

SUPER CHIP

A HIGHLY COMPETITIVE 1/2A CLASS PYLON RACER WITH OUTSTANDING SPORT-PATTERN PERFORMANCE FOR THAT LITTLE FLYING FIELD CLOSE TO HOME.

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Photos by Lou Francavillo, Jr.

Super Chip was designed to be a highly competitive 1/2 A class pylon racer; an excellent sport-pattern performer; and capable of glider-like performance after the race is over. As an added bonus, it is also somewhat scale, in that it was patterned after a full size pylon racer. Like most small aircraft, it can be constructed, complete with everything except the radio, for considerably less than the cost of an R/C engine used in more common larger designs. Construction is straightforward, and the resultant aircraft is strong enough to be considered a good trainer.

Does this all seem too good to be true? Must it defy the laws of aeronautics? No, it is the result of defying the traditional concept that a bigger airplane with a more powerful engine generates a more desirable aircraft, and therefore more flying fun.

This design, like many of the new breed of 1/2 A powered racing and sport aircraft, combine small, lightweight airframes, high performance engines, and one of the new sub-miniature digital radio systems. The aircraft that results is considerably different from the rudder-only training and sport aircraft that were so common in this size range in the past decade. Most of this difference is due to state-of-the-art improvements in digital proportional systems, especially the new 2 and 3 channel radios with the receiver and two servos in one crash-resistant package.

If you're just beginning in R/C, and you're looking for something more than just a rudder-elevator trainer, Super Chip would be a good step up. It is capable of exciting performance without the expense of larger aircraft and engines. For you experts, there is enough competition potential in this new small racing class to satisfy the most proficient flyer. This particular design can put you right up there in the winners circle. When not racing, Super Chip makes an excellent sport

pattern ship for that little flying field close to home. As for me, I just think she is a cute little ship, and fun to fly.

Super Chip was designed after a full season of experience flying in 1/2 A races sponsored by the Aeroguidance Society, Inc. I raced a kit Junior Falcon modified to resemble the shoulder wing Miss Cosmic Wind. Flying with rudder and elevator control, it was a satisfactory racer. I felt that its aerobatic potential, however, was limited. The new design had to retain the scale-like appearance of the Miss Cosmic Wind, but must have



