

Section 6

Tail Boom

Installation

Procedures covered in this section:

Install inspection covers; mount tail boom; fit and install winglets; install horizontal trim fins; fabricate and install tail rotor slider rails; install vertical trim fin; fabricate bearing mounting plates; assemble, balance and install tail rotor.

Cards used in this section:

HARDWARE CARD	E09 CARD 3F	E17 CARD 2F
E09 CARD 1F	E09 CARD 4F	E17 CARD 3F
E09 CARD 2F	E17 CARD 1F	

Prints used in this section:

E09-2000	E17-2000
E09-2001	E17-2001

Templates used in this section:

E09-1	E17-1	E17-3
E09-2	E17-2	

Tools required for this section:

Air or electric drill	Dzus tool	Plumb bob	String or twine
Band saw or hacksaw	Files	Pop rivet gun	Tape measure
"C" clamps	Framing square	Protractor level	Vise
Chalk line	Grinder	Ruler	90 degree drill (or equivalent)
Cleco	Grease pencil	Scotchbrite	
Cleco Pliers	Hammer	Screwdriver	
Countersink	Mallet	Snap ring pliers	
Drift punch	Metal cutting snips	Straight edge	

Drill bits of the following sizes: 1/8", 3/16", 1/4", 1/2", #40, #19, Letter "D"

Ratchet with sockets of the following sizes: 3/8", 1/2", 9/16"

Wrenches of the following sizes: 3/8", 7/16", 1/2", 9/16"

Notes:

1. **MOUNTING TAIL BOOM TO AIRFRAME:** When mounting the tail boom to the airframe, be sure to hold the correct measurement to the square drive tube and also hold the correct tail boom angle. Try to use the same level for all the angles that are to be checked. The quality of level or protractor used during the construction process can greatly affect the results. Care should be taken to utilize the most accurate tools available for positioning.
2. **PAINTING:** Prior to painting the surface of the tail boom, a light sanding is required for good paint adhesion. Scotchbrite works well for this. When possible, sand the area around rivet holes before installing the rivets. (The tail boom will be painted at the same time as the body - see Section 9.)
3. **SLIDER RAILS:** When mounting the slider rails in the tail boom, the use of a simple wood fixture can make the task much easier. Mount the bearing plates in the slider rails as far forward as they will go. Temporarily install the assembly into the #4 bulkhead, ensuring the rails are pushed tight against the inside. Measure the inside diameter of the bulkhead and fabricate a fixture from a block of wood to fit as shown in the drawing below. (Drill a large hole in the wood to help make removal easier.) This will hold the rails in correct alignment and tight against the bulkhead while the 3/16" holes for the mounting bolts are being drilled. Make sure that the bearing plates fit snug against the rails, and slide them forwards and backwards to ensure that the rails are parallel. (See Photo # 25 in this section.)

4. TAIL BOOM SUPPORT: A wooden support can be fabricated to hold the tail boom safely during installation. Use foam padding between the wood and the tail boom to prevent dents and scratches. See photo below.



Photo #1

Referring to print E09-2000, locate, drill, and install cleco for the inspection covers, avoiding existing rivets in tail boom. Dzus location can be adjusted for best fit. Install Dzus fasteners when satisfied with fit.

Note: For Dzus springs, use 1/8 x 1/4 steel pop rivets found on E09 CARD 2F. Thickness of material should determine which rivets to use throughout tail boom.

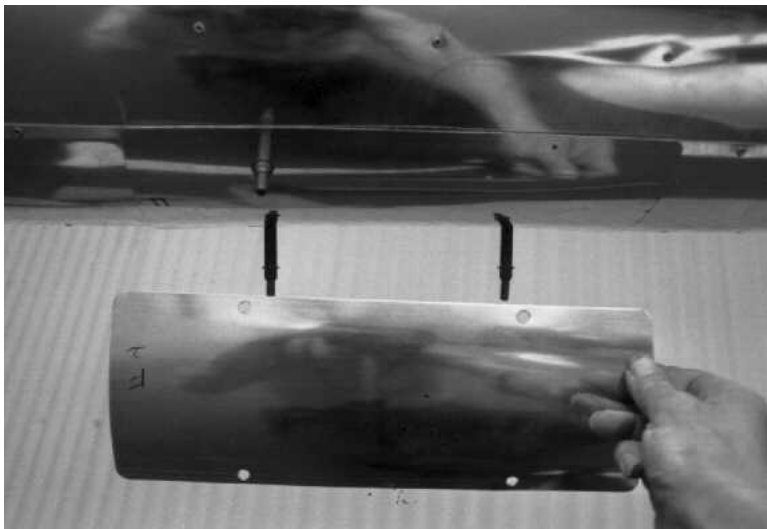


Photo #2

Aircraft centerline can be found by using the forward cross tube and the cross tube at the rear of the airframe where the tail boom support tubes are attached. Pull a string tight just above the floor. Use plumbs to place the aircraft centerline on the string. Insert the tail boom attachment brackets into the airframe. (The two with the greater angle are the upper brackets.) Install the tail boom to the airframe with the end of the boom centered over the string. Use "C" clamps to hold the boom in place until the desired angle is achieved. Check vertical alignment by aligning the two small holes drilled in the #1 bulkhead with a straight edge, using a level to confirm it is vertical. Using the same method, check the #4 bulkhead. If #4 is not vertical, rotate the tail boom to achieve vertical alignment. The intent is to have the best vertical positioning of the tail boom brackets over the ears of the #1 bulkhead.

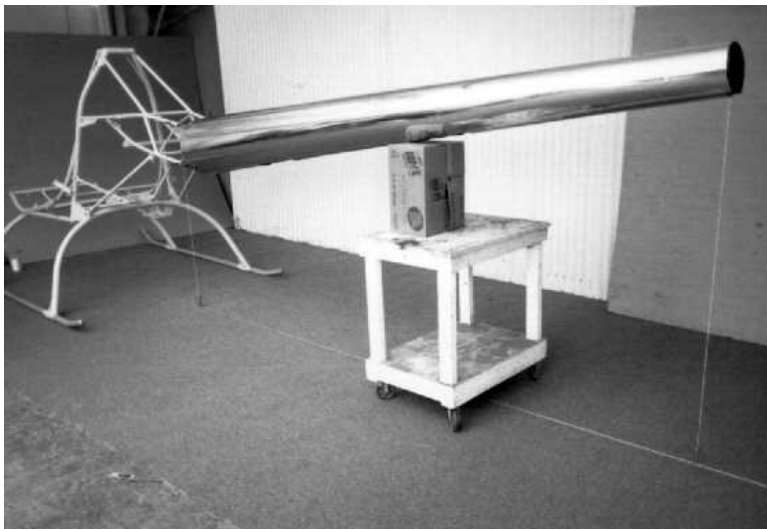
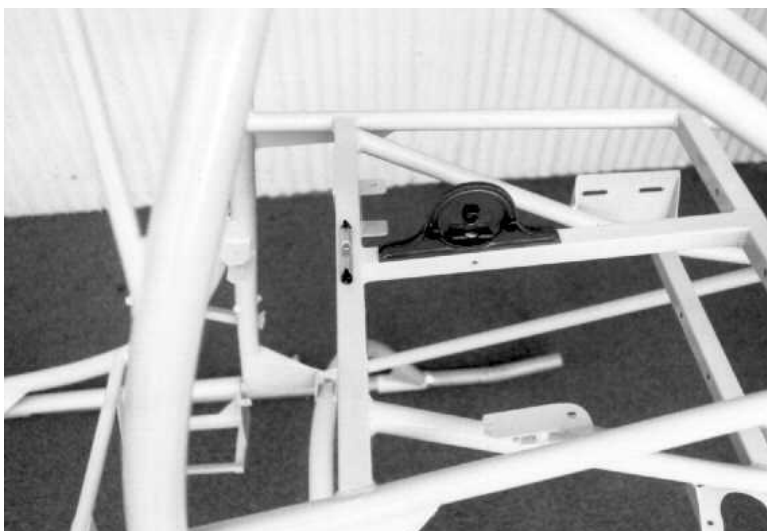


Photo #3

Level the square drive tube laterally, and check the angle fore and aft.



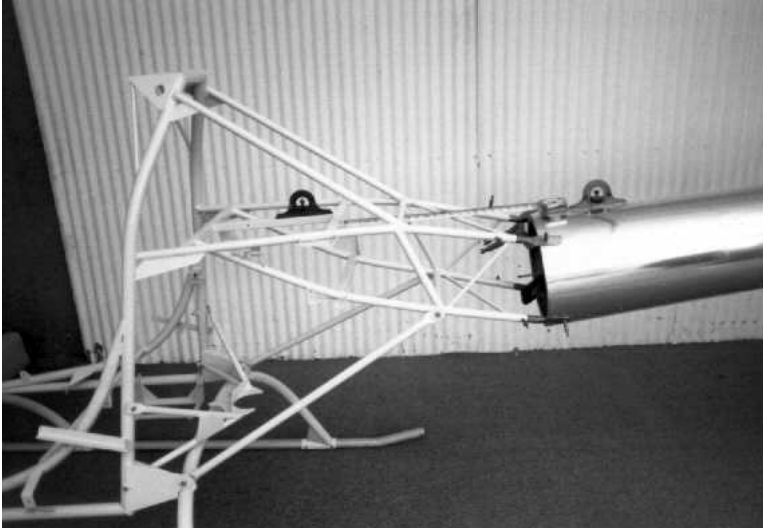


Photo #4

Measure the angle of the square tubes fore and aft and add 2-1/2 degrees. This is the angle that the top of the tail boom should be. The distance from the back of the square drive tube (where the top of the secondary drive mounts) to the front of the #1 bulkhead should be 22-1/2" to 23".

