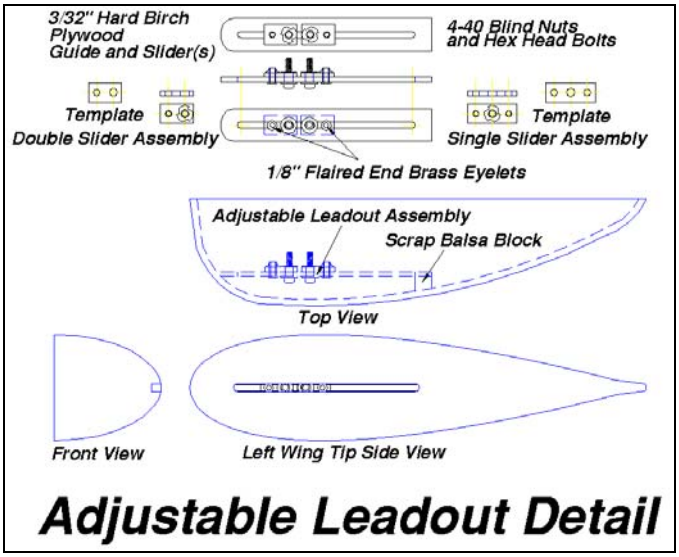
Building a Better Profile

Part 10 - Details

Adjustable Leadouts

You wouldn't expect to NOT have adjustable leadouts on your Better Profile, would you? Here's a drawing lifted from my *Mo'Best* plan, which illustrates a simple adjustable leadout system which is hidden away completely inside the inboard wing tip. The slider can be loosened, moved, and re-tightened using a hex-head driver.



The slider assembly is easy enough to build from scratch, using Lite Ply, brass tubing or eyelets, and 4-40 blind nuts and hex head bolts (just like the ones on your motor mount).. Or, you can buy one ready-made from Hobby Fasteners.

Carved Wing Tips

Carved wing tips tend to look better, are not difficult to cover, and easily accommodate adjustable leadouts and tip weight boxes. They are also quite easy to make.

A simple carving technique for wing tips uses two 1" balsa sheets. Start by drawing the outline of the wing tip on each sheet and cutting it out very slightly (perhaps 1/8") oversized, particularly at the front and aft edges. Tack two sheets together with tiny drops of thin CA around the edges, then hold them in place on the wing tip rib and draw around the perimeter of the rib. Cut away the bulk of excess wood, then shape with a very coarse (#80 paper) sandpaper block. Initially, the tip will look crude and feel very heavy, but have faith!

Tack glue the tip to the wing to complete coarse shaping. Wrap masking tape around the wing next to the tip to protect it from accidental sanding. Complete most shaping, within perhaps 1/16", and switch to finer (say #220) sandpaper to finish the final shape. Remove the tip from the wing, cut the sheets apart, and freehand mark a line about 1/8" inside the perimeter edge of each sheet. Using a round or diamond shaped Exacto carving gouge tip, remove the bulk of the material inside, leaving only two 1/8" thick or thinner "clamshell" halves.

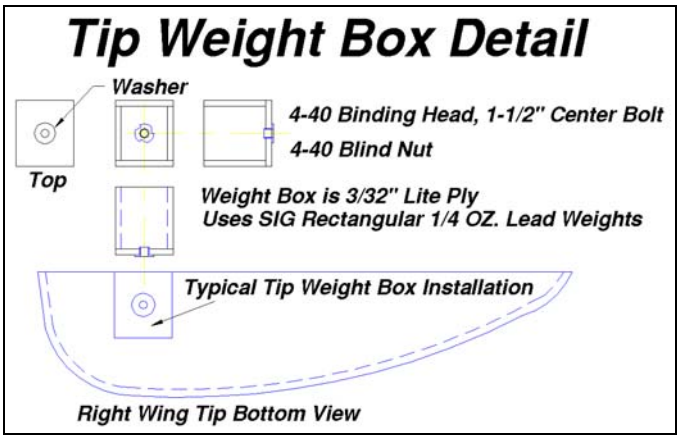
If you are fortunate enough to have very soft, light, clear balsa, it will carve "like butter", and the work will be easy, fast, and very satisfying. With harder, heavier wood, change tools: use an acorn ball auger bit on the Dremel tool. The going is messy and not nearly so easy, but the harder wood can be hollowed to an even thinner shell, so that the weight penalty for heavier wood is actually quite small.

