The Zephyr
ß Boost/Glide

by Dan Wolf

The Zephyr is a boost glider designed primarily for the B engine class. It was designed by Phil Slaymaker back in the 70s when he was a member of the Monroe Astronautical Rocket Society. It is the "big brother" of the Turnup, another of Phil's designs from that era. Plans for the Turnup, designed for 1/2A and A engine classes, were published in the Fall 1995 issue of *Sport Rocketry*. Since appearing there, the Turnup has placed in many NAR regional competitions, and has also taken top places at several NARAMs.

Like the Turnup, the Zephyr is fairly straightforward to build. Like any glider, the key to good performance is building it strong and light. However, when gliders move up to the B and C class, achieving this is not always an easy task. Built too light and the glider will shred, even on a B4 engine. Built too strong and it will glide like a brick. As always, experience is the best teacher. I have had some Zephyrs that were able to survive the boost of a C engine (but never to be seen again after they glided away) and have also had them thermal away on A3-2T engines in test flights.

Assembly is fairly straightforward. Start with the wing. Cut out the wing as a single piece from 3/32" or 1/8" light C-grain balsa. For beginners, I recommend the later. See the plan for Phil's recommended balsa density in each size. Airfoil the wing with the high point 30% back from the leading edge using the following procedure. Cover the front third of the wing and sand the back two thirds of the wing to a taper down to 1/16" thickness at the trailing edge. Start with 220 grit sandpaper. Once the back side of the wing is done, uncover the front third and sand it down to a taper, rounding it too. Make sure that the same amount of balsa is removed from each wing half. I usually balance the wing on the center line while airfoiling to make sure it balances there, and do additional sanding on the heavy side. Once it is airfoiled, cut the wing in half, bevel the cut edges and glue the two wing halves together at the desired dihedral (2.5" under each wing tip, 5" total).

The boom is cut from an 1/8" thick piece of hard balsa. In most hobby shops, the narrower pieces of balsa (e.g. 1/8" x 3/4" x 36") are the hard type needed for this. The stab and rudder are made from 1/32" C-grain balsa. Again, the stab is cut out as a single piece. Round the edges of the stab and the rudder (except for the root edge of the rudder).

For B engine class and above I prefer using yellow glue and double glue joints instead of CA. If done properly, there shouldn't be a significant weight penalty. Yellow glue also allows for pieces to be aligned while drying (in other words, it is a little more forgiving). Glue the stab on the back of the boom first. I usually make a "fixture" out of small paint bottles, scrap boom material, and a rubber band to make sure the stab is glued on perpendicular to the boom.

The rudder is attached next. I use a 3" x 5" index card or something similar to check alignment of the rudder to the stab while drying to insure it is square. Once that is dry, the wing assembly is attached to the top. With the tail section hanging off of the back of the workbench, I attach the wing to the boom, again using small square paint jars, scrap balsa, and rubber bands to make a fixture to keep everything square, measuring the distance from each wing tip to the workbench to make sure both tips are the same height. The key is to keep everything aligned as much as possible during assembly. If the two wing halves were kept at nearly the same weight during airfoiling and everything aligned properly during assembly, the likelihood of a spiral glide is greatly reduced. Spiraling glides (once called "Midwest glides") are one of the most common problems beginners have with B/Gs.

The pop pod design shown in the plan is the "Flanigan" standard pod from the *MIT Rocket Society Competition Handbook*. This pod insures straight boosts. Feel free to use your favorite pod design instead. The Flanigan pod uses a piece of spruce to make a hook that fits in a notch cut from the boom. See the *Competition Handbook* for details. In fact, I recommend obtaining it and building the variety of gliders in it to gain experience.

For finishing, I always tissue my gliders. This is especially recommended for gliders in the B class and above. Tissuing with Japanese tissue adds very little weight but greatly strengthens the glider. It also adds visibility. Use a bright color on top such as red, yellow, or orange, and black on the bottom.

C-Grain Balsa?

