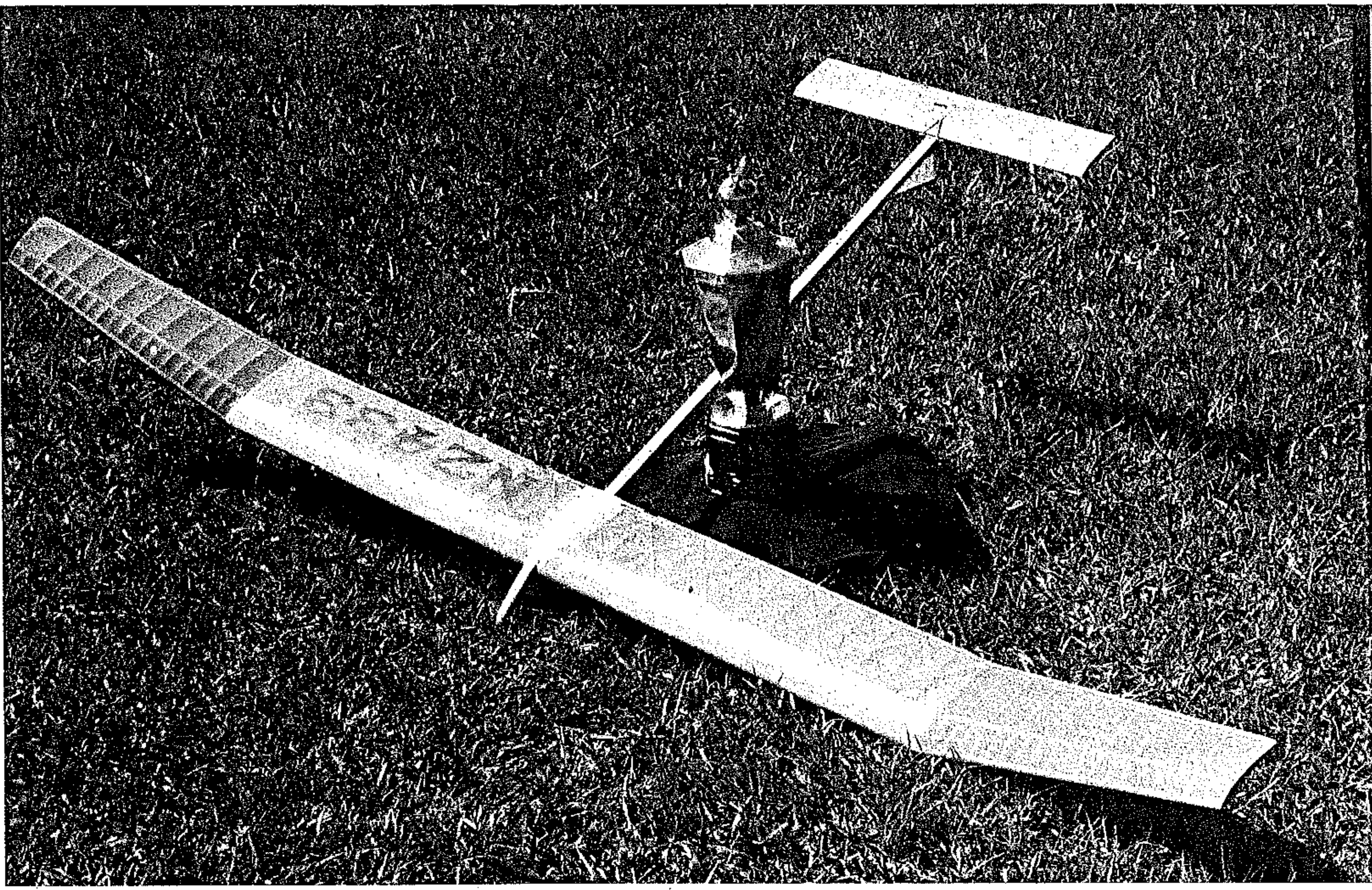


The Pacer 15 and the Swedish Glider Cup, the latter the Individual World Champion award for F1A (A-2 Towline Glider). Gewain was only the second American to win the coveted award; the other was the late Gerry Ritz, who won in 1959. Photos by Gail Gewain, except as noted.