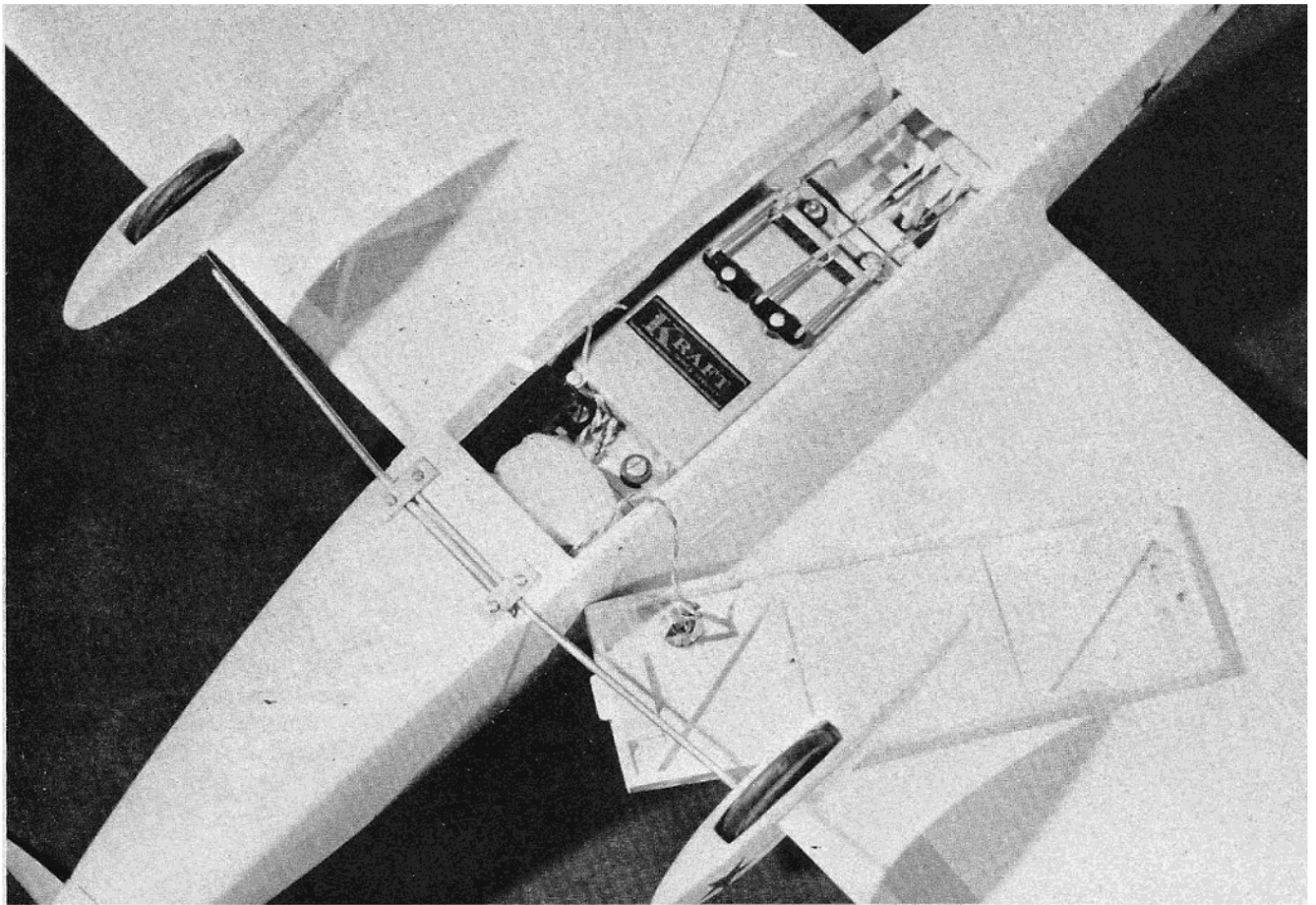
ailerons for smoother aerobatics, a much stronger but lighter wing, better longitudinal weight distribution, and be as aerodynamically clean as practical. A search for a full size shoulder wing racer with a constant chord wing turned up many cassutt versions, the Bonzo, the Buster, and other often modeled designs. While looking through "Racing Planes Guide" by Joe Christy, I spotted a photo of Ned Kensinger's Tater Chip design. Raced by Jim Rice at Fort Wayne in 1956, this design met all the requirements. Another good photo was found, and

off to the old drawing board. The rudder shape was altered to move the center of vertical area rearward, but the modified design still had the sleek lines of old number 88. Because of the more modernistic tail shape, I named the new racer Super Chip.

A one-piece shoulder wing design, utilizing a belly hatch for access to the radio gear, had been used with considerable success on the earlier Miss Cosmic Wind, and these features were retained on the Super Chip. This one-piece design makes perfect alignment much easier, promotes a rugged but lightweight structure, and really protects the radio in event of a mishap. The Miss Cosmic Wind is still racing after hitting two wood pylon poles and a snow fence, so the latter feature was a little over-tested! Also, aileron linkages are somewhat easier to design and install if the wing and fuselage stay together. When using the two channel brick-type radio systems, this becomes even more important. To eliminate the lack of torsional rigidity common in wings of smaller aircraft, diagonal ribs were used in conjunction with fore-and-aft closed D-tube sections. Sufficient space was made available between the D-tubes to mount most radio gear, thereby providing maximum survivability for these expensive components.

Drag reduction was enhanced by keeping all control horns and linkage inside the slipstream, incorporating a spinner, and by extensive use of fillets around the wing, canopy, and tail surfaces. Narrow wheel pants were used for good looks and drag reduction on the removable torsion-bar landing gear, and have yet to cause a nose-over in the thick grass of local flying fields. If in doubt about the wheel pants, build an extra set of landing gear without pants for practice flying.

With the hot Cox Tee Dee .049 providing plenty of reliable go-power, the little ship has been a delightful



View showing hatch details and Kraft brick installation. Note how radio rests inside the wing structure, and ease with which the aileron connections can be made. Tab on hatch leading edge fits into former behind landing gear while screw holds down rear. Wire and plug is for battery charging without removing hatch. Fillets add strength, reduce drag.

performer. Power off, the light wing loading becomes apparent, as Super Chip glides like a single-channel trainer. All of my design objectives have been met or exceeded. If these objectives are similar to your requirements for your next project, then clear the workbench and let's go.

