Funtana 125 ARF

Assembly Manual

HANGAR 9®

Fly First Class™

Specifications

Wingspan	*69.5 in (1765 mm)*
Length	*68.5 in (1745 mm)*
Wing Area	*1108 sq in (71.5 sq dm)*
Weight	*8.0–8.5 lb (3.63–4.03 kg)*
Engine Size	*.61–1.20 2-stroke; .90–1.25 4-stroke*
Motor Size	*90–110 brushless outrunner Motor*
Radio	*4-channels or more w/6 servos (5 w/electric option)*

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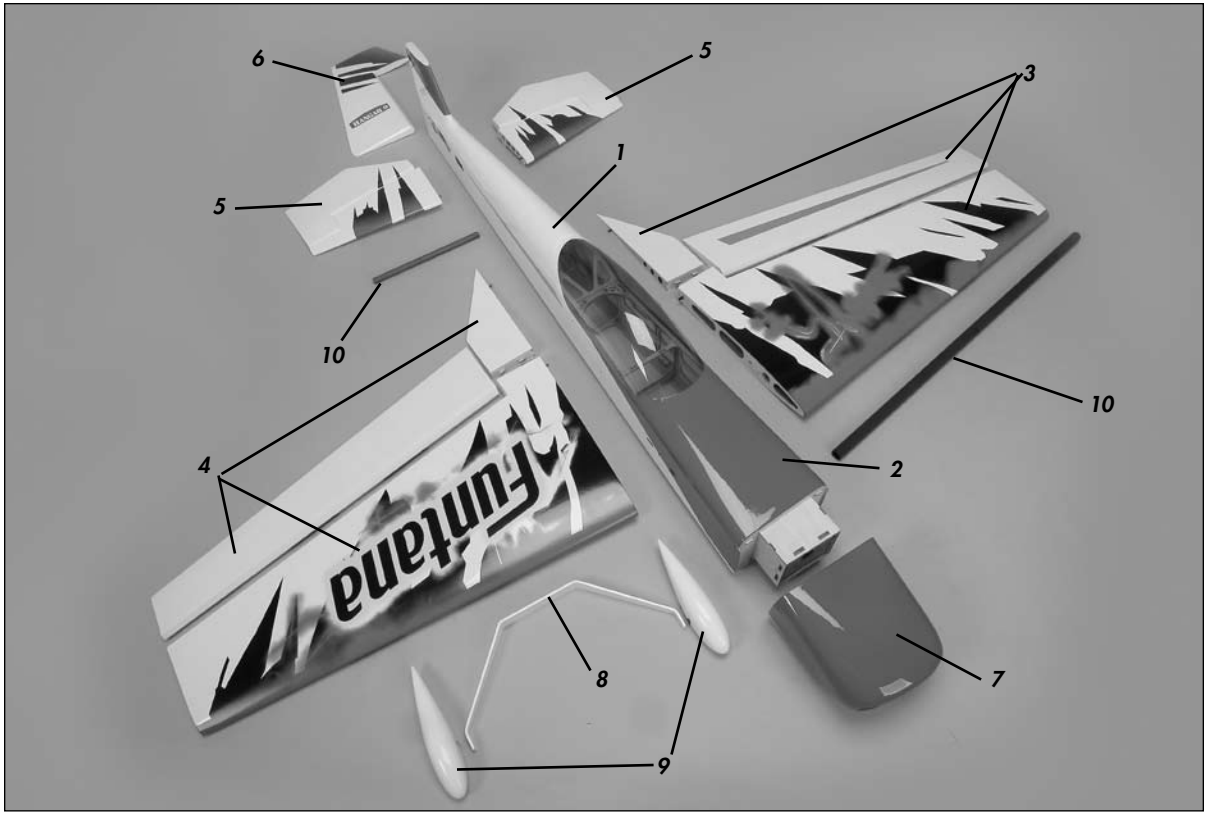


Contents of Kit and Parts Layout

Replacement Parts

1.	HAN47501	Fuselage with Hatch
2.	HAN47502	Fuselage Top Hatch
3.	HAN47503	Left Wing Panel
4.	HAN47504	Right Wing Panel
5.	HAN47505	Stabilizer with Elevators
6.	HAN47506	Rudder
7.	HAN47507	Cowl
8.	HAN47508	Landing Gear with Axles
9.	HAN47509	Wheel Pants (2)
10.	HAN475011	Wing and Stabilizer Tube, Carbon

Items not shown:

HAN475010	Axles (2)
HAN475013	Fuel Tank
HAN475014	Wheels, 3-inch (90mm)
HAN475015	EP Motor Box and Battery Tray
HAN475016	Engine Mount with Hardware
HAN475017	Small Parts
HAN475018	Pushrods
HAN475019	1¼-inch (30mm) Tail Wheel Assembly
HAN475020	Control Horns with Hardware
HAN475021	Ball Joints and Hardware
HAN475022	Wing Retention Nylon Bolts (2)

Optional accessories:

HAN475012	Side Force Generators

Included Parts Listing

Fuselage	1	
Left wing with aileron	1	
Right horizontal stabilizer with elevator	1	
Left horizontal stabilizer with elevator	1	
Rudder	1	
Canopy hatch	1	
Aluminum landing gear (white)	1	
Wheel pants (white)	2	
Wing trailing edge extensions	2	
Carbon fiber wing tube	1	
Carbon fiber stabilizer tube	1	
4mm x 30mm socket head cap screws	4	engine mount to firewall (4)
4mm x 25mm socket head cap screws	4	engine to engine mount (4)
4mm x 16mm socket head cap screws	3	landing gear to fuse (3)
3mm x 16mm socket head cap screws	2	canopy hatch (2)
3mm x 12mm socket head cap screws	14	cowling to fuse (4); wheel pants to landing gear (2); stabilizer to fuse (4); SFG's (4)
1/4-20 x 3/4-inch nylon wing bolts	2	wing to fuselage (2)
4mm silver flat washer	17	mount to firewall (4); engine to mount (8); landing gear to fuse (3); wheel axles to landing gear (2)
3mm silver fender washers	12	wheel pants to landing gear (2)
3mm silver flat washer	10	cowling to fuse (4); stabilizer to fuse (4); canopy hatch to fuse (2)
3mm x 16mm socket head cap screws	5	ball-links
3mm ball links	5	rudder, elevator, and ailerons
3mm locknuts	5	rudder, elevator, and ailerons
3mm x 27mm control horn w/base	5	rudder, elevator, and ailerons
Nylon clevis	5	rudder, elevator, and ailerons
Nylon horn bracket	5	rudder, elevator, and ailerons
2mm x 16mm sheet metal screws	15	control horn attachment
2mm x 12mm phillips machine screw	5	horn brackets to nylon clevis
2mm silver flat washers	10	horn brackets to nylon clevis
2mm nylocks	5	horn brackets to nylon clevis
4mm wheel axles	2	
2mm x 16mm sheet metal screws	2	tail wheel to fuselage
4mm lock nuts	6	wheel axles (2); engine to engine mount (4)
4mm wheel collars	4	main landing gear assembly
2mm wheel collar	2	tailwheel assembly
Pushrod connector with setscrew	1	throttle
CA hinges	15	
2mm x 12mm sheet metal screws	2	receiver tray
Plywood receiver tray	1	
Plywood EP battery tray	1	
3mm blind nut	2	wheel pant to landing gear
Plywood EP motor box	1	
4mm x 17mm socket head cap screws	8	EP motor box to firewall (4); EP motor to box (4)
4mm silver flat washers	8	EP motor box to firewall (4); EP motor to box (4)
4mm lock nuts	4	EP motor to box
3-inch (90mm) rubber wheels	2	main landing gear
$1^1/_4$-inch (30mm) foam wheel	1	tail wheel
Black nylon motor mounts	2	
Tail wheel assembly with bracket	1	
Fuel tank	1	
Fuel stopper	1	
Brass tubing	3	
12-inch gas fuel line	3	medium diameter
12-inch glow fuel line	2	medium diameter; pink (1), green (1)
12-inch clunk line	2	small diamter
3mm x 146mm pushrod (two end thread)	2	elevator
3mm x 127mm pushrod (two end thread)	1	rudder
3mm x 70mm pushrod (two end thread)	2	ailerons
1.5mm x 495mm pushrod (one end thread)	1	throttle
$16^1/_2$-inch (450mm) clear plastic tube	1	throttle linkage guide

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.

UltraCote® Covering Colors

• Silver	HANU881
• White	HANU870

Before Starting Assembly

Before beginning the assembly of your model, 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 covering iron to remove them. Use caution while working around areas where the colors overlap to prevent separating the colors.

HAN100 – Heat Gun

HAN150 – Covering Glove

HAN101 – Sealing Iron

HAN141 – Sealing Iron Sock

Your model is covered in a printed version of UltraCote developed specifically for your Funtana 125. It has all the same properties as UltraCote. All the instructions provided with our original UltraCote apply to this new and exciting product.

Transmitter Requirements

The Funtana 125 ARF requires a minimum of a 4-channel radio to operate the functions of your aircraft. We suggest the following radio systems available through Horizon Hobby or your local hobby distributor.

Spektrum DX6i with receiver	SPM6600
Spektrum DX7 with receiver	SPM2710
JR Systems X9303 2.4GHz with receiver	JRP2915

Radio Equipment Requirements

Note: The elevator will require one standard rotation and one reverse rotation servo to operate correctly without the use of a computer radio. Two identical rotation servos can be used, but you will need to use a computer radio or a JR MatchBox™ to operate the servos in the correct direction for the elevator.

The following items are recommended when installing the receiver in your aircraft:

AR7000 7-Channel Receiver	SPM6070
DS9411 Digital Mid MG Servo (4)	JRPSDS9411
DS9411R Digital Mid MG Reverse Servo	JRPSDS9411R
DS821 Digital Sport Servo (Not required for EP version)	JRPS821
18-inch Servo Extension (3)	JRPA097
3-inch Servo Extension (2)	JSP98100 or
Y-harness (2)	JSP98020
JR Switch, Chargeswitch	JRPA004
Receiver Battery, 6-volt, 2700mAh	JRPB5008
Servo Arm, 1-inch (JR) (2)	HAN9154
Servo Arm, 1 1/2-inch (JR) (3)	HAN9151

Optional Items for Elevator Servo Install:

MatchBox Servo Matching/Power System	JRPA900
Y-Harness 6-inch with Reverser Heavy-Duty	EXRA325

Aileron Option 1:
DS9411 Digital Servo (2) (no mixing required)

- Y-harness (plugged into receiver)
- 6-inch extension (connected to servo) (2)
- Servo Arm, 1 1/2-inch (JR) (2)

Aileron Option 2:
DS9411 Digital Servo (2)
(requires mixing of aileron servos)

- 3-inch extension (plugged into receiver) (2)
- 6-inch extension (connected to servo) (2)
- Servo Arm, 1 1/2-inch (JR) (2)

Rudder: DS9411 Digital Servo

- 18-inch extension (connection between servo and receiver)
- Servo Arm, 1 1/2-inch (JR)

Elevator Option 1:
DS9411 Digital Servo and DS9411R Reverse Servo
(no mixing required)

- Y-harness (plugged into receiver)
- 18-inch extension (2) (connection between servo and receiver)
- Servo Arm, 1-inch (JR) (2)

Elevator Option 2:
DS9411 Digital Servo (2)
(requires mixing of elevator servos)

- 18-inch extension (2) (connection between servo and receiver)
- Servo Arm, 1-inch (JR) (2)

Elevator Option 3:
DS9411 Digital Servo (2)
(requires no mixing of elevator servos)

- 18-inch extension (2) (connection between servo and receiver)
- Servo Arm, 1-inch (JR) (2)
- MatchBox Servo Matching/Power System or
- Y-harness 6-inch with reverser

Throttle: DS821 Servo (Not required for electric version)

Use the Correct Propeller

The Funtana 125 was designed specifically for the 3D flight envelope, which favors thrust over speed. Flying your aircraft at high speeds may cause flutter due to the extremely large control surfaces. To keep the speed down and thrust up, use low-pitch propellers such as a 16 x 4 or 15 x 6 for engines such as the Saito™ 1.25 & FG-20

Recommended Setup–2-Stroke Glow

- Evolution® 120NX (EVO1200)
- APC Propeller, 16 x 4 wide (APC16040W)
- Evolution Propeller, 15 x 6 (EVO15060)
- Tru Turn 2 3/4-inch Spinner (TRU2502BW)
- Tru Turn Propeller Adapter (TRUTT0518A)
- Fuel Dot (HAN115)
- Bisson Evolution 1.20 Pitts Muffler (BIS05610)

Recommended Setup–4-Stroke Glow

- Saito™ 1.25 AAC w/Muffler (SAIE125A or SAIE125AGK)
- APC Propeller, 16 x 4 wide (APC16040W)
- Evolution Propeller, 15 x 6 (EVO15060)
- Tru Turn 2 3/4-inch Spinner (TRU2502BW)
- Tru Turn Propeller Adapter (TRUTT0828A)
- Fuel Dot (HAN115)
- Muffler 90-Degree Adapter (SAI120S140)

Recommended Setup–4-Stroke Gas

- Saito™ FG-20 4-Stroke Gas Engine (SAIEG20)
- APC Propeller, 16 x 4 wide (APC16040W)
- Evolution Propeller, 15 x 6 (EVO15060)
- Tru Turn 2 3/4-inch Spinner (TRU2502BW)
- Tru Turn Propeller Adapter (TRUTT0828A)
- Fuel Dot (HAN115)
- Muffler 90-Degree Adapter (SAI120S140)
- JR Switch, Chargeswitch (JRPA004)
- Ignition battery, 6-volt 2300mAh (JRPB5006)

Recommended Setup–Power 110 (EP)

- E-flite® Power 110 BL Outrunner Motor (EFLM4110A)
- 110-Amp Speed Control (CSEPHX110HV)
- APC Propeller, 16 x 12 (APC16012E)
- APC Propeller, 17 x 10 (APC17010E)
- Li-Po Battery, 5000mAh 4-Cell/4S 14.8V (2) (THP50004SP30)
- Tru Turn 2 3/4-inch Spinner (TRU2502BW)
- 24-inch (610mm) Servo Extension (JSP98040)

Field Equipment Required

- Fuel (15% recommended)
- Propeller
- Long Reach Glow Plug Wrench (HAN2510)
- Metered Glow Driver w/Ni-Cd & Charger (HAN7101)
- 2-Cycle Sport Plug (EVOGP1)
- Manual Fuel Pump (HAN118)

Optional Field Equipment

- Hinge gap sealing tape
  or
- UltraCote covering (white or clear)
- Selfstick weights, 6 oz (HAN3626)
- PowerPro 12V Starter (HAN161)
- 12V 7Ah Sealed Battery (HAN102)
- Power Panel (HAN106)
- Blue Block After Run Oil Applicator (EVOX1001)
- Blue Blocker After Run Oil Refill (EVOX1002)
- Cleaner and towels

Optional Side Force Generators

Your Funtana 125 has been prepared to use the optional Side Force Generators (HAN475012). In addition, you will need to purchase four 3mm washers and four 3mm x 12mm hex head bolts to attach them to the wing tips. The instructions cover their installation.

Additional Required Tools

Card stock	Covering iron
Clear plastic or waxed paper	Clear tape
Drill	Epoxy brush
Felt-tipped pen	Flat file
Hex wrench: 1.5mm, 3/32-inch, 2.5mm, 3mm	
Hobby knife with #11 blade	Hinge tape
Hobby scissors	Hook and loop strap
Light oil	Low-tack tape
Medium grit sandpaper	Mixing cup
Mixing stick	Music wire: 1/32-inch
Open end wrench: 10mm	Paper towel
Pencil	Phillips screwdriver: #1
Pin vise	Pliers
Rubbing alcohol	Ruler
Small hammer	Solder
Soldering iron	String or dental floss
T-pins	
Drill bit: 1/16-inch (1.5mm), 9/64-inch (3.5mm), 5/32-inch (4mm)	
Foam rubber: 1/4-inch (6mm)	
Hex wrench (to fit spinner bolt)	
Nut driver: 4mm, 1/4-inch or 5.5mm, 7mm	
Rotary tool with sanding drum	

Additional Required Adhesives

• Canopy Glue	(PAAPT56)
• Thin CA	(PAAPT08)
• Threadlock	(PAAPT42)
• 30-Minute Epoxy	(HAN8002)

Important Information Regarding Warranty Information

Please read our Warranty and Liability Limitations section on Page 55 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 to the place of purchase.

FS One®

With FS One (HANS2000) you get more than photorealistic fields, gorgeous skies and realistic-looking aircraft. You get incredibly advanced aerodynamic modeling that simulates every possible aspect of real-world flight.

The first Hangar Pack (HANS4010) will add even more aircraft to FS One. This latest edition includes ten new planes and helis from your favorite brands, including Hangar 9, E-flite and Align. You'll be able to fly aircraft that are only available on FS One such as the T-REX, Blade CX2, Blade CP Pro, Hangar 9 P-51 and F-22 PTS. And as always, with the Hangar Pack, you still get all the same great features that you did with the original aircraft.

HANS2008

HANS4010

Radio Installation

Required Parts

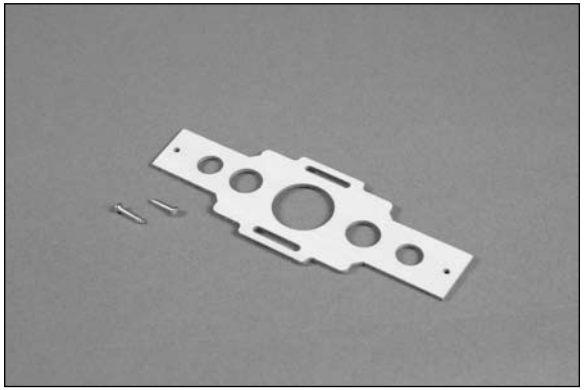
Fuselage
Plywood receiver tray
Servo with hardware (3) (Rudder (1), Elevator (2)
Receiver
Switch harness with hardware
3-inch (76mm) servo extension (2) (ailerons)
18-inch (457mm) servo extension (rudder)
18-inch (457mm) servo extension (2) (elevator)
2mm x 12mm self-tappng screw (2)
Receiver battery (gas or glow option)
Servo with hardware (gas or glow option)

Tools and Adhesives

Drill bit: 1/16-inch (1.5mm)
Pin vise
Thin CA
Phillips screwdriver: #1
Hook and loop strap
Foam rubber: 1/4-inch (6mm)

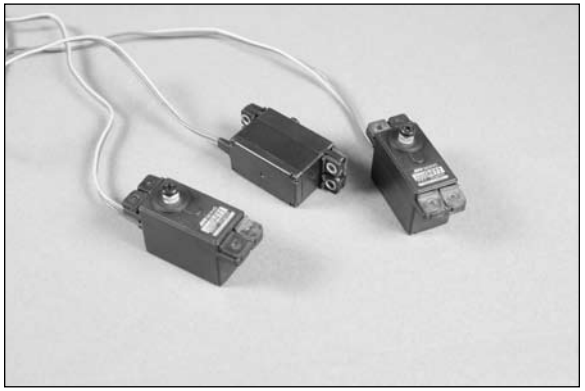
☐ Step 1

Locate the items necessary to install the radio components included with your model.



☐ Step 2

Prepare the rudder and elevator servos by installing the grommets and brass eyelets in each servo. Remove the servo arms from the servos at this time.



☐☐ Step 3

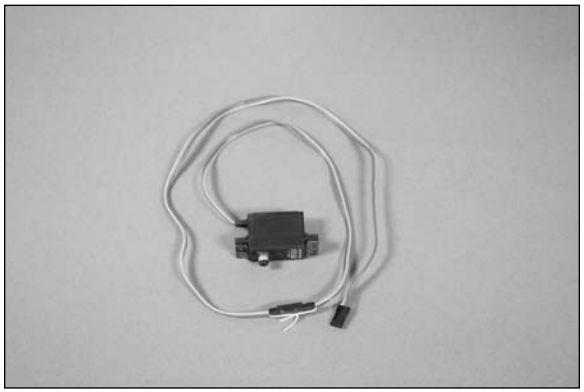
Place the rudder servo in the opening in the left side of the fuselage with the output of the servo facing toward the rear of the model as shown. Make sure the servo is centered in the opening. Use a pin vise and 1/16-inch (1.5mm) drill bit to drill the four holes for the servo mounting screws.

☐☐ Step 4

Remove the servo. Place 2–3 drops of thin CA in each of the holes to harden the surrounding wood. This harder surface for the servo mounting screws makes them less likely to vibrate loose.

☐☐ Step 5

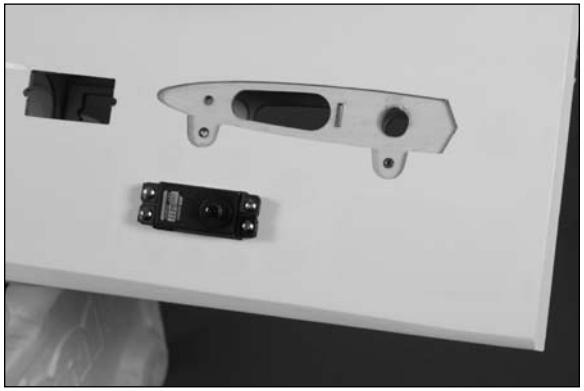
Secure an 18-inch (457mm) servo extension to the rudder servo lead using string or dental floss. This will keep the connection from disconnecting inside the fuselage.



Hint: Tie a small piece of string or place a piece of tape on the end of the extension so you can differentiate the rudder lead from the elevator leads later in this section of the manual.

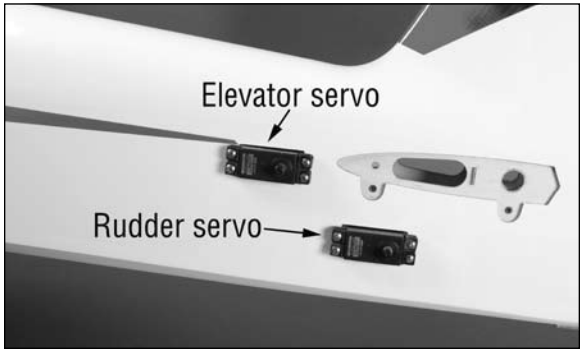
☐☐ Step 6

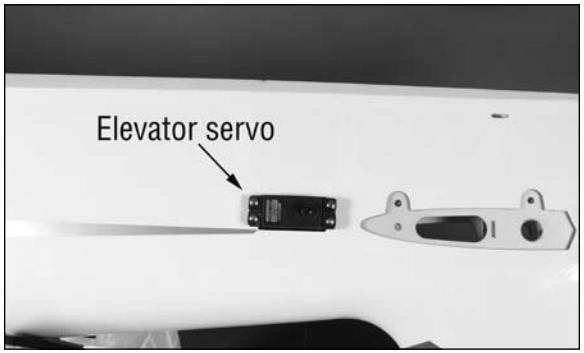
Mount the servo using the four screws that were included with the servo. Tighten the screws using a #1 Phillips screwdriver.



☐ Step 7

Repeat Steps 3 through 6 to install the two elevator servos. Make sure the output of the servos face to the rear of the fuselage.



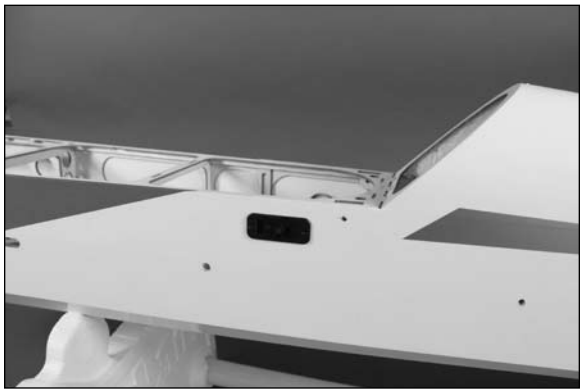


☐ Step 8

Use a hobby knife with a #11 blade to remove the covering from the side of the fuselage to expose the opening for the receiver switch.

☐ Step 9

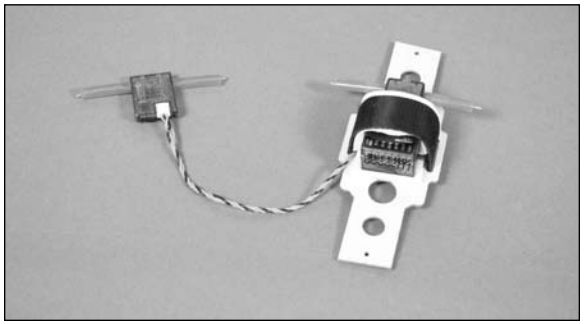
Mount the switch to the side of the fuselage using the hardware provided with the switch. Use a #1 Phillips screwdriver to tighten the screws that secure the switch in position.



☐ Step 10

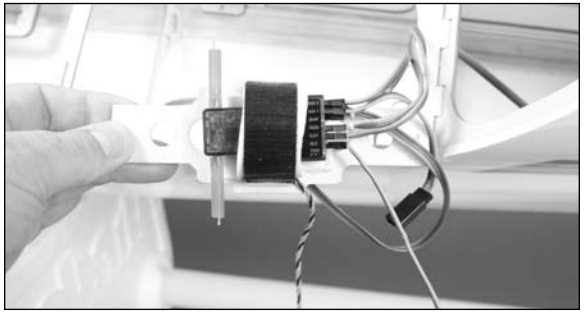
Locate the plywood receiver tray. Use 1/4-inch (6mm) foam and a hook and loop strap to secure the receiver to the tray. Make sure the foam isolates the receiver from vibrations that could be transferred to it through the tray or strap.

Note: Small pieces of fuel tubing can be placed over the antenna of the receivers to keep them straight for the best reception from your radio system.



☐ Step 11

Plug the elevator and rudder servo leads into the receiver. Two 3-inch (76mm) extensions will be required for the ailerons. Finally, plug the switch into the receiver as well.

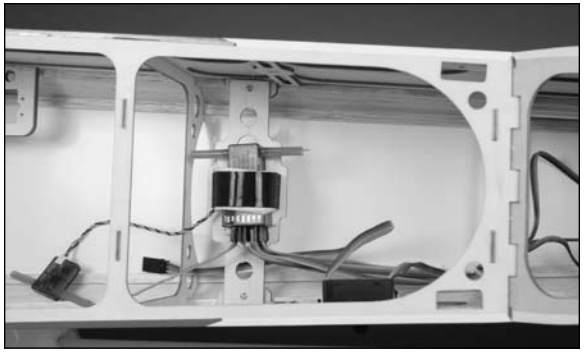


Note: We are using a computer radio and mixing the two elevator channels and two aileron channels to operate correctly. If you are not using a computer radio, we highly recommend the use of the JR MatchBox to operate the elevator and aileron servos.

Important: Using a Y-harness for the elevator servos will make them rotate in opposite directions. A MatchBox, reverse servo, reversing Y-harness, or best yet, a computer radio, will be required for the elevator servos.