# pacer 15

**We are privileged to present the model which won the 1983 World Championships in F1A (FF A-2 Towline Gliders)—the first U.S. winner since 1959. It is a state-of-the-art model in all respects.**

**■Matt Gewain**

THIS DESIGN is a state of the art F1A model which combines a proven circle-tow mechanism with a strong, lightweight structure reinforced with carbon-fiber and fiberglass materials. The result is a model which gives high performance and consistency. The Pacer is not intended as a beginner's model, but like all good contest designs, the model is simple to build.

I had been flying Nordic Glider for quite a few years when, in 1977, I was transferred to the Los Angeles area. I quickly discovered that, if I was going to compete in that hotbed of Glider activity, I would have to design an improved Glider and dedicate a lot more effort to preparing for competition.

Since that time, I have built 20 models in the series which I call Pacer. Each has been different, and many ideas were tried and discarded. The most all-round successful design thus far has been the Pacer 15, which incorporated lighter wing tips and tail structures with a glide rudder delay system. The lighter-weight extremities had been used on Pacer 14, a high aspect ratio calm-air model which flew very well in the previous season. The Pacer 15, with this same concept, is a thermal-type model.

The glide rudder delay holds the rudder in a position between straight tow and glide for a predetermined amount of time after the model leaves the towline. This works like an auto-rudder on a Power model, allowing the model to zoom-climb with a rudder position that is independent of the glide rudder setting. The gadget can make trimming of the zoom-climb much easier, and the climb pattern is more consistent.

**Construction.** The Pacer 15 is not a good "first model" for a beginner, as it utilizes a number of unusual construction techniques. Rather than go through a step-by-step list of how the model is assembled, I will just point out the unusual aspects that you may find useful.



474

**Wing.** This is built on a jig which consists of a 1-in. balsa plank 6 in. wide glued to the top of a straight hardwood plank. The lower camber shape of the wing is drawn on one end of the balsa plank, and then a series of spanwise cuts are made ⅛ in. apart in the top of the plank with a table saw. The depth of each cut is adjusted so it comes down just to the lower camber outline. Then, using a razor plane and a sanding block, the balsa between the saw cuts is removed down to the lower surface contour. The jig allows building and repairing wings while always maintaining the same lower surface shape.

The wing ribs are cut from three 1/16-in. sheets of the hardest balsa I can find. The sheets are cut into 6-in. lengths which are stacked and taped together; the rib shape is then cut a little oversize with a band saw. The required number of ribs for the center panels are pinned together for sanding the lower camber to shape with the aid of coarse sandpaper tacked to the wing jig (used as a sanding block). Do the same for tip ribs.

Sand the upper surface of the ribs with a flat sanding block. If any area gets too much material taken off, just Hot Stuff a sheet of balsa to the top of the rib stack, and continue sanding until you have exactly the intended airfoil shape. Then cut away for the D-tube sheeting and lower spar. The ribs are then separated. If you had to add material to the top of the ribs, cut the ribs apart with a sharp knife. The same technique can be used for the tip ribs, giving a very exact, consistent airfoil shape to the wing.

The wing leading edges are built-up by Hot-Stuffing a ¼-in. strip of carbon-fiber sheet down to the lower D-tube sheet, then gluing on a second layer of carbon-fiber in the area shown on the plans, Hot-Stuffing the ⅛ x ¼ leading edge piece on top. I use Jim Bradley's carbon-fiber sheet material. It is cut with a sharp razor blade guided by a straightedge, then glued down with Hot Stuff. It's much easier to use and quicker than loose fibers and epoxy.

