14. Aileron quick-connect system

When attaching the wings to the fuselage the aileron control system is automatically coupled via angled bellcranks, two of which are mounted in the fuselage and one in each wing.

The pivot centres of the bellcrank in the fuselage and its corresponding one in the wing, provided by bellcrank bearings, must be aligned correctly for the system to work properly, so careful setting up is essential.

Examine the figures in this section to get a full understanding of how the quick connect system works before starting assembly.

Step 1

Bellcranks

The two bellcranks CS15P and CS15S require BC4W10 bellcrank bearings to be riveted to them. Each bearing is attached to the outside of the 'L' shaped bellcrank using six AN470AD4-7 or TLPD435BS rivets - see figure 1.

The edge of the large hole in the bellcrank may need chamfering to enable the bellcrank bearing's flange to sit flat on it.
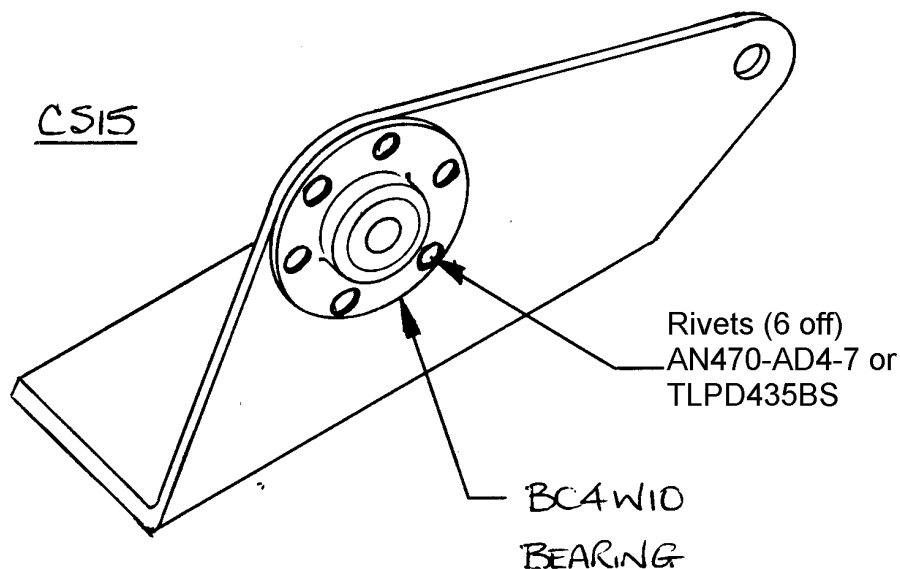

Fig 1. Quick-connect bellcrank CS15S shown.

Hint: *Put the rivets in with their heads on the bellcrank flange side as these sides will be visible on your de-rigged Europa.*

Step 2

Spar sockets and spar alignment bushes

The port wing, which is always the first wing to be rigged to the fuselage, has to have a spar socket S02 attached to it to locate the starboard wing's spar to aid the rigging process. The port wing's spar locates in an identical socket attached to the cockpit module.

The purpose of the spar sockets is solely as an aid to rig the wings, they are not designed to contribute to the structural integrity of the wing to fuselage interface.

With the spars tips located in the sockets, spar pins are inserted through alignment bushes in the cockpit module into the bushed holes in the spars thus locking the wings together.

Both the spar sockets and alignment bushes are to be bonded in their respective positions in one operation.

Preparation for bonding

Step 3

Starboard wing spar socket

Sand the starboard spar's tip until the spar socket S02 is a snug fit onto it and its holes can line up with the hole of the spar bush. Sand a 5 mm x 5 mm chamfer onto the radiused portion of the spar to aid its insertion into its socket during rigging.

Scuff sand the surface of the socket which, when both wings are rigged, will be against the port spar with 80 grit paper and scuff also the spar where it will be bonded.

Step 4

Cockpit module spar socket

Sand the tip of the port wing's spar until the spar socket S02 is a snug fit over it and its holes line up with the spar bush holes. Sand the chamfer on the spar's tip as with the other spar to assist rigging. Mark out and open out the hole on one side only of the socket to be 25 mm (1") diameter to allow the head of the bush through. Scuff sand the face of the socket with the large hole and the cockpit module in the area it will be attached with 80 grit paper.

Step 5

Spar alignment bushes

Clean the two pre-drilled holes in the seat backs of the cockpit module with thinners, MEK or acetone, then scuff sand the unmoulded side of the hole to be flat and also the bore of the hole itself.