☐ Step 12

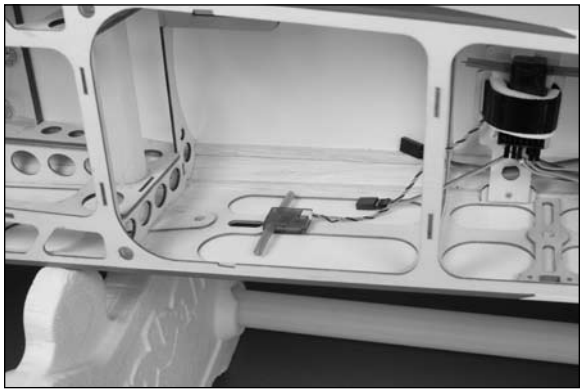
Mount the receiver tray in the fuselage using two 2mm x 12mm self-tapping screws. Use a #1 Phillips screwdriver to tighten the screws. Make sure to harden the holes for the screws by placing 2–3 drops of thin CA in each hole before installing the screws.



Hint: Secure any excess servo extensions using tie-wraps or clear tape to clean up the radio installation.

☐ Step 13

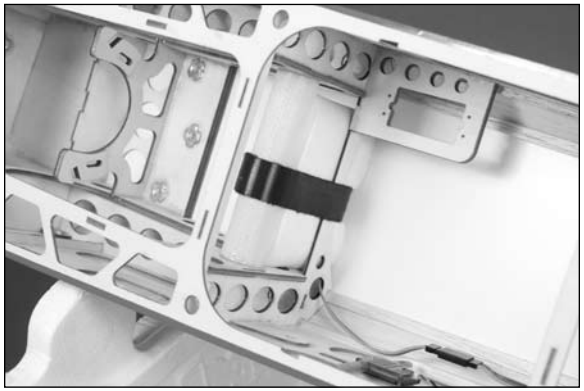
Use hook and loop tape or two-sided tape to secure the remote receiver inside the fuselage. The remote receiver should be as far away from the main receiver as possible and the antenna oriented vertically for the best radio reception.



Note: The following steps detail installing the receiver battery pack and throttle servo. If you are building your model for electric flight you can skip to the next section of the manual.

☐ Step 14

Wrap the receiver battery in 1/4-inch (6mm) foam. Use a hook and loop strap to secure it under the wing tube inside the fuselage. The strap will go over the tube and behind the former to keep the battery from moving inside the airframe. Make sure not to damage the wing tube when tightening the hook and loop strap. Connect the battery to the lead from the switch.



☐ Step 15

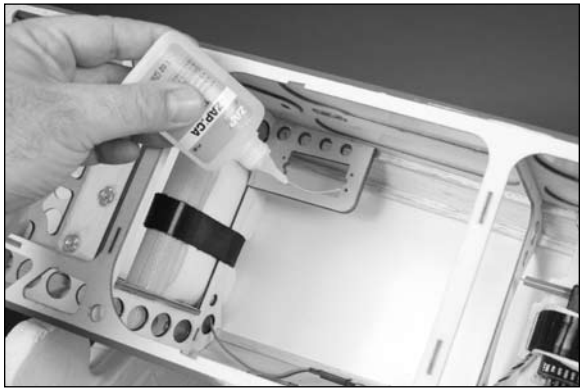
If you haven't done so already, you will need to bind your radio system. Follow the instructions provided with the radio to do so.

☐ Step 16

Thread a servo mounting screw into each of the holes in the throttle servo tray. This will cut threads for the screws. Use a #1 Phillips screwdriver for this step.

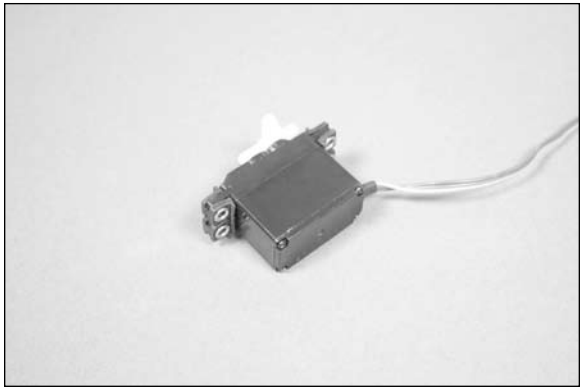
☐ **Step 17**

Place 2–3 drops of thin CA into each of the four holes to harden the thread. This will keep the screws from vibrating loose in flight.



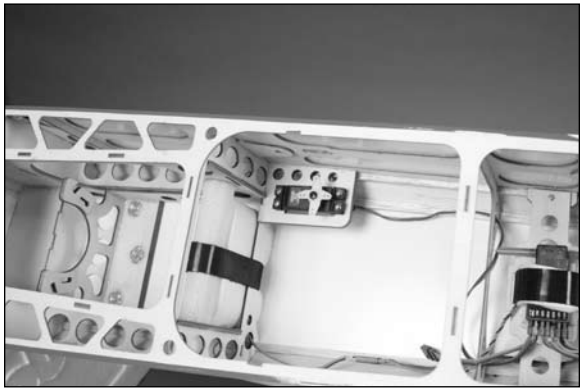
☐ **Step 18**

Prepare the throttle servo by installing the grommets and brass eyelets as described in the servo instructions.



☐ **Step 19**

Secure the throttle servo in the fuselage using the screws provided with the servo and a #1 Phillips screwdriver. Plug the throttle servo into the receiver at this time.



Hinging the Elevators and Ailerons

Required Parts

Elevator (2)	CA hinge (14)
Stabilizer (right and left)	Wing panel (right and left)
Aileron (right and left)	Control horn (4)
Control horn end (4)	
2mm x 16mm self-tapping screw (12)	

Tools and Adhesives

Ruler	Felt-tipped pen
Phillips screwdriver: #1	Drill
Drill bit: 1/16-inch (1.5mm)	Low-tack tape
Pin vise	Thin CA
Hobby knife with #11 blade	Hinge tape
T-pins	

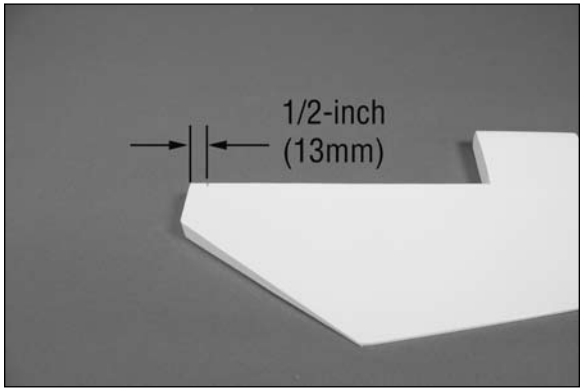
HINGING THE ELEVATORS

☐ **Step 1**

Locate the items required to hinge the elevators and ailerons. In addition, locate the hardware necessary to install the control horns at this time as well.

☐☐ **Step 2**

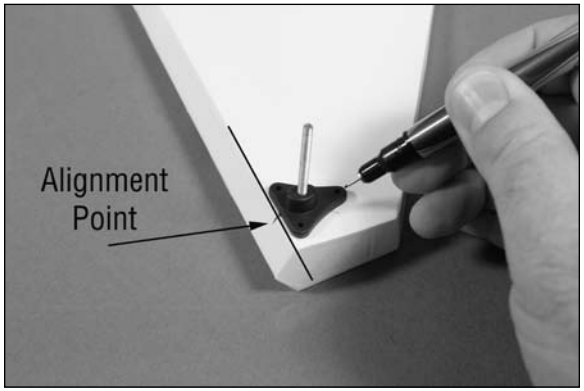
Measure in 1/2-inch (13mm) from the inside edge of the elevator on the bottom. This will mark the center for the control horn.



Note: The bottom of the elevator will have no black trim. The trim is on the top of the elevator, and will align with the trim on the top of the stabilizers.

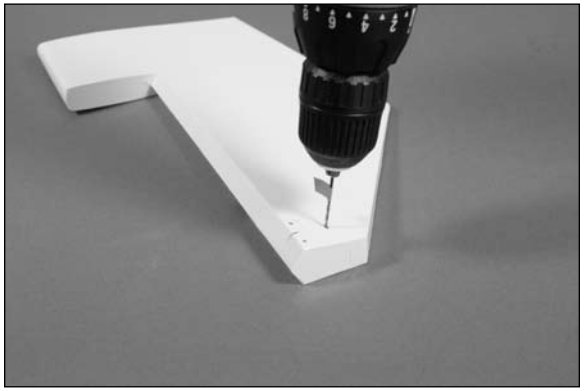
☐☐ **Step 3**

Position the control horn on the elevator. The front (straight edge of the horn) will align with the tapered edge of the hinge line as shown. Align the center line of the horn aligned with the mark made in the previous step. Use a felt-tipped pen to transfer the location for the three mounting holes on the elevator.



☐☐ **Step 4**

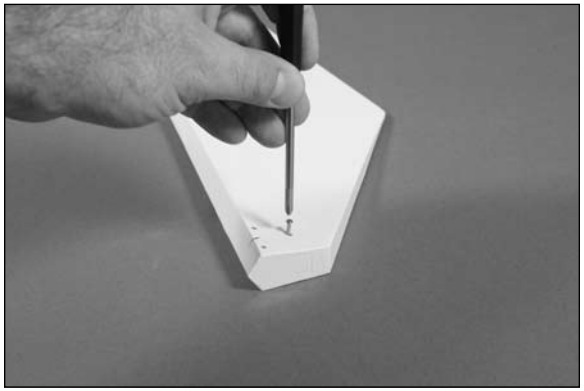
Use a drill and 1/16-inch (1.5mm) drill bit to drill the holes for the horn mounting screws. Drill the holes 5/8-inch (16mm) deep.



Hint: Wrap a piece of tape around the drill bit so you can drill the depth of the holes accurately. The tape will indicate when you reach the proper depth.

☐☐ **Step 5**

Use a #1 Phillips screwdriver to thread a 2mm x 16mm self-tapping screw into each of the holes. This will cut threads in the wood.

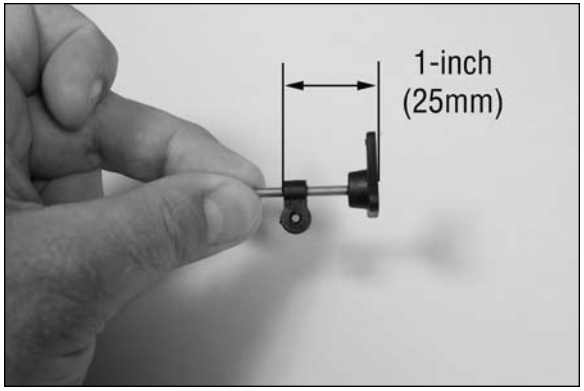


☐☐ **Step 6**

Place 2–3 drops of thin CA into each hole. This will harden the threads and prevent the screws from pulling loose.

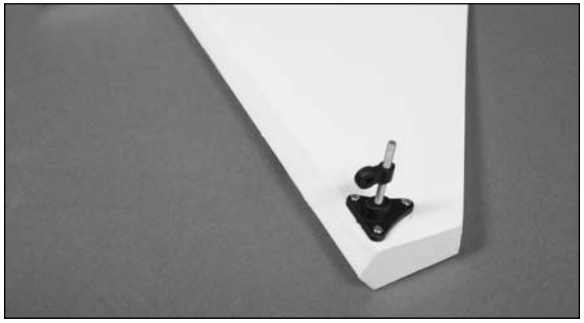
☐☐ **Step 7**

Thread a control horn end on the control horn until the top edge of the end is 1-inch (25mm) from the base of the horn as shown.



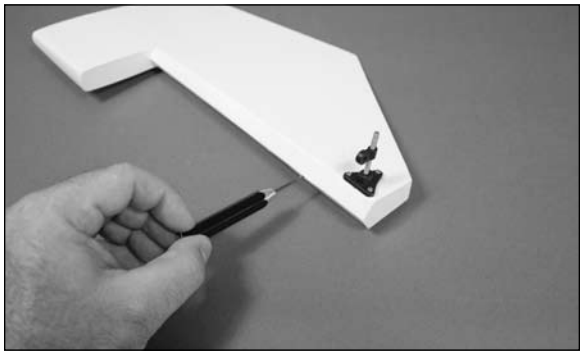
☐☐ Step 8

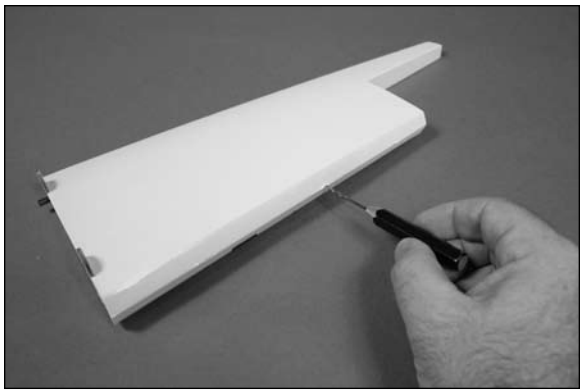
Secure the control horn to the elevator using three 2mm x 16mm self-tapping screws and a #1 Phillips screwdriver.



☐☐ Step 9

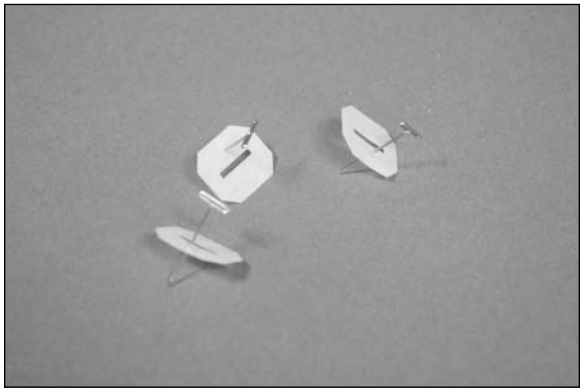
Use a pin vise and a 1/16-inch (1.5mm) drill bit to drill a hole in the center of each of the three hinge slots in the stabilizer and elevator. This creates a tunnel for the CA to wick into, making a better bond between the hinge and surrounding wood.





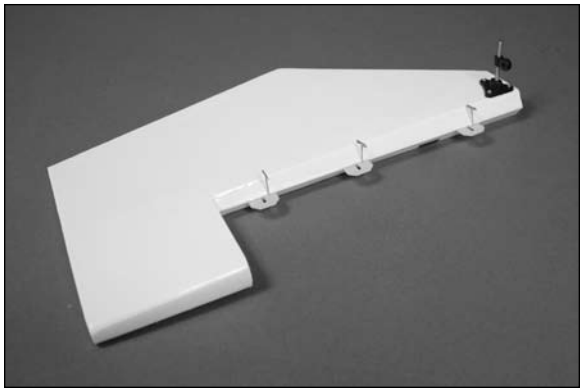
☐☐ Step 10

Place a T-pin in the center of each of the three hinges that will be used to hinge the elevator to the stabilizer. The T-pins will center the hinge evenly in both the elevator and stabilizer.



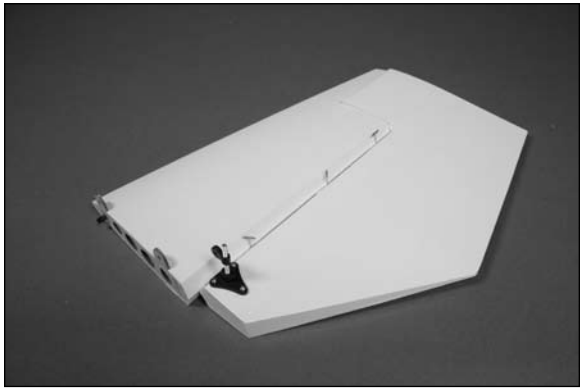
☐☐ Step 11

Slide the hinges into the elevator.



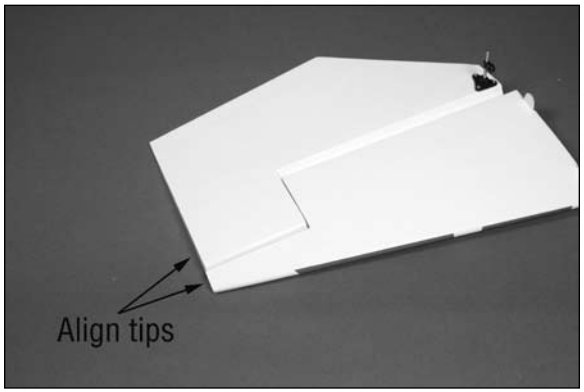
☐☐ Step 12

Slide the elevator in position against the stabilizer. Make sure all three hinges go into the slots in the stabilizer.



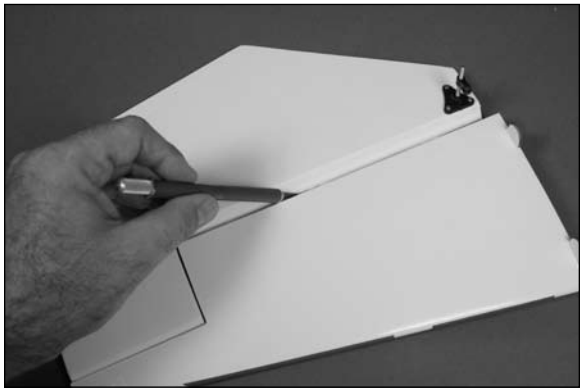
☐☐ Step 13

Position the elevator and stabilizer so their tips are aligned. Remove the T-pins from the hinges.



☐☐ Step 14

Use a hobby knife with a #11 blade to set the hinge gap. You should just be able to slide the blade through the gap between the elevator and stabilizer. Check that the elevator can move freely without binding on the stabilizer.



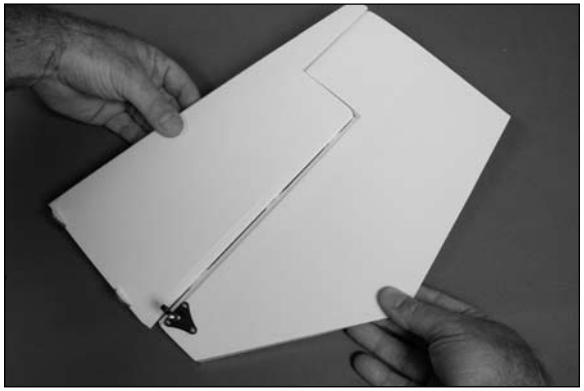
☐☐ Step 15

Use thin CA to saturate each of the three hinges on both the top and bottom of the hinge. Allow the CA to fully cure before proceeding.

Important: Do not use accelerator on the hinges. The CA must be allowed to soak into the hinges. Using accelerator will not allow the CA enough time to correctly soak each hinge.

☐☐ Step 16

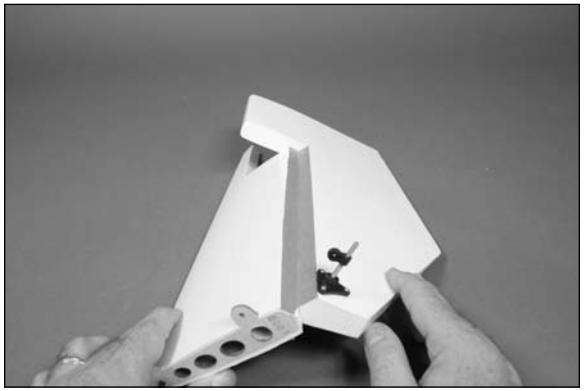
Gently pull on the stabilizer and elevator to make sure each of the hinges is secure. If not, reapply CA to the hinge that is not secure.



Important: Sealing the hinge gap is necessary on models that have large control surfaces and use large control throws. Not sealing the hinge gap can lead to flutter of the control surface and could result in the loss of your aircraft. Make sure to seal the hinge gap at this time.

☐☐ Step 17

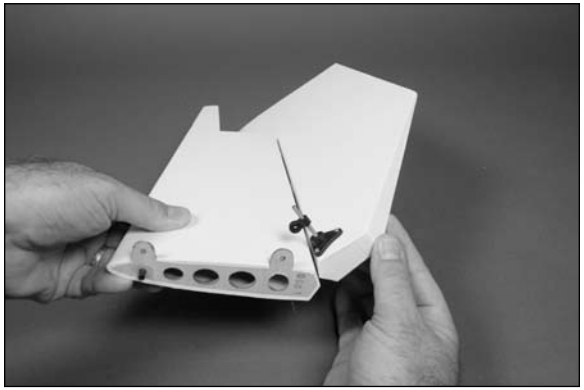
Use clear tape, clear covering or white covering to seal the hinge gap on the elevator. Flex the elevator to open the gap as far as possible when installing the hinge gap tape.

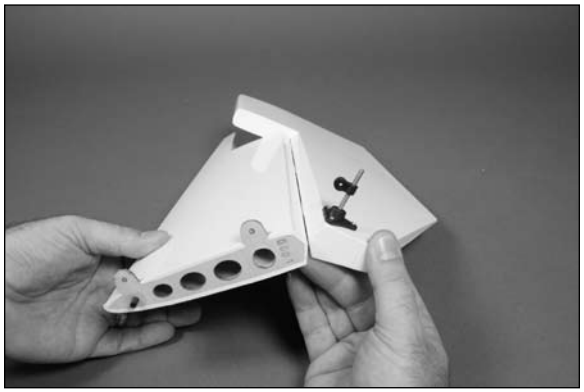


Note: We used colored tape to illustrate the position of the hinge gap sealing tape.

☐☐ Step 18

Flex the elevator through its range of motion a few dozen times to break in the hinges and hinge gap tape.





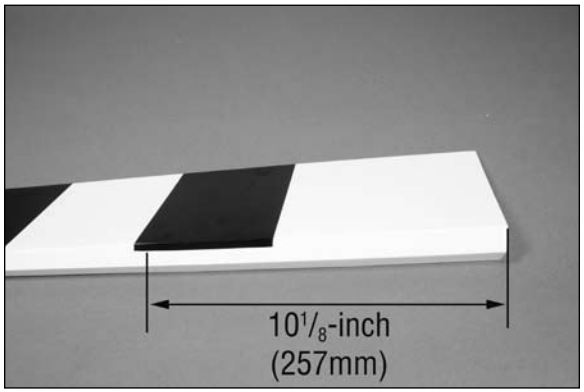
☐ Step 19

Repeat Steps 2 though 18 to prepare the remaining stabilizer and elevator. Make sure you are making both a right and left assembly when installing the control horn.

HINGING THE AILERONS

☐☐ Step 20

Measure in $10^{1}/_{8}$-inch (257mm) from the inside edge (widest end) of the aileron on the bottom. This will mark the center for the control horn.



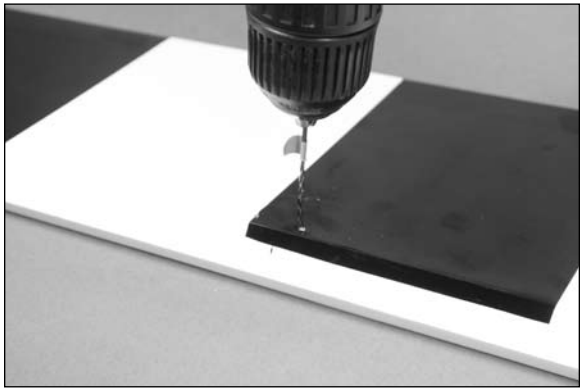
Note: The bottom of the aileron will have two black stripes.

☐☐ Step 21

Position the control horn on the aileron. The front (straight edge of the horn) will align with the tapered edge of the hinge line as shown. Align the center line of the horn aligned with the mark made in the previous step. Use a felt-tipped pen to transfer the location for the three mounting holes on the aileron.

☐☐ Step 22

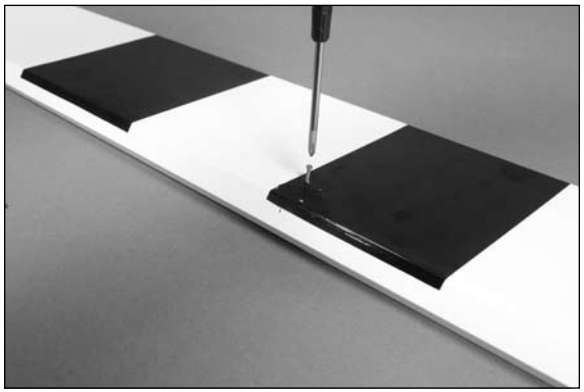
Use a drill and 1/16-inch (1.5mm) drill bit to drill the holes for the horn mounting screws. Drill the holes 5/8-inch (16mm) deep.



Hint: Wrap a piece of tape around the drill bit so you can drill the depth of the holes accurately. The tape will indicate when you reach the proper depth.

☐☐ Step 23

Use a #1 Phillips screwdriver to thread a 2mm x 16mm self-tapping screw into each of the holes. This will cut threads in the wood.

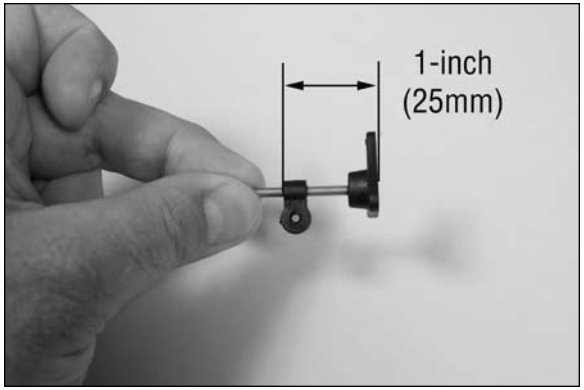


☐☐ Step 24

Place 2–3 drops of thin CA into each hole. This will harden the threads and prevent the screws from pulling loose.

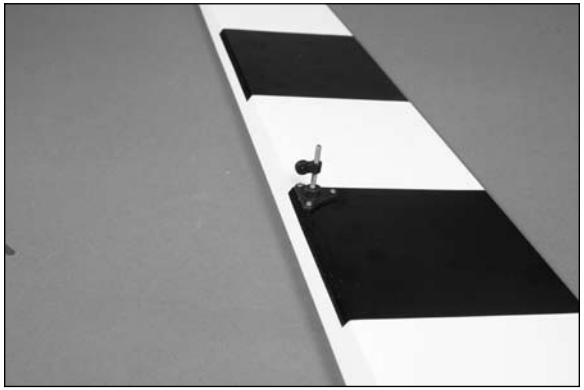
☐☐ Step 25

Thread a control horn end on the control horn until the top edge of the end is 1-inch (25mm) from the base of the horn as shown.