I cut my trailing edges on a table saw from very hard blocks of balsa. I do this because it is very difficult to find pre-cut trailing edge stock that is hard enough. In order to build a wing that will remain free of warps with this construction method, it is very important to use the hardest wood you can find for the wing ribs and trailing edges. (A wing that is a little lighter but has warps that cannot be controlled is worthless for contest flying, as you cannot consistently trim such a model.)

After the trailing edges are cut to shape, use a Dremel Moto Tool set up in a router table to cut ⅛-in. slots for the carbon-fiber. Glue the carbon-fiber sheet material to the trailing edges with Hot Stuff.

**Matt is checking the timer and tow hook mechanisms before going to the flying site, a practice he says can save models and much time. For competition flying in the top levels, nothing can be left to chance—and personal fitness is a must. U.S. Air Force photograph.**

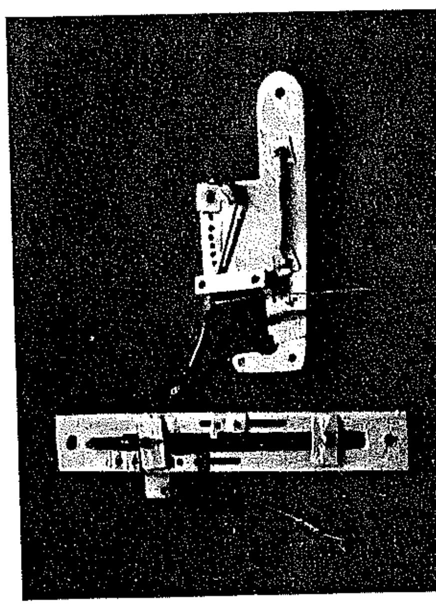
The inboard top spars are built-up next. The spars are cut to shape first, then pinned upside down on a flat building board with the aft edge along any convenient straightedge. A 6-in. length of 3/16-in. aluminum tubing, which will be the wing wire tube, is Hot-Stuffed across the center, on top of the spars, and a balsa fairing block is added behind and extending out an inch on both ends of the wing wire tube. Make sure there are no openings where epoxy can get inside the tube.

Next, shape the fairing block of balsa into a triangular section, as shown on the plans. Then wrap the center part of the spar (cut 5 in. from the center) with a 1½-in.-wide strip of 2-oz. glass cloth so that there will be at least two layers of glass over the entire tube; Hot Stuff the ends. Coat the glass with slow-curing epoxy, and pin the spar assembly, top down, on a flat surface that has been covered with plastic wrap. The epoxy on the exposed surfaces of the spar assembly should be blotted away with a paper towel, leaving only enough to wet the glass cloth. The extra epoxy only adds weight and no increased strength.

Assemble each wing panel on the wing jig. The inner portion of the top D-tube sheeting has two layers of carbon-fiber sheet laminated under the balsa. This was done on a special jig which provides the correct curvature to the sheeting. Then put in the dihedral joints on the wing jig. Next, cut the center panel diagonal ribs well oversize, and fit them in place carefully. Also install the spar vertical shear webs, the spruce leading edge cap, and the root bay planking.

