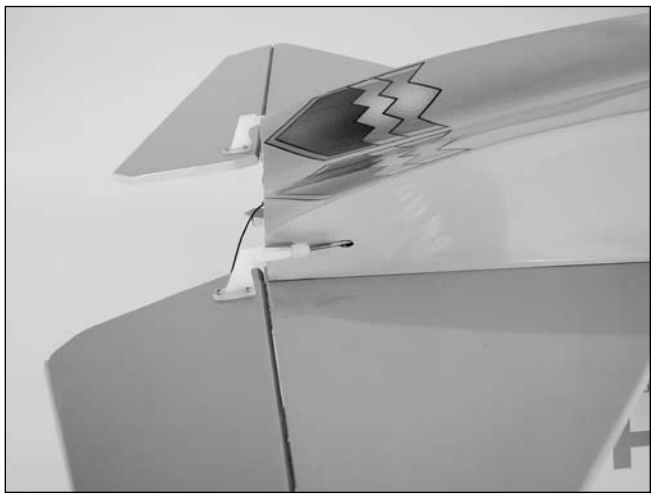
☐ Step 19

Prepare two 3/16-inch wheel collars by threading 3mm x 10mm machine screws into the collars. Slide the collars onto the elevator pushrod wire. Use the same method as Steps 14 and 15 to secure the elevator pushrod to the elevator servo. Make sure to remove any unused arms from the servo horn so they won't interfere with the operation of the rudder servo.



☐ Step 20

Slide a clevis retainer onto a clevis. Thread the clevis onto a 18 $^{3}/_{4}$-inch (476mm) pushrod wire. Slide the wire into the pre-installed elevator pushrod tube in the fuselage. Attach the clevis to the inside hole of the elevator control horn.



☐ Step 21

Pass the elevator pushrod wire through the two wheel collars installed on the other elevator pushrod wire in Step 19. Bend the second wire if necessary using pliers. Apply a drop of threadlock on each screw. Center the second elevator and tighten the screws to secure the pushrod wires.

Note: Check the wheel collars periodically to make sure they are tight.

Section 9: Wing Installation

Items Required

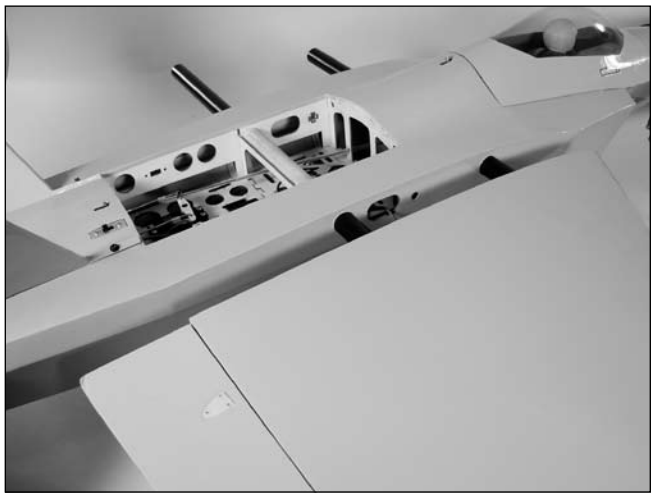
- Wing panel (left and right)
- Wing tube (short)
- Wing tube (long)
- 1/4-20 x 2 1/2-inch nylon wing bolt (2)

☐ Step 1

Slide the short wing tube into the hole in the wing towards the leading edge. The longer wing tube slides into the hole towards the center of the wing.

☐ Step 2

Slide the tubes and wing panel into the holes in the fuselage. Pass the aileron servo extension wire (and flap servo lead, if flaps have been installed) into the fuselage.



☐ Step 3

Press the wing snug against the fuselage. Use the 1/4-20 x 2 1/2-inch nylon wing bolt to secure the wing panel to the fuselage.

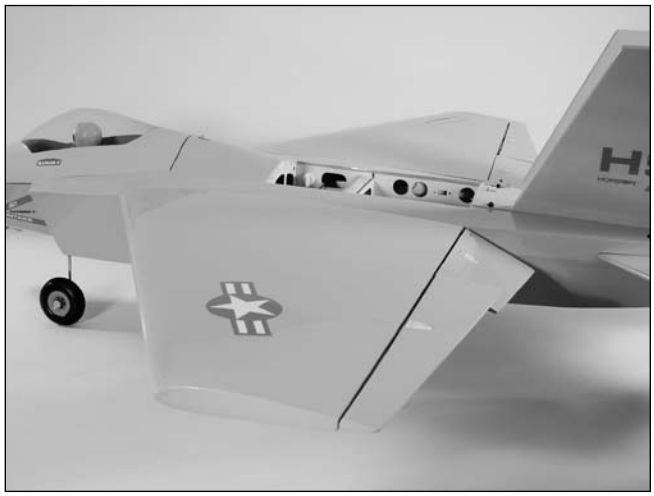
☐ Step 4

Pass the aileron servo extension (and flap servo lead, if installed) back and under the wing tube. The connector end of the extension then goes through the servo lead retainer. The wire will fit into the notch in the retainer. Plug the connectors together and slide the retainer against the connectors to secure them together.