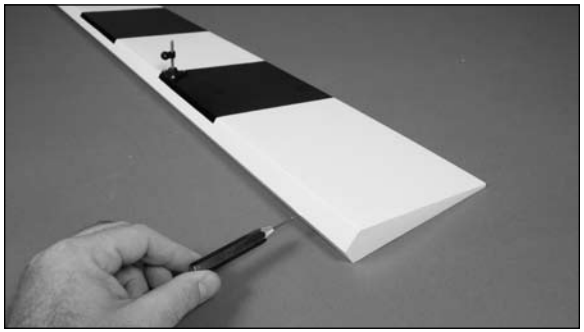
☐☐ Step 26

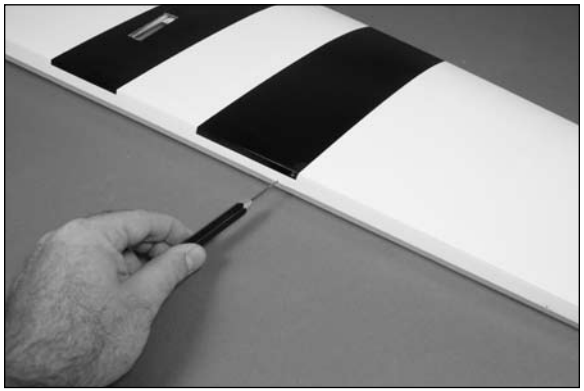
Secure the control horn to the aileron using three 2mm x 16mm self-tapping screws and a #1 Phillips screwdriver.



☐☐ Step 27

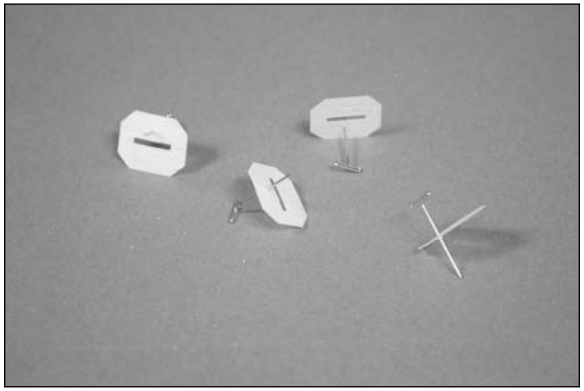
Use a pin vise and a 1/16-inch (1.5mm) drill bit to drill a hole in the center of each of the four hinge slots in the aileron and wing. This creates a tunnel for the CA to wick into, making a better bond between the hinge and surrounding wood.





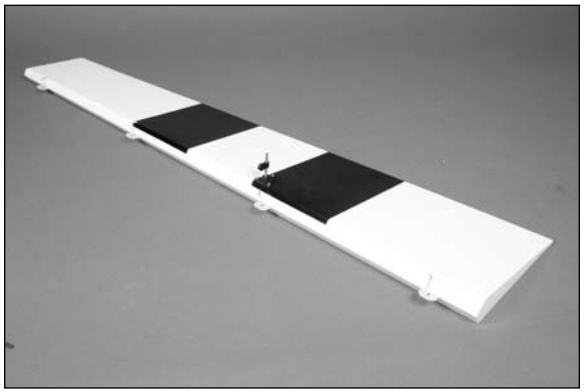
☐☐ Step 28

Place a T-pin in the center of each of the four hinges that will be used to hinge the aileron to the wing. The T-pins will center the hinge evenly in both the aileron and wing.



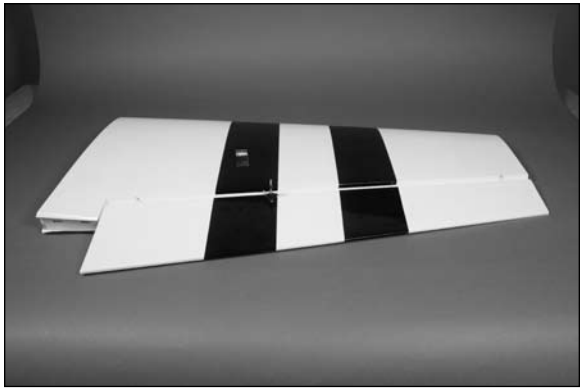
☐☐ Step 29

Slide the hinges into the aileron.



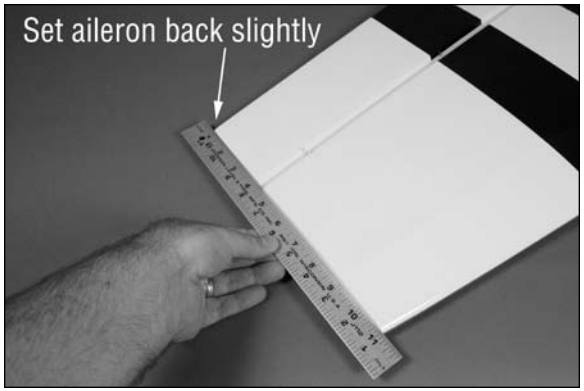
☐☐ Step 30

Slide the aileron in position against the wing. Make sure all four hinges go into the slots in the wing.



☐☐ Step 31

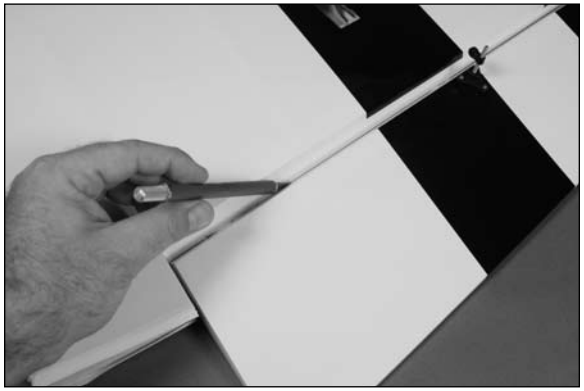
Position the aileron so it is set back 1/32-inch (.5mm) from the wing tip. This will be necessary to prevent the aileron from rubbing against the side force generator. A ruler against the wing tip can help visualize the location of the side force generator in relationship to the aileron. Remove the T-pins at this time.



Note: The installation of the optional SFG's will be covered later in the manual.

☐☐ **Step 32**

Use a hobby knife with a #11 blade to set the hinge gap. You should just be able to slide the blade through the gap between the aileron and wing.



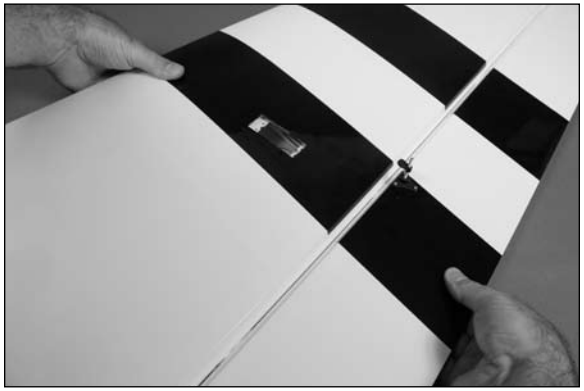
☐☐ **Step 33**

Use thin CA to saturate each of the three hinges on both the top and bottom of the hinge. Allow the CA to fully cure before proceeding.

Important: Do not use accelerator on the hinges. The CA must be allowed to soak into the hinges. Using accelerator will not allow the CA enough time to correctly soak each hinge.

☐☐ **Step 34**

Gently pull on the aileron and wing to make sure each of the hinges is secure. If not, reapply CA to the hinge that is not secure.



Important: Sealing the hinge gap is necessary on models that have large control surfaces and use large control throws. Not sealing the hinge gap can lead to flutter of the control surface and could result in the loss of your aircraft. Make sure to seal the hinge gap at this time.

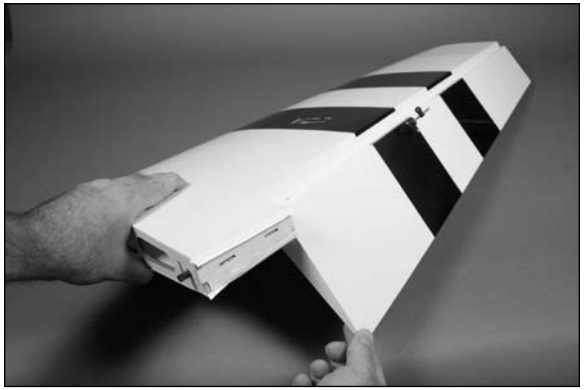
☐☐ **Step 35**

Use clear tape, clear covering or white covering to seal the hinge gap on the aileron. Flex the aileron to open the gap as far as possible when installing the hinge gap tape.

Note: We used colored tape to illustrate the position of the hinge gap sealing tape.

☐☐ **Step 36**

Flex the aileron through its range of motion a few dozen times to break in the hinges and hinge gap tape.



☐ **Step 37**

Repeat Steps 20 though 36 to prepare the remaining stabilizer and elevator.

Rudder Installation

Required Parts

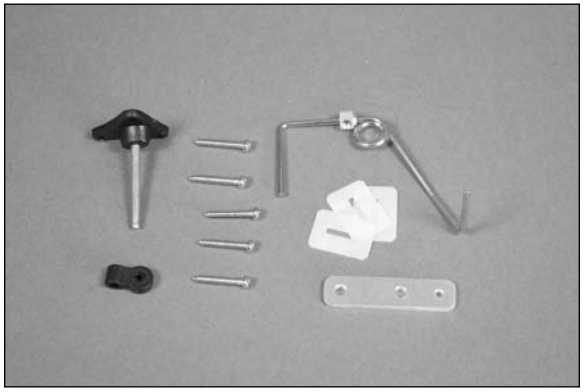
Fuselage assembly	Rudder
Tail wheel bracket	CA hinge (3)
Control horn	Control horn end
2mm x 16mm self-tapping screws (5)	

Tools and Adhesives

Drill	Pin vise
Drill bit: 1/16-inch (1.5mm)	Low-tack tape
T-pins	Thin CA
Phillips screwdriver: #1	Ruler
Felt-tipped pen	30-minute epoxy
Mixing stick	Rubbing alcohol
Paper towel	

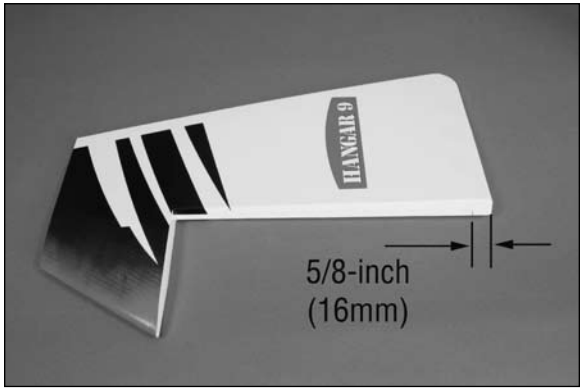
☐ Step 1

Locate the items necessary to attach the rudder that are included with your model.



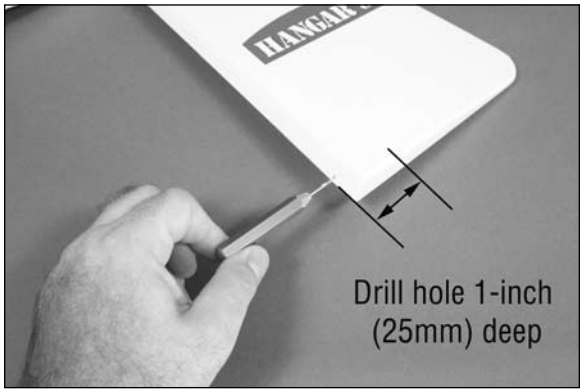
☐ Step 2

Measure up from the bottom of the rudder 5/8-inch (16mm) and mark the rudder using a felt-tipped pen.



☐ Step 3

Use a pin vise and 3/32-inch (2.5mm) drill bit to drill a hole that is 1-inch (25mm) deep in the rudder at the mark made in the previous step. This hole must be at the high point of the hinge line as shown.

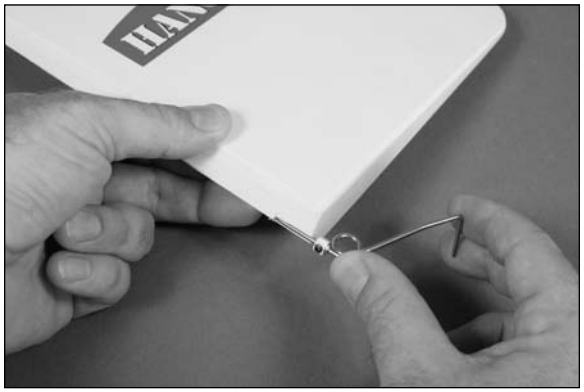


☐ Step 4

Carefully use a hobby knife and #11 blade to cut a notch in the rudder from the hole to the bottom of the rudder for the tail wheel wire to fit into.

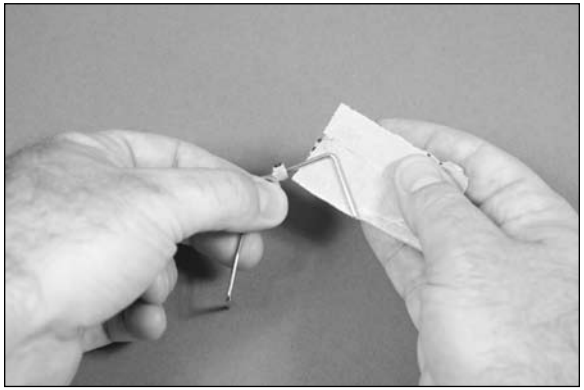
☐ Step 5

Test fit the tail wheel wire to the rudder. It must fit flush with the rudder hinge line. If not, drill the hole deeper or make the notch deeper to fit the wire.



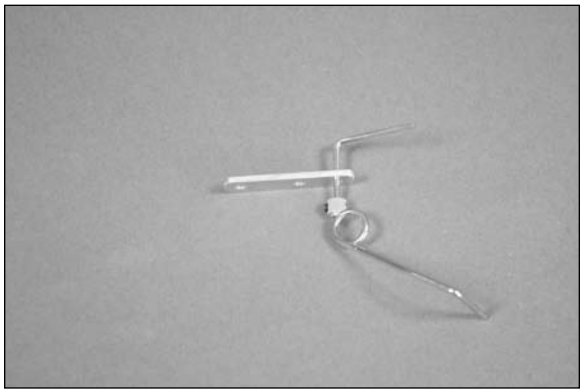
☐ **Step 6**

Once fit, remove the tail wheel wire and use medium grit sandpaper to roughen the wire where it contacts the rudder.



☐ **Step 7**

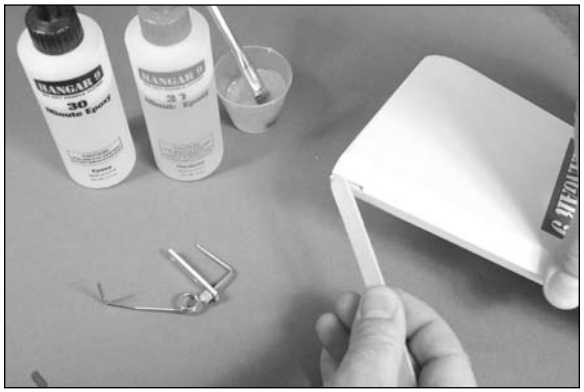
Slide the tail wheel bracket onto the tail wheel wire. The wire fits in the smallest of the three holes in the bracket.



Note: Prior to installing the wire confirm that the wires are at 90 degrees to each other. If not it is much easier to adjust now prior to installation.

☐ **Step 8**

Mix a small amount of 30-minute epoxy. Apply the epoxy to the wire as well as the hole and notch in the rudder.



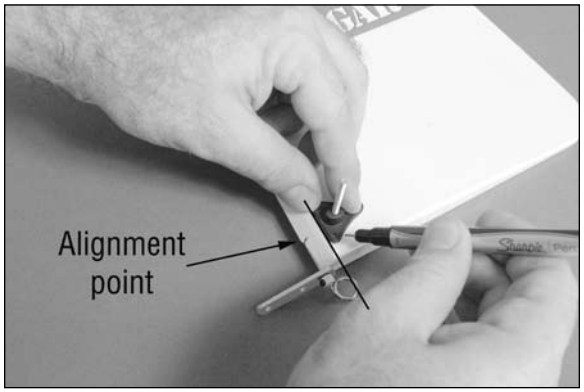
Hint: Use a toothpick to get the epoxy into the hole in the rudder.

☐ **Step 9**

Slide the tail wheel wire into the hole. Use a paper towel and rubbing alcohol to remove any excess epoxy. Use low-tack tape to hold the wire in position until the epoxy fully cures.

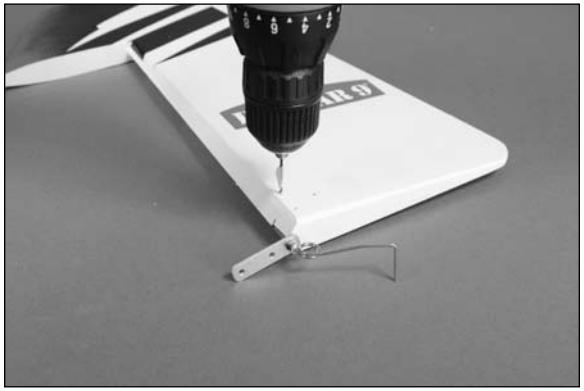
☐ **Step 10**

Position the control horn on the rudder. The front (straight edge of the horn) will align with the tapered edge of the hinge line as shown. Align the center line of the horn aligned with the mark made for the tail wheel wire. Use a felt-tipped pen to transfer the location for the three mounting holes on the aileron.



☐ **Step 11**

Use a drill and 1/16-inch (1.5mm) drill bit to drill the holes for the horn mounting screws. Drill the holes 5/8-inch (16mm) deep.



Hint: Wrap a piece of tape around the drill bit so you can drill the depth of the holes accurately. The tape will indicate when you reach the proper depth.

☐ **Step 12**

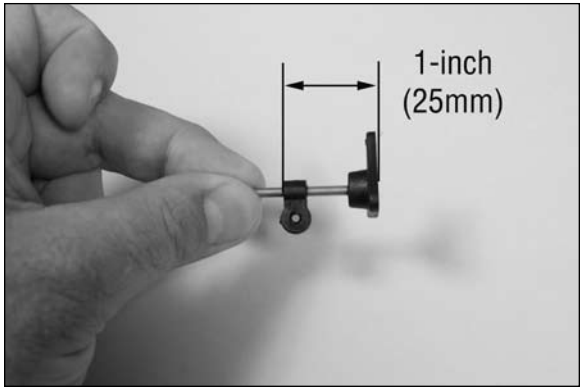
Use a #1 Phillips screwdriver to thread a 2mm x 16mm self-tapping screw into each of the holes. This will cut threads in the wood.

☐ **Step 13**

Place 2–3 drops of thin CA into each hole. This will harden the threads and prevent the screws from pulling loose.

☐ **Step 14**

Thread a control horn end on the control horn until the top edge of the end is 1-inch (25mm) from the base of the horn as shown.

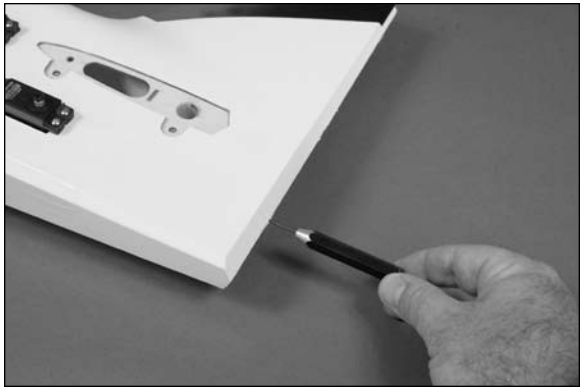


☐ **Step 15**

Secure the control horn to the rudder using three 2mm x 16mm self-tapping screws and a #1 Phillips screwdriver.

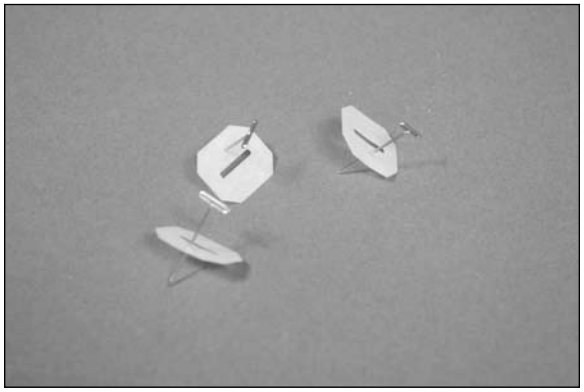
☐ **Step 16**

Use a pin vise and a 1/16-inch (1.5mm) drill bit to drill a hole in the center of each of the three hinge slots in the rudder and fuselage. This creates a tunnel for the CA to wick into, making a better bond between the hinge and surrounding wood.



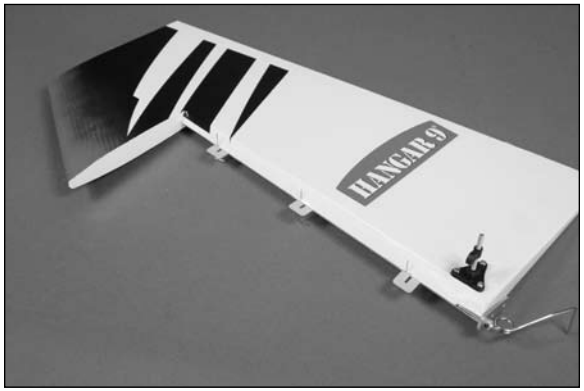
☐ **Step 17**

Place a T-pin in the center of each of the three hinges that will be used to hinge the rudder to the fuselage. The T-pins will center the hinge evenly in both the rudder and fuselage.



☐ **Step 18**

Slide the hinges into the rudder.



☐ **Step 19**

Slide the rudder in position against the fuselage. Make sure all three hinges go into the slots in the fuselage.

☐ **Step 20**

Position the rudder so it can move freely without the balance tab rubbing at the top of the fin. Also make sure the rudder is offset slightly from the bottom of the fuselage so the tail wheel bracket (when installed) will not interfere with the operation of the rudder. Remove the T-pins from the hinges. Make sure there is as little gap between the rudder and fuselage as possible.

☐ **Step 21**

Use thin CA to saturate each of the three hinges on both sides of the hinge. Allow the CA to fully cure before proceeding.

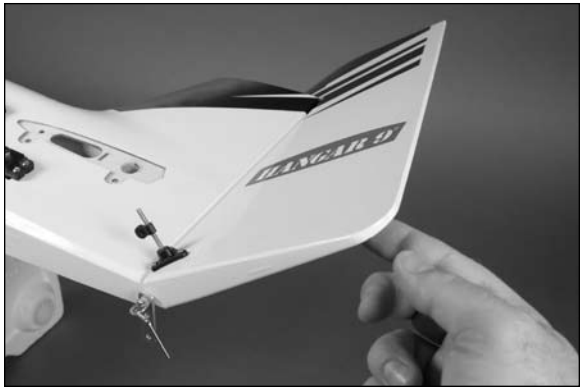
Important: Do not use accelerator on the hinges. The CA must be allowed to soak into the hinges. Using accelerator will not allow the CA enough time to correctly soak each hinge.

☐ **Step 22**

Gently pull on the rudder and fuselage to make sure each of the hinges is secure. If not, reapply CA to the hinge that is not secure.

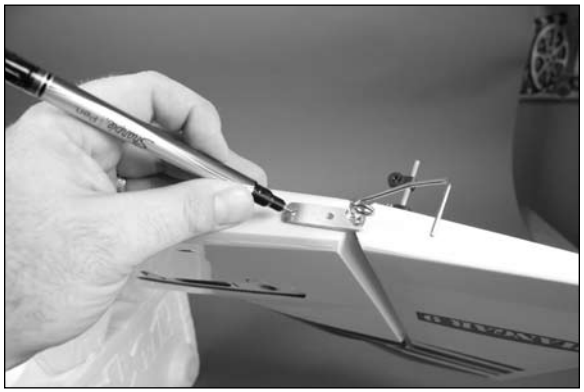
☐ **Step 23**

Flex the rudder through its range of motion a few dozen times to break in the hinges.



☐ **Step 24**

Use a felt-tipped pen to mark the locations for the two screws that will secure the tail wheel bracket to the fuselage.

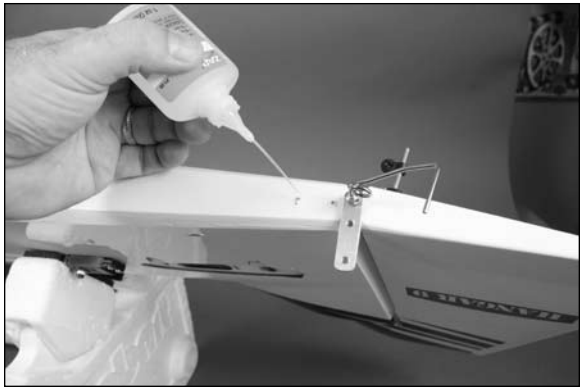


☐ **Step 25**

Move the bracket out of the way and use a drill with a 1/16-inch (1.5mm) drill bit to drill the two holes for the screws.

☐ **Step 26**

Place 2–3 drops of thin CA into each hole to harden the surrounding wood. This will keep the screws from pulling out of the fuselage.



☐ **Step 27**

Secure the tail wheel bracket to the fuselage using two 2mm x 16mm self-tapping screws and a #1 Phillips screwdriver.

Landing Gear Installation

Required Parts

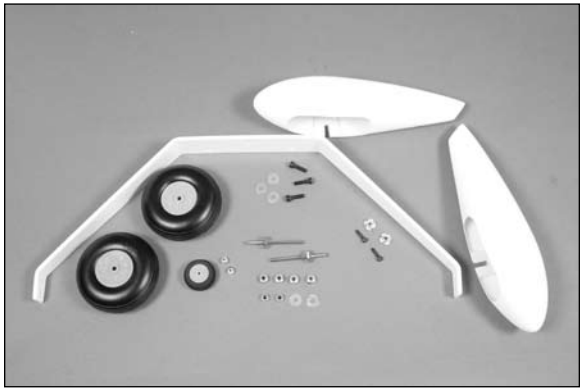
- Fuselage assembly
- Aluminum landing gear
- Wheel axle (2)
- 4mm locknut (2)
- 4mm washer (5)
- 3mm blind nut (2)
- Tail wheel, $1^{1}/_{4}$-inch (30mm)
- Main wheel, 3-inch (90mm) (2)
- 3mm x 12mm hex head bolt (2)
- 4mm x 15mm hex head bolt (3)
- Wheel collar with setscrew: 1/16-inch (2)
- Wheel collar with setscrew: 4mm (2)

Tools and Adhesives

- Light oil
- Flat file
- Hex wrench: 1.5mm, 3mm
- Threadlock
- Nut driver: 7mm
- Open end wrench: 10mm
- Drill bit: 5/32-inch (4mm)
- Drill
- Felt-tipped pen
- Ruler
- Threadlock

☐ **Step 1**

Locate the items necessary to attach the landing gear that are included with your model.



☐ **Step 2**

Slide one of the 1/16-inch wheel collars on the tail gear wire. Use a 1.5mm hex wrench to tighten the setscrew and secure the wheel collar to the wire.

Hint: Orient the wheel collar so the tapered end faces to the wheel for less friction between the collar and wheel.

