Blueprint for beginners Part II • • • • •

***RCM's** yellow, white, and black Virus — CS 505 4 & Septalette provide proportional rudder*

the virus

Flight Tested by RCM

• • • **by KEN WILLARD**

STEP-BY-STEP INSTRUCTIONS FOR THE IDEAL BEGINNERS SHIP

Full Size Timely Plan Available

Last month we talked about the radio equipment for beginners in R/C model flying—transmitters, receivers, and actuators. Having covered that phase, our next concern is the model in which to install the equipment. And here again, you'll find, as many opinions as there are modelers. If, however, we keep uppermost in our minds that the beginner I'm trying to help is neither a tree flight or control-line convert, nor is he a radio ham, certain basic facts can be listed for use in selecting a design.

Let's digress for a moment, though, and mention some good kit designs for modeler converts from free flight and control-line. For free flight converts, accustomed as they are to polyhedral, paper covering, single box fuselage-typical free flight construction - the Nomad makes a good beginners R/C trainer. For the sport free flighters — modelers who like to fly Veco Dakota's. Midwest Sniffers, and similar sport models, there are many good kits, both large and small. The Schoolboy, Lightning Bug. Lil Esquire are good small jobs: the Esquire. DeBolt Champion, and other similar models are good in the larger size.

For the control-line converts, it's hard to beat DeBolt's Champion — the construction is similar, and when built true and properly balanced, first flights are usually completely successful — unless the modeler gets too nervous and goofs on the controls!

But back to you, the absolute beginner. Let's list all the things that are most likely to cause you trouble:

1. Covering

Your first covering job is likely to be pretty sad. Sure, some of you will do great, but for most beginners; this is a real chore, with no assurance that even with care you'll have a smooth job. The solution? Eliminate the chore. Make the entire model of balsa.

2. Gluing

"Laying a bead of glue" is standard practice, but at first try it's hard to keep the flow from the glue container smooth and regular as you apply the glue. So, the answer is to make the areas to be glued together big enough so that the pieces can be pressed together and the excess, glue wiped away without losing all of the cohesion.

3. Warping

The variation in balsa weight, strength and stiffness, are very likely to cause warps when two dissimilar pieces are bent to a shape. So — do a minimum of bending, and when necessary, do it so that the pieces are firmly fixed in place on your flat workbench until dry.

4. Installing the equipment.

Most beginners tend to be a little "ham-fisted." To overcome this, the equipment should be easily accessible with no need to get your hands deep inside the fuselage. Solution - make the escapement, radio and batteries easily reached through a removable hatch in the top of fuselage. All wiring right at the top, too.

5. Engine operation

The engine has to be easy to start. Fortunately, most of today's engines meet that requirement, particularly if the manufacturer's instructions are followed. The engine should also be kept clean—and this isn't always easy. However, it's possible to reduce the frequency with which dirt gets into the engine by putting the motor on a pylon above the wing. Then, in addition to it's being readily accessible; it isn't always nosing into the ground on rough landings. Sure, the fuel drips down on the model, but it's easier to wipe off a model than to clean a dirty engine,

6. "Finishing" the model

This really is minor, if you go the all-balsa route. "Finish" can be either glass smooth, through the use of balsa filler coat and careful sanding before applying the final coatings, or it can be smooth, but with the balsa grain showing, if you simply apply the dope directly to the sanded wood, then sand smooth and add more coals until the surface is well sealed.

Dope comes in two kinds — nitrate and butyrate. Nitrate is cheaper but does not have the fuel resisting qualities of butyrate. All dopes have a characteristic of shrinking, and if your balsa structure does not have uniform strength, the shrinkage can cause warping. A new material, called HobbyPoxy, solves not only the shrinkage problem, but in addition, is absolutely fuel proof. True, it a little more tedious to use than dope, but for a simple beginner's air-plane, all balsa in construction, two good coats of HobbyPoxy applied directly in the smooth sanded balsa, serve to seal, strengthen, and fuel proof the model without introducing warps. Later on you can decorate the model for appearance, following the manufacturer's instructions. I'd advise a couple of practice coats on scrap balsa first.

7. Adjusting

Here you get into a real meaty area, which we'll discuss, later in more detail. For now, let's just look at the logical design approach to minimize the adjustment problem. The design must inherently be very close to the final requirement with respect to the angular setting of the wing, tail, and motor; then it should provide an easy means to make minor adjustments in order to achieve the desired flight. Finally, the design should be capable of flying, even though badly out of adjustment, so you don't bust it up before the final trim is achieved.

