#586

Snapdragon

A no-frills airplane with all-frills performance and convenience are the earmarks of this .25 size model for four-channel controls.

■ Kin Cartrette

HOW DOES ONE design a better mousetrap? It begins with a brainstorm that draws strange looks, a brainstorm that takes a semblance of order. Design it in your head, build it, draw the plans, and build more to make certain that it isn't a fluke. Will it fly? Your last one flew rather strangely. Yes, this one flies nicely! And what will you call this mousetrap? How about calling it Snapdragon? Thus it was born, this flying mousetrap.

The Snapdragon began as a personal challenge. The objective of the design was to develop a .25-size plane that would be fully aerobatic and could serve as a Sunday flier or a Fun Fly machine.

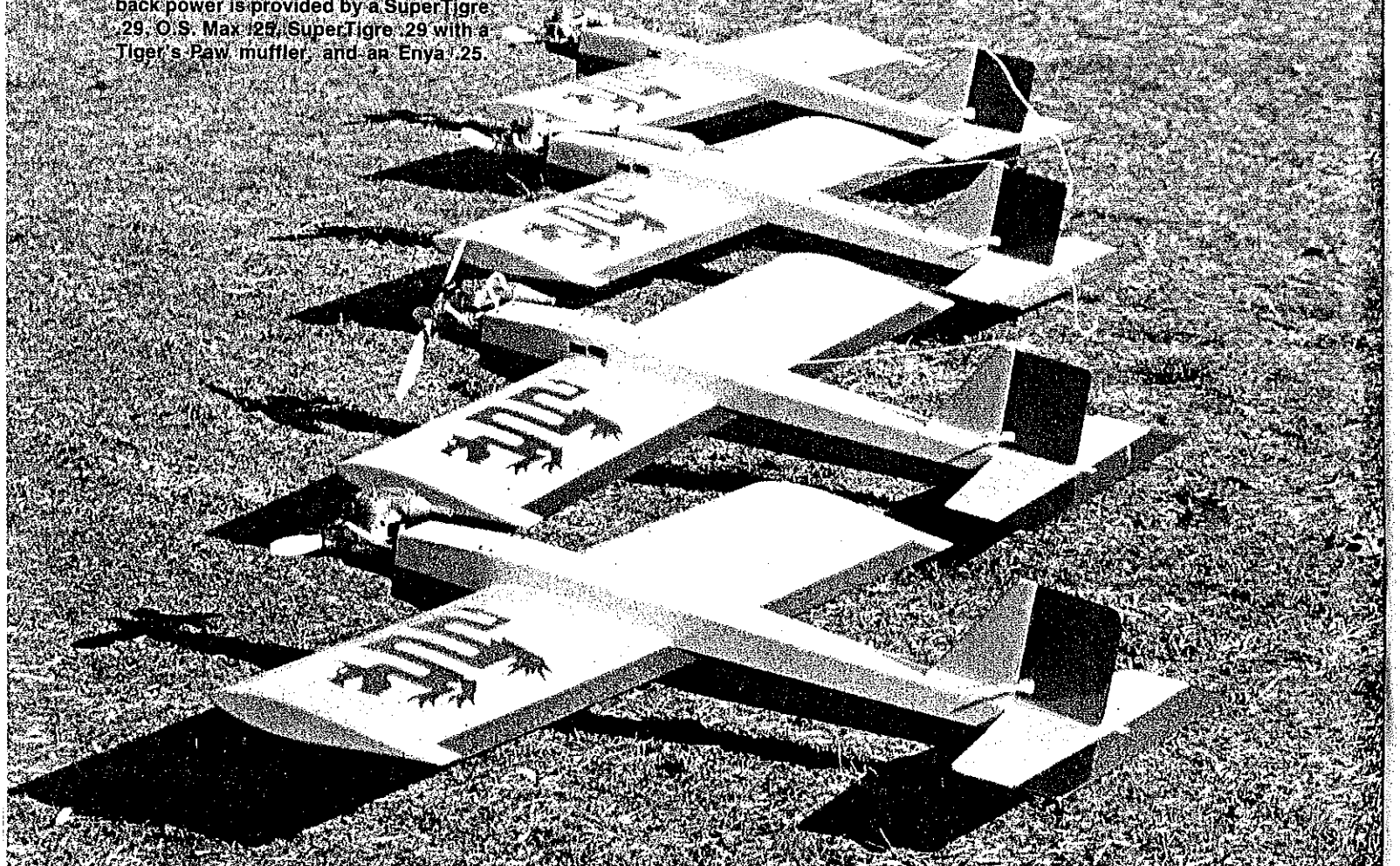
There are plenty of Fun Fly planes on the market that perform well and are inexpensive. However, most of them require a .40-size engine. There are those that will turn to balsa dust on a rough landing or minor crash. The conflict between weight savings and strength has yielded to lightness. I have also noted that some of the designs tend to balloon on landing due to the thick airfoil. These are minor headaches that are outweighed by high performance, but they are still headaches. Could they be ironed out without the plane suffering?

The solution turned out to be fairly simple. Throw looks out the window and let come what may! Actually the Snapdragon isn't such an ugly plane, but it is void of any graceful curves which usually appeal to the eye. The covering job can dress it up a bit, and a canopy can be added.

A .25-size airplane best fit my wallet and car. The wide variety of .25 engines on the market today are relatively inexpensive, simple to keep up, provide ample power, and consume less fuel than their bigger brothers. That .25 engine you may have put in mothballs after you advanced beyond your trainer will do nicely on the Snapdragon. Flying has shown that the Snapdragon will keep up with the .40-powered birds.