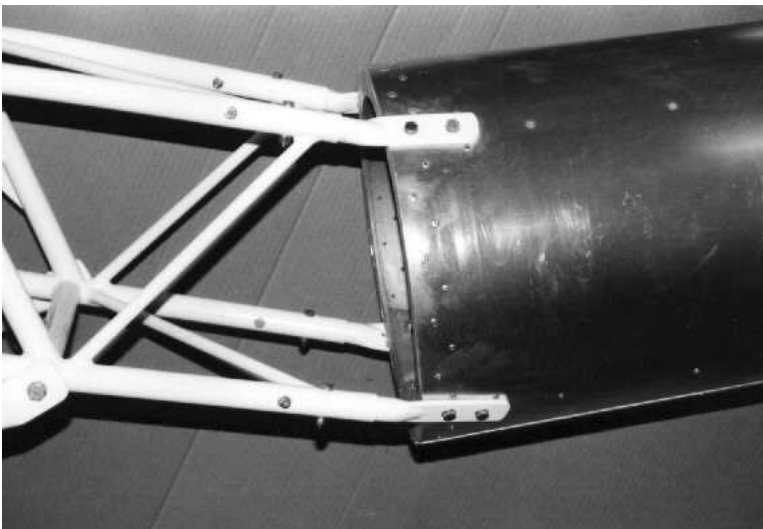


Photo #5

Grind a radius on the aft ends of the tail boom brackets, then install them in the airframe. Make sure that the flat part of the tail boom brackets are over the ears in the #1 bulkhead, and the flats extend beyond the front of the bulkhead. Locate, drill, and install the bolts. The forward bolts on the lower brackets should go through the 1" airframe tubes horizontally, because they will also be used for radiator mounting. Refer to prints E09-2000 and E30-2000.

Note: If a gap of 1/4" or less exists between a bracket and the tail boom, use the bolts to draw the bracket to the boom. If the gap is more than 1/4", bend the bracket slightly to fit. Use no heat when bending.

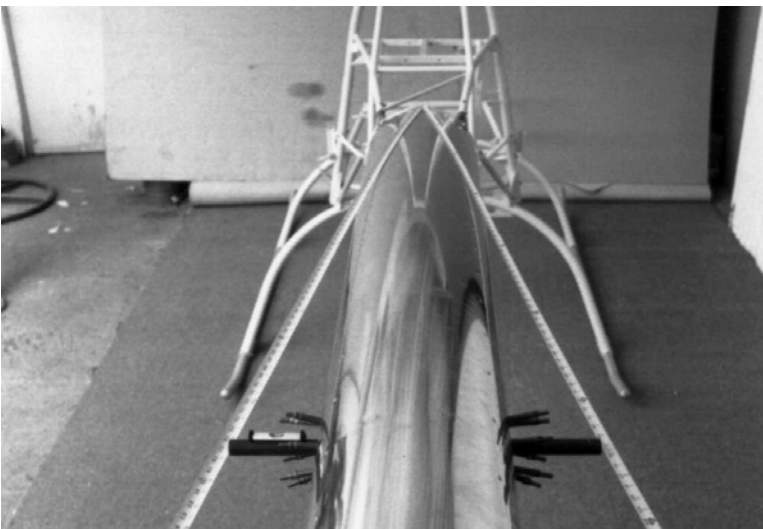


Photo #6

A small hole is pre-drilled where the horizontal trim fin mounts (1/4" below tail boom centerline). Install a small straight rod with equal amounts extending from each side of the boom. It must be level. The distance from the top center of the #1 bulkhead to each end of the rod must be equal. Using this method will ensure the Horizontal fin is level and 90 degrees to the aircraft's centerline.

Photo #7

Enlarge the hole to fit the trim fin spar, making sure that the spar will be level when installed. Make two 4" diameter doublers from .025 aluminum, and drill a 7/8" diameter hole in the center of each.

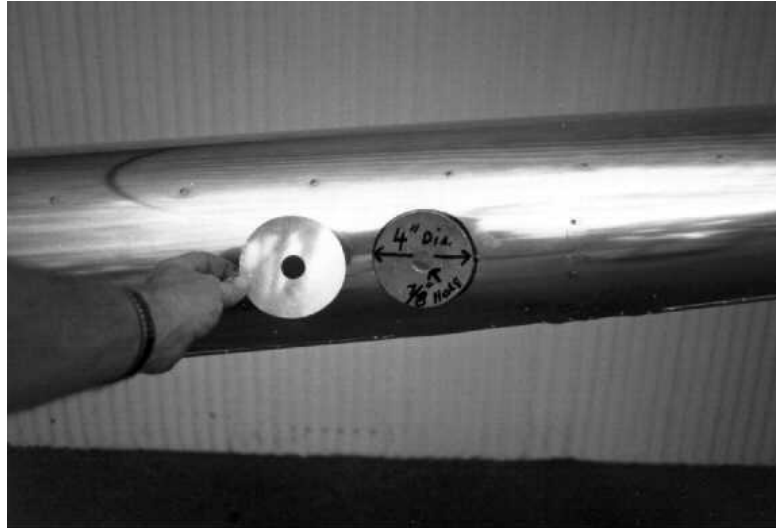
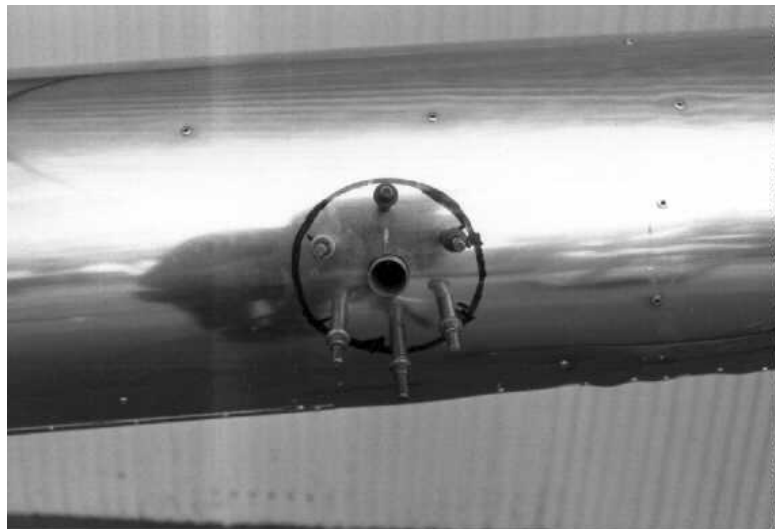


Photo #8

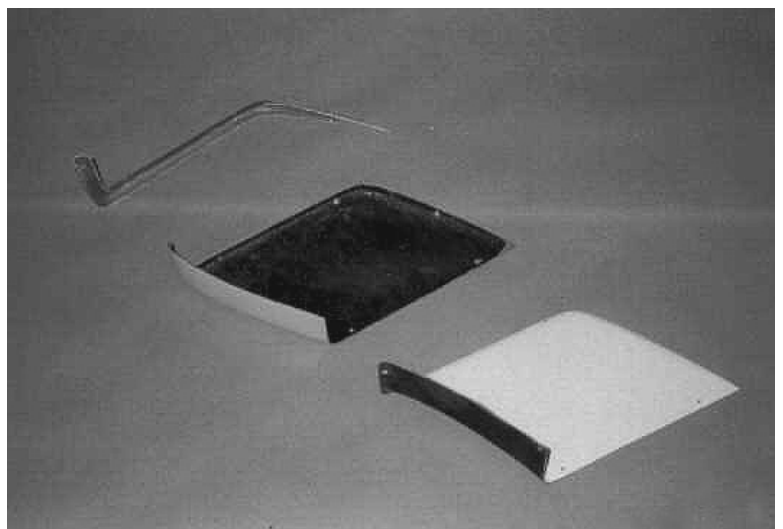
Open the holes in the doublers to match the holes in the tail boom. Install the doublers on the inside of the tail boom skin.



WINGLETS AND HORIZONTAL TRIM FINS

Photo #9

Winglets as supplied: doubler, outside, and inside.



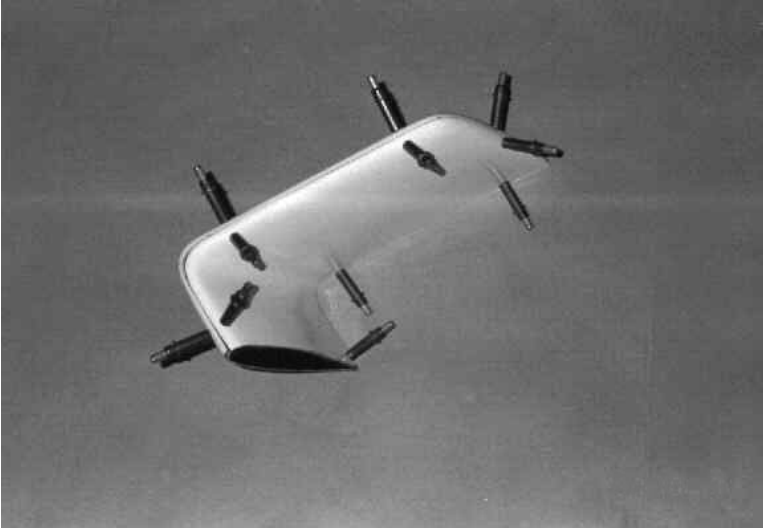


Photo #10

Use clecos to hold the three pieces together while fitting. Trim and sand as necessary.



Photo #11

Lay a strip of fiberglass mat saturated with resin all around the inside edges of the winglet half.



Photo #12

Place the doubler in position on the fiberglass and install clecos to hold. Work quickly to complete the assembly before the resin hardens.

Photo #13

Install the other winglet half. When assembly is complete and resin is dry, remove clecos. Fill holes and low spots with bondo, then finish with sandpaper.

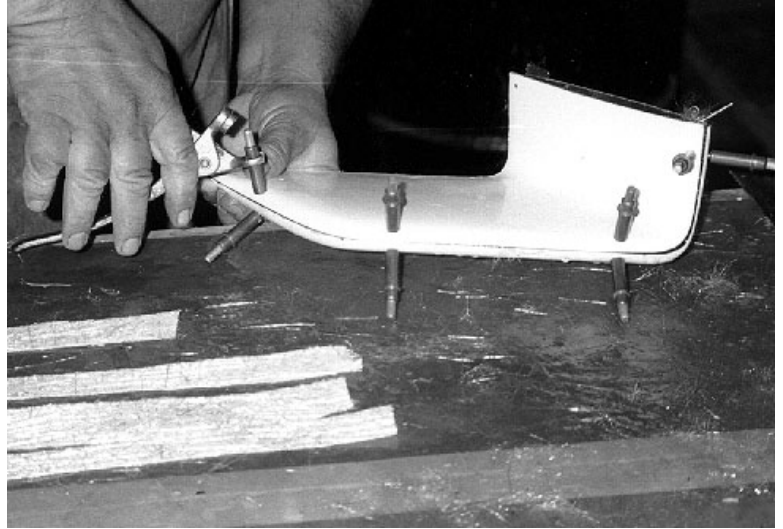


Photo #14

Insert a short piece of 7/8" diameter tubing in the end of the fin, in line with the spar. Clamp the airfoil against the tube. This will ensure that the fin is the same shape here as it is on the other end. Place the wooden end plug material against the end of the fin and mark the outline of the airfoil.