8. Flying

Obviously, for a beginner, the model should be reasonably slow, so it doesn't "get ahead" of the modeler. It's response to a radio command should be both gentle and firm, and the model should be stable enough that if you get confused you just leave it alone for a few seconds and it returns to level flight all by itself. Small models have the reputation of being a little tricky to fly. Large models, on the other hand, have a more stately flight, but when they crash, it's much more catastrophic. So, ideally, we should try to come up with a relatively small model, which is easily built and repaired (and less susceptible to damage), yet which flies like a big job. The compromise is hard to achieve, particularly when you keep in mind all the other things we've talked about thus far!

Okay — there are all the major problems with ideas for their solutions. Put all the ideas together and what comes out? An all-balsa airplane, mostly straight line in design, with a wide shallow fuselage, easily accessible equipment bays, engine on a pylon above the wing, and easily adjustable surfaces and thrust line. Such a plane may not be the most aesthetic job in the sky, but you'll be hypnotized into thinking it is as you learn to fly your first radio job. It's like a virus; once you've; had it. You're hooked. So here is the VIRUS. Don't build it unless you're ready to pay the penalty - hours and hours of fascinating fun!

THE VIRUS Construction

Let's start with the wing for two reasons: first, its very simple to make, and secondly, when you've finished, you'll be that much more impatient to construct the fuselage, which does take longer and, admittedly, has a couple of tedious steps which the inspiration of the finished wing will help to ease. Before beginning, obtain a sheet of 7" wide by 34" long 3/32" medium grade balsa sheet. It your hobby dealer does not stock as wide as 7", obtain a 3" and a 4" wide sheet, selecting two pieces that are similar in weight and grade and which butt together snugly along one edge. Be sure to select your material with care, rejecting those sheets that have a curvature to their edges.

Step 1. Lay a piece of wax paper on your work table, then butt the two sheets together, and tape them with masking tape per Fig. 1.

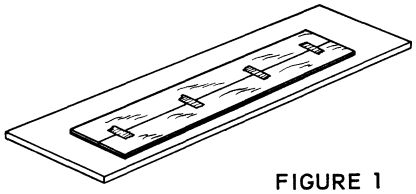


FIGURE 1

Step 2. Next, pick up the sheets, and using the tape as a hinge, open up the butt joint, per Fig. 2.

Step 3. Lay a "bead of glue" along the edge.

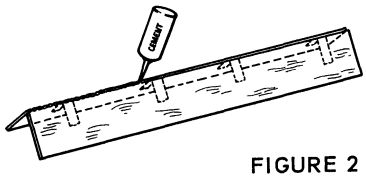


FIGURE 2

Step 4. Now lay the sheets down flat on the table, with the tape hinges down. The butt joint will close tight, and excess glue will squeeze out. Wipe it off, then tape the top together, so both sides are now firmly held together in the flat position, and let dry. See Fig. 3.

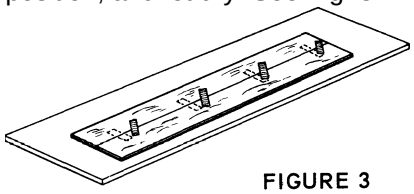


FIGURE 3

Step 5. When dry, cut into two 17" wing panels, shape tips and proceed.

Step 6. Cut out the ribs from medium 3/16" stock. Note rib depth is 1/8" greater than the airfoil curve of the sheet. This makes the ends project out at the leading edge and trailing edge.

Step 7. Pin the ribs of each panel in place on your flat table. Insert the pins at the leading edge as shown in Fig. 4, so the leading edge of the sheet will fit tight against the pins when the sheet is placed in position.

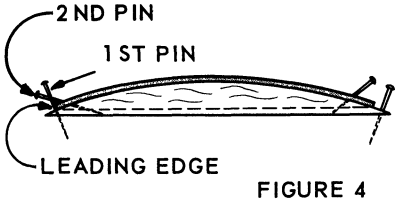


FIGURE 4

Step 8. Lay a head of glue

along the ribs, using reasonably slow drying glue. Any of the regular brands will do — just don't use the "extra fast"' type designed primarily for on the spot field repairs.

Step 9. Pin the leading edge of the sheet in place with a second pin, as shown in Fig. 4, at all the ribs, then gently press the sheet down to fit the rib curve. Pin the trailing edge down. Let dry.