Step 6

Bonding sockets and bushes in place

The bonding in place of the spar sockets and alignment bushes may be done in separate steps or, for those in a hurry, all in one go. Whichever way you choose the preparation time is the same.

Step 7

Preparation and trial set-up using wing spars

During the following set-up, and some subsequent steps, both wings are required to be rigged together with the cockpit module. If you don't have the luxury of a workshop which measures about 9 metres (30 feet) across the corners you may have to have one wing extending outside - check the weather forecast for tornadoes or severe storms first!
Alternatively, if space is simply not available, the use of a dummy spar as a jig, instead of the real spars is described at the end of the chapter.

Step 8

Bush Installation

For this step a short spacer made from a piece of the 25 mm (1") diameter tube remaining from the aileron lateral push-rod and a large diameter washer with a ½" diameter hole in will be required. Figure 2, showing a section of the set-up for this bonding operation, should explain what they will be used for.
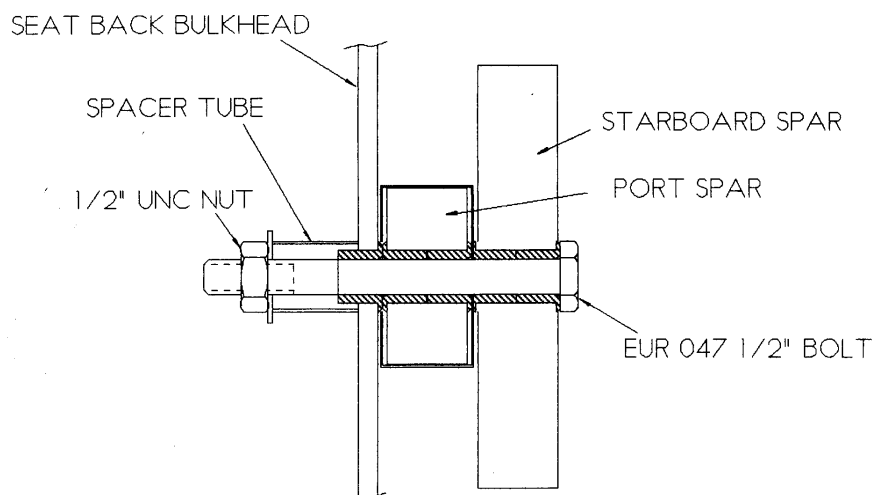

Fig 2. Section through starboard side spar bush area.

Cover the spar ends, and any other areas which will come in close contact with adhesive but are not to be bonded, with a thin plastic adhesive tape to act as a release agent and place the sockets onto their relevant spars.   Insert the two S01 bushes into the holes in the cockpit module from the rear of the seat back.

Unbolt the wing quick connect bellcranks W16, tie them out of the way and remove the long bolts as you'll need the holes when jigging up the brackets to support the fuselage mounted quick connect bellcranks.

Set the cockpit module vertically with the baggage bay uppermost, and support the wing with padded blocks. Bolt the two spars together with the EUR047 ½" bolts entering them from their back faces then locate them onto the cockpit module. Place your large diameter washer and piece of 25 mm tube onto the bolts and, using a ½" UNC nut, tighten the spars and cockpit module together, keeping the short tube roughly concentric with the bolt.

Adjust the wings so that their spars are parallel to the front of the seat back in the cockpit module. Use a spirit level to check this. The wing incidence (the angle of the wing chord relative to the fuselage horizontal datum line) cannot be set precisely at this stage. This is done after the cockpit module has been bonded into the fuselage, but the described set-up is close enough. You'll now have to disturb all this careful setting up, but it should be easy to get everything back in position quickly.

Step 9

Bonding bushes and sockets

During this stage the two alignment bushes S01 are to be bonded in to the cockpit module, using the wing spars as a jig, the port spar socket is bonded to the cockpit module and the starboard socket to the port spar. As mentioned before they may be done in separate stages but the following instructions described them being done in one operation.

Remove the wings from the cockpit module and separate the spars to give access for applying adhesive to the various bonding areas. Make sure everything is clean then grease the ½" bolts and the bores of all the bushes to act as a release agent.

Mix up some Araldite 420 and, saving a small amount to bond the bushes in with, mix some flox into the rest.
Pull the alignment bushes out of the cockpit module enough to expose the shank and apply some of the pure Araldite 420 before pushing them back in. Wipe away any excess.

