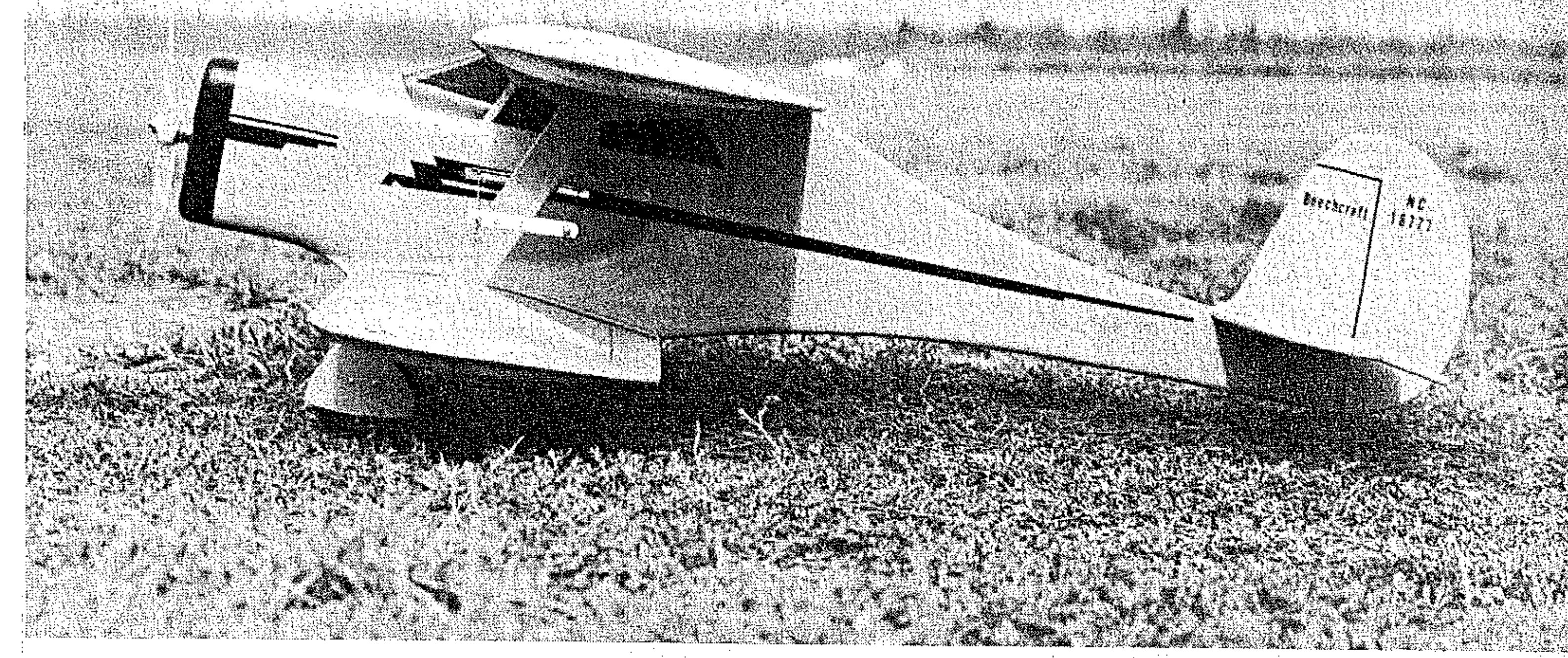
BEECHCRAFT D-17-S

At last, a man's-size profile scale for macho pilots. Acres of area and a gutsy 35/40 engine guarantee great flying at reasonable cost.



