

Twin Otter ARF

Assembly Manual

HANGAR 9[®]

Fly First Class[™]



Specifications

<i>Wingspan.....</i>	<i>82.0 in (2080mm)</i>
<i>Length.....</i>	<i>65.0 in (1651mm)</i>
<i>Wing Area.....</i>	<i>738 sq in (47.61 sq dm)</i>
<i>Weight.....</i>	<i>11 1/2–12 1/4 lb (5.2–6.0 kg)</i>
<i>Radio.....</i>	<i>7-channel w/8–10 servos</i>
<i>Engine.....</i>	<i>36 2-stroke; Power 25</i>

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Contents of Kit and Parts Layout

1	HAN461001	Fuselage Assembly with Hatch	12	HAN461012	Left Main Gear
2	HAN461002	Cowling	13	HAN461013	Right Main Gear
3	HAN461003	Left Nacelle	14	HAN461014	Wing and Tail Tubes
4	HAN461004	Right Nacelle	15	HAN461015	Landing Gear Fairings
5	HAN461006	Left Stabilizer	16	HAN461020	2 1/4-inch Black Spinners
6	HAN461005	Right Stabilizer	17	HAN461021	Fiberglass Nose Cone
7	HAN461007	Rudder	Not Illustrated		
8	HAN461008	Left Wing	1	HAN461016	Electric Mounting Pack
9	HAN461009	Right Wing	2	HAN461017	Glow Mounting Pack
10	HAN461010	Struts	3	HAN461018	Main Hardware Pack
11	HAN461011	Nose Gear Assembly	4	HAN461019	Fuel Tanks

Included Hardware

Packaged in Kit

Fuselage assembly with hatch	1
Fiberglass nose cone	1
Right wing	1
Left wing	1
Right stabilizer with elevator	1
Left stabilizer with elevator	1
Right nacelle	1
Left nacelle	1
Rudder	1
Cowling	2
Right main landing gear with screws	1
Left main landing gear with screws	1
Nose leg assembly with screws	1
Landing gear fairings (left and right)	2
Wing struts (left and right)	2
3/4 x 19 1/2 inch aluminum wing tube	1
3/8 x 11 inch aluminum stabilizer tube	1
Fuel tanks 200cc	2
2 1/4-inch white nylon spinners	2

Control Horn Bag

Small control horns	2
#4 x 1/2 in Phillips head screws	4
Nylon clevises	9
Snap keepers	9
Silicone keepers	18
1/4-20 x 2 in nylon screws	2

Pushrod Bag

2-56 x 4-in steel pushrod	7
2-56 x 10-in steel pushrods	2
2-56 x 7-in steel pushrod	1

Rudder Cable Bag

Rudder cable 82 inch	1
Copper crimps	4
Wire cable ends	2
EZ links	2

rudder
rudder control horns
steel pushrods
steel pushrods
clevises
wing retention

ailerons and flaps
throttles
nose gear steering

rudder cables
rudder servo

Main Hardware Bag

8-32 x 1-inch Allen head machine screws	6	main landing gear
#4 x 7/16-inch wood screws	3	nose cone
4-40 x 1-inch Allen head machine screws	2	strut to wing attach
8-32 x 1-inch Allen head machine screws	4	nose gear attach

Glow Engine Mount Bag

Small nylon engine mount	4	engine
6-32 x 1-inch Allen head machine screws	8	engine mount
6-32 blind nuts	8	engine mount
#6 steel washers	4	engine mount
4-40 x 1-inch Allen head machine screws	8	engine
4-40 nylon lock nuts	8	engine
#4 steel washers	16	engine

Electric Power Mount Bag

4-40 1 1/4-inch Allen head machine screws	8	motor
3/8-inch diameter x 3/4-inch nylon standoffs	8	motor

Servo Mounting Bag

10 x 11 x 20mm hardwood blocks	10	aileron and flap servos
8 x 8 x 14mm hardwood blocks	4	elevator servos
12-inch hook and loop straps	2	battery/fuel tank
4-inch adhesive-backed hook and loop tape	3	

Hatch Screw Pack

#2 x 3/8-inch woodscrews (silver)	12	servo hatches
#2 x 1/4-inch woodscrews (black)	46	hatches and cowls

Introduction

Hangar 9's latest introduction, the Twin Otter is a scale model of the UV-18 'Twin Otter', the military version of the DeHavilland DHC-6. The trim scheme is based on the three UV-18B planes used by the US Air Force Academy cadet parachuting program which carry a pilot, copilot and up to 17 jumpers. There are only three owned by the Air Force. Although this is a multi-engine model, the high-wing design and Clark Y airfoil improve low-speed handling and provide stable flight characteristics making this a great first-time twin for intermediate to advanced pilots. The Twin Otter ARF also features an electric power option which adds to the reliability. It also features fiberglass cowlings and fairings which make it very durable and easy to repair. The aircraft also includes fixed gear and large landing flaps to provide easy and fun landings without the addition of complicated landing gear necessary.

Important Warranty Information

Please read our Warranty and Liability Limitations section on page 45 before assembling this product. If you as the purchaser 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.

Recommended Setup—2-Stroke Glow

- Evolution® .36NT with muffler (EVOE0520) (2)
- Evolution propeller 11x6 (EVO11060) (2)
- Fuel dot filler (HAN115) (2)

Recommended Setup—Electric Power

- E-flite® Power 25 (EFLM4025A) (2)
- E-flite 40-Amp Pro Switch-Mode BEC Brushless ESC (EFLA1040) (2)
- E-flite 3200mAh 3S 11.1V 30 Li-Po (EFLB32003S30) (2)
- APC Propeller 12x8E (APC12080E)

Radio Equipment Requirements - 7-Channel Receiver

The following items are required when installing the 7-Channel AR7000 receiver (SPM6070) in your aircraft:

Spektrum A6000 Digital Servo (6) SPMSA6000
JR SPORT MC35 Micro Servo (4) JSP20030
(Note: Two less micro servos required for EP version)
9-inch Servo Extension (7) JRPA097
36-inch Servo Extension (2) JRPA103
Y-Harness (3) JRPA135
Receiver Battery, 6-volt, 2300mAh JRPB5006
JR Chargeswitch JRPA004

Ailerons: A6000 Servo (2)

- 9-inch Extension (connected to servos) (2)
- Y-harness (connected to receiver)

Flaps: A6000 Servo (2)

- 9-inch Extension (connected to receiver) (2)

Elevator: MC35 Micro Servo (2)

- 36-inch Extension (plugged into receiver) (2)

Rudder: A6000 Servo

- Y-harness (connected to receiver and nosewheel steering servo)

Nosewheel Steering: A6000 Servo

- 9-inch Extension (connected to servo)

Throttles: MC35 Micro Servo (2)

- Y-harness (connected to receiver)
 - 9-inch extension (connected to servo)
- (Also required for ESC connection)

Transmitter Requirements

The Twin Otter requires a minimum of a 5-channel radio to operate all the functions of your aircraft. We suggest the following radio systems available through Horizon Hobby or your local hobby distributor.

Spektrum DX7 SPM2710
JR X9303 2.4GHz JRP2915

Required Tools and Equipment

Drill motor	Pin vise
Low-tack tape	Needle-nose pliers
Ruler	Sidecutters
File	Felt-tipped pen
Pencil	Coarse grit sandpaper
Tapered reamer	Hobby knife w/ #11 blade
Dental floss	Manila card stock
Alcohol	Paper towels
Scissors	Double-sided adhesive tape
Mixing sticks	Mixing cups
Small cable ties	T-pins
Toothpicks	String
Pliers	Pencil
Round file	Z-bend pliers
Phillips screwdriver: #1, #2	
Rotary tool with cutoff wheel and sanding drum	
Hex wrench: 3/32, 1/8, 7/64-inch, 1.5mm, 2.5mm	
Open-end wrench: 5/16-inch, 10, 12, 13mm	
Drill bit: 3/64, 5/64, 3/32, 5/32, 9/64, 11/64, 13/64-inch	

Required Adhesives

Thin CA	(PAAPT08)
Medium CA	(PAAPT02)
30-minute epoxy	(PAAPT39)
Threadlock	(PAAPT42)
Canopy glue	(PAAPT56)

UltraCote Covering Colors

Golden Yellow	(HANU889)
White	(HANU870)
Deep Blue	(HANU873)

Field Equipment Required

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

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 completed sections. Steps with a single box (☐) are performed once, steps with two boxes (☐☐) indicate the step needs to be repeated, such as for left and right wing panel, or two servos etc. Note that references to direction such as left and right-hand are as viewed in the direction of flight.

Before beginning it is a good idea to read through the manual completely to familiarize yourself with the assembly process. Remember to take your time and follow the directions.

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

Product Registration

Horizon Hobby wants to ensure that you get maximum enjoyment from your Hangar 9 products. We strongly encourage you to register your product using the online Product Registration tool so we can notify you when there are service bulletins, new option parts or accessories, or updates available for your product.

Please register your product today at:
<http://www.hangar-9.com/Register/>

Work Area Cleanliness

It is a good practice to maintain a clean work area, both to prevent damage to your model and to keep track of parts and hardware. Put away any tools not being used, and set aside parts of the model that are not being worked on.

Of special importance is keeping debris out of sensitive components such as the radio and engine or motor. Tape over engine intake and exhaust ports when drilling or cutting the firewall and cowling to prevent causing damage to the internal components.

Optional Accessory

Setting up servos is a whole lot easier with a JR® MatchMaker™. It lets you accurately center servos, evaluate endpoints, and cycle servos at varying speeds, without ever having to switch on a transmitter. It allows the precise digital centering of up to 2 servos at a time to help with setup on the building bench.

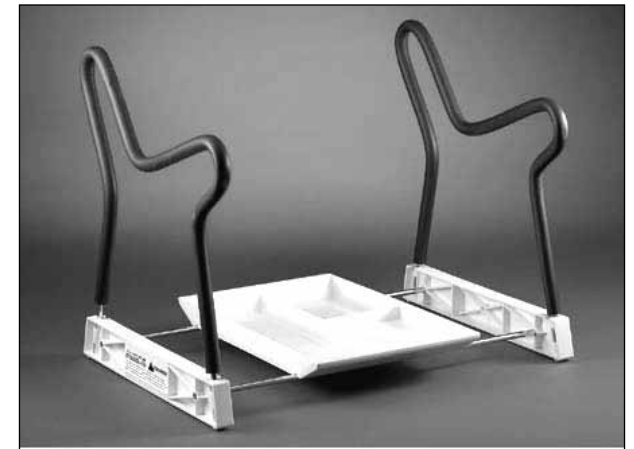


Workspace Preparation

During the course of building your Twin Otter we suggest you use a soft base on the building surface. Such things as a large piece of bedding foam or a thick bath towel work well to protect the model from damage during assembly. A flat area measuring at least 28 x 60 inches is required to work on the model sub-assemblies comfortably. The completed and assembled model requires a space of 48 x 96 inches. Ensure you have adequate lighting, and a place to set aside completed parts.

The use of a stand to support the fuselage on the workbench is highly recommended. This will hold it secure while in different positions during assembly and prevent damage to items such as the tail that are not designed to support the weight of the model.

Midwest Stand-In (MID813)



Elevator Servo Installation

Parts Required

- Stabilizer halves (left and right)
- Micro servos with hardware (2)
- Snap keepers (2) Clevises (2)
- Silicone keepers (2) 4-inch steel pushrods (2)
- 8 x 8 x 14mm servo mounting blocks (4)
- #2 x 3/8-inch woodscrews (8)
- Radio

Tools Required

- | | |
|---------------------|----------------------------|
| Ruler | #1 Phillips screwdriver |
| Sidecutters | Pin vise |
| 1/16-inch drill bit | 5/64-inch drill bit |
| Pliers | Pencil |
| Felt-tipped pen | Low-tack tape |
| Thin CA | 30-minute epoxy |
| Mixing sticks | Mixing cups |
| Z-bend pliers | Hobby knife with #11 blade |

Note: The left-hand elevator servo installation is shown here.

- Step 1
Prepare two servos by installing rubber mounting grommets and brass bushings. Note that the bushings are installed from the bottom of the servo.



- Step 2
Use a #1 Phillips screwdriver to remove the small arm from the servo. Use sidecutters to remove three arms from a standard 4-way servo arm, leaving one long arm. Center the servo using your radio and install the arm as shown.



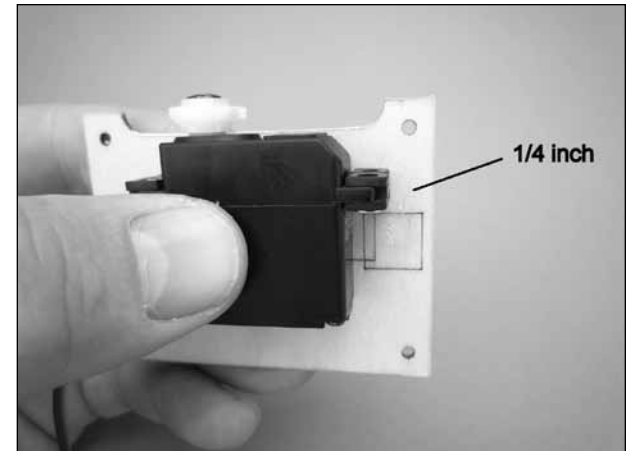
- Step 3
Repeat step 2 to install the arm on the second servo, but install the arm in the opposite direction.



- □ Step 4
Enlarge the outer hole in the servo arm using a 5/64-inch drill bit in a pin vise, providing a servo arm length of 1/2 inch (13mm).

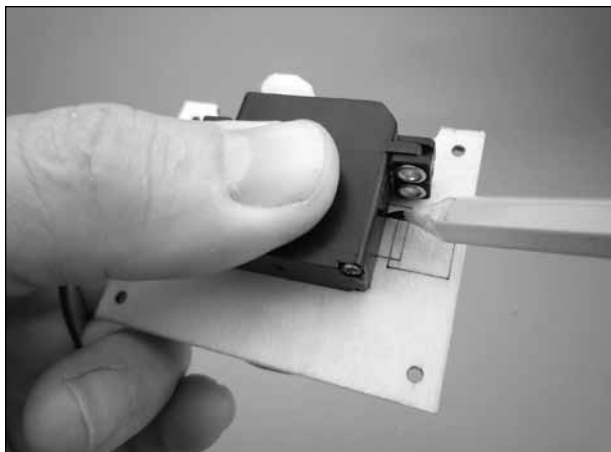


- □ Step 5
Remove the elevator servo hatch from the lower surface of the stabilizer. Place the servo against the inside surface of the hatch and use a ruler to position it 1/4 inch from the aft end of the hatch.



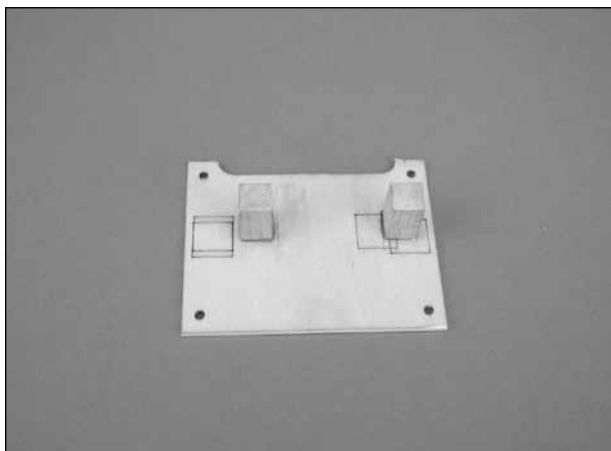
□ □ Step 6

Use a pencil to mark the servo location on the inside of the hatch.



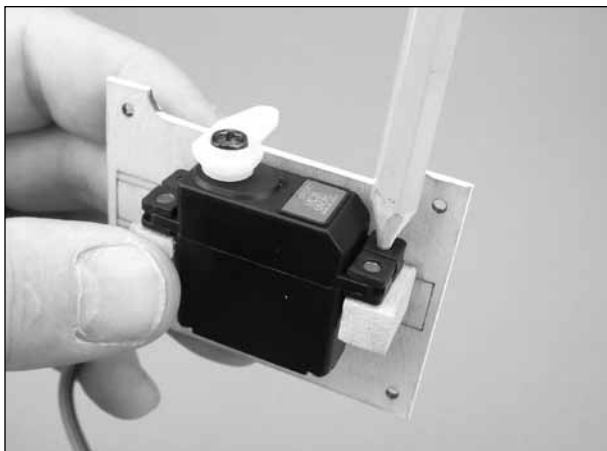
□ □ Step 7

Mix a small amount of 30-minute epoxy and glue the 8 x 8 x 14mm servo mounting blocks to the hatch.



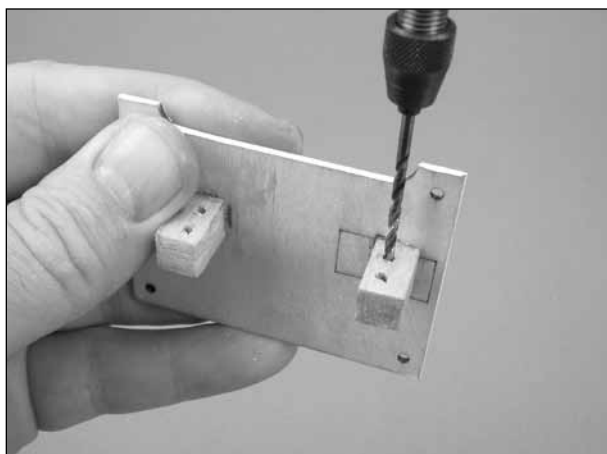
□ □ Step 8

Set the servo in place on the mounting block with a 1/32-inch gap between the servo and the hatch surface. Mark the servo mounting hole locations on the blocks with a pencil.



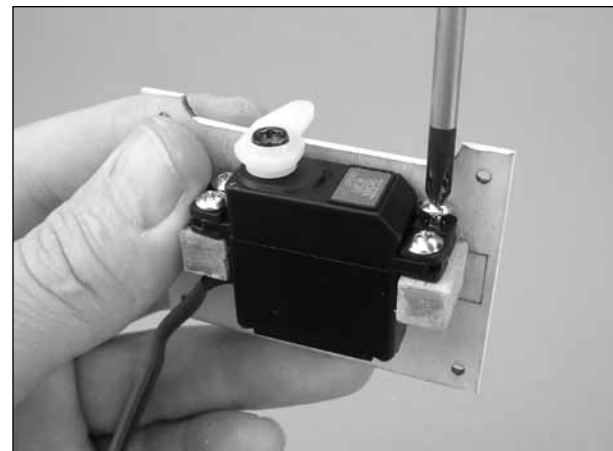
□ □ Step 9

Remove the servo and use a 1/16-inch drill bit in a pin vise to drill the mounting holes. Apply a small drop of thin CA to each of the holes to strengthen the wood. Allow the CA to cure without using accelerator.