A 15% fully symmetrical airfoil with a 4.5-to-1 aspect ratio was selected. The wing chord came out to 10¼ inches and the span to 45½ inches. This results in roughly 466 square inches of wing area. The generous wing area compensates for the lack of a 20%-thick airfoil. The thinner wing allows a slightly higher top end. This combination solved the ballooning problem on landing.

To enhance maneuverability a mid-wing configuration was incorporated, and generous control surface area was used. The large chord gives ample room for radio and servo installation. The mid-wing configuration, combined with the low aspect ratio, gives excellent roll performance, and the symmetrical airfoil permits very stable inverted flight. The wing has no dihedral; therefore, the plane stays where you put



Enter the dragon's lair! From front to back power is provided by a SuperTigre .29, O.S. Max .29, SuperTigre .29 with a Tiger's Paw muffler, and an Enya .25.

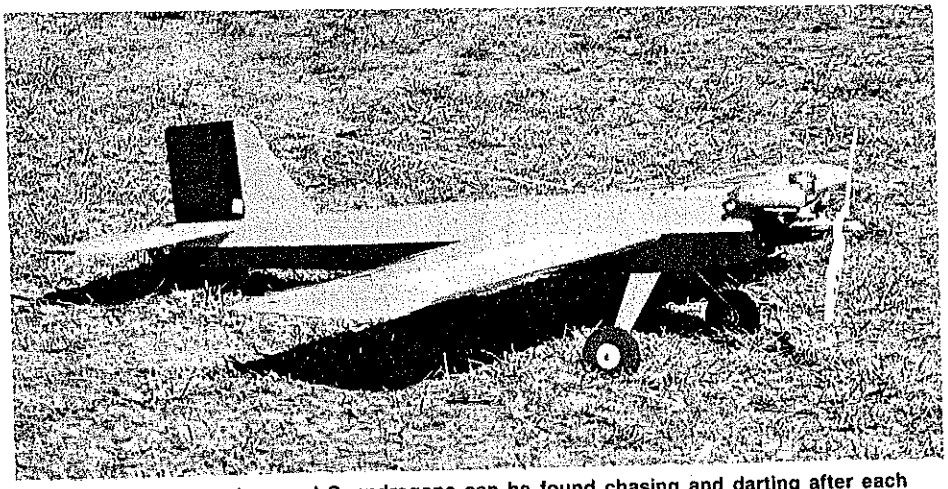
it. All moments were kept to reasonable lengths, but tight enough for hot performance when wanted.

The mid-wing configuration resulted in certain difficulties. Considering the size of the Snapdragon, a one-piece plane was inevitable. Radio space could also be a problem with the spars, leading edge, and trailing edge passing through the thrust line. As previously stated the wing chord turned out perfect for the radio installation.

Should a wing be severely damaged with a one-piece airplane, it could mean having to junk the whole thing. Therefore, strength was a must. The wing is of D-tube construction with trailing edge sheeting. The tips were squared off for simplicity with no detrimental effects. A ply "dihedral" doubler was added just to be on the safe side, even though the spars run straight through. Trailing edge tips were used to prevent the possibility of aileron flutter.

A box-style fuselage offered simplicity and strength (remember that looks didn't count for this project). To help with aerobatic ability, the top and bottom contours of the fuselage are symmetrical. All hatches allow full and easy access to the fuel tank and radio equipment. Formers were kept to a minimum, and a blunt-nose, Stik-type firewall was selected.

No nose wheels, please! A tail dragger with a wide stance and generous tail wheel moment will do nicely. Joining the wing to the fuselage offers no big problem. Just as with profile Control Line planes, a hole is cut, the wing inserted and aligned, and epoxy applied. The fin and horizontal stabilizer were cut from sheet balsa to round out this brainstorm.



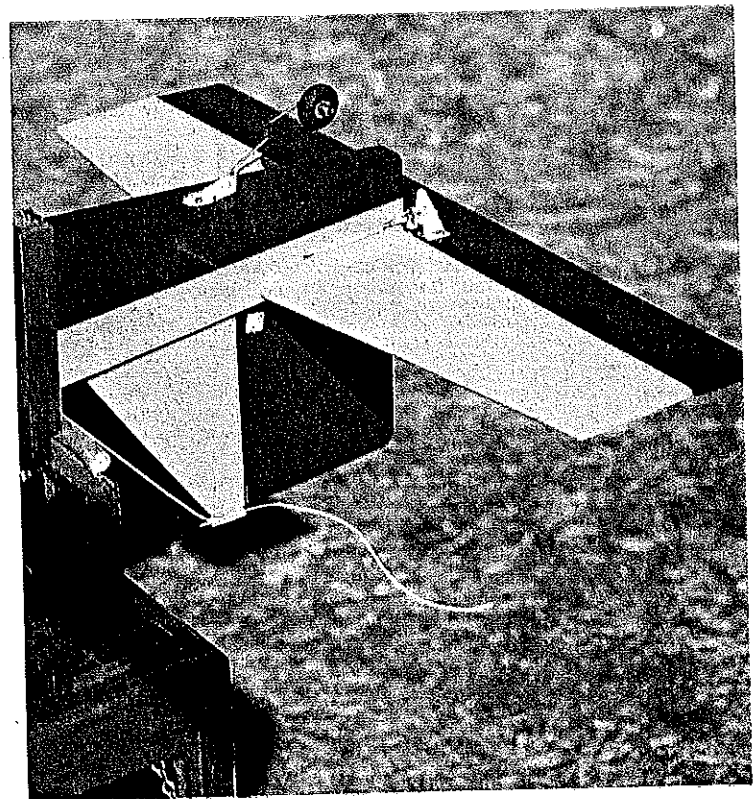
On any given weekend several Snapdragons can be found chasing and darting after each other up and down the Yadkin river bottom at our author's local club field in North Carolina.

