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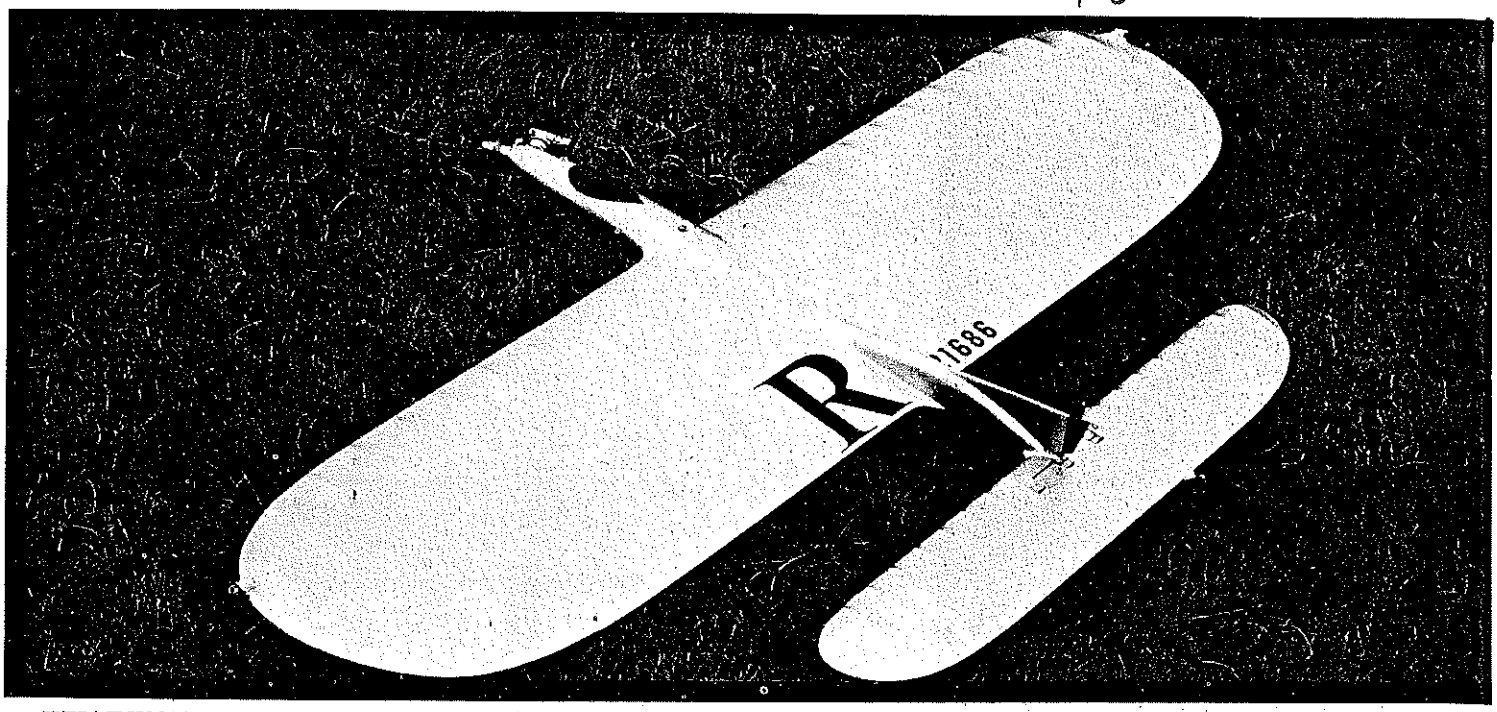
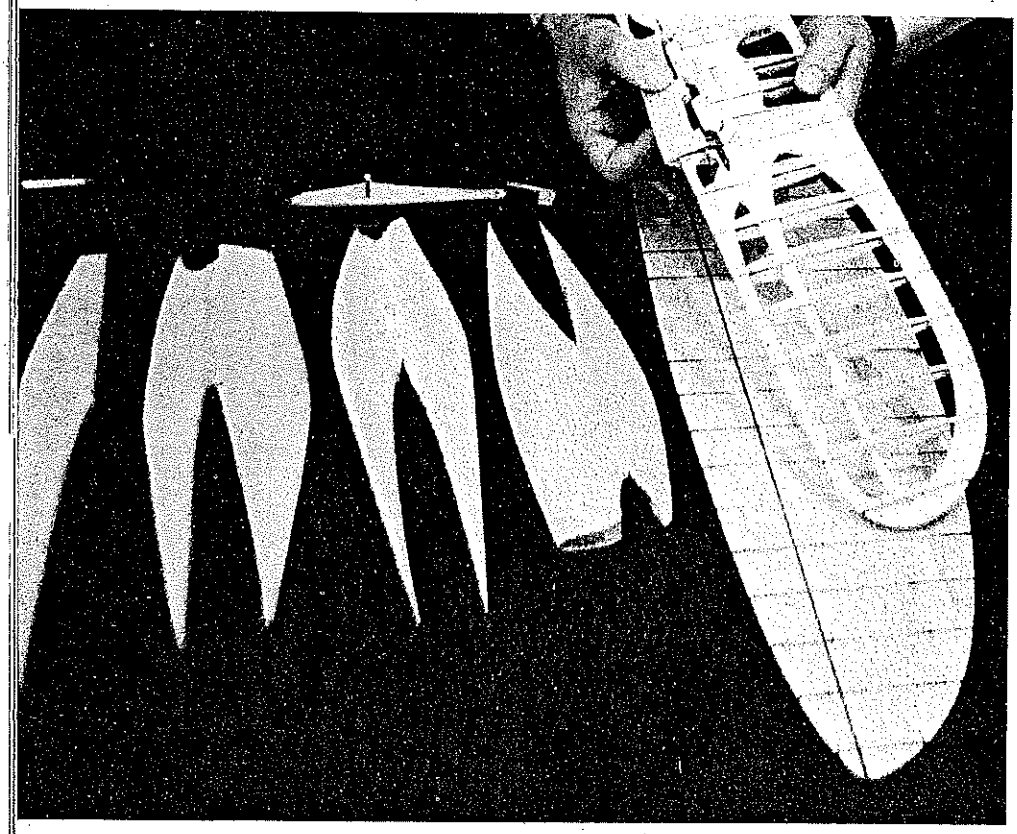