When hollowing work is complete (you can start to see light through it!), the clamshell halves can be glued together for final finishing.

Some folks suggest not hollowing an outboard tip (since it needs tip weight anyway). But for profile ships, particularly with longer inboard wing sections and larger wing tips of harder balsa, the solid tip can turn out too heavy. I personally prefer to hollow both tips and add lead tip weight as necessary.

Tip Weight Box

Equally vital to the Better Profile stunter is a tip weight box. Another use for Lite Ply! Although you CAN simply purchase a tip weight box already built, if you can spare 20 minutes for labor, you can easily make your own.



I personally prefer the SIG flat 3/4" x 11/16" lead weights (1/4 ounce), with a 1/8" hole drilled in the exact center. Externally, the finished 3/32" Lite Ply weight box approximates a 1" cube. The top, bottom, and two opposite vertical sides are cut out as 1" square pieces; the remaining two sides are 1" tall, and narrower by two thicknesses of Lite Ply, about 3/16", that is 1" tall x 13/16".

For gluing this assembly, I use thick CA. Remember NOT to glue the TOP on! Your lead weights should just drop into the box.

Draw lines from corner to corner on the bottom of the finished box to find the exact center, and drill a hole and install a 4-40 blind nut. Mark the top in the same manner, drill a hole and install a 1-1/4" long 4-40 hex head bolt and washer, to hold the top in place. Secure the blind nut to the bottom of the box with epoxy or JB weld.

Make a trip to your hardware store and find a small compression spring (say ½" or less in diameter), which sits between the top and the lead weights, to holds the weights in position.

The remaining task is installing the tip weight box in the wing tip, on either side of the outboard tip rib, positioned horizontally somewhere close to the CG. The “top” of the tip weight box will end up flush with the bottom surface of the wing. If you install in a carved wing tip, you’ll want to carefully cut a square hole which closely fits the box.

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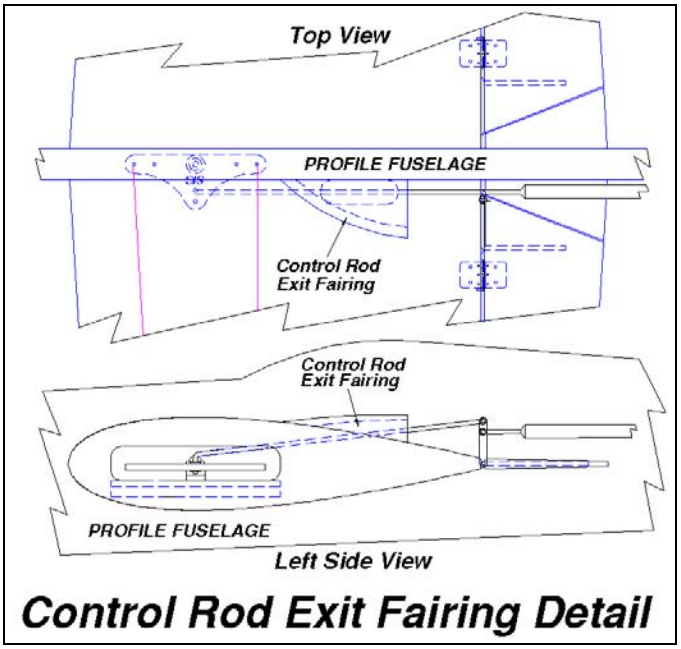
Just a note here - although not terribly critical, the horizontal position of the tip weight box CAN affect the yaw trim on your airplane. If installed too far aft, it will have the effect of swinging the nose toward the center of the flight circle, possibly affecting line tension. The opposite effect occurs if the weight box is too far forward. I suggest that ideally we want to minimize any yaw effects from the tip weight box. (Perhaps we should be using the wing's center of aerodynamic pressure for a reference point, instead of horizontal CG. (Anyone want to tell us exactly how to find it?)

Control Rod Exit Fairing

One of the easier items you can add to your Better Profile is a fairing over the control rod exit hole in the wing. This functional item not only looks good, it helps keep raw fuel and dirt out of the wing. It is easily constructed from a small scrap block of balsa.