Section 9: Wing Installation

☐ Step 5

Slide the remaining wing panel onto the tubes, remembering to guide the servo lead into the fuselage. Secure the wing panel then plug the servo extensions together.



Section 10: Installing the NACA Droops

If you are not comfortable soloing your F-22 Raptor ARF, you may want to install the anti-spin NACA droops. This is done by simply taping them on the top and bottom of the wing tape, along with double-sided tape between the wing and droops. The droops will greatly improve the stability and stall characteristics of your F-22 Raptor, making it suitable for use as a trainer aircraft.

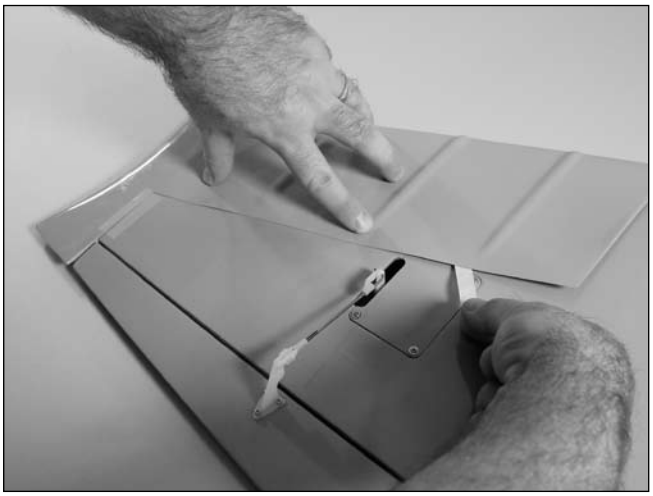
Without the droops, your F-22 Raptor ARF will be an all-out jet-like fighter. Have an instructor nearby for the first few flights. Without the droops, the F-22 Raptor ARF will descend more quickly and land faster like a sport model. In the air, it will be able to do a variety of aerobatics such as rolls, loops and spins.

☐ Step 1

Test fit the droops into position on the wing. The tip will slide fully rearward until the it aligns with the end of the aileron. Once you have determined the fit of the droop, apply the double-sided tape to the inner edge on the top and bottom of the droop, as well as to the inside of the wing tip.

☐ Step 2

Position the droop back onto the wing. Start by taping the wing tip into position using clear tape. Carefully pull the backing from the double-sided tape while pressing the droop onto the wing.



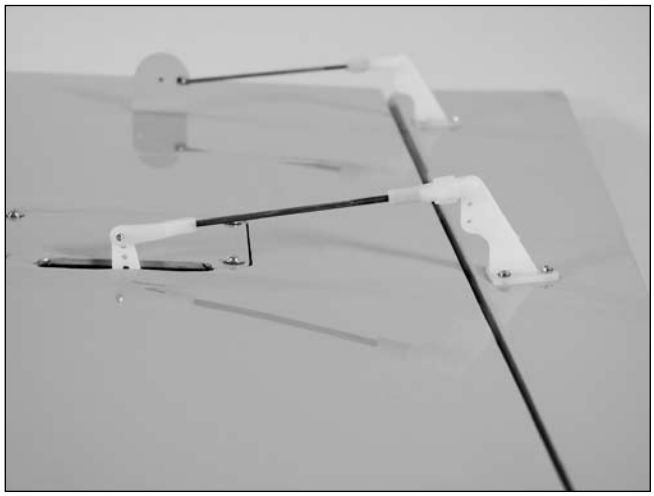
☐ Step 3

Complete the installation process by applying clear tape to the droop to secure it to the wing on both the top and bottom of the wing.

Section 11: Centering the Control Surfaces

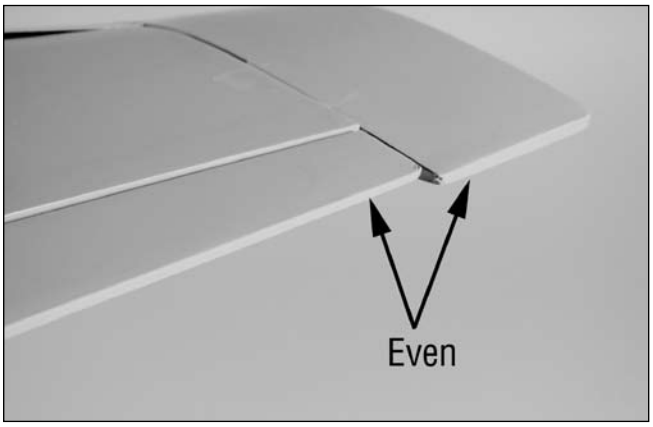
☐ Ailerons

Check to make sure the clevis is located in the outer hole of the control horn. If not, slide the clevis retainer forward, disconnect the clevis, connect it in the correct location, and slide the clevis retainer back into position.