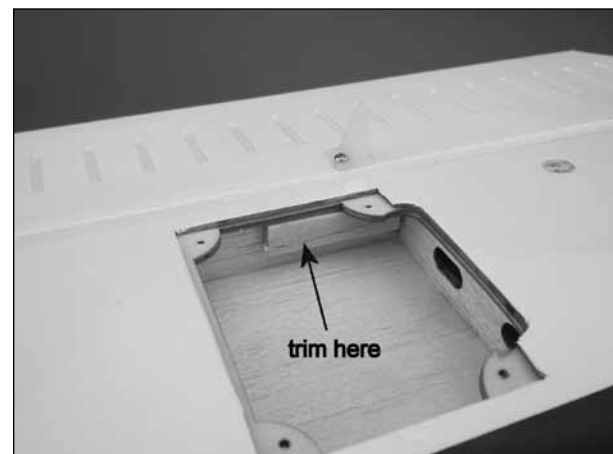
□ □ Step 10

Use a #1 Phillips screwdriver and the hardware provided with the servo to install it on the hatch. Be sure to maintain a 1/32-inch gap between the servo and the hatch surface.



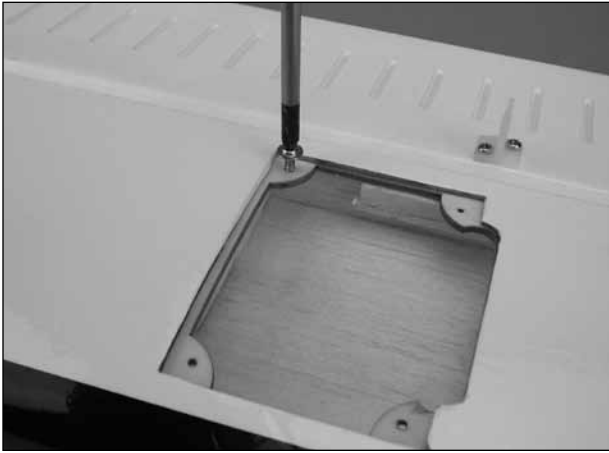
□ □ Step 11

Use a hobby knife to trim the CA hinge where it protrudes into the servo bay in the stabilizer. Be careful not to puncture the upper skin.



□ □ Step 12

Use a #1 Phillips screwdriver to thread a #2 x 3/8-inch woodscrew into each of the mounting holes in the stabilizer. Remove the screw and apply a small drop of thin CA to each hole to harden the wood and help retain the screw. Allow the CA to cure without using accelerator.



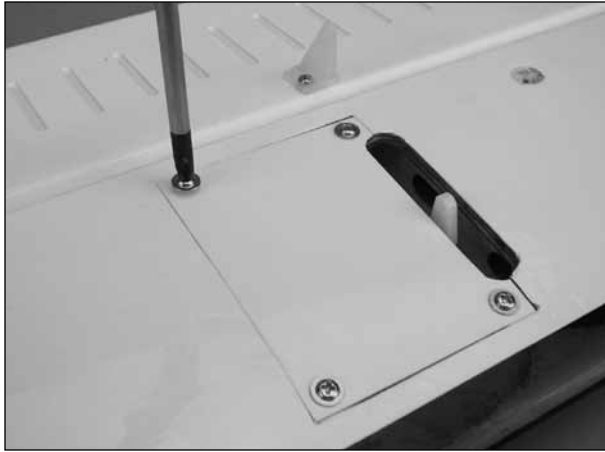
□ □ Step 13

Feed the elevator servo lead through the forward holes in the ribs to the stabilizer root and set the hatch in place.



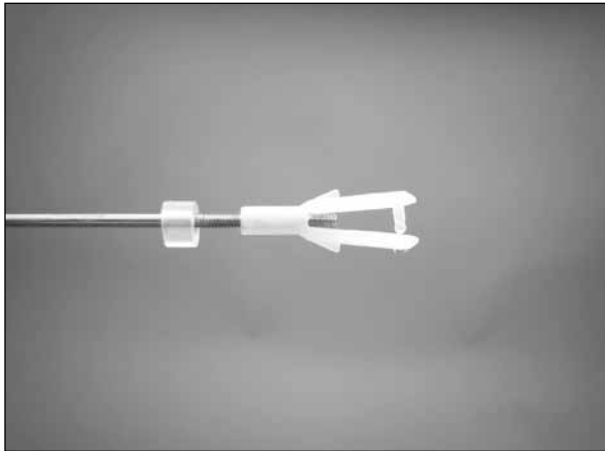
□ □ Step 14

Use a #1 Phillips screwdriver to secure the hatch to the stabilizer with four #2 x 3/8-inch woodscrews.



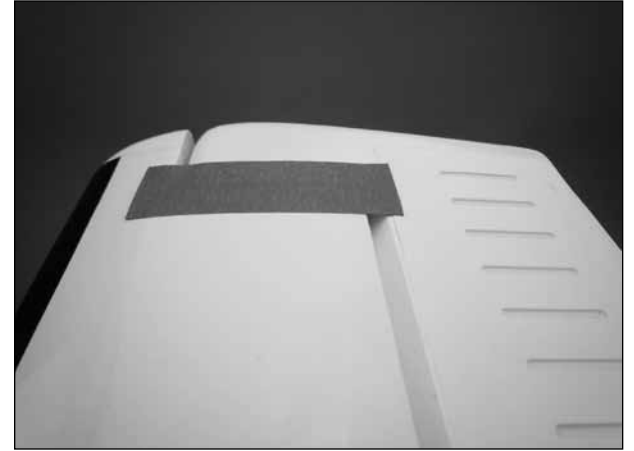
□ □ Step 15

Slide a silicone keeper onto a 4-inch steel elevator pushrod then thread on a clevis so it is centered on the threads.



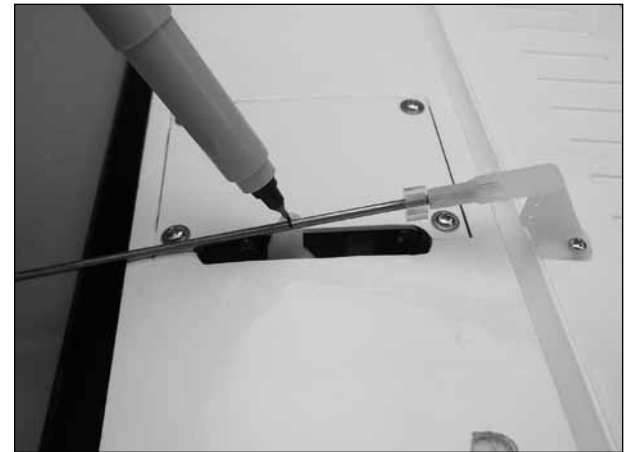
□ □ Step 16

Center the elevator by aligning the balance tab to the stabilizer. Secure it in place with low-tack tape on both the top and bottom sides.



□ □ Step 17

Attach the clevis to the outer hole of the elevator horn. Use your radio to center the elevator servo then use a felt-tipped pen to mark the pushrod at the servo arm.



□ □ Step 18

Remove the pushrod from the elevator horn and use pliers to make a 90-degree bend in the pushrod at the marked location. Trim the bent portion to a length of 1/4-inch with sidecutters.



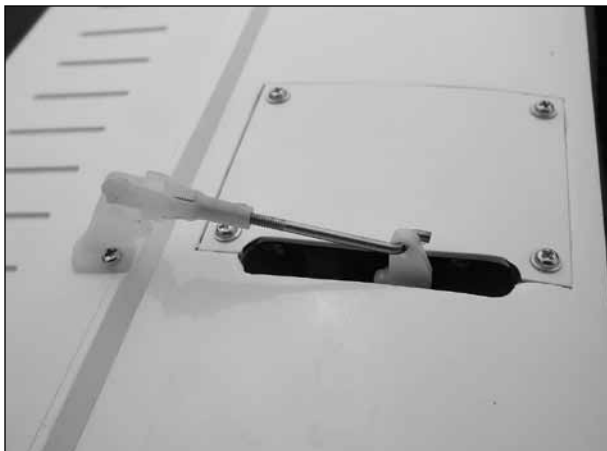
□ □ Step 19

Attach the clevis to the outer hole of the control horn and secure it with the silicone keeper. Slide the bent end through the outer servo arm hole and secure it with a snap keeper.



□ Step 20

Optional Setup: You may choose to use Z-bend pliers to form a Z-bend in the pushrod in place of the 90-degree bend and snap keeper.



□ Step 21

Repeat steps 4 through 19 to install the servo in the opposite stabilizer half.

Aileron Servo Installation

Parts Required

- Wing panels (left and right)
- Servos with hardware (2)
- Clevises (2) Snap keepers (2)
- Silicone keepers (2) 4-inch steel pushrods (2)
- 9-inch servo extension leads (2)
- #2 x 3/8-inch woodscrews (8)
- 10 x 11 x 20mm servo mounting blocks (4)
- Radio

Tools Required

- | | |
|-----------------|-------------------------|
| Ruler | #1 Phillips screwdriver |
| Pin vise | 5/64-inch drill bit |
| Sidecutters | Pencil |
| Low-tack tape | Felt-tipped pen |
| Dental floss | Thin CA |
| 30-minute epoxy | Mixing sticks |
| Mixing cups | Pliers |
| Z-bend pliers | |

Note: The left-hand aileron installation is shown here.

□ Step 1

Install the grommets and bushings in each of the two aileron servos. Note that the bushings are installed from the bottom of the mounting lugs.



□ Step 2

Locate the large 4-way servo arm. Use sidecutters to remove three of the arms, leaving one long arm. Use your radio to center the servo and install the arm using a #1 Phillips screwdriver.



□ Step 3

Prepare a second servo for the right-hand aileron with the arm facing the opposite direction.



□ □ Step 4

Use a 5/64-inch drill bit in a pin vise to enlarge the outer hole in each servo arm.



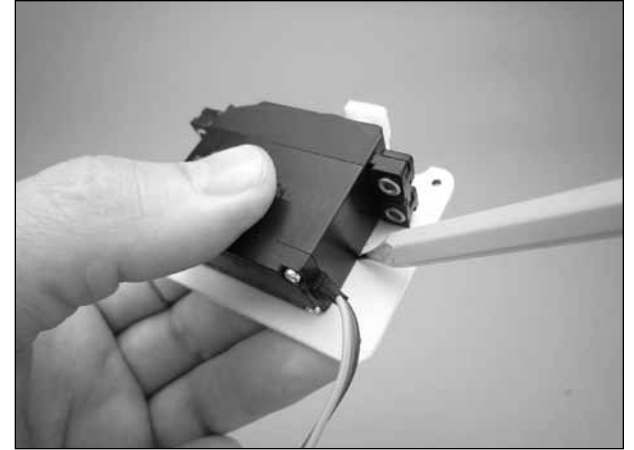
□ □ Step 5

Remove the hatch from the wing and position the servo against the inside surface so that it is equally spaced in the long direction of the hatch. There will be approximately a 3/16 inch gap at each end.



□ □ Step 6

Align the servo arm with the top edge of the hatch and mark the mounting lug locations with a pencil.



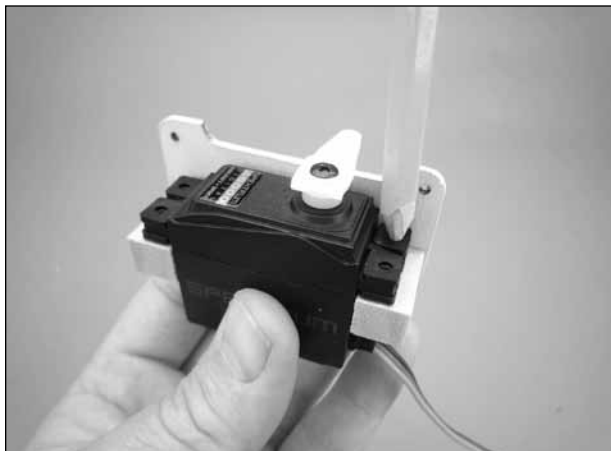
□ □ Step 7

Mix a small amount of 30-minute epoxy and glue the 10 x 11 x 20mm servo mounting blocks in place.



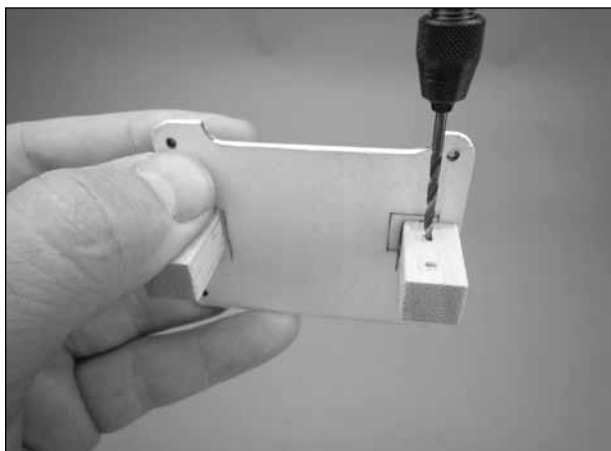
□ □ Step 8

Place the servo on the mounting blocks with a 1/32-inch gap between it and the hatch. Use a pencil to mark the servo hole locations on the blocks.



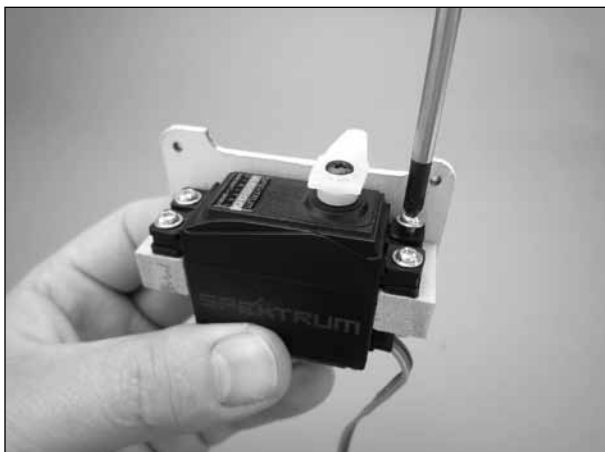
□ □ Step 9

Use a 5/64-inch drill bit in a pin vise to drill the servo mounting holes. Apply a small drop of thin CA to each hole to strengthen the wood and help retain the screw. Allow the CA to cure without using accelerator.



□ □ Step 10

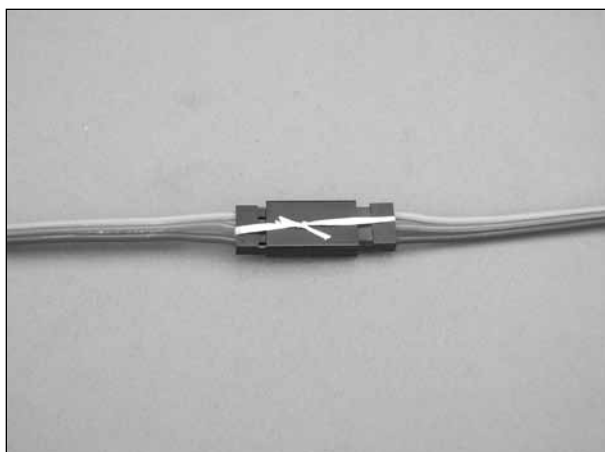
Use a #1 Phillips screwdriver to install the servo with its provided hardware.



□ □ Step 11

Attach a 9-inch servo extension lead to the servo and secure the connection with a piece of dental floss.

Hint: Apply a very small drop of thin CA to the knot to prevent it coming loose.



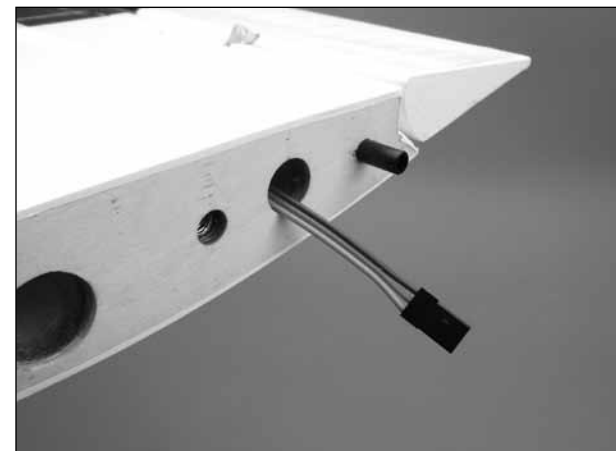
□ □ Step 12

Use a #1 Phillips screwdriver to thread a #2 x 3/8-inch screw into each of the hatch mounting holes in the wing. Remove the screw and apply a small drop of thin CA to each hole to strengthen the wood. Allow the CA to cure without using accelerator.



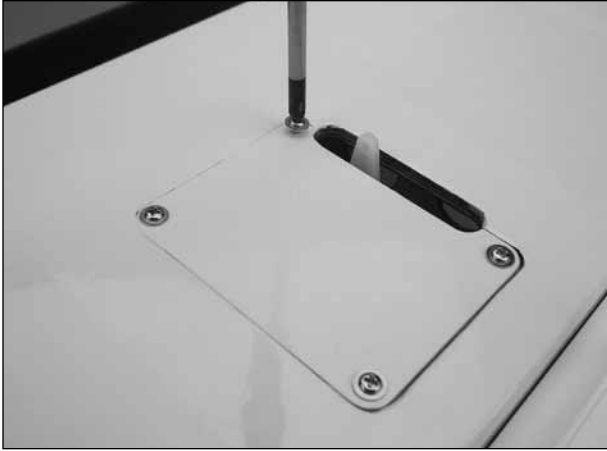
□ □ Step 13

There is a pull string provided to draw the aileron servo lead through the wing. Tape the string to the servo extension and pull it through to the wing root.