Construction of the model is quite conventional, although there are a few techniques that have been used to save time and assure alignment. I've tried to include sufficient detail such that most beginners will have a good chance of success. Use soft contest balsa throughout unless otherwise noted. In a small aircraft such as this one, you can afford to be more selective, choosing the right piece for the job.

WING

As stated earlier, the wing is really only two closed D-tubes, running from wing tip to wing tip, with both conventional and diagonal ribs between them. This type of structure is really rigid, so build it straight the first time. You'll find a straight wing is easy if 1) you use a really flat building board, and 2) you use jig pieces similar to those shown on the plan. Cut six

leading edge jigs from 1/8" hard balsa or plywood, using a jigsaw or bandsaw, if available. Be sure they are exactly the same. Tack glue or pin them, equally spaced along each wing panel, over the plan. Do the same with some 1/8" thick balsa shims at the lower spar location. The result, shown in the Wing Construction Detail on the plan, is a quick but accurate wing jig.

Cut out all of the wing components. Leading and trailing edge sheeting is cut from 2 sheets of 1/16" by 3" soft balsa, preferably 48" long, saving the leftover sheet for the ribs. Spars are 1/8" by 1/4" medium hard balsa, and the leading edge 3/16" square hard balsa. Note that the top spar extends beyond the end of the tip rib, all the way to the tip outline. It is used to support the wing tip sheeting during those vertical three point landings (wing tip, propeller spinner, and the vertical fin, in that order). Wing shear webs, grain vertical, run between the wing spars and between the top and bottom trailing edge sheeting. These webs complete the structural D-tubes, and thus increase wing strength far beyond what their small size and

weight may indicate. Cut a 10" long piece of 1/16" balsa sheet to the proper width, and slice off the required number of shear webs for both locations, all at once. You may notice on the plans that I did not cut a hole in the ribs for the aileron torque rods until after the ribs were glued to the bottom trailing edge sheet. To do so before this step might weaken the ribs enough to complicate assembly.

Actual wing construction is quite easy, once all the parts have been cut. Tack glue or pin the leading edge in position in the jig blocks. Pin the lower spar and the trailing edge sheet in place on the building board, with the spar shimmed up 1/8". Start assembly with the tip ribs, omitting the diagonal ribs until later. Glue a rib in place, followed by the spar and trailing edge shear webs, then another rib, etc. If you're off a little when you get to the center, I won't tell. The center section sheeting will cover it up anyway. The upper spar is added next, followed by a break to let the glue set.

As suggested earlier, now is the best time to cut the clearance holes for the

aileron torque rods, and install the rods in the wing. Sheet the top of the wing, including center section and tips, and add the diagonal ribs. The latter should be trimmed to fit as required. Let the wing dry overnight.

The wing may now be removed from the jig, and the sheeting of the bottom leading edge, center section, and tips completed. The wing tips are easier if you follow the following procedure: 1) Cut the top sheeting to the outline shown in the wing top view. 2) Use a sanding block to bevel both the top and bottom sheeting and the spars to the cross-section shown in the Tip Section on the plan. 3) Glue pieces of 1½" long soft 1/16" sheet balsa together to form two pieces, each 8" wide. The object is to cover the undersurface of the tip with one smooth piece, with the grain running spanwise. 4) Glue and pin the pieces to the tips. The result is a tip that is strong, light, and aerodynamically efficient.

Shape the wing with a sanding block, and cut out the ailerons. Glue the 1/16" and 1/4" thick aileron ribs in place, and cut 5/16" off the leading edge of each aileron to allow for facing. Face the ailerons with 3/16" thick balsa. Glue the soft balsa hinge support blocks in place between the top and bottom wing trailing edge sheeting. Face the trailing edge of the wing in the area of the ailerons with 1/8" sheet, cutting a slot in the facing to clear the aileron torque rods.

The wing panels can now be joined, but be sure to install the torque rod bearings at the wing center section. I glued the dihedral braces and torque rod bearings into the right panel. After the joint had set, I applied more glue and mated both panels. Raise one wing tip ¼" off the bench for the proper dihedral, and check the aileron torque rods for freedom of movement.

FUSELAGE

You may note the ample use of plywood in the fuselage, most of it forward of the center of gravity. As nose weight is often required in these smaller aircraft due to the light weight of the engines used, I chose to make the weight in this area do some useful work.

Begin by cutting out all the plywood and balsa parts. To prevent splitting, the grain direction of the doublers run at an angle to that of the fuselage sides. The 1/8" by 1/4" balsa triplers reinforce the radio equipment and landing gear area, as well as support the belly hatch.