Step 10. When dry, pick up the wing panel assembly and trim oil the ribs at the leading edge and trailing edge. Also, trim off the center ribs so the bottom flat surface is flush with the leading edge and trailing edge. This is so you can get a flat surface at the center section when you join the two panels. See Fig. 5.

FIGURE 5

Step 11. Next, make a wedge shaped piece of wood to join the panels together at the center. The angle of the wedge, 16 degrees, determines the dihedral, which is 8 degrees for each panel. Fig. 6. If you're lucky, your dealer may have a piece of trailing edge stock, which fits the requirement.

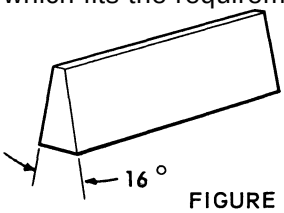


FIGURE 6

Step 12. Glue this centerpiece to the center rib of one panel. When dry, trim the top to fit the airfoil curve.

Step 13. Block up the tips to 3-1/4" and glue the other panel to the center piece, making sure that the bottom of the center ribs and the center piece are flush on the table from leading edge to trailing edge.

Step 14. To strengthen the center, cover the joint from leading edge to trailing edge on top with a 1" strip of either strong nylon cloth, or preferably, "Celastic, a hobby material available in most hobby shops. Fig. 7.

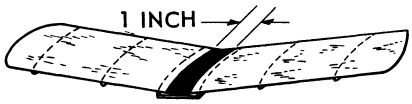


FIGURE 7

Step 15. For additional strength, cover the bottom of the center section from the center to the first ribs with 1/16" flat sheet. Grain should run span-wise.

Step 16. Wing is now finished, except for sanding and doping, and is ready for the engine pylon.

Step 17. Cut engine pylon from 3/16" plywood.

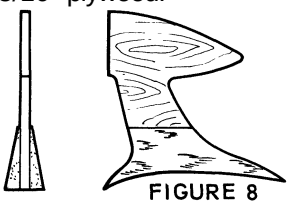


FIGURE 8

Step 19. Make engine angle braces from .040 aluminum and drill mounting holes but do not mount. Fig. 9.

Step 18. Glue side braces, made from 1" trailing edge stock, in place at bottom. Tailor to fit wing curve as in Fig. 8.

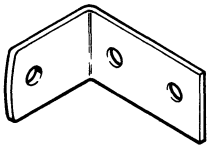


FIGURE 9

Step 20. Butt glue pylon assembly to top of wing and Jet dry thoroughly.

Step 21. Whole assembly can now be sanded and doped or sprayed with HobbyPoxy as described earlier.

Step 22. Next, bolt angle braces in place and mount the Tee Dee .020 engine.

Fuselage

Step I. Cut the fuselage sides from 2" by 1/16" by 36" stock. Lay flat on table, over wax paper.

Step 2. Glue 1/8" sq. longerons and braces in place. Pin longerons as necessary to hold in place. Glue 1/2" x 1/8" x 4-7/8" nose brace in place on each side.

Step 3. Lay right side on table, glue 1/4" x 3/4" x 1-1/2" tail block in place. Shave sides of block to fit the taper angle. Fig. 10.

Step 4. Glue 1/8" x 1-1/2" x 21- l/16" nose aligning block in place.

Step 5. Glue left side to top edges of tail and nose blocks as in Fig. 11

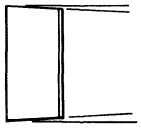


FIGURE 10

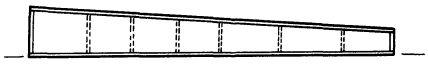


FIGURE 11

Step 6. Make rectangular bulkheads for stations 3, 4, 5, 6, 7. Cutouts can be made now, or later, as discussed in Step 9. It depends on what tools you have. Glue bulkheads in place.

Step 7. Cut 3/8" hole in tail block, centered 5/8" up from bottom, for escapement rubber to be inserted. Also cut 3/16" hole, centered 3/8" down from top to accommodate torque rod.

Step 8. Make tail plate 1-1/2"x 1-1/8" sq. from 1/16" plywood. Glue in place. Drill 3/64" hole, centered 3/8" down from top for torque rod bearing, and 3/8" hole, 5/8" up from bottom, for escapement rubber access hook.

Step 9. Cut holes in bulkheads (shown dotted on plans), to permit torque rod and rubber to extend freely from tail to escapement at station 2. Holes are not cut before gluing bulkheads in place because the solid bulkhead is easier to put in place: also it helps to keep every-thing aligned. It is a little awkward cutting the holes after the bulkheads are glued, but better for reasons slated.