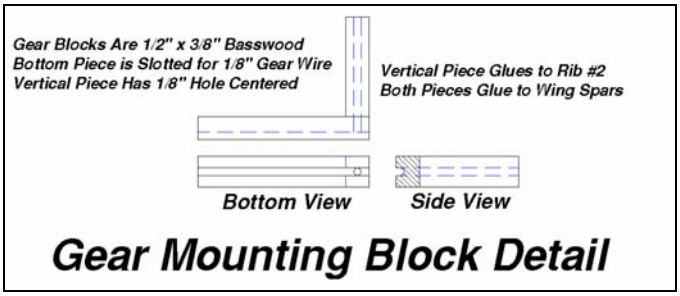


Use an aerodynamic, sexy shape for this fairing. A rectangular box shape, when rounded off, looks more like a loaf of bread than a blister for an oil cooler or supercharger. Smooth Epoxolite fillets around the edges complete the effect.

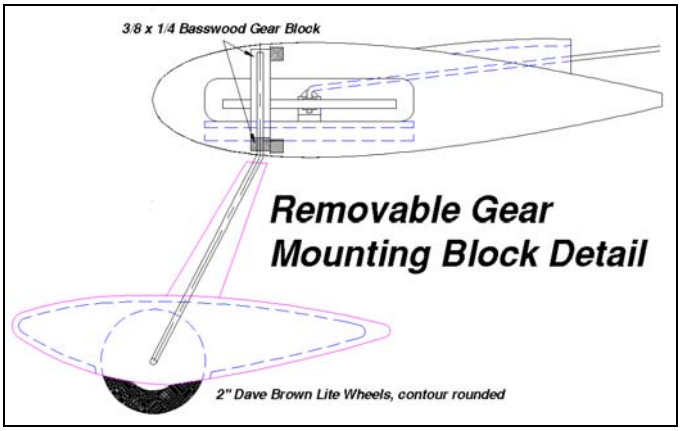
Control rod exit fairing visible on "Justice"

Removable Landing Gear (Wing Mount)

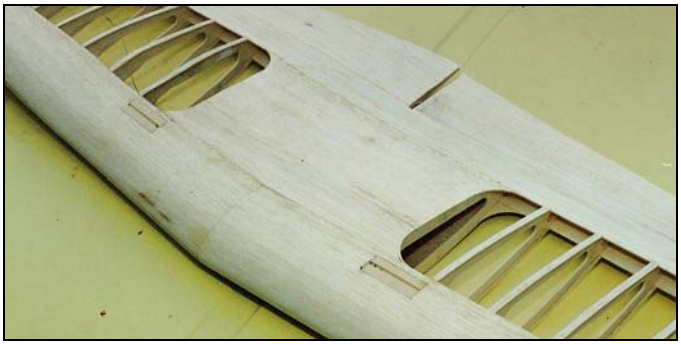
The convenience of a removable landing gear seems so obvious: ease of finishing, ability to change gear, etc. Considering its simplicity, it is the obvious choice for wing mounted gear.



The slotted basswood stock is available commercially, or you can route the 1/8" wire slot (in narrower material, for example).



A simple L-shaped gear mounting block is constructed and installed in the wing, glued to top and bottom spars and a rib.



Gear mounting blocks in "Special Effects" wing

Wheel Choice

I recommend Dave Brown Electra Lite wheels for stunters. These wheels are lightweight and spongy. They look like little automotive "slicks" with their square corners. However, they are easily mounted on a bolt and chucked into an electric drill to be contoured with #100 sandpaper block. I shape them round (like a real airplane tire).

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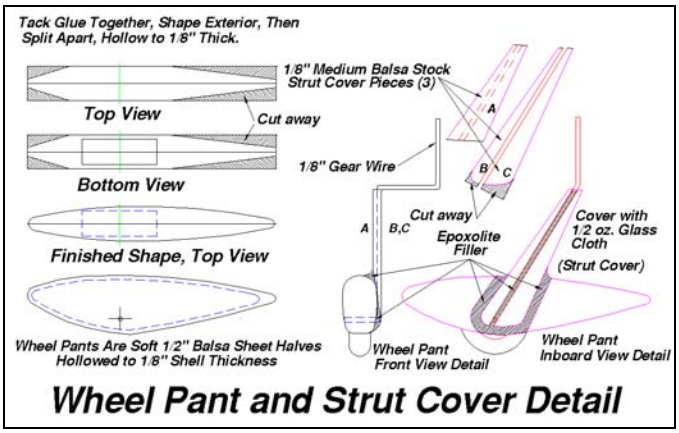
Wheel Pants