☐ **Step 3**

Slide the tail wheel on the tail gear wire. Apply a small drop of oil on the axle so the wheel can spin freely on the wire.

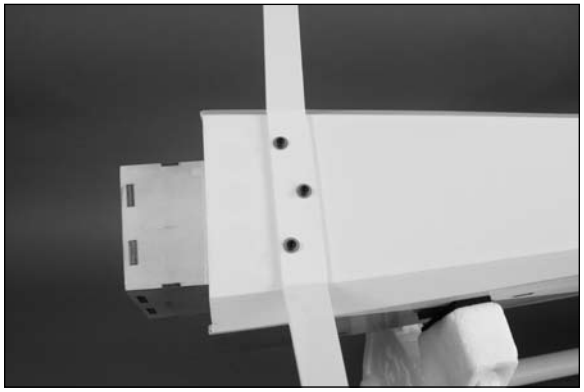
☐ **Step 4**

Secure the tail wheel using the remaining 1/16-inch wheel collar. Tighten the setscrew using a 1.5mm hex wrench to secure the collar to the wire.

Note: Use threadlock on the setscrews of both wheel collars to prevent the setscrew from vibrating loose.

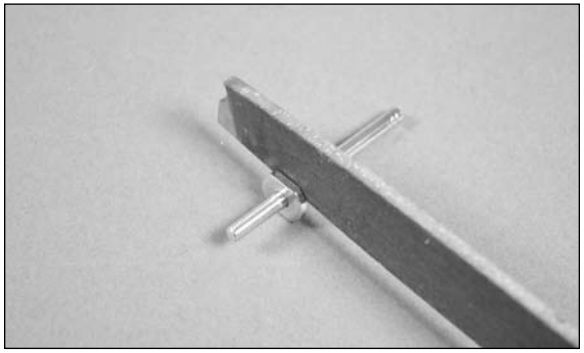
☐ **Step 5**

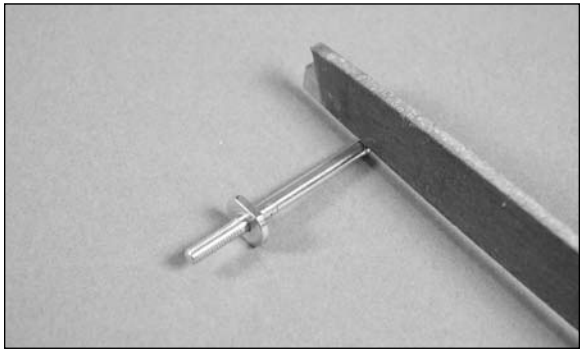
Attach the main landing gear to the fuselage using three 4mm x 15mm hex head bolts and three 4mm washers. Make sure to use threadlock on the screws so they don't vibrate loose. Tighten the bolts using a 3mm hex wrench.



☐☐ **Step 6**

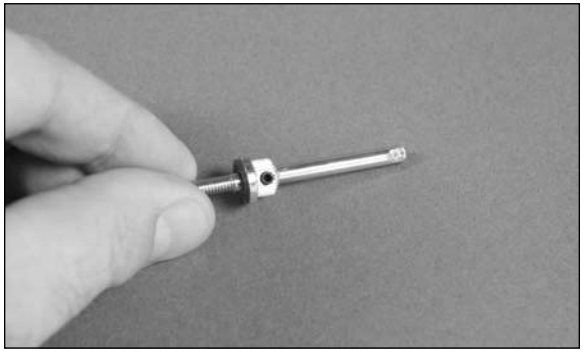
Use the edge of a flat file to make two flat areas on the bottom of the axle against the mounting flange and at the end of the axle.





☐☐ **Step 7**

Slide one of the 4mm wheel collars to the axle against the mounting flange of the axle as shown. Tighten the setscrew using a 1.5mm hex wrench. Use threadlock on the setscrew so it doesn't vibrate loose in flight.



☐☐ **Step 9**

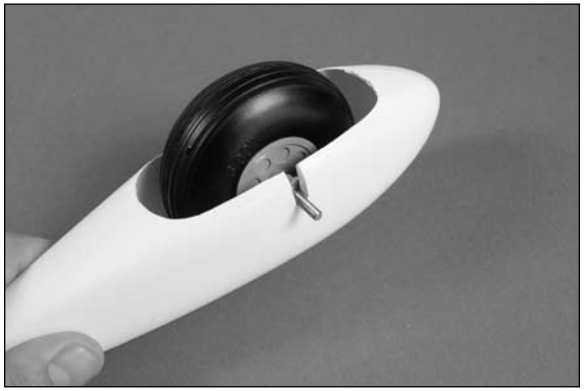
Slide the wheel on the axle. Place a drop of oil on the axle so the wheel will spin freely when installed.

☐☐ **Step 10**

Use a second 4mm wheel collar and setscrew to secure the wheel to the axle. Use a 1.5mm hex wrench and threadlock on the setscrew.

☐☐ Step 11

Place the wheel assembly in the wheel pant. The threaded portion of the axle will fit in the notch of the wheel pant as shown. Position the flange on the axle so the flat area is as horizontal as possible so the wider portion of the flange spans the slot in the wheel pant to distribute the load more evenly on the wheel pant.



☐☐ Step 12

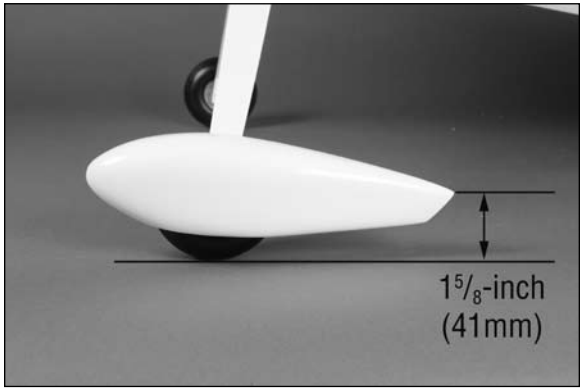
Use a 4mm washer and 4mm locknut to secure the axle to the landing gear. Leave the nut slightly loose so the wheel pant can be positioned for the next step. Use a 7mm nut driver to tighten the 4mm locknut while holding the axle at the flange with a 10mm open end wrench.

☐ Step 13

Repeat Steps 6 through 12 to prepare and install the remaining wheel and wheel pant.

☐☐ Step 14

Place the fuselage on your work surface so the main and tail wheels are resting on the same surface. Make sure the wheel pant is fully pressed against the axle. Position the wheel pant so the trailing edge tip of the wheel pant is $1^5/_8$-inch (41mm) from the work surface as shown.



☐☐ Step 15

Use a felt-tipped pen to mark the wheel pant through the screw hole in the landing gear.

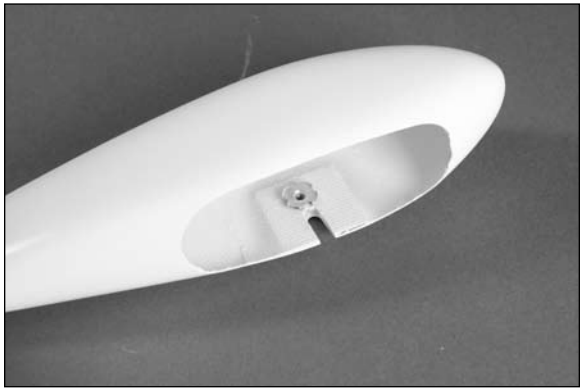
☐☐ Step 16

Remove the wheel pant and use a drill and a 5/32-inch (4mm) drill bit to drill a hole in the wheel pant at the mark made in the previous step.

Hint: Use a pin vise and small bit to make a small dimple so the larger drill bit doesn't wander and damage the finish of your wheel pant.

☐☐ Step 17

Use pliers to press the blind nut into the hole made in the wheel pant.



☐☐ Step 18

Attach the wheel pant using a 3mm x 12mm hex head bolt, 3mm washer and a 2.5mm hex wrench. Make sure to use threadlock on the bolt so it won't vibrate loose in flight.

☐ Step 19

Repeat Steps 14 through 18 to attach the remaining wheel pant to the landing gear.

Electric Motor Installation

Required Parts

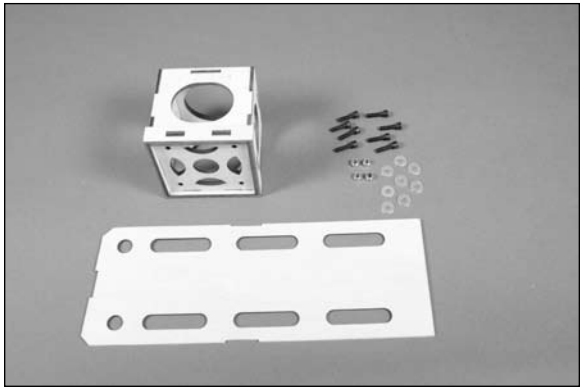
- Fuselage assembly
- Motor with hardware
- 4mm washer (8)
- Hook and loop strap (5)
- Motor battery (2)
- 4mm x 15mm hex head bolts (8)
- 24-inch (610mm) servo extension
- Plywood motor box
- Electronic speed control
- Plywood battery tray
- Tie wrap (3)

Tools and Adhesives

- Hex wrench: 2.5mm, 3mm
- Solder
- 30-minute epoxy
- Mixing stick
- Rubbing alcohol
- Threadlock
- Soldering iron
- Ruler
- Mixing cup
- Paper towel
- Clear tape

☐ Step 1

Locate the items necessary to install the electric motor included with your model.



☐ Step 2

Use a 2.5mm hex wrench to attach the propeller adapter to the front of the motor. Make sure to use threadlock on the screws so they don't vibrate loose.

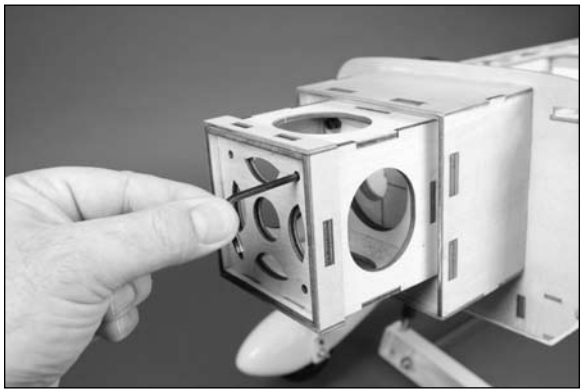
☐ Step 3

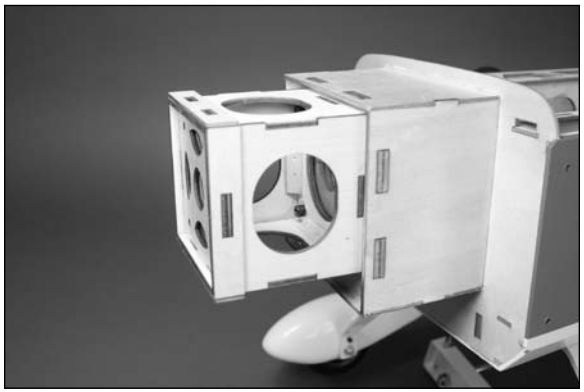
Use a 2.5mm hex wrench to attach the X-mount to the rear of the motor. Again, use threadlock on the screws.

☐ **Step 4**

Attach the electric motor box to the firewall using four 4mm x 15mm hex head bolts and four 4mm washers to secure the motor box to the firewall. Use a 3mm hex wrench to tighten the screws after using threadlock on the screws.

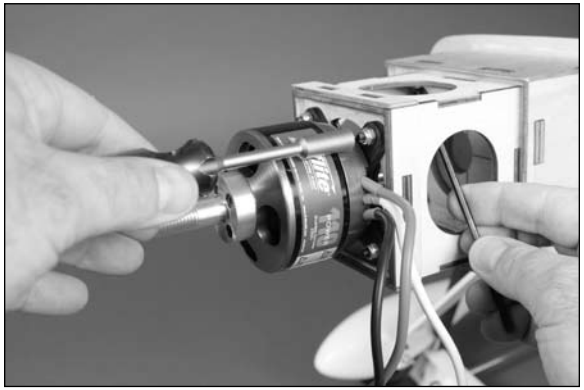
Hint: Use a pair of hemostats to position the screws.





☐ **Step 5**

Attach the motor to the front of the electric motor box using four 4mm locknuts, four 4mm x 15mm hex head bolts and four 4mm washers. You'll need to use a 7mm nut driver and 3mm hex wrench to tighten the hardware to secure the motor.

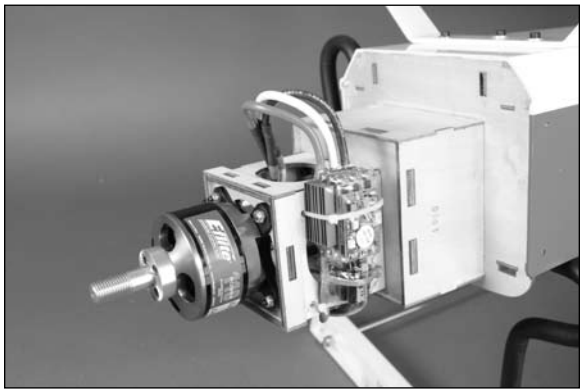


☐ **Step 6**

Solder any necessary connectors to the speed control at this time.

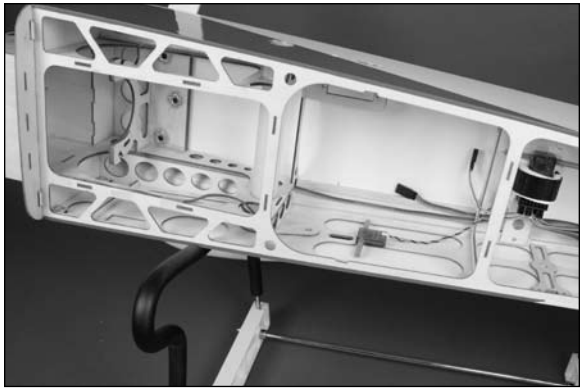
☐ **Step 7**

Attach the speed control to the side of the motor box using two-sided tape and tie wraps. Connect the appropriate leads from the speed control to the motor. Make sure the leads will not interfere with the operation of the motor.



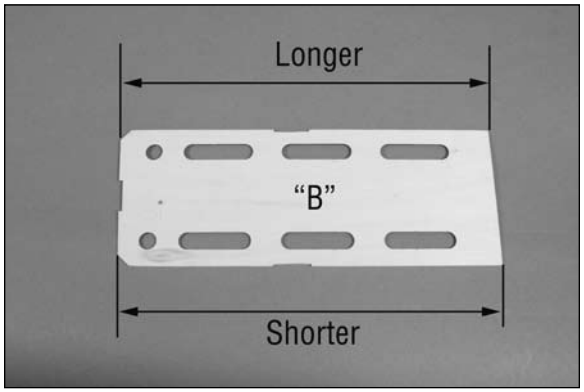
☐ **Step 8**

Secure a 24-inch (610mm) servo extension to the lead from the speed control using string or dental floss. Route the extension through the lightening holes in the fuselage. Use clear tape to keep the extension from moving inside the fuselage.



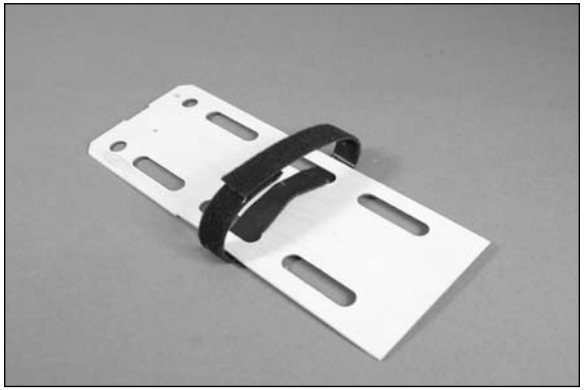
☐ **Step 9**

Locate the plywood battery tray. In the photo, the bottom edge is shorter and the top edge is longer. Mark the side facing up with a "B" using a felt-tipped pen. When the tray is installed this will be the bottom of the battery tray.



☐ **Step 10**

Pass a hook and loop strap through the slots in the sides of the battery tray as shown. This method will allow the installation of the receiver battery without having the strap where it will interfere with the installation of the motor batteries.



☐ **Step 11**

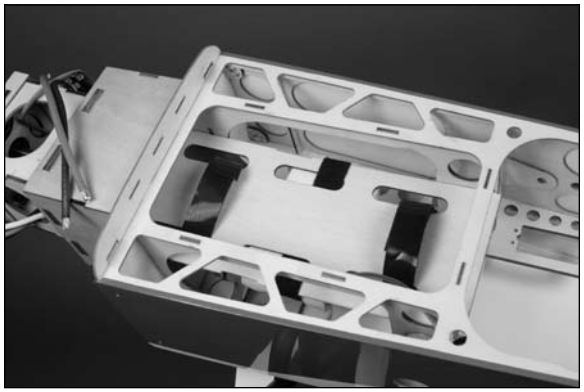
Place two more hook and loop straps through the tray as shown. These straps will be used to secure the motor battery.

☐ **Step 12**

Secure the receiver battery to the bottom of the battery tray.

☐ **Step 13**

Test fit the battery tray in the fuselage. Once fit, use 30-minute epoxy to glue the tray in position. Apply epoxy to any points where the tray contacts the fuselage and to the wing tube. Allow the epoxy to fully cure before moving to the next step.



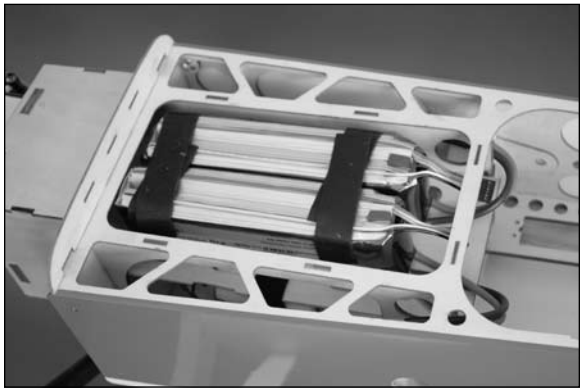
Hint: You can leave the tray loose for now. The receiver battery and motor batteries can be repositioned to adjust the CG if needed. If the receiver battery requires moving, it will be easier to remove the battery tray to move the receiver pack. Once the tray is glued in, it will be difficult to access the receiver battery.

☐ **Step 14**

Use a 6-inch (152mm) extension to connect the receiver battery to the lead from the switch harness. Use clear tape to secure the leads in the fuselage so they don't move during flight.

☐ **Step 15**

Secure the motor batteries in the fuselage using the hook and loop straps. Use hook and loop tape on the batteries and battery tray to keep them from moving forward or backward inside the fuselage during extreme aerobatic maneuvers.



2-Stroke Glow Engine Installation

Required Parts

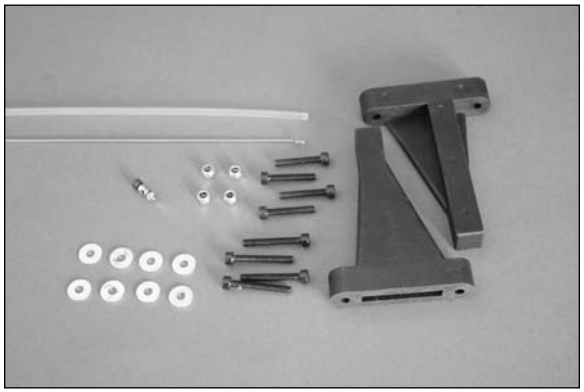
- Fuselage assembly
- Pushrod connector
- 2mm washer
- 2mm knurled nut
- 4mm locknut (4)
- 4mm washer (8)
- Throttle pushrod tube, 16 1/2-inch (420mm)
- Throttle pushrod wire, 19 3/8-inch (492mm)
- 4mm x 25mm hex head bolt (4)
- 4mm x 30mm hex head bolt (4)
- Engine mount rail (right and left)

Tools and Adhesives

- Pencil
- Drill
- Hex wrench: 2.5mm, 3mm
- Nut driver: 7mm
- Threadlock
- Pin vise
- Phillips screwdriver: #1
- Felt-tipped pen
- Ruler
- Drill bit: 1/16-inch (1.5mm), 9/64-inch (3.5mm), 5/32-inch (4mm)

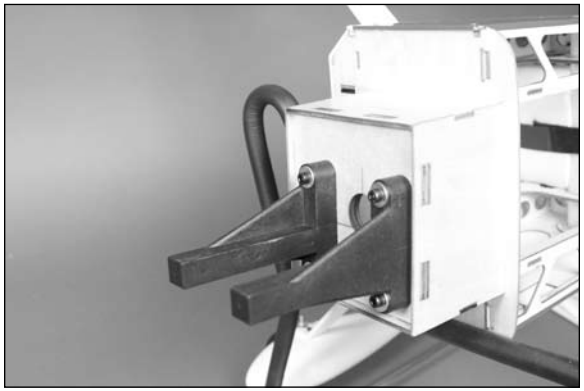
☐ **Step 1**

Locate the items necessary to install the engine included with your model.



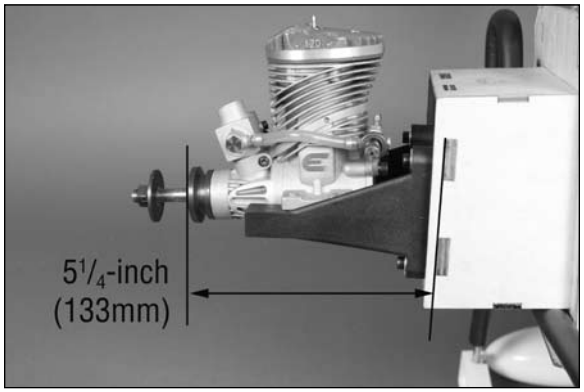
☐ **Step 2**

Use four 4mm x 25mm hex head bolts and four 4mm washers to attach the engine mount rails to the firewall. Tighten the screws using a 3mm hex wrench after applying threadlock to each of the screws.



☐ **Step 3**

Position the engine so the drive washer is 5 1/4-inch (133mm) forward of the firewall.

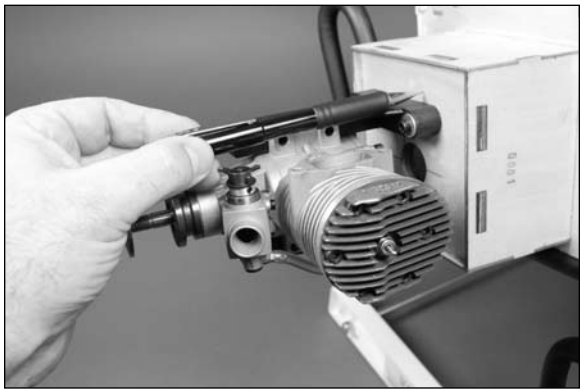


☐ **Step 4**

Use a pencil to transfer the locations for the engine mounting bolts to the engine mount rails.

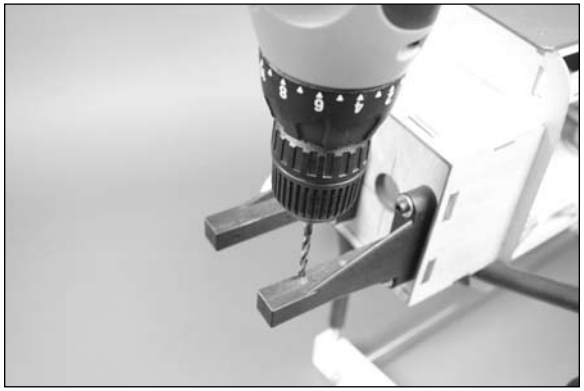
☐ **Step 5**

Use a pencil to mark the location for the throttle pushrod tube.



☐ **Step 6**

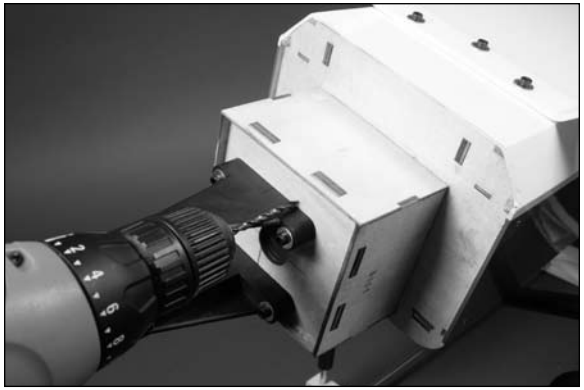
Remove the engine from the mount and use a drill and a 5/32-inch (4mm) drill bit to drill the four holes for the engine mounting bolts.



Hint: It is recommended to use a drill press to drill the holes so they are straight in the mount.

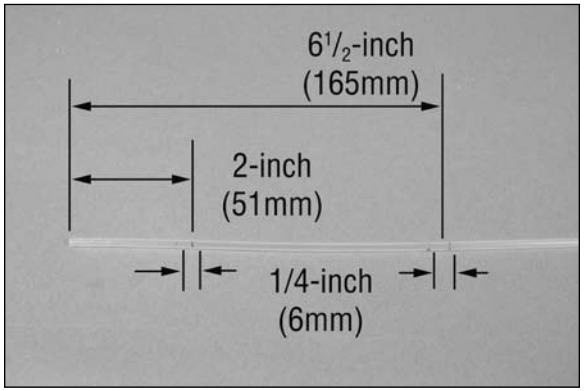
☐ **Step 7**

Use a drill and a 9/64-inch (3.5mm) drill bit to drill the hole in the firewall for the throttle pushrod tube.



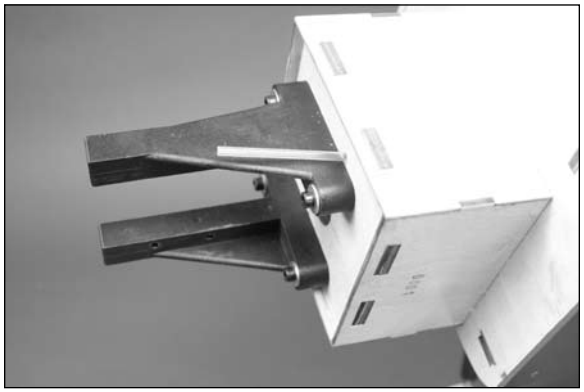
☐ **Step 8**

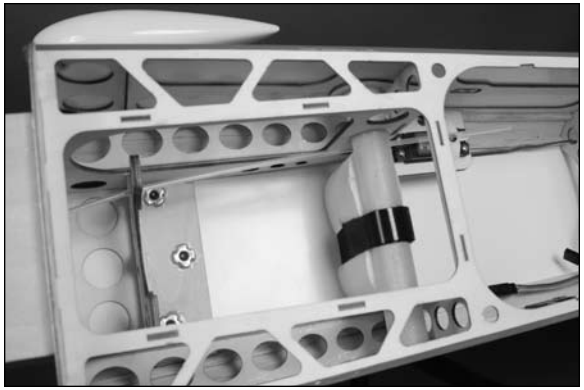
Use medium sandpaper to sand a 1/4-inch (6mm) section of the 16 1/2-inch (420mm) throttle pushrod tube at positions that are 2-inch (51mm) and 6 1/2-inch (165mm) from one end of the tube.



