

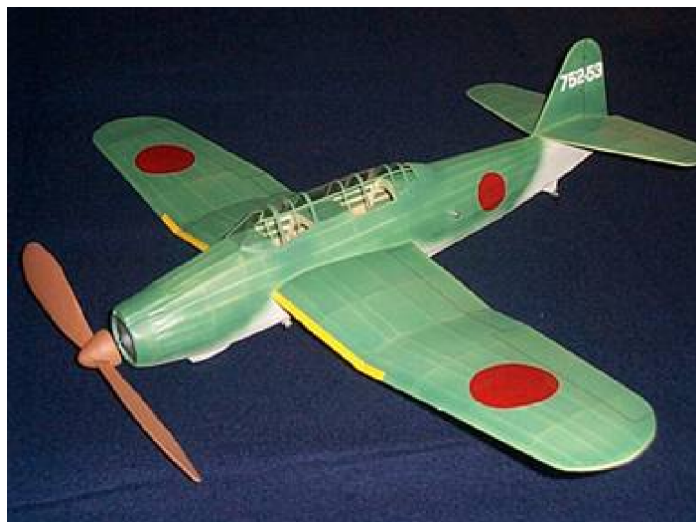
# WING ATTACHMENTS FOR MID-WING MODELS

By George White

In a recent conversation with our highly skilled PFFT flyer Jack Coyle, he mentioned that he'd very much like to tackle a Grumman F4F, but couldn't think of a reasonable method to attach the wings. I then remembered a series of emails I exchanged with Gene Smith several years ago on that very subject. The illustrations below and much of the verbiage are from Gene, who learned the technique from Clarence Mather. Clarence had used a similar arrangement on his SK3.

There are really two, or perhaps three parts to the problem: (1) getting an attachment which is strong enough to deal with flying loads and a relatively mild gust while the model is being held; (2) getting the wings at the same incidence angle on each side; and (3) providing for a means by which the wing can be removed or knocked off if that feature is desired. For purposes of this article, I'll assume all three goals are desired.

To illustrate the technique Gene used, he described the building of his 24"WS Aichi B7A Grace, which he built from a Diels kit. As you can see, it would be impossible to build a through-wing arrangement on this model.



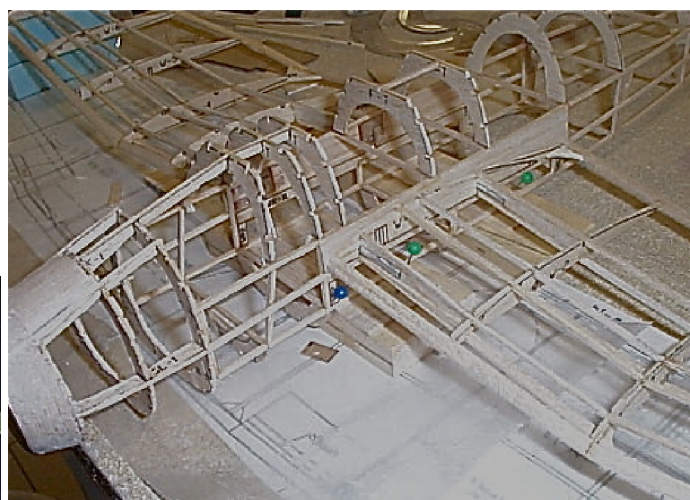
The first step in making attach points is to fold a piece of music wire double and then flare the ends into a "T" with the ends of the "T" bent into an extended "S" shape to provide more stability. The two sets shown here illustrate one set for the main spar and the other, smaller one for further aft as an alignment point, attached to an aft spar.



In the photo below you can see the shape of the "T."



Each of these "Ts" are mounted on a piece of 1/64" ply which will be epoxied into the fuselage as shown in the photo above. The wire "Ts" are epoxied into a piece of aluminum tubing about an inch long, which will telescope into other aluminum tubes mounted between spars in the wing. The wing tubes may be seen in the photo below.



Gene used a combination of 1/16" and 3/32" tubing for the rear spars and 3/32" and 1/8" tubing for the main spars. **The larger tube in each pair is mounted in the wing, with the smaller tube attached to the fuselage.** When doubling the wire for the T, it should be a snug fit inside the smaller tubing. Gene used .025" wire for the 3/32" tubing and .015" wire for the 1/16" tubing.

Before epoxying or assembling of any of these items, ensure that the fuselage plates to which the wings are to be attached are of at least medium balsa and are braced internally to handle the flexing of the wing. This needs to be done without interfering with the flailing motor as it unwinds. A couple of vertical braces inside the fuselage wing mount plate should do the trick (although Gene didn't find them necessary), and the mount plate is fit between a couple of stronger-than-normal stringers or longerons as seen in the photos.