The first Snapdragon was constructed using a balsa fuselage to keep down weight. Problems developed rather quickly: the tail moment was too short, and proper balance was a problem. The control throws had been set up too high, and the roll rate was uncontrollable. The end result was a nose-heavy, erratic aircraft.

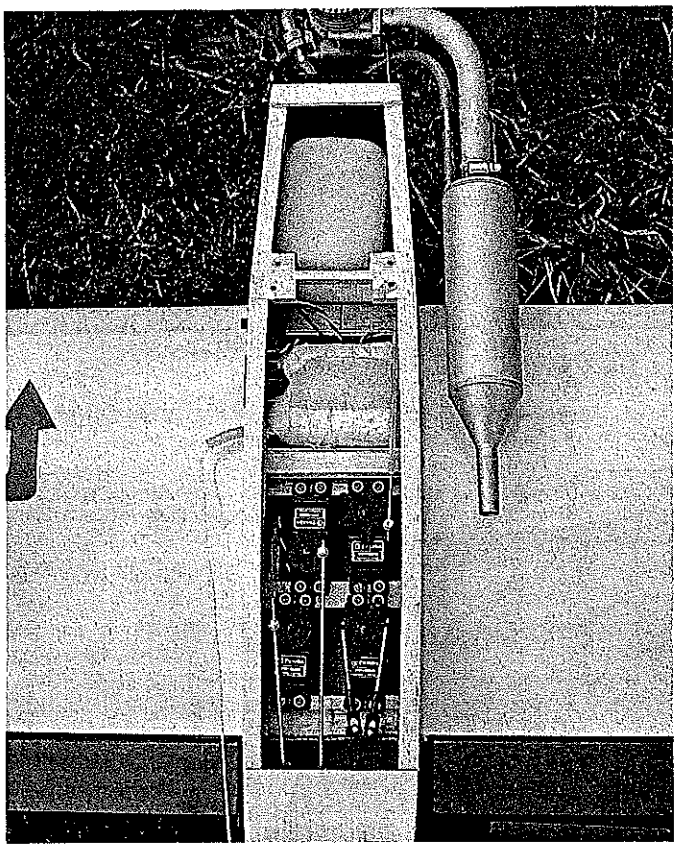
Step by step and pounding after pounding, the kinks were worked out. The tail was glued back on, control throws slowed down, and center of gravity (CG) reworked. On the last two flights the sticks were handed to friend and fellow club member Jeff Stoltz (he'll fly anything at least once). This time it flew, although it was still somewhat sensitive. After two successful easy flights, the tail popped off again on landing; Snapdragon One found the bottom of a trash can. Lessons learned were applied, and three more were built with plywood fuselages and corrected tail moments.

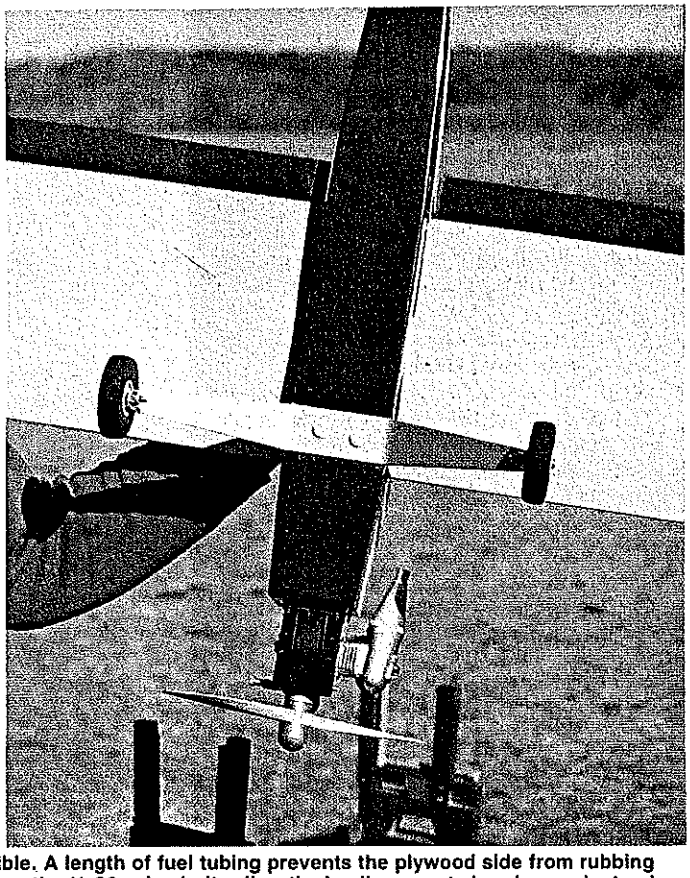
In late August Jeff and I went to the field and tried again. Jeff set his plane up with an Enya .25XTV, and I set mine up with a Supertigre S-29 with a Tiger's Paw muffler. Jeff went up first. "Well, how's it doing?" Jeff went up first. "Well, how's it doing?" After a thoughtful pause Jeff responded, "I'll tell ya as soon as my nerves calm down." After landing and settling down a bit, Jeff took mine up. I was out of practice and figured that he was now an experienced Snapdragon pilot. The result again was sweet success.