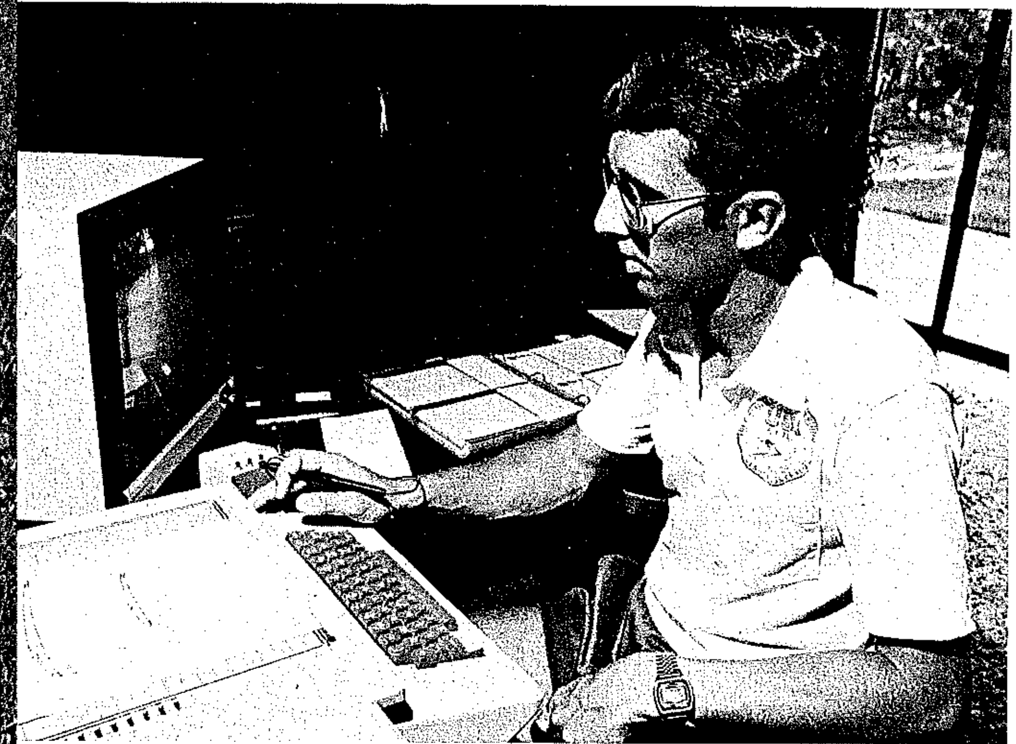
After all of these parts are glued in place, finish shaping the wing. The lower surface is sanded by tacking a sheet of sandpaper to the wing jig and sliding the wing spanwise back and forth over the jig until the bottom is sanded smooth. Use a flat sanding block to shape the upper surface.

Apply two layers of ½-oz. glass cloth to the center panel D-tubes, as shown on the plans, with K&B Super Poxy clear finish reduced 50-50 with thinner. I find it takes about 1 oz. of the mixture. Cut the glass with the weave at 45° to the span, and wrap it all the way around the D-tube, with the overlap on the vertical shear web. The glass is hard to handle before it is applied to the wing, but it adds tremendous strength for very little weight.



**What you see here is the heart of the circle-tow mechanism. The tow hook and base plate are made from aluminum with a band saw, drill press, and many hours of work.**

**Fuselage.** Build it on a flat jig as shown in the pictures by putting down the left-side pieces, then stacking up the nose layers of balsa and plywood. Glue on the tail boom upper and lower pieces to finish the core. After the glue dries, sand the top of the core structure, and glue on the right side of the fuselage. After the fuselage is taken from



**The wing structure was designed with the aid of an Apple II home computer. Design of A-2 wings is more critical than most others—a thin, high aspect ratio needed for glide performance and a great deal of strength required to withstand zoom launches. Air Force photo.**

the jig, add the fin, stabilizer platform, and the wing trailing edge platform. Note that the fin frame is made out of very hard balsa, with the vertical fin post being particularly hard. Cut a hole aft of the stab platform in the top of the fuselage as shown on the plan. This reduces weight and makes running the dethermalizer (DT) line easier.

**The stabilizer** uses normal construction, except that the leading edge and trailing edge are built-up. This is done very simply by pinning down the lower leading edge, spar, and trailing edge; add the ribs, then the top part of each of the spanwise elements.

**Covering, etc.** Note that the spars throughout the model are tapered so the ribs need to be notched individually for their locations. Also, when covering the stabilizer, be sure to stick the tissue down to the top and bottom of each rib; otherwise, the ribs will buckle as the tissue tightens. I use only one coat of 50/50 nitrate on the stabilizer and four coats on the wing. This causes the tissue to sag in damp weather, but this does not affect the model's performance.