Note: The width of the end plugs should be the full thickness of the material, about 1-5/8" wide.

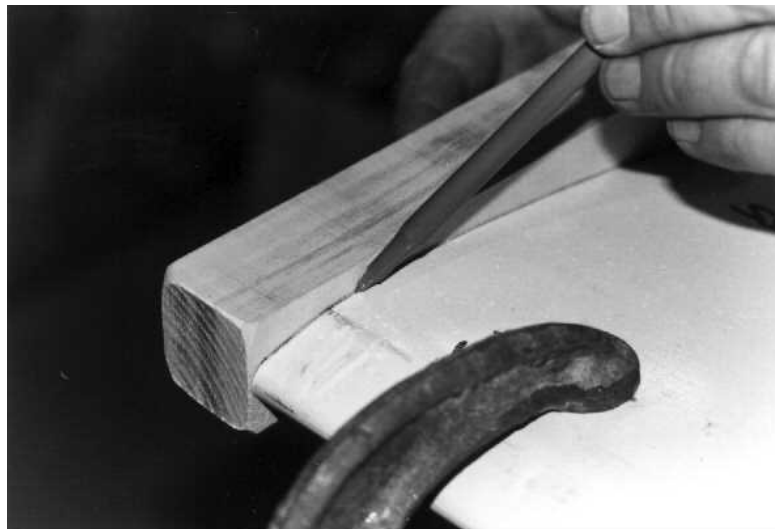


Photo #15

The end plugs will be used to splice the winglets to the fins. Cut out and shape each end plug so that half fits into the fin and half fits into the winglet.



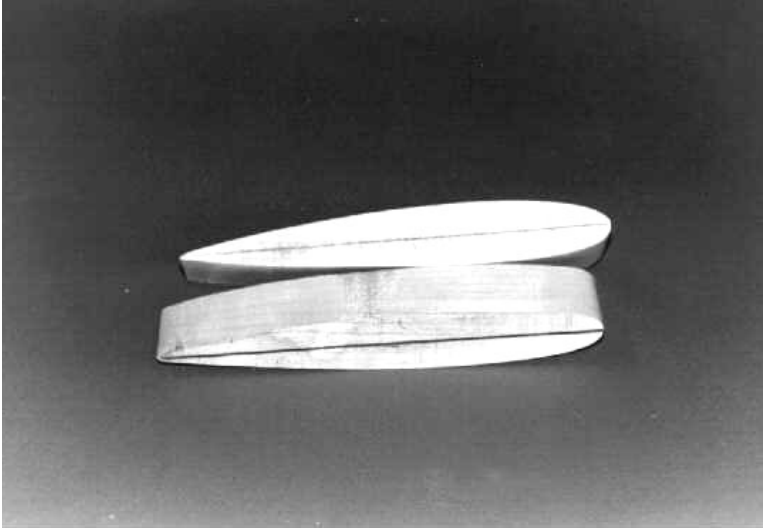


Photo #16

Mark the chord line on each plug.

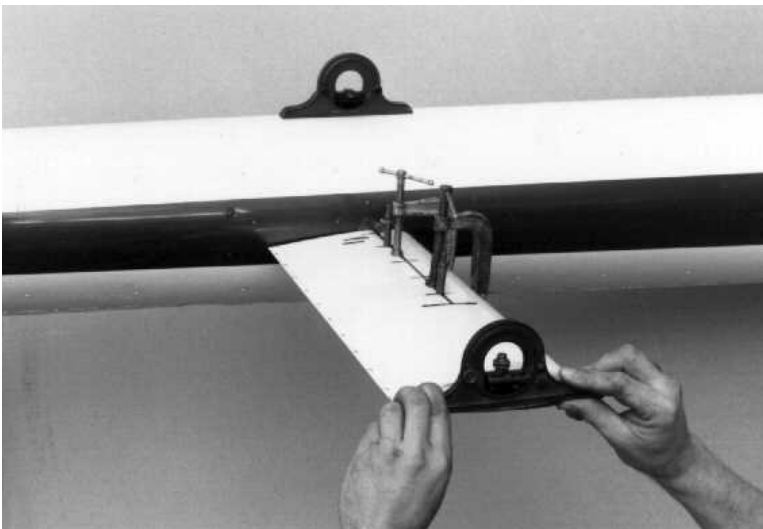


Photo #17

Insert the end plugs half way into the fins. Install the fin assembly on the tail boom. Align the chord line on the end plugs to be parallel with the top of the tail boom. While holding this position, drill through the holes in the trim fin brackets to mark the location on the tail boom. Then remove the fin assembly.

Note: The trim fin brackets should just make contact with the tail boom skin. If they do not, trim the splice tube until the correct fit is achieved.

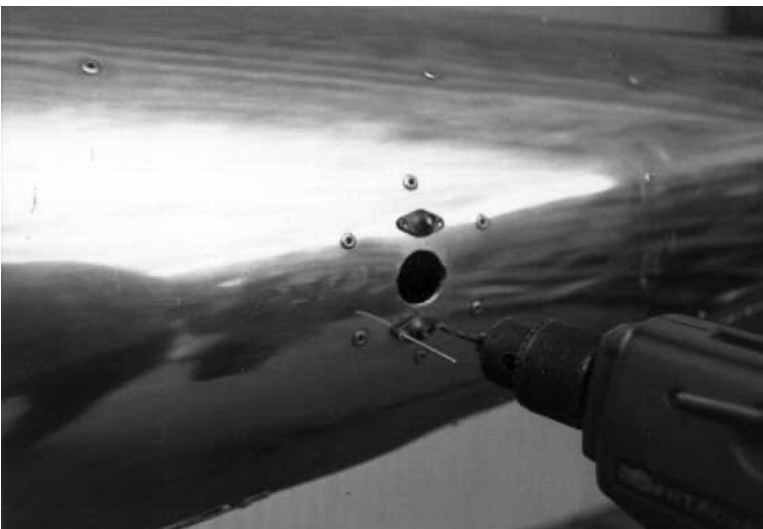


Photo #18

Locate the nut plates for the horizontal trim fin according to the previously drilled holes. Install the nut plates inside the tail boom.

Note: The nut plates are shown on the outside in this photo to clarify their position.

Photo #19

Attach the winglet to the fin, using blade glue to bond the wood end plug inside both pieces. Secure with 16 countersunk wood screws.

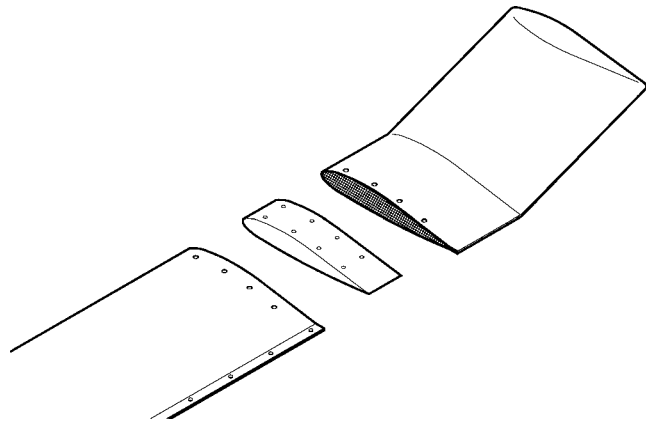


Photo #20

Peel back the protective film from the aluminum and sand the fin in the area to be bonded. Apply two layers of fiberglass cloth and resin over the seam. (The first strip should be about 3/4" wide, the second about 1-1/2".) When dry, sand the fiberglassed area. Fill any low spots with bondo and sand smooth.



Photo #21

Overall view of the completed horizontal trim fin with winglets installed. Mount the assembly on the tail boom.





SLIDER RAILS

Photo #22

Fabricate the tail rotor slider rails per print. There are two stringers riveted together to form each slider rail.

Note: Use template E09-2 for the slider stringer cross brace.

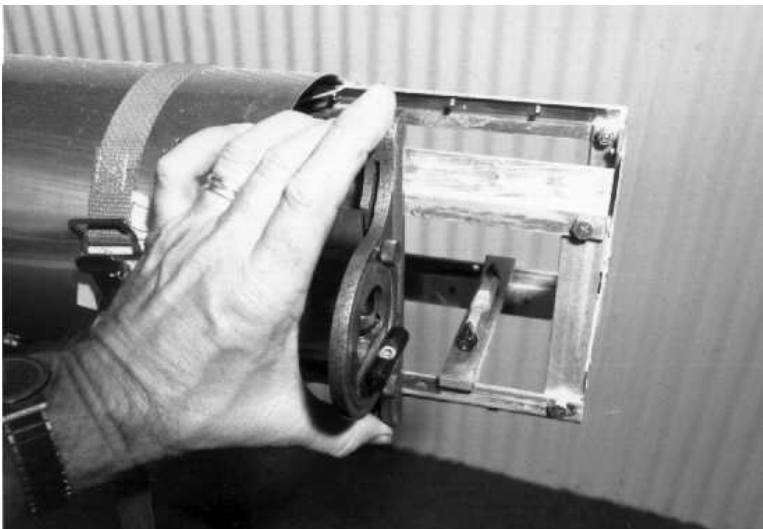


Photo #23

To help make mounting the slider rails easier, fabricate the bearing plates as shown later in this section. Mount them on the rails as far forward as they will go, then install the assembly into the end of the tail boom. The rails must be level across the bottom, and the sides must be level vertically (90 degrees to the ground).

Note: It may be necessary to remove the tail end of the rivets where the slider rails fit into the inner flange of the 4th bulkhead.