● Clarence Haught

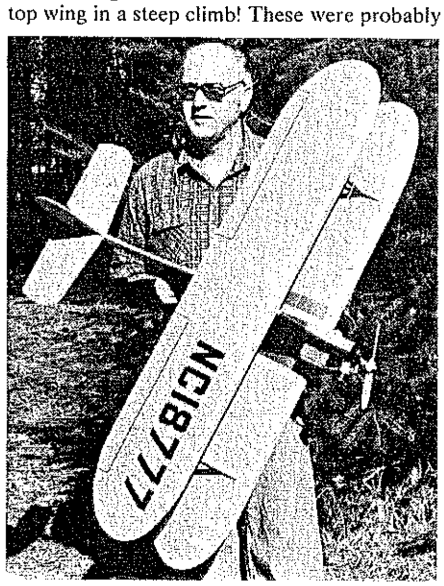
STAGGERWING! If the word excites you then no explanation is necessary. If it doesn't no explanation is possible! The D-17 Beechcraft is one of the classics from the so called "golden era" of aviation—the 1930s. Like its contemporaries, the Howards, Stinsons and Wacos, the Beech was a prestigious private or corporate aircraft designed for speed and passenger comfort. Boasting such niceties as mohair upholstery, carpet and sound proofing, these aircraft played a major role in making air travel an acceptable alternative, if not a must, for executive transportation.

Class did not stop with just fine internal appointments, as 20-25 coat hand-rubbed dope finishes protected and beautified the exterior fabric covering. Close scrutiny was required to pick out the edges of surface and finishing tapes over ribs and stringers. Ribstitching (the lacing of fabric and wing ribs) was tied off on the top of upper wings and on the bottom of lower panels to minimize detracting bumps created by knots beneath the surface tape. These typically fine finishes paid for themselves many times over in drag reduction and increased fabric life. Such finishes have been known to protect fabric up to 25 years when conventional 8- to 10-coat factory finishes allowed fabric deterioration to occur in as little as 8 to 10 years.

The romance of the radial engines adds to general appeal of these old birds. High dependability and low weight-to-power ratio were basic advantages. Although lower pilot visibility detracted from the popularity of this engine configuration, I personally know of one pilot, short in stature, who inadvertently allowed that big Pratt and Whitney R-985 engine to devour the wing of a Piper Super Cruiser and a Piper Comanche on separate occasions. Perhaps it was just a round engine's way of letting its flat brethren know who was boss!

Airplanes in this category are referred to as "pilot's airplanes," as they required more than an average duffer to chauffer them around, and Staggerwing pilots tend to be a proud group.

The Beech was not without its critics who initially claimed the design would not fly because of the negative stagger. They theorized that the bottom wing would blanket out the air flow to the top wing in a steep climb! These were probably



Top: The classic Beech profile. Early aerodynamists claimed negative stagger would not fly, theorizing that the lower wing would blanket the upper in a steep climb! Above: Clarence shows how big this profile really is. Hard to think of it as a profile.