Step 10. Make escapement holder frame from 1-15/16" x 2-3/8" x 1/8" plywood. Cut out to accommodate escapement, drill mounting holes and mount escapement with #3-48 machine

screws, 1/4" long.

Step 11. Cut out top and bottom of fuselage from 1/16" sheet. Straight taper from 3-1/16" at front to l-1/8" at tail. You can use 3" wide wood to save money, and start taper 1" back from nose.

Step 12. Glue bottom in place. If any small curve may have developed in the sides when the bulkheads were glued in. the sides can be bent straight to fit the straight taper of the bottom, and pinned until dry. Since you built the sides on a flat table, this may not happen, but if it did, it will be very slight and easily corrected by fitting the bottom on.

Step 13. Glue two 3/16" x 1/4" x 2-3/8" balsa cross pieces across the bottom at Station 2-1/8" apart. This makes a slot where the escapement holder fits in at the bottom. Keep excess glue from clogging this slot by wiping it clean with 1/8" sq. slick before glue dries.

Step 14. Fit 1/8*" x* 1/2" x 2-5/8" plywood brace behind the 1/8" sq. brace at top of Station 2. Notch top corners 1/8" square to fit longerons. Glue in place and at same time glue in 1/8" *x* 3/8" x 2-3/4" balsa braces on sides, under top longerons, from Station 2 to 3. Tailor these for a good tight fit to the plywood cross brace.

Step 15. Escapement now can be easily installed and removed by sliding holder into slot at bottom, using small wood screws to fasten at the top.

Step 16. Glue 1-1/2" *x* 3" x 2" balsa nose block to front. You can shape it before or after, as you prefer. I like to cut it roughly to shape, glue it, and

EQUIPMENT RECOMMENDATIONS FOR THE VIRUS

TRANSMITTERS	RECEIVERS	ACTUATORS
CS-502 Falcon	CS 505A	Babcock Mk II
Citizenship SPX	CS-511 Honey Bee	Banner SN
Citizenship CTX	Citizenship MDL	C&S Septalette
Citizenship FLX	Citizenship LT3	Citizenship PSN-2
Citizenship TXX	Controlaire 5 Relayless	Citizenship SE-2
Controlaire Mule	Ecktronics E3V Courier	Elmic Commander
Ecktronics Truflite	F & M Pioneer	
Ecktronics Pacesetter	Kraft K3V	
F&M Echo	Min-X Sportsmaster RR-1	
Irving Tone EQ100	Otarion 0-21	
Klinetronics Flightline TTR-1	Otarion 0-22	
Lee's Lightning	Spacetron Opal 400	
Min-X Powermaster T-2		
Min-X Powermite TT-1		
Orbit Single		
Otarion OT-31		
Spacetron Mustang I		

finish the shaping after the rest of the fuselage is done.

Step 17. Add 1/8" x 1/2" balsa cross-brace at bottom behind nose block.

Step 18. Glue 1/8" dowels in place at stations 4, 7, and at tail for landing gear and stabilizer holders.

Step 19. Glue 1/16" sheet top in place. Cut at Station 2, since top from Station 1 to 2 will be an access hatch.

Step 20. Glue 1/4" square wing cradles in place.

Step 21. Glue 1/16" x 1" x 2-5/16" plywood landing gear doubler to bottom — tailor to fit.

Step 22. Round all corners of fuselage for appearance by sanding with sanding block.

Step 23. Glue 3/16" square braces to hatch cover. Tailor them to fit between sides and also between back of nose-block and front of escapement holder.

Step 24. Drill 7/64" hole vertically through center of nose block, 1/4" from back. This will house the tubing through which nose gear wire is attached. Landing gear is optional if your field is all grass and takeoffs are not possible with 1-3/8" wheels.

Step 25. Fuselage is now ready for sanding and finishing.

Stabilizer

The easiest way to make the stabilizer would be to cut it out of a 4" X 17" X 3/32" sheet. However, since flat sheet balsa is subject to warping, you can avoid this by making the "box" structure as shown. Cut out a sheet of 4" x 17" X 1/32" to shape, lay it on your flat table, glue the 1/8" square leading edge, trailing edge, and 1/8" flat tip braces in place — also the 1/8" ribs and diagonals. Then glue the 1/32" flat top sheet in place and let dry. Now you have a stab that won't warp.

