

## WING INCIDENCE DRILLING SIMPLIFIED

1: Don't put in all of the wing attach bolts right away! You may have to remove each wing a couple of times in this process. Just put in four bolts in a square pattern for each wing. Don't use the good bolts! Put in hardware store variety and grease them and the holes in the spar to protect the spar and facilitate insertion.

2: Once the wings are TEMPORARILY installed, level the fuselage laterally. You want the two wings to be level left to right. Don't simply rely on placing a level across the longerons (they are hand bent and may have slight errors), put a level on the top of the main spar center section as well. If the two agree, move on to the next step, if not, average the two. A ½" or less height error at the wing tip is close enough. Now check the forward sweep! Hang 2 plumb bobs on each wing, one at the tip and one at the root (tank area). Then stretch a single long string across the front of these four plumb bobs. If there is no or minimal (get real, less than ½") sweep fore or aft, then move on to #4 below. At the same time, triangulate from each wing tip to some center point on the aft fuselage. The two measurements should be the same (get real, within ½" or so will be fine)

3: If there is a sweep or triangulation problem **STOP**. The common reasons are:

A: The rear spar structure that sticks out of the fuselage is comprised of two pieces of 1/8" aluminum bar. One piece ends up on the front side of the wing rear spar stub and one is on the back side (where you can see it). The forward piece **OFTEN** is too long and hits the wing root rib flange and prevents sufficient insertion of the rear spar stub into the "hand" of the fuselage (thus producing forward sweep). If so, then remove the wing and cut off the minimum amount required to correct for the sweep error. In general, if the tip of the wing is swept forward 1" then trim 1/8" to ¼" from the end of the bar.

B: Sometimes the culprit is the wing rear spar stub! If it is running into the spacer block in the "hand" of the fuselage, and that is all that is wrong, then remove the wing and trim off as in "A" above.

C: Sometimes it is both problems! Just be sure what the problem is before you get too handy with the trimming!

4: If all is OK, then start the process with the bubble level of setting the wing incidence. **DON'T DRILL THE HOLE YET**. There is more to this than you think. The **CRITICAL** part of incidence is not so much the amount, but rather that both wings have the same amount. Other factors to assess are the following:

A: The edge distance of the rear spar attach bolt is **PARAMOUNT**. 5/8" from the center of the hole in **ALL** directions in **ALL** of the material it goes through is the first consideration. Take a good look.

B: It was the hope of the designer that the flaps might fit once the wing is installed! If you look at your flap, you will see that it has a bottom skin that seems to want to go under the fuselage belly skin when the flap is UP. It is really nice if this skin just kisses the bottom of the fuselage. Try putting the flaps on.

If you have edge distance met, the flaps fit well, the sweep is OK, the triangulation is good, and incidence is set, **TAKE A BREAK**. Move off and away from the airplane and take a look, you are very close to drilling a **PILOT** hole (say 1/8" or so) in the rear spar! IF you're ready, go to instruction #6.

5: The only real problem you may have is that the incidence does not allow one of the requirements above to be met. Try some of the advice below:

A: THE FLAPS ARE TOO HIGH TO GO UNDER THE FUSELAGE AND YOU CAN'T RETRACT THEM TO AN "IN TRAIL" POSITION. There are a couple of solutions to this... one is to change the incidence of the wings (lower the rear spar until they will). To a degree, this is OK but of course you must retain that critical edge distance for the attach bolt. IF you can retain this distance and not change the incidence too much (say a degree?) then what will happen? The horizontal stabilizer may need to be repositioned. HOW, and HOW MUCH? Clamp the wing spar in the new location, put Van's block of wood under the level, and raise the tail of the fuselage until the bubble centers. Now check the horizontal for level fore and aft. Very likely you can't measure the change from its original position. IF you can and all else is OK then consider changing the spacer under the front spar of the horizontal to correct it.

B: Another solution is to simply cut off the skin that would have been under the fuselage. Now the flap will come up in trail and you will simply have an uncovered hole showing in the fuselage bottom where the actuator push rod will come out (unsightly but no big deal).

C: THE FLAPS ARE TOO LOW WHEN RETRACTED FOR THE BOTTOM FLAP SKIN THAT UNDERLAPS THE FUSELAGE TO TOUCH THE BELLY. Not a big deal but if everything else looks good and you don't want to raise the rear spar of the wing (thus reducing the wing incidence and maybe losing the **PARAMOUNT 5/8"** bolt edge distance) then you can simply bend the lower flap skin up a little until it "kisses" the bottom of the fuselage.

6: **Get ready to drill the hole!** The toughest part of this is getting the hole **SQUARE** to the surface of the material. Everything there in the rear spar attach area is at a different angle to everything else. It is very hard to hold a drill perpendicular by eye! Make a drill guide! Find a block of iron or aluminum at

least an 1" thick. and 2" square. On a drill press, drill a 1/8" hole through the center of the block. Now you can clamp the block to the rear spar of the wing and it will help to assure that the drill bit penetrates the surface perpendicularly.

7: **Drill the hole to 1/8" diameter first!** Put a cleco in and check everything again, step back away from the plane and check again! Only then can you safely drill the hole out to the correct size. A nice hole can be achieved by first drilling an undersize hole and then, using a reamer, enlarge it to the final size.

8: During all of the above setup and machinations, **DON'T FORGET** the wing root fairings. They can be marked and drilled during this fit up stage. The belly skin of the fuselage can be marked and it's hole locations identified during the above processes as well. Also, look at and identify the transition points for the fuel lines and vent lines from the tanks into the fuselage. This is a great time to finish these details. How about the pitot line? Time to take a break!!