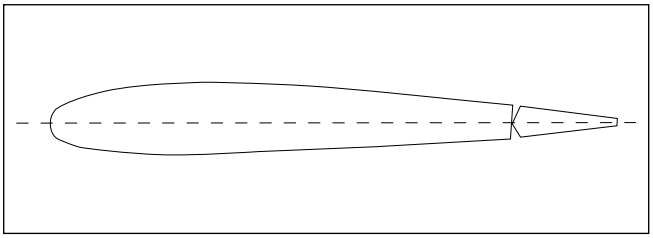


Make sure the aileron servo leads are connected as described in the previous section. Center the aileron trim on the transmitter.

Turn on the transmitter, then the receiver. Thread the clevis as necessary until the aileron is even with the wing tip.



Note: Align the aileron with the wing tip as shown if you are not installing the NACA droops on your F-22 Raptor.



☐ Elevator

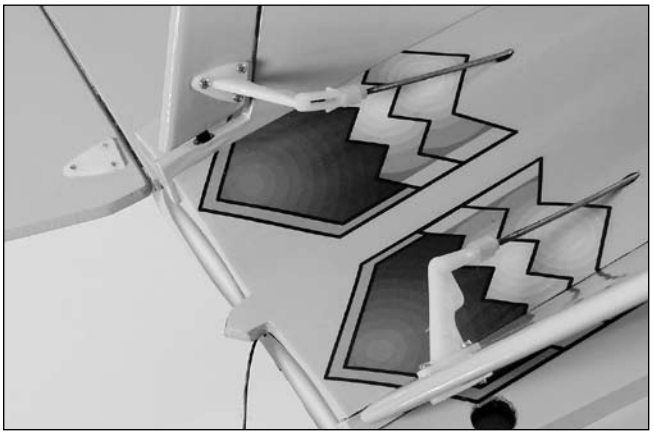
Connect the elevator clevis to the elevator control horn.

Center the trim lever for the elevator on the transmitter.

With the radio system on, thread the clevis until the elevator is aligned with the stabilizer. Slide the clevis retainer onto the clevis to secure its location.

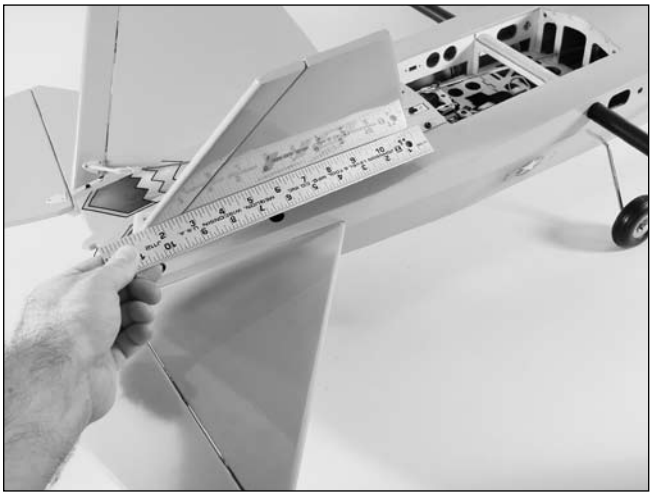
☐ Rudder

Connect the rudder clevis to the center hole on the rudder control horn.



Center the trim lever for the rudder on the transmitter.

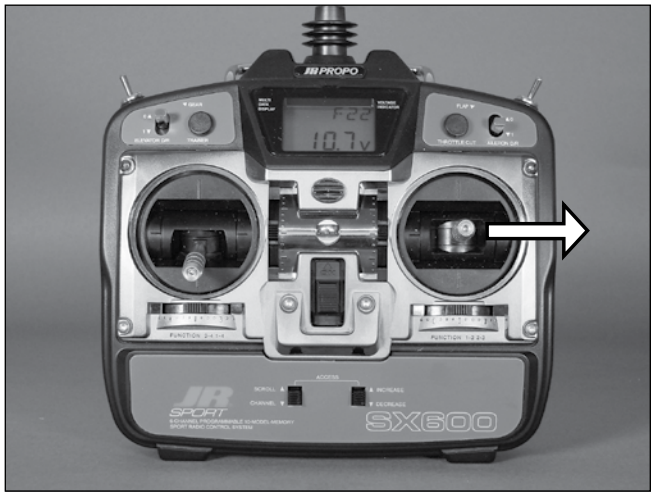
With the radio system on, thread the clevis until the rudder is aligned with the fin. Slide the clevis retainer onto the clevis to secure its location.