☐ **Step 9**

Slide the pushrod tube in the firewall and guide it through the fuel tank mount and alongside the receiver battery. The amount of tube forward of the firewall should measure 1 7/8-inch (47mm). Use medium CA to glue the tube to the firewall and the fuel tank mount.



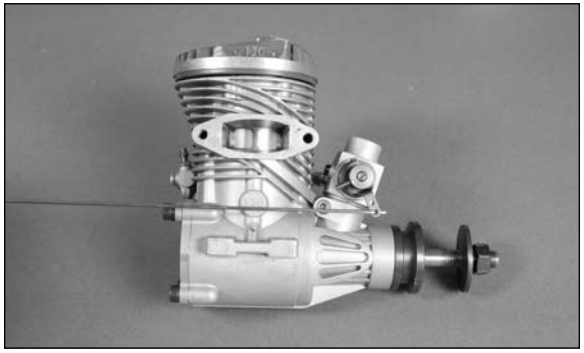


☐ **Step 10**

Use side cutters to trim the tube at the forward edge of the throttle servo.

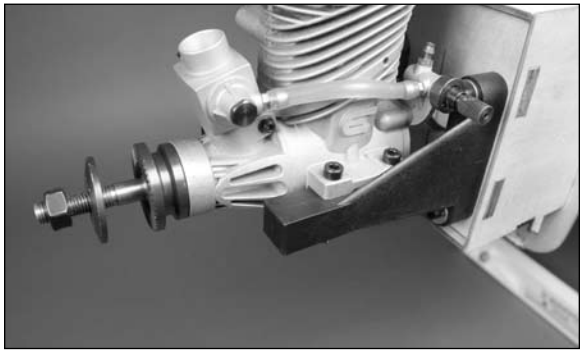
☐ **Step 11**

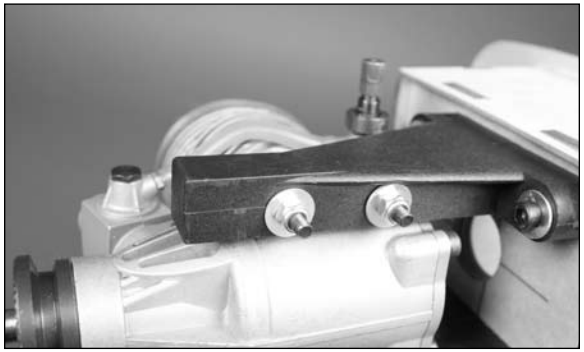
Connect the Z-bend in the 19 3/8-inch (492mm) throttle pushrod to the outer hole of the carburetor arm as shown.



☐ **Step 12**

Slide the throttle pushrod wire into the tube. Position the engine between the mounts. Use four 4mm x 30mm hex head bolts, four 4mm washers and four 4mm locknuts to secure the engine to the mount. Use a 3mm hex wrench and 7mm nut driver to tighten the hardware securing the engine to the mount.





☐ **Step 13**

Center the throttle stick and trim. With the radio system on, remove the standard servo horn from the throttle servo and place a 180 degree servo horn on the servo so it is perpendicular to the servo. This will provide equal throw from open to close at the carburetor.

☐ **Step 14**

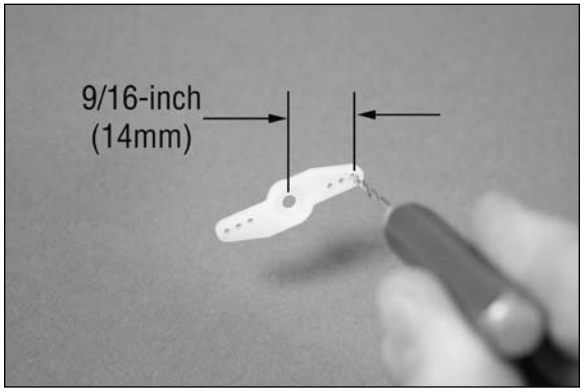
Use the radio to move the servo to the closed throttle position. Close the carburetor at the engine and use a felt-tipped pen to mark the pushrod where it crosses the outer hole of the servo horn.

☐ **Step 15**

Move the throttle servo to open using the radio. Open the carburetor at the engine and note where the line crosses the servo horn. If it does not line up to the outer hole you may need to use a different length servo arm, a different hole in the servo horn or reposition the linkage at the carburetor. Adjusting the throws at the radio can also be used when using a computer radio, but it is best to set the throw as closely as possible using mechanical methods.

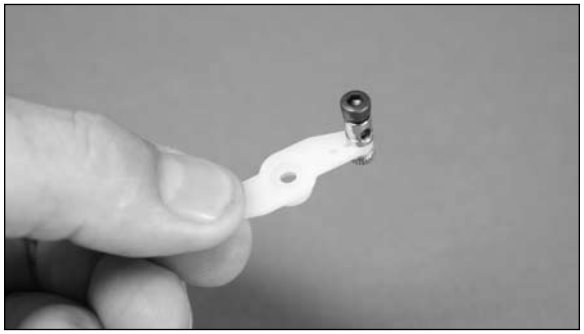
☐ **Step 16**

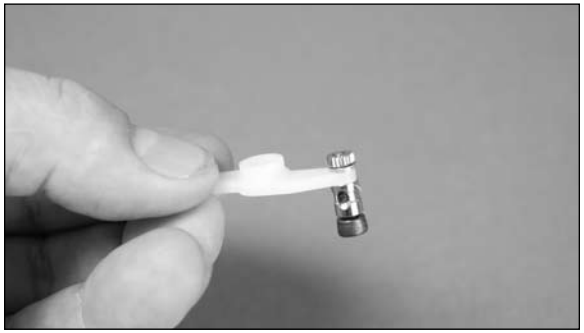
Remove the servo horn from the servo. Use a pin vise and 5/64-inch (2mm) drill bit to enlarge the hole in the servo horn that worked best for your throttle linkage installation. On our model we used the hole that was 9/16-inch (14mm) from the center of the servo horn.



☐ **Step 17**

Insert the pushrod connector in the servo horn as shown. Use the 2mm washer and 2mm knurled nut to secure the connector to the servo horn. Make sure to use threadlock on the nut or the connector will vibrate loose.





☐ **Step 18**

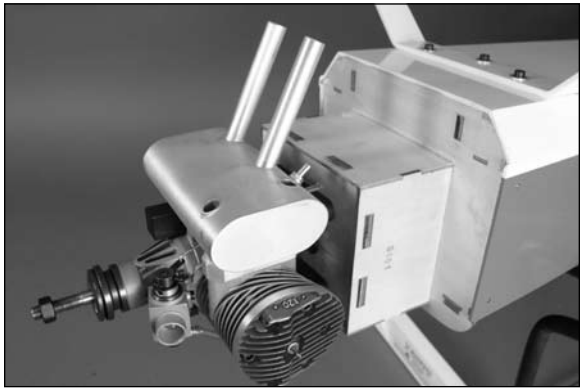
Reinstall the servo horn by sliding the connector over the pushrod wire. Center the throttle stick and trim and install the servo horn perpendicular to the servo center line.

☐ **Step 19**

Move the throttle stick to the closed position and move the carburetor to closed. Use a 2.5mm hex wrench to tighten the screw that secures the throttle pushrod wire. Make sure to use threadlock on the screw so it does not vibrate loose.

☐ **Step 20**

Attach the muffler to the engine using the hardware provided with the muffler.



4-Stroke Glow Engine Installation

Required Parts

Fuselage assembly	Pushrod connector
2mm washer	2mm knurled nut
4mm locknut (4)	4mm washer (8)

Throttle pushrod tube, $16^{1}/_{2}$-inch (420mm)
Throttle pushrod wire, $19^{3}/_{8}$-inch (492mm)
4mm x 25mm hex head bolt (4)
4mm x 30mm hex head bolt (4)
Engine mount rail (right and left)

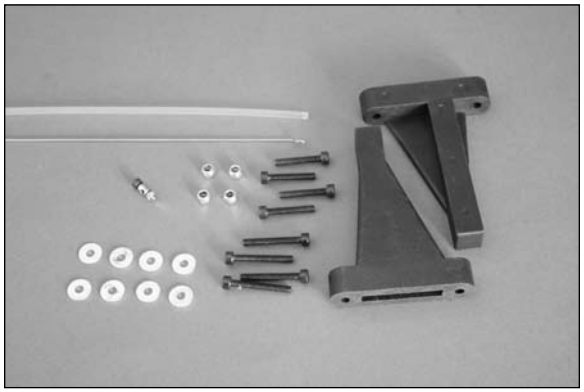
Tools and Adhesives

Pencil	Drill
Hex wrench: 2.5mm, 3mm	Nut driver: 7mm
Threadlock	Pin vise
Phillips screwdriver: #1	Felt-tipped pen

Drill bit: 1/16-inch (1.5mm), 9/64-inch (3.5mm), 5/32-inch (4mm)

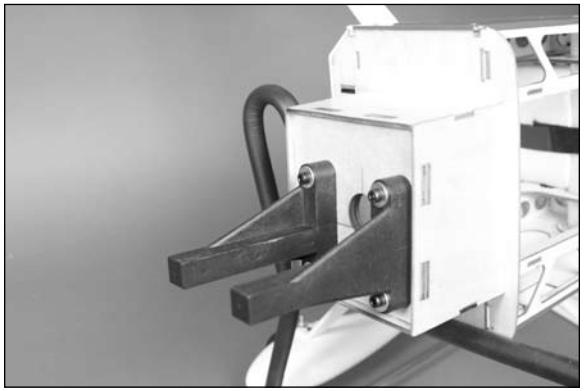
☐ **Step 1**

Locate the items necessary to install the engine included with your model.



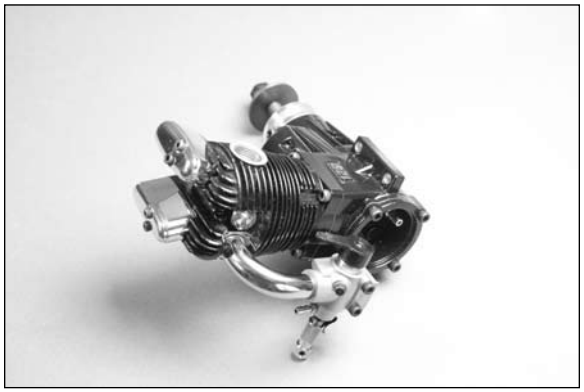
☐ **Step 2**

Use four 4mm x 25mm hex head bolts and four 4mm washers to attach the engine mount rails to the firewall. Tighten the screws using a 3mm hex wrench after applying threadlock to each of the screws.



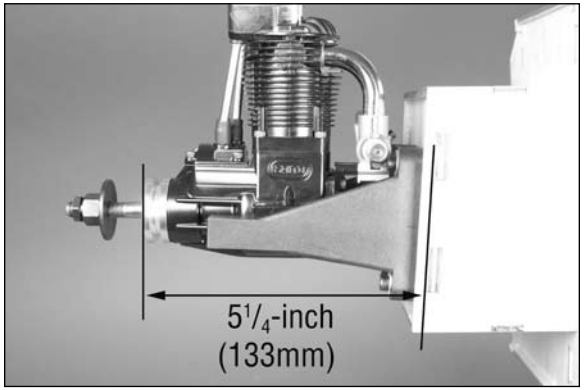
☐ **Step 3**

Check the position of the carburetor in relationship to the engine. It should match the photo. If not, you will need to rotate the carburetor following the instructions provided with the engine. Also make sure the carburetor arm is facing to the top of the engine.



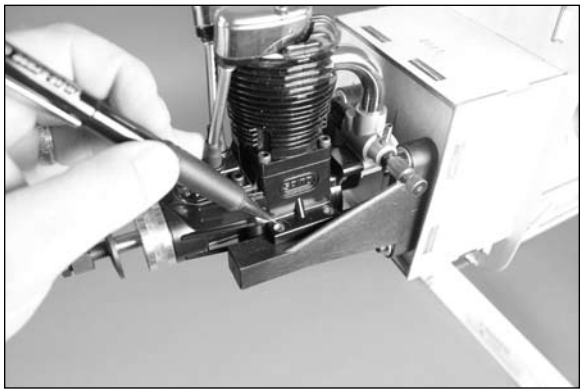
☐ **Step 4**

Position the engine so the drive washer is 5¼-inch (133mm) forward of the firewall.



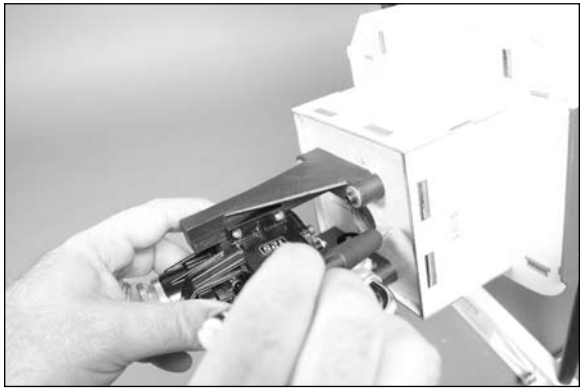
☐ **Step 5**

Use a pencil to transfer the locations for the engine mounting bolts to the engine mount rails.



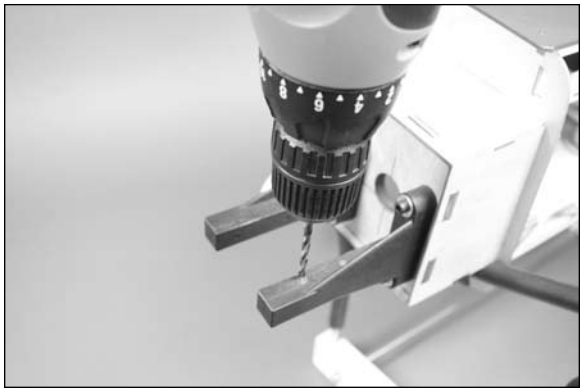
☐ **Step 6**

Use a pencil to mark the location for the throttle pushrod tube.



☐ **Step 7**

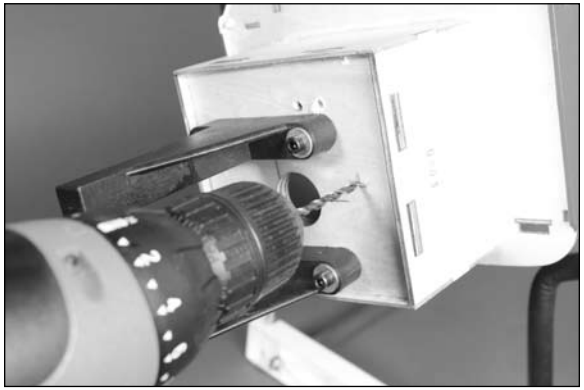
Remove the engine from the mount and use a drill and a 5/32-inch (4mm) drill bit to drill the four holes for the engine mounting bolts.



Hint: It is recommended to use a drill press to drill the holes so they are straight in the mount.

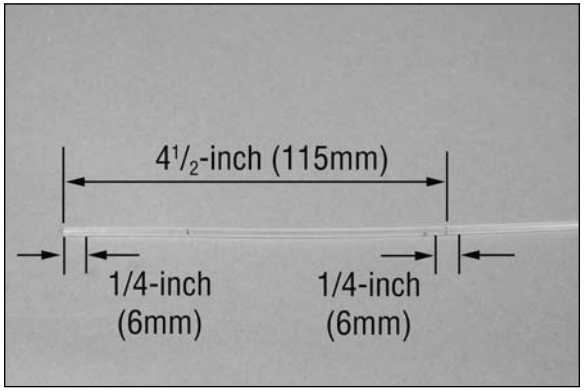
☐ **Step 8**

Use a drill and a 9/64-inch (3.5mm) drill bit to drill the hole in the firewall for the throttle pushrod tube.



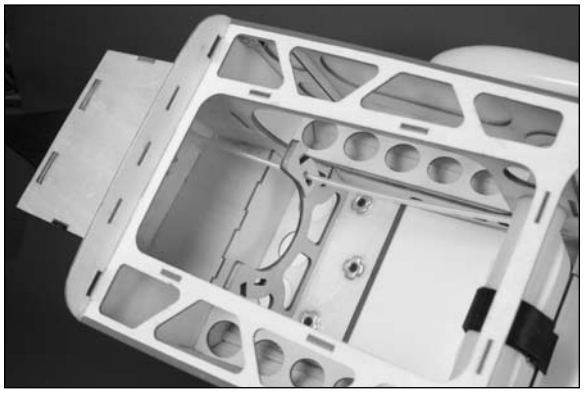
☐ **Step 9**

Use medium sandpaper to sand a 1/4-inch (6mm) section of the 16 1/2-inch (420mm) throttle pushrod tube at positions that are at one end of the tube and 4 1/2-inch (115mm) from one end of the tube.



☐ **Step 10**

Slide the pushrod tube in the firewall and guide it through the fuel tank mount and alongside the receiver battery. The amount of tube forward of the firewall should measure 1/16-inch (1.5mm). Use medium CA to glue the tube to the firewall and the fuel tank mount.

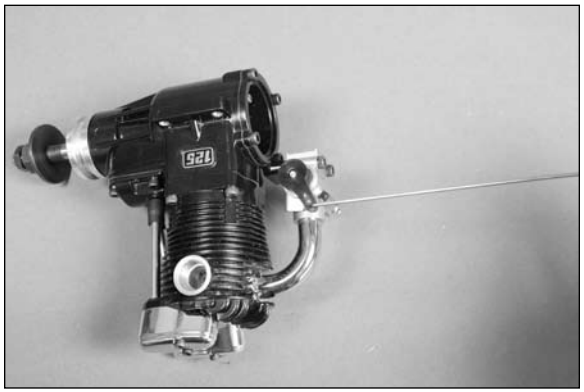


☐ **Step 11**

Use side cutters to trim the tube at the forward edge of the throttle servo.

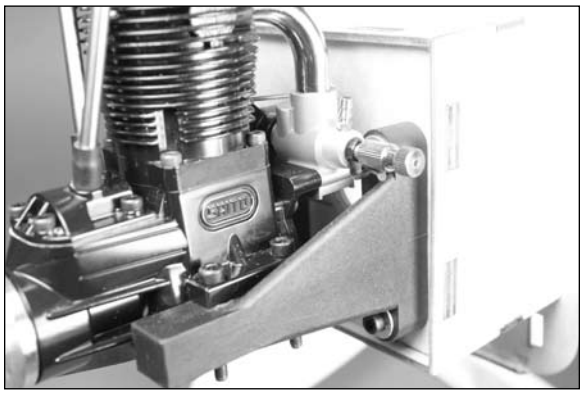
☐ **Step 12**

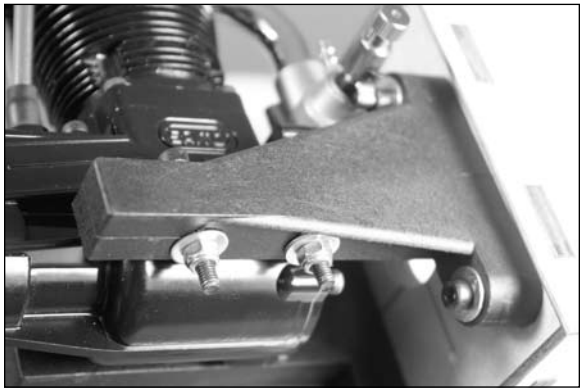
Connect the Z-bend in the 19 3/8-inch (492mm) throttle pushrod to the outer hole of the carburetor arm as shown.



☐ **Step 13**

Slide the throttle pushrod wire into the tube. Position the engine between the mounts. Use four 4mm x 30mm hex head bolts, four 4mm washers and four 4mm locknuts to secure the engine to the mount. Use a 3mm hex wrench and 7mm nut driver to tighten the hardware securing the engine to the mount.





☐ **Step 14**

Center the throttle stick and trim. With the radio system on, remove the standard servo horn from the throttle servo and place a 180 degree servo horn on the servo so it is perpendicular to the servo. This will provide equal throw from open to close at the carburetor.

☐ **Step 15**

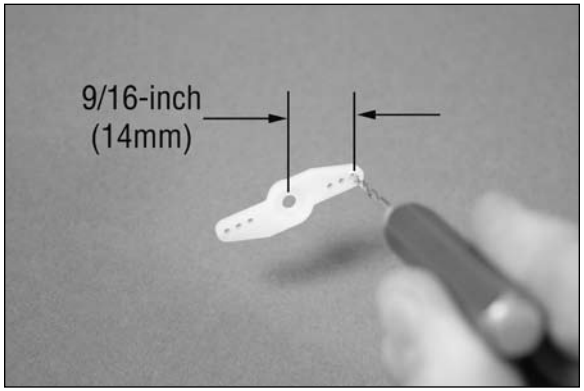
Use the radio to move the servo to the closed throttle position. Close the carburetor at the engine and use a felt-tipped pen to mark the pushrod where it crosses the outer hole of the servo horn.

☐ **Step 16**

Move the throttle servo to open using the radio. Open the carburetor at the engine and note where the line crosses the servo horn. If it does not line up to the outer hole you may need to use a different length servo arm, a different hole in the servo horn or reposition the linkage at the carburetor. Adjusting the throws at the radio can also be used when using a computer radio, but it is best to set the throw as closely as possible using mechanical methods.

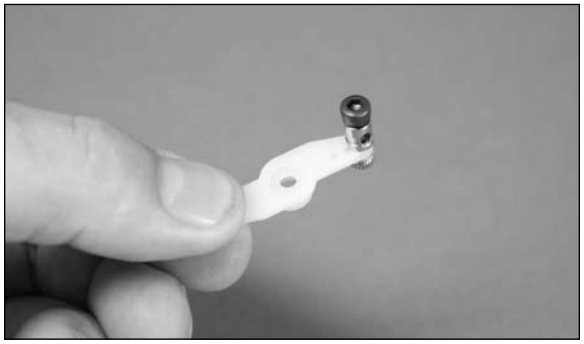
☐ **Step 17**

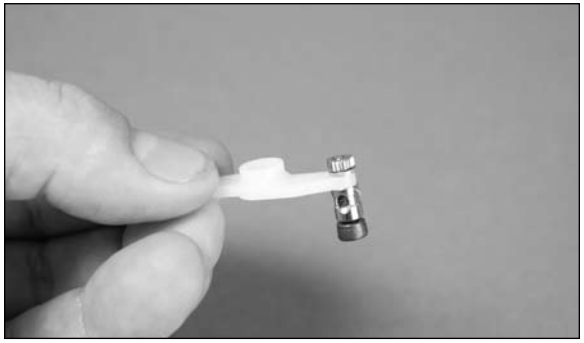
Remove the servo horn from the servo. Use a pin vise and 5/64-inch (2mm) drill bit to enlarge the hole in the servo horn that worked best for your throttle linkage installation. On our model we used the hole that was 9/16-inch (14mm) from the center of the servo horn.



☐ Step 18

Insert the pushrod connector in the servo horn as shown. Use the 2mm washer and 2mm knurled nut to secure the connector to the servo horn. Make sure to use threadlock on the nut or the connector will vibrate loose.





☐ Step 19

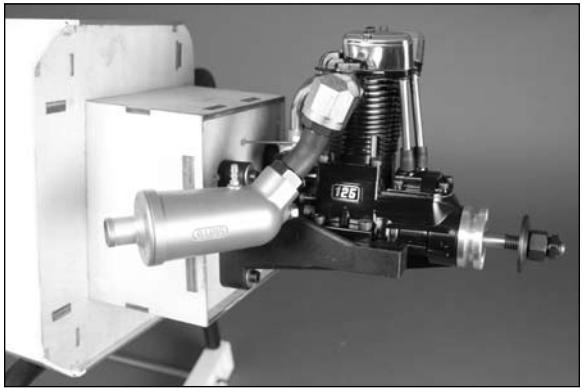
Reinstall the servo horn by sliding the connector over the pushrod wire. Center the throttle stick and trim and install the servo horn perpendicular to the servo center line.

☐ Step 20

Move the throttle stick to the closed position and move the carburetor to closed. Use a 2.5mm hex wrench to tighten the screw that secures the throttle pushrod wire. Make sure to use threadlock on the screw so it does not vibrate loose.

☐ Step 21

Attach the muffler to the engine using the hardware provided with the muffler.



Note: We used a 90 degree adapter to center the muffler to reduce the amount of cowling that will need to be removed.

4-Stroke Gas Engine Installation

Required Parts

Fuselage assembly	Pushrod connector
2mm washer	2mm knurled nut
4mm locknut (4)	4mm washer (8)

4mm x 20mm hex head bolt Throttle pushrod tube, $16^{1}/_{2}$-inch (420mm)

Throttle pushrod wire, $19^{3}/_{8}$-inch (492mm)

Engine mount with hardware

Tools and Adhesives

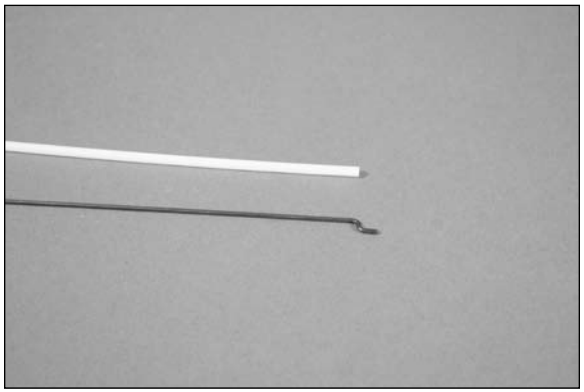
Pencil	Drill
Hex wrench: 2.5mm, 3mm	Nut driver: 7mm
Threadlock	Pin vise
Phillips screwdriver: #1	Felt-tipped pen
Small hammer	Low-tack tape

Ruler

Drill bit: 1/16-inch (1.5mm), 9/64-inch (3.5mm), 5/32-inch (4mm)

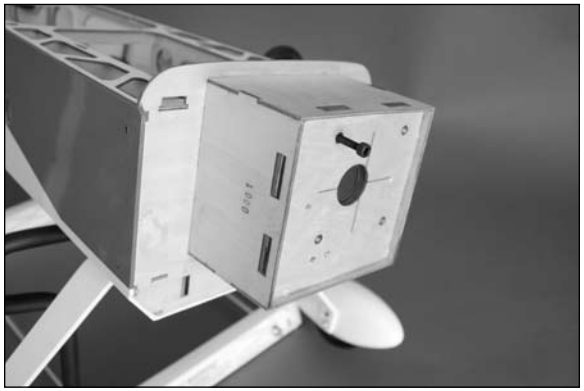
☐ Step 1

Locate the items necessary to install the engine included with your model.