Next apply some of the Araldite 420/flox mixture to the front faces of the spar sockets, keeping it well clear of the holes then put the spars together with the ½" bolts in place. Make a generous fillet around the starboard spar socket, which is now in contact with the port spar, to give added strength.

Now slide the ½" bolts into the cockpit module to bring it in contact with the port socket.

Check that the spars and the seat back of the cockpit module are parallel with a spirit level then leave everything to completely cure.

Mounting quick-connect bellcrank brackets in cockpit module

The quick-connect bellcranks CS15P and CS15S will be mounted to the brackets CS14P and CS14S respectively. Firstly the brackets must be set up and attached to the cockpit module in the correct position relative to the wing bellcrank holes.

Step 10

Required to set up the alignment of the brackets CS14 with the spars are two lengths of 1/4" diameter threaded rod and two pairs of plain nuts. Insert a piece of the 1/4" diameter threaded rod into the bellcrank pivot hole of the CS14 bracket and clamp it in place with a nut each side. Adjust the length of the rod such that it enters the W16 bellcrank pivot hole in the spar when the bracket flanges are in contact with the cockpit module. The 1/4" hole in CS14 should be biased towards outboard and up in relation to the aircraft. (Remember the definitions relate to the aircraft's orientation).

Set CS14 to be vertical relative to the cockpit module; an eyeball assessment will be sufficient in this case. Ensure the spars are clear of the brackets.
Clamp the CS14 brackets against the cockpit module and insert shims of wood under one of the flanges if required. Make adjustments to the shim so that the rod, when re-adjusted until its end is no longer engaged in the hole in the spar, maintains alignment with the hole. This is to be the position the bracket should be installed.

Check that the legs of the CS14 brackets are not distorted and carefully adjust the bends as necessary so that the legs are 162 mm (6-3/8") apart at the attachment flanges.

Step 11

Drill all four holes for the bracket through the cockpit module then remove the bracket and apply wax on the flanges to act as a release agent. Reinstall the bracket with Araldite 420 and flox under the flanges to form a smooth pad and install greased AN3-6A bolts from the cockpit module side with AN970-3 washers under their heads and use MS21042-3 nuts with AN960-10L washers on the bracket's flange. Tighten the bolts only so much to hold the bracket, checking that the correct alignment has been re-achieved, then before allowing the Araldite 420/flox mixture to cure, make fillets all around the flanges to aid positive re-location after their temporary removal during installation of the fuel tank.
After cure, fully tighten the bolts, checking the bracket isn't pulled out of alignment.

Remove the wings from the cockpit module and re-assemble the W16 bellcranks onto the spars.

Don't flox the pivot bolt heads in just yet.

Fuselage mounted quick connect bellcranks

To enable removal of the CS15 bellcrank for maintenance purposes, the head of the bolt it rotates on will need captivating permanently. To do this the bolt is simply bonded into the hole through CS14 with Araldite 420. To reinforce the bond the head is to be surrounded with a Araldite 420/flox mix and, to protect the fuel tank from fretting on the bolt head, a plywood pad is bonded to the rear face of CS14. The work required to do this is most easily carried out with the cockpit module standing on its forward flange

Step 12

Cut a piece of 3 mm plywood to be the same size as the portion of CS14 bracket which would normally be vertical and, with it held in place, drill through the 1/4" hole into the wood. Enlarge the hole in the plywood to allow the head of the AN4 bolt through. Having sanded all mating surfaces, install the AN4-12A bolt into the CS14 plate with some Araldite 420 under the head, then bond in place the piece of 3 mm plywood. Fill the gaps around the bolt head and plywood with Araldite 420/flox mix and, having checked the bolt is fully home and square to CS14, allow to cure.