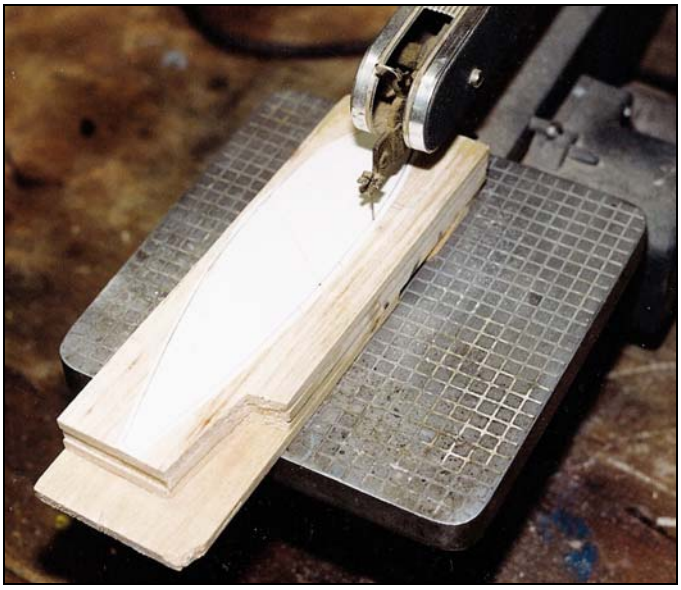
Huh? Wheel Pants? On a PROFILE? (OK, think of them as "training" construction for that *Trivial Pursuit* you plan to build someday..)

Wheel pants are not often seen on profiles. Part of the reason must be that people do not feel a profile ship is worth the construction effort of wheel pants.



I have been trying to extinguish that attitude about profiles - the Better Profile is just as worthy of wheel pants as any full fuselage ship!

There are considerations besides appearance. A proper wheel pant is certainly more aerodynamically "clean" than a raw wheel. You may remember my own ideas about the benefits of drag on a modern stunter - but I was referring to drag placed somewhere near the thrust line of the model - say the fuselage and wing. Clearly, dreggy wheels introduce a couple (torque: force on a moment arm) which acts to pitch the ship downward.



Cutting out balsa wheel pants

Just as wheel pants reduce drag on full sized aircraft, they will on models. They have a potential to HELP the model's trim (unless they are crooked and act as rudders!).

Another consideration is how EASY it is to make your own wheel pants. Contrary to popular belief, we need not pay up to 40 bucks for a commercial set of fiberglass wheel pants (fine though they might be). You can easily knock out a very custom pair in BALSA in an evening or two. The key ingredient is a little patience.

For carving the wheel pant, the same method described for wing tips applies. The typical wheel pant needs to be about 1" thick, so you use 1/2" sheets tacked together. Drill the 1/8" hole for the wheel axle after cutting the outline on the sheets. Once the side view outline is established, use a razor saw to cut away the bulk of excess material of the top view. Go to the coarse sanding block to complete the external shaping.

Remember, aerodynamic shapes, like wheel pants are SMOOTH and ROUND, not sharp and blocky! Much of the perceived beauty of a wheel pant comes from our mind's modeling of its shape in an air stream, and our brain's 'approval' of its Design and Formation (Ask Claus Maikis!). Non-sleek wheel pants not only offend our eyes, but are almost certainly poor aerodynamically.

Once the outside shape of both wheel pants are perfect, and symmetrical (!), we have the slightly complicated task of splitting the halves apart and hollowing them out, with cutouts for the wheels. I use square cuts for the wheel opening on the bottom of each pant. These are easily cut with careful use of the razor saw and a #11 Exacto blade. Otherwise the procedure is similar to hollowing wing tip shells, using the same tools.

Bill Huang's wheel pants, with ultra-light "racing" wheels

Do not hesitate to remove most material inside the wheel pant. There is no benefit to dead weight here - properly hollowed to a thin shell and prepared, they will be extremely light (1/2 ounce per pair or less) and adequately strong. Also, your wheel pant needs to have side clearance for the wheel, yet it should snugly enclose the wheel. So, there's a little patience and precision required here! What else is new?

Once the wheel pants are shaped and hollowed, pop the halves apart and brush on a couple of coats of clear butyrate dope on its INSIDE surface. Though this part of the wheel pant is never seen, it is subjected to moisture and raw fuel. The wheel pant shell halves can then be glued permanently together.