Fin and Rudder

Since there are small surfaces, they can be cut from 3/32" flat stock. Just make sure the sheet is not warped when you

cut it. The hinges are cut from cloth, or you can buy ready-cut cloth hinges from your hobby dealer. There's only one thing to be careful with, and that's to be sure that when you glue the hinges on, keep the glue away from the cloth right on the hinge line, otherwise the cloth stiffens up and your rudder won't move freely.

Be very careful in gluing the fin to the fuselage. Glue the 1/8" square side braces to the bottom of the fin first, wiping excess glue away so the fin bottom and braces set flush on the fuselage top. Make sure the fin is aligned so there is no offset, which would cause a left or right turn. Sight along the fuselage as you glue it in place

Landing Gear

This is a straightforward wire-bending job, although the nose gear attachment is a little unique. Note how the wire is bent so one end is inserted in the tube imbedded in the nose block, and the end juts out at the bottom. Then a washer or nut is slipped on the wire and soldered just below the notching bend below the forward end of the nose-block. Finally, a rubber band, wrapped around the end of the wire jutting out at the bottom and the notch just above the nut, will secure the nose gear wire in place. The nut or washer serves to keep the rubber band from slipping.

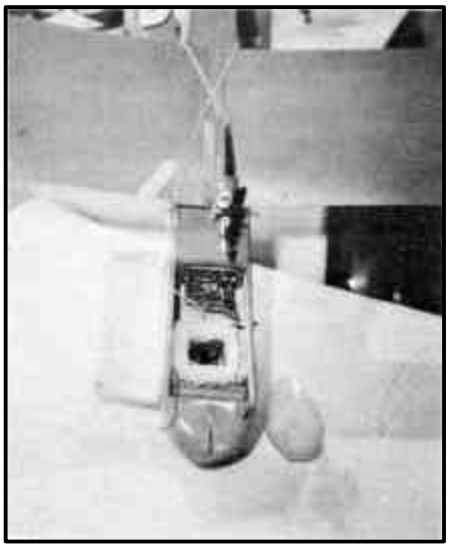
Equipment Installation

This is about as simple as it can be. Make a rudder torque rod of hard 1/8" square balsa, tipped with .040 wire, bound and glued, to go through the escapement bearing and the tail bearing. The easiest way to install it is to insert it through the 3/8" hole at the tail, then fit the front end into the escapement bearing (with the escapement mounted on the plywood holder). Next (and this is somewhat like threading a needle while blindfolded), insert the rear end wire into the tail bearing, at the same time sliding the escapement holder into position at Station 2. Secure with two small wood screws, and escapement and torque rod are mounted. Add the rudder linkage at the rear, plus the arm follower at the escapement, making sure that the rudder is aligned properly with the escapement in neutral, then solder in place.

The mounting of the escapement provides easy access to the circuit contacts for soldering. The battery box fits against the nose block, and can be secured by a couple of wood screws through the bottom of the box into the nose block. Alternatively, the box with batteries can be held against the nose block by the pressure of the foam padding around the receiver.

The receiver fits behind the batteries. It can be wrapped in foam padding or you can make a cutout in a piece of foam and fit the receiver in the cutout. The 1/8" dowel just ahead of the escapement serves a double purpose. It prevents the receiver from sliding back in its foam housing and interfering with the escapement operation, and it provides an anchoring stud on either side pf the fuselage to attach a rubber band across the top to hold the access hatch in place.

So now you have the structure finished and equipment installed, and its time to balance the model. The plans show the Center of Gravity (C.G.). You can achieve balance two ways; one is to add weight to the nose or tail as required. The other is to find out where the model balances, then slide, the wing forward or back as



required until the C.G. is located properly *with respect to the wing,* then glue the dowel in so the wing stays put in the right location when the rubber bands are attached.

You may be surprised at the "down thrust" angle on the engine. So was I, but after trying various angles, this one, with the single surface wing, gave the best transition from power flight to glide. One last word, space does not permit a completely detailed explanation of the operation of all the equipment. That would take a book and they're out of date before they're published, what with the rapid changes in the state of the art of radio control. But, if you'll *read the manufacturer's instructions* on the equipment, and add that information to what has been presented here, you're *almost* sure to have a successful introduction to R/C.

Next month we'll try to eliminate that word "almost" by discussing some of the tricks in adjusting and flying the VIRUS. Now I know some of you just won't wait — and that's O.K., so long as you get someone to help you who knows what to look for. Catching, isn't it?