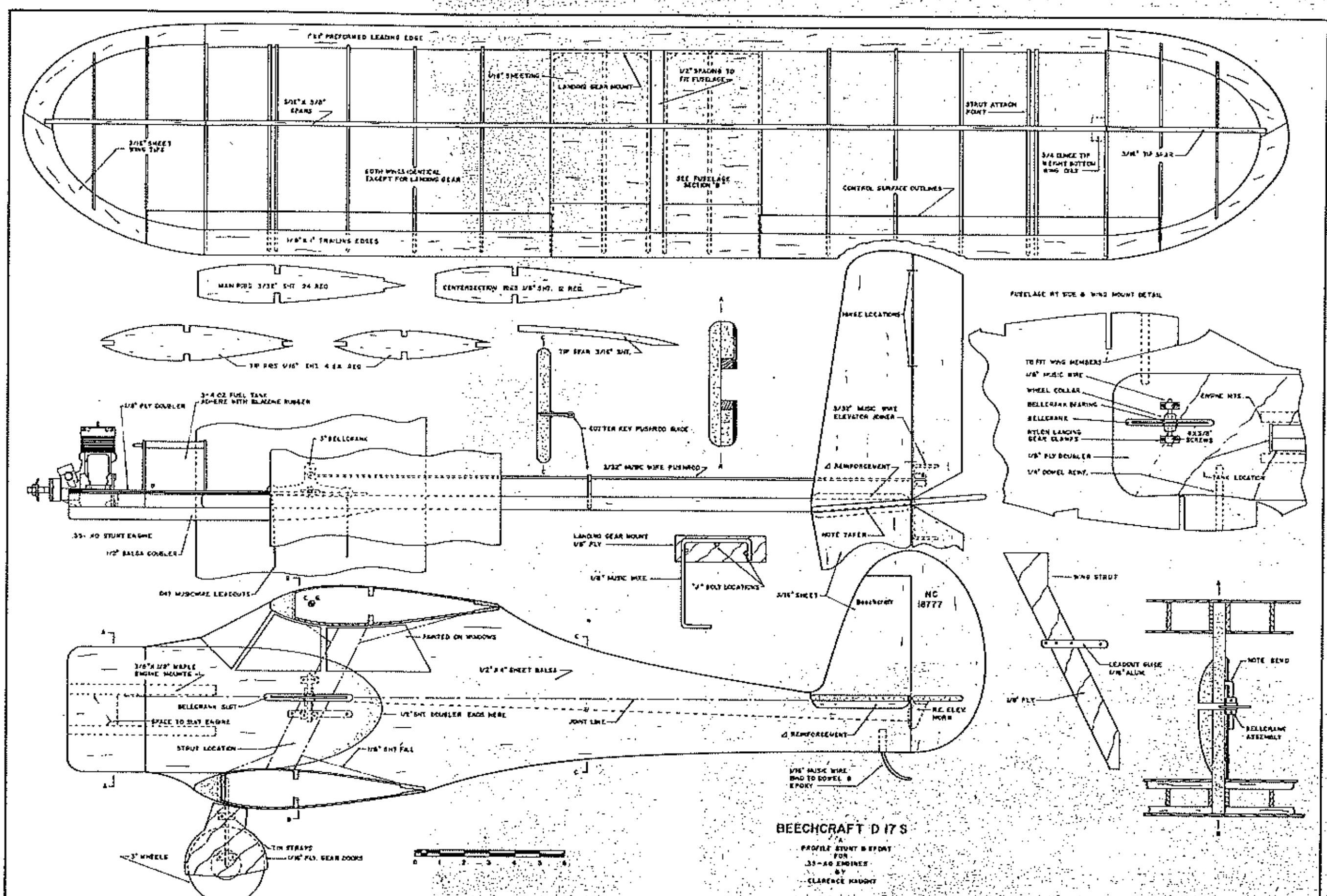
the same people who insist that aerodynamically a bumble bee cannot fly. About the only real criticism that was valid at all was the pilot visibility problem, but that was basically a ground handling problem.

The model presented here was designed as an entry in a CL Profile Scale for a local contest. The event was designed to create interest in scale with a quickly built airplane. In addition, the event would encourage flight maneuvers not usually undertaken with true scale models. Who has the nerve to try inverted flight, loops, eights, etc., with a model that took months to construct?

The model turned out quite large at 50-in. span and sports approximately 800 sq. in. of wing area. Total weight with a McCoy .40 engine is 45 ounces. This favorable wing and power loading results in a model that is stable, easy to fly and will perform the entire AMA stunt pattern as well as the average non-flapped stunter. Construction is simple and strong and can be accomplished in a relatively short period of time.

Construction begins with the wings. Both wings are identical with the exception of the landing gear and the tip weight. After cutting out all the parts and joining the tip pieces, pin down a ⅛ by 1 sheet over the plan for the lower half of the trailing edge. Pin the center section and main ribs to both of the spars but do not glue yet. Glue ribs to trailing edge sheet. This will result in the front of the ribs being raised above the surface of your building board. Check for alignment with plan and insure that the spacing between the center two ribs is exactly ½" (fuselage width) and that the center ribs are at right angles to the trailing edge. This is of particular importance as it affects wing alignment at final assembly.