WHAT WOULD *YOU* call a model which so totally flies in the face of tradition in both concept and size? It may not be the ultimate Stunter, but I feel that it is the closest approach to that pinnacle yet obtained. The design of this model has been developed over several years of extensive testing. Except for the part of my as-yet unconfirmed airfoil discoveries, most of the aerodynamic design of this Stunter owes its inception to the genius of Bill Netzeband, with whom I have been working closely for years.

The quest which Bill and I have been on is to get a Precision Aerobatic model which will actually do a 5-to-7-ft.-radius corner (as per the AMA rule book) in the square and triangular maneuvers. We have definitely proved, both by photographic and advanced optical-measurement techniques, that no previous Stunter can even come close to turning that 5-to-7-ft. corner—no matter what it may look like to the naked eye of a judge or observer! Ridiculous (R) can do it with ease and consistency.



Top: If not ridiculous, then certainly unusual. Looking quite a bit like a Combat ship, "R" is a very special plane that can actually perform a rule book 5- to 7-ft.-radius turn. Note the large amount of engine offset (22°) necessary to provide sufficient line tension. Above: Here we see the simple act of snapping the stab mount into the stab. Note the gap in the center section stab ribs that allows the hinge pin to slip right into position. Top-half ribs on each side are then glued on, and top gussets are added just behind the hinge line to the ribs/stab center plank section for needed structural purposes; remember to "build in lightness."

Our tests (and Bill's calculations) showed that the only way to get that minimum-radius turning capability was to decrease the wing loading. If we had stuck to the conventionally-sized engines, our models would have been of truly monstrous size in order to get the wing loading we wanted. My Real Double Voodoo model (1,325 sq. in. with a Webra Speed .61—see Bill Winter's "Just For the Fun of It" column in the November 1980 issue of *Model Aviation*) was one experimental step in that direction, and it really didn't do the job—at that time. (Later experiments have brought its performance up to expectations.) *It* was the one that was ridiculous!

The Cox Tee Dee .049/.051 engines have a very good power-to-weight ratio, so it was felt that we should exploit this possibility. From that point, Ridiculous just grew! It was designed for fun and for ultimate CL Precision Aerobatics performance. Clearly, it is in no way what most modelers would think of as a ½A Stunter. It is, instead, a CL Precision Aerobatics model, powered by a ½A! I fly it on 50 to 70-ft. lines (depending on wind conditions) in competition. For real hair-raising demonstrations, I'll fly it on 26-ft., .012 lines for a pattern at "Combat speed."