Takeoffs were quick. Outrageous climb-out angles were possible. The model turned, rolled, and looped better than I had expected. Stall turns and snaps were something to behold. The little planes seemed to float in the sky as they snapped to their hearts' content. On one occasion since

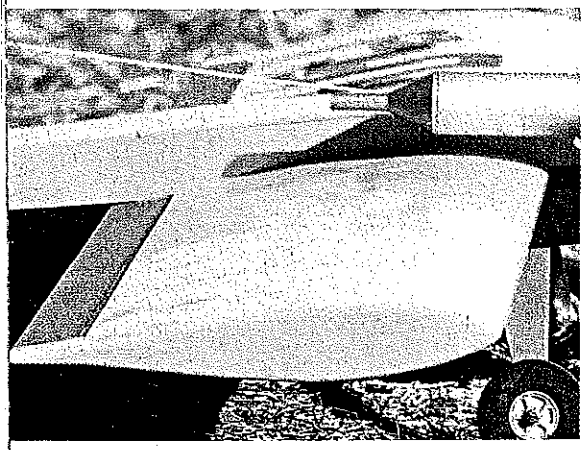


Left: Somehow using a flower logo didn't quite seem right, so this fellow was drawn up. His square corners are certainly indicative of the model's flight performance. Right: Control surfaces are rather large, which results in quick, tight maneuvers when desired. It's hard to see here, but the clevices are kept closed with a small piece of fuel tubing, something that should be standard on any high-performance model.





Left: With the hatches off, the radio and fuel tank are completely accessible. A length of fuel tubing prevents the plywood side from rubbing through the insulation on the antenna. Right: On rough landings and crashes the ¼-20 nylon bolts allow the landing gear to break away instead of tearing out the bottom of the fuselage. The Dave Brown Lite Flight Wheels are very durable and offer a significant weight savings.



A 15%-thick, fully symmetrical airfoil with a long chord provides plenty of lift for this small plane. Blunt tips keep it simple, and big ailerons provide plenty of roll response.

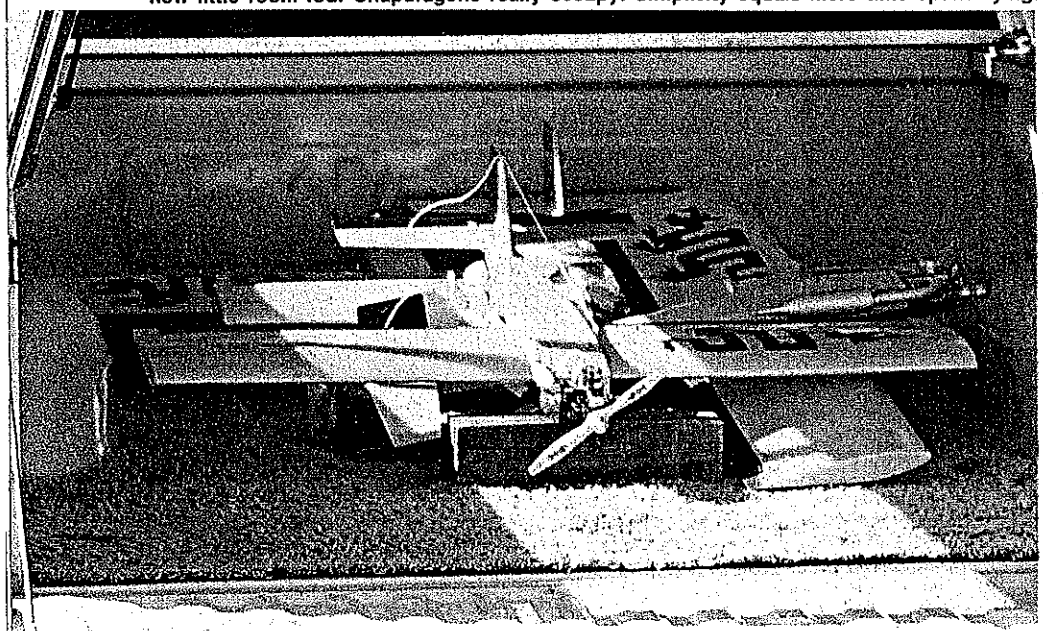
then, I tried a half snap to inverted, and it worked. Vertical dives with L-shaped pull-outs were possible; Jeff was the one bold enough to try it.

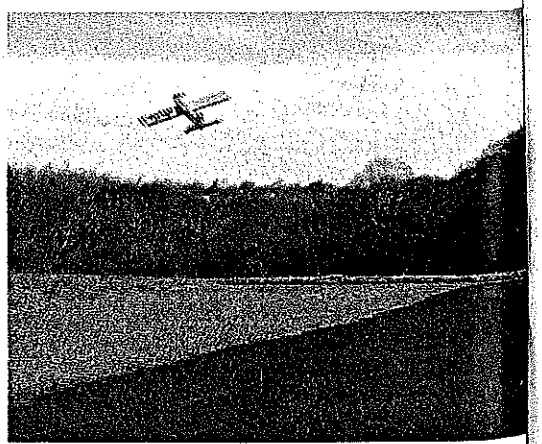
The Snapdragon has exceeded my expectations. The size is perfect for transport and yet is large enough to be seen in flight. The design has all the elements in fair symmetry, and this results in good inverted flight performance. With the controls turned up, it will tie itself in knots for you. Slow it down and you have a quick sport ship that is fully aerobatic.

