The wing spar strap installation made easy, well easier.
By Bud Yerly CFC,Inc.

In the Europa build manual care is taken to explain the reason for the spar strap, why it needs to allow some movement for vertical bending and security from twisting. There are those early builders which have stated they see no need for the spar strap. They are terribly mistaken. With the Mod 52 Gross Weight Increase, testing revealed the spars bend and move significantly under maximum load conditions. The spar strap, ½ inch Pip Pin and ½ inch straight pin along with the reinforced articulated rear wing attachment are essential structural components and can never be omitted or compromised. I won't go into this further. The spar strap is also a rigging aid by its location and assists in spar alignment during starboard wing rigging.

Wing Rigging for Spar Strap Installation Background:
I have done many spar straps and found setting up and jigging the wings with complete disregard of how the wings are set in the fuselage is a problem for some builders and in my years of repairing and finishing partially built Europa's, I have found owners with cracked or even completely failed spar straps and the owners had only flown a few hours or in one case not at all. To assist my builders in the shop I came up with a different but similar method to assure proper fit of the spar strap and most of my clients find the spar strap an excellent rigging aid.

You might wonder, how do the builders not see this. The Europa is like any other airplane, there are numerous times it is a game of fractions of a millimeter to get everything aligned properly. In Chapter 14 while rigging the spar cup, many use the supplied dummy spar. It works reasonably well, but not as well as rigging the wing to the fuselage cockpit module and gluing the spar socket on. Most have found placing the heavy cockpit module on its nose and installing the wing to be less than an idea setup, and frankly frustrating to jig up safely. It must be done, however, I tend to do this with the wings at their proper incidence and fuselage bottom in the horizontal dead level position (resting on a low table) which puts the bulkhead vertical. This places the spars where they should be and up against the fuselage bulkhead. I use adjustable height wing walkers to lock the wing incidence in. Saw horses will work as well but getting the height just right can be frustrating for the novice builder. To be honest, placing the wings leading edge down and hard against the cockpit module and supporting the leading edge of the wing on some foam blocks works just as well.

During the wing to fuselage installation and wing lift socket installation some builders fail to keep the spar hard against the bulkhead. Although bolts and nuts were included to assist the builders, some spar cups on the starboard side are a bit far from the bulkhead, or not properly clearanced to allow the cup inner surface to fit over the fuselage bulkhead bushing and unfortunately the starboard wing is set aft (and on a sweepback) not intended. In their haste, they shim the starboard rear lift socket to force the wing to bend to be the same sweep back from tip to tail on each side. This makes rigging in the future a completely frustrating operation.

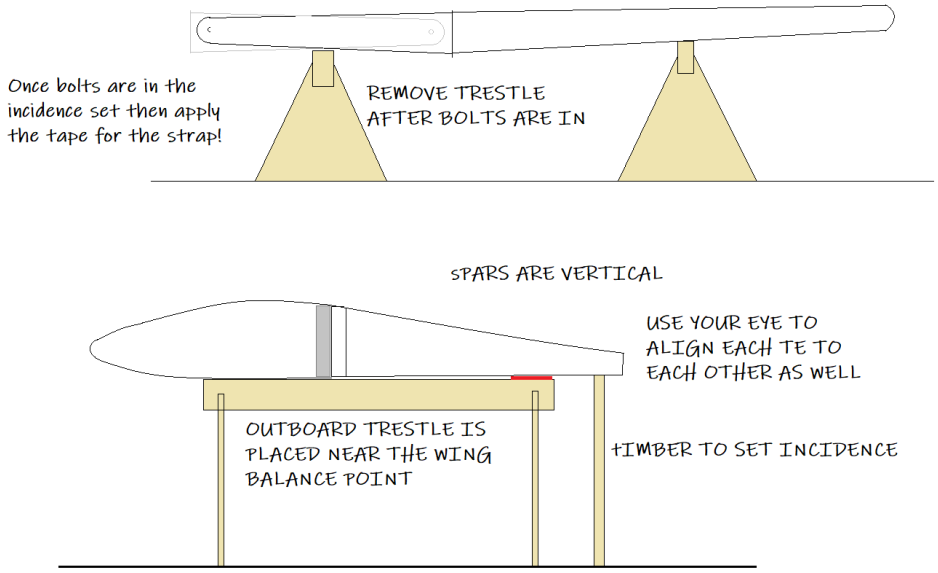
To do the spar strap one needs a facility that is roughly 30 feet long and 10 feet wide and climate controlled. Hard to find in the dead of winter up north. Keep the faith. Look at the weather reports and find a dry sunny day and make yourself an outdoor area that you can use. I prefer to do this on a solid flat concrete slab. Not frozen turf.