I am assuming at this point that the gear wires are already pre-bent and adjusted so that the model even rolls nice and straight. Right? (grin)

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Also, you have PROPER clearance for your largest prop (don't get carried away here - extra long gear is not desirable on a model!) Make absolutely sure that the gear wires will not require further bending - once wheel pants and strut covers are installed, bending wires will be out of the question. You should leave the gear axle portion of the wire extra long at this point, say 2" - it will be cut to final length AFTER the wheel pants are installed.

Now we come to the (apparently) challenging part of the wheel pant construction - assembly onto the gear wires. What holds it all together? Well, each part holds the other! Here are the engineering principles behind my method: 1) the wheel rides on the wire axle, between washers, and the washer on the bend side is soldered onto the wire [solder on that washer as soon as all bending is complete], 2) the washer(s) on the open side are held on by the wheel pant, 3) the wheel pant is held on by the gear wire strut cover, and 4) the gear wire strut cover is epoxied to the gear wire. Finally, 5) all the external joints between the strut cover are finished in Epoxolite.

Yes, I use balsa wheel pants on ALL my stunters! Here they are on my "Special Effects" full fuselage pipe ship

The first step is to fit the wheel pant to the wire axle. That means threading the axle through the inboard hole, wheel, and outboard hole in the wheel pant. Fit both wheel pants in position, with the model sitting on its gear. That washer I told you to solder to the gear wire axle at the bend should be touching the exterior surface of the inboard side of each wheel pant.

Rotate each wheel pant so that they are 'correct' - that is, typically, they are about level in alignment with the wing, yet the aft portion of the wheel pant has clearance when the model is sitting on the ground. Take your time here. When it is just right, use the smallest drop of thin CA to tack each wheel pant to the axle washer. With alignment established, draw carefully around the washer and the line of the strut wire itself, on the external surface of the inboard side of each wheel pant.

The next part usually upsets the first time builder of wheel pants. You see, a properly placed wheel pant sits CLOSE to the axle bend - in fact, the washer is intended to butt against the hub of the wheel itself, so that the wheel has clearance INSIDE the wheel pant. To accommodate this, carefully drill the axle hole on the inboard side of the wheel pant just large enough for the washer to pass through. Now use your razor saw to very carefully cut a 1/8" wide slot from the hole partially up the inboard side of the wheel pant. (You marked the exact direction of the gear wire earlier.)

Take your time here as well, carefully fitting and re-fitting the wheel pant and gear wire. Properly fitted, the wheel is nicely centered inside the wheel pant and the gear wire ends up about flush with the inboard surface of the wheel pant.

The strut covers complete the assembly, and are made from three pieces of medium hard 1/8" balsa stock. (See drawing). The gear wire sits on top of part A and parts B and C fit snugly on either side of the gear wire. Do a dry fit with the gear wire in place and carefully relieve the strut covers as required to achieve a close fit with the inboard side of the wheel pant. When everything fits just EXACTLY right, assemble the wheel pant with the wheel and all washers and the strut cover, check for the 17th time that the wheel runs true and does not bind, and tack it all together with thin CA.

When both gears are assembled in this manner, make one last check to ensure that the ship really does track straight and roll perfectly free. NOW would be the time to break the tacked joints and correct a problem.

When everything is copacetic, glue away! Use your sanding block to carefully shape the strut cover cross section to a nice uniform elliptical shape. Shape the bottom edge of the strut cover to smoothly taper into the inboard surface of the wheel pant. Don't expect to be able to achieve perfection here until the Epoxolite filler has been added and cured out. Here again, your patience will be rewarded!

A properly finished wheel pant and strut gets sanded to a beautifully smooth, seamless structure with smooth fillets. Use a cutoff wheel to trim the excess axle wire length flush with the outboard wheel pant surface. Once the proper shape is established, sand it all very smooth and apply 2 or 3 coats of clear dope, then apply 1/2 ounce fiberglass cloth over the entire assembly. Carefully sand the glassed part to eliminate any rough spots, but do not destroy the weave of the fiberglass.

Prefinish the wheel pant assemblies with silkspan and clear dope/filler. The soft surface of the wheels themselves can be gently cleaned with lacquer thinner - but be careful! Lacquer thinner dissolves the rubber (which is why it cleans so well).

Underside of "Liberty". What's to NOT love about these wheel pants?

-Larry Cunningham