□ □ Step 14

Use a #1 Phillips screwdriver to install the aileron hatch with four #2 x 3/8-inch woodscrews.



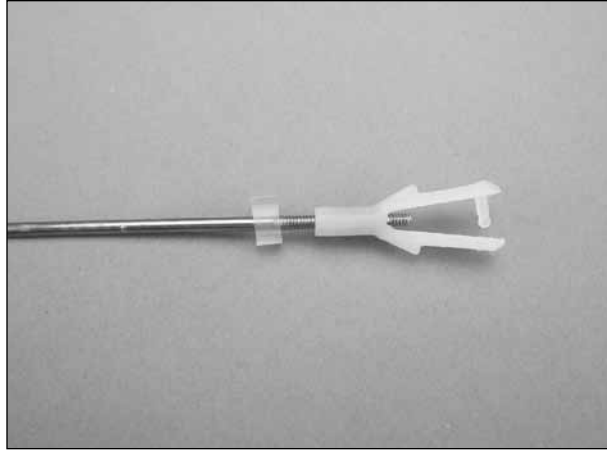
□ □ Step 15

Center the aileron by aligning it with the fixed portion of the wing tip and tape it in place with low-tack tape.



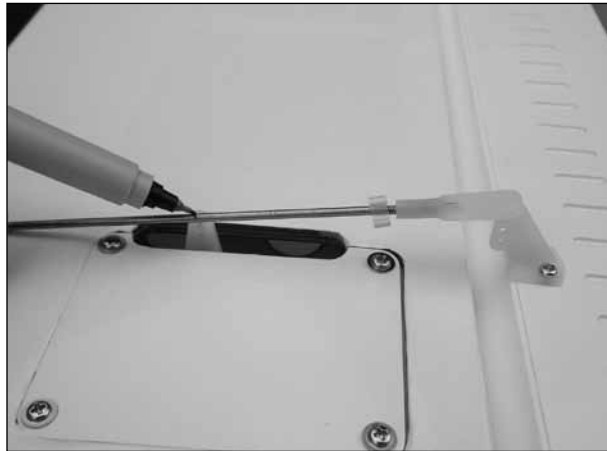
□ □ Step 16

Slide a silicone keeper onto a 4-inch steel pushrod then thread on a clevis so it is centered on the threads.



□ □ Step 17

Attach the clevis to the outer hole of the aileron control horn. Center the servo then use a felt-tipped pen to mark the pushrod at the servo arm.



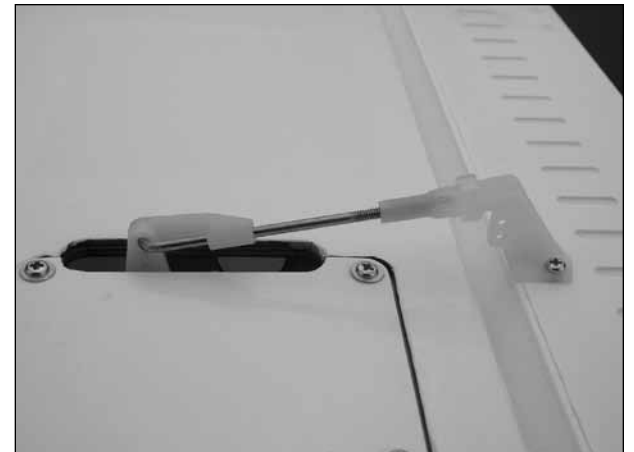
□ □ Step 18

Remove the pushrod and use pliers to make a 90-degree bend at the mark. Trim the bent portion of the pushrod to a length of 1/4 inch using sidecutters.



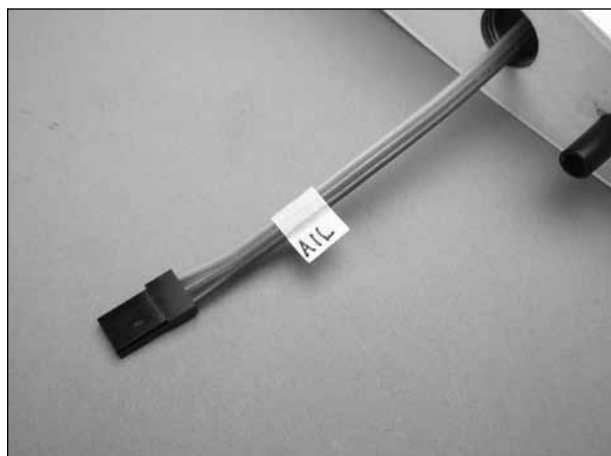
□ □ Step 19

Attach the clevis to the outer hole of the control horn and secure it with the silicone keeper. Slide the bent portion of the pushrod through the outer hole of the servo arm and secure it with a snap keeper.



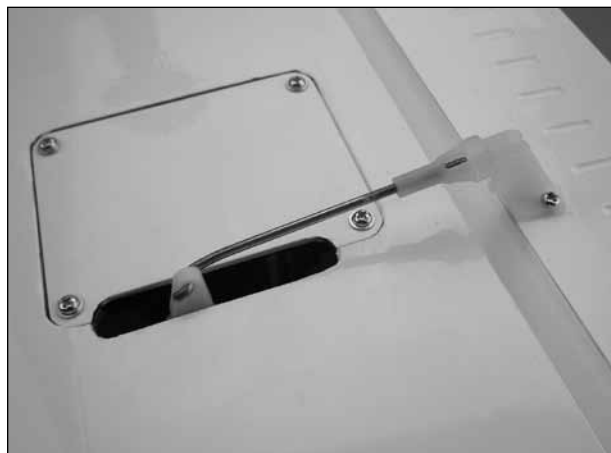
□ □ Step 20

Use a piece of low-tack tape and a felt-tipped pen to label the aileron lead where it exits the wing root.



□ □ Step 21

Optional Setup: You may choose to use Z-bend pliers to form a Z-bend in the pushrod in place of the 90-degree bend and snap keeper.



□ Step 22

Repeat steps 4 through 20 to install the servo in the right-hand wing panel.

Flap Servo Installation

Parts required

- Wing panels (left and right)
- Servos with hardware (2)
- 4-inch steel pushrods (2)
- Clevises (2)
- Snap keepers (2)
- Silicone keepers (2)
- Radio
- 10 x 11 x 20mm servo mounting blocks (4)
- #2 x 3/8-inch woodscrews (8)

Tools Required

- Ruler
- Pin vise
- Pliers
- Pencil
- 30-minute epoxy
- Mixing cups
- #1 Phillips screwdriver
- 5/64-inch drill bit
- Sidecutters
- Thin CA
- Mixing sticks

Note: the left-hand side installation is shown here.

□ Step 1

Prepare two flap servos by installing grommets and bushings. Note that the bushings are installed from the bottom of the mounting lugs.



□ □ Step 2

Locate the large 4-way servo arm. Use sidecutters to remove three arms, leaving one long arm. Center the servo using your radio then use a #1 Phillips screwdriver to install the arm as shown.



□ □ Step 3

Use a 5/64-inch drill bit in a pin vise to enlarge the second hole from the center, providing a servo arm length of 9/32 inch (7mm).



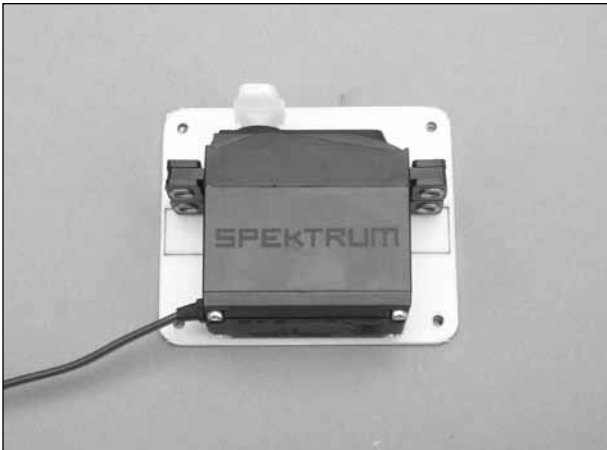
□ □ Step 4

Use sidecutters to remove the excess servo arm beyond the enlarged second hole.



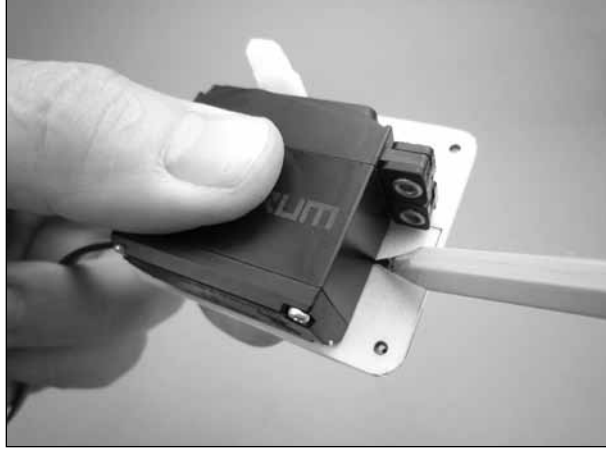
□ □ Step 5

Remove the flap hatch from the lower wing. Note the orientation of the hatch by the black portion of its covering. Position the servo as shown with the bottom of the servo 1/8 inch above the outboard edge of the hatch, and centered fore and aft.



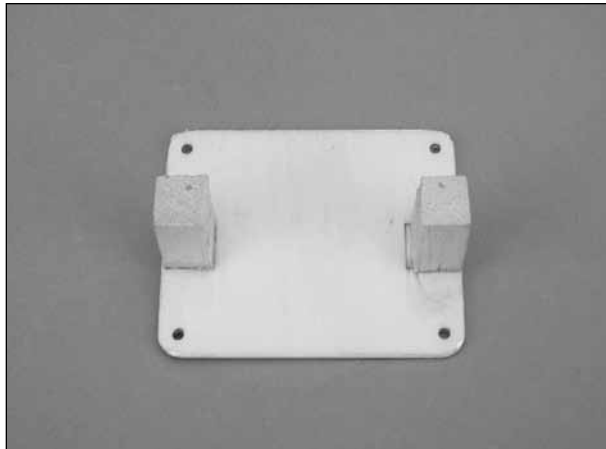
□ □ Step 6

Use a pencil to mark the servo mounting locations on the hatch.



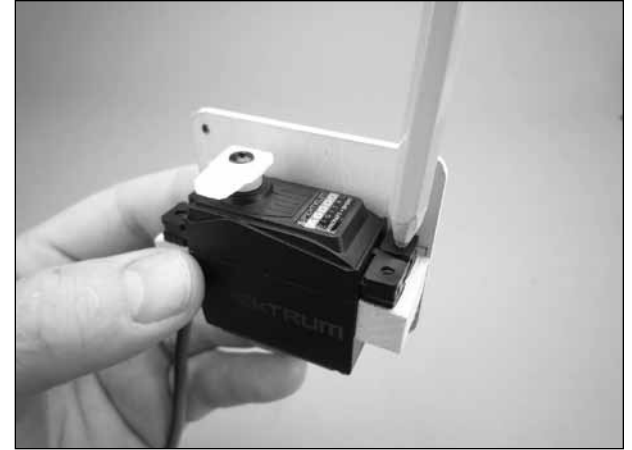
□ □ Step 7

Mix a small amount of 30-minute epoxy and glue the 10 x 11 x 20mm mounting blocks to the hatch. Orient the blocks so they do not protrude beyond the edge of the hatch.



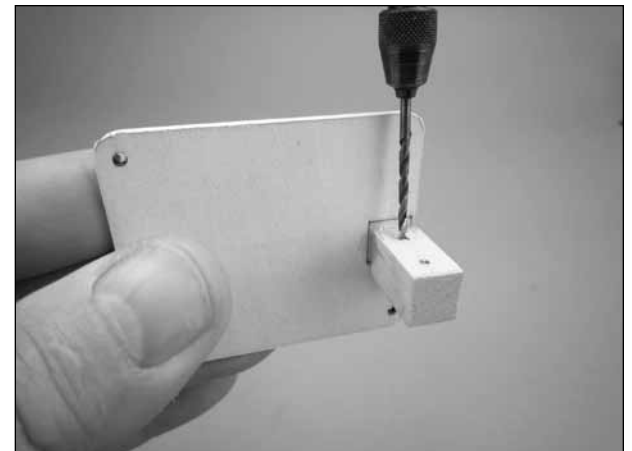
□ □ Step 8

Place the servo on the mounting blocks with a 1/32-inch gap between it and the hatch. Use a pencil to mark the mounting hole locations.



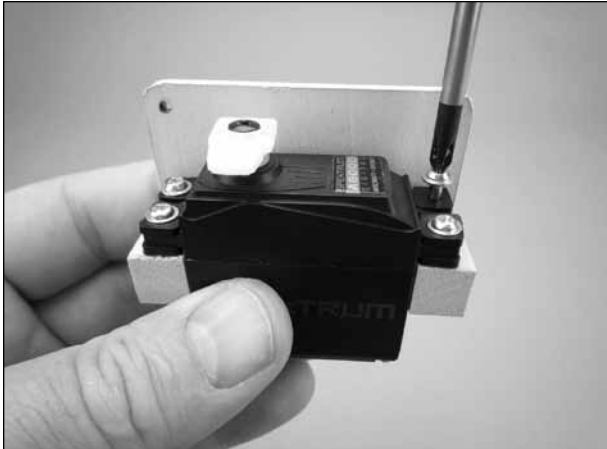
□ □ Step 9

Use a 5/64-inch drill bit in a pin vise to drill the servo mounting holes. Apply a small drop of thin CA to each to strengthen the wood. Allow the CA to cure without using accelerator.



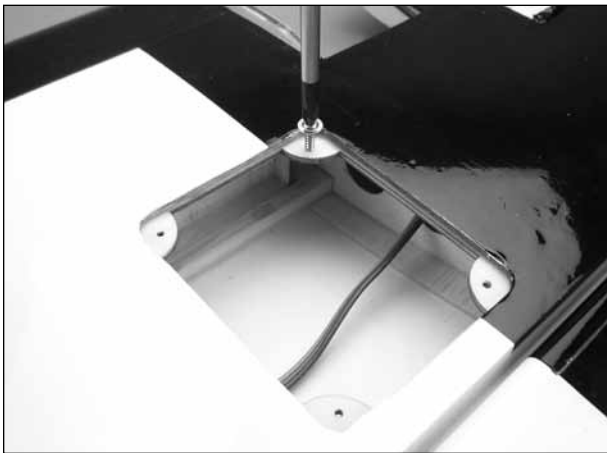
□ □ Step 10

Use a #1 Phillips screwdriver and the hardware provided with the servo to install it on the hatch.



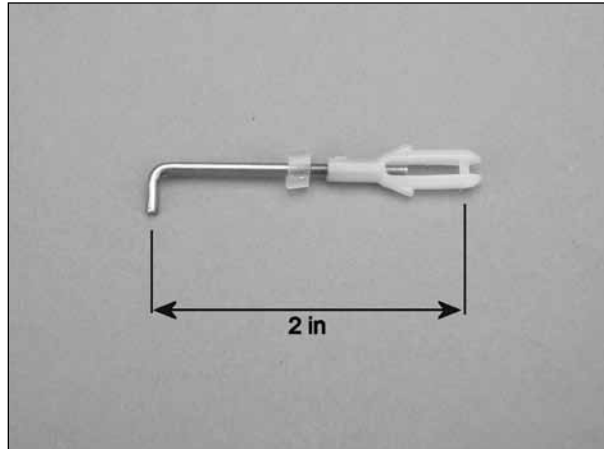
□ □ Step 11

Use a #1 Phillips screwdriver to thread a #2 x 3/8-inch woodscrew into each of the hatch mounting holes in the wing. Remove the screw then apply a drop of thin CA in each hole to strengthen the wood.



□ □ Step 12

Slide a silicone keeper onto a 4-inch steel pushrod then thread on a clevis so it is centered on the threads. Measure 2 inches from the clevis pin and use pliers to make a 90-degree bend at that location. Trim the bent portion of the pushrod to a length of 1/4 inch.



□ □ Step 13

Deflect the flap and insert the pushrod through the hole in the wing trailing edge with the bend towards the wing root (left-hand side). Attach the clevis to the flap horn and secure it with the silicone keeper.



□ □ Step 14

Feed the servo lead to the wing root. Insert the bent end of the pushrod into the servo arm and secure it with a snap keeper.



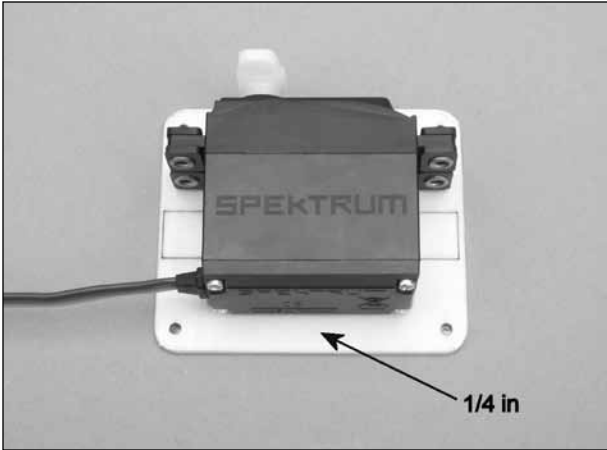
□ □ Step 15

Use a #1 Phillips screwdriver to install the hatch on the wing with four #2 x 3/8-inch woodscrews.



□ Step 16

Perform steps 2 through 15 to install the right-hand flap servo. Note that the servo position on the hatch is different for the right-hand side. When performing step 5 position the servo 1/4 inch from the edge of the hatch rather than 1/8 inch as for the left-hand side.



Note: The pushrod length provided will place the flaps in the mid-position with the servo centered. This will ensure correct operation throughout the range of motion.