The Supertigre S-29 was the faster of the two models, though it was slightly heavier than Jeff's both due to the heavier engine and weight that was added to the tail for balancing. With an Enya .25XTV or an O.S. Max .25FP, the Snapdragon balances perfectly without having to add any ballast. A larger, .40-size engine would be too much for this plane. Sometime I intend to try an Enya .19TV to see just what the bottom end of the range is.

Slow flight characteristics were surprising. The generous wing and control surface area allow it to putter along like a trainer. On landing approaches, the plane flares nicely. If you pull the nose up higher, it will mush in. Do be careful, though; it will snap if you try to "park" it. Remember that it

The back of Jeff Stoltz' pick-up looks like it's loaded up for a combat match, but it shows just how little room four Snapdragons really occupy. Simplicity equals more time spent flying.

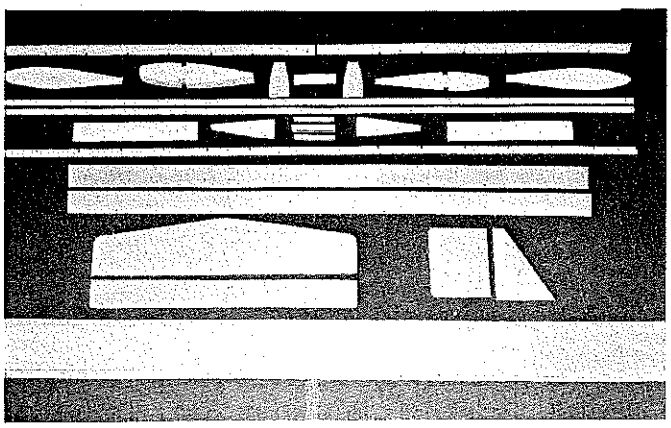


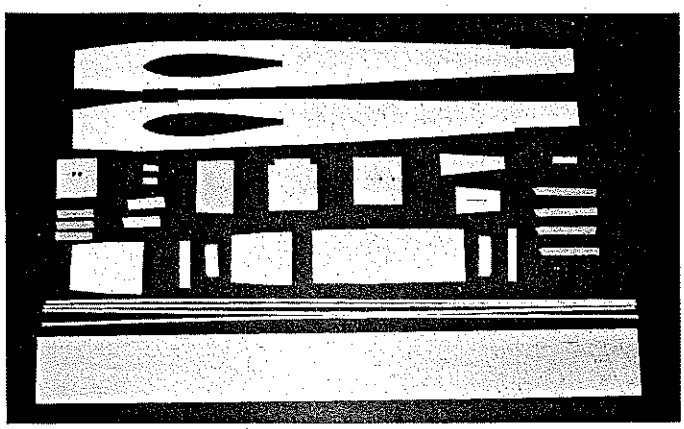


Using half the runway, this bird is up and banking away. Takeoff rolls are short and straight. No difficulty with ground looping has been experienced. Steep climb-out angles can be made with a strong .25 engine.

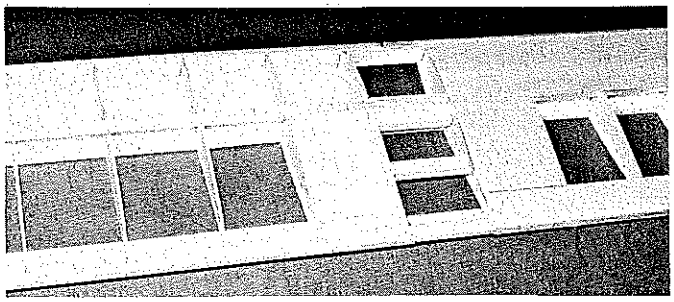
SNAPDRAGON

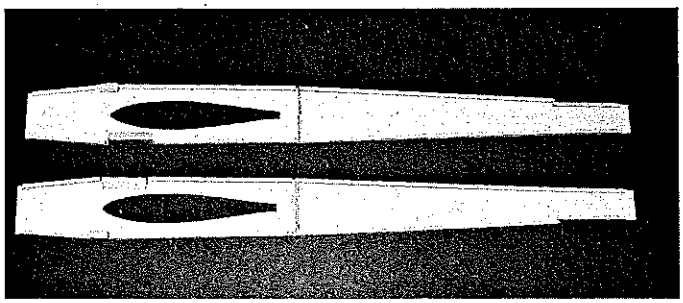
W. M. CARTRETTE





Cutting out all the parts before you begin construction reduces clutter on the workbench and makes assembly go much faster. The easiest way to cut the ribs is by stacking and shaping blanks. Note the notches cut into the leading and trailing edge pieces shown in the picture on the left. Our author says he prefers to pre-drill the firewall and formers, but you may want to wait until after your model has been assembled.





Left: The wing is of standard D-tube construction. The open center bay allows plenty of radio room. No cap strips were used on the ribs to save assembly time; they really aren't necessary on this plane. Right: Be certain that you build a right and a left fuselage side. (It is best to lay them out as mirror images to make sure.) No cutouts are needed in the fuselage; it will balance without them and still have plenty of tail strength.

isn't a trainer. No ballooning tendencies have been noted on landings.