To aid in fuselage alignment, draw

vertical centerlines on all formers and cross braces. Assemble the fuselage inverted over the top view on the plan. Lay the two side pieces flat on the workbench, assuring yourself that you have both a left and a right side. Glue all balsa doublers and triplers, plywood landing gear mounts (note that left and right mounts are different), the top triangular section, 1/16" by 1/8" vertical side reinforcements, and 1/32" tail doublers in place. After sufficient drying time, usually overnight, remove from the bench and glue formers 2 and 4A in place between the sides. Pin the assembly in place over the top view on the plan. Add the 1/16" by 1/8" top and bottom cross braces at stations 5, 6, and 7. Return to the nose area, pull in, and epoxy the firewall in place at station 1. Check alignment thus far by sighting down former and cross brace centerlines and the centerline on the plan. Epoxy the 1/16" plywood tail skid mount in place, and sheet the fuselage bottom from the tail skid mount forward to station 4. Prepare the 1/8" thick plywood motor mount by pressing 3-48 blind nuts in place. Epoxy the mount in place, along with the 3/32" plywood torsion bar mounts and the 1/2" thick balsa nose block. Let the whole thing dry and cure overnight.

Turn the fuselage upright, and add the top nose block, top 3/32" sheet, and the turtledeck formers at stations 3 through 7. The 3/16" square top stringer may now be glued in place. Cut the top turtledeck sides to approximate shape, and initially glue them only to the fuselage sides. After that glue joint has dried, the sides may be moistened with liquid ammonia on the outside, bent into shape, and held with masking tape until dry. Trim the top edge, pull the sheets back slightly, and glue to the formers and the top stringer. Do both sides simultaneously, again holding the sides in place with strips of masking tape until dry. The procedure is more difficult to describe than to perform. The result is a smooth sheeting job, free from pull-in between formers.

Sand the nose blocks and sides to match the 2 degrees right and down thrust in the motor mount, and epoxy the 1/16" plywood nose ring in place.

The belly hatch is built up by pinning the pieces right into the fuselage, with scraps of wax paper in the corners allowing removal when the hatch framework is complete. Hatch sides, ends, and cross braces are cut from 1/8" sheet balsa. When all the parts have been glued in place and the

joints are dry, sand the hatch flush with the bottom of the fuselage sides. Remove the hatch, and cover the bottom with 1/16" sheet balsa. The bottom of the fuselage sides between stations 2 and 4 should now be covered with pieces of scrap 1/16" by 1/8" balsa, with the grain running parallel to the sides. Trim the hatch sheeting, and tack glue the hatch back in place in the fuselage.

The entire fuselage, including the hatch, may now be carved and sanded to final shape. Don't spare the effort in this step, as it is a key to light weight and good looks in any design.

TAIL SURFACES

Everything back here is sheet balsa. Weight is critical, so use fairly soft stock for everything except the vertical fin, which needs medium grade for strength. I feel the key to high strength, no warpage, and light weight in these very thin surfaces is the exclusive use of epoxy in fabrication and final finish. I used Hobbypoxy Formula II for all joints. The Easy-Does-It Method works perfectly for the finish, provided that all the scraping is done **before** the stab and vertical fin are attached to the fuselage. Do the scraping on a smooth, flat surface, and you'll be amazed at the warp-free surfaces that can be obtained.

LANDING GEAR

Bend the two main gear legs to shape from 3/32" diameter music wire. The tail skid is 1/32" diameter wire, sewn to its plywood mount with carpet thread, and then coated with epoxy.

The wheel pants are not really necessary, but as they are very narrow, they don't seem to be a handicap during landings on even rough grass fields. They add measurably to the appearance and the authenticity of a pylon racer, however, and those described here are really quite easy to make and install. The pant cores are cut from either one sheet of 5/16" balsa, or laminated from sheets of 1/16" and 1/4" stock. Sandwich the cores between the balsa side sheets, add the plywood mounting blocks, and carve and sand to final shape.

FINAL ASSEMBLY AND FINISHING

Remove the belly hatch, slide the wing into the fuselage, and epoxy securely. Epoxy the horizontal stabilizer in position on the fuselage, checking for alignment with the wing. Carve some soft balsa blocks to flare the vertical fin into the fuselage, and epoxy both the fillets and the fin in place. Epoxy the aileron horns in place

on the torque rods as shown in the fuselage side view. The differential action and center-hinged ailerons give smooth rolls without adverse yaw.