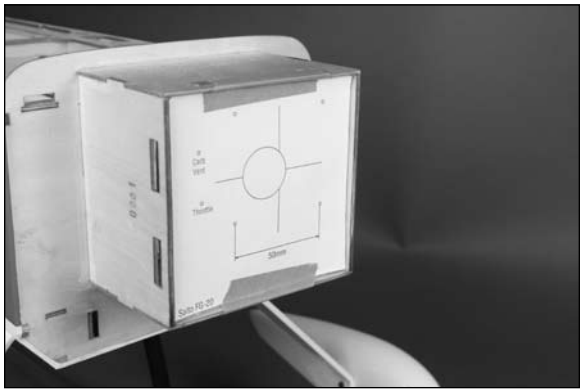
☐ **Step 2**

Thread a 4mm x 20mm hex head bolt partially into the preinstalled blind nut. Tap the head of the bolt using a small hammer to remove the blind nut from the fuselage. Remove all four blind nuts at this time.



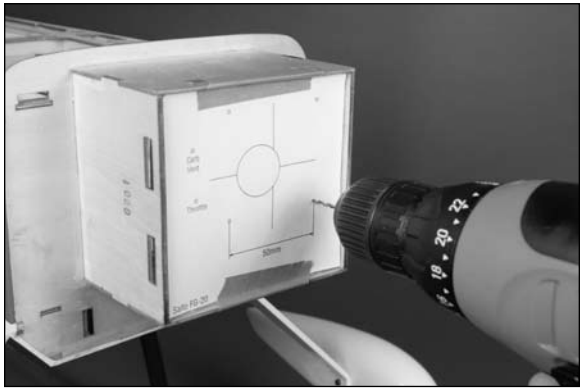
☐ **Step 3**

Cut the mounting template from the back of the manual. Use low-tack tape to secure it to the firewall.



☐ **Step 4**

Use a drill and 1/16-inch (1.5mm) drill bit to drill the holes for the mount, carburetor vent and throttle pushrod.



☐ **Step 5**

Use a drill and 7/32-inch (5.5mm) drill bit to enlarge the holes for the mount, and a 9/64-inch (3.5mm) drill bit to enlarge the hole in the firewall for the throttle pushrod.

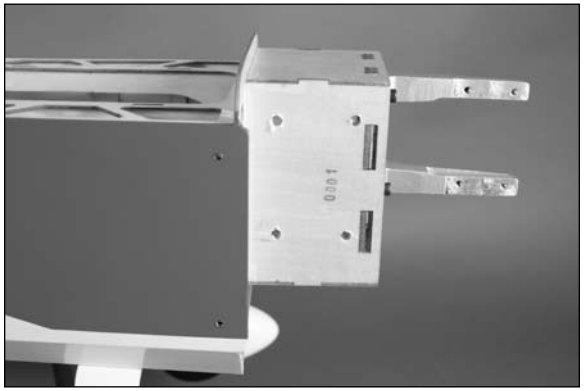
Important: Enlarge the hole for the carburetor vent using a 1/4-inch (6mm) drill bit. Although nothing mounts in this hole, it is necessary to allow the carburetor to see true air pressure. Without this hole the engine will not operate correctly.

☐ **Step 6**

Attach the mount to the firewall using the hardware provided with the mount. Use the longer 4mm x 20mm hex head bolts, four 4mm star washers and four 4mm blind nuts for this purpose. Use a 3mm hex wrench and threadlock on the screws.

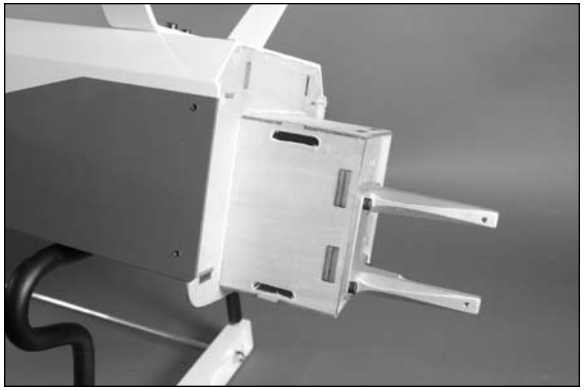
☐ **Step 7**

Use a 7/32-inch (5.5mm) drill bit to drill four holes in the side of the engine box. The first set of holes is 3/4-inch (19mm) down from the top of the engine mounting box. The second set is 3-inch (76mm) down from the top of the engine mounting box. The forward set are 3/4-inch (19mm) back from the front edge of the engine mounting box, and the rear set are 2-1/8-inch (54mm) back from the front edge of the engine mounting box.



☐ **Step 8**

Use a hobby knife with a #11 blade and a rotary tool to cut two 3/4-inch (19mm) wide slots in the opposite side of the engine mounting box. These slots are centered and are 1/8-inch (3mm) from the top and bottom of the box.

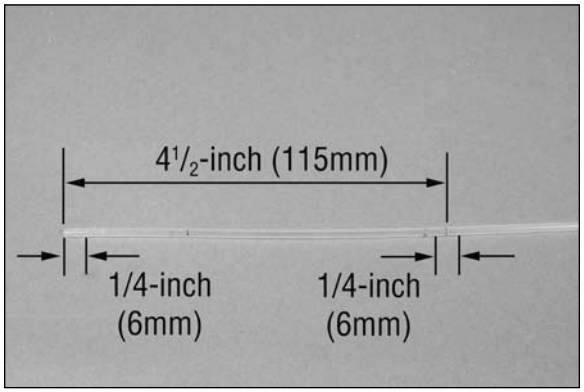


☐ **Step 9**

The last item is to make a 1/2-inch (13mm) wide slot in the fuselage to pass the battery leads through.

☐ **Step 10**

Use medium sandpaper to sand a 1/4-inch (6mm) section of the 16$^{1}/_{2}$-inch (420mm) throttle pushrod tube at positions that are at one end of the tube and 4$^{1}/_{2}$-inch (115mm) from one end of the tube.



☐ **Step 11**

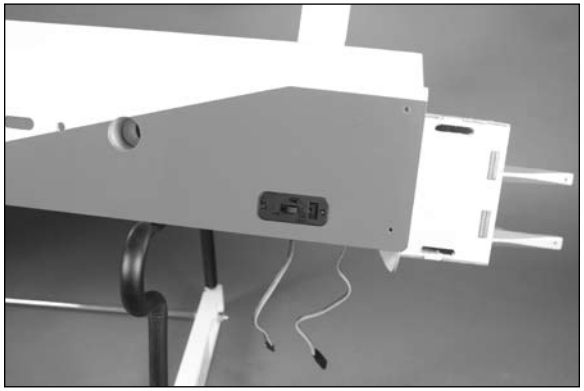
Slide the pushrod tube in the firewall and guide it through the fuel tank mount and alongside the receiver battery. The amount of tube forward of the firewall should measure 1/16-inch (1.5mm). Use medium CA to glue the tube to the firewall and the fuel tank mount.

☐ **Step 12**

Use side cutters to trim the tube at the forward edge of the throttle servo.

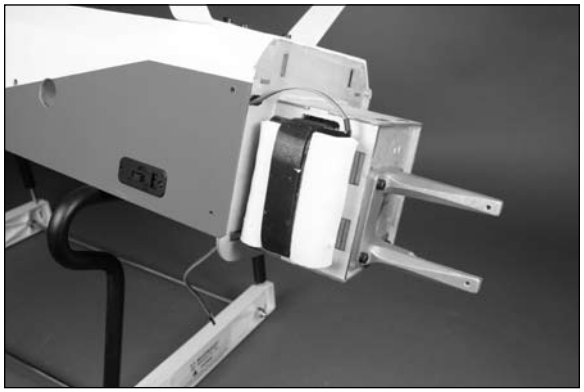
☐ **Step 13**

Use a hobby knife and a #11 blade to remove the covering from the fuselage for the ignition switch. Mount the switch using the hardware provided with the switch.



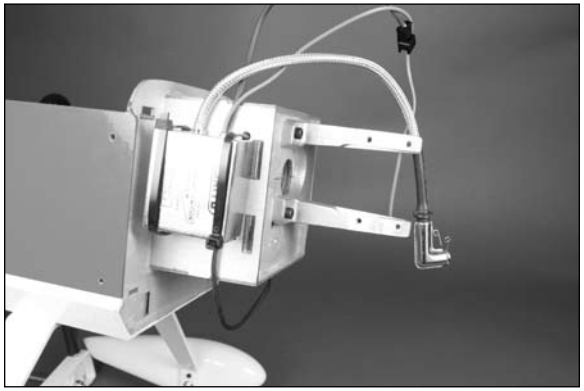
☐ **Step 14**

Use a hook and loop strap to secure the ignition battery to the side of the fuselage. Connect the leads from the switch and battery. Make sure to use string or dental floss to keep the leads from accidentally disconnecting inside the fuselage. The battery should be wrapped in 1/4-inch (6mm) foam to protect it from vibration.



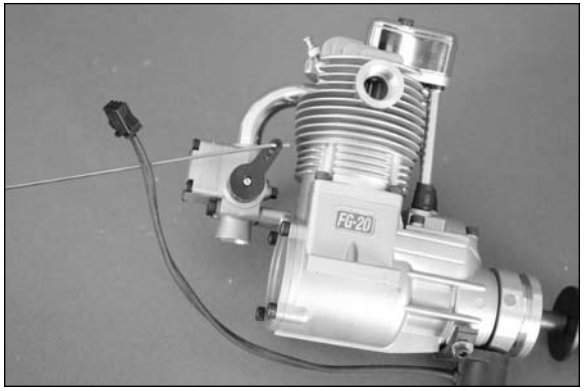
☐ **Step 15**

Use two tie straps to secure the ignition module to the engine box. Connect the lead from the module to the switch harness at this time as well.



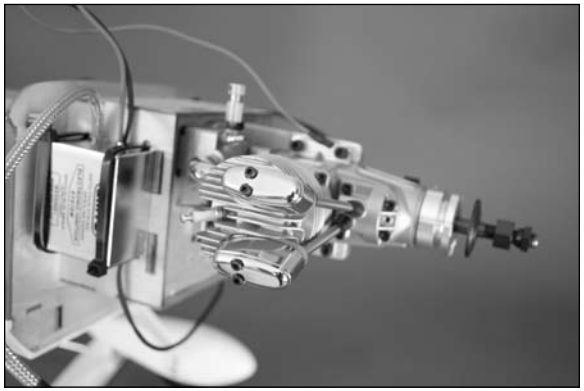
☐ **Step 16**

Connect the Z-bend in the $19^{3}/_{8}$-inch (492mm) throttle pushrod to the outer hole of the carburetor arm as shown.



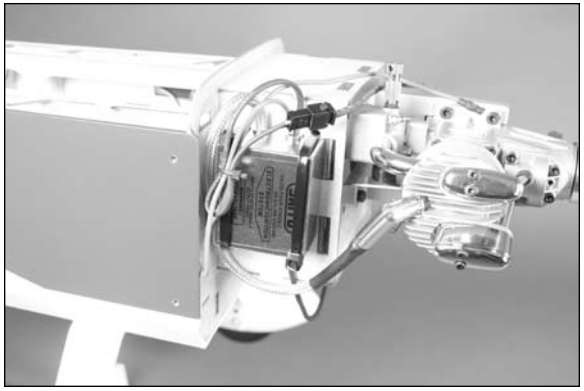
☐ **Step 17**

Slide the throttle pushrod wire into the tube. Position the engine between the mounts. Use the four 4mm x 15mm hex head bolts and four 4mm star washers to secure the engine to the mount. Make sure to place the grounding strap from the ignition module on one of the bolts so it is grounded to the case of the engine. Tighten the screws using a 3mm hex wrench after applying a drop of threadlock on each bolt.



☐ **Step 18**

Make the necessary connections between the ignition module and engine. Use a tie wrap or two to keep the wires organized so they don't interfere with the operation of the engine.



☐ **Step 19**

Center the throttle stick and trim. With the radio system on, remove the standard servo horn from the throttle servo and place a 180 degree servo horn on the servo so it is perpendicular to the servo. This will provide equal throw from open to close at the carburetor.

☐ **Step 20**

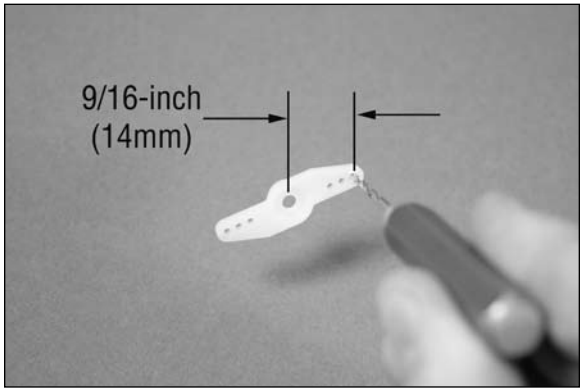
Use the radio to move the servo to the closed throttle position. Close the carburetor at the engine and use a felt-tipped pen to mark the pushrod where it crosses the outer hole of the servo horn.

☐ **Step 21**

Move the throttle servo to open using the radio. Open the carburetor at the engine and note where the line crosses the servo horn. If it does not line up to the outer hole you may need to use a different length servo arm, a different hole in the servo horn or reposition the linkage at the carburetor. Adjusting the throws at the radio can also be used when using a computer radio, but it is best to set the throw as closely as possible using mechanical methods.

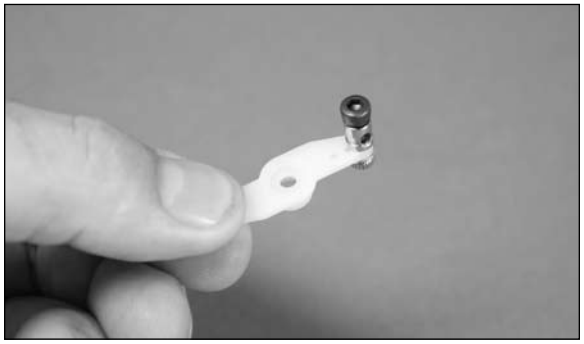
☐ **Step 22**

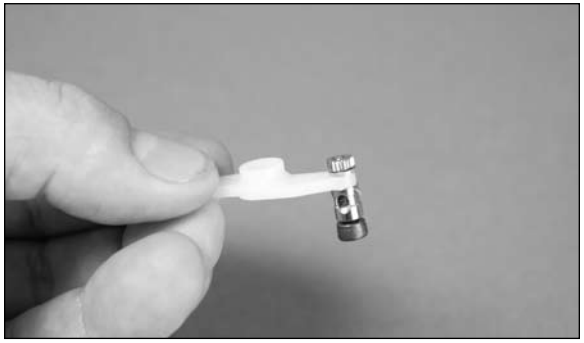
Remove the servo horn from the servo. Use a pin vise and 5/64-inch (2mm) drill bit to enlarge the hole in the servo horn that worked best for your throttle linkage installation. On our model we used the hole that was 9/16-inch (14mm) from the center of the servo horn.



☐ **Step 23**

Insert the pushrod connector in the servo horn as shown. Use the 2mm washer and 2mm knurled nut to secure the connector to the servo horn. Make sure to use threadlock on the nut or the connector will vibrate loose.





☐ **Step 24**

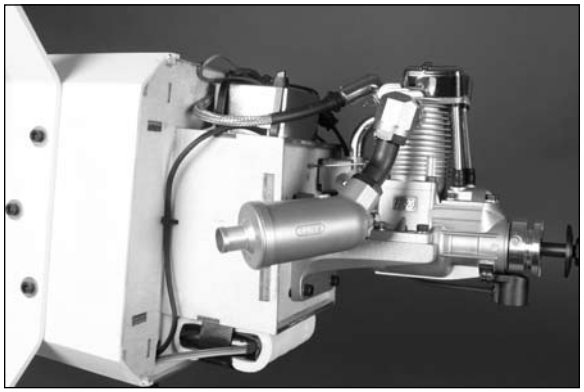
Reinstall the servo horn by sliding the connector over the pushrod wire. Center the throttle stick and trim and install the servo horn perpendicular to the servo center line.

☐ **Step 25**

Move the throttle stick to the closed position and move the carburetor to closed. Use a 2.5mm hex wrench to tighten the screw that secures the throttle pushrod wire. Make sure to use threadlock on the screw so it does not vibrate loose.

☐ **Step 26**

Attach the muffler to the engine using the hardware provided with the muffler.



Note: We use d a 90 degree adapter to center the muffler to reduce the amount of cowling that will need to be removed.

Fuel Tank Installation

Required Parts

Fuselage assembly	Fuel tank
Stopper	Stopper plate, small
Stopper plate, large	Brass tube, straight
Brass tube, pre-bent	Fuel tubing (gas or glow)
Clunk	Rubber band (2)
3mm x 20mm machine screw	

Tools and Adhesives

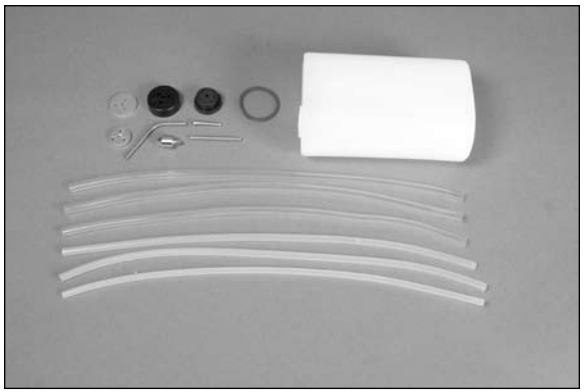
Hobby knife with #11 blade	Ruler

Optional Accessories for Gas

Soldering iron	Solder
Music wire: 1/32-inch	Pliers

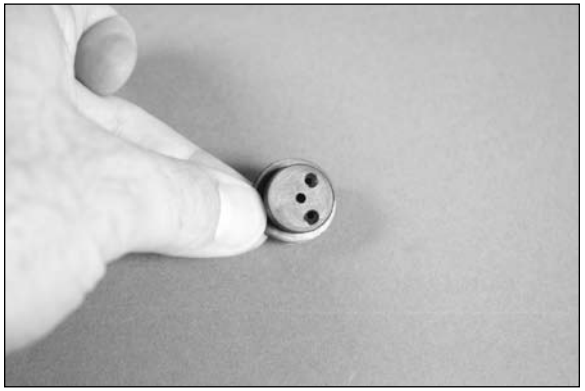
☐ **Step 1**

Locate the items necessary to assemble and install the fuel tank in your model. Two sets of fuels lines have been included with your model. The three yellow lines are for use with gas engines, while the red, green and clear tubes are for glow engines. ***The stopper is compatible with both fuel options.*** Select the tubing that best fits your engine's fuel requirements.



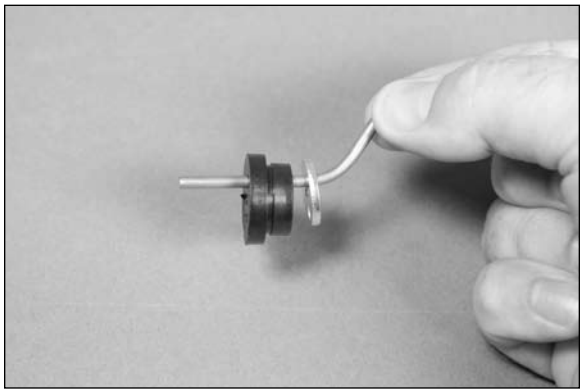
☐ **Step 2**

Remove the material so two of the three holes in the stopper pass completely through. Use a hobby knife and #11 blade for this procedure.



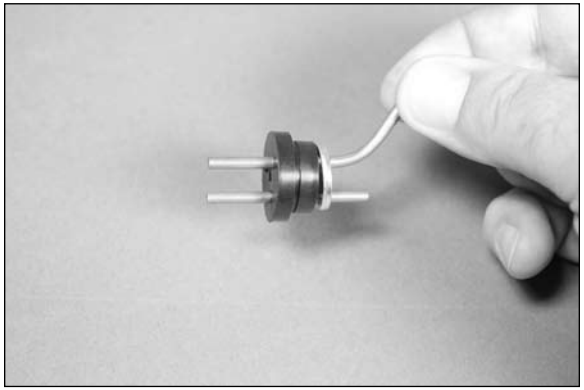
☐ **Step 3**

Slide the pre-bent brass tube through the smaller stopper plate. The tube is then inserted in the stopper from the smaller or back, of the stopper. Leave 5/8-inch (16mm) of the tube forward of the stopper.



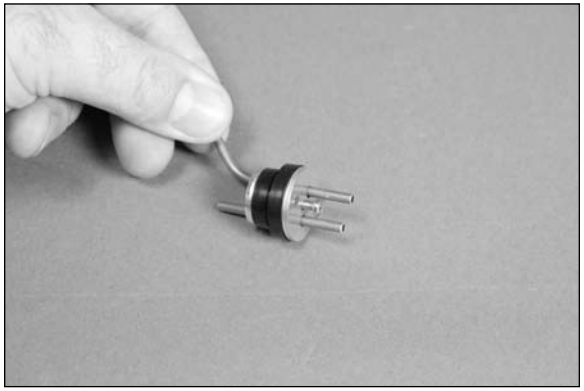
☐ **Step 4**

Slide the straight brass tube through the stopper. Position the front of the tube even with the bent tube as shown.

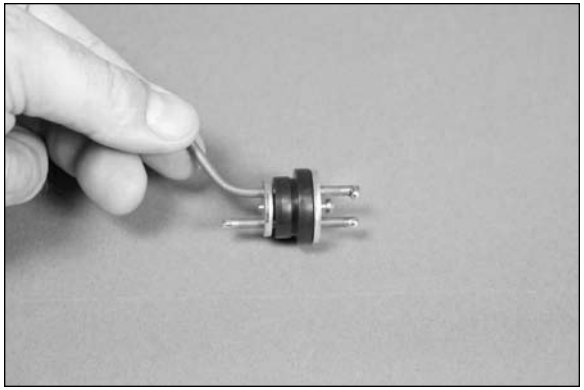


☐ **Step 5**

Slide the larger stopper plate over the tubing at the front. Start the 3mm x 20mm machine screw using a #1 Phillips screwdriver. The screw only needs to be in far enough to keep the large stopper plate from falling off.

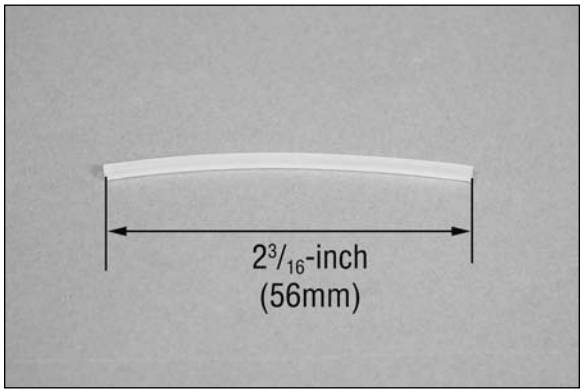


Important: If you are assembling the fuel tank for use with a gas engine, you will need to use solder and a soldering iron to create a small barb for the fuel line. This is necessary as the tubing will need to be wired on to prevent it from sliding loose.



☐ **Step 6**

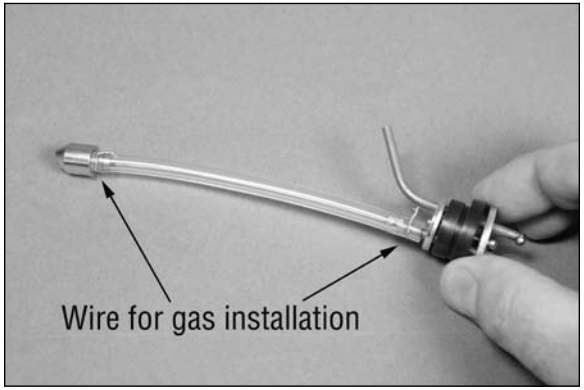
Cut a piece of fuel tubing to a length of $2^{3}/_{16}$-inch (56mm). Use the clear tubing for glow and the yellow tubing for gas.



☐ **Step 7**

Slide the fuel tubing on the straight piece of brass tubing. The clunk will be placed on the opposite end of the fuel tubing.

Important: When attaching the tubing for gas, use a piece of small music wire to secure the line to the clunk and the brass tubing. If the tubing is not wired on, the oils in the fuel will decrease the friction fit between them and they will slide free.



☐ **Step 8**

Insert the stopper assembly into the fuel tank. Make sure the vent line faces to the top of the tank as shown.

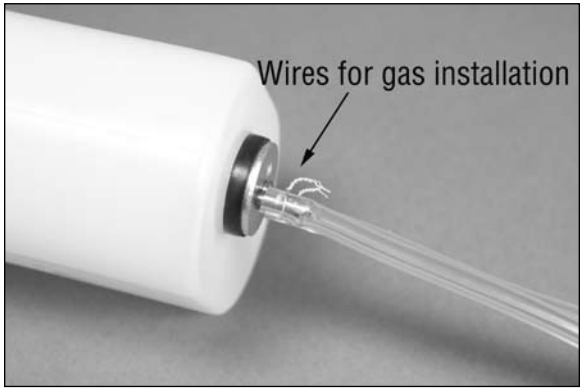
☐ **Step 9**

Use a #1 Phillips screwdriver to tighten the 3mm x 20mm machine screw that secures the stopper in the tank. Don't over-tighten the screw as you could damage the fuel tank. It needs to be tight enough to create a seal between the tank and stopper.

☐ **Step 10**

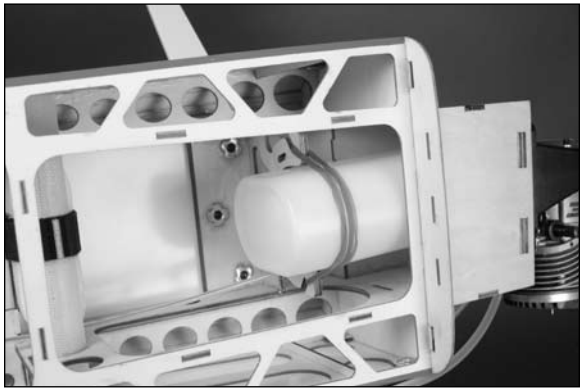
Slide the fuel tubing on the brass tubes outside the tank. Slide the red line on the vent line and the green line on the line from the clunk.

Important: Use the two yellow tubes for the gas installation. Make sure to wire the tubes to the brass tubes so they don't slip off in flight.