Ground handling is excellent. The wide stance of the main gear and the tail moment combine to give a straight takeoff roll and landing roll-out. No ground looping has occurred. Prop clearance is ample for nine-inch props, and surprisingly few props have been broken on this plane. The low profile allows for good crosswind taxiing and flying.

A 2½-in. wheel was selected for the main gear to allow for rough terrain, and foam wheels were selected to keep the weight down. Contact with the ground on landing results in very little bouncing. Like any plane, if you slam it in for a landing it will bounce—but it responds quickly enough to allow you to gun the engine and go around to reclaim your pride. I chose not to use a nose gear for obvious reasons. They tend to bend on rough landings, the steering gets sloppy with wear, and they love to eat props. The Snapdragon's main gear is mounted with ¼-20 nylon bolts which shear away nicely if you ditch. They have already saved a few headaches.

Construction. Before we assemble anything it is advantageous to cut out all parts and create a "kit." Go ahead and drill out all firewall and former holes. Save the hatches and landing gear mount holes until later. Stack and sand all W3 ribs; leave the W4 tips a bit oversized since they will be sanded to the wing contour later. All the balsa I used was of the hard grade, and I used Sig Lite Ply throughout.

For the adhesive I used Zap CA and Slo-Zap. The thinner Zap is great for sheeting, tacking, and bonding balsa to balsa. The Slo-Zap gives you more working time and works better for butt joints and areas that require more strength. You will also need some 30-minute epoxy for the firewall and fuselage/wing joint. Flex-Zap can safely be substituted with some savings in weight.

Wing. Let's begin here. Cut the ¾ x ⅜ x 36-in. leading edge (LE) pieces down to 22½ in.. Also cut the 48-in.-long spars and ¼ x ½-in. balsa trailing edge (TE) down to 45 in. Using the plan, carefully mark the rib locations on the LE, TE, and spars. As shown on the plan, use a razor saw to notch the LE and TE to accept ribs W2 and W3. Do not cut any notches for ribs W1; these are butt joints.

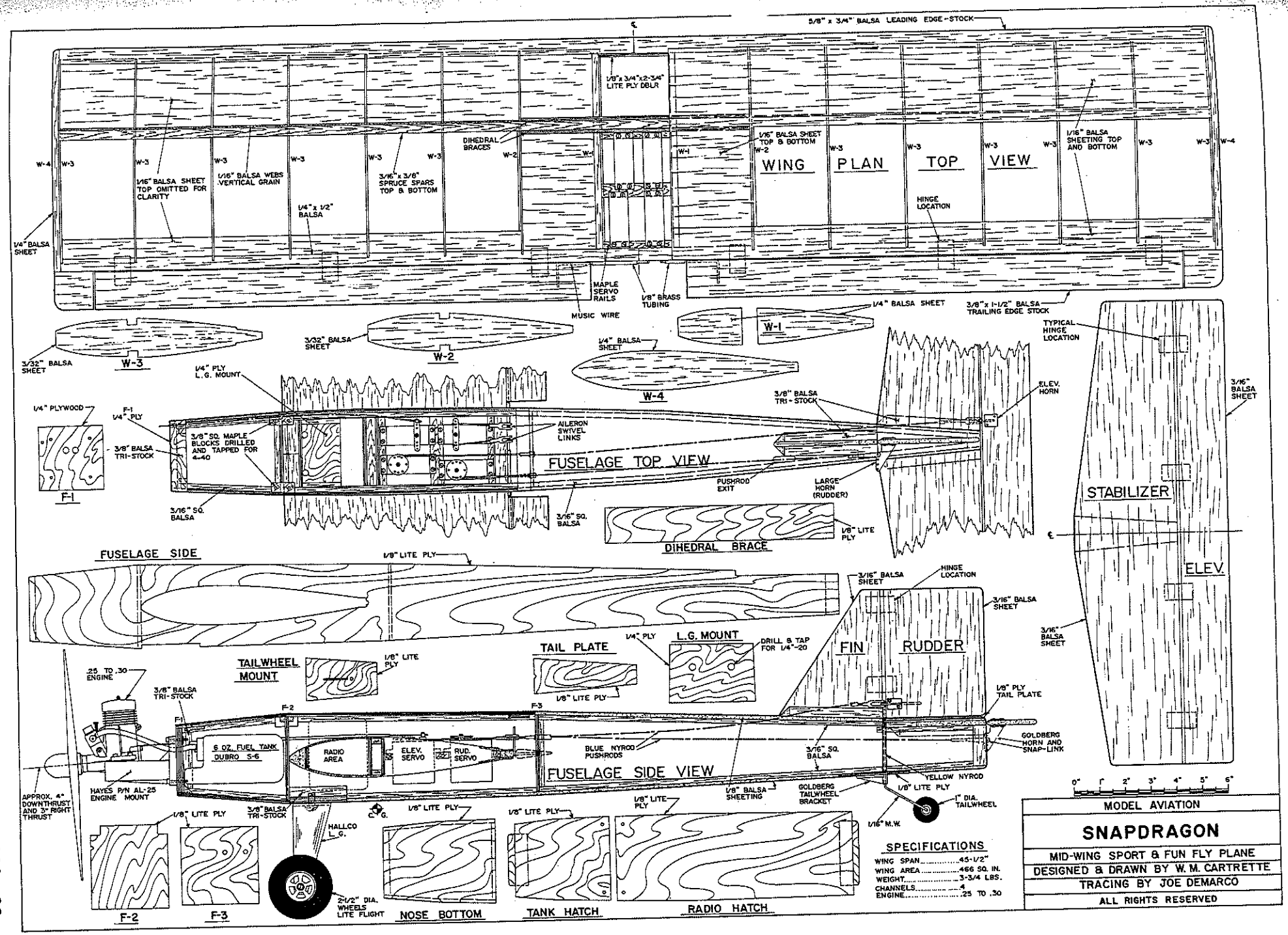
Note that the LE pieces have been butt-joined and doubled by a piece of ⅛ x ⅜ x 2¾-in. ply. It is important to center this ply doubler between the marks for ribs W1. Glue the LE and doubler together now. Make sure that the leading edges are straight. Use a flat surface and a straightedge if necessary.