Glider plans often call for using "C-grain balsa" for the wings, stab, and rudder. The different cuts of balsa (A-grain through C-grain) depend on the angle at which the piece was cut from the balsa log, relative to the growth rings of the tree. So, how do you identify the types of balsa in the hobby shop?

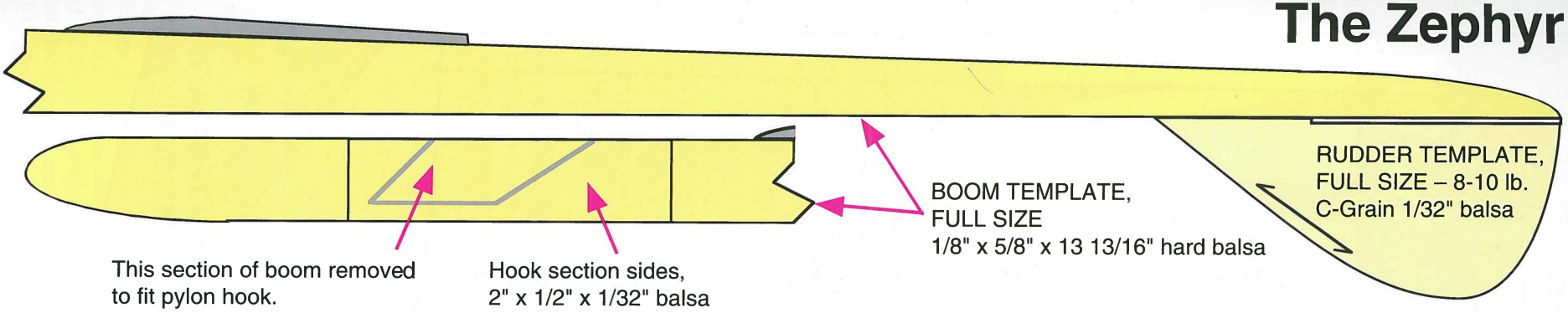
A sheet of A-grain balsa has long grain lines on the face of the sheet. A-grain is very flexible across the width of the sheet. This cut of balsa is great for rolling balsa tubes, but it tends to warp easily, so it is not good for glider wings.

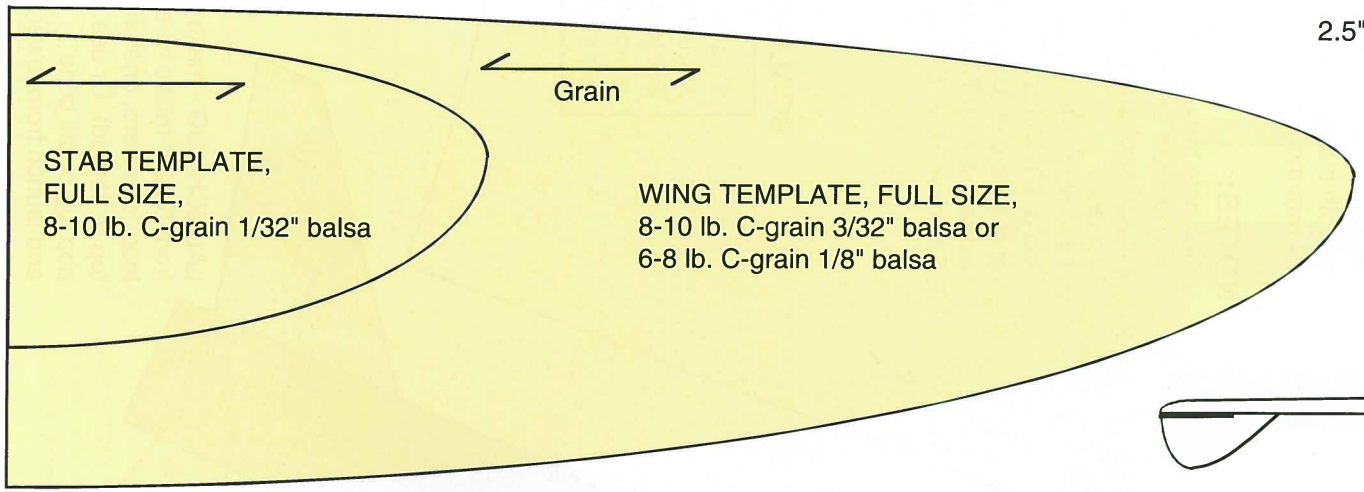
A sheet of C-grain balsa has a mottled surface, with shorter grain lines along the length of the sheet. It is very stiff across the width of the sheet (and would split if you bend it too far). This stiffness makes it resistant to warping, so it is prized for use in glider wings.