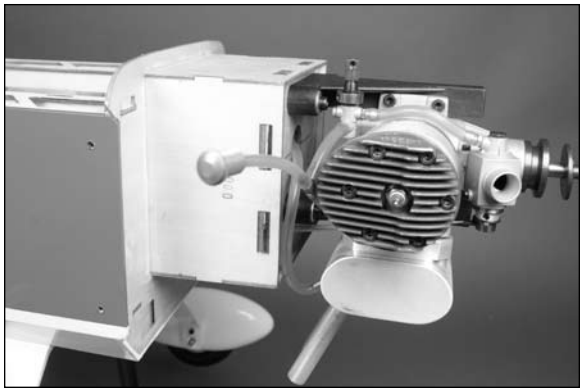
☐ **Step 11**

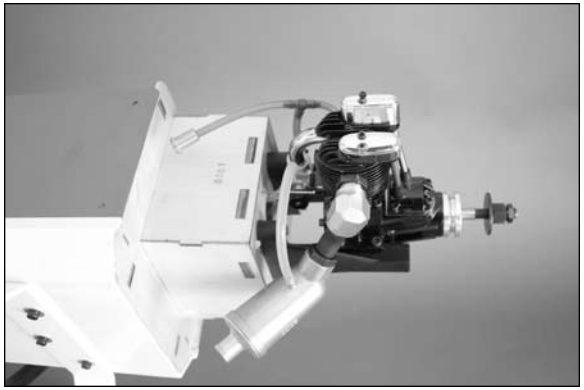
Slide the fuel tank into the fuselage. Guide the lines from the tank through the hole in the firewall. Use two rubber bands to secure the tank in the fuselage.

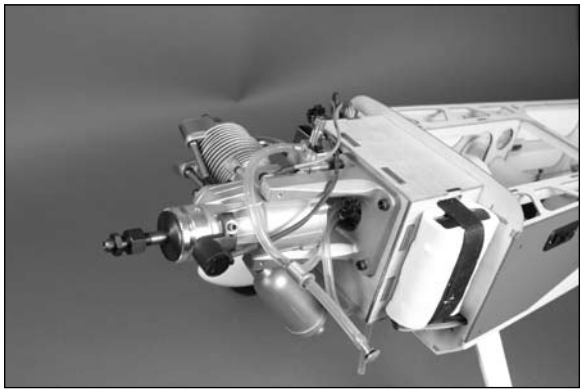


☐ **Step 12**

Connect the lines from the tank to the engine and muffler. The vent line will connect to the muffler and the line from the clunk to the carburetor. We used a fuel dot and a T-fitting on the line to the carburetor so the tank can be fueled without removing the cowling.







Note: If you are installing a gas engine, simply route the vent line to the bottom of the fuselage.

Cowling Installation

Required Parts

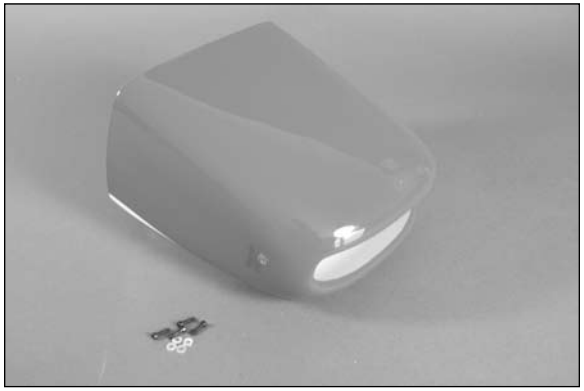
Fuselage assembly	Cowling
3mm washer (4)	Canopy hatch
Spinner with backplate	Propeller
Propeller adapter	
3mm x 12mm hex head bolt (4)	

Tools and Adhesives

Card stock	Hobby scissors
Medium grit sandpaper	Low-tack tape
Ruler	
Hex wrench (to fit spinner bolt)	
Rotary tool with sanding drum	

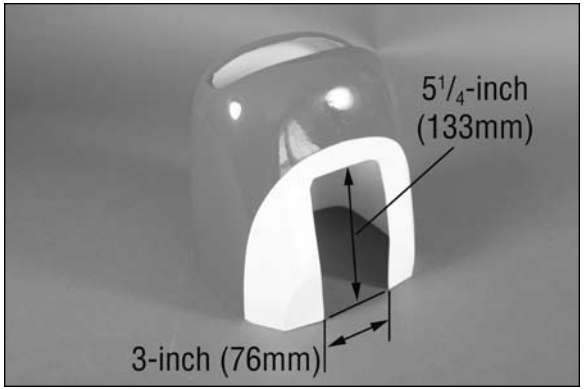
☐ Step 1

Locate the items necessary to install the cowling included with your model.



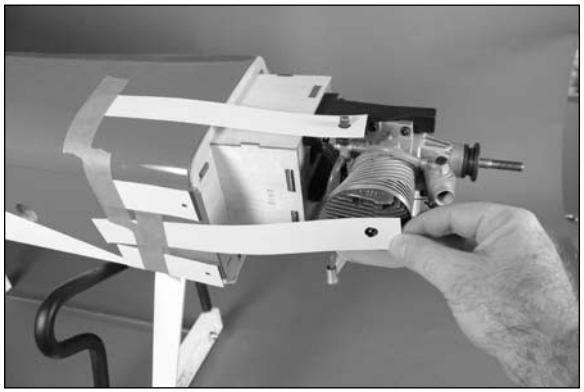
☐ Step 2

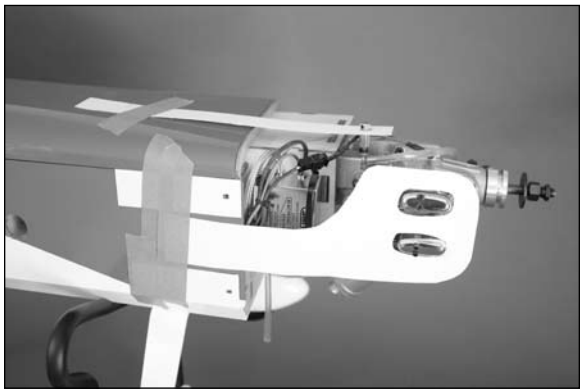
Use hobby scissors and a rotary tool to remove the area from the bottom of the cowl. This will allow air to pass through the cowl and over the engine or motor for cooling. The opening will measure $5^1/_4$-inches by 3-inches (133mm x 76mm).



☐ Step 3

Place the canopy hatch on the fuselage. Use card stock and low-tack tape to make templates to locate the mounting holes for the cowling, glow plug, needle valve and any other items that may protrude or need access from outside the cowling.



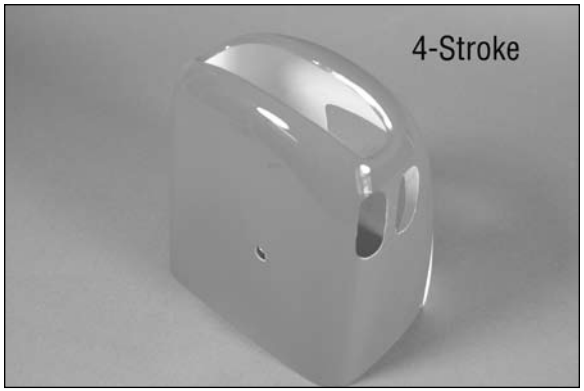


☐ **Step 4**

Slide the cowl over the engine. Slide the spinner backplate on the engine shaft and position the cowling so the backplate is centered in the opening. Also make sure there is enough room between the backplate and cowl so the spinner will not rub against the cowl. Use a felt-tipped pen and the templates to mark the cowling.

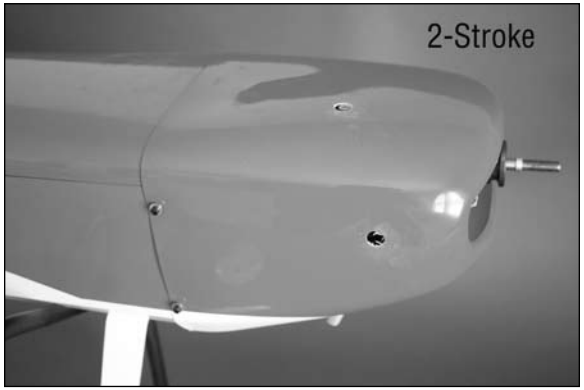
☐ **Step 5**

Use hobby scissors and a rotary tool with a sanding drum to make the access holes and mounting holes in the cowling. The mounting holes for the cowling are best made using a pin vise and 1/8-inch (3mm) drill bit.



☐ **Step 6**

Slide the cowl back on the fuselage and check that all the openings align. It may be necessary to fine-tune things slightly. Once final fit has been determined, use four 3mm x 12mm hex head bolts and four 3mm washers to secure the cowl. Use a 2.5mm hex wrench to tighten the screws.



Hint: Slide a small 1/4-inch (6mm) piece of fuel tubing on each screw after sliding the washer in position. This will keep the screws from vibrating loose.

☐ **Step 7**

Slide the spinner backplate on the engine shaft. It may be necessary to use a space to take up the space between the backplate and engine shaft. This will be included with the spinner adapter.

☐ **Step 8**

Slide the propeller on the engine shaft. Make sure to balance the propeller before installation to reduce vibrations that could damage the engine or airframe.

☐ **Step 9**

Secure the propeller and spinner backplate using the adapter kit that matches your spinner selection. Always use an open end or box wrench to tighten the propeller adapter. Using an adjustable wrench will eventually damage the nut.

☐ **Step 10**

Secure the spinner cone to complete the cowling installation.

Rudder Linkage Installation

Required Parts

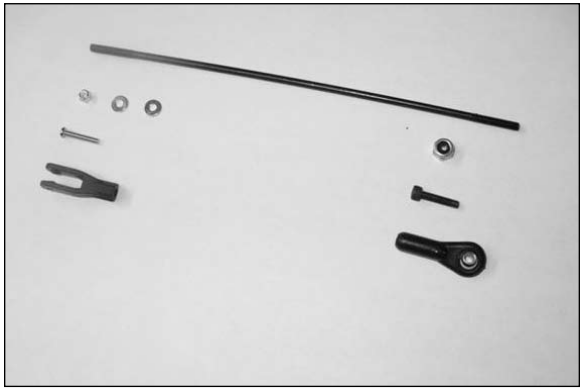
Fuselage assembly	Ball end
Clevis end	4-40 locknut
2mm x 12mm machine screw	2mm washer
2mm locknut	$1^1/_2$-inch servo arm
4-40 x 1/2-inch hex head bolt	
Threaded pushrod, 5-inch (127mm)	

Tools and Adhesives

Phillips screwdriver: #1	Ruler
Hex wrench: 3/32-inch or 2.5mm	
Nut driver: 4mm, 1/4-inch or 5.5mm	

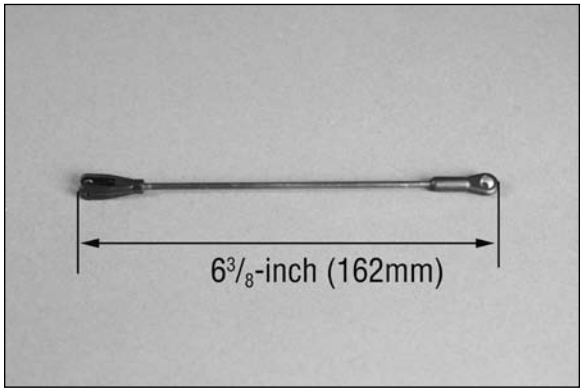
☐ **Step 1**

Locate the items necessary to install the rudder linkage included with your model.



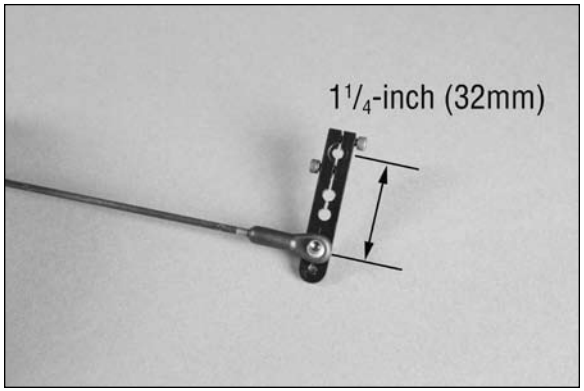
☐ Step 2

Thread a ball end and clevis on a 5-inch (127mm) threaded pushrod. Thread both ends equally on the pushrod. The overall length of the pushrod will be $6^3/_8$-inch (162mm) when assembled.



☐ Step 3

Use a 4-40 x 1/2-inch and 4-40 locknut to secure the ball end to the servo horn. Use a hole that is $1^1/_4$-inch (32mm) from the center of the horn as shown. Use a 3/32-inch hex wrench and 1/4-inch nut driver to tighten the hardware.



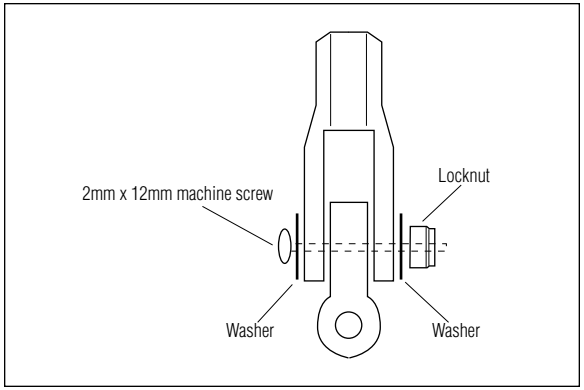
Note: We have also included 3mm x 12mm socket head bolts and 3mm locknuts if you are not using JR or Hangar 9 servo horns on your model. Use a 2.5mm hex wrench and 5.5mm nut driver to tighten this hardware.

☐ Step 4

Use the radio system to center the rudder servo. Use the hardware included with the servo (and servo horn if applicable) to secure the servo horn to the rudder servo. Make sure the horn is perpendicular to the center line of the servo.

☐ Step 5

Use a 2mm x 12mm machine screw, 2mm locknut and two 2mm washers to secure the clevis to the rudder control horn. Use a #1 Phillips screwdriver and a 4mm nut driver to tighten the hardware. Don't over-tighten the hardware causing the clevis to bind. It may be necessary to adjust the length of the linkage slightly to center the rudder when the rudder servo is centered.



Elevator Installation

Required Parts

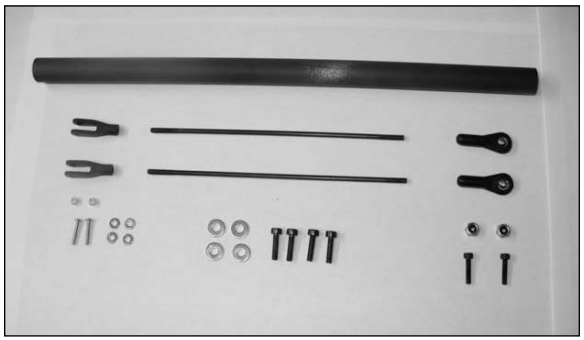
Fuselage assembly
Clevis end (2)
Carbon stabilizer tube
2mm locknut (2)
2mm x 12mm machine screw (2)
1-inch servo horn (2)
4-40 x 1/2-inch hex head bolt (2)
Threaded pushrod, 5 1/2-inch (146mm)
3mm washer (4)
3mm x 12mm hex head bolt (4)
Ball end (2)
4-40 locknut (2)
2mm washer (2)

Tools and Adhesives

Phillips screwdriver: #1
Hex wrench: 3/32-inch, 2.5mm
Nut driver: 4mm, 1/4-inch or 5.5mm
Ruler

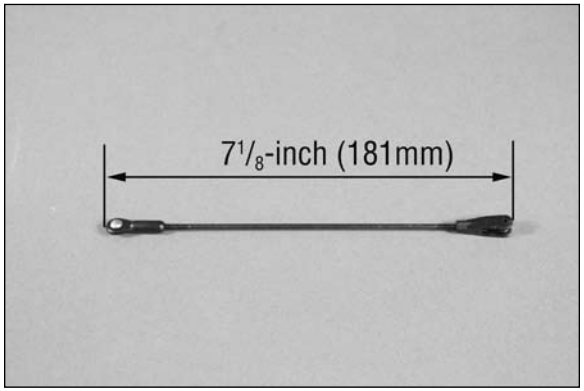
☐ Step 1

Locate the items necessary to install the elevator included with your model.



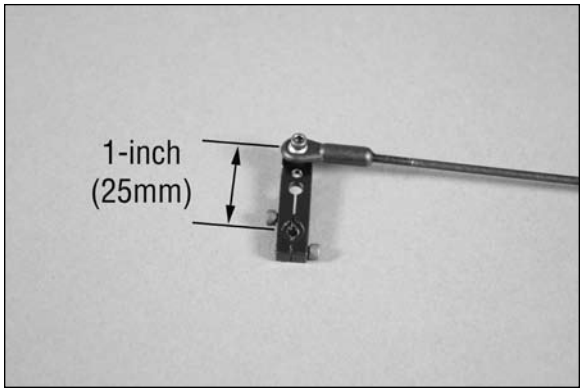
☐☐ Step 2

Thread a ball end and clevis on a 5 1/2-inch (146mm) threaded pushrod. Thread both ends equally on the pushrod. The overall length of the pushrod will be 7 1/8-inch (181mm) when assembled.



☐☐ Step 3

Use a 4-40 x 1/2-inch and 4-40 locknut to secure the ball end to the servo horn. Use a hole that is 1-inch (25mm) from the center of the horn as shown. Use a 3/32-inch hex wrench and 1/4-inch nut driver to tighten the hardware.



Note: We have also included 3mm x 12mm socket head bolts and 3mm locknuts if you are not using JR or Hangar 9 servo horns on your model. Use a 2.5mm hex wrench and 5.5mm nut driver to tighten this hardware.

☐☐ Step 4

Use the radio system to center the elevator servo. Use the hardware included with the servo (and servo horn if applicable) to secure the servo horn to the elevator servo. Make sure the horn is perpendicular to the center line of the servo.

☐ Step 5

Repeat Steps 2 through 4 to prepare the linkage for the servo on the opposite side of the fuselage.

☐☐ Step 6

Slide the carbon stabilizer tube into the stabilizer. Slide the tube in only as far as it will easily slide. Forcing the tube can damage the stabilizer.

☐☐ Step 7

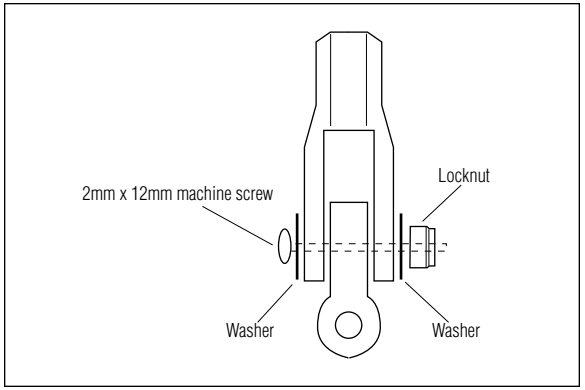
Slide the tube into the fuselage. The stabilizer will fit tight against the fuselage.

☐☐ Step 8

Use two 3mm x 10mm hex head screws and two 3mm washers to secure the stabilizer to the fuselage. Make sure to use threadlock on the screw before tightening it with a 2.5mm hex wrench.

☐☐ Step 9

Use a 2mm x 12mm machine screw, 2mm locknut and two 2mm washers to secure the clevis to the elevator control horn. Use a #1 Phillips screwdriver and a 4mm nut driver to tighten the hardware. Don't over-tighten the hardware causing the clevis to bind.



☐ Step 10

Repeat Steps 6 through 9 to install the remaining stabilizer assembly and linkage.

Aileron Servo Installation

Required Parts

Wing panel assembly (right and left)

Ball end (2)	3mm washer (4)
Clevis end (2)	4-40 locknut (2)
Servo with hardware (2)	2mm locknut (2)
2mm locknut	$1^1/_2$-inch servo arm

2mm x 12mm machine screw (2)
Servo extension, 6-inch (152mm)
4-40 x 1/2-inch hex head bolt (2)
Threaded pushrod, 6-inch (152mm)
3mm x 12mm hex head bolt (4)

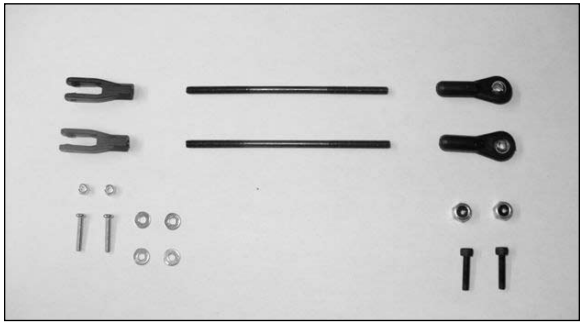
Tools and Adhesives

Phillips screwdriver: #1	Ruler
Thin CA	String or dental floss

Hex wrench: 3/32-inch or 2.5mm
Nut driver: 4mm, 1/4-inch or 5.5mm

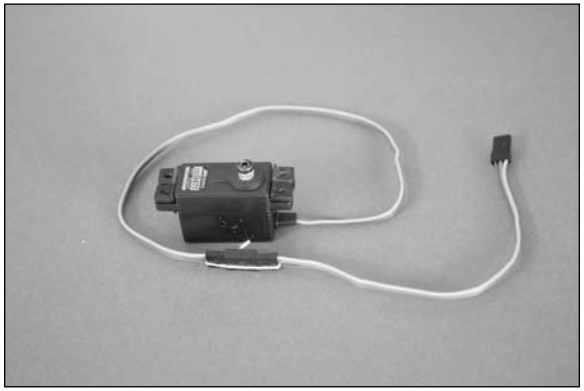
☐ Step 1

Locate the items necessary to install the aileron servo included with your model.



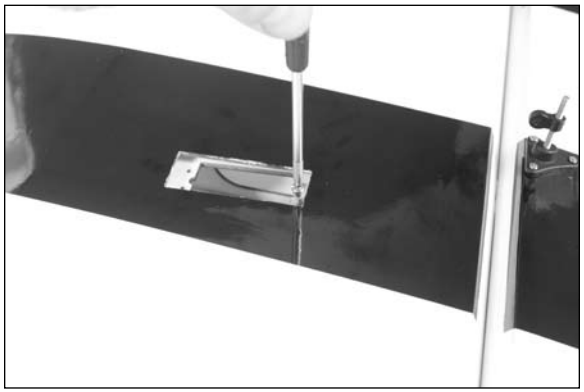
☐☐ Step 2

Remove the servo horn from the aileron servo. Use string or dental floss to secure a 6-inch (152mm) extension to the aileron servo lead.



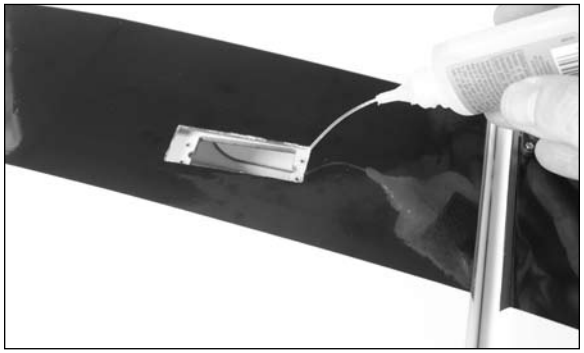
☐☐ Step 3

Use a #1 Phillips screwdriver to thread a servo mounting screw into each of the four holes in the aileron servo mounting plate. This will cut threads in the wood for the next step.



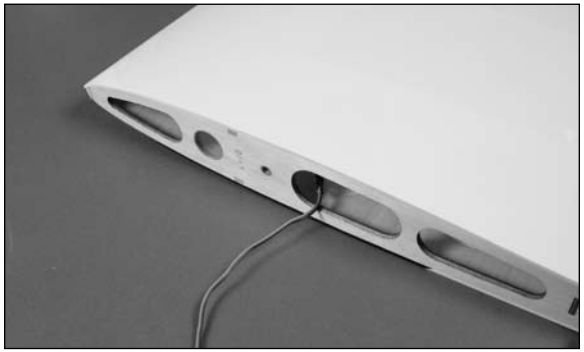
☐☐ Step 4

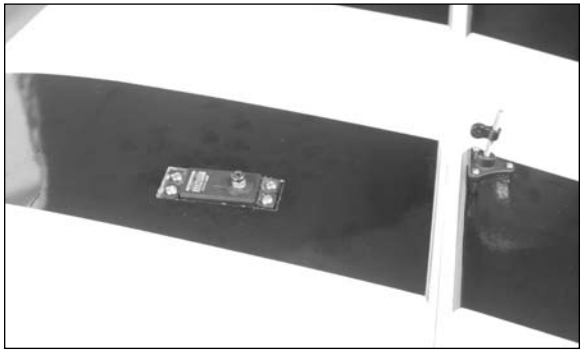
Place 2–3 drops of thin CA into each of the holes to harden the threads cut in the previous step. This will make the screws more secure when installed and prevent them from vibrating loose in flight.



☐☐ Step 5

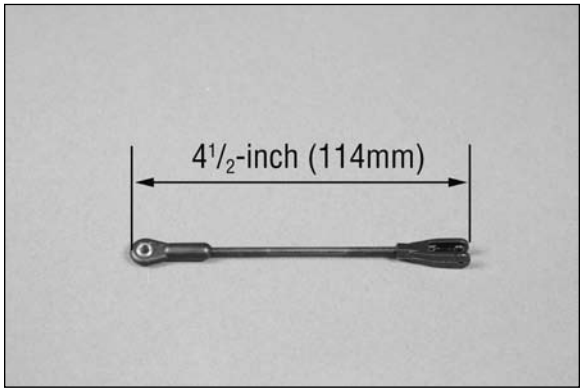
Guide the aileron servo lead through the wing. Secure the servo in the wing using a #1 Phillips screwdriver and the screws included with the servo. Make sure the output of the servo faces toward the aileron as shown.





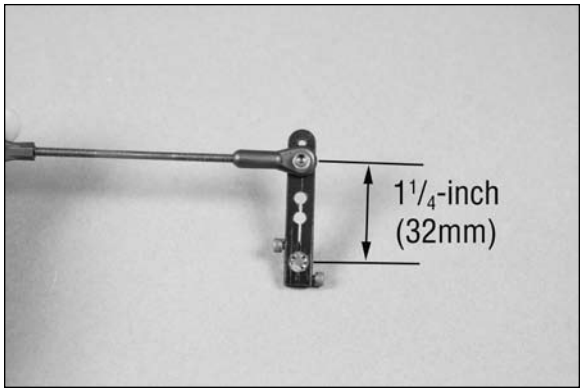
☐☐ Step 6

Thread a ball end and clevis on a $3^3/_4$-inch (70mm) threaded pushrod. Thread both ends equally on the pushrod. The overall length of the pushrod will be $4^1/_2$-inch (114mm) when assembled.



☐☐ Step 7

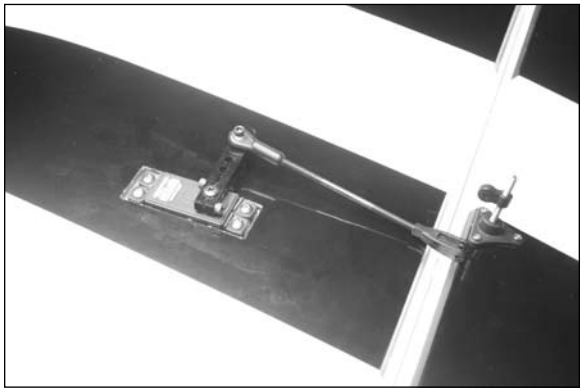
Use a 4-40 x 1/2-inch and 4-40 locknut to secure the ball end to the servo horn. Use a hole that is $1^1/_4$-inch (32mm) from the center of the horn as shown. Use a 3/32-inch hex wrench and 1/4-inch nut driver to tighten the hardware.