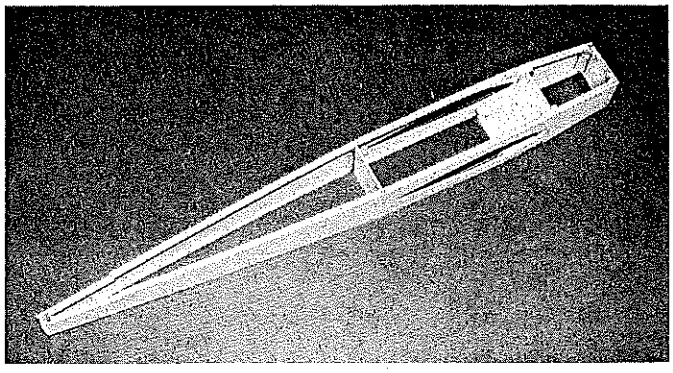
Using a flat surface, lay out the plans and cover them with the protective film of your choice. I prefer wax paper, but I'll not enter that debate. Align the lower spar and TE on the plans. Shim up the spar with a scrap strip of 1/16 balsa and the TE with ⅜-in. blocks. Making sure that everything lines up with the plans, position and glue ribs W2 and W3. Use a building triangle to ensure that the ribs are 90° to the spar. Now glue on the top spar and LE. Glue the ⅛-in. ply "dihedral" braces and 1/16 balsa vertical webbing to the spars as per the plan. Align and glue in the fore and aft pieces of ribs W1. Glue on the LE and TE sheeting as shown.

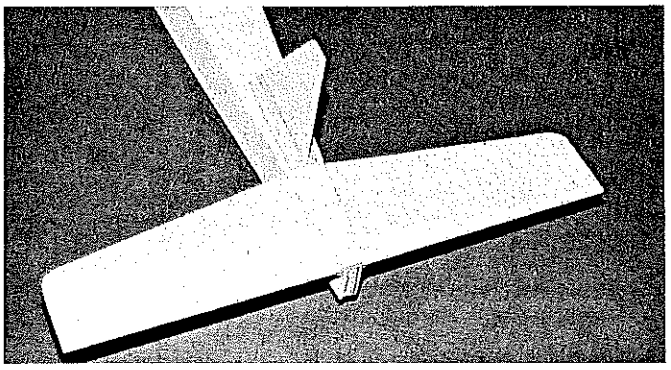
Carefully align and glue in place the maple servo rails. Pay special attention to the side view on the plans to ensure that the tops of the servo rails line up and are level. Use an actual servo to check for a proper fit. Finish sheeting the two center sections from W1 to W2. This completes the wing assembly for now.

Fuselage. Being sure that you have a right and a left side, mark the locations for the firewall, formers F2 and F3, maple hatch anchor blocks, and tail block. Cut and glue the 3/16-sq. balsa strips as indicated flush with the edges of both fuselage halves. Next attach the maple hatch anchors and ⅜-in. triangular balsa pieces that reinforce the landing gear mount.

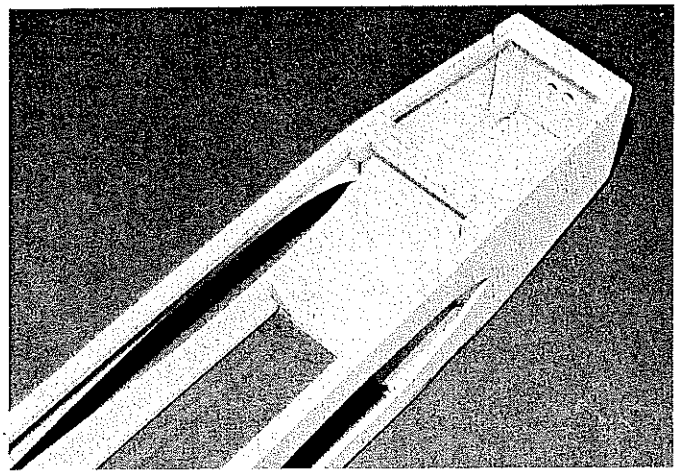
Align the two fuselage halves and secure the tail ends together with masking tape. With the fuselage sides in straight alignment, epoxy-glue the firewall and also glue F2 and F3. Glue the ⅜-in. balsa triangular braces to the firewall and the 3/16-sq. strips that reinforce the formers and run along the top edge of F2. Remove the masking tape and install the tail block, again checking for fuselage alignment. Glue on the ⅛-in. ply nose bottom, ¼-in. landing gear mount, and ⅛-in. ply strips under which the radio and fuel tank hatch tongues will anchor. Sheet the top of the fuselage with ⅛-in.