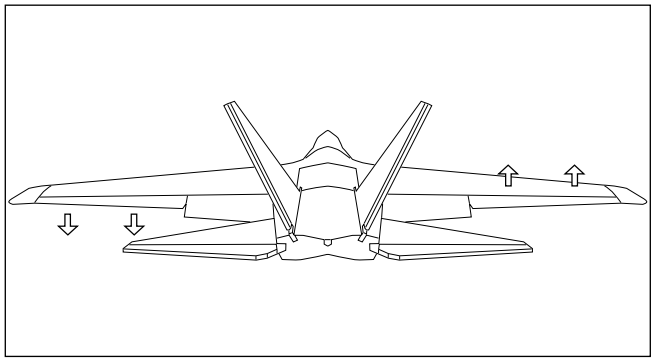


Section 12: Checking the Control Surface Directions

☐ Ailerons

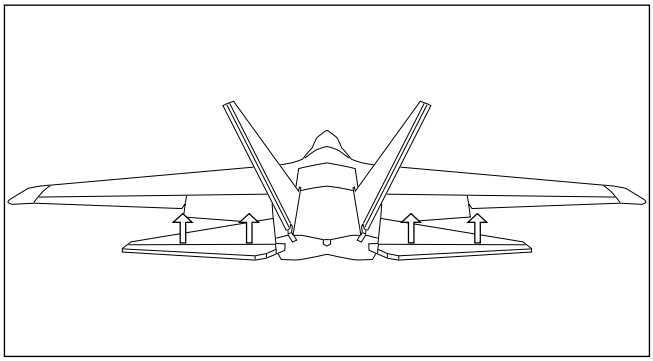
Turn on the transmitter, then the receiver. Move the aileron stick to the right, which is the input for a right turn. The right aileron will move up, and the left aileron will move down. If not, check the radio instructions on how to reverse the direction electronically at the transmitter.





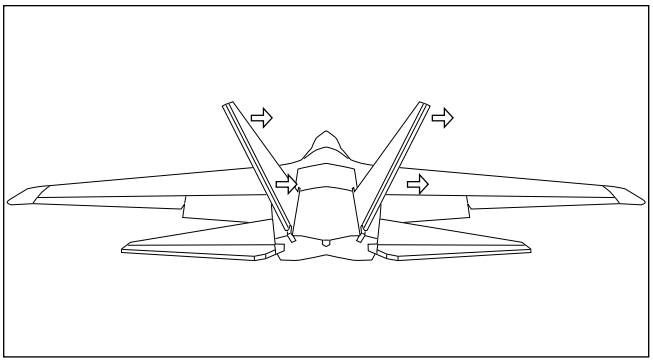
☐ Elevator

With the radio system still on, pull back on the elevator control stick to give an up elevator input. The elevator should move up from center. If not, check the radio instructions on how to reverse the direction electronically at the transmitter.



☐ Rudder

The final control surface direction to check is the rudder. With the radio system on, move the rudder stick to the right, this will make the plane turn right. The rudders should deflect to the right as well. If not, check the radio instructions on how to reverse the direction electronically at the transmitter.



Note: Operating the functions at the transmitter opposite as described will result in the control surfaces moving opposite as well.

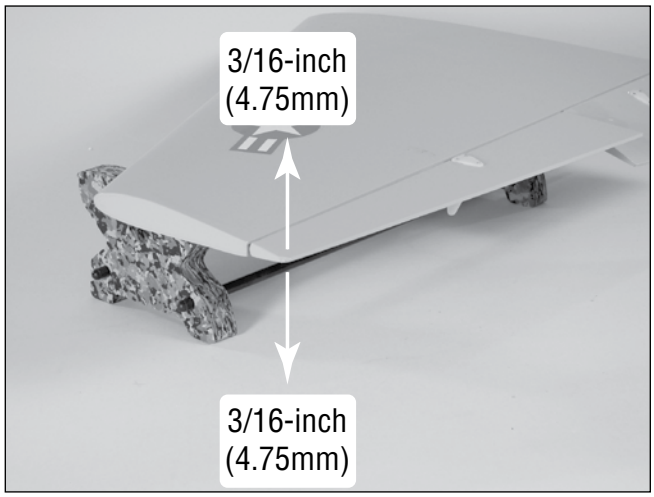
Section 13: Checking the Control Throw Amounts

After checking that the controls are moving in the correct directions, the amount of the control movement can be checked. By moving the control stick of each surface to its full deflection, you will measure the amount the surface has moved. By holding a ruler next to the surface and establishing a reference, use the radio to make the surface move and compare the measurements to those shown. The following photos show how to measure the control rates with the throws listed for the low rates for your F-22 Raptor.

The control throws for your F-22 Raptor are as follows:

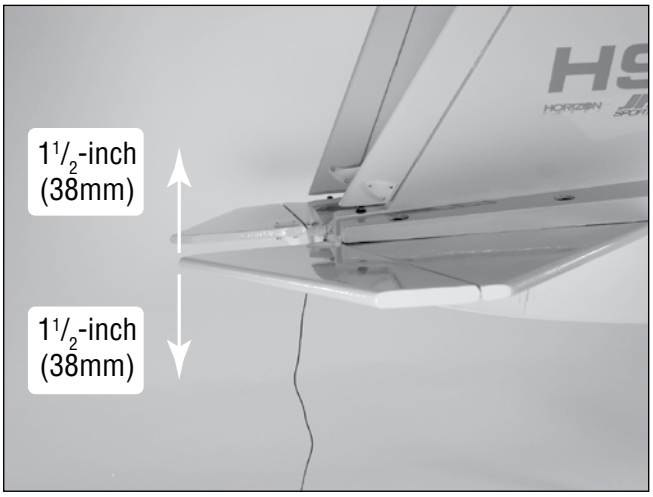
Aileron Rate: 3/16-inch (4.75mm) up and down

> **Note**: Measure the aileron throw at the wing tip.