When satisfied, cement top half of trailing edge in position and allow to dry thoroughly. Notch a 1 X 1 preformed leading edge as shown and glue



FULL-SIZE PLANS AVAILABLE . . SEE PAGE 128

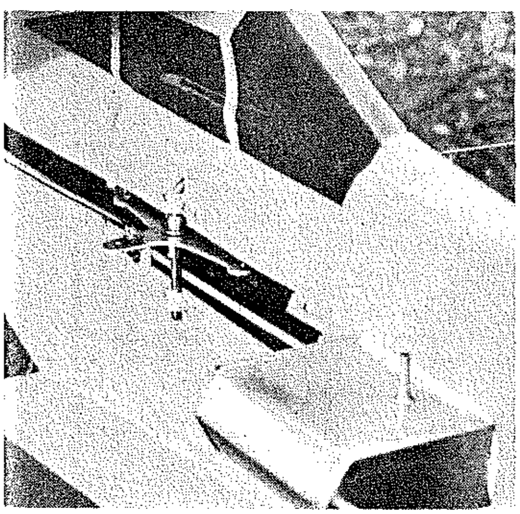
to ribs, being sure ribs are properly aligned. Apply glue to the rib-to-spar joints with the aid of a small brush. When dry, remove from the plan and install tips, tip ribs and tip spars. Build two identical structures. Select one wing for the top and install center planking. The planking that will be on top is bridged across all the center section ribs. The planking for the bottom of the top wing is installed up to the center two ribs leaving a slot for inserting the fuselage.

Bend up the landing gear from ⅛ music wire and attach to plywood landing gear mounts with "J" bolts. Gouge out the leading edge for bolt clearance and secure the mounted gear legs with epoxy. Add reinforcements as shown to strengthen installation. Plank center section and install ¾-ounce tip weight in the outboard wing tip. (Coiled solder works well and is easily glued with epoxy.)

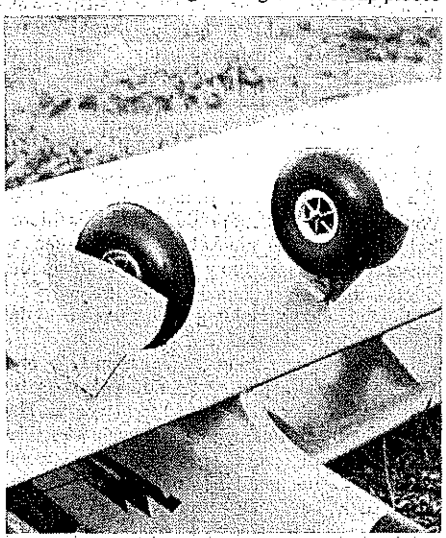
Tail surfaces are cut from medium weight 3/16 sheet balsa. The rudder-fin combination is built up in one piece and the whole assembly offset as shown on top fuselage view. Elevators are joined with 3/32 music wire. A standard RC elevator horn is employed. Use your favorite hinge system. Most any of the currently available hinges are satisfactory including the one piece molded variety. The main consideration is freedom of movement.

The profile fuselage is cut from two sheets of ½ by 4 balsa joined edge to edge. The scrap pieces are then joined to make up the ½" sheet balsa reinforcement doubler for the left side. The fuselage outline is best cut with a power jig saw, but a hand coping saw may be used. The hardwood engine mounts are spaced to suit the engine used and may be glued in place simultaneously with the ⅛ plywood doubler for the right fuselage side. When dry, the plywood doubler may be cut away for engine clearance and the bellcrank slot. To cut the slot, drill each end with a ¼" drill and cut away the area between the drilled holes.