The bellcranks CS15P and CS15S can now be installed onto the brackets CS14P and CS14S respectively. Refer to figures 3 and 4 for installation details.
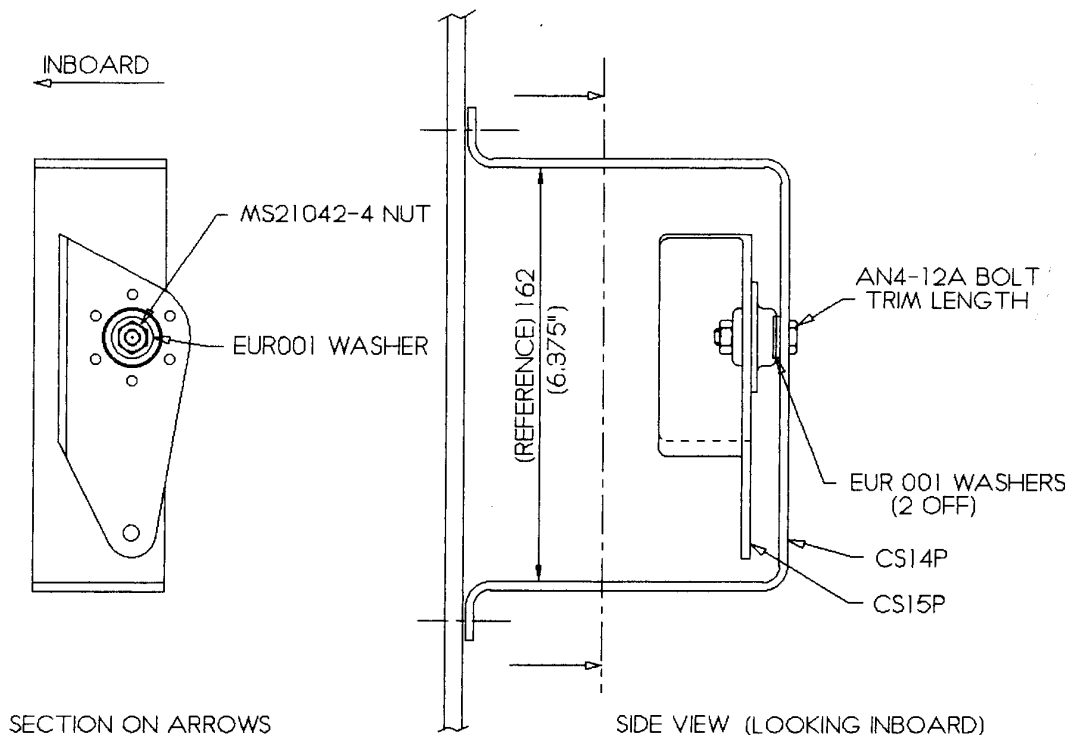

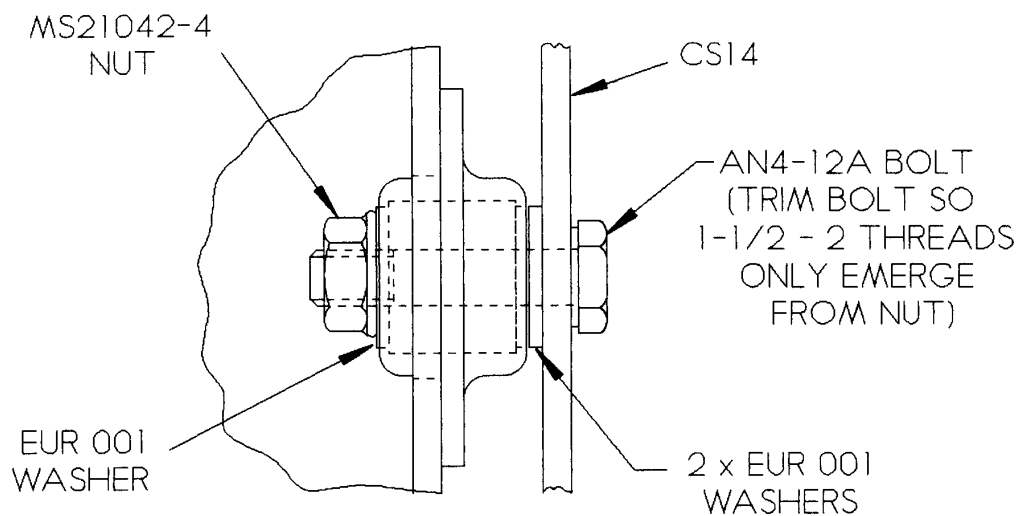*Fig 3. Installation of CS15 to CS14 - port side shown.*

Fig 4. Enlarged view of bellcrank attachment.

