

One Man's Approach to Building Plug-In Wings

By Mike Isermann

About 6-7 years ago I made the decision to change the way I traveled to contests. After my last 40 hour road trek from Houston to Geneseo, New York, I swore off such trips and vowed never to do it again. It is a horrible waste of vacation days. Especially when you only have 2 weeks a year! Flying to contests was about to become my new mode of transportation. The decision to fly brought to light a whole new set of transportation problems that needed to be solved. So I sat down at the drafting table and designed a travel box capable of carrying a good number of finished aircraft. Building the box took some time, but the finished product turned out to be quite versatile.

The travel box has served me well for many years now; however, it limits the number of events in which I can participate in. My travel box dimensions are roughly 34"x 26"x 7." I have been able to fit up to nine airplanes in the box at one time. This is due to the fact that several of them are duration ships and can be broken down into three pieces. Scale ships, on the other hand, are all one piece. They take up most of the room in the box and you have to be good at puzzles to make them all fit. This fact is what got me thinking about building all of my models so that they can be broken down into smaller components. Bottom line, more airplanes in the box means more events flown.

Constructing a Plug-In Wing

The plug-in wing concept is not new. Duration flyers have been doing it for decades. After talking it over with Don a few times to see how he gets it done, I decided to design my plug-in system in the following manner:

This process requires that you have built the wings, installed a 1/8" thick wing root rib at the correct dihedral angle, and have completed the fuselage up to the point of having the formers installed, but haven't installed the stringers and the wing mounting plate on the fuselage.

First, it is helpful if you build wings using full depth spars. These spars serve as the perfect support structures for the aluminum tubing that your .050 diameter Carbon Fiber Rod (CFR) will slide in to. Using a sharpened brass tube, find the center of the primary spar on the outboard side of the 1/8" thick root rib and carefully cut a hole through the rib. As you are cutting through the inboard side of the root rib you should find that the tubing is directly in line with the horizontal and vertical center of the spar. Continue to cut straight across the spar all the way to second rib. The tubing should appear to straddle the spar from side to side. What you are actually doing is cutting a slot through the center of the spar. Once you have cut all the way to the second rib, pull the tubing out and cut the slot free with the point of a #11 razor blade. Now you should be able to slide a piece of 3/32 OD aluminum tubing into the slot. Cut to length and glue in with CA. Find some 8 lb 1/16" balsa and cut two doublers the full height of the spar to cover the aluminum tubing. Be sure to turn the grain perpendicular to the grain of the spar.

When you get ready to align the wing to the correct incidence angle, you're going to need a short piece of dowel at the aft end of the wing to ensure it stays at the correct angle. To accommodate that dowel, glue in a balsa doubler inside the root rib at approximately 85% of the the cord, and install a short piece of 1/8" aluminum tube through the root rib and the doubler. That tube will serve to hold a 1/16" dowel which you'll mount in the wing mount plate on the fuselage. Don't mount that dowel at this point.

Purchase four Neodymium Magnets 1/4" dia x 1/16" thick. Using a sharpened 1/4" brass tube, cut a circle about half way through the 1/8" thick root rib. (See attached picture) Then scrape out the wood to create a recessed cavity. The magnets can now be glued in flush with the rib surface using CA. You will later need to do the same thing on the wing mount plate on the fuselage, but hold off doing that until you've completed the incidence alignment process.

The second part of building a plug-in wing system involves alignment and mounting the wing to the fuselage. When building the fuselage, try to place one of the formers at approximately 33% of where the wing chord will be located. This change may require some slight modifications to the fuselage design, or it may require a false former to accommodate the CFR inside the fuselage. (Keep in mind that this description applies to half shell construction but can easily be adapted to box and former construction.). Make a wing mounting plate which will fit into the side of the fuselage where the wing root rib will be aligned. This wing mounting plate is usually a 5 lb piece of 1/8" sheet and is secured in notches cut into 3 to 4 formers depending on the root rib thickness and chord. Do not glue this in place yet.

Determine from the plan, or hold/jig the wing up to the spot where the wing will meet the fuselage and determine the exact point at which the CFR from the wing will enter the fuselage and mark that point on the former at which the CFR will enter.

Before gluing the wing mounting plate in place you will need to transfer the dihedral angle to the underlying former. The angle needed can be identified by tracing around the balsa former onto a piece of paper or copying it off the plan, then drawing the wing dihedral to scale per the plan. Then transfer that angle to the former. The dihedral line must project through the center of the root rib of the wing where it meets the fuselage.

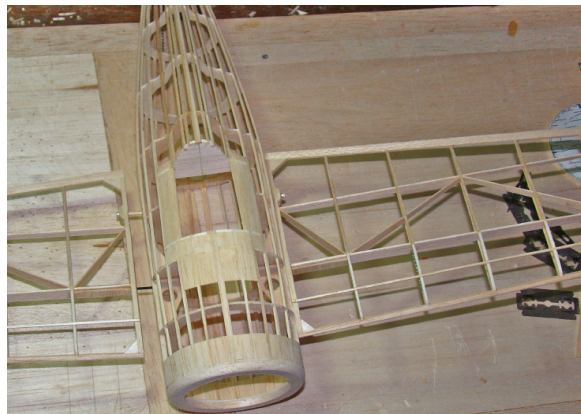
Now, very carefully cut a .050" wide slot along the dihedral line in the former with a #11 blade. By doing this you have just created the slot into which the CFR will rest. Next you will need to sandwich the slot with 1/64" plywood. Make sure the CFR fits snugly into the slot/hole. Push through until the CFR slightly protrudes out of the inboard side of the former. The CFR can now be cut in length equal to the inboard slot plus the length of the aluminum tube in the wing. Also note here that I prefer not glue the CFR into the fuselage, but to make it removable in case of failure due to a hard impact (yes, CFR CAN break!).

You're now ready to attach the wing mounting plate. Glue it in place and extend the hole for the CFR to enter from wing into the mounting plate and former. For added strength, I would recommend that you reinforce the surface of the mounting plate around that hole with CA and consider gusseting the CFR support former to the wing mounting plate on the inside of the fuselage. One triangular gusset fore and aft the slot location should suffice.

The next task is to establish the exact incidence of the wing, and ensure it's the same for both wings. This is best done with a jig of whatever design you desire. As soon as you've established the correct incidence and that both wings are identical in that respect, drill a 1/16" hole in the fuselage mounting plate at that point and install a short piece of 1/16" dowel which will fit into the 1/8" tube in the wing to serve as the incidence alignment peg. Install a small doubler to strengthen the point at which the dowel will enter the mounting plate and install the 1/16" dowel. The dowel should only be long enough to fit through the tube you've mounted in the wing.

Now all that is left to do is install the final two magnets on the wing mount plate and you should be in business. Beware here, Murphy's law can bite you if you're not careful. Since magnets have polarity, make sure the magnets you install in the wing mounting plate are oriented to attract, not repel the magnets in the wing. Cut a recessed holes for these magnets as described above. If you have exercised care in aligning your magnets, shafts and aluminum tubes, you should be rewarded with a snug-fitting wing arrangement that is positioned properly. I believe you will find that the qualities of plug-in wings are quite satisfying as well. They will enhance your traveling abilities and reduce the need for storage space at the house. If you are like me, then I know your shop can use it. It will also be something that the wife will most likely appreciate! Good luck with your build

Thermals,
OOS Mike



THE ISERMANN QUARTER ROUND CRACKED RIB HYBRID METHOD

"QUARTER ROUND" CRACKED RIB HYBRID