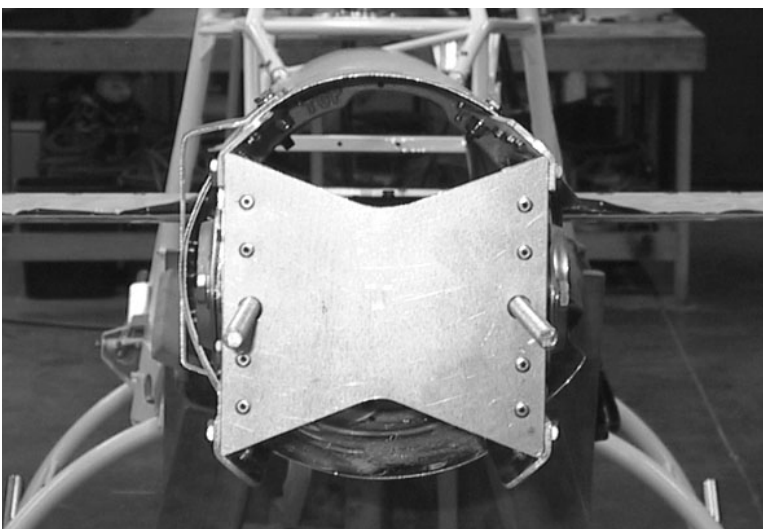


Photo #24

The slider rails must be parallel from end to end, in line with the stringers inside the lip, and tight against the wall of the #4 bulkhead. The vertical centerline of the slider rail assembly must be matched to the vertical centerline of the tail boom, so that the tail rotor assembly, when installed, will slide smoothly during belt tensioning.

Photo #25

Measure the inside diameter of the bulkhead and fabricate a fixture from a block of wood to hold the rails in place (as shown in the drawing). Then drill the four holes for the 3/16" bolts that hold the assembly to the tail boom. These bolts will go through the stringers, bulkhead, and skin, plus the vertical trim fin bracket on the pilot's side.

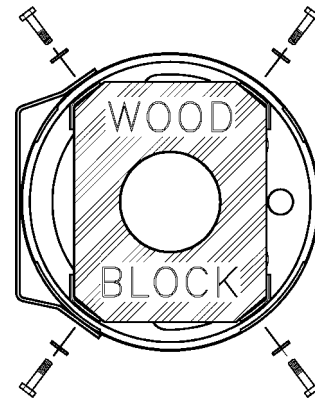
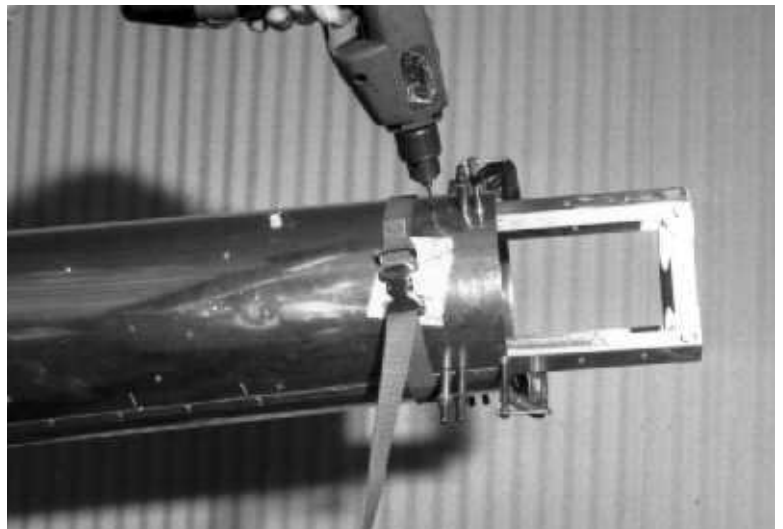


Photo #26

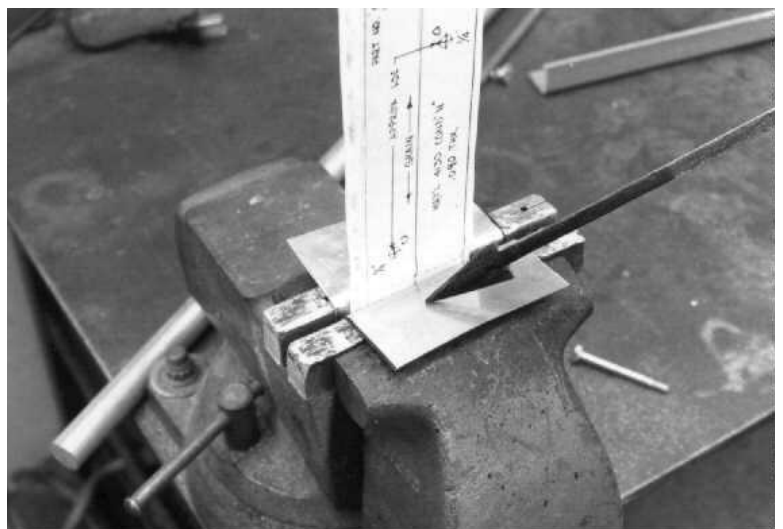
Locate, drill, and install the pop rivets to hold the rear of the slider rails to the tail boom skin. The lower rivets should also attach the tunnel cover that extends past the 4th bulkhead.



VERTICAL TRIM FIN

Photo #27

Cut out, bend and fit the vertical trim fin bracket to the tail boom. It must fit to the bolts holding the slider rails and be level vertically (90 degrees to the ground). When bending, be sure to make a radius in the bends. One way to do this is to bend the part over a piece of scrap material.



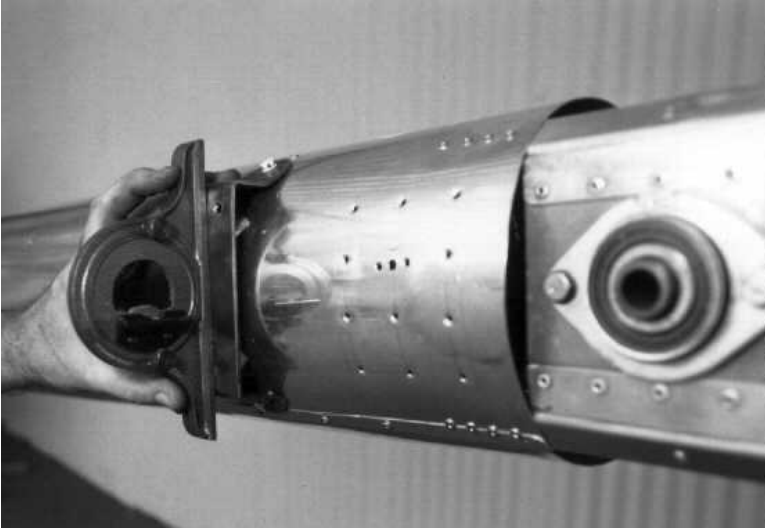


Photo #28

Use a protractor level to verify that the bracket is level vertically before drilling. Attach the bracket to the tail boom at bulkhead #4 with the same bolts that mount the slider rails. (Refer to print E09-2001).

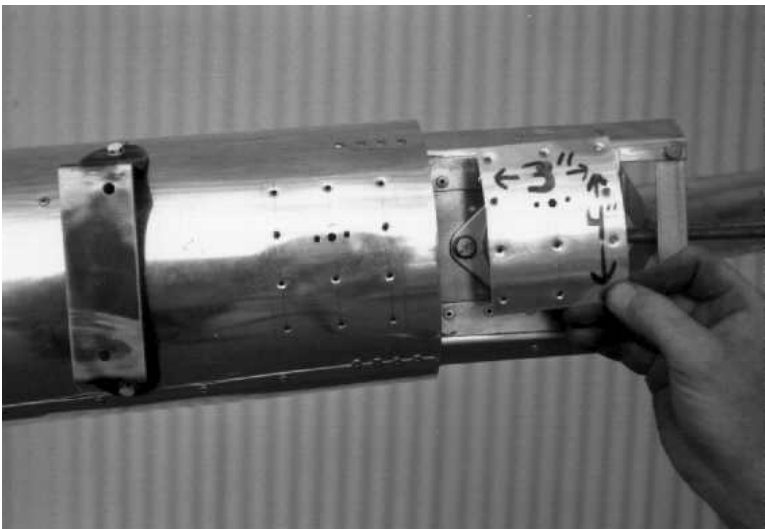


Photo #29

This doubler reinforces the nut plate area for the rear bolt of the vertical trim fin. The nut plate should locate in the center of the doubler. Make the doubler from .050 aluminum and attach it to the inside of the tail boom with pop rivets, then install the nut plate.

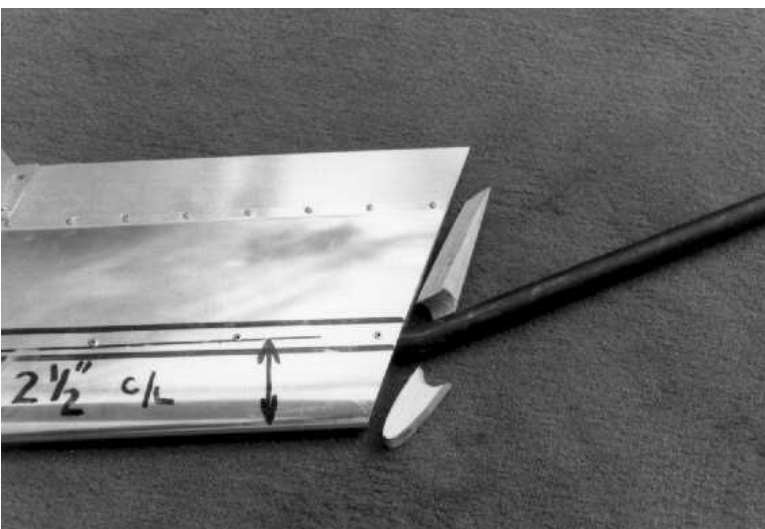


Photo #30

Cut out and fit the end plugs on the bottom and top of the vertical trim fin. Install wood screws to hold them in place.

Photo #31

Contour the edges of the end plugs. A piece of sandpaper wrapped around a wood block works well for this.
Install the vertical trim fin on the tail boom according to print E09-2001.



TAIL ROTOR

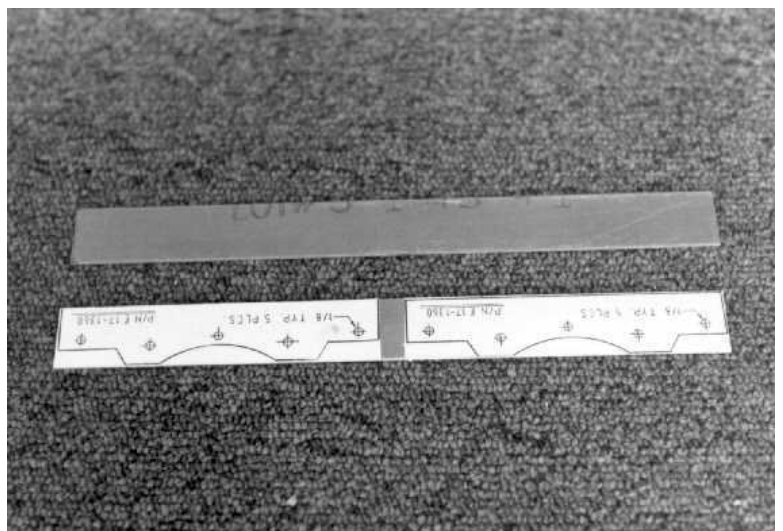
Photo #32

Use prints E17-2000 and E17-2001 and templates E17-1, E17-2 and E17-3 when constructing the tail rotor assembly.
Parts as received from RotorWay International.