Nacelle Installation

Parts Required

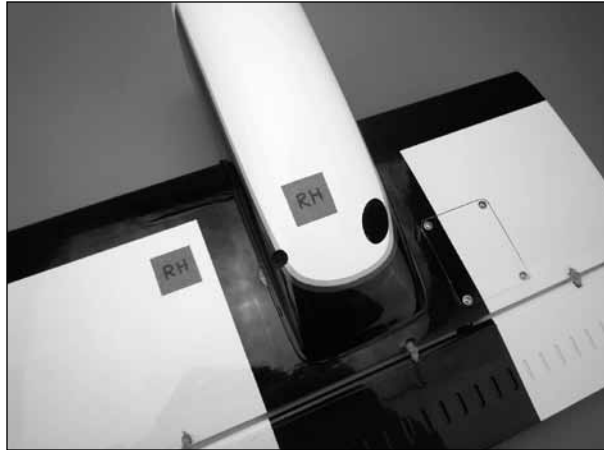
Wing panels (left and right)
Nacelles (left and right)

Tools Required

Low-tack tape
Mixing sticks
Paper towels
Canopy glue
30-minute epoxy
Mixing cups
Felt-tipped pen
2 3/4-inch wooden dowel

□ Step 1

Identify the left and right-hand nacelles. The larger hole on the lower surface of the nacelle locates to the inboard side to receive the wing strut. Label each nacelle and wing panel with low-tack tape to prevent installing them incorrectly.



□ □ Step 2

Remove the hatch and cowl from the nacelle. Trial fit the nacelle and check that it will seat fully against the wing. If there is resistance to the nacelle fitting properly check that there is not a buildup of fiberglass between each of the nacelle sides and the motor box. Use a flat file to remove the excess if necessary.



□ □ Step 3

Mix some 30-minute epoxy and apply it to each of the plywood ribs on the wing.



□ □ Step 4

Slide the nacelle into place and push it all the way against the wing. Use low-tack tape if necessary to hold the nacelle in place while the glue cures.

Hint: Cut a 2 3/4 inch piece of dowel and insert it between the motor box sides to help the nacelle make complete contact with the wing ribs.



□ □ Step 5

Apply a bead of canopy glue around the perimeter of the nacelle where it meets the wing surface. Use tape or weights as necessary to hold the nacelle in contact with the wing. Use a damp paper towel to clean any excess glue before it cures.



□ Step 6

Repeat steps 1 through 5 to install the opposite nacelle.

Motor, ESC and Battery Installation

Parts Required

- Wing panels (left and right)
- Motors (2)
- 19mm standoffs
- #4 steel washers (8)
- Batteries (2)
- Hook and loop strap (2)
- 9-inch servo extensions (2)
- 4-40 x 1 1/4-inch Allen head machine screws (8)
- Double-sided adhesive tape (not included)
- Cable ties (not included)
- ESC (2)
- Firewall drilling template
- 4-40 blind nuts (8)

Tools Required

- Felt-tipped pen
- Drill motor
- Pin vise
- 1/16-inch drill bit
- 3/32-inch hex wrench
- Dental floss
- Tapered reamer
- #1 Phillips screwdriver
- Low-tack tape
- Ruler
- 9/64-inch drill bit
- Scissors
- Threadlock

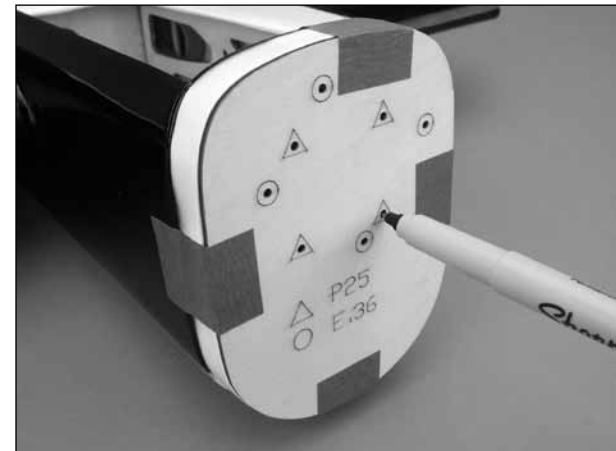
□ □ Step 1

Apply a drop of threadlock to each of the screws provided with the motor then use a #1 Phillips screwdriver to install the mount.



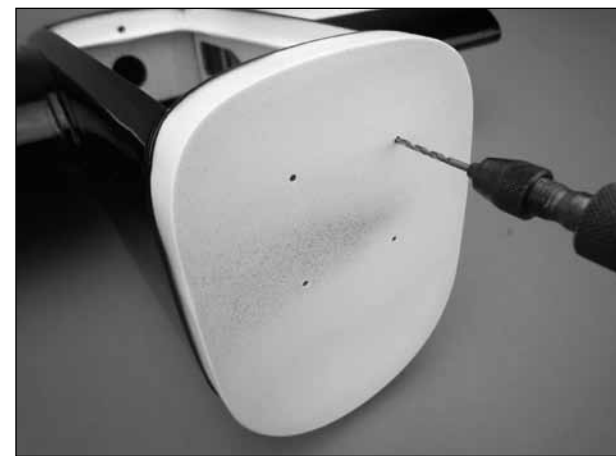
□ □ Step 2

Position the firewall drilling template against the firewall and flush with its edges. Use low-tack tape to hold it in place while marking the electric motor mounting holes with a felt-tipped pen.



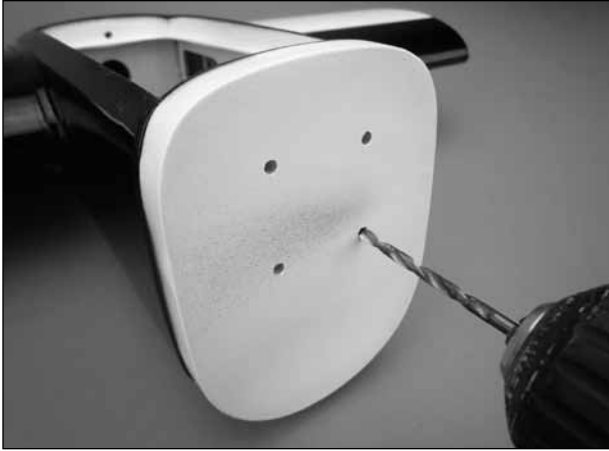
□ □ Step 3

Remove the template and use a 1/16-inch drill bit in a pin vise to pilot drill the holes.



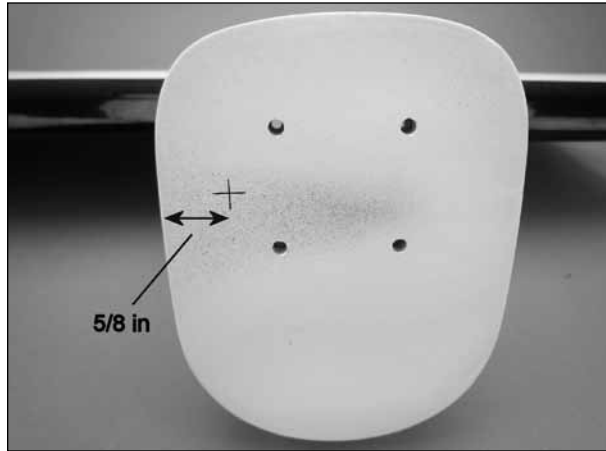
□ □ Step 4

Use a drill motor and 9/64-inch drill bit to enlarge the four mounting holes.



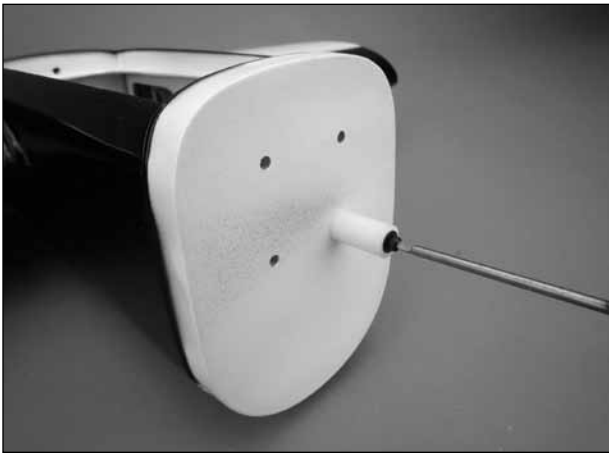
□ □ Step 6

Measure 5/8 inch from the right-hand side of the firewall and mid-way between the upper and lower mount holes. Make a mark with a felt-tipped pen.



□ □ Step 5

From inside the nacelle, insert a 4-40 blind into each of the mounting holes. Use a 4-40 screw, #4 washer and 19mm standoff to draw each of the blind nuts into place with a 3/32-inch hex wrench.



□ □ Step 7

Use a tapered reamer to make a 1/2-inch hole through the firewall at the marked location.



□ □ Step 8

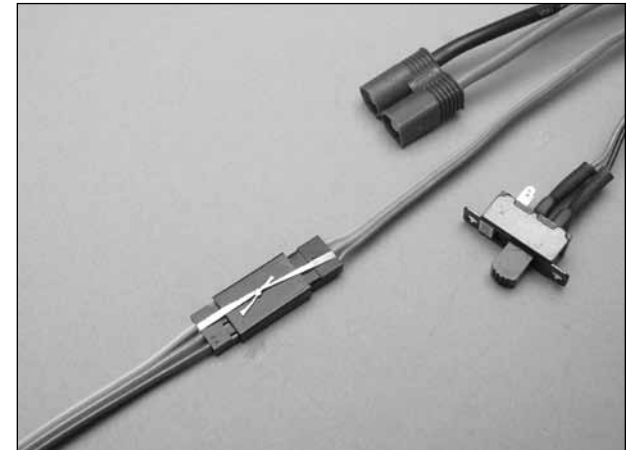
Cut a hook and loop strap to a length of 8 inches using scissors. Slide it through the aft set of slots in the nacelle floor.



□ □ Step 9

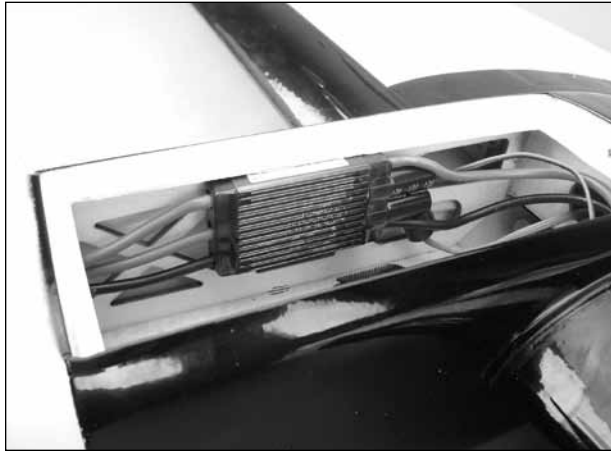
Connect a 9-inch servo extension lead to the ESC and secure it with dental floss.

Hint: Apply a very small drop of thin CA to the knot to prevent it coming loose.



□ □ Step 10

Feed the extension lead through the wing to the wing root and pass the motor leads through the firewall. Use double-sided adhesive tape to attach the ESC to the right-hand side of the battery compartment.



□ □ Step 11

Place a #4 steel washer on each of the 4-40 x 1 1/4-inch Allen head machine screws. Apply a drop of threadlock to each of the screws then use a 3/32-inch hex wrench to install the motor and 19mm standoffs. Mount the motor with the leads to the right-hand side.



□ □ Step 12

Connect the motor leads to the ESC.



□ □ Step 13

Use cable ties to secure the leads so they cannot interfere with operation of the motor.



□ □ Step 14

Insert the battery and secure it with the hook and loop strap. You may choose to use adhesive-backed hook and loop tape (not included) under the battery for additional security.



□ □ Step 15

Repeat steps 1 through 14 for the opposite side.

Hint: Glue a scrap block of balsa to the back of the firewall to prevent the battery contacting the motor mount screws.



Cowling, Propeller and Spinner Installation-EP

Parts Required

Wing panels (left and right)
#2 x 1/4-inch woodscrews (8)
Cowlings (2) 2 1/4-inch spinners (2)
Propellers (2) Propeller adapters (2)

Tools Required

Ruler #1 Phillips screwdriver
Pin vise Felt-tipped pen
1/16-inch drill bit 5/64-inch drill bit
Tapered reamer Low-tack tape

□ □ Step 1

Apply a 2 1/2-inch long piece of low-tack tape to the aft edge of the cowling on both sides. Align it flush to the aft edge and just above the blue trim line.



□ □ Step 2

Use a felt-tipped pen to mark a line on the tape 1/4 inch forward of the aft edge.



□ □ Step 3

Measure 5/8 and 2 1/4 inches above the top of the blue trim line and make two marks with a felt-tipped pen.



□ □ Step 4

Use a 1/16-inch drill bit in a pin vise to drill a hole at each of the marked locations. Remove the tape.



□ □ Step 5

Place the cowling on the nacelle and use the trim stripes as an alignment guide. Secure the cowling to the nacelle with low-tack tape.



□ □ Step 6

Use the holes in the cowling to drill mounting holes in the nacelle using a pin vise and 1/16-inch drill bit. Remove the cowling and apply a small drop of thin CA to each of the mounting holes in the nacelle. Allow the CA to cure without using accelerator.



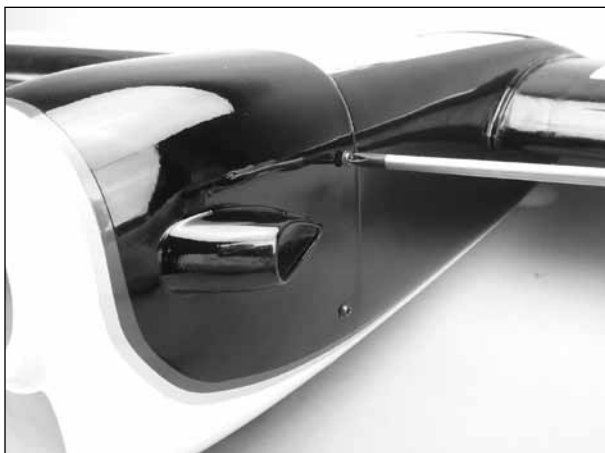
□ □ Step 7

Use a 5/64-inch drill bit in a pin vise to enlarge the mounting holes in the cowling.



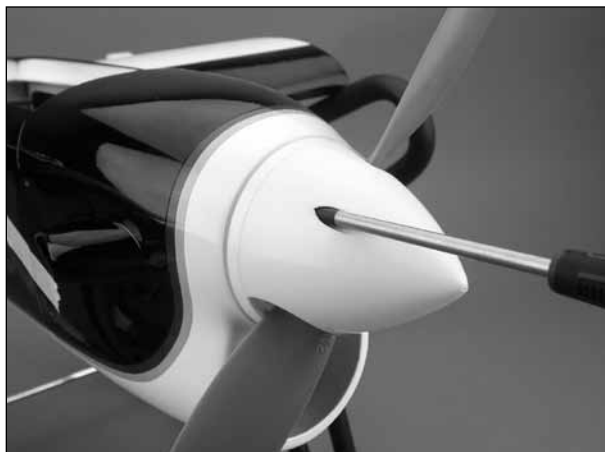
□ □ Step 8

Use a #1 Phillips screwdriver to install the cowling with four #2 x 1/4-inch woodscrews.



□ □ Step 9

Slide the prop adapter onto the motor shaft then install the spinner backplate and propeller. Use the shaft of a hex wrench to tighten the propeller nut. Secure the spinner cone using a #1 Phillips screwdriver and the screws provided with the spinner.



2-Stroke Installation

Parts Required

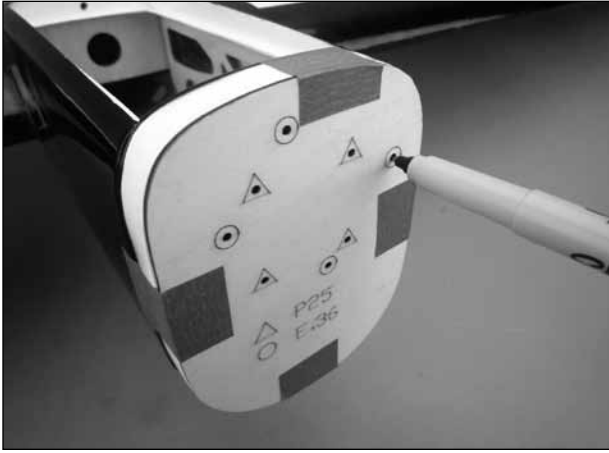
- Wing panels (left and right)
- Micro servos with hardware (2)
- 9-inch servo extension leads (2)
- Engines (2)
- Radio
- Throttle pushrods (2)
- Clevises (2)
- Silicone keepers (2)
- Engine Mounts (2 sets)
- Fuel tanks (2)
- Hook and loop strap (2)
- Cowlings (2)
- Firewall drilling template
- #4 steel washers (16)
- #8 steel washers (8)
- 6-32 blind nuts (8)
- 4-40 nylon lock nuts (8)
- 4-40 x 1-inch Allen head machine screws (8)
- 6-32 x 1-inch Allen head machine screws (8)

Tools Required

- Ruler
- Pencil
- Felt-tipped pen
- #1 Phillips screwdriver
- Pliers
- Drill motor
- Tapered reamer
- Thin CA
- 3/32-inch hex wrench
- 7/64-inch hex wrench
- Round file
- Low-tack tape
- Dental floss
- Threadlock
- Sidecutters
- Needle-nose pliers
- 1/4-inch wrench
- Drill bits: 1/16, 11/64, 5/16-inch
- Rotary tool with cutoff wheel and drum sander

□ □ Step 1

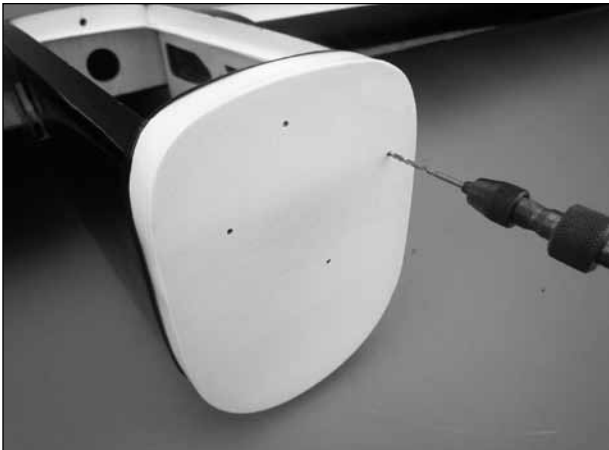
Position the firewall drilling template against the firewall and flush with its edges. Tape it in place with low-tack tape then use a felt-tipped pen to mark the 2-stroke engine mounting holes.