Step 13

Connect the short push-rods which attach CS08 to the bellcranks CS15P and CS15S according to figure 5, adjusting their lengths so that the bellcranks are vertical when the control columns are vertical.
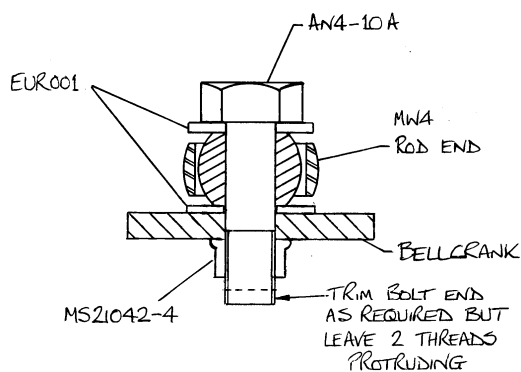
Fig 5. Rod-end attachment to CS15.

Step 14

Bush reinforcement pads

Using two thicknesses of 3 mm plywood make a reinforcement pad with beveled edges for each of the two bushes according to figure 6.

Scuff sand the plywood all over on both sides and scuff sand also the area around the bushes' shanks in preparation for bonding.

Fig 6. Detail of cockpit module seat back area - starboard side shown.

Bond the plywood pads in place over the bush shanks using epoxy and flox and layup two plies of 'bid' at +/-45°, lapping onto the cockpit module by at least 2 cm all around. Take care not to let epoxy into the bore of the bushes.

Step 7

Preparation and trial set-up using dummy spars

If workshop space is limited the following method will enable much of the work previously detailed to be carried out without using the wings.
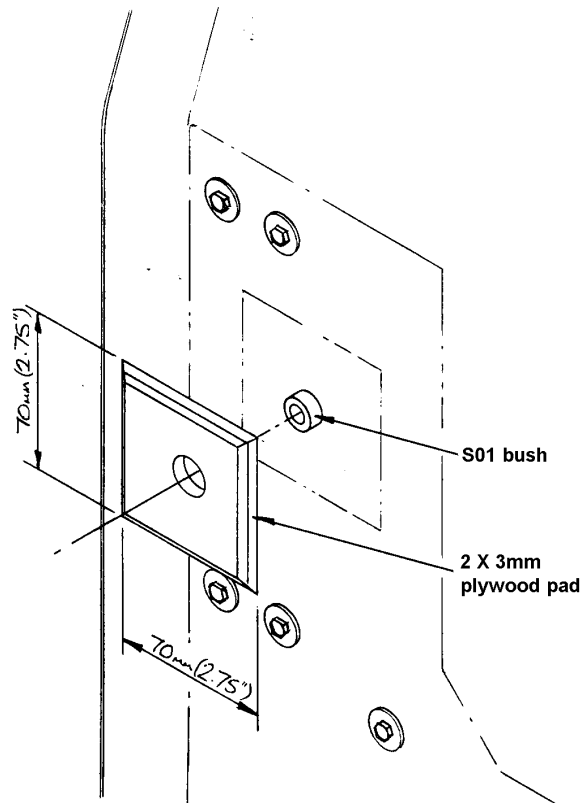
Step 8

Bush installation

For this step a short spacer made from a piece of the 25 mm (1") diameter tube remaining from the aileron lateral push-rod and a large diameter washer with a ½" diameter hole in will be required.   A dummy spar, which is provided, maybe used as a jig instead of the port wing spar. Figure 7, showing a section of the set-up for this bonding operation, should explain what they will be used for.
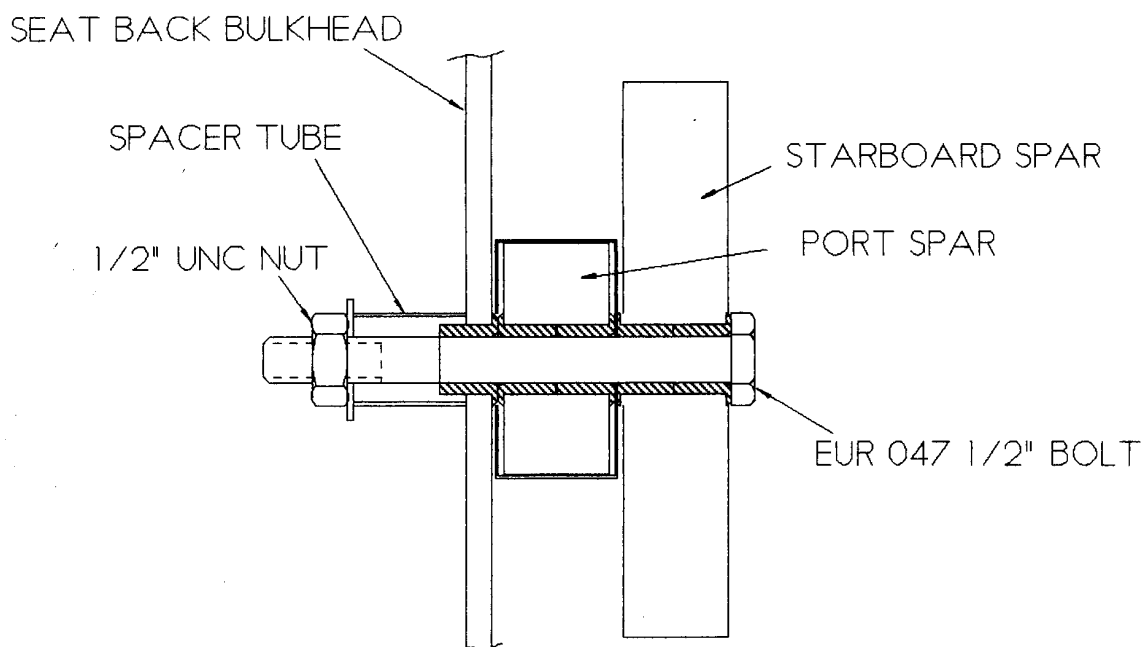
Fig 7. Section through starboard side spar bush area.