R is not a fast airplane. For real precision, a model needs to be fairly slow—particularly when we're talking about lap speed, the length of time it takes to get around the circle once in level flight. In calm air, I can use 70-ft., .008 lines and fly a lap in from 6.1 to 6.3 sec. Under most weather conditions, R is at its best at about 48 mph. Even 52 mph isn't too bad,

ridiculous

Designed specifically to perform a true 5- to 7-ft. corner for CL Precision Aerobatics competition, our author takes an in-depth look at the unusual characteristics necessary for a model to meet such a requirement. While the plane's size and looks—using a Cox .049/.051 engine and flown on 50- to 70-ft. lines—may justify the name, its performance is anything but ridiculous. Part 1. ■Rich Porter

especially on the longer lines.

To get that kind of performance out of an .049 dragging a 555 sq. in. wing (at a weight of about 20 oz.) and 50 ft. or more of lines, we've got to work the engine hard. I've done a lot of experimenting with fuels, props, and engine setups, and I have my own personal preferences in that line, but for the flier who just wants to build R and have a ball flying it (and maybe winning some Stunt contests!), I suggest using a stock engine with a slightly modified needle valve (for infinite adjustment), a bored-out venturi, 15% nitro fuel, and a Cox black nylon 5-3 prop. It should turn about 22,200 to 23,500 rpm in the air at 46-52 mph. (You can check engine rpm if you use the technique given in my "Musical Tach" article in the January 1981 issue of *Model Aviation.*) Airplane trim and weather conditions affect airspeed; rain on the model can slow it down 5 mph!

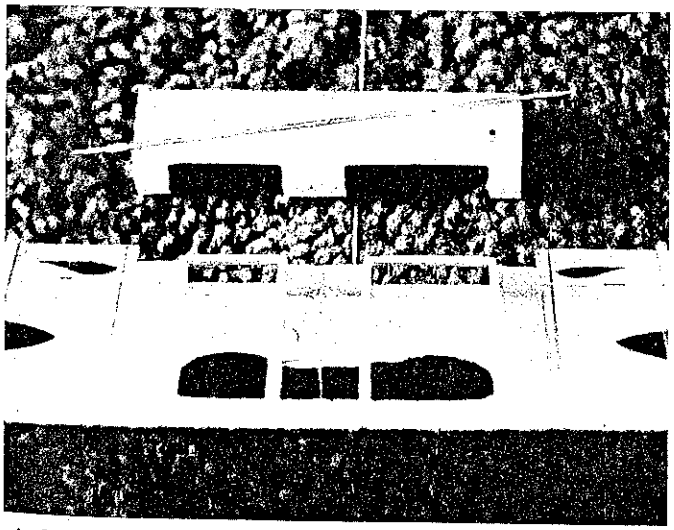
To keep the little engine running steadily through all maneuvers, you'll need a super fuel-supply system. I use a pressure bladder system with two bladders, a fuel filter, and a fuel shutoff to attain maximum consistency. I'll describe this more fully later in the article.

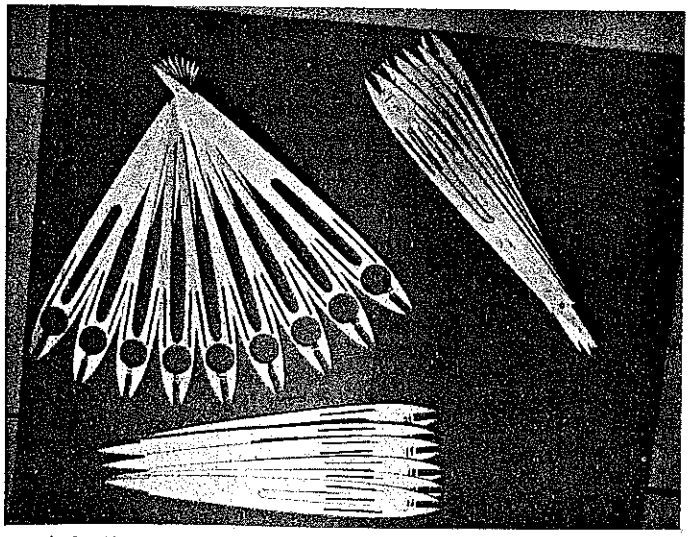
Line tension can be quite light, and very precise elevator control is needed. Due to these factors, I use a very large bellcrank to give plenty of "muscle" to handle surface air loads—and a custom-fitted, fingers-only control handle. I'll describe these more fully later on. If you don't intend to try any precise flying with R on long lines, you can use an ordinary large commericial bellcrank, but you will have to experiment with the line-spread dimension on your control handle to harmonize it with the bellcrank.

Don't even think about trying to put one of those exotic, aesthetically-pleasing, glass finishes on R. It would make the model too heavy to do its thing. With R, you've got to "add lots of lightness" in all its parts! Use MonoKote for covering, and maybe a little dope on the fuselage.