□ □ Step 2

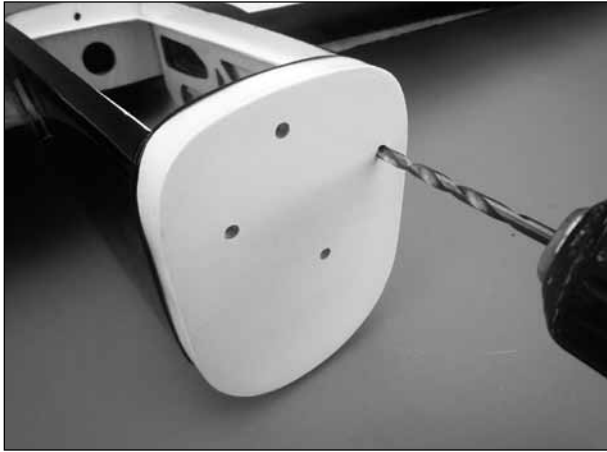
Remove the template and use a 1/16-inch drill bit in a pin vise to pilot drill the mounting holes.

Note: When drilling the upper hole use care not to drill too far beyond the firewall and into the fiberglass of the nacelle.



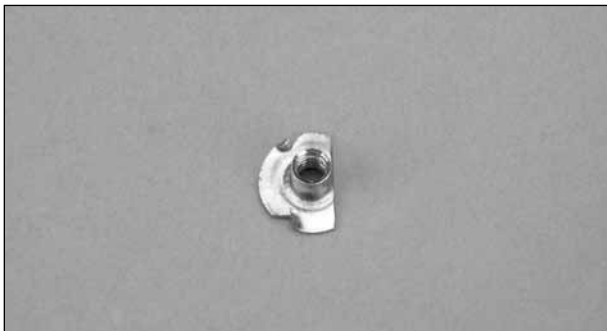
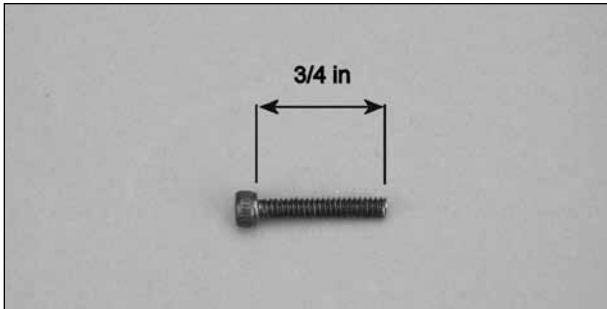
□ □ Step 3

Use an 11/64-inch drill bit in a drill motor to enlarge the mounting holes.



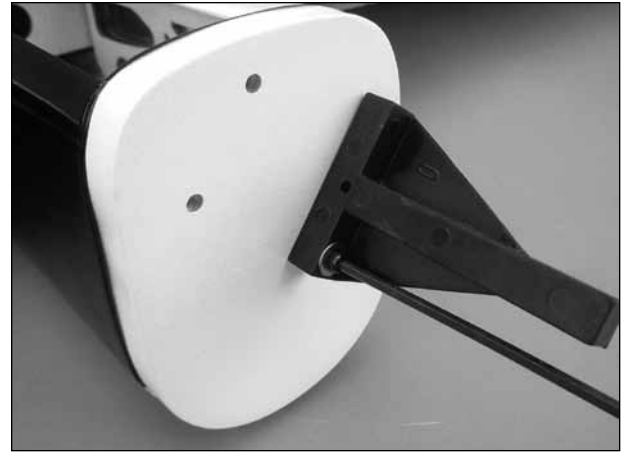
□ □ Step 4

Use a cutoff wheel in a rotary tool to shorten one of the 6-32 Allen head machine screws to a length of 3/4 inches. Also modify one 6-32 blind nut by removing one side of the flange as shown.



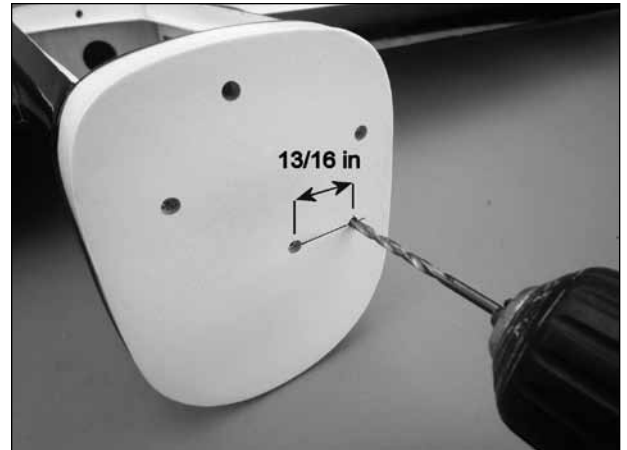
□ □ Step 5

Press the blind nuts into the mounting holes from inside the nacelle. The modified blind nut is installed in the left mounting hole against the side of the motor box. Use the 6-32 x 3/4-inch screw with a #6 washer and engine mount to draw the blind nuts into place with a 7/64-inch hex wrench.



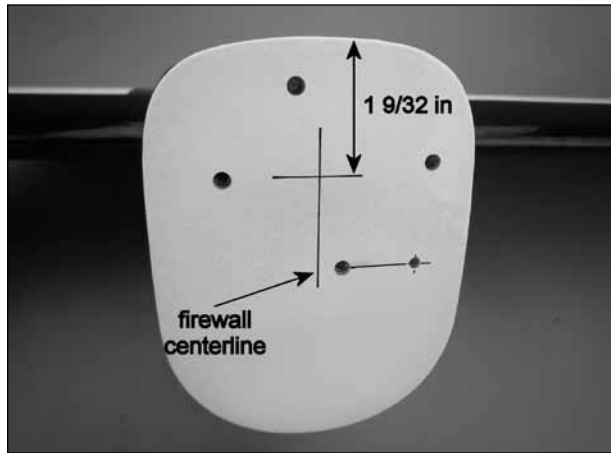
□ □ Step 6

Measure 13/16 inch (20mm) across from the lower left-hand engine mount hole and drill a 1/8-inch hole for the throttle pushrod.



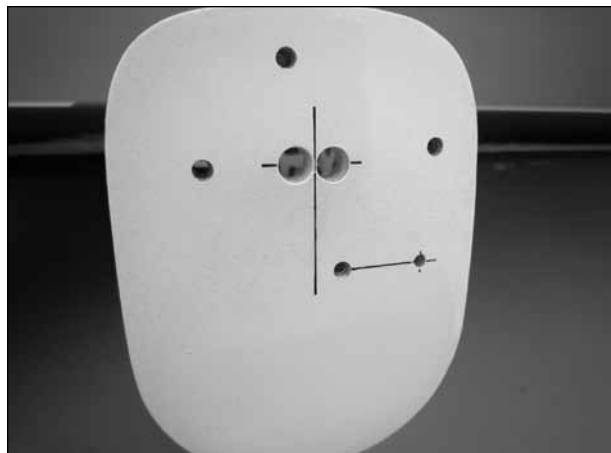
□ □ Step 7

Use a ruler to measure the vertical centerline of the firewall and mark it with a felt-tipped pen. Measure down 1 9/32 inch from the top of the firewall and mark a horizontal line.



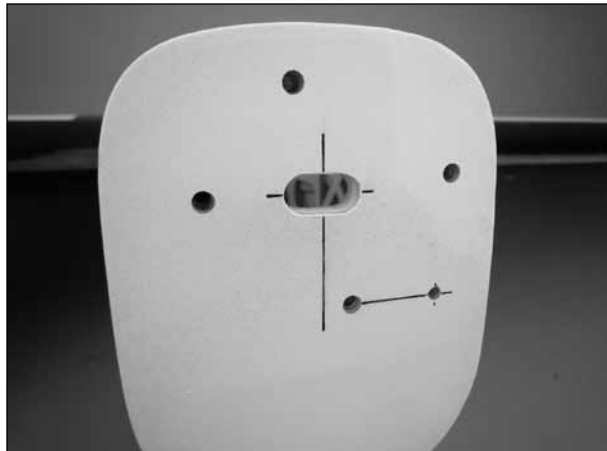
□ □ Step 8

Use a drill motor and 5/16-inch drill bit to drill a hole 5/32 inch each side of the centerline.



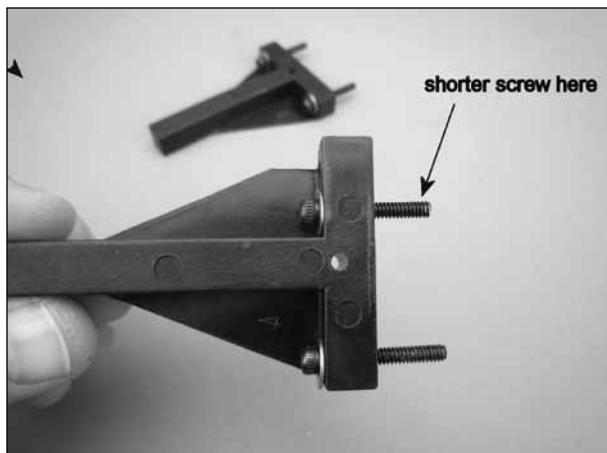
□ □ Step 9

Use a round file to remove the material between the holes, creating a slot measuring 5/16 x 5/8 inches.



□ □ Step 10

Place a #6 steel washer onto each of the 6-32 Allen head machine screws. Insert the screws and washers in the engine mounts, noting that the modified screw locates in the lower of the two holes under the beveled edge of the right-hand mount.



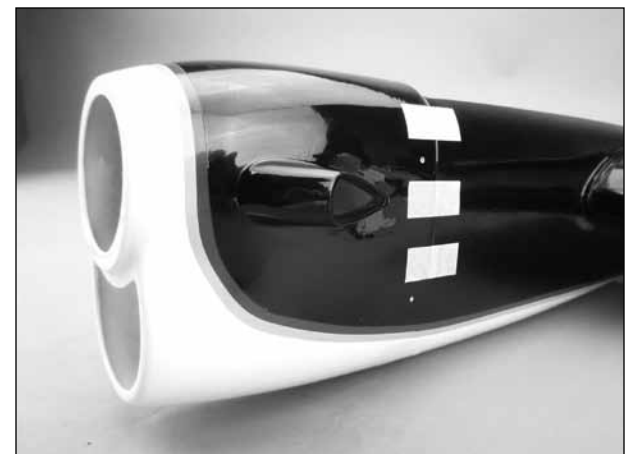
□ □ Step 11

Apply a drop of threadlock to each of the screws then use a 7/64-inch hex wrench to secure the mounts to the firewall.



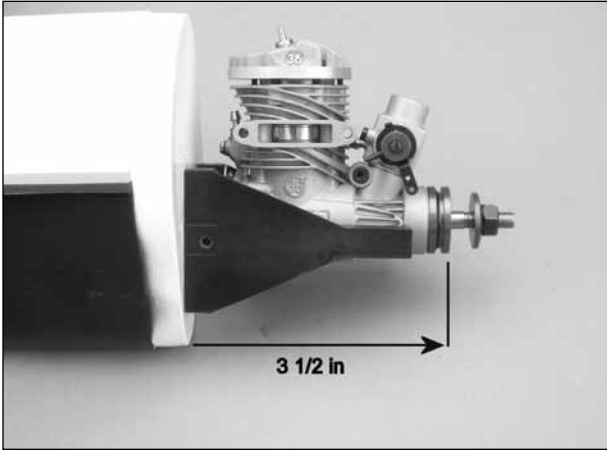
□ □ Step 12

Perform steps 1 through 7 beginning on page 20 to install the cowling on the nacelle. Set the front face of the cowl 3 7/16 inches from the firewall when taping it in place to drill the mounting holes in the nacelle.



□ □ Step 13

Invert the nacelle and position the engine on the mounts so the face of the drive washer is 3 1/2 inches from the firewall.



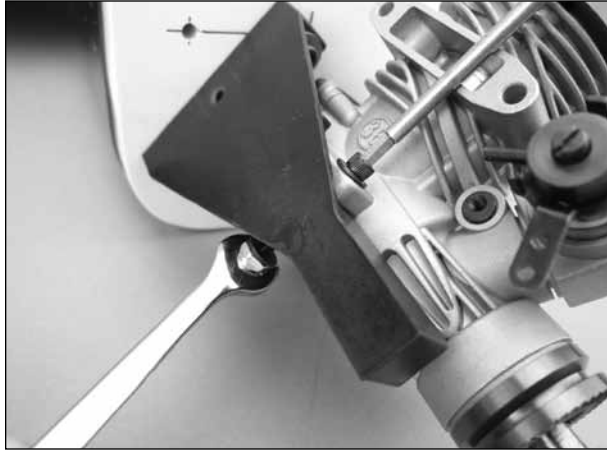
□ □ Step 14

Mark the engine mounting holes on the mounts then remove the engine. Use a drill motor and 1/8-inch bit to drill the mounting holes.



□ □ Step 15

Place a #4 steel washer onto each of the 4-40 x 1-inch Allen head machine screws. Place the engine on the mount and insert the screws. Slide a second #4 washer on each screw then thread on a 4-40 nylon locknut. Use a 3/32-inch hex and 1/4-inch wrench to tighten the engine to the mount.



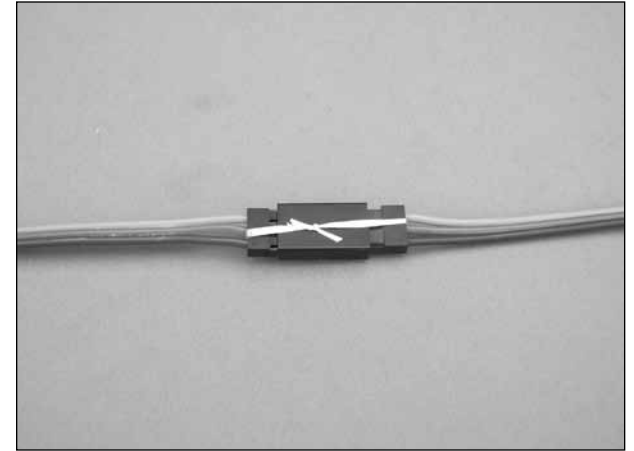
□ □ Step 16

Prepare a micro servo with grommets and bushings. Note that the bushings are installed from the bottom of the servo.



□ □ Step 17

Attach a 9-inch servo extension lead to the servo and secure the connectors with dental floss. **Hint:** Apply a very small drop of thin CA to the knot to prevent it coming loose.



□ □ Step 18

Use a #1 Phillips screwdriver to remove the small arm. Use sidecutters to remove three arms from a standard 4-way arm, leaving one long arm. Install the arm on the servo as shown.



□ □ Step 19

Use a 5/64-inch bit in a pin vise to enlarge the outer hole of the servo arm, then install an EZ link. Use needle nose pliers to press the keeper into place.



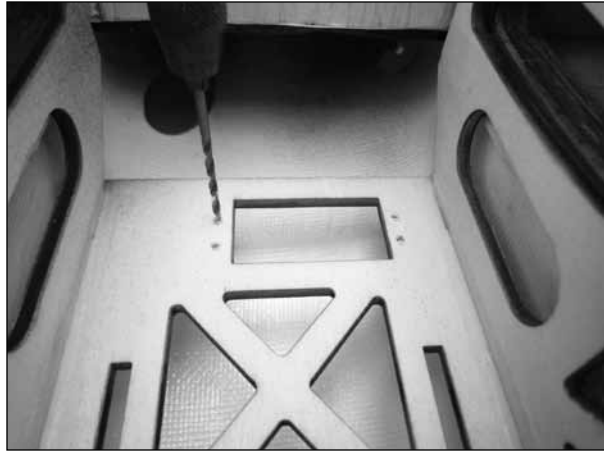
□ □ Step 20

Set the servo in place in the nacelle and mark the mounting hole locations with a pencil.



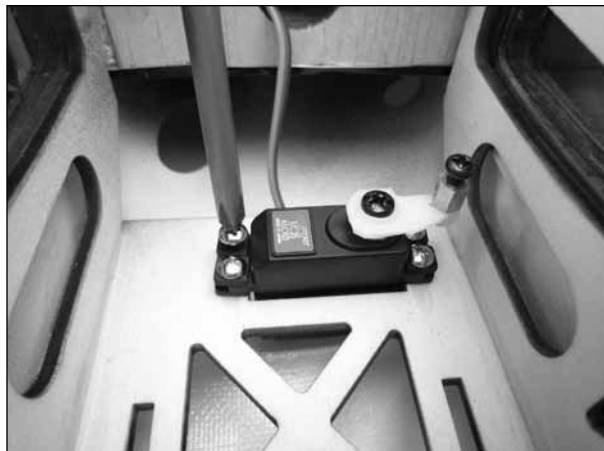
□ □ Step 21

Remove the servo and use a 1/16-inch drill bit in a pin vise to drill the mounting holes. Apply a drop of thin CA to each of the holes to strengthen the wood. Allow the CA to cure without using accelerator.



□ □ Step 22

Feed the throttle servo lead through the hole in the spar and through the wing to the wing root. Position the servo with the output shaft to the left-hand side. Use the hardware provided with the servo to install it with a #1 Phillips screwdriver.



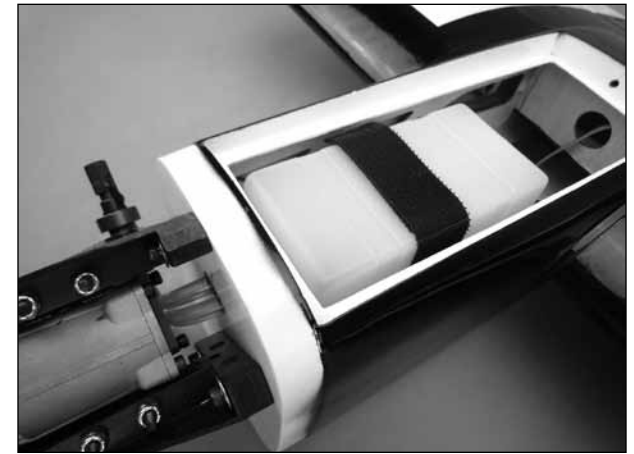
□ □ Step 23

Insert an 11 3/4-inch hook and loop strap through the forward slots in the nacelle tray.



