Steps for F21:

1. Prepare location for setting the two fuselage sides inverted (saw horses). Do not worry about level/ straight at this time.
2. Approximately locate the two sides inverted on the sawhorses.
3. Place the bottom skin over the two sides. Drilling of the bottom skin will be down through the skin into the lower longerons of the side panels. Side skin is set up to overhang the lower longerons slightly, so bottom skin will fit inside the side skins.
4. Make spring-clamp spacer blocks. ¾" thick wood works with blocks cut about 2" square.
5. Clamp several of the bottom cross braces in place across the fuselage using the spacer blocks and spring clamps. This will keep the bottom skin from sagging. Remember to establish the 40" width at the forward end, 2 ½" width at the aft end. The spacer blocks are needed because the "C" of the verticals faces the opposite direction of the "C" of the bottom cross braces. Fill the "C" with the spacer blocks so the spring clamps don't crush the side flanges of the "C". Optional: Make loops of masking tape, sticky side out to stick the spacer blocks to the metal. This will keep them from falling down while adjusting the spring clamps.
6. Clamp the forward cross brace into position – it is helpful here to draw a line on the bottom flange of the part halfway across the flange (3/8" from the edge of the ¾" wide flange) to know when it is located axially under the leading edge row of holes in the bottom skin. The vertical "Z"'s at the forward end of the side panels can rock forward and aft quite a bit. Locating this row of holes across the front of the bottom panel will lock this down. Also center this cross brace side to side.

7. Drill the bottom skin to the lower longerons. Drill a few holes across the forward cross member to stabilize the front edge of the bottom skin. Do not worry about drilling the rest of the cross braces to the bottom skin. This will be done later when everything is square and the side-to-side of the cross braces can be accurately set.
8. Using the spacer-blocks and spring clamps, clamp a few of the upper cross braces in place. This will make the assembly stiff enough to turn over.
9. Turn the assembly over. Move it to the work table at this point, though it could stay on the saw horses. Might be at a more convenient height to work on the saw horses, though on the table, the aft end can be propped up to bring the upper longerons level fore-to-aft (not necessary initially). On the table, set the assembly up on 3 spacer blocks made of 2x4 lumber. One on each side near the forward end, and one at the aft end of the assembly. Assembly does not need to be level side-to-side. Only working squareness at this point.
10. Bring in the upper forward box beam to set the 40” width at the forward end of the tail cone box. It may need to be trimmed slightly where it contacts the 3/16 splice plates on each side. Trim only where it would contact the splice plate, not all around the box beam.
11. Clamp the #2, #3, and #4 upper cross beams in using the spacer blocks and spring clamps.
12. The side-to-side of the lower cross beams can be set. To prevent the lower skin from sagging and impacting the width of the bottom of the assembly, add a few more 2x4 spacers at the cross beam locations (just short pieces in the center).
13. Set squareness working from middle (#3 cross beam) to front, then middle to aft. Don’t worry about the aft end (verticals with the rudder cable fairleads and aft of there). There is enough flex in the assembly that squareness there can be set later.
14. When setting squareness, if the assembly is not leveled fore-to-aft (and it won’t be set on 2x4 blocks), the carpenter’s square is set across the upper longerons, but the part of the square hanging down must be rotated forwards to be parallel with the vertical rows of rivets for the vertical channels.

If the square is left to hang via gravity, it rotates back away from the side of the fuselage, giving the impression that it is not square when it may be.

15. Width at the bottom of the assembly cannot be changed – it is set by the bottom skin, so tweaking the upper cross beams is the only adjustment. Once the forward box beam is set, the others only really need to be centered – releasing the spring clamps to allow the side panels to spring to their natural flatness.
16. Drill the 4 forward upper and lower cross beams to the verticals on the side panels. Drill the lowers by just reaching over the side. Up on the work table, may need to stand on a milk crate or something to reach the bottom.
17. Work the 3/16" splice plates at the forward end. Prop the forward end up higher than the 2x4's for this. For the lower "T" shaped splice plates, a .090" spacer is required for the short leg. Line these spacers up with the plate loose in hand and drill them on the drill press. That way you know where the spacers will end up.
18. Clamp the splice plates to the OUTSIDE of the bottom of the fuselage through the two attach holes. Then drill up through the splice plates into the bottom skin and lower cross brace. It may not be possible to get a drill through the splice plate with it clecoed in place inside the assembly. After drilling, move the splice plate and spacer plate to the inside of the assembly.
19. Drilling the upper "T" splice plates – The aft side of the box beam will sag if not held up. Hold or clamp it up and align the leading edge of the "T" with the edge of the upper skin of the box beam, then drill down through this.
20. Aft end – the vertical tail spar parts are needed to complete this (it's not all "F" parts here, some "T" parts stay with this assembly). Clamp the vertical tail spar into position. Verticalness can be adjusted not only with the clamping to the side panels, but also with where the spar attach angle is clamped to the upper longerons. At this point, verticalness can be checked.
21. Boost the aft end of the assembly up higher on the table. Level the forward end of the assembly. (It didn't need to be level to this point). Now check

level at the aft end (somewhere within the last foot or so). Levelness here can be adjusted by reclamping the vertical tail spar channel to the side skins, and reclamping the spar attach angle to the longerons. Vertical of the vertical tail spar can be checked both with the level vertical along the spar and with a plumb bob clamped to the upper end of the spar.