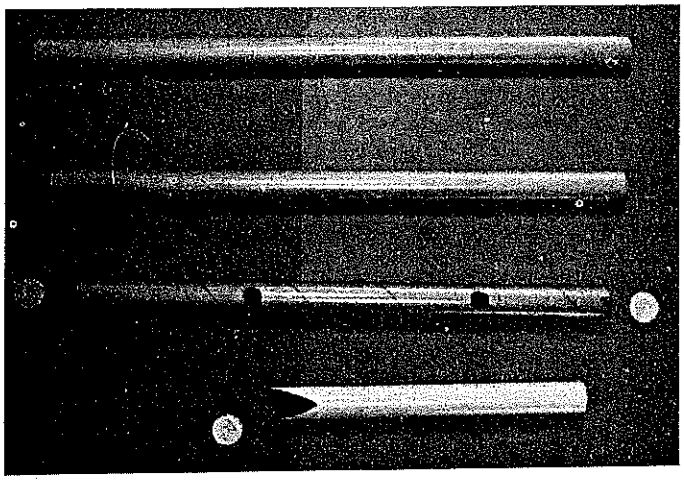
One negative aspect of R's light wing loading and sharp-turning ability is that these factors can allow it to appear to bob around unacceptably in turbulent air. This phenomenon of lightweight ships on long lines can influence some judges (those who seem to prefer flight characteristics that resemble some sort of "flying forest on a bombing run") into giving an otherwise-superior-flying airplane low maneuver scores. The moral of this is to either not get too precise about literal rule-book performance flying capability for competition, or learn to enjoy the agony of defeat! However, a really fun thing for me is to continue to flail away in competition with such machinery and enjoy the challenge of trying to accomplish the impossible. Sometimes, superior flying performance can actually wipe out the formidable force imposed by the very impressive-looking/sounding arsenals of the conventional Stunt heavy weaponry.

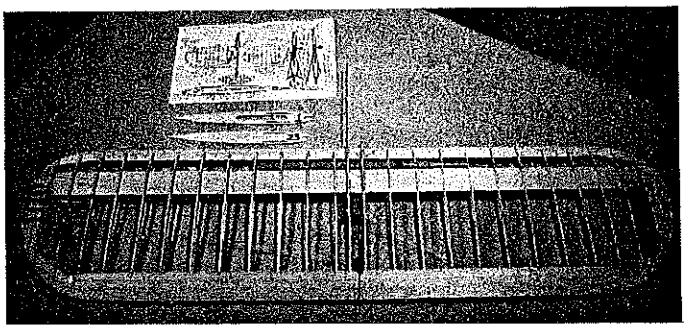
At any rate, everybody really enjoys



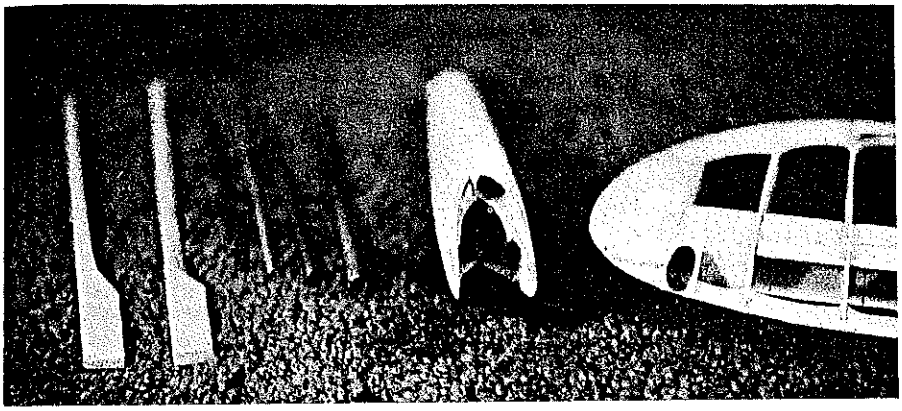


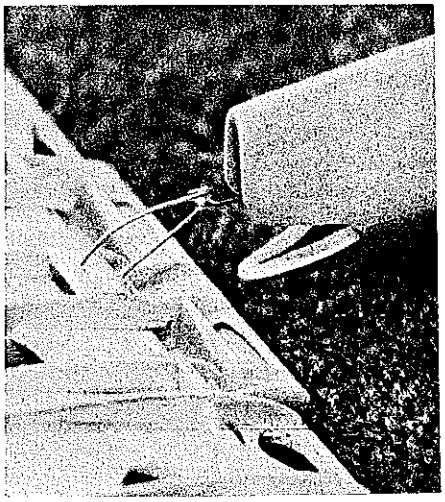
Left: The top section of the stabilator complete to the point where it is ready for the installation of the stab mount. The top halves of the ribs and the gussets will be installed after the stab mount has been snapped into place: Right: The uniquely-shaped ribs used in the wing.