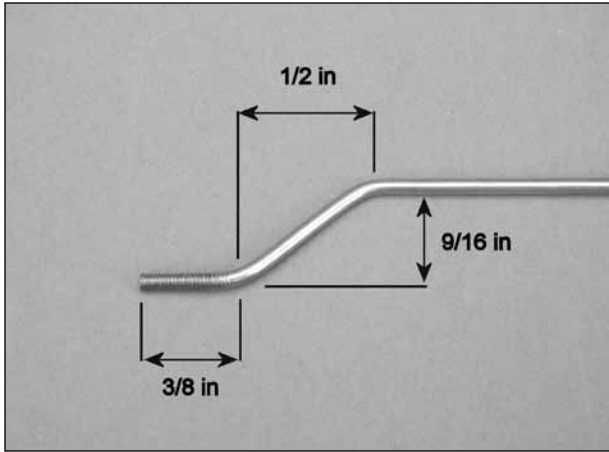
□ □ Step 24

Guide the fuel lines through the slot in the firewall and use the hook and loop strap to secure the fuel tank in place. Note that the tank stopper and vent tube should be towards the top.



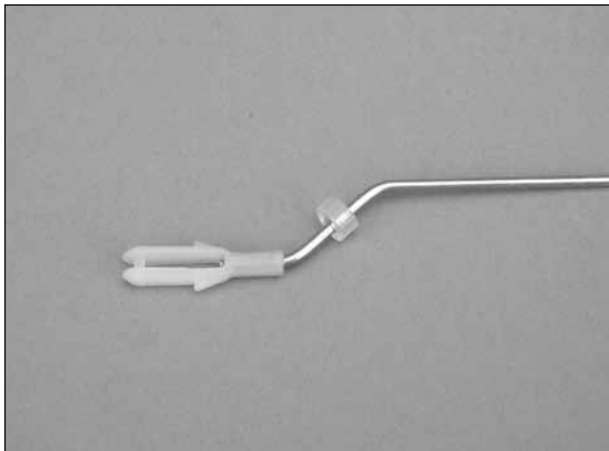
□ □ Step 25

Use sidecutters to trim the threaded portion of the throttle pushrod to a length of 3/8 inch. Then use pliers to bend the pushrod to the dimensions shown.



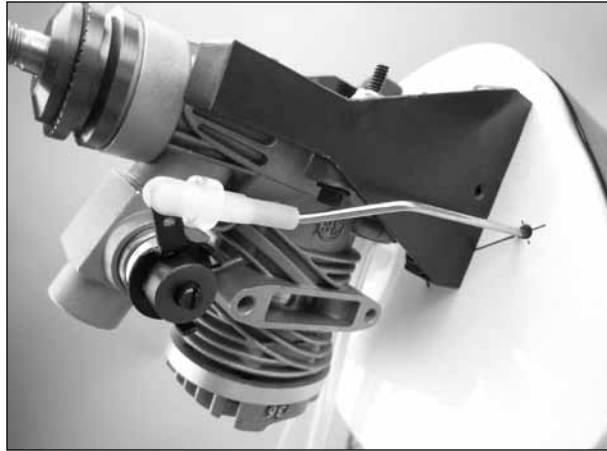
□ □ Step 26

Slide a silicone keeper onto the pushrod then thread on a nylon clevis up to the bend.



□ □ Step 27

Slide the pushrod through the hole in the firewall and into the EZ link on the servo. Attach the nylon clevis to the outer hole of the carburetor throttle arm and secure it with the silicone keeper.



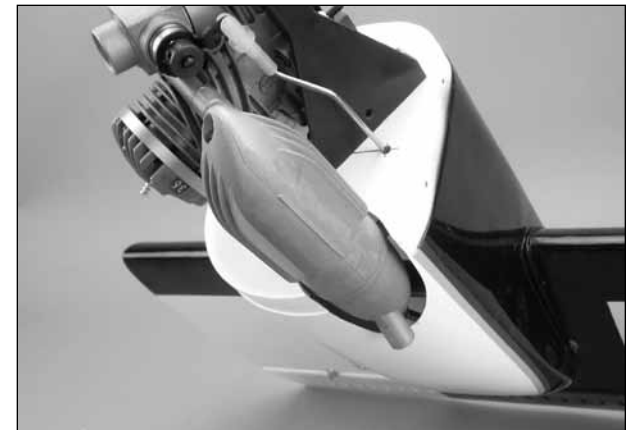
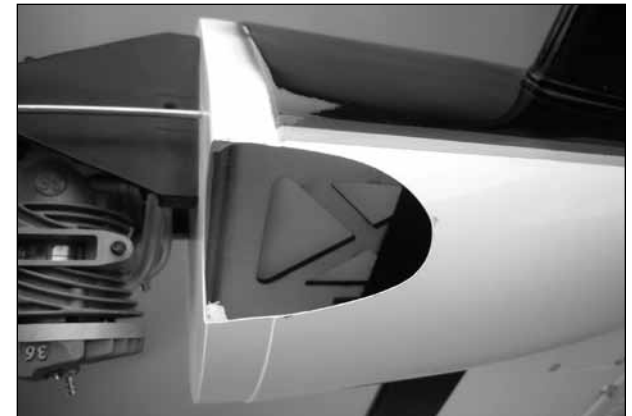
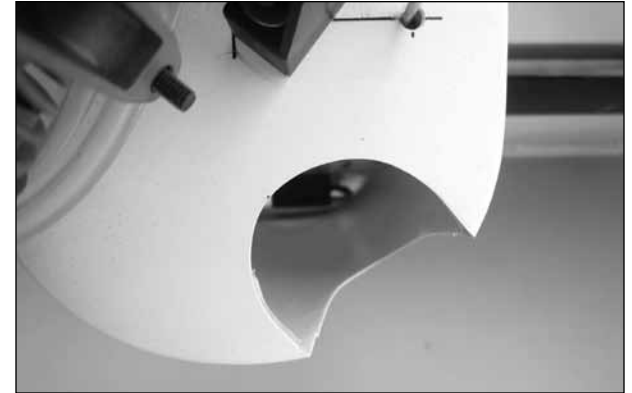
□ □ Step 28

Now is a good time to set the throttle travel before the cowl is installed. Use your radio to move the throttle servo to the fully open position. Move the pushrod forward to open the carburetor to the full open position and use a #1 Phillips screwdriver to secure the throttle pushrod in the EZ link. Now use your radio to check operation of the throttle throughout its range and make any adjustments to the pushrod or servo travel volume as necessary. Using the equipment and dimensions shown here we found ATV values of 100% for both high and low settings to be ideal.



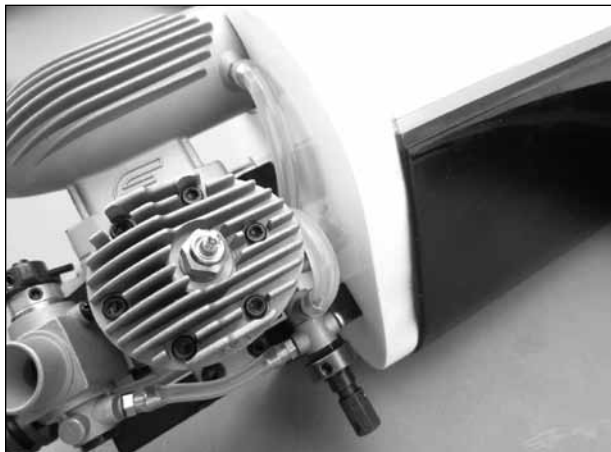
□ □ Step 29

Use these pictures as a guide to cut the firewall and lower nacelle for the muffler. A cutoff wheel and sanding drum in a rotary tool work well for this. Install the muffler using the gasket and hardware provided with the engine.



□ □ Step 30

Connect the fuel tank vent line (pink) to the pressure nipple on the muffler and the feed line (green) to the fuel inlet on the carburetor or needle valve assembly.



□ □ Step 31

Shown here is a tee fitting installed in the feed line. You may choose to install a fuel filler dot in the cowling or run a fuel into the tank compartment for fueling purposes.



□ Step 32

Repeat steps 1 through 31 for the opposite side.

Cowling, Propeller and Spinner Installation—2-Stroke

Parts Required

Wing Panels (left and right)
Cowlings (2) Clear cowlings (2)
Propellers (2) Spinners (2)
#2 x 1/4-inch woodscrews (8)

Tools Required

Ruler Felt-tipped pen
#1 Phillips screwdriver
Rotary tool with cutoff wheel and drum sander

□ □ Step 1

Use scissors to trim the clear cowling so it will fit over the fiberglass cowl. Transfer the mounting holes to the clear cowl to serve as a reference.



□ □ Step 2

Cut openings in the clear cowling so that it can be mounted without obstruction from the engine. You may find it easier to remove the needle valve until after the cowl is fit.



□ □ Step 3

Slide the clear cowling over the fiberglass cowl and mark the required cutouts with a felt-tipped pen. Then use a cutoff wheel and drum sander in a rotary tool to make the cutouts in the fiberglass cowling.



□ □ Step 4

Shown here is the cutout for the muffler. Use the nacelle cutout made in step 29 as a guide for the muffler opening in the cowling.



□ □ Step 5

Use a #1 Phillips screwdriver to install the cowling with four #2 x 1/4-inch woodscrews.



□ □ Step 6

Install the spinner backplate and propeller and secure them with the propeller washer and nut. Use a #1 Phillips screwdriver to secure the spinner cone with the provided #4 x 7/16-inch screws.



Rudder Hinging

Parts Required

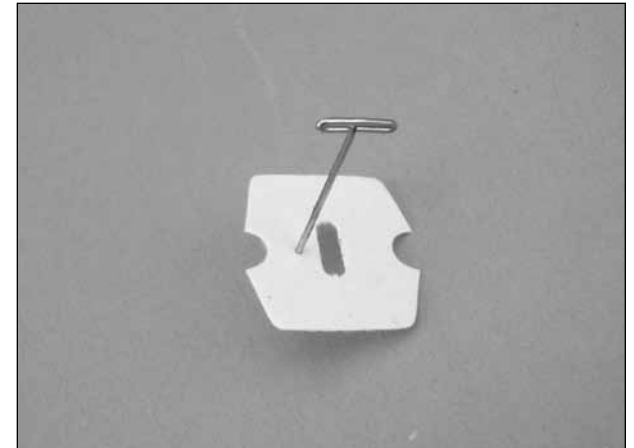
Fuselage	Rudder
CA hinges (4)	

Tools Required

T-pins	Thin CA
--------	---------

□ Step 1

Prepare four CA hinges by inserting a T-pin in the center of each hinge.



- Step 2
Slide a CA hinge into each of the pre-cut hinge slots in the rudder leading edge.



- Step 3
Slide the rudder hinges into the slots in the fin and align the rudder with the top and bottom of the fin.



- □ Step 4
Remove the T-pins and apply 3–4 drops of thin CA to each of the hinges. Allow the CA to cure without using accelerator so it can penetrate the hinges completely.



Rudder Servo and Linkage Installation

Parts Required

Fuselage	Servo with hardware
7-inch steel pushrod	Small control horns (2)
Copper sleeves (4)	82-inch rudder cable
Wire cable ends (2)	EZ links (2)
Radio	M3 x 4 screws (2)

Tools Required

Felt-tipped pen	Pin vise
1/16-inch drill bit	5/64-inch drill bit
Needle-nose pliers	#1 Phillips screwdriver
Sidcutters	Pencil
Thin CA	Ruler
Threadlock	Hobby knife with #11 blade

- Step 1
Prepare the rudder servo by installing the grommets and bushings. Note that the bushings are installed from the bottom of the servo.



□ Step 2

Use sidecutter to trim two arms from a large 4-way servo arm, leaving two arms opposite each other. Center the servo using your radio, then use a #1 Phillips screwdriver to install the arm as shown.



□ Step 3

Use a 5/64-inch drill bit in a pin vise to enlarge the outer holes in the servo arm. This provides a servo arm length of 5/8 inches (16mm) from center. Install an EZ link in each of the holes.



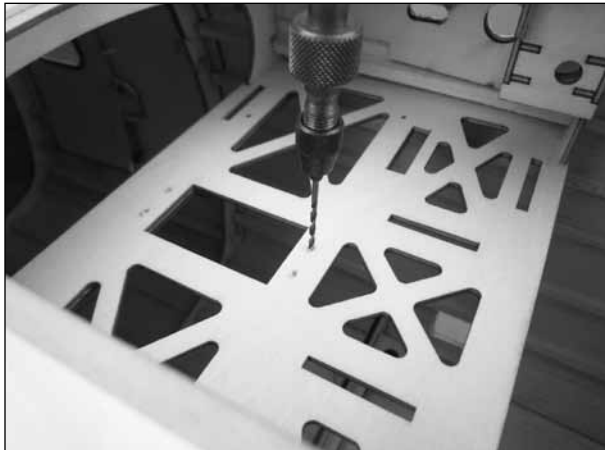
□ Step 4

Place the servo in the radio tray in the upper fuselage and mark the mounting hole locations with a pencil.



□ Step 5

Remove the servo and use a 1/16-inch drill bit in a pin vise to drill the mounting holes. Apply a drop of thin CA to each of the holes to strengthen the wood. Allow the CA to cure without using accelerator.



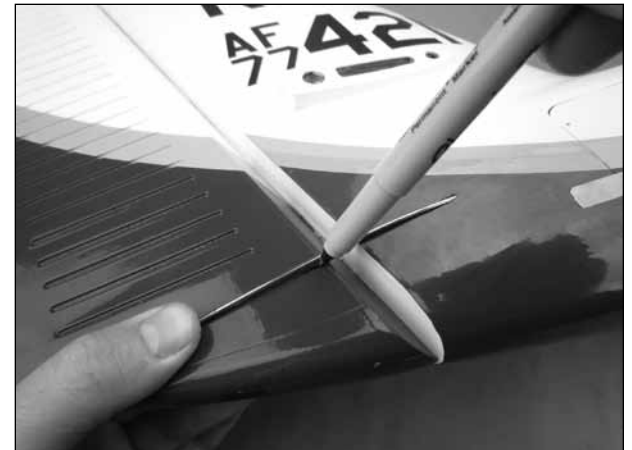
□ Step 6

Use a #1 Phillips screwdriver and the hardware provided with the servo to secure it to the radio tray with the output shaft forward.



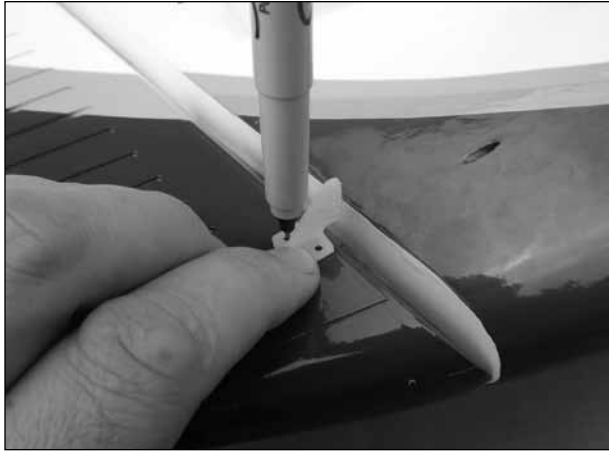
□ □ Step 7

Insert the 7-inch steel pushrod into the rudder cable slot in the right-hand side of the rear fuselage. Use a felt-tipped marker to mark the rudder.



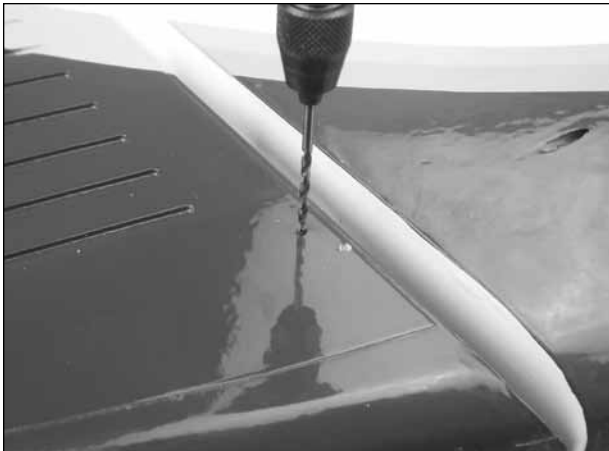
□ □ Step 8

Remove the pushrod. Place a small control horn on the rudder at the marked location and use a felt-tipped pen to mark the mounting holes.



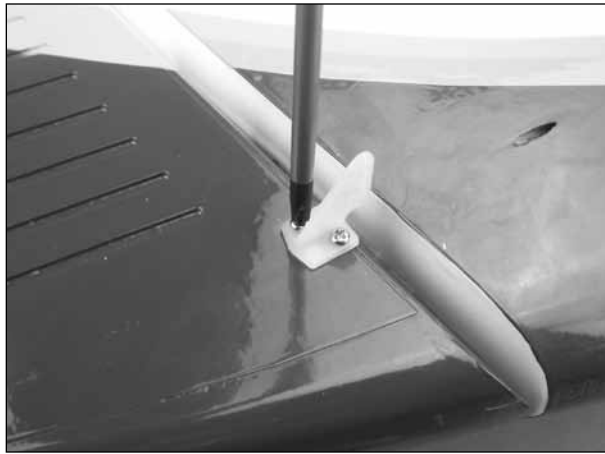
□ □ Step 9

Use a 1/16-inch drill bit in a pin vise to drill the mounting holes for the control horn. Apply a drop of thin CA to strengthen the wood and help retain the screws. Allow the CA to cure without using accelerator.



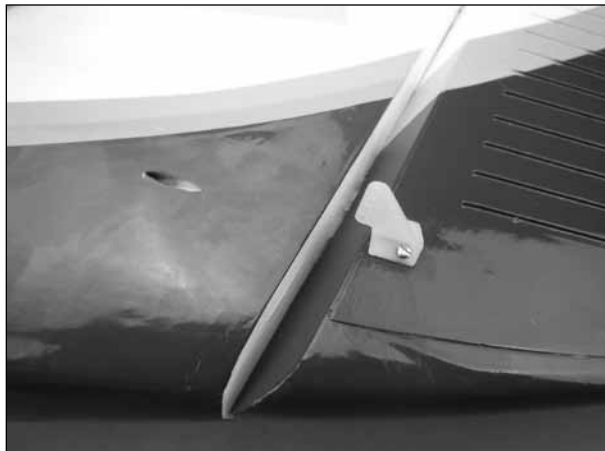
□ □ Step 10

Use a #1 Phillips screwdriver to install the control horn with two #2 x 1/2-inch screws.