Photo #33

Using template E17-1, cut out and drill holes in the bearing mounting plate slider straps.



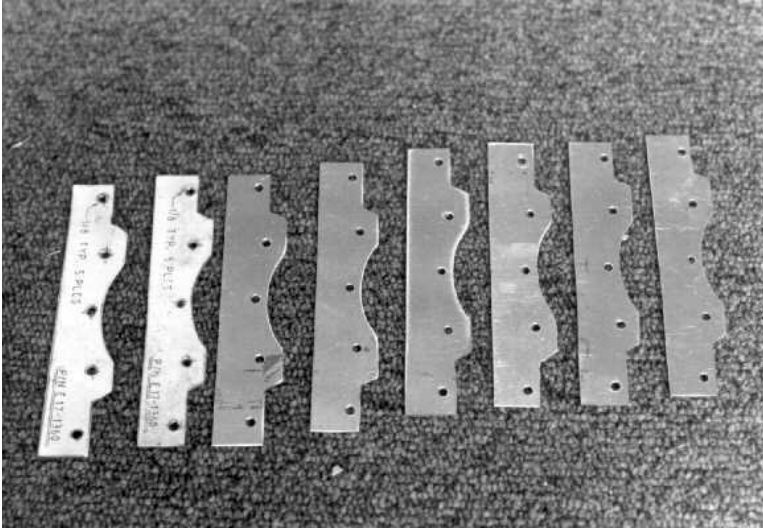


Photo #34

When drilling the 1/8" holes, it is recommended to stack and drill two parts at a time. Install a cleco, then as each hole is drilled, install another cleco. Keep each pair as a set.

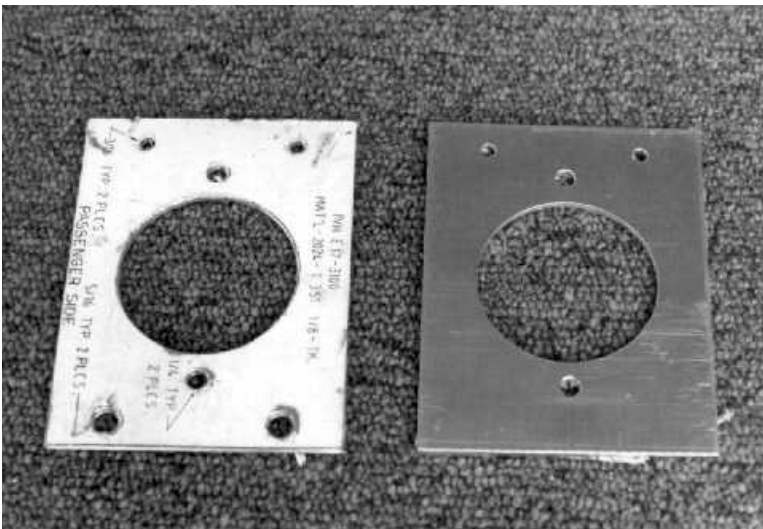


Photo #35

Use template E17-2 to make the tail rotor bearing mounting plates.

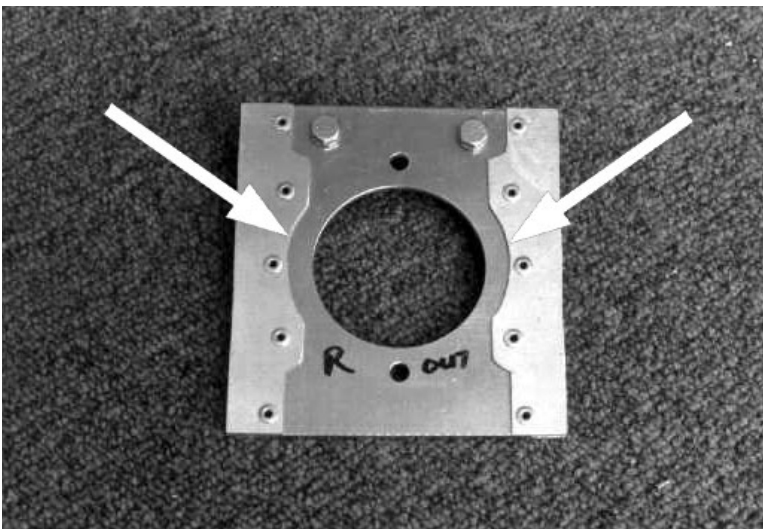


Photo #36

Using each set of slider straps as a template, drill and rivet the straps to the bearing mounting plate per print E17-2001.
Note: Before riveting, make sure radius (arrows) will clear bearing flanges. Rivets should be installed so that the heads are towards the outside when assembled.

Photo #37

Assemble the bearing mounting plates and slider straps. Make the bearing plate adjustment angles and mount one on each of the bearing mounting plates.



Photo #38

Use template E17-3 to make the tail rotor pitch actuator arms.

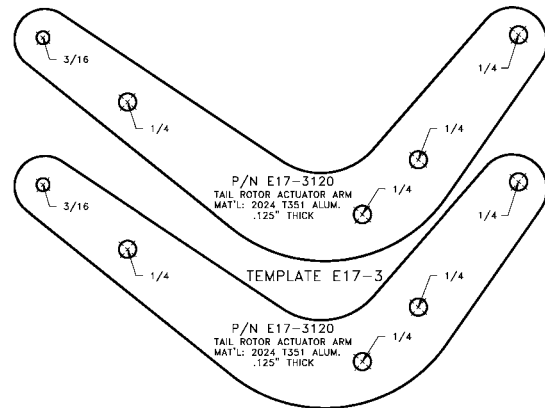


Photo #39

Mount the pitch actuator arm pivot casting to the bearing mounting plate assembly and safety wire the two bolts to each other. Install the spacers and the rod end between the pitch actuator arms. Mount the arm assembly to the pivot casting.

Note: Apply grease to the bolt that goes through the pivot casting before assembly.

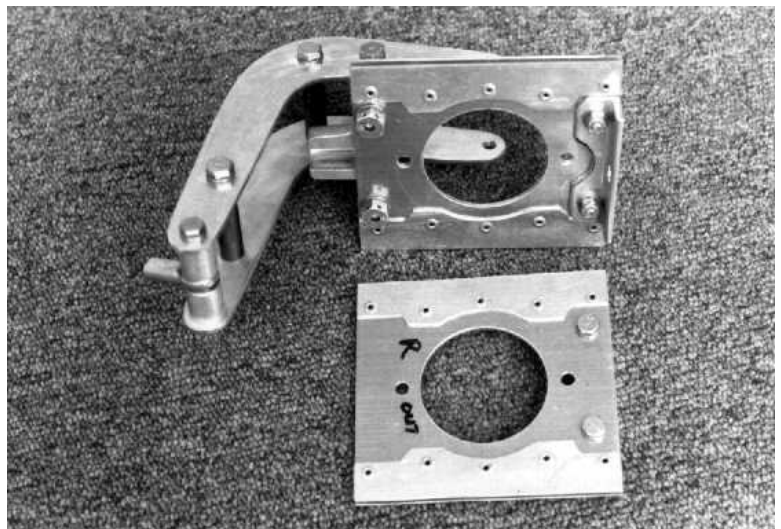




Photo #40

Other side of the assembly constructed in previous photo.

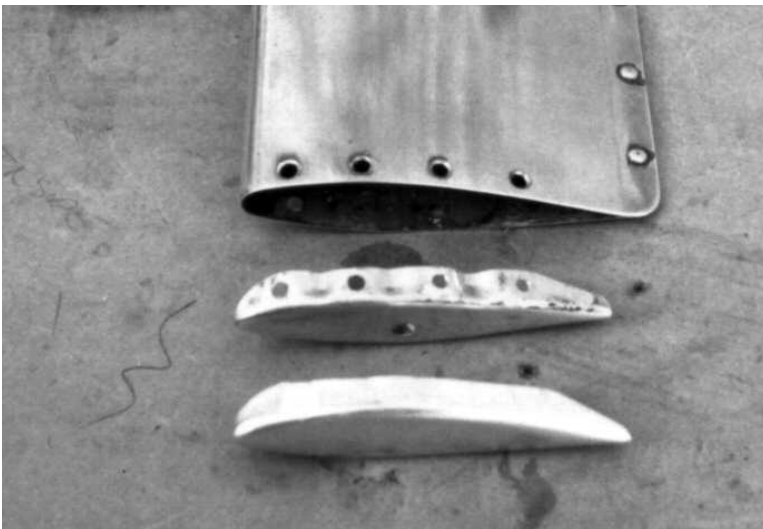


Photo #41

Remove the plastic from the blades and fit the end caps. It may be necessary to bend the cap slightly to achieve a good fit.

Note: Do not install the pop rivets until after balancing the blades.

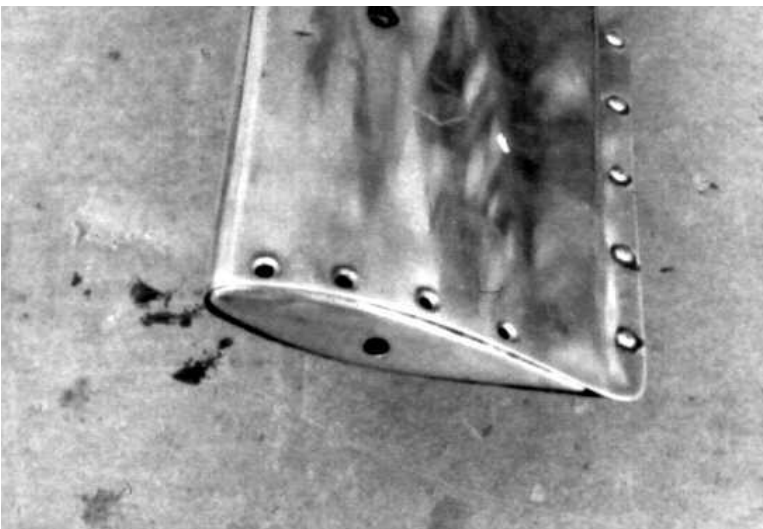


Photo #42

The cap does not need to fit perfectly to the airfoil of the blades. Countersink just enough to make the head of the pop rivet flush with the airfoil. Do not countersink too far or the pop rivet will not hold the end caps.