Left: Rocket tubes used to hold the fuel bladders. The tubes are coated with epoxy paint or glue to fuel proof them, sanded smooth, and then plugged with 1/16 balsa end caps. Above: Ribs numbered 1 and 23 result from stack-sanding all the ribs and then deciding those two would not be needed during the designing/building stages. Note the five lead-out guides that allow experimenting with different line rakes for various wind conditions and line lengths.





Above: The forward-facing wing tip weight box made from a section of ½-in. rocket tube. It holds the weight snugly, but allows it to break free in a crash to minimize structural damage. Also in the picture are a nose pod (rear view, with its lightening holes), the special hollowing chisels made from sharpened brass tubing, and the engine mounts. Right: This picture shows how the Z-bend can be threaded onto the soft steel, infinite-adjust control horn. The balsa sheeting is not yet installed on the stab mount or in the two spaces between the innermost rib pairs. Note the internal built-up stab mount structure. All pictures by the author.

CLPA competition so long as fun and fellowship are the main emphases and the victory is always uncertain enough to ensure lots of excitement.

I hope that, at this point, I've convinced you that you just have to have your own R to wring out. If so, here's how we do it.

Construction. It really doesn't take an overly-observant CL fan to notice that R is not much more than a highly-modified Combat design that takes a little extra time to build in order to eliminate most of the structural deadwood. Since weight is the critical factor in this airplane, care must be taken to build as lightly and efficiently as possible. Soft to medium wood is acceptable.

Stabilizer. Contrary to usual practice, let's make the stabilizer first. It is probably the most difficult part of R to build, and it has to be lightweight. Covered and ready to install on the monoboom, the stabilizer and its mounting stub should weigh no more than 1¼ oz. Begin by cutting the stabilizer plank from a sheet of soft to medium weight ⅛ x 4-in. balsa. This provides more than enough mass to handle air loads and to resist hangar rash encounters. The pattern of weight-saving recess areas shown on the plans is for medium weight wood. This makes the plank more efficient structurally, and the whole stab is stronger and lighter than if an unrecessed plank is used. Softer balsa should probably have smaller recess areas.

The 3/32-in. brass tube bushings are glued to the front of the plank as indicated and reinforced with a wrap-around layer of nylon fabric. The ribs (actually made up of upper-half and lower-half pieces) are glued on each side of the plank and sanded to final shape with a sanding block. Ribs are 1/32 balsa, with the exception of a few 1/16 ones adjacent to the hinge bushings, as shown on the plans.

If you're looking for a way to cut corners on building, you might elect to use a piece of flat ⅛-in. balsa for the stab-mounting stub instead of the more streamlined unit shown on the plans, but it could produce a little more drag and might not look as neat.

The built-up stab-mounting stub is made on a 1/16 balsa plank. The 3/32-in. brass bushings are glued to the front and reinforced with a wrap of nylon fabric. The 1/32 balsa ribs are glued in place and sanded to shape. Add the two horizontal-grain, vertical 1/32-in. webs, then the top and bottom 1/32 sheeting. The final step is to add the three sections of vertical-grain 1/32 balsa webbing over the hinge bushing areas. It will probably be easier to Mono-Kote (or dope) the assembly now. If it's doped, be sure to mask off the area where it will be glued to the monoboom structure. MonoKote can be cut and peeled off later, if it's used here.

Before the stab is covered, it must be joined to the mounting stub. A 1/16-in. music wire hinge pin is used. A short section of the same brass tubing used for the hinge bushings is cemented to one end of the wire, before it is run through the hinges, after which an identical piece is glued to the other end. Use cyanoacrylate instant glue (CyA) for this purpose, but be sure to sandpaper the ends of the wire first and to wash the wire ends and the inside of the end retainer tubes with a good solvent (to make sure there's no oil or grease on them which would prevent the glue from sticking). I apply graphite grease to the bushing/pin areas to prevent instant glue "lube" from ruining my day.

Another item which needs to be completed before covering the stab is to add the 3/32-in. spacers and gussets to the 1/16-in. center rib-pairs. Also, add the 3/32-in. horn-mount reinforcement and the elevator horn.