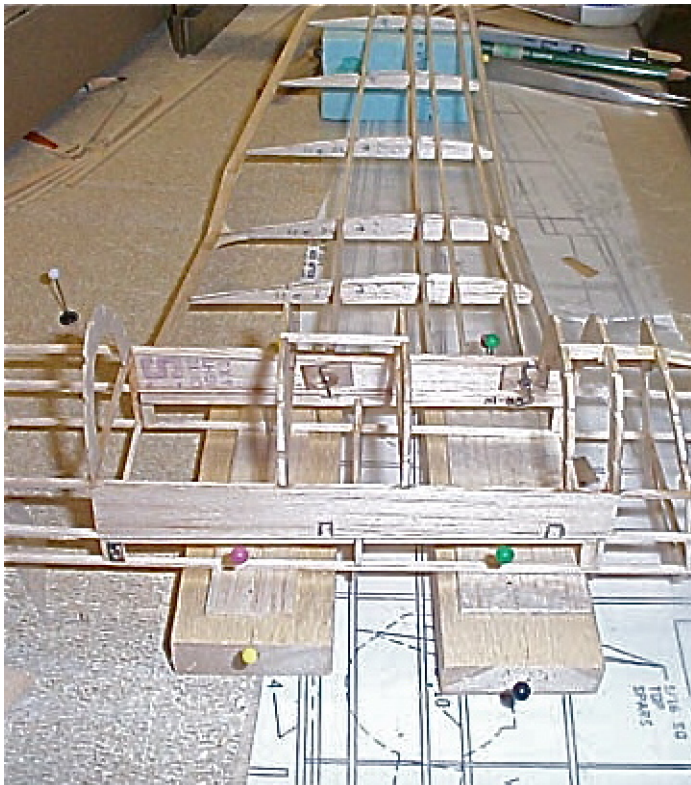
Once the fuselage mounting plate is in place, the wing incidence is decided on, and a root rib is held against the fuselage mounting plate and a reference line is drawn on the fuselage mount plate along the bottom of the root rib, with the root rib set at the correct incidence. Don't forget that incidence is set based upon a straight line running from the center of the leading edge of the wing through the center of the trailing edge. The bottom of the wing is very rarely the

incidence line. The line you are drawing here is merely a reference line to ensure the wing is set at the correct incidence. Do this on both sides. The use of a jig and plenty of eyeballing at final assembly is essential to ensure both wings have the same incidence.

The aluminum tubes in the wing are installed first. They must be at right angles fore and aft to the center line of the fuselage and must be parallel to each other. One technique to ensure they are parallel would be to insert long pieces of aluminum tubing into the wing tubing so you can either measure or eyeball that they are parallel in both vertical and horizontal planes. These tubes are reinforced with a web between the spars and are epoxied in place.

While you are epoxying the wing tubing in, go ahead and lightly epoxy the “T” fixtures into the smaller tubes (don’t overdo it) which will later be installed in the fuselage. **Do not** install the “T” fixture and tube through the 1/64 plywood backing plate at this time. Instead, just bore a hole in each of the 1/64” plywood plates the same size as the fuselage tubing and set these parts aside.

Once the reference line for the bottom of the root rib has been drawn on the fuselage wing mounting plate, it is critical that the fuselage and wing be stabilized on the building board and the wings be jugged into place with the bottom of the root rib exactly on the reference line. A piece of music wire, sharp on one end and slightly longer than the wing tubes, is inserted into the wing tubes to mark the position where the fuselage tube hole must be drilled. This could also be done by pushing a piece of tubing the size of the fuselage tubing into the wing tubes and rotating it against the fuselage wing mount plate to make a mark for drilling.



Remove the wing and drill the hole for the fuselage fixture

tube, then replace the wing in the jig again and test fit the fuselage tube fixture into the wing tubing. Ensure that the dihedral angle is set correctly with a jig as seen in the use of a piece of foam under the wingtip in the photo at left below. You may have to bend the “Ts” to meet the wing tubing and still have the ply backing plate for the “T” fit flat against the inside of the wing mount plate — a critical fit for the strength of this assembly. **When bending and fitting the “T” fixture, ensure that the arms of the “T” are vertical,** otherwise resistance to vertical movement of the wing will be compromised. The wire “T” fixture must fit snugly against the ply backing plate and the backing plate must fit snugly against the fuselage when the wing is in perfect alignment. Once that is accomplished, a small amount of 30-minute epoxy is applied to the inner 1/16” of the fuselage tubing, and it is slipped through the 1/64” ply backing plate, and a small amount of epoxy is applied to the plywood plate and the assembly slipped through the fuselage. Epoxy is then added to adhere the wire “T” to the plywood plate. **Ensure that the arms of the “T” are vertical, and that none of the epoxy gets into the wing tube or between the wing and the fuselage.**

Repeat the process for the other wing. Before doing any final gluing of the “T” fixture to the other side of the fuselage, obviously **extreme care must be taken to ensure that the two wings have exactly the same incidence angle.**

Once this process is completed, determine what size magnets are appropriate (3/16” X 1/16” magnets should be strong enough for most wings), drill a hole the size of the magnet in the fuselage mounting plate at about midpoint of the rib area, and either CA or epoxy a magnet in each side. Remember that the round magnets used for this purpose are very directional. Avoid mounting the matching magnets, only to find that they repel instead of pull the wing to the fuselage. The way I would accomplish this is to wait until the glue holding the magnet in the fuselage is set, then let the matching magnet adhere to it solely through magnetism. Using a marking pen, smear ink on the second magnet, and mate the wing to the fuselage, letting the ink mark the rib where the matching magnet should go. Drill a hole in the wing root rib for that magnet and check the fit. Then, place a piece of Saran Wrap between the two magnets to prevent them from being glued together, fit up the wing again and glue the wing magnet in place.

Gene says he’s used this technique in two models. The first, a MiG 9, which is long lost in the cornfields of Geneseo, and the Grace, shown in this article. He says the Grace landed wing low several times during the trimming process, and each time the wing popped off with no damage. He has not used this technique on models larger than those two.