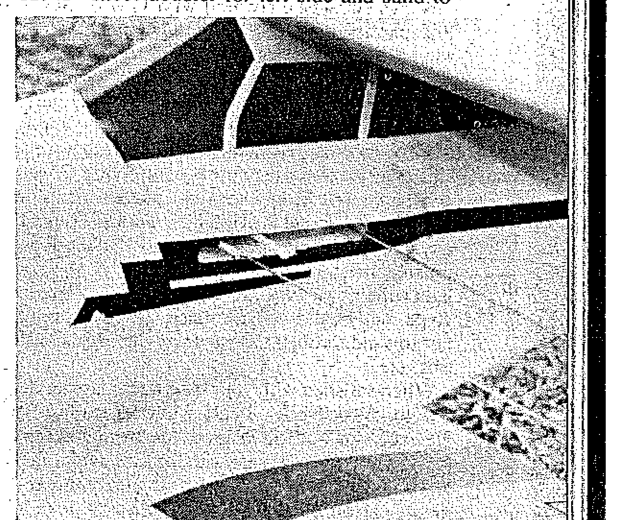
Smooth any roughness with a file. Drill engine mounting holes and install blind mount nuts. Cut out ½" sheet doubler for left side and sand to



Bellcrank installation uses all commercially available parts. Two wheel collars position bellcrank on music wire pivot. Landing gear straps secure pivot to fuselage. Note bend in pivot to engage hole in ⅛ ply fuse doubler. Cotter key serves as pushrod guide.



Large wheels allow ship to be flown from rough fields. Simple ply gear doors do not hamper operation off grass. Gear mounts made from tin can stock, soldered to gear wire. Doors are attached with screws.

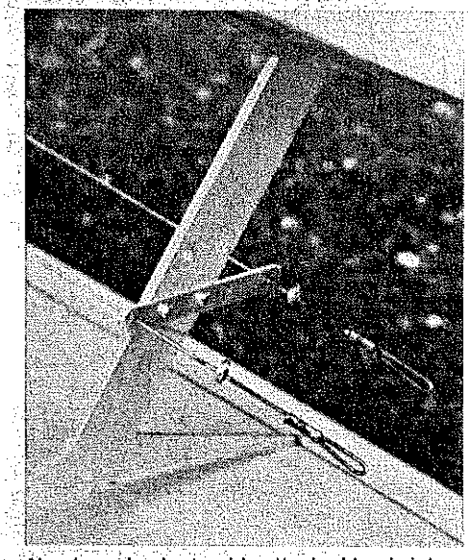


Left fuselage doubler of ½" balsa sheet gives contoured nose effect to basic profile. Solid wire leadouts wrapped with soft copper wire and soldered. Wing walks cut from 220-grit wet-or-dry sandpaper, adhered with contact cement.

shape before gluing to fuselage side. Complete bellcrank slot after glue has dried. Complete sanding of total fuselage. Note taper at rear to match rudder offset. Check fit of fuselage to wing joints and adjust as required by trimming or adding small strips of balsa. This joint should fit well without causing any missalignment of wings. A little extra time fitting these joints will pay off in appearance and flight characteristics.

The plan shows two ¼" reinforcing dowels to strengthen the profile fuselage in the wing mount area. These are purely optional. If you are using light wood or are anticipating an occasional roll-over landing they are advisable. If you are using firm wood they are probably unnecessary.

At this point some preliminary finishing steps are necessary. All components receive a final sanding and are given two coats of clear dope lightly sanded between coats. Cover the sheet tail parts with GM Silkspan. This is best accomplished by laying the dry paper on the wood and brushing on a coat of dope thinned 1 part dope to 2 parts thinner. Covering these surfaces not only contributes greatly to their resistance to splitting and overall strength but makes filling the grain much easier. This procedure is also desirable on the fuselage, but is more difficult due to all the

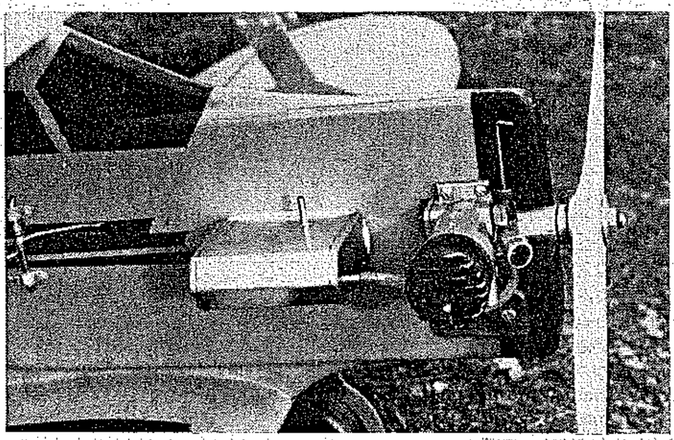


Aluminum leadout guide attached to ply interplane struts with sheet metal screws, allowing positioning for line tension and wing leveling flight trim. Control stops are brass washers soldered to the leadout wires.