Paint the cockpit area with flat black enamel or Aero Gloss. The canopy I used is a cut-down Sig 13" model, dyed with Rit #29 Royal Blue. The tinted canopy, with flat black underneath, makes the cockpit seem larger and more nearly to scale. Notch the turtledeck sheeting at former #3 about 1/64" deep, and back towards the tail about 1/16". This allows the canopy to seat flush with the surface of the turtledeck. Glue the canopy in place with Aero Gloss C-77 cement. When dry, completely cover the canopy to within 1/8" of the edge with masking tape to protect it during subsequent finishing steps.

Add the 1/2" square plywood front hatch hold down tab to the hatch. Fit it so that it just slips over the lip of the former at station 2. I used a long 4-40 screw and nut to hold down the rear of the hatch, but you may have a cleaner solution.

Everyone has their own way of applying surface preparation and final finish to a model. There isn't much surface area on the Super Chip, but light weight is important. Some may prefer to use MonoKote for lightness and ease of application. I suggest the following method. For small aircraft, I feel it's the best of the many I've tried.

Sand everything smooth, working down to #400 sandpaper, and apply two coats of clear butyrate dope to everything except those Hobbypoxy-coated tail surfaces. Cover the wing with medium weight Silkspan, applied wet. Cover the fuselage and wheel pants with very light weight silk, also applied wet. Seal the covering with three coats of clear, sanding well between coats.

Add fillets, using Sig Epoxylite, to the canopy and the wing. After the fillets have been sanded to final contour, give everything except those tail surfaces a coat of 50/50 dope and talc mixture. Sand carefully, and finish the surface preparation with a thin coat of clear over everything.

Cut a small square of finish away from the inside of each wheel pant, and slide pants and wheels onto their gear legs. Install the gear temporarily on the model, and epoxy the pants in place. Reinforce the attachment with a small patch of glass cloth epoxied in place over that spot of bare wood on the inside. While you're mixing epoxy, apply a coat or two to the interior of the engine mount area.

Hinge the ailerons and elevator to suit your taste. Epoxy the ailerons to the torque rods in the process. Leave your masterpiece alone for three days, allowing the dope solvents to evaporate prior to finish coats.

The color finish on most of my small models is Hobbypoxy. Hot 1/2 A fuels and even the best hot fuel proof dopes just aren't compatible. Lightly sand the entire aircraft with #400 paper, clean well, dry, and spray Hobbypoxy. I'm sure a letter to the folks at Hobbypoxy will get you the details. Remove the masking tape from the canopy, and allow the finish to cure for a week before exposing to raw fuel.

EQUIPMENT INSTALLATION

I used a Kraft two channel brick system in the prototype, although there is room for two servos from a conventional system. The brick was mounted on two 1/4" by 1/2" spruce rails laid across the fuselage. A 225 mah. battery pack was located in the nose, under the 1 oz. Sullivan fuel tank. I wired a separate charging plug into the battery pack, and attached the plug to the belly hatch. I now can charge the system without the need to remove the hatch.

Make up the aileron and elevator pushrods, the latter incorporating a length of 3/16" diameter dowel. Numerous commercial fittings are available, so I'll leave the choice to you. Suggestions for control surface throws shown on the plan give lively aerobatic performance. A little less elevator might be advisable for a beginner, especially with a rearward center of gravity location. The Tee Dee .049 used on my prototype has run well with a 5 1/4 Cox prop. For best performance, be sure the prop is balanced and the spinner is running true.

Check the center of gravity location, and add weight if necessary. If the CG is much behind the rear limit shown on the plan, I suggest you move all spectators back 100 feet for each 1/4" of aft CG. Small models need a more forward CG to help in pitch stability due to their lower inertia about the pitch axis. Otherwise, they're wild!

FLYING

Flying weight, less fuel, should be between 21 and 26 ounces. Choose a calm day to get used to the small size and greater apparent speed of your Super Chip. When you become accustomed to these little aircraft, windy weather flying is no problem. A hand launch is suggested for the first flights.

If you're new to aileron flying, get someone more experienced to do the test flying.

Good luck, and let me know how you like your Super Chip. Start racing with anything available. Organize club races at your local level, and let R/C Modeler Magazine and your AMA representatives know of your interest in 1/2 A racing. Only in this way can this racing class for everyone grow and mature. □

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