If forced to do the assembly one will have to make a tent or a cover over at least the spars. I've used Styrofoam insulation and standard incandescent lamps to keep a small cube warm enough to allow the epoxy to cure at about 75F. One of my workers used a Styrofoam coolers for his warm box doing some spar work on a glider wing. He notched the two Styrofoam coolers to fit over the spar, installed my 100 watt work light, and used our shop wall thermometer to check the temperature (OAT about 45F or 7C so not too cold for us but too cold for a fiberglass cure). He cut a hole in the Styrofoam to see the thermometer and within a few minutes the temp rose to nearly 80. Good enough. I can't believe I paid him to open and close that viewing hole to regulate the temp. He played about 3 hours until he got the lower and upper hole size adjusted to keep the temperature reasonable. I left the assembly overnight and it was fine the next morning.

The process of setting the wings for spar strap installation:

1. To start. If the wings are properly installed and rigged in the aircraft as outlined in Chapter 27, the starboard spar is tight against the starboard side socket and in the port wing spar socket. Remember, the port spar is in a socket also that was set along with the starboard side socket on the port tip. I don't set the bushings and spar cup at the same time because the Redux can really squeeze out and make the assembly very difficult to remove. I prefer to set the spar bushings with the wings well jigged at exactly the incidence, sweep and dihedral. Then after clean up, install the spar cup using both wings. I have no excuses then on wing alignment. If done all at once and if the builder does not pay attention to the alignment and angles he can build an assembly slightly askew. Later, while building the spar strap, we do not account for the spar cup and alignment previously accomplished. Hence there is often a slight difference in spar alignment while building the spar strap if the thickness of the spar cup is not compensated for. Normally, the spars are simply put together hard with a bolt completely forgetting about the spar cup thickness. That .016 inch doesn't seem like much but it is multiplied by the spar length. So measure the thickness of your starboard side spar cup and make a washer, or use one of those "AN8L" washers supplied (which is .032 inches) to displace the spars, or wrap a couple of pieces of tape over the port tip with a hole for the pin. This then angles the spars out just a small amount giving an extra bit of clearance and angle.

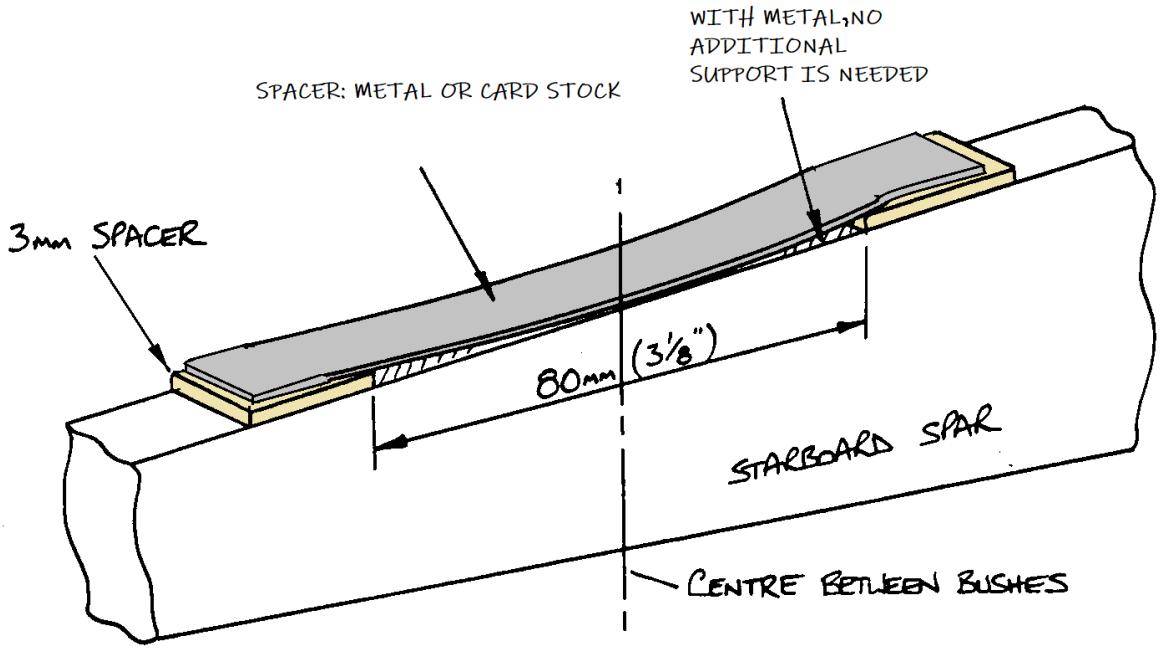
2. The next steps are fairly simple. Using two to four standard saw horses (or trestles) set the wings on the saw horses as shown below. Use scrap wood under the trailing edge to set the incidence exactly, then shim carefully works for me. The best thing to do is simply set both spars on one saw horse and position the outer saw horse to nearly balance the wings so there is little pressure on the center or spar saw horse. I believe the drawing will make that clear.



3. Shim the wing with wood scrap or shims to set the wing at its proper incidence. This is very near vertical for the spar. The exact incidence is not as important as is setting both wings the same. (This is why doing the spar strap vertically works provided you take care setting the two wings so their root ribs are even or said another way, at the same incidence angle.)

4. Start taping it up. I use a single layer thickness of blue 2 inch painters tape around the starboard spar fist, and then wrap the release tape over that. It is only a few thousands but glass shrinks 1-3% after cure, so it gives me a bit more clearance for a slip fit rather than a zero clearance fit.