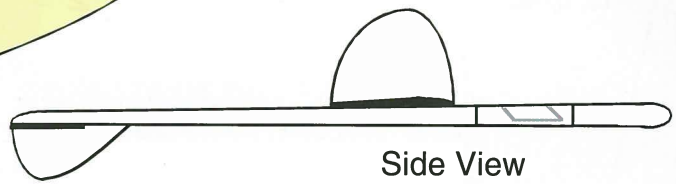
Most balsa you find may be of the B-grain cut, with properties and appearance between those of A and C.

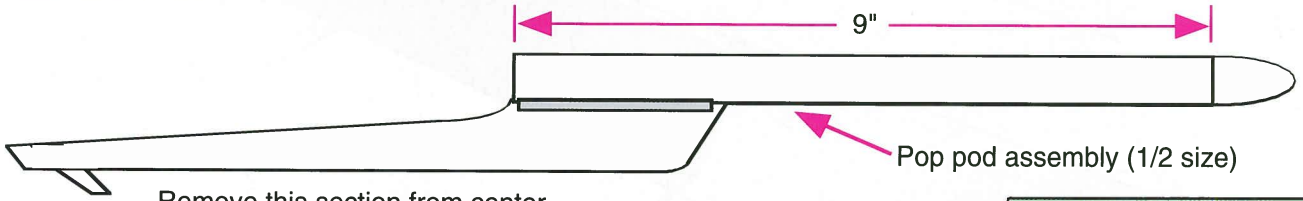
Also pay attention to the weight of the wood. A lighter sheet will give your glider lighter wings. Denser, harder balsa is better for the fuselage of the glider.

The Zephyr

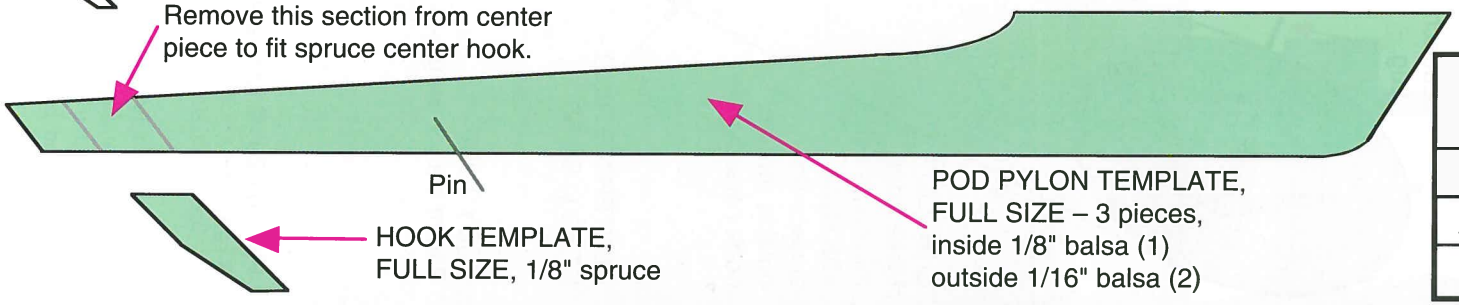








Recommended Engine: B4-2



Zephyr BG

B Boost/Glide Plan

Designed by: P. Slaymaker

Drawn by: D. Wolf