Another trick that has proven to be very helpful in making the model more consistent is use of cut-down 12-in. drills (instead of music wire) for wing wires. If you use music wire, the wire will bend after one or two hard launches, and the flight trim will change due to the increased dihedral angle. I have been using the cut-down drills for two years and have yet to bend one.

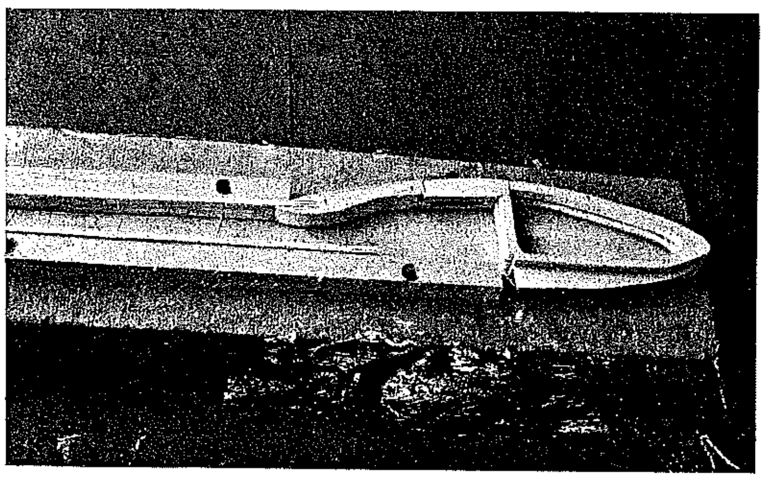
**Trimming** is the most crucial step in getting any model to fly well. Do your trimming carefully. Balance the model 3¼ in. behind the leading edge. Normally, I end up with the model weighing about five to 10 grams under the 410-gram minimum—with the model properly balanced. I tape on the extra weight to the outside of the fuselage at the center of gravity (CG) to bring the weight up to 415 to 420 grams.

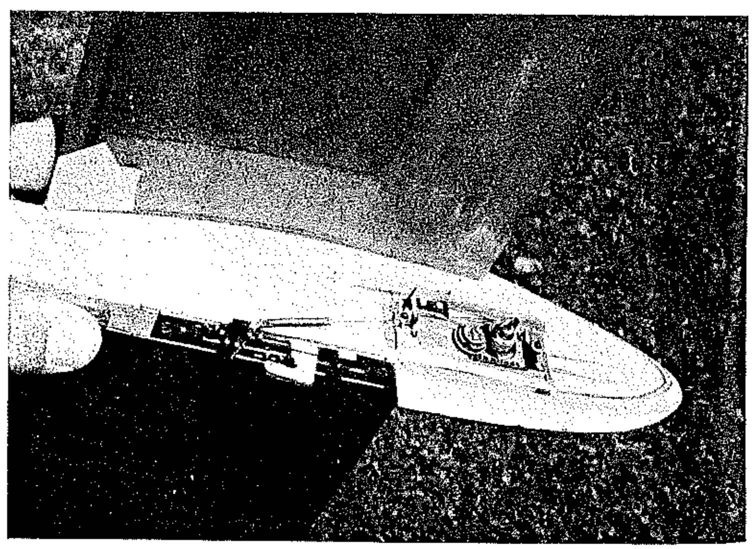
Next, check the warps on a flat surface by holding three corners of a panel down and measuring the height above the surface of the fourth corner. For a right-turning model, the right inner wing panel has 1/16 in. of washin. Both wing tips have ⅜ in. of washout. Verify that the tips are exactly the same by comparing them on the flat surface.

The stab and left center panel should be flat, and the hook position and rudder deflection should be as shown on the plans. The hook unlatch tension is set at 6 lb., and the stab should have a slight amount of right tilt. Take the model to a big schoolyard or other big, open field, and hand-glide it to get the correct stabilizer incidence and to set the circle-tow rudder by adjusting the rudder line turnbuckle.