Before you use the dummy spar, check that the pitch of the holes matches that of the spars.

Cover the dummy spar end, and any other areas which will come in close contact with adhesive but are not to be bonded, with a thin plastic adhesive tape to act as a release agent. Insert the two S01 bushes into the holes in the cockpit module from the rear of the seat back. Set the cockpit module vertically with the baggage bay uppermost.

Step 9

Bonding in the bushes and the port spar socket

During this stage the two alignment bushes S01 are to be bonded in to the cockpit module, using the dummy spar as a jig. Also the port spar's socket S02 is to be bonded to the cockpit module after the CS14's are in place. These operations may be done in separate stages but the following instructions describe them being done in one go.

Make sure everything is clean then grease the bolts and the bores of the bushes to act as a release agent.

Bolt the dummy spar to the back of the seat back with the ½" bolts entering from their back faces, and the dummy spar simulating the tang end of the port wing.

Mix up some Araldite 420 Pull the bushes out of the cockpit module enough to expose the shank and apply some of the Araldite before pushing them back in. Wipe away any excess.

Place the large diameter washer and piece of 25 mm tube onto the spar pins and, using a ½" UNC nut, tighten the dummy spar and cockpit module together, keeping the short tube roughly concentric with the spar pin.

Check that the dummy spar and the seat back of the cockpit module are parallel with a spirit level then leave everything to cure completely.

Mounting quick-connect bellcrank brackets in cockpit module

The quick-connect bellcranks CS15P and CS15S will be mounted to the brackets CS14P and CS14S respectively. Firstly the brackets must be set up and attached to the cockpit module in the correct position.

Step 10

Refit the dummy spar to the seat back with the tang end on the port side. Offer up CS14S with the 1/4" hole biased towards outboard and up in relation to the aircraft. (Remember the definitions relate to the aircraft's orientation). Slide an AN4-12A bolt through the 1/4" hole in the CS14S and into the upper 1/4" hole in the dummy spar.

Set CS14S to be vertical relative to the cockpit module; an eyeball assessment will be sufficient in this case.

Clamp the CS14S bracket against the cockpit module and insert shims of wood under one of the flanges if required. Make adjustments to the shim so that the bolt, if removed, can be refitted to the dummy spar without forcing or adjustment. This is to be the position the bracket should be installed.

Check that the legs of the CS14 brackets are not distorted and carefully adjust the bends as necessary so that the legs are 162 mm (6-3/8") apart at the attachment flanges.

Step 11

Drill all four holes for the bracket through the cockpit module then remove the bracket and apply wax on the flanges to act as a release agent. Reinstall the bracket with Araldite 420 and flox under the flanges to form a smooth pad and install greased AN3-6A bolts from the cockpit module side with AN970-3 washers under their heads and use MS21042-3 nuts with AN960-10L washers on the bracket's flange. Tighten the bolts only so much to hold the bracket, checking that the correct alignment has been re-achieved, then before allowing the Araldite 420/flox mixture to cure, make fillets all around the flanges to aid positive re-location after their temporary removal during installation of the fuel tank.