Note: Drill a 3/16 inch hole in the middle of each end cap as shown, so that grease thrown out by centrifugal force during operation will not build up inside the blade.

Photo #43

This shows how the end cap will look when final installed. Do not install pop rivets until blades have been balanced.

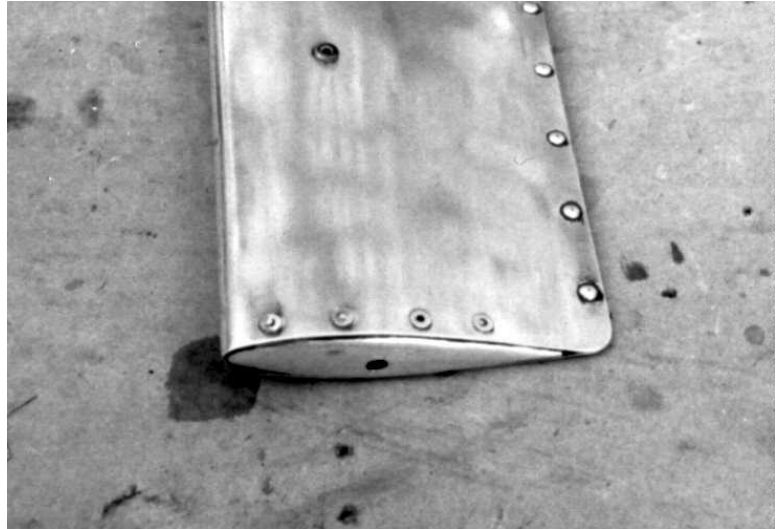


Photo #44

Install the tail rotor barrel on the shaft. Then install the inner snap rings with the numbers (flat side) facing the shaft. The opening in the snap rings should be in line with the shaft.

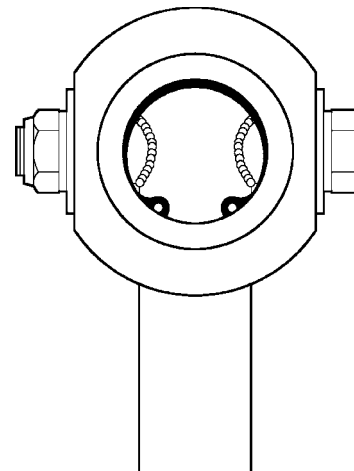
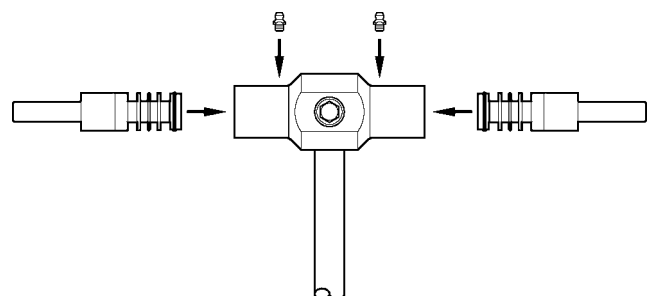


Photo #45

Mount the O-rings on the pitch pins. Grease the pitch pins, thrust bearings and alignment bearings, and assemble as shown on print E17-2000. Install the pitch pin assembly in the tail rotor barrel. Then install the outer snap rings with the flat side out, and with the openings parallel to the tail rotor shaft. Also, install the grease fittings in the tail rotor barrel.



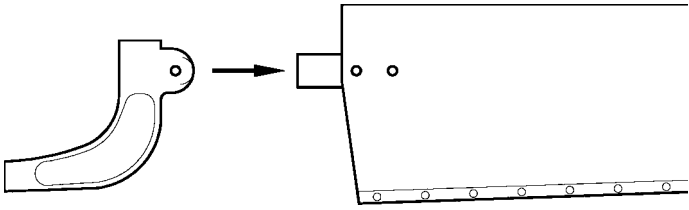


Photo #46

Position the pitch horns on the blade spars.

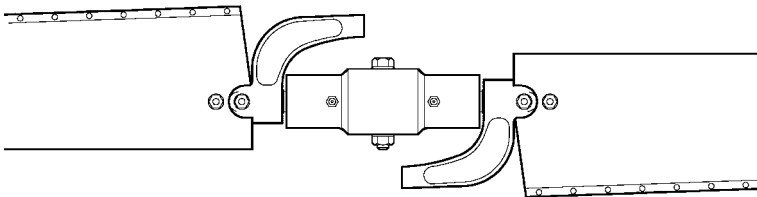


Photo #47

Install the blades and pitch horns on the pitch pins.



Photo #48

Build a balancing fixture like the one shown using a vise, a 2x4 board, and two pieces of .050" aluminum. The top edges must be level in all directions.

Photo #49

Use the tail rotor pulley and the carriage slider assembly as a counter balance. Use small pieces of foam to wedge the tail rotor blades as shown and to keep the tail rotor barrel 90 degrees to the shaft while balancing. Extend the blades as far away from the edge of the aluminum fixture as the counter balance will allow.



Photo #50

If weight is needed for horizontal balance, add it to the inside of the airfoil at the tip.
Note: Blades must be forced out against the thrust bearings so that they will be in the same position as if forced out by centrifugal force when in flight.

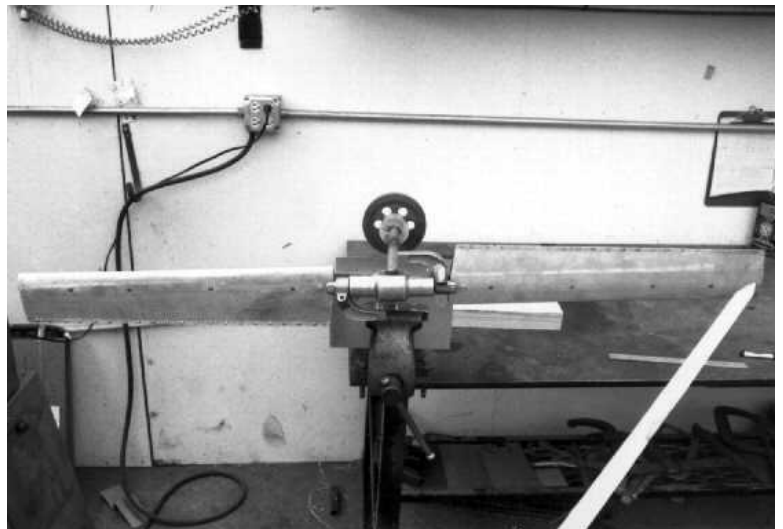
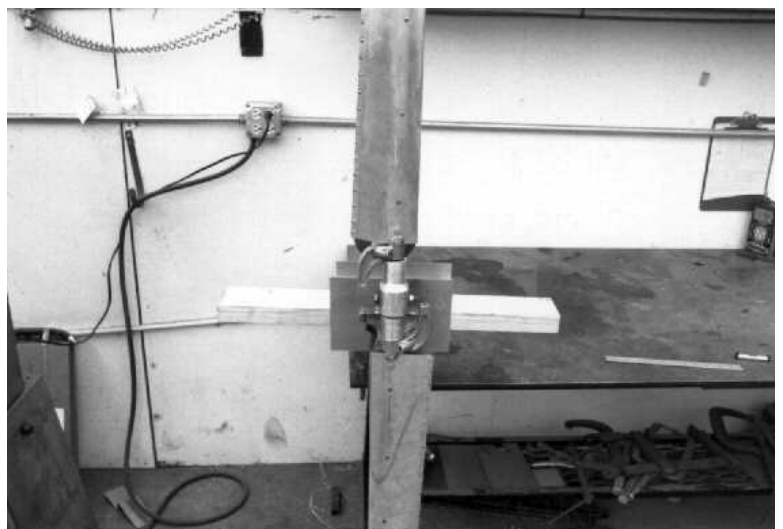


Photo #51

Balance the tail rotor vertically. The blades must be held outward the same as when in flight.



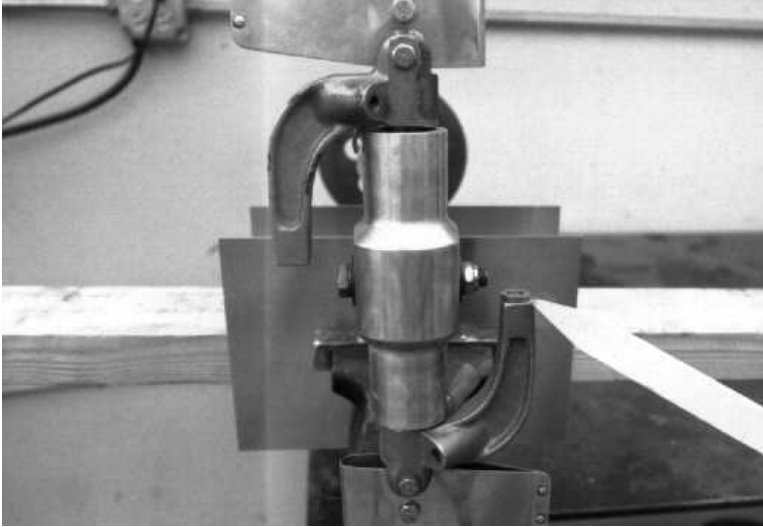


Photo #52

If weight is needed to achieve balance, add washers to the pitch horn bolt. If more than 4 regular 5/16" washers are required, contact RotorWay Customer Service.