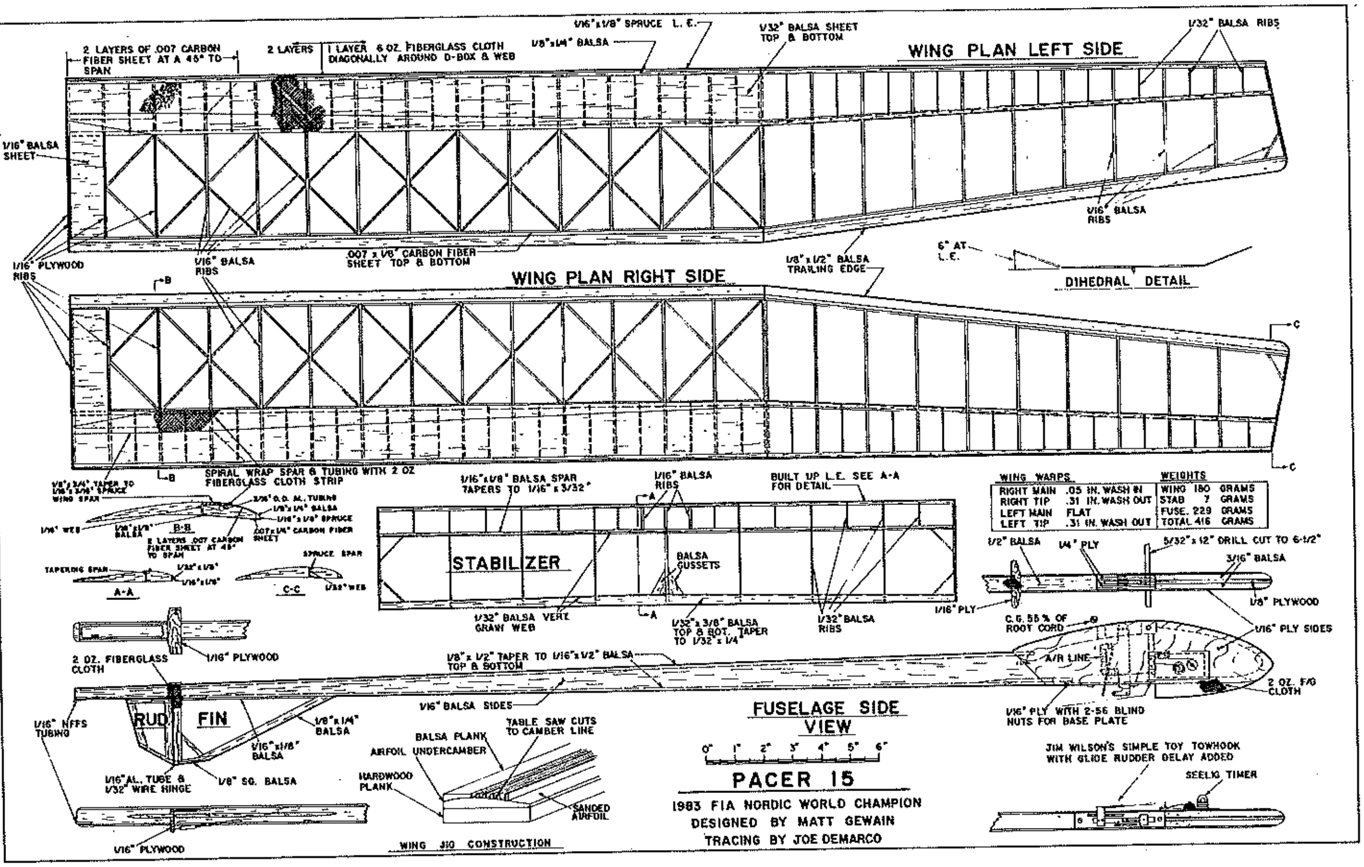
The model is ready to start circle-towing. I always circle-tow the model on the first flight. If you have circle-towed before, you should have no trouble on the first flight. If the model does not turn tightly enough, bounce the model by pulling the nose down a little, then letting the model have a slack line. If the washin and stab tilt are working properly, as the nose comes back up and the model stalls, it will turn as much as 90° to the right.