The elevator horn is super-easy to make and provides an infinitely-adjustable trim feature. Make the horn from a piece of fairly heavy (18 gauge, or so) iron wire, the kind you buy at the hardware store in a roll. Use a piece about 6-in. long. Take a piece

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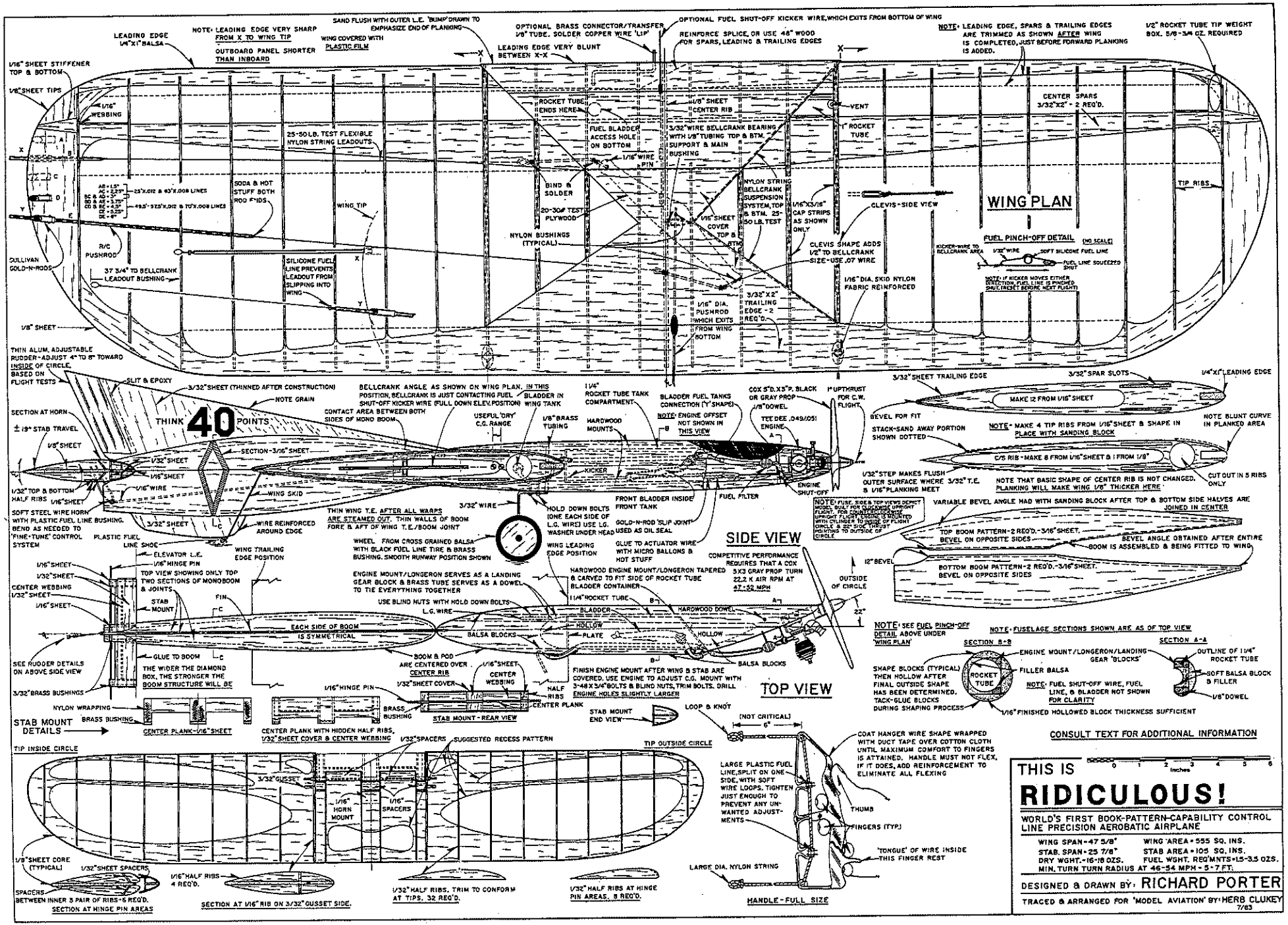

Full-Size Plans Available . . . See Page 104

Ridiculous/Porter

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of 1/16-in. music wire about 2 in. long, and insert it into a ½-in. length of small-diameter plastic fuel line. Hold this in a vise (or with a pair of pliers) while you wrap a turn of the iron wire around it, pulling the loop *tight* around the plastic tube/music wire. Squeeze the loop with pliers until it compresses the plastic slightly around the music wire. The iron wire should end up with the two loose ends sticking in the same direction. They can be cut to a length of 1¾ in. Pull the music wire out of the plastic fuel line, hit the tubing/iron wire connection with a few drops of CyA, cut off the excess length of plastic tube on each side of the iron wire, and presto! There you have the finest adjustable, bushed control horn that can possibly be made.