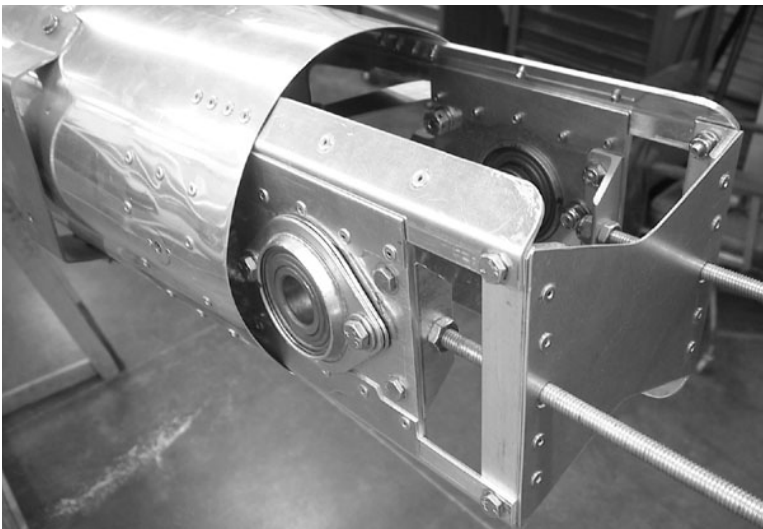


Photo #53

Install the bearing mounting plates in the slider rails. Note: Part of the tail boom must be cut out for clearance of the actuator arms. However, this should not be done at this point, because clearance will be determined by the location of the tail rotor cable. The tail rotor drive assembly can sit back for the time being while the remaining components are fitted.

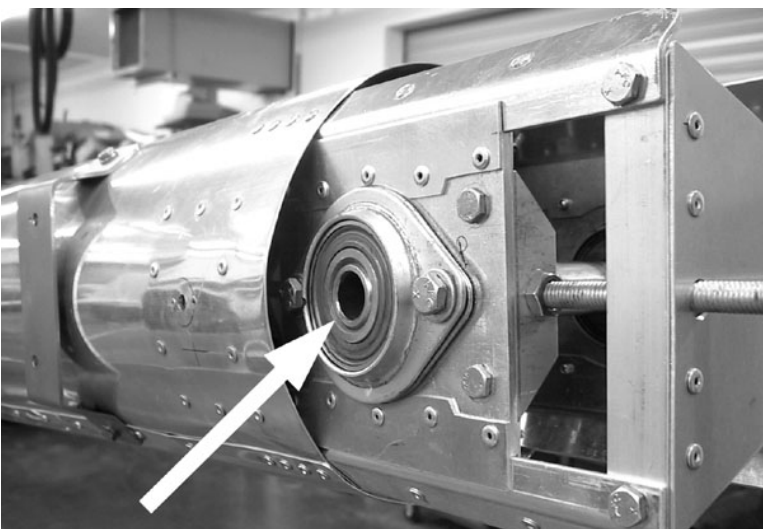


Photo #54

Install the tail rotor shaft along with the pulley in the bearings, so the end of the shaft is even with the bearing on the pilot's side.

Photo #55

The sliders should be 5" apart. The extended inner races of the bearings must be facing towards one another so that the lock rings will be on the inside of the mounting plates. The pulley should be located off center 1/2" toward the tail rotor side for proper clearance and belt alignment. Cut the spacers to length to position the pulley in the correct location. Drill the hole for the 1/4" bolt that pins the tail rotor drive pulley to the shaft on assembly. This hole must be a precision fit. Use a 3/16" drill first, then drill to size with a "D" drill.

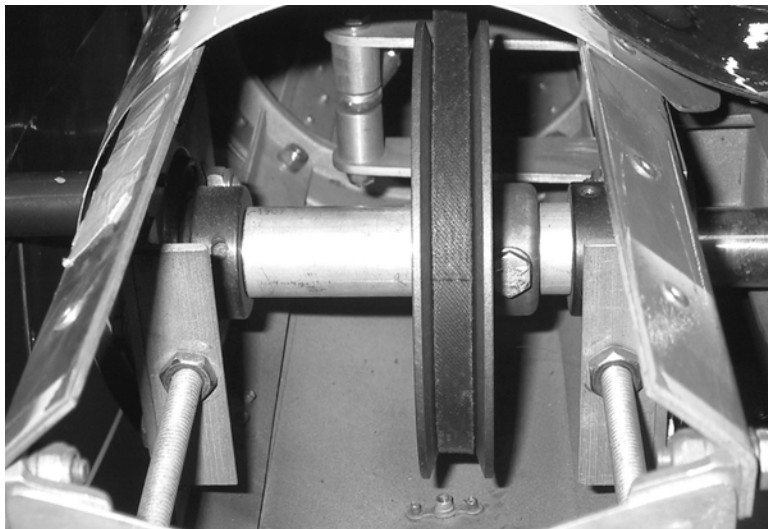
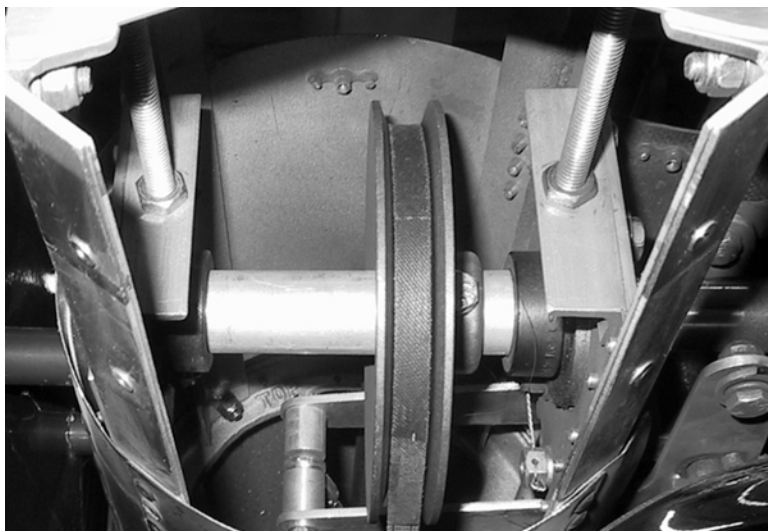


Photo #56

Before final installation of the tail rotor shaft, place the carriage slider assembly on the shaft (see the following instructions).
On final installation of the tail rotor shaft, the bearings must be Loctited to the shaft for maximum longevity. When the Loctite is dry, set the lock rings in the direction of rotation.



CARRIAGE SLIDER

Photo #57

Make a reference mark on the tail rotor shaft. Measure 1-5/16 inch (1.312) from the key towards the tail rotor barrel, then mark the shaft using a felt tip marker or pencil.
Note: The mark does not have to be permanent. Do not use a scribe or other sharp object to mark the shaft.





Photo #58

Grease the tail rotor shaft, the bore of the carriage slider, and the quad seals. Install the notched end cap (E17-6271) on the tail rotor shaft. Install a quad seal, lifting to prevent damage when sliding over the key on the shaft. Install the carriage slider assembly on the shaft in the direction shown, engaging the key in the keyway.

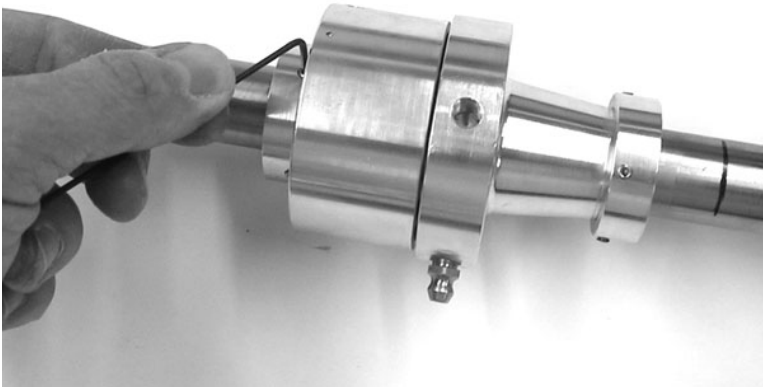


Photo #59

Seat the quad seal inside the end cap, then place the cap on the carriage slider assembly. Install the cone point set screws so that the tip of the screw engages in the groove in the slider. Install the other end cap in the same manner.

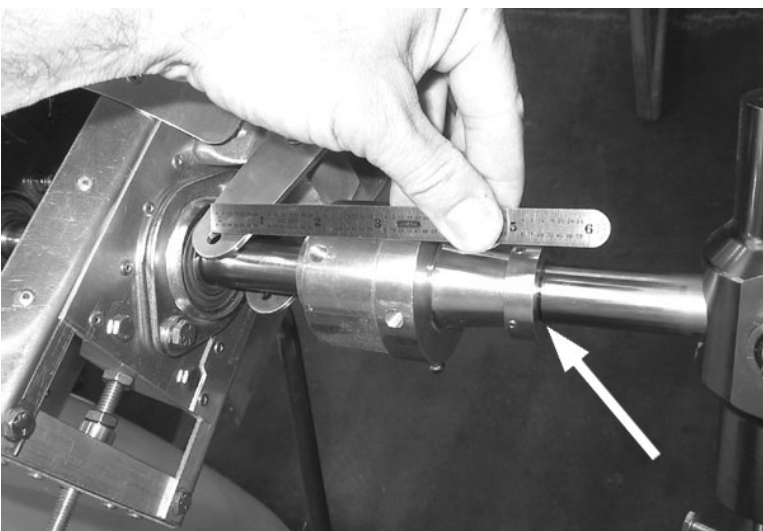


Photo #60

Install the assembled tail rotor shaft in the tail boom. Place the carriage slider on the reference mark (arrow). Position the tail rotor actuator arm so that it just misses the bearing flange. Measure the distance between the hole in the actuator arm and the hole in the carriage slider, and use this measurement to drill the holes in the slider to actuator arm clevis (E17-9010). The distance should be 2-1/4" to 2-3/8" as shown on print E17-2001. The clevis should not contact the inner end cap throughout the full range of travel (see next photo).

Photo #61

Make sure that the clevis does not contact the inner end cap throughout the full range of travel.