22. Drill the vertical tail spar channel to the aft edge of the side skins.
23. Drill the vertical tail spar attach angle to the inside of the upper longerons. A 12" drill bit can be used to do this. Be aware that the 1/8" spacer takes the place of the 1/8" plate in the spar – so do NOT have the spacer in place when drilling, just the spar. If the spacer is in place, the spar attach angle will be 1/8" too far forwards. Do not worry that a little of the spar attach angle is visible between the upper longerons, there is still plenty of edge distance.
24. Mark the location of the bottom end of the 3/16 spar plate on the spar channel. (2 lines, since it's split into a fork at this end).
25. Remove the portion of the spar which is to be removed at this point. If no bolts are installed in the spar, it's a simple removal of 3/16 clecoes.
26. Using the tailwheel mount spacer plate (3/16" plate, 2 ¼ by 2 7/8), hold it up to the marks on the spar channel. Mark where the upper end of this plate falls on the spar channel.
27. Tape the spacer plate to the tailwheel mount weldment, lining it up side to side and at the upper end.
28. Remove the vertical tail spar channel from the aft fuselage assembly.
29. Using small C clamps, clamp the tailwheel mount weldment and spacer plate to the channel, using the reference line drawn for the upper end of the spacer plate.
30. Using a short right-angle drill, drill the holes through the spar channel into the spacer plate and tailwheel mount weldment. Access to these holes by a drill press from this side is blocked by the forward end of the weldment. (Kind of painful, but the holes need to get through).

31. Remove the tape from the spacer plate. Cleco the tailwheel mount weldment and spacer plate to the vertical spar channel.
32. Un cleco the aft 3 feet of the bottom skin from the side panels. The skin needs to hang down to allow access into the aft end of the assembly at this point.
33. Re-cleco the vertical spar channel with spacer plate and tailwheel mount weldment on the aft fuselage assembly.
34. Locate the shear web on the forward end of the tailwheel mount weldment. It helps to have drawn hole reference lines along the side flanges of this shear web – these line up exactly with the holes in the side skins. Clamp the shear web to the tailwheel mount weldment with cleco clamps to lock down the forward-aft and side-to-side position of the shear web.
35. Drill the holes for the shear web through the side skins starting at the top and work down (as a plans builder, I believe my shear web may have been bent a little narrow. At the top it pulled out easily, and by the time I got to the bottom, it had pulled out.)
36. Remove the cleco clamps from the shear web. Locate the forward tailwheel mount weldment attach angle ahead of the shear web. Clamp it to the lower longerons with cleco clamps. (I found I had to adjust the angle on this part a little to get it to sit flat to the lower longerons and the shear web. Since it had already been cut, I used the prybar-in-vise method to calmly adjust the angle.)
37. Drill the tailweel mount forward attach angle to the shear web and tailwheel mount from front to back. A 12” drill bit can be used for this.
38. Uncleco the tailwheel mount forward attach angle from the shear web and tailwheel mount. Uncleco the shear web from the side skins. Move the shear web forward and down out of the way.
39. Put the F22-02 shear web assembly (with the flanged 4” access hole) into position. Bring the shear web back up into position. (I found I had to uncleco the tailwheel mount weldment entirely to do this because the tubing in the center of the weldment does not allow the shear web to be brought back into position with the F22-02 shear web assembly in place.)

40. Bring the F22-02 shear web assembly forwards until its aft angle is tight to the vertical shear web. Cleco clamp the F22-02 shear web to the vertical shear web through the right side (elevator pushrod) access hole.
41. Clamp the F22-02 shear web to the upper longerons through the 4" access hole and at the aft end.
42. Drill the F22-02 shear web aft angle through the vertical shear web (from front to back). The 12" drill bit is used again here. It is hard to see all the holes – there are 7 per side.
43. Drill the F22-02 shear web to the upper longerons. Again use the 12" drill bit here.
44. Clamp the forward upper angle under the F22-02 shear web assembly.
45. Drill the holes through the vertical channels and up through the shear web assembly.
46. Position and drill the lower #5 cross beam.
47. Turn the entire assembly over, bottom side up.
48. Drill the lower cross beams to the bottom skin through the bottom skin. If you have centerlines on the lower cross beam flanges, the hole location can be checked for edge distance prior to drilling.
49. Final size the bottom skin holes. There are two bolt-size holes for the forward tailwheel mount weldment.
50. Turn the assembly back upright and final size all holes.
51. Disassemble.
52. Debur.
53. Reassemble.
54. Rivet and bolt. See rivet hints and drawing notes below.

Riveting hints:

- Don't rivet the forward .032" angle to the shear web assembly. This angle gets in the way of riveting the 1x1x.125 angle just aft. I had to drill it out because I followed the shear web assembly print (F22?) to install the rivets.
- Rivet the shear web assembly (with the 4" flanged access hole) to the aft shear web (the vertical member with the racetrack shaped elevator pushrod hole) on the bench, prior to installing in the fuselage. This makes some difficult to access rivets easy.

- Rivet the forward tailwheel mount support angle to the aft shear web on the bench as well. Same reason.
- Rivet the aft support angles to the upper forward box beam on the bench. Same reason.
- Install the bolts through the upper splice plates through the box beam with the fuselage bottom side up. With the fuselage right side up, it's practically impossible to get the washers and nuts on the bolts. With the fuselage inverted, it's just tricky, but not too hard.

Drawing unclear:

- On the upper forward corner of each side panel, the splice plate to the forward fuselage is shown with fasteners (the splice plates on the sides, not the top). These fasteners are not called out on F21, just shown in place. I expect to use the same fasteners as for the lower side splice plates, but since these holes also have to go through the turtledeck skin, I waited for the t-deck skin to be in place before drilling these holes out to size. The fasteners are called out – on F17 after the turtledeck assembly (F19), on the print where the bottom skin installation is described.
- On the bolts through the upper splice plates into the box beam, the print calls for 2 washers – one under the bolt head, one under the nut. I found that the aft bolt on each splice plate would bottom out the nut before tightly gripping the joint, so I put two washers under the nut. Still plenty of thread protrusion, and a tight joint.