Note: We have also included 3mm x 12mm socket head bolts and 3mm locknuts if you are not using JR or Hangar 9 servo horns on your model. Use a 2.5mm hex wrench and 5.5mm nut driver to tighten this hardware.

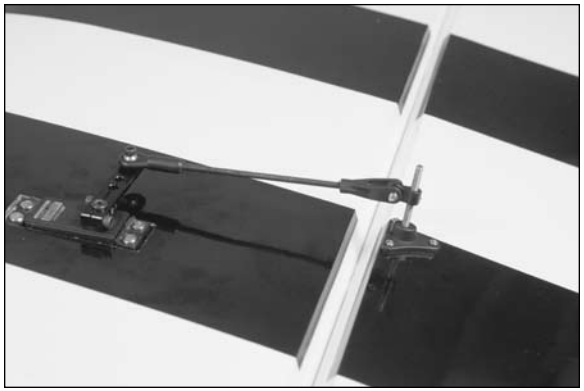
☐☐ Step 8

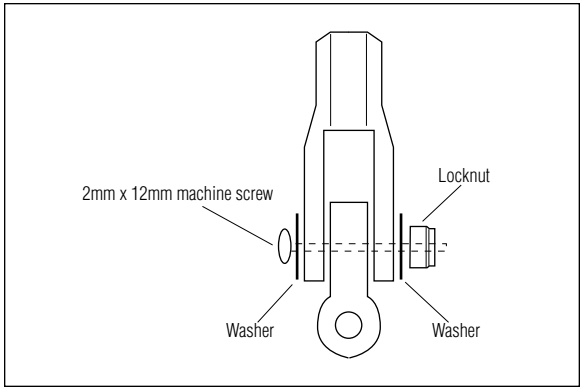
Use the radio system to center the aileron servo. Use the hardware included with the servo (and servo horn if applicable) to secure the servo horn to the aileron servo. Make sure the horn is parallel to the aileron hinge line.



☐☐ Step 9

Use a 2mm x 12mm machine screw, 2mm locknut and two 2mm washers to secure the clevis to the aileron control horn. Use a #1 Phillips screwdriver and a 4mm nut driver to tighten the hardware. Don't over-tighten the hardware causing the clevis to bind. It may be necessary to adjust the length of the linkage slightly to center the aileron when the aileron servo is centered.





☐ Step 10

Repeat Steps 2 through 9 to install the remaining aileron servo and linkage.

Wing Installation

Required Parts

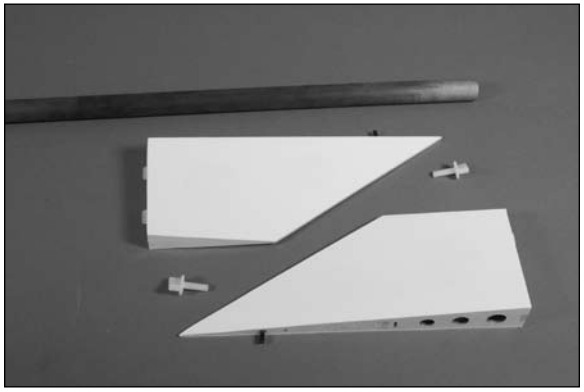
Fuselage assembly	Carbon wing tube
Wing fillet (2)	Nylon wing bolt (2)
3mm x 12mm hex head bolt (6)	
3mm washer (6)	
Wing panel assembly (right and left)	

Tools and Adhesives

Clear plastic or waxed paper	Low-tack tape
30-minute epoxy	Mixing cup
Mixing stick	Epoxy brush
Rubbing alcohol	Paper towel
Covering iron	Hex wrench: 2.5mm
Hobby knife with #11 blade	

☐ Step 1

Locate the items necessary to attach the wing to the fuselage.

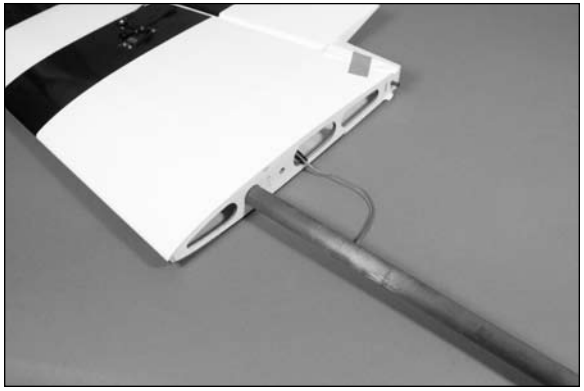


☐☐ Step 2

Use low-tack tape to keep the covering away from the area where the wing fillet will be glued.

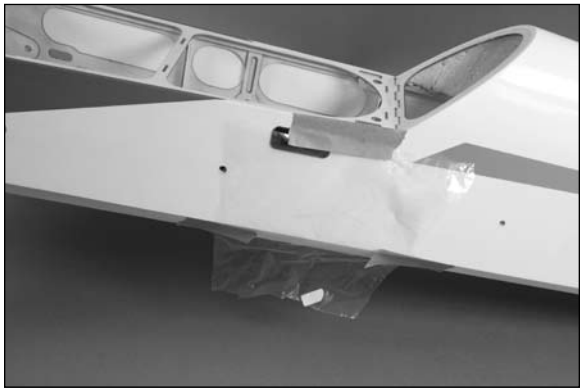
☐☐ Step 3

Slide the carbon wing tube into one of the wing panels. Only slide the tube in as far as it will easily slide. Forcing the tube could possibly damage the wing.



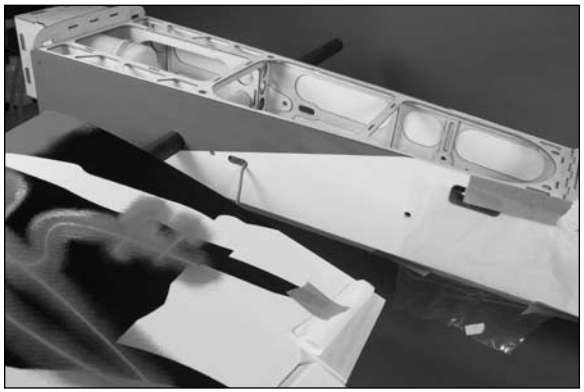
☐☐ Step 4

Use low-tack tape to tape a piece of plastic or waxed paper to the fuselage directly behind the wing alignment dowel. Make sure it doesn't cover the smaller hole where the wing fillet plugs into the fuselage.



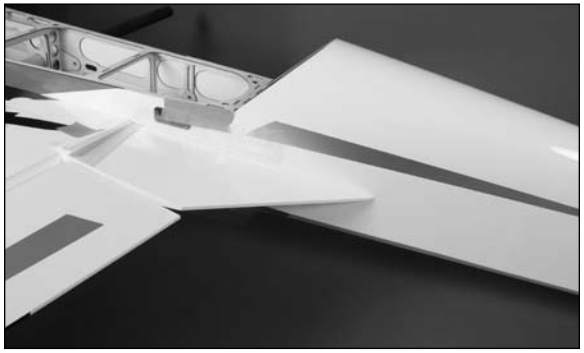
☐☐ Step 5

Slide the wing panel and tube into position on the fuselage. Make sure to guide the aileron servo lead through the slot in the fuselage.



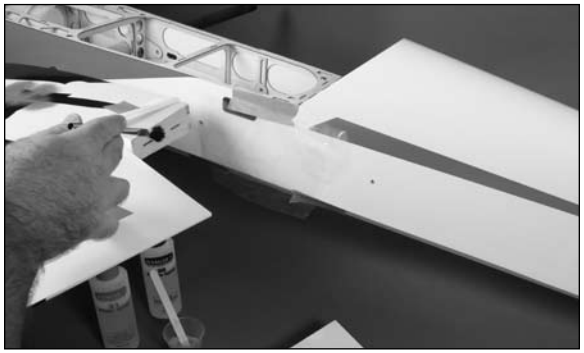
☐☐ Step 6

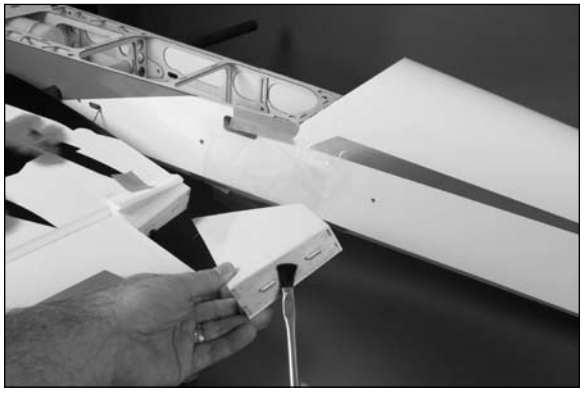
While sliding the wing in position, test fit the wing fillet to the wing. You should be able to hold the fillet in position and slide the wing tightly against the fuselage as shown.



☐☐ Step 7

Once the fit of the fillet has been determined, mix 1/2 ounce (15mL) of 30-minute epoxy and apply the epoxy to the mating surfaces of both the fillet and wing panel.





☐☐ Step 8

Position the fillet back on the wing and slide the wing tight against the fuselage. Use a nylon wing bolt to hold the wing panel tightly against the fuselage until the epoxy fully cures. Use a paper towel and rubbing alcohol to remove any excess epoxy that may have oozed from the joint.

☐☐ Step 9

Once the epoxy cures, remove the wing from the fuselage. Remove the tape from the covering and use a covering iron to seal the covering on the wing and over the fillet.

☐ Step 10

Repeat Steps 2 through 9 to install the remaining wing panel and fillet.

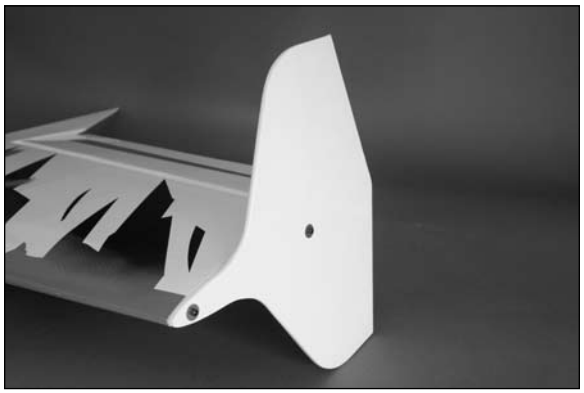
OPTIONAL SIDE FORCE GENERATOR INSTALLATION

☐☐ Step 11

If you elect to purchase the side force generators, now is a good time to attach them to the wing. Use a hobby knife and #11 blade to remove the covering to expose the two blind nuts at the wing tip.

☐☐ Step 12

The side force generator is held in position using two 3mm x 12mm hex head screws and two 3mm washers. Use a 2.5mm hex wrench to tighten the screws. Use threadlock on the screws to prevent them from vibrating loose.



☐ Step 13

Repeat Step 11 and 12 to install the remaining side force generator on the opposite wing panel.

☐ **Step 14**

Secure the canopy hatch using two 3mm x 12mm hex head bolts and two 3mm washers. Tighten the bolts using a 2.5mm hex wrench.

Center of Gravity

An important part of preparing the aircraft for flight is properly balancing the model.

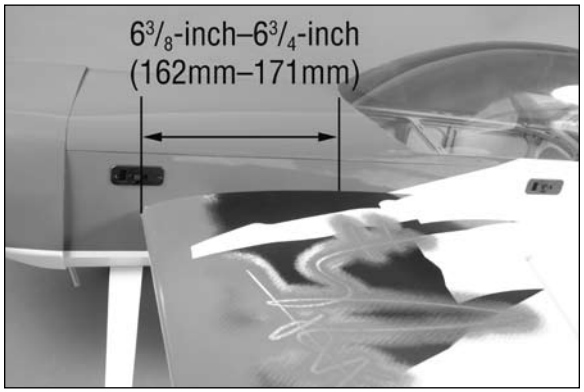
Caution: Do not inadvertently skip this step!

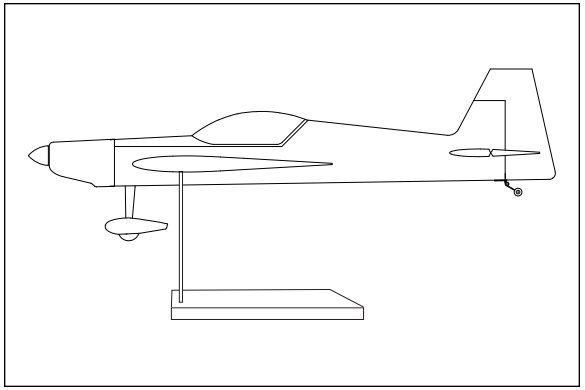
The recommended Center of Gravity (CG) location for the Funtana is $6^3/_8$-inch–$6^3/_4$-inch (162mm–171mm) behind the leading edge of the wing against the fuselage.

> ***Note***: The CG can also be measured at the wing tip. This measurement is $3^1/_8$-inch–$3^1/_2$-inch (80mm–89mm) behind the leading edge of the wing.

If necessary, move the battery pack or add weight to either the nose or the tail until the correct balance is achieved. Stick-on weights are available at your local hobby shop and work well for this purpose.

When balancing your model, support the plane upright at the marks made on the wing with your fingers or a commercially available balancing stand. This is the correct balance point for your model. You might find you may be required to add a small amount of weight to either the front or back of the fuselage to achieve the correct balance.





After the first flights, the CG position can be adjusted for your personal preference.

Control Throws

☐ **Step 1**

Turn on the transmitter and receiver of your model. Check the movement of the rudder using the transmitter. When the stick is moved right, the rudder should also move right. Reverse the direction of the servo at the transmitter if necessary.

☐ **Step 2**

Check the movement of the elevator with the radio system. Moving the elevator stick toward the bottom of the transmitter will make the airplane elevator move up.

☐ **Step 3**

Check the movement of the ailerons with the radio system. Moving the aileron stick right will make the right aileron move up and the left aileron move down.

☐ **Step 4**

Use a ruler to adjust the throw of the elevator, ailerons and rudder.

Aileron High Rate

Up	3-inch	(77mm)	35 Degrees
Down	3-inch	(77mm)	35 Degrees

Aileron Low Rate

Up	1 1/2-inch	(35mm)	17 Degrees
Down	1 1/2-inch	(35mm)	17 Degrees

Elevator High Rate

Up	4 1/2-inch	(115mm)	50 Degrees
Down	4 1/2-inch	(115mm)	50 Degrees

Elevator Low Rate

Up	15/16-inch	(24mm)	13 Degrees
Down	15/16-inch	(24mm)	13 Degrees

Rudder High Rate

Left	4 3/4-inch	(120mm)	52 Degrees
Right	4 3/4-inch	(120mm)	52 Degrees

Rudder Low Rate

Left	2-inch	(50mm)	24 Degrees
Right	2-inch	(50mm)	24 Degrees

Note: Measurements are taken at the inner or widest point on the control surface.

These are general guidelines measured from our own flight tests. You can experiment with higher rates to match your preferred style of flying.

Note: Travel Adjust, Sub-Trim and Dual Rates are not listed and should be adjusted according to each individual model and preference.

Rates and Expos

Use Expo to soften the feel of the model. On high 3D rates, use quite a bit of expo. The goal on 3D rates is to get the model to feel the same around neutral as it does on low rates.

Use low rate settings for all flying except for 3D aerobatics. For precision flying or general sport hotdogging, the low rate throws are perfect, even for snap rolls. The only exception is rudder rates. Use 3D rudder rate when doing stall turns and rolling circles, since the more rudder the better for these. When doing 3D aerobatics, flip to 3D rates just before the maneuver.

As soon as the maneuver is done, flip back down to low rate to avoid over-controlling the model.

Flight Preparations

Flight preparations must be checked each time you travel to the flying field. Because your model 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 using a Spektrum radio system, follow the guidelines 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.

☐ **Fueling your Model**

Fill the fuel tank with the proper fuel. Fill the tank by connecting the fuel pump to the line going to the needle valve or to the fuel dot on the side of the cowling. 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 or insert the plug into the fuel dot and connect the line to the 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.

Safety Do's and Don'ts for Pilots

- Ensure that your batteries have been properly charged prior to your initial flight.
- Keep track of the time the system is turned on so you will know how long you can safely operate your system.
- Perform a ground range check prior to the initial flight of the day. See the "Daily Flight Checks Section" for information.
- Check all control surfaces prior to each takeoff.
- Do not fly your model near spectators, parking areas or any other area that could result in injury to people or damage of property.
- Do not fly during adverse weather conditions. Poor visibility can cause disorientation and loss of control of your aircraft. Strong winds can cause similar problems.
- Do not point the transmitter antenna directly toward the model. The radiation pattern from the tip of the antenna is inherently low.
- Do not take chances. If at any time during flight you observe any erratic or abnormal operation, land immediately and do not resume flight until the cause of the problem has been ascertained and corrected. Safety can never be taken lightly.

Dual Rate Recommendations

- We recommend that the rudder dual rate be set to Low for takeoff to help minimize overcorrection during the takeoff roll.
- We recommend the rudder dual rate be set to High for landing to help maintain heading as the model transitions from flying speed to taxi speeds.
- Elevator and Aileron dual rates should be adjusted for personal feel and also if there is any unusual wind conditions.

Daily Flight Checks

☐ **Step 1**

Check the battery voltage on both the transmitter and the receiver battery packs. Do not fly below 4.3V on the transmitter if you are using a Spektrum transmitter that uses 4-cells to power the transmitter. Do not fly below 9.5V on the transmitter if you are using a JR or Spektrum transmitter that uses 8-cells to power the transmitter. Do not fly if the receiver pack is at or below 4.7V. To do so can crash your aircraft.

Note: When you check these batteries, ensure that you have the polarities correct on your expanded scale voltmeter.

☐ **Step 2**

Check all hardware (linkages, screws, nuts, and bolts) prior to each day's flight. Be sure that binding does not occur and that all parts are properly secured.

☐ **Step 3**

Ensure that all surfaces are moving in the proper manner.

☐ **Step 4**

Perform a ground range check before each day's flying session.

☐ **Step 5**

Prior to starting your aircraft, turn off your transmitter, then turn it back on. Do this each time you start your aircraft. If any critical switches are on without your knowledge, the transmitter alarm will warn you at this time.

☐ **Step 6**

Check that all trim levers are in the proper location.

☐ **Step 7**

All servo pigtails and switch harness plugs should be secured in the receiver. Make sure that the switch harness moves freely in both directions.

Age Requirements

Age Recommendation: 14 years or over. This is not a toy. This product is not intended for use by children without direct adult supervision.

Safety, Precautions and Warnings

As the user of this product, you are solely responsible for operating it in a manner that does not endanger yourself and others or result in damage to the product or the property of others.

Carefully follow the directions and warnings for this and any optional support equipment (chargers, rechargeable battery packs, etc.) that you use.

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 necessary 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 out 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.

Warranty Information

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 1/2 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.

United States:

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

Horizon Service Center
4105 Fieldstone Road
Champaign, Illinois 61822
USA

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

Horizon Product Support
4105 Fieldstone Road
Champaign, Illinois 61822
USA

Please call 877-504-0233 or e-mail us at productsupport@horizonhobby.com with any questions or concerns regarding this product or warranty.

United Kingdom:

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

Horizon Hobby UK
Units 1-4 Ployters Rd
Staple Tye
Harlow, Essex
CM18 7NS
United Kingdom

Please call +44 (0) 1279 641 097 or e-mail us at sales@horizonhobby.co.uk with any questions or concerns regarding this product or warranty.

Germany:

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

Horizon Technischer Service
Hamburger Strasse 10
25335 Elmshorn
Germany

Please call +49 4121 46199 66 or e-mail us at service@horizonhobby.de with any questions or concerns regarding this product or warranty.

CE Compliance Information for the European Union

INSTRUCTIONS FOR DISPOSAL OF WEEE BY USERS IN THE EUROPEAN UNION

This product must not be disposed of with other waste. Instead, it is the user's responsibility to dispose of their waste equipment by handing it over to a designated collection point for the recycling of waste electrical and electronic equipment. The separate collection and recycling of your waste equipment at the time of disposal will help to conserve natural resources and ensure that it is recycled in a manner that protects human health and the environment. For more information about where you can drop off your waste equipment for recycling, please contact your local city office, your household waste disposal service or where you purchased the product.

2009 Official Academy of Model Aeronautics Safety Code

GENERAL

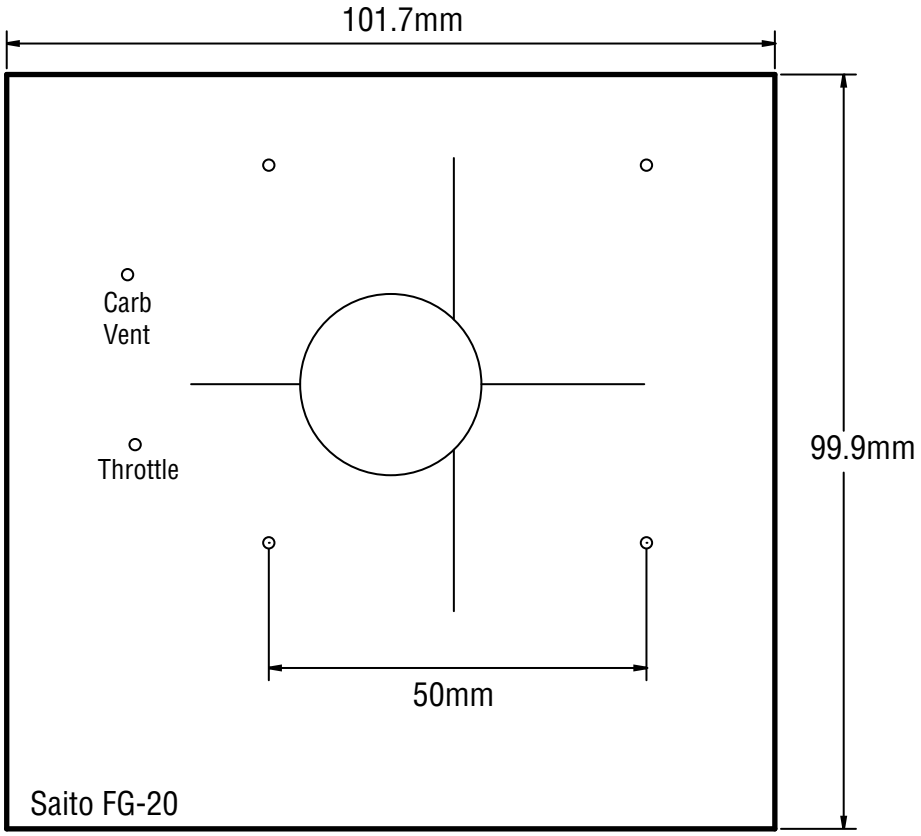
1. A model aircraft shall be defined as a non-human-carrying device capable of sustained flight in the atmosphere. It shall not exceed limitations established in this code and is intended to be used exclusively for recreational or competition activity.
2. The maximum takeoff weight of a model aircraft, including fuel, is 55 pounds, except for those flown under the AMA Experimental Aircraft Rules.
3. I will abide by this Safety Code and all rules established for the flying site I use. I will not willfully fly my model aircraft in a reckless and/or dangerous manner.
4. I will not fly my model aircraft in sanctioned events, air shows, or model demonstrations until it has been proven airworthy.
5. I will not fly my model aircraft higher than approximately 400 feet above ground level, when within three (3) miles of an airport without notifying the airport operator. I will yield the right-of-way and avoid flying in the proximity of full-scale aircraft, utilizing a spotter when appropriate.
6. I will not fly my model aircraft unless it is identified with my name and address, or AMA number, inside or affixed to the outside of the model aircraft. This does not apply to model aircraft flown indoors.
7. I will not operate model aircraft with metal-blade propellers or with gaseous boosts (other than air), nor will I operate model aircraft with fuels containing tetranitromethane or hydrazine.
8. I will not operate model aircraft carrying pyrotechnic devices which explode burn, or propel a projectile of any kind. Exceptions include Free Flight fuses or devices that burn producing smoke and are securely attached to the model aircraft during flight. Rocket motors up to a G-series size may be used, provided they remain firmly attached to the model aircraft during flight. Model rockets may be flown in accordance with the National Model Rocketry Safety Code; however, they may not be launched from model aircraft. Officially designated AMAAir Show Teams (AST) are authorized to use devices and practices as defined within the Air Show Advisory Committee Document.

9. I will not operate my model aircraft while under the influence of alcohol or within eight (8) hours of having consumed alcohol.
10. I will not operate my model aircraft while using any drug which could adversely affect my ability to safely control my model aircraft.
11. Children under six (6) years old are only allowed on a flightline or in a flight area as a pilot or while under flight instruction.
12. When and where required by rule, helmets must be properly worn and fastened. They must be OSHA, DOT, ANSI, SNELL or NOCSAE approved or comply with comparable standards.

RADIO CONTROL

1. All model flying shall be conducted in a manner to avoid over flight of unprotected people.
2. I will have completed a successful radio equipment ground-range check before the first flight of a new or repaired model aircraft.
3. I will not fly my model aircraft in the presence of spectators until I become a proficient flier, unless I am assisted by an experienced pilot.
4. At all flying sites a line must be established, in front of which all flying takes place. Only personnel associated with flying the model aircraft are allowed at or in front of the line. In the case of airshows demonstrations straight line must be established. An area away from the line must be maintained for spectators. Intentional flying behind the line is prohibited.
5. I will operate my model aircraft using only radio-control frequencies currently allowed by the Federal Communications Commission (FCC). Only individuals properly licensed by the FCC are authorized to operate equipment on Amateur Band frequencies.
6. I will not knowingly operate my model aircraft within three (3) miles of any preexisting flying site without a frequency-management agreement. A frequencymanagement agreement may be an allocation of frequencies for each site, a day-use agreement between sites, or testing which determines that no interference exists. A frequency-management agreement may exist between two or more AMA chartered clubs, AMA clubs and individual AMA members, or individual AMA members. Frequency-management agreements, including an interference test report if the agreement indicates no interference exists, will be signed by all parties and copies provided to AMA Headquarters.
7. With the exception of events flown under official AMA rules, no powered model may be flown outdoors closer than 25 feet to any individual, except for the pilot and located at the flightline.
8. Under no circumstances may a pilot or other person touch a model aircraft in flight while it is still under power, except to divert it from striking an individual.
9. Radio-controlled night flying is limited to low-performance model aircraft (less than 100 mph). The model aircraft must be equipped with a lighting system which clearly defines the aircraft's attitude and direction at all times.
10. The operator of a radio-controlled model aircraft shall control it during the entire flight, maintaining visual contact without enhancement other than by corrective lenses that are prescribed for the pilot. No model aircraft shall be equipped with devices which allow it to be flown to a selected location which is beyond the visual range of the pilot.

Engine Mounting Template–Saito FG20



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