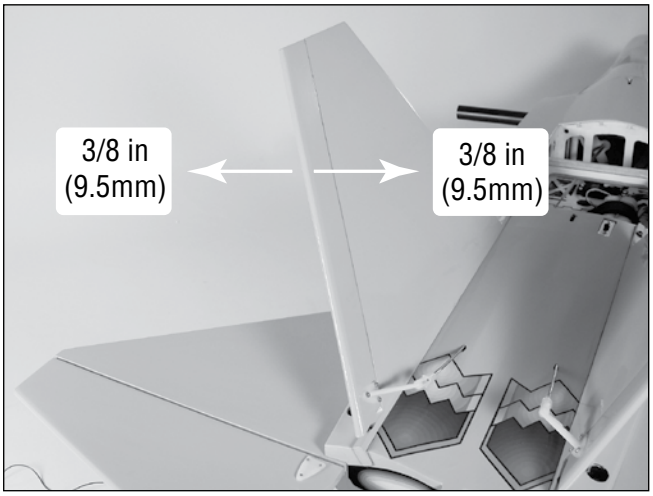


Elevator Rate: 1 $^{1}/_{2}$-inch (38mm) up and down

> **Note**: Measure the elevator throw at the widest part of the elevator.



Rudder Rate: 3/8-inch (9.5mm) left and right



> **Hint**: Place your ruler on a solid surface, rather than hold it in the air, to take measurements. This will guarantee your ruler is not moving. If the ruler is moving you will get inaccurate readings.

If the throws of the control surfaces are not moving the amounts as described, you may need to change the Travel Adjustment setting in the radio. To do so, read the section in the radio manual on programming the radio.

Section 14: Adjusting the Throttle

With the radio system on, move the trim lever and throttle lever towards the bottom of the transmitter. Look into the carburetor to check that the barrel is closed.

Move the trim lever up towards the top of the transmitter. The barrel in the carburetor should have an opening of around 1/16-inch (1.5mm).

Move the throttle stick toward the top of the transmitter. The carburetor will now be in the fully open position.

If the throttle is not operating as described, you may need to change the Travel Adjustment setting in the radio. To do so, read the section in the radio manual on programming the radio.

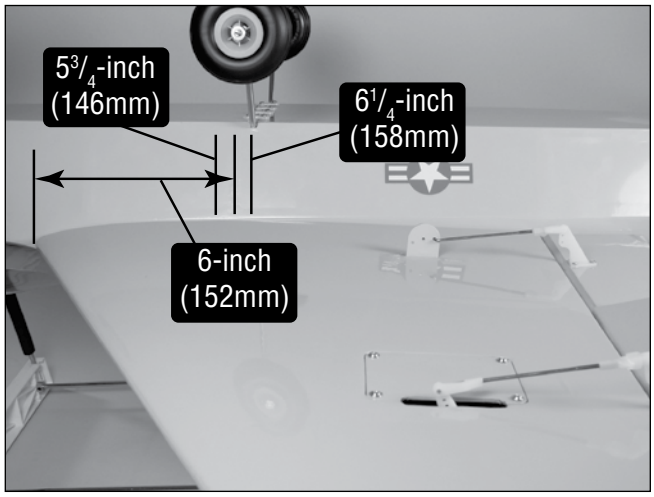
> **Note**: Once all the radio adjustments are complete, remember to turn off both the receiver and the transmitter.

Section 15: Balancing Your F-22 Raptor

In order for your F-22 Raptor ARF to fly correctly, you will need to check the balance of the plane with the fuel tank empty. This is done by supporting the aircraft either using your fingers or by using a balancing stand. Not checking the balance can result in an aircraft that is difficult to fly, which can lead to the possibility of crashing your model.