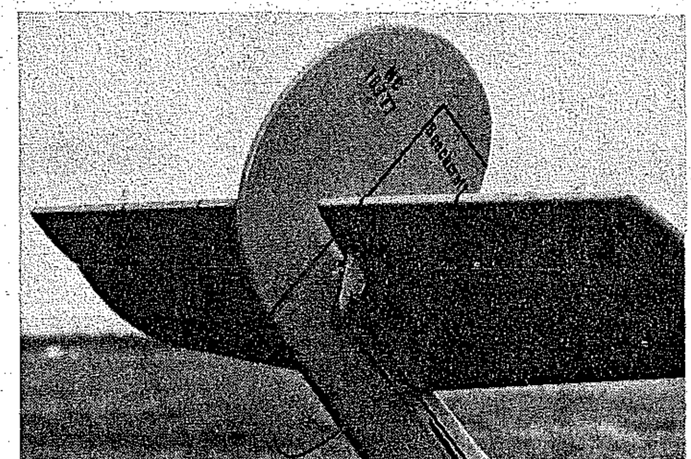
with orange Aero Gloss dope and all trimming was done with MonoKote trim sheet. Control surface outlines were formed from Vinyl tape obtained from an automotive parts house. Wing walks were cut from 220-grit wet or dry sandpaper and secured with contact cement.

After the finish is complete the control system is installed. Begin with the bellcrank pivot. Bend a piece of ⅛ music wire 90 degrees and cut to size as shown on plan. The short bend is fitted to a hole in the ⅛ plywood fuselage doubler. This prevents the pivot from moving vertically. The bellcrank with its bearing is centered on the pivot with two wheel collars. You will probably need to trim the fuselage slightly to accommodate the wheel collars. This entire assembly is then secured to the fuselage with two ⅛ inch landing gear clamp strap. Either nylon or metal will work.

The combination of the retaining hole and straps merely serve to keep the bellcrank in position as all flight loads are carried by the plywood fuselage doubler. Install an RC elevator horn to the right elevator and install the 3/32 music wire pushrod. Be sure to install the "cotter key" pushrod guide at this time. Attach the solid wire leadouts to the bellcrank by wrapping and soldering the joint as shown in the photos.



The 3- to 4-oz. tank secured with rubber bathtub caulk (3M). Fuel pick-up tube must be aligned with center of engine venturi for even running in both upright and inverted flight. Note lead ballast for proper CG.



Standard RC elevator horn allows adjustment of elevator sensitivity. Farthest holes from hinge line produce least sensitivity. Elevator-fuselage joint reinforced with triangle balsa.

curves. Lightly dampening the Silkspan with a spray bottle will help in this respect and does not really affect the dope-thinner mixture all that much.

Wings should be covered with GM or SGM Silkspan applied damp. Lay a dry piece on the wing structure and position it as desired. Dampen with a spray bottle and smooth out any wrinkles. Carefully lift edges and apply dope to the perimeter of the structure. There is no need to apply dope to the ribs or centersection planking as this will take place during subsequent coats. Cover tips separately from the main panels, using a smaller piece to aid in avoiding wrinkles. Trim off any excess tissue and build up a good clear dope finish consisting of 4 to 5 brushed coats. A very light wipe-down with 600-grit sandpaper between coats will yield a smooth finish. Just be careful not to sand through the paper on the high spots: ribs, etc.