After cure, fully tighten the bolts, checking the bracket isn't pulled out of alignment then remove the AN4-12A bolt.

Step 12

Repeat the whole operation of steps 4 and 5 with the dummy spar now fitted to the opposite side for CS14P.

Step 13

Fitting starboard side socket

The port wing spar, which is always the first wing to be rigged to the fuselage, locates in to a spar socket S02 attached to the starboard side of the cockpit module.

The function of the spar sockets is solely to act as an aid to rig the wings, they are not designed to contribute to the structural integrity of the wing to fuselage interface.

Before you fit the sockets in place, check that they will go onto the tips of the spars. Carefully file the spar tips as necessary until the spar sockets are a sliding fit.

Mark out and open out the hole on one side only of the socket to be 25 mm (1") diameter to allow the head of the bush in the cockpit module through. Scuff sand the outer face of the socket which has the large hole in it and the cockpit module in the area it will be attached with 80 grit paper.

Cover the end of the dummy spar, and any other areas which will come into close contact with the adhesive but which are not to be bonded, with a thin plastic strip to act as a release agent. Fit the socket onto the end of the dummy spar.

Mix up some Araldite 420 with flox and apply it to the front face of the spar socket, keeping it well clear of the holes, then fit it to the cockpit module with the socket end on the starboard side, with the bolts inserted from the rear again, held against the cockpit module by the ½" nut, spacer and washer as before. Leave to cure fully before removing the bolts.

Fitting port side socket

You will need the port wing for this operation. The dummy spar can be used to simulate the starboard wing spar with which to hold in position the port side socket. With the exception of this time not opening the hole in the socket to allow it to pass over the bush head, installation of this socket is identical to that of the starboard side socket. Remember though that the port side socket is bonded to the port spar and not the cockpit module.

'PHENOLIC' PAD
(THICKNESS AS REQUIRED)

BEARING
BC4W10

BELLCRANK
CS15P

RIVET (6oFF)
TLPD435BS

BOLT
AN4-12A

AILERON
QUICK CONNECT
BRACKET - CS14P

INBOARD

FWD

NUT MS 21042-3

WASHER
AN960-10L

NUT MS21042-4

WASHERS
EUR001

BELLCRANK
ASSEMBLY
CS15P

EUR001

NUT
MS21042-4

WASHER
EUR001 (2oFF)

BOLT
AN4-10A

WASHER
AN960-3

QUICK CONNECT
PUSH ROD
CS13

BOLT
AN3-6A

NOTE: PORT WING ASSEMBLY
SHOWN.

STARBOARD QUICK CONNECT
BELLCRANK ASSEMBLY
SIMILAR. - OMIT SPACER
S03. (STBD. WING SPAR
SOCKET FITTED TO FUSELAGE.)

PORT WING

BEARING
BC4W10

QUICK CONNECT
BELLCRANK WIGP

RIVET
TLPD435BS

WASHER
EUR001 (3oFF)

NUT
MS21042-4

AILERON
PUSH ROD

ROOT RIB

NUT
MS21047-4

WASHER EUR001
(2oFF)

ROD END
MW4 - C3

WING SPAR
SOCKET-S02

WING
SPAR

BOLT
AN4-7A

SPACER
S03

OUTBOARD

FWD

WASHER
EUR001

BOLT
AN4-31A

'COUNTERBORE'
SPAR

AILERON CROSS LINK / PUSH ROD

FUSELAGE (PORT SIDE)
QUICK CONNECT
BELLCRANK-CS15P

PIVOT ℄

WING (PORT SIDE)
QUICK CONNECT
BELLCRANK-W1GP
(ATTACHED TO AFT
FACE OF WING SPAR)

PIVOT ℄

AILERON CONTROL
CRANK CS08

QUICK
CONNECT
PUSH ROD

AILERON
PUSH ROD

PITCH TORQUE
TUBE CS10

PITCH
PUSH ROD

NOTE: WHEN WING ASSEMBLED INTO
FUSELAGE, BOTH FACES OF
QUICK CONNECT BELLCRANKS
ARE IN CONTACT.

TORQUE
TUBE

FORWARD

NOTE: VIEW AFT ON AIRCRAFT ℄

AIRCRAFT ℄

CONTROL STICK NEUTRAL

AILERON

AILERON

STARBOARD SIDE

PORT SIDE

CONTROL STICK TO PORT

AILERON

AILERON

CONTROL STICK TO STARBOARD

AILERON

AILERON