5. Make your spar strap slightly wider than 3 inches, for trimming and rounding of the edge. The raw edge can cut you to death after it is cured as the end does not stay flat when compressed. You are making a knife edge. Also make your curved spacer slightly longer for an easier layup and nicer entry to the strap of the spar end. See figure below. I like using metal of about .016 or 1mm for my form. It is simply snipped out of aluminum, bent to the desired shape, taped over and then set on the spar during the prep as shown in the book.



6. On the bottom of the spar I make a smaller ramp also. It is not necessary to make it metal, a couple of strips of 1 inch painters tape is all that is needed. It is important to look at this area as the spar height and angles clearly are different and the strap will sag even if wrapped tightly from the higher spar and leave the lower glass sagging. It is permissible for the lower layup be relatively flat, but if it is indented to the shape of the other spar, it tends to bind. A bit of flox comes in handy to assist fighting gravity around the square corners of the spars and allow a smoother glass transition. Later, a bit of sanding cleans up this flox. The bottom of the spar strap is often best if it is rather flat.

7. Dry run your installation. Move your spars and rig your bolts and check your angles and spacing. It is nice to have an assistant during the dry run as things get slick, dropped, greasy, and then gravity sets in. Support the wings and spars so the spars are exactly vertical, each wing is at the same incidence and the spar pins rotate easily. This is important to ensure the strap is going to be properly aligned and not just slightly askew. NEVER clamp the spars together to get alignment. The spars should stay horizontally and vertically parallel. The bushings should be snugly bolted, not torqued.

8. To help my assistant visualize the spar strap, I will occasionally make a 4 mil plastic piece the size of the layup and demonstrate the lap, where we need the flox on top and bottom and how the tape simply butts on the port spar front. Gravity works, so the assistant also sees the method of wrapping the peel ply to keep it tidy.

9. Pull the bolts out and move the wings outboard and spars slightly apart. I abuse the assistant and have him or her hold both spars. Since the wings are nearly balanced on the saw horses, it isn't much of a load.

10. Flox up the low spots as planned.

11. Install you two three inch square tapes between the spars as depicted in the manual. Assemble the spars and lay the three inch tapes nicely. Don't forget to install that spacer washer if you didn't tape the port spar tip to simulate the spar cup in the fuselage. The bolts should be snug and the bushes snugly together and the starboard spar tip in its cup.

12. Apply additional flox where needed. The clear 4 mil plastic can aid you in this so you apply sufficient flox but also can semi-control the squeeze out.

13. Pull the multilayer tape off the table and wrap around the spars. Carefully trim to a butt trim and then pull the plastic off. Gravity will work immediately so an assistant can simply hold the bottom up until you can get the peel ply wrap installed.

14. Some make a caul to hold the glass flat against the port spar which makes for a neat job. This is tough because you can't use a standard clamp across the spars. I find using a spring clamp and taking advantage of the differing spar height on one side allows one to firmly affix the caul which will hold my glass nice and snug to the spar. The other side has to be fixed somehow. (A drop or two of superglue can work as a clamp) But a regular clamp is pretty tough to use. I have found that it is best not to use clamps and cauls at all, simply wrap your peel ply like a bandage wrap around the assembly. Place a thin piece of ply caul properly covered with release tape if you desire and wrap the assembly with tape. Most of the time I never even use a caul, I just wrap the heck out of it with my release tape (or painters tape) to hold my layup firmly where I want it so as to defy gravity. The release tape doesn't stick initially to the peel ply due to the ooey glue, so multiple wraps until the tape sticks to itself gets the job done. Now it is an assembly.

    Note: The wrap of tape can't be pulled super tight. If pulled too tight it may pull the spars together, so only pull the tape tight in the vertical.

    Once it is wrapped, keep the cure temp fixed per the glue manufacturers instructions. Allow to cure for at least 8 hours and preferably 12. Use a tent or box as stated above to keep your cure temp reasonable.

Simply take a sharp razor and cut the tape you wrapped around the peel ply. Remove your peel ply and inspect. If all looks well proceed to pull the wings apart.

To pull the wings apart you can use a jack, lumber, large co-workers or be smart about it. I use a thin putty knife of about 1.5 inches wide to slide between the release tape and the glass. It is obvious where the glue is releasing. Keep working around the release tape. The one side and top and bottom should work free. Remove the spacer you made. If it is metal, once the small ply spacers are removed, the metal often times will slide out.

Remove your bolts. Grab the free spar tip and try to move the free spar tip up and down a bit on that starboard side. The washer you used for a spacer should fall out.
Put your lower back against one root and your foot on the other and push. Remember that the wings are balanced so use your assistant to hold one wing tip and you will hold the spar while you push. Don't get too excited and knock the saw horses over. Readjust the saw horse positions if necessary.

I have steel wing rigging jigs called wing walkers I use now to speed up the process. They are expensive and large, but for a large shop they make rigging wings and doing spar straps rather easy.