When satisfied with your base finish, assemble the complete model. Begin with the stabilizer-elevator. Be sure it is level (perpendicular to fuselage side) and square with the fuselage center line. Glue securely and install the triange reinforcements shown on the plan. It is wise to poke a series of small holes into the wood under the glue joints to allow good glue penetration for a secure bond. Install rudder in offset position as shown on plan. Attach wings with epoxy glue paying particular attention to their alignment as mentioned during the construction phase. Utilize your square and check wing tip to tail measurements with a tape measure.

When dry, trim tissue from between strut attachment ribs and install wing struts. If any warps are evident you may corrent them by steaming prior to installing struts. Slight warps can be corrected when installing struts. Triangular pieces are then cut from ⅛ sheet balsa to produce a faired-in look to the struts.

You may wish to provide some fillets between the wing and fuselage joints and perhaps to smooth out any imperfections at the edges of the doublers. An excellent product for this is micro-balloons. Mix the micro-balloons in some 5-minute epoxy and apply to model. Form the fillets with a finger dipped in dope thinner. This technique allows molding and shaping of the fillets without sanding!

The landing gear doors are cut from 1/16 plywood and are attached to the landing gear wire by means of a tin strap cut from a food can lid. The strap should be soldered to the ⅛ music wire. The gear doors are secured with small sheet-metal screws or with small nails cut to length and soldered in place. These doors are quite durable even if you fly from grass fields, and add to the appearance of the model.

The final finish is now applied. Brushed-on color finishes are ok, but for a real neat job spraying is best. The original model was sprayed

Thread the outboard ends through the leadout guide and secure the leadout guide to the left wing strut. I recommend installation of control stops to limit elevator travel to 45 degrees up and down. This is easily accomplished by soldering a brass washer on the leadout wire to bear against the leadout guide. Add loops for control line hookup.

Mount your engine and wheels. Select a suitable fuel tank. It should hold between 3 to 4 ounces of fuel and be of the "stunt" variety. Either conventional or one of the special "profile" type tanks. I secure my tanks with silicone rubber, sometimes sold as bathtub caulking cement. This material holds well, is unaffected by fuel and tends to absorb some vibration. This glue needs to dry several hours. Be careful to align the center of the tank with the center of the engine venturi or air intake. This will assure the engine running the same both upright and inverted (i.e., if the tank is too high, the engine will lean out when upside down).

Check the balance point as shown on the plan and add lead if needed. A little nose heavy is ok but never attempt to fly a tail-heavy ship. If in doubt add a little nose weight.

With a 10-6 prop installed and .015" 60-foot multistrand lines attached you are ready for the first flight! Pay particular attention to this initial flight so any necessary trim changes can be

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dowels (for lightness), and the movable tail surfaces are actuated by the movable stubs which fit into the tail. The Soar Gull is not only different, it's a package of clever innovations in linkages and design.

FAI team selection program. It's here again and well underway by the time you read this. Subject to vote by program entrants, the Team Finals will be in Pensacola, FL (excellent flying site), over Labor Day weekend, and Rae Fritz (excellent contest director) will keep everybody honest. It's guaranteed excitement and worth watching if you can't compete. The outcome of the Second World Championships last year in Belgium surely will have an influence on designs this year. So if you want to see what F3B is all about and see some designs which were only dreams a year ago, think Pensacola—Labor Day. For further information on the program contact: *Ray Marvin, 2781 South Garfield, Denver, CO 80210.*

Let's go flying.

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RC HELICOPTERS/CHESNEY

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quired to pull the wing through the air fast enough to get the plane in the air and keep it there. The same is true of the helicopter; but, where airplane drag is largely a result of the induced drag of creating lift plus parasitic or profile drag caused by the resistance of the bumps and lumps like wheels, canopies, and other junk sticking out in the airstream, the helicopter is also subject to mechanical drag. Power-robbing drag is bad enough without binds in the helicopter gear train. Of course, even without binds, running friction is a factor; so the mechanics of the drive system should be assembled carefully to reduce friction.