☐ Marking the Balance Point

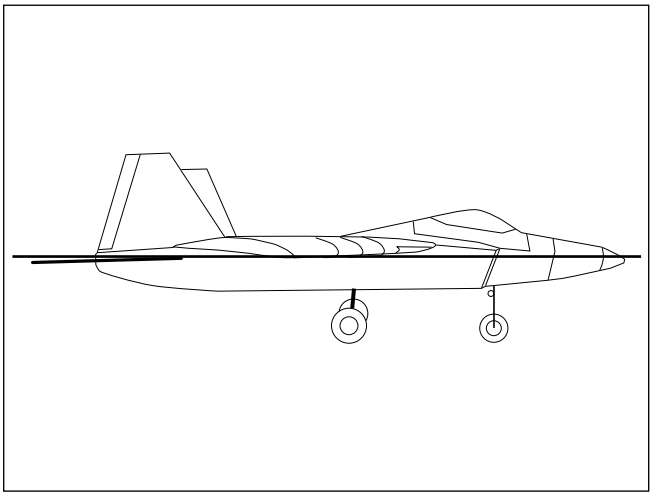
The first step in balancing your F-22 Raptor ARF is to mark the location for the balance point. The ideal balance point for the F-22 Raptor ARF is 6 inches (152mm) back from the leading edge against the fuselage, but it can vary up to 1/4-inch (6mm) in front or behind the 6-inch mark without causing any problems. If your plane is only slightly out of balance, try placing the balancing stand towards the nose or tail by this 1/4-inch (6mm) and recheck the balance. If it looks good and sits level, then you're good to go!



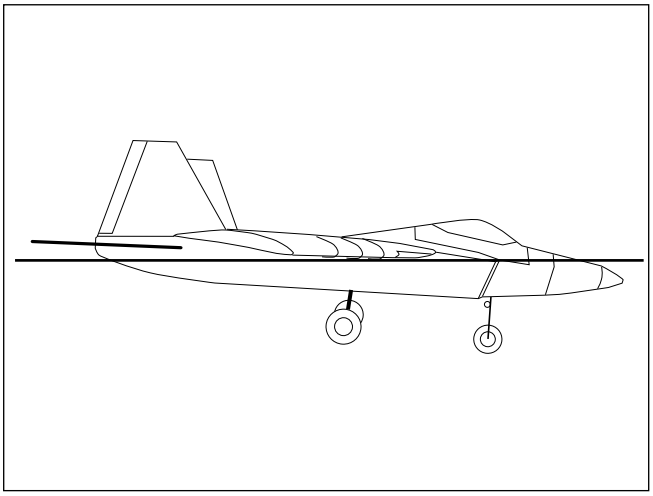
☐ Lifting the Model and Observations

Make sure the F-22 Raptor ARF is balanced using either your fingers or a balancing stand. Place or lift the airplane so it is supported at the marks made in the previous step. The plane will rest level when balanced correctly. If not, weights must be added to correct any balancing problems.