I use this same horn system on all my Stunters, even up to .60-size, with nary a problem. The pushrod will bend or the stab will break before the horn will bend substantially. Use a pair of needle-nosed pliers to finish shaping the horn, then epoxy it in place on the stab. It's best to sandpaper the wire where it will be glued to the bushing and the stab structure to assure that the glue will hold well.

Once this is done, the stab can be covered. I'll warn you ahead of time that this can be a heart-stopping adventure the first time you do it, because the shrinkage of the iron-on plastic covering, as you seal the edges with an iron, will warp the stab pretty severely! Just ignore the warp, and cover the other side. You'll have to iron out the warps as you shrink the covering. Start from the tips and work towards the center.

Wing. The center spar system was used in an attempt to help develop an airfoil with minimum skin friction drag characteristics. To minimize warps and other irregularities, I not only stack-sand the ribs with stub spars in the rib slots, but I also number every rib in the exact order that it came out of the stack. The ribs are then installed in the wing structure in the same relative position they had as they came out of the stack. The center ribs, which will be planked and cap-stripped, require a little more work. Slip them back on the stub spars, and sand the aft part of the ribs, from the airfoil high point to the rear end, leaving only a 1/32-in. step where the trailing edge (TE) starts, thus eliminating any abrupt "step" in the outer surface at the TE/center-planking joint.

The center spars, ribs, leading edge, and rocket-tube bladder-tank container are all going to be assembled at once, so get all of these parts ready. The ribs are 1/16 sheet balsa, as per the plans, except for the center rib, which is ⅛-in. Make the circular cutouts for the rocket tube in only the center ribs, and then only after they have been stack-sanded. Cut the 1-in.-dia. rocket tube to a length of 9½ in., as shown on the plans, and coat the inside with two thin applications of epoxy paint or glue, lightly sanded between coats to make it slick and fuel proof. Make end caps of 1/16 balsa, fuelproof them with epoxy, and epoxy them in the ends of the tube. Cut the access and vent holes in the tube as shown.

Note that the spars are plain, flat 3/32 x 2 x 43¾-in. balsa, at this point. The weight-saving scallops will be added later. If you can't get 48-in.-long balsa for the LE, TE, and spars, splice them from shorter lengths as indicated by the dotted lines on the plans. Note that the rib spacing on the outer part of the outboard wing panel is different than on the inboard panel. (The outboard panel is 1 in. shorter than the inboard one.) The LE is a piece of ¼ x 1 x 43¾ balsa, and it will be easier if you taper the front before assembly.

Slide all of these parts together, and line up the wing structure very carefully. Try to get it as straight and warp-free as possible at this stage. When you're satisfied, bond it all together with CyA glue.

There are at least two different methods of making the trailing edge. Use your favorite. The lightest method is to pre-join the two 3/32 x 2 x 36¼ balsa sheets at the edge with CyA glue, then slip them onto the ribs and glue on one side (top or bottom) at a time with CyA—using a long spout. Be sure to sand a nice bevel on each sheet and make a trial fit before gluing.

The more-accurate method is to attach one of the TE sheets to the top or bottom of

the structure with CyA, then bevel the aft edge so that the second sheet can be easily laid right on top of the ribs and beveled edge. Apply 5-min. epoxy to the ribs and the beveled edge of the installed sheet, and lay the second sheet on, pressing it into place with a straight-edged piece of wood to ensure a straight TE.

Get out the teakettle, and steam/twist all warps out of the structure. Hold the warped portion in the steam and twist the warp out, even going a little past the neutral position, then letting the structure cool while holding it in the de-warped position. This may have to be repeated a few times to eradicate the warp.

Add the wing tips. Either follow the plans, or design your own aesthetically-pleasing shape from 3/32 or ⅛-in. soft to medium sheet balsa. Sorry, but the tip shape doesn't seem to matter much as far as performance goes. Make both tips the same size. The two tip ribs on each side are made in much the same manner as on the stabilizer. Use a sanding block to help blend everything together so that the finished product will look as if you planned it that way. Again check for warps, and steam out any that may have crept in.

The bellcrank and lead-outs should be installed now—also the fuel shutoff if you intend to use one (I highly recommend the shutoff, as it's very handy to abort a flight if the engine is not running right). This stage of construction is very critical, because any control friction or slop here is going to be virtually impossible to correct, and the final result could end up being a wild, hunting beast.