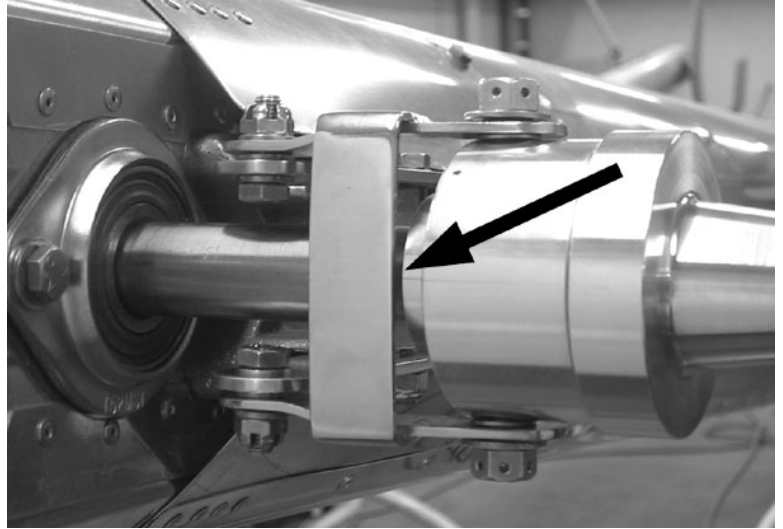


Photo #62

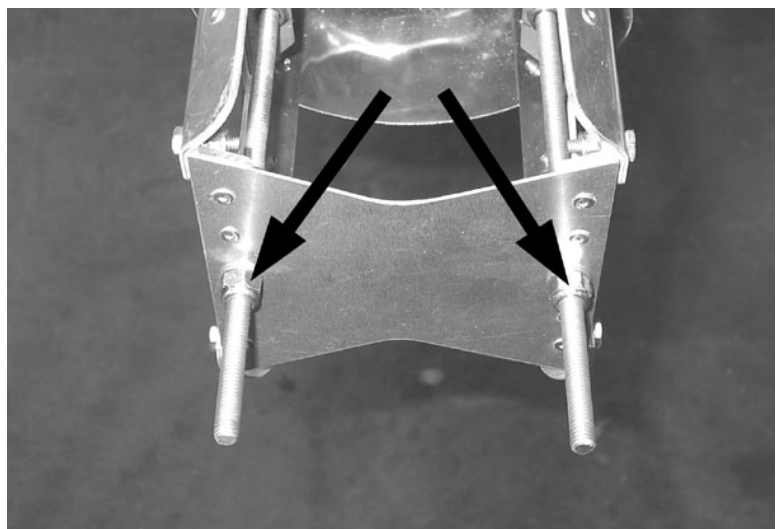
Install the grease fitting (E17-6250). Use a grease gun to slowly inject one "shot" of grease, while moving the slider back and forth to spread the grease evenly. Add grease again every 25 hours of operation or as needed.



Photo #63

To tighten the tail rotor drive belts, tighten the 5/16" nuts indicated here. To check alignment, place a straight edge on the pilot's side of the pulley. Sight down the straight edge; it should align with the center of the main shaft.

Note: Specific procedures for tensioning and adjusting the tail rotor belts are found in Section 25 (Rigging Procedures).



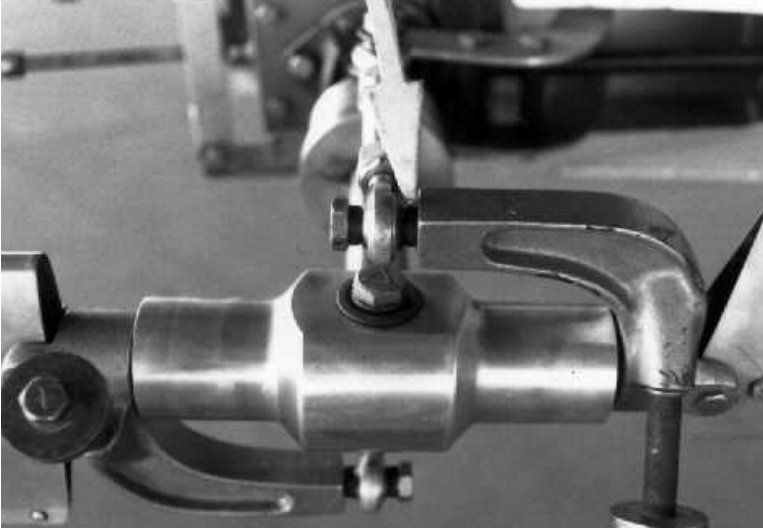


Photo #64

If necessary, use a washer as a spacer between the rod end and the pitch horn to get the rod end centered on the pivot bolt. Whatever weight is added to one pitch horn must be added to the other. If a washer is added to get vertical balance, it must be installed between the rod end and the head of the bolt.



Photo #65

Close up of the tail rotor hub area. Fit the fiberglass parts so they do not interfere with the tail rotor operations.

Note: For correct fit, installation of the fiberglass tail cone cover and slider cover, as shown in photos 65-70, should be completed after installing and adjusting the tail rotor control cable (see Section 13).

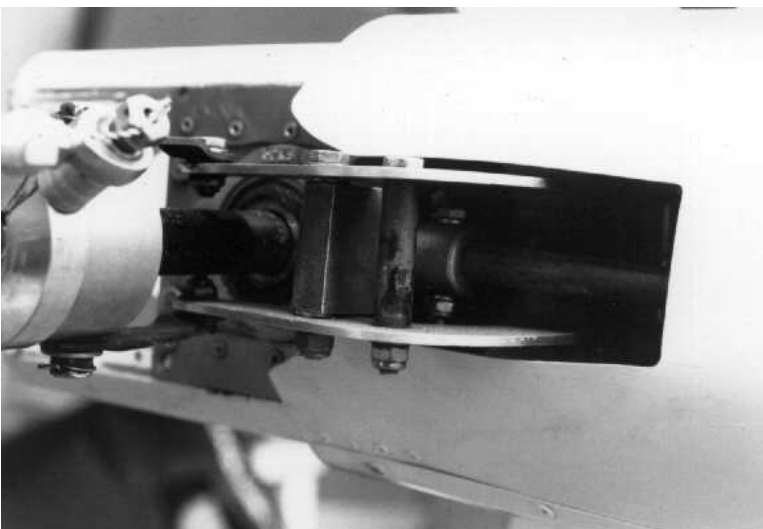


Photo #66

Cut the tail boom skin to clear the actuator arms. Only remove what is necessary to clear the arms. (The tail boom skin and fiberglass can be final trimmed as necessary when the tail rotor cable is fitted and adjusted.)

Photo #67

Slide the fiberglass tail cone cover over the end of the tail boom. Overlap 1-1/4". Hold the cover tight on the fin side and drill a 1/8" hole on top and bottom. Hold together with cleco.

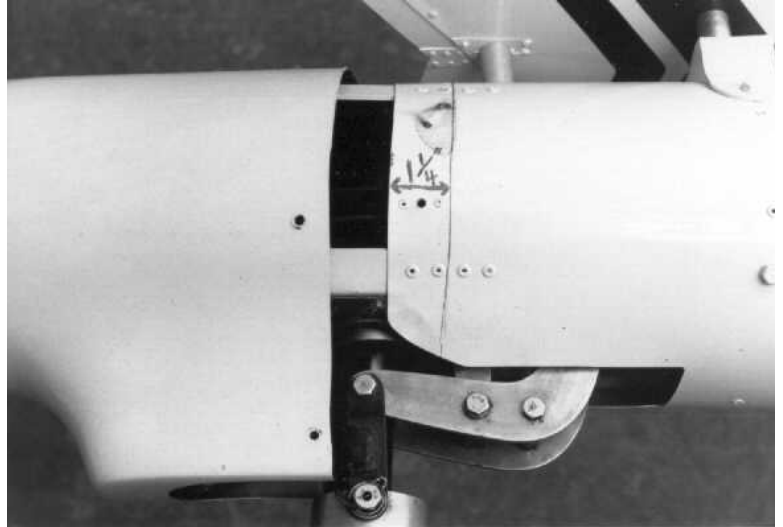


Photo #68

Fill the small end of the slider cover using fiberglass mat and resin and allow it to dry. This will provide enough material to countersink for the screw (see next photo). Fit the slider cover to the tail boom and tail cone cover, moving it fore/aft to determine best fit.

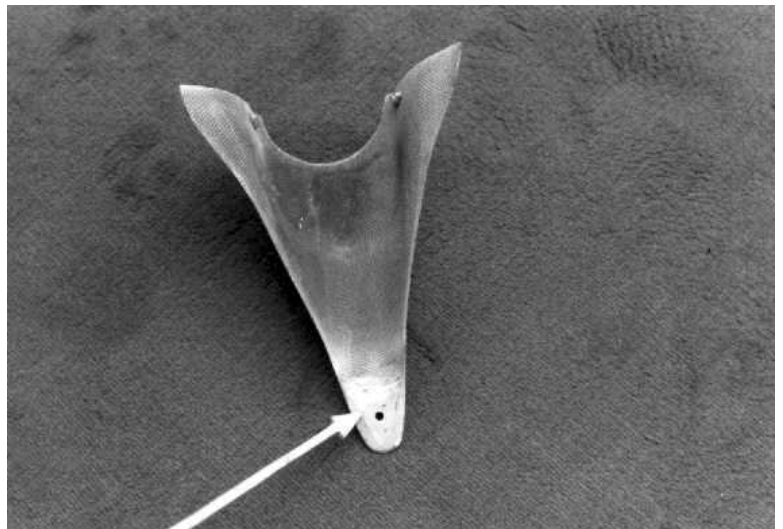


Photo #69

After the tail cone cover and slider cover fits, install the nut plates, then install the covers.
Note: Avoid existing rivets and other obstacles when locating the fasteners.

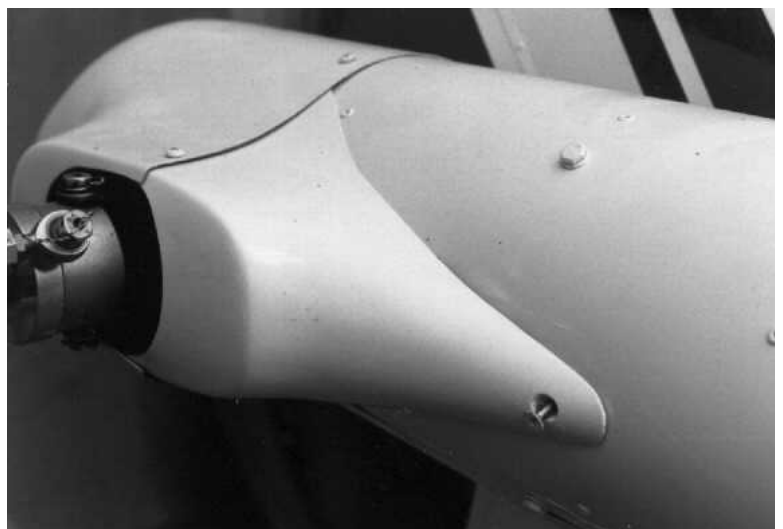




Photo #70

Remove material on the covers as necessary to allow the tail rotor assembly to travel freely.



Photo #71

This view shows the tail of the aircraft with the tail rotor and trim fins installed.