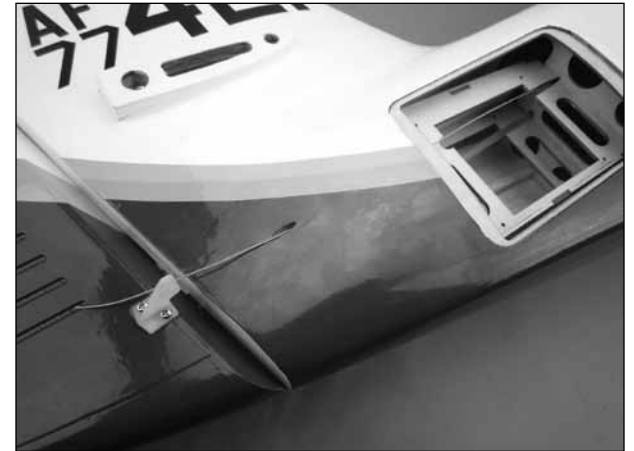
□ Step 11

Repeat steps 7 through 10 to install the second control horn on the left-hand side of the rudder. You may need to use a hobby knife to remove the covering from the cable exit hole in the fuselage.



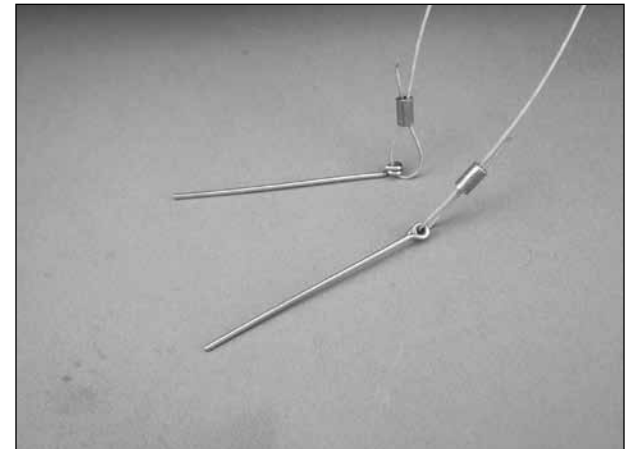
□ Step 12

Remove the hatch from the right-hand side of the rear fuselage and set it aside. Fold the 82-inch rudder cable in half and use sidecutters to cut it into two 41 inch lengths. Insert each cable into the guide tubes in the rear fuselage and feed them into the forward fuselage area. Tape the cable ends to the fuselage so they don't get pulled inside the fuselage.



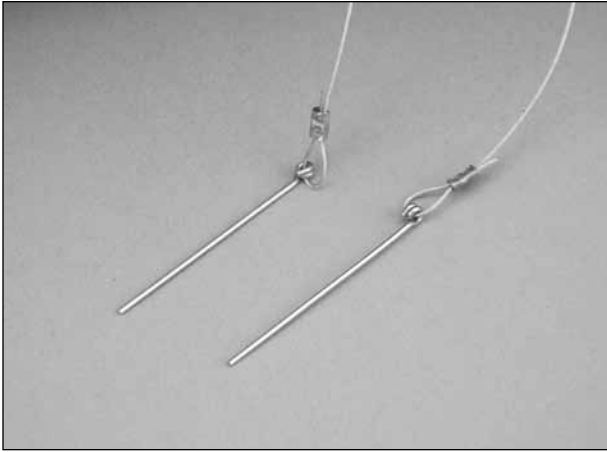
□ Step 13

Open the cabin doors in the left-hand side of the fuselage and bring the cables out to prepare the end connections. Slide a copper sleeve onto each of the cables, then insert the cable ends through the loop of a wire cable end and back through the sleeve.



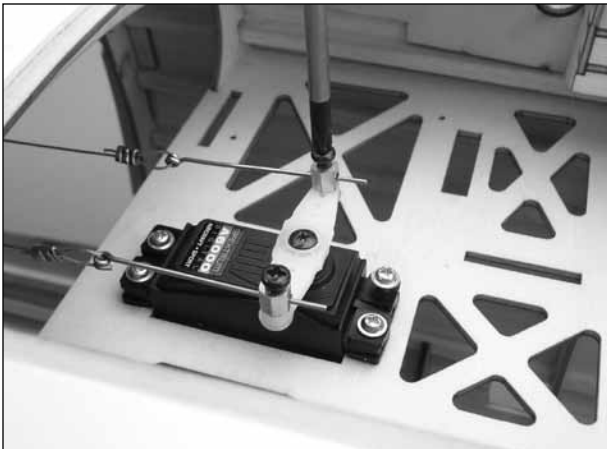
□ Step 14

Use pliers to crimp the sleeves and secure them to the cable ends.



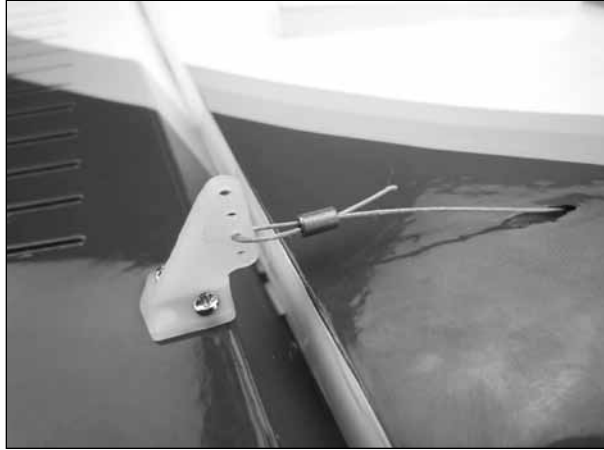
□ Step 15

Insert the cable ends into the EZ links on the servo so that 1/4 inch of the wire protrudes. Be sure the cables are not crossed inside the fuselage. Apply a small drop of threadlock to each of the M3 x 4mm screws. Use a #1 Phillips screwdriver to install the screws in the EZ links and secure the cable ends to the servo.



□ Step 16

Slide a copper sleeve onto each of the cables then pass them through the second hole from the base of the rudder control horns. Insert the ends of the cables back through the sleeves.



□ Step 17

Use you radio to check that the rudder servo is centered, and center the rudder by aligning the balance tab at the top with fin. Then use pliers to crimp the sleeves to the cables. Trim the excess cable with sidecutters. Any required cable tension adjustments can be made at the servo end.



Nose Gear and Steering Servo Installation

Parts Required

Fuselage	Nose gear assembly
7-inch steel pushrod	Nylon clevis
Silicone keeper	Servo with hardware
8-32 x 1-inch Allen head machine screws (4)	
#2 x 1/4-inch woodscrews (4)	

Tools Required

Ruler	Pliers
Felt-tipped pen	Pencil
Pin vise	#1 Phillips screwdriver
1/16-inch drill bit	5/64-inch drill bit
Sidecutters	1/8-inch hex wrench
Thin CA	Threadlock
Dental floss	

□ Step 1

Invert the fuselage on the work surface. Remove the hatch from the forward fuselage and set it aside.



□ Step 2

Prepare the nosewheel steering servo with grommets and bushings. Note that the bushings are installed from the bottom of the servo.



□ Step 3

Use sidecutters to remove three arms from a standard 4-way servo arm, leaving one long arm. The required servo arm length is 1/2 inch (13mm). Center the servo using your radio then use a #1 Phillips screwdriver to install the arm as shown.



□ Step 4

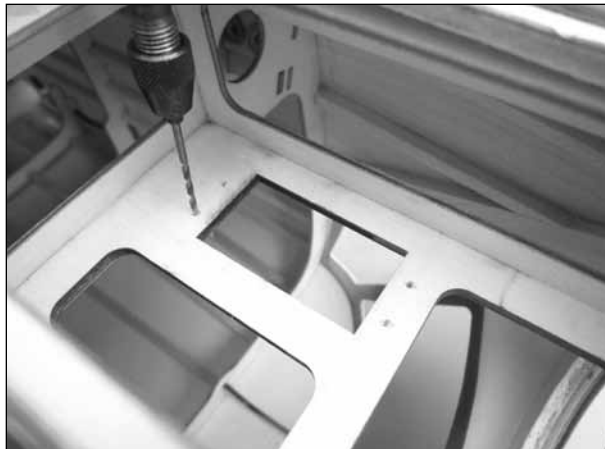
Set the servo in place and mark the mounting holes with a pencil.



□ Step 5

Remove the servo and drill the mounting holes with a 1/16-inch drill bit in a pin vise. Apply a drop of thin CA to each of the holes to strengthen the wood. Allow the CA to cure without using accelerator.

Hint: Place a rag in the fuselage so that any drip of CA does not damage the windshield.



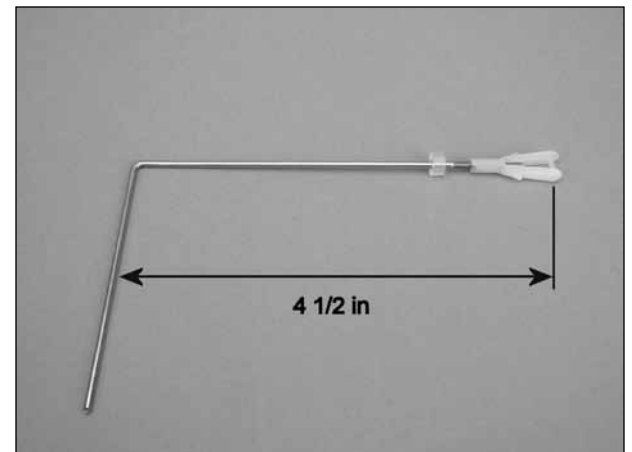
□ Step 6

Use a #1 Phillips screwdriver and the hardware provided with the servo to install it with the output shaft towards the rear of the fuselage.



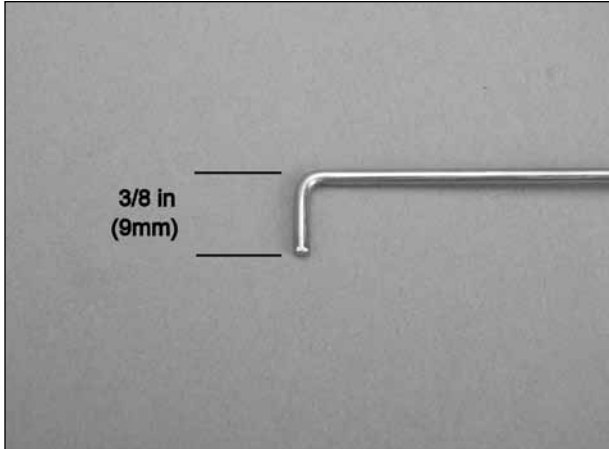
□ Step 7

Slide a silicone keeper onto the pushrod then thread on a nylon clevis so that it is centered on the threads. Measure 4 1/2 inches from the clevis pin and make a mark with a felt-tipped pen. Use pliers to form a 90-degree bend at the marked location.



□ Step 8

Use sidecutters to trim the bent portion of the wire to a length of 3/8 inch (9mm).



□ Step 9

From inside the fuselage, pass the bent end of the pushrod through the slot in the bulkhead then connect the clevis to the outer hole of the servo arm and secure it with the silicone keeper.



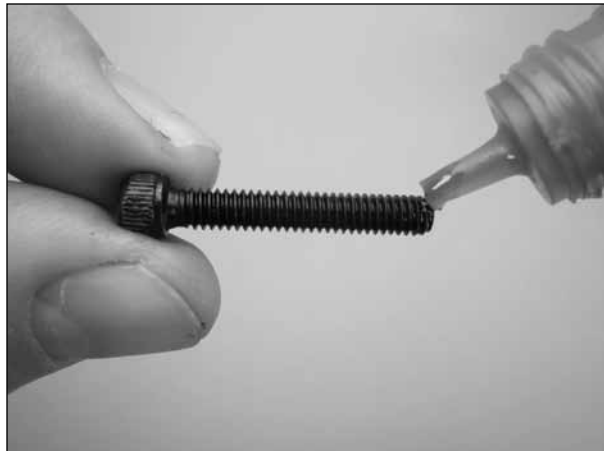
□ Step 10

Use a 5/64-inch drill bit in a pin vise to enlarge the center hole in the nose gear steering arm.



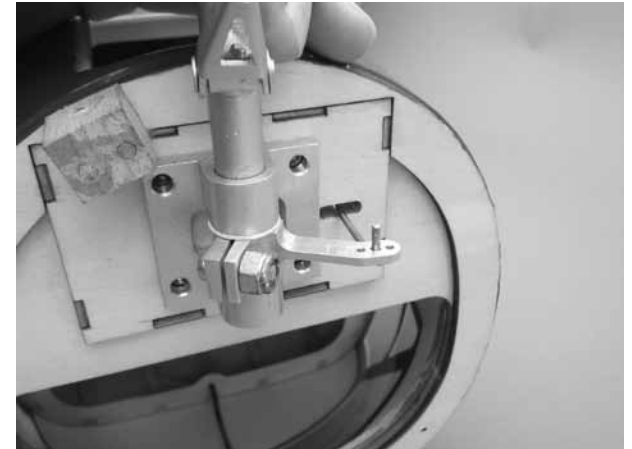
□ Step 11

Prepare the four 8-32 x 1-inch nose gear mounting screws by applying a drop of threadlock to the ends of the threads.



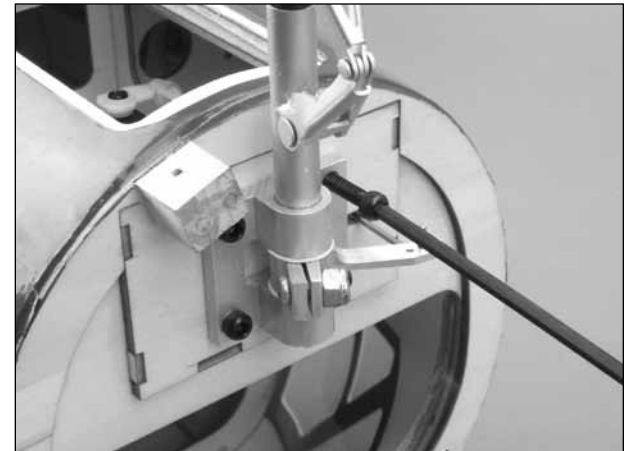
□ Step 12

Insert the steering pushrod into the center hole of the steering arm while placing the nose gear against the bulkhead. Note that the anti-torque (scissor) link faces forward.



□ Step 13

Use a 1/8-inch hex wrench to secure the nose gear to the bulkhead with four 8-32 x 1-inch Allen head screws.



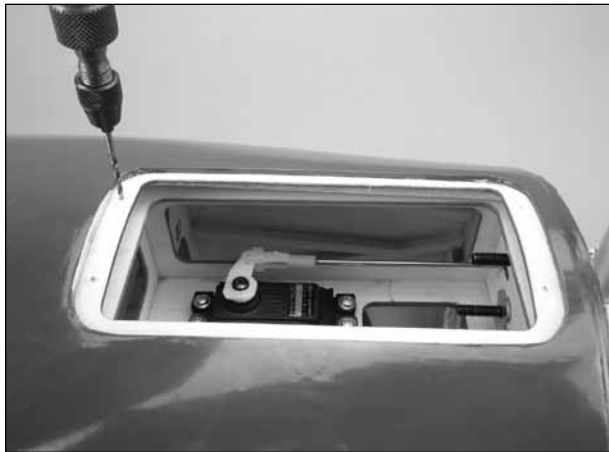
□ Step 14

Set the hatch in place and mark the mounting hole locations with a pencil.



□ Step 15

Remove the hatch and use a 1/16-inch drill bit in a pin vise to drill the mounting holes. Apply a drop of thin CA to each of the holes to strengthen the wood. Allow the CA to cure without using accelerator.



□ Step 16

Use a #1 Phillips screwdriver to install the hatch with four #2 x 1/4-inch woodscrews.



Main Landing Gear Installation

Parts Required

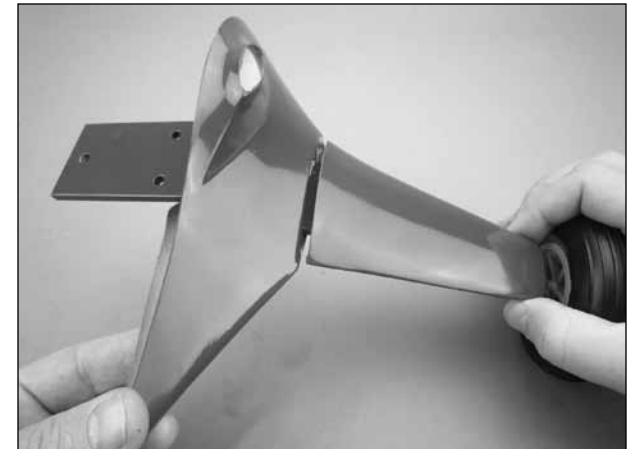
Fuselage	Wing tube
Wing struts (left and right)	
Landing gear (left and right)	
Wing panels (left and right)	
Landing gear fairings (left and right)	
8-32 x 1-inch Allen head machine screws (6)	

Tools Required

Low-tack tape	1/8-inch hex wrench
Threadlock	Canopy glue

Step 1

- □ Slide the fairing onto the landing gear.



□ □ Step 2

Prepare two 8-32 x 1-inch screws by applying a drop of threadlock to the end of the threads.



□ □ Step 3

Slide the landing gear and fairing into the fuselage. Insert an 8-32 x 1-inch screw into the inboard and aft holes and use a 1/8-inch hex wrench to secure the gear to the fuselage.



□ □ Step 4

Insert the wing strut into the gear fairing and align the hole in the strut with the forward landing gear mounting hole. Use a 1/8-inch hex wrench to secure the strut to the fuselage with an 8-32 x 1-inch Allen screw.