I use 25 to 50-lb.-test nylon string for lead-outs. At the lead-out guides, I use sections of the outer tubing of Sullivan Gold-N-Rod (red tube) material. There are five of them to allow me to string the lead-outs through various combinations in order to adjust the line rake (which is vital if you are going to experiment with different line lengths and wind conditions).

In order to reduce friction and possible wear on the nylon string, I encase portions of the lead-out in the inner rod sections of the Gold-N-Rod material. The plans show this clearly. Not only does the lead-out run through the tube, but I also add a length of lead-out string in parallel with the lead-out, to provide "strain relief" where the lead-out emerges from the tube. The tube is affixed to the lead-out and strain relief with CyA glue and microballons at each end. Taper the glue/microballoon glob smoothly to eliminate any possible stress points that might develop with age. The lead-out rod runs a sufficient length to protect the entire length of lead-out which contacts the lead-out guide sheath. A ⅛-in. slice of silicone fuel line is pressed on the outboard tapered end of each inner rod to prevent it from falling through the lead-out guide and into the wing (these are easily removed and replaced during line-rake changes).

I also use the inner rod material on the bellcrank/engine shutoff kicker wire contact points and as an exit guide for the fuel shutoff pushrod where it goes to the engine. A section of outer sheath is glued to the fuel shutoff wire at this point, providing an oil-deflecting slip joint which keeps engine oil out.

Before even thinking about planking the center section, *be absolutely sure* that the control system is tight and friction-free in every line-rake mode. Once again, steam out any warps which may have developed in the wing structure since the last de-warping operation; *do not wait* until after the top and bottom planking are added, or you will be *very* sorry.

The plans show a bellcrank-support suspension system which I heartily recommend. It is extremely rugged, and the bellcrank should never pull out. The string reinforcement along the planking even helps prevent the outer wing panel from coming apart in the event that "underground flight" is attempted. The suspension system uses the same 25 to 50-lb.-test nylon string material as the bellcrank lead-outs. The string is put in place before any of the planking is attached. Press light "dimples" into the ribs where the string crosses them, and glue the string in place. After the planking has been added, glue the string along the inner edge of the planking. (If you wish, you can leave out the string suspension system and use a ¼-in. center rib reinforced with 1/16 plywood.) Now, add the 1/16 balsa planking, using a convenient-width sheet for quick and easy as-

sembly. Also add the 1/16 x ⅛-in. cap strips. The leading edge is rounded to a very blunt curve in the planked area.

After the planking and cap strips are dry comes the fun part: "adding lightness." If you want R to have its maximum performance potential, this is a step which you must not omit. Incredible as it may seem, if properly done, "adding lightness" can result in a finished model being much sturdier than if this often-disregarded principle is overlooked. Mark the limits of the area to be removed with a soft pencil, then carve and sand the LE, spars, and TE to final contours. After all warps are steamed out, use coarse sandpaper to thin the TE to approximately 1/16 in. The plans show what can best be understood as a general strategy of concentrating the model's structural mass in the center and tapering the structure toward the wing tips, stab, stab tips, and engine mount in such a way as to approximate the strength needed at every point to withstand the variable stress patterns that can occur as a result of a vertical dive into the ground, so as to maximize the probability of structural survival of the impact forces.

The recommended outboard wing tip weight "box" is made from a length of ½-in.-dia. rocket tube. Carve a ⅛-in. piece of balsa as a plug for the aft end, and epoxy the tube in place in the wing tip. Shape the front end of the tube with a sanding block to match the airfoil section. The lead weight should be pointed on the front end and wrapped in sponge rubber so that it is a snug fit in the tube. Cover the open end of the tube with transparent tape until you have arrived at the final, trimmed weight needed. Then put a patch of MonoKote over it. The glory of this scheme is that the tip weight can bash its way through the tape/covering in the event of a crash, and its mass will not break any of the structure, which it could do if it were glued in place. Cover the wing with iron-on plastic film. Chrome MonoKote on top prevents hot sunlight from warping things.

Sources of rocket tubes. A few hobby shops with model rocketry supplies may carry separate rocket tubes in stock. Otherwise, at the local level, you'll have to buy one or more model rocket kits to get the tubes. If you can be a bit patient and are willing to order by mail, you can get catalogs and prices from either Flight Systems, Inc. (9300 E. 68th St., Raytown, MO 64133—very crush-resistant tubes, many sizes available, finished in bond paper for better gluing, $1 for a catalog) or Estes Industries (Penrose, CO 81240—tubes are thin and lightweight, glassine finished, free catalog). *(To be continued.)*

Nuremberg/Moulton

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indicative of the growth of Spanish industry. All their kits are neat, and many are nearly to scale or true scale. The range is from FAI Combat, to an RC Tucano for