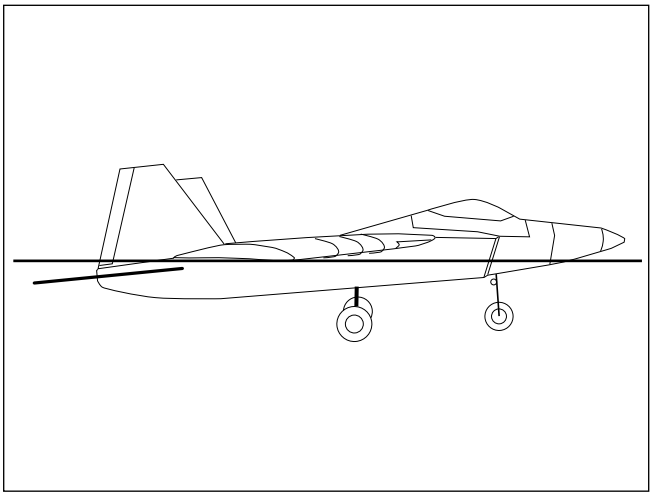
Balanced Correctly



Nose Heavy – Add Weight to Tail

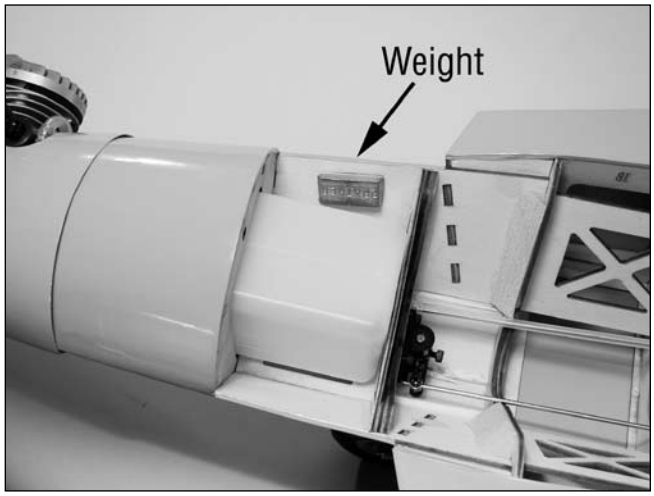


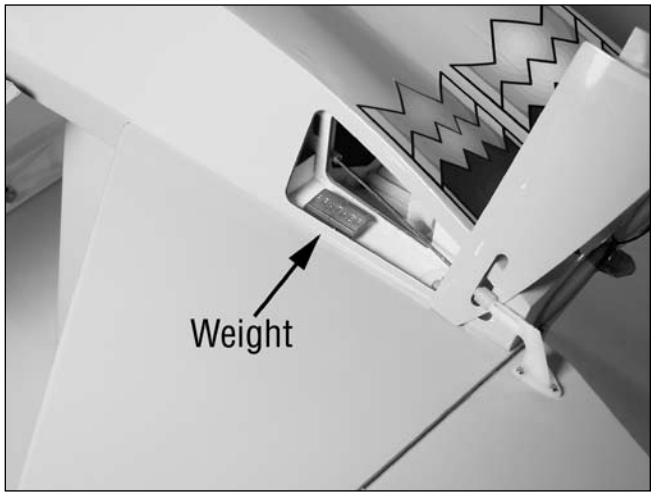
Tail Heavy – Add Weight to Nose



Adding Weights to Correct the Balance

Due to manufacturing differences, it is possible that the F-22 Raptor ARF may not be balanced properly. Weights can be added to either the tail or the nose of your F-22 Raptor ARF if it does not balance properly. Stick-on weights available at your local hobby store are the easiest to use, and come in sizes that are easily placed on your plane. Add just enough weight as necessary to balance your plane. Once the weight has been added, make sure it is secure and will not fall off in flight.





Section 16: Flight Preparations

Flight preparations are the items you must check each time you travel to the flying field. Because the F-22 Raptor ARF will encounter a variety of situations, it is best to keep an eye on the various components of your model to keep it in the best flying condition.

☐ Checking the Frequency

When at the field, check to see if there is some form of frequency control in use. Usually there are clips each pilot will use signifying the channel their plane is flying on. This will prevent other pilots from turning on their radio systems and having more than one pilot using the same frequency. Operating two aircraft at the same time on a single frequency will lead to the demise of one or both aircraft.

When using a Spektrum® radio system, follow the guidlines for use of DSM radio systems at your particular field.

☐ Checking the Controls

Before starting your engine, check to make sure the controls are operating in the correct directions and the linkages and surfaces are not binding anywhere. Also look at the clevises and clevis retainers to make sure they are secure and will not come loose or fail in flight.

☐ Range Check the Radio

A range check should be part of the preflight process as well. The instructions provided with your radio system will detail the correct procedure for checking the range of your particular radio system. This procedure is best done with a partner to hold your aircraft and check for any abnormalities.

☐ Fueling the F-22 Raptor ARF

Fill the fuel tank with the proper fuel. Fill the tank by connecting the fuel pump to the line going to the needle valve. Disconnect the fuel line attached to the pressure fitting of the muffler; your tank is full when fuel begins to run out of the pressure line. Reconnect the fuel lines to the needle valve assembly and muffler.

> **Note**: It is very important to reconnect the lines to the correct place. If they are reconnected incorrectly, the engine will not run properly.

Section 17: Maintaining Your F-22 Raptor ARF

The following is a check list that you should follow every time you have completed a flying session with your F-22 Raptor. Doing so will keep your aircraft in the best flying condition.

☐ Clean Up

After a long flying session with your F-22 Raptor ARF, you will want to clean it up before loading it into your vehicle to head home. Use a cleaner such as Windex or 409 and a paper towel to wipe down the exterior of your plane, removing the fuel residue. Remember a clean plane will last longer since the fuel won't be allowed to soak into any exposed wood.

☐ Checking the Propeller

Check to make sure the propeller is tightly secured to the engine. If not, remove the spinner and use an adjustable wrench to tighten it back down. If you have had any not-so-great landings, you will want to inspect the propeller for any damage. Small nicks and scratches can quickly become fractures, causing the propeller to be unsafe for flight. Always carry a few spare propellers so a damaged propeller can be replaced at the field, increasing your flying time per trip to the field.

☐ Checking the Clevises

Inspect the aileron, elevator and rudder clevises to make sure they are connected and in good working order. If you find a clevis that is showing signs of wear or is broken, replace it with a new clevis. Also check the nylon connectors at the servo for any wear or damage. If they look worn or in bad shape, replace them as well.

☐ Checking the Control Horns

Inspect the control horns to make sure they have not crushed the wood of the control surface. If so, remove the control horn screws to remove the control horn. Place 2–3 drops of thin CA into each of the screw holes. In addition, use a T-pin to poke small holes in the covering in the area where the control horn mounts, then saturate the area with thin CA. This will harden the wood and give the control horns a solid surface to be mounted to.

☐ Checking the Wheel Collars

Check the setscrews on the main and nose wheel collars, as well as the wheel collars on the elevator linkage, to make sure they are not loose. Use a hex wrench or Phillips screwdriver as necessary to tighten the setscrews. It is suggested if they loosen frequently to remove them, apply threadlock to the setscrews, then secure the wheel collars back into position.

☐ Check the Muffler Bolts

Use a 2.5mm hex wrench to make sure the bolts holding the muffler onto the engine are tight and have not vibrated loose during flight.