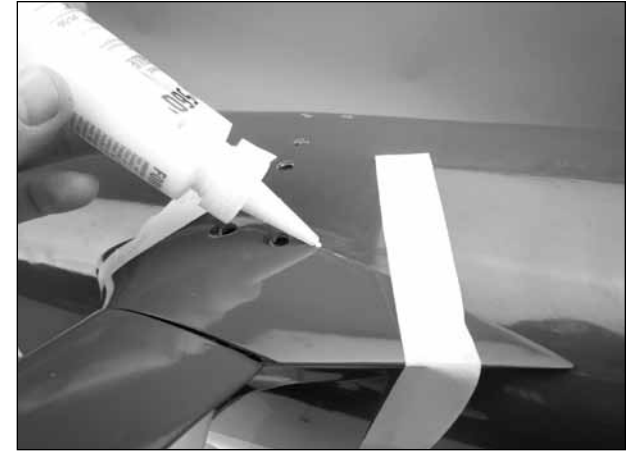
□ □ Step 5

Insert the wing tube in the fuselage. Slide the wing panel onto the tube while guiding the end of the strut into the hole in the lower nacelle. Slide the wing panel all the way against the fuselage and engage the strut end in its pocket under the outboard side of the nacelle. This sets the strut in the correct location so the gear fairing can be glued in place.



□ □ Step 6

Apply a bead of canopy glue around the perimeter of the gear fairing and use low-tack tape to hold it in place against the fuselage while the glue cures. Allow the glue to cure completely before removing the tape.



□ □ Step 7

Remove the wing panel then repeat steps 1 through 6 to install the opposite landing gear and fairing. You may choose to leave the struts installed unless required to remove them for transportation.

Nose Cone Installation

Parts Required

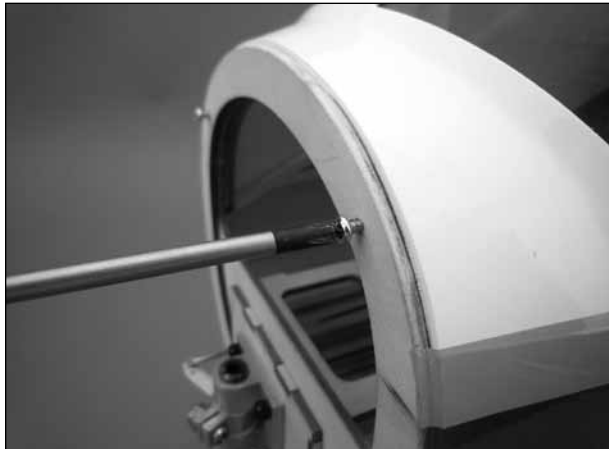
Fuselage Nose cone
#4 x 7/16-inch woodscrews (3)

Tools Required

#1 Phillips screwdriver Ruler

□ Step 1

Use a #1 Phillips screwdriver to install a #4 x 7/16-inch woodscrew in each of the two holes in the top of the nose bulkhead. Install them so that the head of the screw is 1/8 inch from the face of the bulkhead.



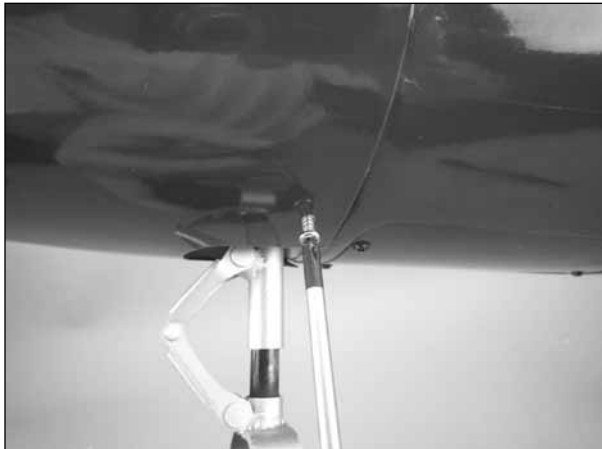
□ Step 2

Slide the nose cone into place over the screws then turn it counterclockwise to engage the screw heads in the keyhole slots in the nose cone bulkhead.



□ Step 3

Use a #1 Phillips screwdriver to install a #4 x 7/16-inch woodscrew in the lower left side of the cowling to retain it on the fuselage.



Receiver, Battery and Switch Installation

Parts Required

Fuselage Receiver
Battery Switch
Y-harness (3) 9-inch extensions leads (2)
36-inch extension leads (2)

Tools Required

Pin vise Double-sided foam tape
1/16-inch drill bit #1 Phillips screwdriver

□ Step 1

Mount the switch in your preferred location. It is shown here on the lower fuselage ahead of the main landing gear.



□ Step 2

Use double-sided foam tape to attach the battery to the left-hand side of the radio tray in the upper fuselage. You may choose to mount the battery in the nose section if required for balancing.



□ Step 3

Use double-sided foam tape to attach the receiver to the radio tray.



□ Step 4

Mount the remote receiver in your desired location using double-sided foam tape. It is shown here on the right-hand fuselage side below the wing tube.



□ Step 5

Connect the necessary extension leads and Y-harnesses to the receiver. Use the equipment list on page 4 as a guide for making these connections.

We recommend securing the elevator servo extension leads within the fuselage so that they cannot become entangled with the rudder cables.



Final Assembly

Parts Required

Fuselage	Wing panels (left and right)
Wing tube	Wing struts
Rear fuselage hatch	Top fuselage hatch
Stabilizer tube	
8-32 x 1-inch Allen head machine screws	
#2 x 1/4-inch woodscrews (10)	
1/4-20 x 2-inch nylon wing bolts (2)	

Tools Required

3/32-inch hex wrench	1/8-inch hex wrench
Pin vise	1/16-inch drill bit
Pencil	#1 Phillips screwdriver
Thin CA	

□ Step 1

Set the rear fuselage hatch in place and mark the mounting holes with a pencil.



□ Step 2

Use a 1/16-inch drill bit in a pin vise to drill the mounting holes. Apply a small drop of thin CA to each of the holes to strengthen the wood. Allow the CA to cure without using accelerator.



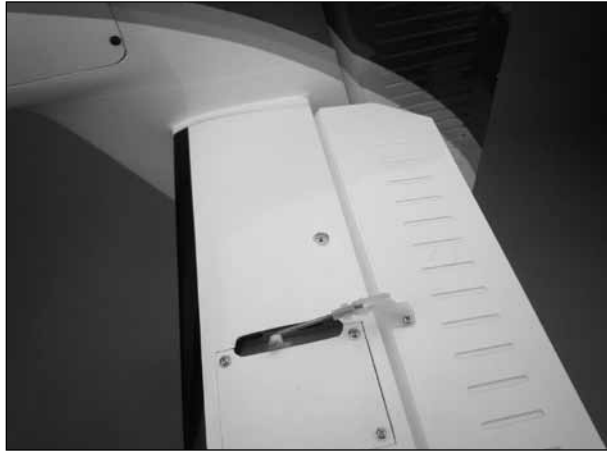
□ Step 3

Use a #1 Phillips screwdriver to install the hatch with four #2 x 1/4-inch woodscrews.



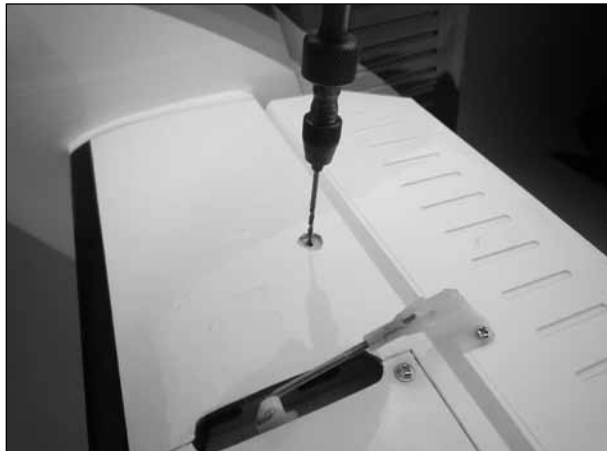
□ Step 4

Invert the fuselage and slide the stabilizer tube into place. Slide each stabilizer half onto the tube and connect the servo leads. Engage the alignment pin in the leading edge and slide the stabilizer into place.



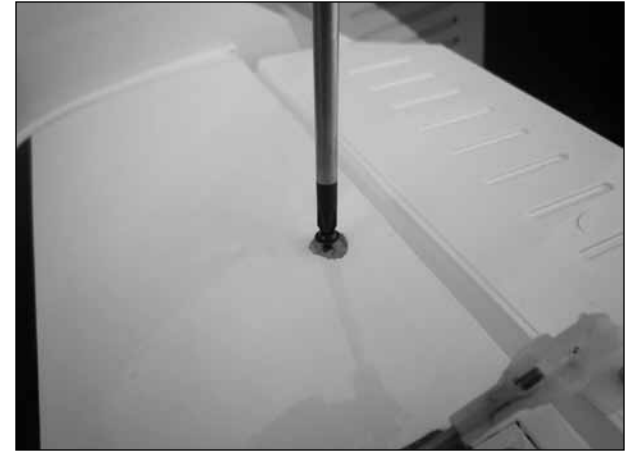
□ Step 5

Use a 1/16-inch drill bit in a pin vise to drill a hole through the stabilizer tube at the retaining screw location on the lower surface of each stabilizer half. Do not drill all the way through the opposite side of the tube.



□ Step 6

Use a #1 Phillips screwdriver to install a #2 x 1/4-inch woodscrew in each side to retain the stabilizer halves. You may choose to apply a small piece of tape over the screw heads for additional security.



□ Step 7

Refer to steps 4 and 5 on page 36 to install the wing struts and wing panels. Before sliding the wings completely against the fuselage make sure to connect the wing servos to the receiver.



□ □ Step 8

Use a 3/32-inch hex wrench to secure the wing strut to the wing with a 4-40 x 3/4-inch Allen head machine screw.



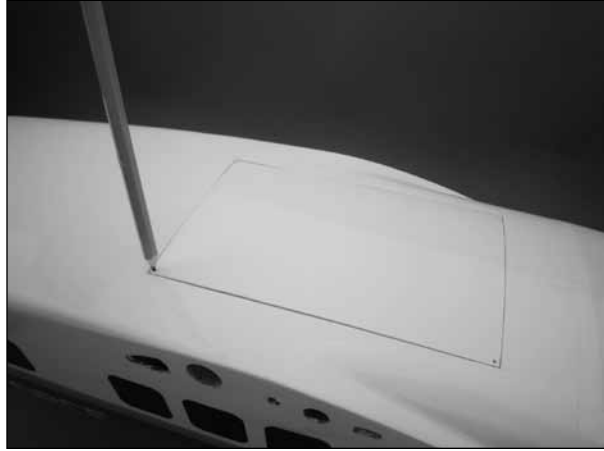
□ □ Step 9

Thread a 1/4-20 x 2-inch nylon bolt into the wing panels to secure them to the fuselage.



□ Step 10

Set the top hatch in place on the fuselage and mark the mounting hole locations with a pencil.



□ Step 11

Use a 1/16-inch drill bit in a pin vise to drill the mounting holes in the fuselage. Apply a small drop of thin CA to each of the holes to strengthen the wood. Allow the CA to cure without using accelerator.



□ Step 12

Use a #1 Phillips screwdriver to install the hatch with four #2 x 1/4-inch woodscrews.



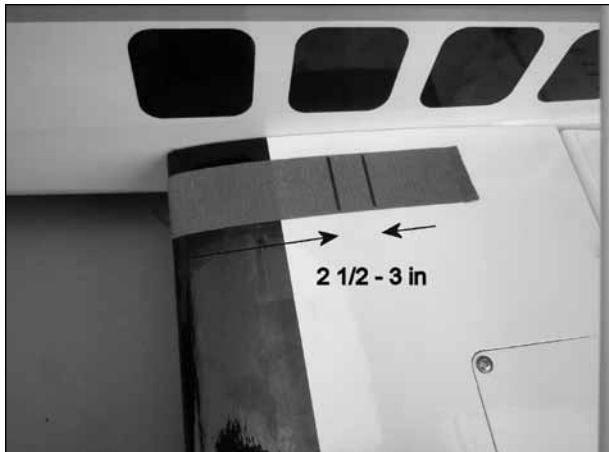
Center of Gravity

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 your model is 2 1/2 (64mm) to 3 inches (76mm) behind the leading edge of the wing.

Mark the location for the Center of Gravity on a piece of low-tack tape on the top of the wing next to the fuselage as shown. When balancing your model, support the model inverted at the marks made on the top of the wing with your fingers or a commercially available balancing stand. This is the correct balance point for your model. You may find you need to add a small amount of weight to either the front or back of the fuselage to achieve the correct balance.



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 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 throws of the elevator, ailerons, flaps and rudder.

Aileron

Up	3/8 inch	(10mm)
Down	3/8 inch	(10mm)

Elevator

Up	1/2 inch	(13mm)
Down	1/2 inch	(13mm)

Rudder

Left	2 inches	(51mm)
Right	2 inches	(51mm)

Flaps

Mid-position	1/2 inch	(13mm)
Full down	1 1/2 inch	(38mm)

Elevator Compensation with Flap

Mid-position	5/32 inch	(4mm)
Full down	3/8 inch	(10mm)

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.

Flight Preparations

Flight preparations should be performed 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 cowl. 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 or vent 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.

Maintaining Your Model

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

□ **Clean Up**

After a long flying session with your model, you will want to clean it before loading it into your vehicle to head home. Use a cleaner and a paper towel to wipe down the exterior of your plane, removing the fuel residue. Remember, a clean airplane will last longer since the fuel won't be able to soak into any exposed wood.

□ **Checking the Propeller**

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

□ **Checking the Clevises**

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

□ **Checking the Control Horns**

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

□ **Checking the Wheel Collars**

Check the setscrews on the wheel collars for the main and tail wheel to make sure they are not loose. Use a hex wrench to tighten the setscrews. It is suggested if they loosen frequently to remove them, reapply threadlock to the setscrews, then secure the wheel collars back into position.

□ **Check the Muffler Bolts**

Use the appropriate hex wrench to make sure the hardware holding the muffler onto the engine is tight and has not vibrated loose during flight.

□ **Check the Engine Mount Bolts**

Remove the spinner (if used) and propeller from the engine. Remove the cowling, and if necessary remove the muffler to gain access to the engine mounting bolts. Use a Phillips screwdriver or hex wrench to make sure the four bolts securing the engine to the mount or firewall are tight.

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 are any unusual wind conditions.

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.

Daily Flight Checks

Step 1
Check the battery voltage on both the transmitter and the receiver battery packs. 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 polarity correct on your expanded scale voltmeter.

Step 2
Check all hardware (linkages, screws, nuts, and bolts) prior to each days 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 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 moves freely in both directions.

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

Horizon reserves the right to change or modify this warranty without notice and disclaims all other warranties, express or implied.

(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

Twin Otter ARF Assembly Manual

by Purchaser must be approved in writing by Horizon before shipment.

Damage Limits

HORIZON SHALL NOT BE LIABLE FOR SPECIAL, INDIRECT OR CONSEQUENTIAL DAMAGES, LOSS OF PROFITS OR PRODUCTION OR COMMERCIAL LOSS IN ANY WAY CONNECTED WITH THE PRODUCT, WHETHER SUCH CLAIM IS BASED IN CONTRACT, WARRANTY, NEGLIGENCE, OR STRICT LIABILITY. Further, in no event shall the liability of Horizon exceed the individual price of the Product on which liability is asserted. As Horizon has no control over use, setup, final assembly, modification or misuse, no liability shall be assumed nor accepted for any resulting damage or injury. By the act of use, setup or assembly, the user accepts all resulting liability.

If you as the Purchaser or user are not prepared to accept the liability associated with the use of this Product, you are advised to return this Product immediately in new and unused condition to the place of purchase.

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

Safety Precautions

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

Questions, Assistance, and Repairs:

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

Inspection or Repairs

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

Warranty Inspection and Repairs

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

Non-Warranty Repairs

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

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:

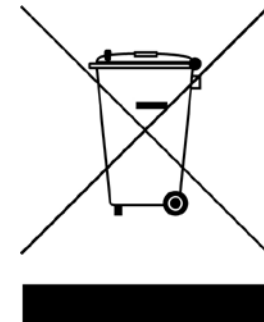
Electronics and engines requiring inspection or repairs should be shipped to the following address:

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.

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.



Academy of Model Aeronautics
National Model Aircraft Safety Code
Effective January 1, 2010

GENERAL

A model aircraft shall be defined as a non-human-carrying aircraft capable of sustained flight in the atmosphere. It may not exceed limitations established in this code and is intended to be used exclusively for sport, recreation, and/or competition.

1. I will not willfully fly my model aircraft in a careless or reckless manner, and will abide by this Safety Code and any additional rules specific to flying sites.
2. I will yield the right-of-way to man-carrying aircraft and will see and avoid all aircraft, utilizing a spotter when appropriate. (See AMA Document #540-D on See and Avoid Guidance.)
3. 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.
4. The maximum takeoff weight of a model aircraft, including fuel, is 55 pounds, except for those flown under the AMA Experimental Aircraft Rules.
5. I will not fly my model aircraft in sanctioned events, air shows, or model demonstrations unless I have previously proven that my aircraft, control system, and piloting skills are adequate by successfully executing all maneuvers intended or anticipated in the specific event. If I am not a proficient pilot, I will not fly in these events unless assisted by an experienced pilot.
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.

8. I will not operate model aircraft carrying pyrotechnic devices which explode or burn, or any device, which propels 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 AMA Air Show Teams (AST) are authorized to use devices and practices as defined within the Team AMA Program Document.

9. I will not operate my model aircraft while under the influence of alcohol or while using any drug which could adversely affect my ability to safely control the model.

10. 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 pilots shall avoid flying models over unprotected people.
2. I will complete a successful radio equipment ground-range check in accordance with the manufacturer's recommendations before the first flight of a new or repaired aircraft.
3. At all flying sites a safety line or lines 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 safety line. In the case of air shows or demonstrations a straight safety line must be established. An area away from the safety line must be maintained for spectators. Intentional flying behind the safety line is prohibited. (See AMA Document #706 for Recommended Field Layout.)

4. 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.

5. I will not knowingly operate my model aircraft within three (3) miles of any preexisting flying site without a frequency-management agreement. (See AMA Document #922 for Testing for RF Interference. See AMA Document #923 for Frequency Management Agreement.)

6. With the exception of events flown under official AMA Competition Regulations rules, excluding takeoff and landing, no powered model may be flown outdoors closer than 25 feet to any individual, except for the pilot and the pilot's helper(s) located at the flight line.

7. 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. This does not apply to model aircraft flown indoors.

8. Radio-controlled night flying requires a lighting system that provides the pilot with a clear view of the model's attitude and orientation at all times.

9. 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. First-Person View (FPV) flying may only be conducted in accordance with the procedures outlined in AMA Document #550.



Fly First Class™



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