Circle-tow and glide are easy to adjust by using the rudder and elevator settings. The hardest part to achieve is a good, consistent zoom-launch. Here is the way the launch should work: First, you have the model circling high on the end of the line in a thermal (if you are not in those conditions, you would not want to launch the model). As the model comes around the downwind side of the circle, run a few steps into the wind, and pull in about 10 ft. of line. The model should straighten out into the wind; as the line unlatches, the zoom rudder will cause a slight turn to the right. As the model comes directly overhead, release the line. The model should pitch up and per-





**Above: The fuselage is built in a special jig which aids alignment and speeds construction. Right: Seelig multi-function timer in the Pacer is rigged for dethermalizer and auto-rudder operations.**




form a climbing right spiral of about one-third to one-half of a circle and settle into a glide with very little stall. Note: If you must take more than three or four steps into the wind to build up the model's speed for launch, there is a chance that you may zoom the model right out of the thermal. Always try to zoom the model into a location directly above the thermal where you were circle-towing.

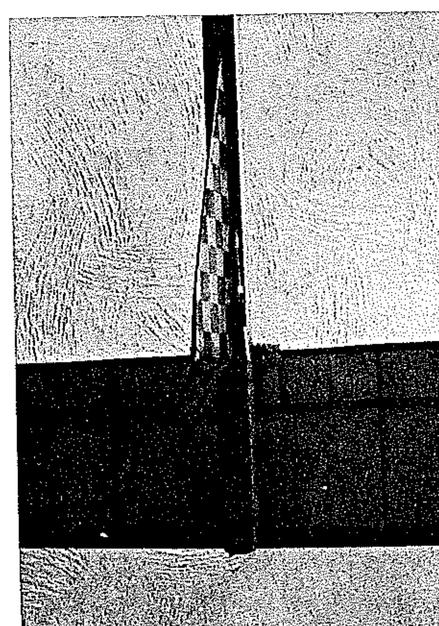
I trim the zoom by using slight changes in the CG position to control pitch and changes in the wing washin and zoom rudder deflection to control yaw. The CG changes are made by moving the small weight (that was taped to the outside of the fuselage) fore and aft. As the CG is moved forward a little, the model will pitch up more on the launch, and it will pull harder on the towline. As the CG is moved aft, the zoom pattern will be flatter, and the stall recovery characteristics may suffer. I normally fly a new model for six months to a year with the weight taped to the outside of the fuselage, and I frequently move the CG a little to see if I can improve the trim on the model.

**Training and tactics.** After flying in many contests over the years, I have learned that very few contests are won based upon one model having superior performance over the others. Most contests are won through consistent performances achieved by having a reliable model and a flier who is prepared (fourmost to fly in a manner to stay out of trouble and, if possible, to fly smarter than the others). The Pacer, along with many other good Nordic designs, has more than enough performance to make a 3-min. max in any round of any contest if the flier does not make any mistakes. The key to winning contests is concentration on training and tactics once you have a good, reliable model.

The first basic part of training is physical fitness. Nordic Glider is the most physical of all the modeling events, requiring varying degrees of stamina, speed, and agility—depending on the tactics you intend to use in your flights. Each flier should establish an exercise routine that allows him to fly in contests without fatigue being a factor. I try to run 30 miles per week. Others bicycle for long distances. Whatever the form of exercise, physical fitness is a necessary part of training for flying this kind of model.

Most of the training for Nordic Glider flying is done through practice flying. Fortunately, this also the most fun. By practice flying, I mean practice with what you are going to do during contests. You should practice in all types of weather with the

*Continued on page 153*



Left: Wing assembly on the jig which is used, also, as a sanding block for the lower camber by tack-gluing sandpaper around the jig and sliding the wing structure spanwise. Right: Rudder hookup, seen from the fuselage bottom, is simple and clean. Note lightweight stab.