☐ Check the Engine Mount Bolts

Remove the spinner and propeller from the engine. Remove the exhaust stacks from the fuselage, and then remove the cowling from the fuselage. Remove the muffler from the engine, and then use a Phillips screwdriver to make sure the four bolts securing the engine to the mount are tight.

2007 Official AMA National Model Aircraft Safety Code

GENERAL

1) I will not fly my model aircraft in sanctioned events, air shows or model flying demonstrations until it has been proven to be airworthy by having been previously, successfully flight tested.

2) I will not fly my model higher than approximately 400 feet within 3 miles of an airport without notifying the airport operator. I will give right-of-way and avoid flying in the proximity of full-scale aircraft. Where necessary, an observer shall be utilized to supervise flying to avoid having models fly in the proximity of full-scale aircraft.

3) Where established, I will abide by the safety rules for the flying site I use, and I will not willfully and deliberately fly my models in a careless, reckless and/or dangerous manner.

4) The maximum takeoff weight of a model is 55 pounds, except models flown under Experimental Aircraft rules.

5) I will not fly my model unless it is identified with my name and address or AMA number, on or in the model. (This does not apply to models while being flown indoors.)

6) I will not operate models with metal-bladed propellers or with gaseous boosts, in which gases other than air enter their internal combustion engine(s); nor will I operate models with extremely hazardous fuels such as those containing tetranitromethane or hydrazine.

7) I will not operate models with pyrotechnics (any device that explodes, burns, or propels a projectile of any kind) including, but not limited to, rockets, explosive bombs dropped from models, smoke bombs, all explosive gases (such as hydrogen-filled balloons), or ground mounted devices launching a projectile. The only exceptions permitted are rockets flown in accordance with the National Model Rocketry Safety Code or those permanently attached (as per JATO use); also those items authorized for Air Show Team use as defined by AST Advisory Committee (document available from AMA HQ). In any case, models using rocket motors as a primary means of propulsion are limited to a maximum weight of 3.3 pounds and a G series motor. (A model aircraft is defined as an aircraft with or without engine, not able to carry a human being.)

8) I will not consume alcoholic beverages prior to, nor during, participation in any model operations.

9) Children under 6 years old are only allowed on the flight line as a pilot or while receiving flight instruction.

RADIO CONTROL

1) I will have completed a successful radio equipment ground range check before the first flight of a new or repaired model.

2) I will not fly my model aircraft in the presence of spectators until I become a qualified flier, unless assisted by an experienced helper.

3) At all flying sites a straight or curved line(s) must be established in front of which all flying takes place with the other side for spectators. Only personnel involved with flying the aircraft are allowed at or in the front of the flight line. Intentional flying behind the flight line is prohibited.

4) I will operate my model using only radio control frequencies currently allowed by the Federal Communications Commission. (Only properly licensed Amateurs are authorized to operate equipment on Amateur Band frequencies.)

2007 Official AMA National Model Aircraft Safety Code

5) Flying sites separated by three miles or more are considered safe from site-to site interference, even when both sites use the same frequencies. Any circumstances under three miles separation require a frequency management arrangement, which may be either an allocation of specific frequencies for each site or testing to determine that freedom from interference exists. Allocation plans or interference test reports shall be signed by the parties involved and provided to AMA Headquarters. Documents of agreement and reports may exist between (1) two or more AMA Chartered Clubs, (2) AMA clubs and individual AMA members not associated with AMA Clubs, or (3) two or more individual AMA members.

6) For Combat, distance between combat engagement line and spectator line will be 500 feet per cubic inch of engine displacement. (Example: .40 engine = 200 feet.); electric motors will be based on equivalent combustion engine size. Additional safety requirements will be per the RC Combat section of the current Competition Regulations.

7) At air shows or model flying demonstrations, a single straight line must be established, one side of which is for flying, with the other side for spectators.

8) With the exception of events flown under AMA Competition rules, after launch, except for pilots or helpers being used, no powered model may be flown closer than 25 feet to any person.

9) Under no circumstances may a pilot or other person touch a powered model in flight.

Organized RC Racing Event

10) An RC racing event, whether or not an AMA Rule Book event, is one in which model aircraft compete in flight over a prescribed course with the objective of finishing the course faster to determine the winner.

A. In every organized racing event in which contestants, callers and officials are on the course:

1. All officials, callers and contestants must properly wear helmets, which are OSHA, DOT, ANSI, SNELL or NOCSAE approved or comparable standard while on the racecourse.

2. All officials will be off the course except for the starter and their assistant.

3."On the course" is defined to mean any area beyond the pilot/staging area where actual flying takes place.

B. I will not fly my model aircraft in any organized racing event which does not comply with paragraph A above or which allows models over 20 pounds unless that competition event is AMA sanctioned.

C. Distance from the pylon to the nearest spectator (line) will be in accordance with the current Competition Regulations under the RC Pylon Racing section for the specific event pending two or three pylon course layout.

11) RC night flying is limited to low-performance models (less than 100 mph). The models must be equipped with a lighting system that clearly defines the aircraft's position in the air at all times.

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