Now, if we succeed in overcoming drag and gravity and get the helicopter and airplane moving in forward flight, the similarities of control response can be checked out. See Figure 2. The airplane is controlled about the roll axis by its ailerons or by increasing and decreasing the lift of each wing tip opposite from the other. The helicopter control is similar to the ailerons and is called right/left cyclic or *lateral* cyclic. So, to roll or bank the airplane, we move the aileron stick. The helicopter is rolled or banked using cyclic—lateral cyclic.

For the pitch axis, the airplane is controlled by elevator; down elevator causes the nose to drop, up elevator, the nose to rise. With the 'copter, our friend cyclic is back again, but now as fore/aft cyclic or *longitudinal* cyclic. Longitudinal cyclic causes the helicopter nose to pitch down with a forward command or up with an aft command; remember, we're in forward flight right now.

In forward flight of a helicopter, the tail rotor is similar to the rudder of an airplane; that is, both control the yaw of the nose of the aircraft right or left. Right stick, right yaw, or left stick, left yaw, with the airplane, but note that some RC helicopter fliers set their control linkage to the tail rotor so that *right* stick gives *left nose* but *right tail boom* movement which is *not* like the full-scale helicopter. Reasons for changing the tail rotor control will become apparent as you begin flight training, but do set up for "normal" yaw initially.

These examples of flight control similarity are for aircraft moving forward through the air. An airplane that is not in motion through the air is called parked, or tied-down—maybe crashed. The airplane must be moving forward against a relative airflow at a speed sufficient to provide lift to overcome gravity. A helicopter may indeed stop or move rearward or sideways because the engine-driven rotating wings provide the relative airflow. The helicopter will be lifted off the ground if engine power and rotor pitch are set and the blades are rotating against their relative wind in such a way as to provide enough lift to overcome gravity. With no other forces acting, the helicopter will *hover.* Now the lateral and longitudinal cyclic controls may be used to slide the helicopter laterally to the left or right or longitudinally forward or rearward. The tail rotor must be used not only for yaw control but also to keep the fuselage from spinning around against the rotation of the main rotor.

We'll get back to the tail rotor later, but for now, what is cyclic pitch of the rotor blades?

Cyclic pitch changes are responsible for the lateral and longitudinal movement of the helicopter. An application of cyclic control causes the pitch of each blade to change, one opposite to the other. In effect, one blade will oscillate from a fixed collective pitch setting through a positive relative pitch back to the collective reference pitch, then to a relative negative pitch setting and back to the reference collective pitch setting. The highest and lowest relative pitch positions of that one blade will be determined by the position of the cyclic stick. Keep in mind that as the one blade reaches its highest pitch, the opposite blade will be at its lowest. (The pitch excursion of the one blade during one revolution is like a sine wave. See Figure 3.)

Next month I will have more about cyclic and collective pitch and the rotor head and swash plate.

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CL BEECHCRAFT/HAUGHT

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made. Instruct your helper to watch for excessive outward yaw and unlevel wings. You will be able to notice these things from the circle's center as well, but another opinion is always useful.

Too much outward yaw causes excessive line tension. If you can see the top or bottom of the wings it indicates a correction is needed. Both of these conditions may be alleviated by relocating the leadout guide. If you see the tops of the wings lower the guide. For too much outward yaw move the guide forward, etc. A tail heavy model will be too difficult to control. Too much nose weight makes a model too sluggish. If the controls are too sensitive move the pushrod in at the bellcrank or down at the elevator horn, etc.

Level flight is boring. You will find the Beech fully aerobatic. Loops are a basic maneuver. Most beginners hold a fixed amount of too much "up" resulting in a mushy loop. Try varying the control throughout the loop, making it big and round. Lazy eights are a logical progression into inverted flight. Begin a normal loop then neutralize the controls ⅔ of the way through the loop, hesitating for a split second while the model is on its back in a shallow dive, then give down elevator to come around the end of the eight returning to level flight.

Practice lazy eights and extending the inverted protion until you achieve that magical first lap of inverted flight! From here on it's merely a matter of practice. Soon you'll not be able to tolerate more than one lap of upright level flight in a row! Staggerwing!