Sikorsky S-76 Spirit. The model is 75 in. long and uses GMP Competitor mechanics. Tail drive is accomplished via a speedometer cable. The model features MK retracts and weighs 12 pounds all-up. The model flies very scalelike and will eventually sport four-bladed main and tail rotor systems.

**This month's three-view.** We will look at the Russian Kamov KA-25. Nikolai Kamov, who died in 1973, was one of the leaders of rotorcraft design in the Soviet Union, a characteristic of nearly all his designs being the use of superimposed coaxial rotors to give greater lift in a vehicle of smaller overall size. Large numbers of Ka-15 and -18 piston-engined machines were used by Soviet armed forces, but in 1961 the Aviation Day fly-past at Tushino included a completely new machine designated Ka-2- which carried a guided missile on each side. It was allotted the NATO code-name of Harp. Clearly powered by gas turbines, it looked formidable.

Later in the 1960s, it became clear that Kamov's design bureau, under chief engineer Barshevsky, had developed this machine into the standard ship-based machine of the Soviet fleets, replacing the Mi-4. Designated the Ka-25 and allotted the new Western code name of Hormone, it is in service in at least five major versions with numerous subtypes. Whereas the "missiles" displayed in 1961 have never been seen since and are thought to have been dummies, the Ka-25 is fully-equipped with all-weather anti-submarine sensing and attack equipment. The four landing wheels are each surrounded by a buoyancy-bag ring, which can be swiftly inflated by the gas bottles just above it.

Ka-25s are deployed in two main versions, each with sub-types which have shown changes over the years. The basic ASW model is called Hormone-A in the West and has a chin radar, towed MAD (magnetic anomaly detector) bird, a dunking sonar normally housed in its own rear compartment, and an EO (electro-optical) sensor. The major warships Kiev, Minsk and sister(s) each carry 27 of this model, while Moskva and Leningrad carry 18 each, and the new Kirov about five. Cruisers such as the Kresta and Kara ships normally carry one or two, and three will have been supplied to India by the time that country receives its three Krivak cruisers.

An EW (electronic warfare) version is called Hormone-B, and this one acquires targets for ship-launched missiles, probably providing mid-course or terminal (semi-active) guidance as well as performing other EW duties. It has a larger radar of different shape, another radar under the rear, and extensive, data-like equipment. Three of these are aboard both Kiev and Minsk. BCNU.

*Larry Jolly, 5501 W. Como, Santa Ana, CA 92703.*

## Pacer 15/Gewain

*Continued from page 59*

models you would fly in a contest—and strive to always launch in air that will make maxes. You should practice with other modelers, if possible. There is a great deal to be learned by comparing performances of models.

I believe in practice flying as much as possible. First, I want to know the models' characteristics very well before the contest. Each model has its own peculiarities. Some glide better; some turn tighter on the towline. By learning these characteristics in practice, you can set up the trim and take advantage of these otherwise upredictable differences. Then choose the model that will perform best on a particular contest day. Secondly, with lots of practice, flying the model and launching into thermals become very routine—so I can concentrate on staying out of trouble and flying the best tactics for the conditions.

The tactics you should choose to fly in a contest are very dependent on your ability, the flight characteristics of your model, the weather conditions, and the size and nature of the contest. For example, circle-towing downwind and using piggybacking tactics work very well at large contests if the thermals are fairly strong and you can comfortably circle-tow the model. In many other circumstances, however, these tactics do not work very well. For example, in the early morning with very little helpful air, frequently you cannot tell which models are in good air unless you know the model and watch it for an extended period—so piggybacking frequently does not work for me in these conditions. I would suggest that you develop your tactics by watching the more-successful fliers at each contest and trying different tactics until you find what you are most comfortable with for any set condition.

If your goal is to be a successful competitor, nothing will better prepare you than actually competing. Fly in as many contests as you can. Develop tactics and model trim for all conditions. Do not give up when you drop a max—it only means you need more practice, and the best place to practice is when you have contest conditions.