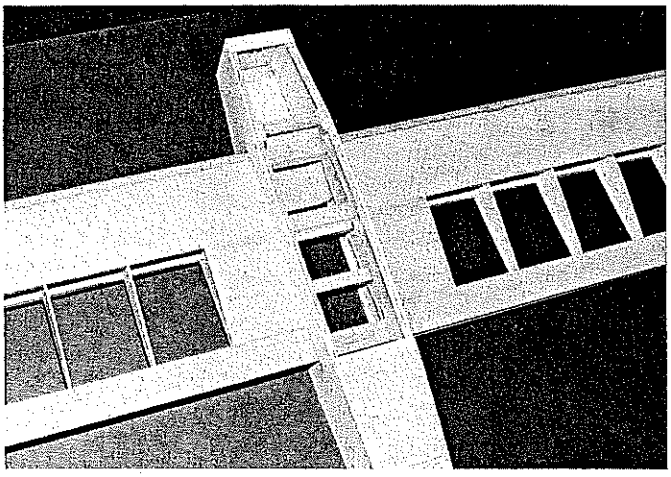






Left: It is very important to keep the fuselage straight and untwisted during construction. The easiest method is to temporarily tape the tail together, install the firewall and formers, and then permanently join the tail. Right: The stab must be level with the wing. Measure from stab tip to wing tip on each side to get the alignment correct. Draw a centerline down the top of the fuselage as a guide to mount the fin by, and line it up with a triangle. Be absolutely certain that the fin/rudder hinge line is inline with the hole where the tail wheel wire comes through.





Left: The firewall and landing gear mount should be solidly braced. At this stage the fuel tank hatch lip and ply nose bottom are already in place. Also, note the strips along the top edge of F2 to create a hatch seat. Right: Center and align the wing carefully by measuring tip to fuselage side and tip to tail joint. Make sure the top of the wing is up as far as it will go. Sheet the top rear of the fuselage with cross-grain balsa.

cross-grain balsa from F3 to the stabilizer saddle. We are now ready to attach the wing.

Give the wing a preliminary sanding, and carefully sand off any burrs in the wing slots of the fuselage. Making sure that the wing is right side up, carefully and patiently slide it through the fuselage. Take care not to splinter any ribs or dig into the sheeting. If necessary, sand out the wing slot some more, but do not alter the incidence! Once the wing is centered and aligned with the fuselage, tack it in place with a few drops of Zap.

Slide the 1/8-in. brass tubing over the aileron torque rods, and bend and cut them as shown. Note that they are of different lengths, as are the brass tubes. My preference is for the Rocket City swivel links with the included 3/32-in. torque rods. Insert the torque rod assemblies through the fuselage along the TE of the wing as shown. Recheck to make sure they are on their proper sides, and then tack in place with CyA.

Glue the wing in place with 30-minute epoxy. Be generous on the inside, but not excessive. On the outside, build up a slight fillet by using a wet finger to smear the epoxy along the joint. Also epoxy the brass tubing to the wing and fuselage, being careful not to get any on the torque rods. I recommend wrapping a bit of fiberglass around the longer left brass tubing and the TE for added strength on that torque rod. Coat it with thin cyanoacrylate (CyA), and you will have a very secure bond.

Carefully align the horizontal stabilizer with the fuselage, and glue it on with epoxy. The stab, elevator, fin, and rudder are cut from 3/16 hard balsa sheet. Be certain that the stabilizer is centered, level with the wing, and at 90° with the fuselage centerline. When dry, glue on the 3/8-in. triangular braces which support the stab and the 1/8-in. ply tail plate.

Attach the fin and triangular braces to the fuselage as shown, making certain that the TE lines up with the notch in the tail plate. This is where the tail wheel wire will come through, and it should fall on the rudder hinge line.

Bore the hole through the balsa underneath and glue in the yellow Nyrod guide flush with the tail plate. Insert a piece of straight 1/16 music wire through the Nyrod to help line up the 1/8-in. ply tail wheel plate on the bottom of the fuselage with the fin on top. Once you are satisfied, CyA the tail wheel plate in place.

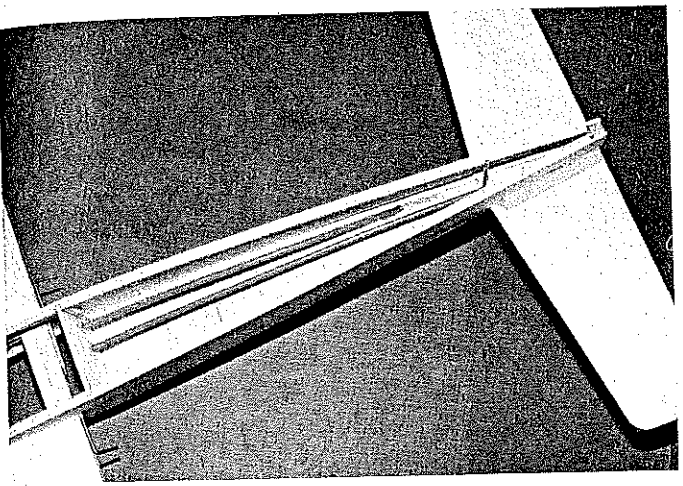
Position and glue in the rudder and elevator control rod guides. I prefer the blue Sullivan Products Gold-N-Rod control linkages and have drawn the plans using them. I have found no problems with slop, but you can add a brace midway up the fuselage if you so desire to reinforce the guides. Once your control system is set, it is time to sheet the bottom of the fuselage with 1/8-in. cross-grain balsa.

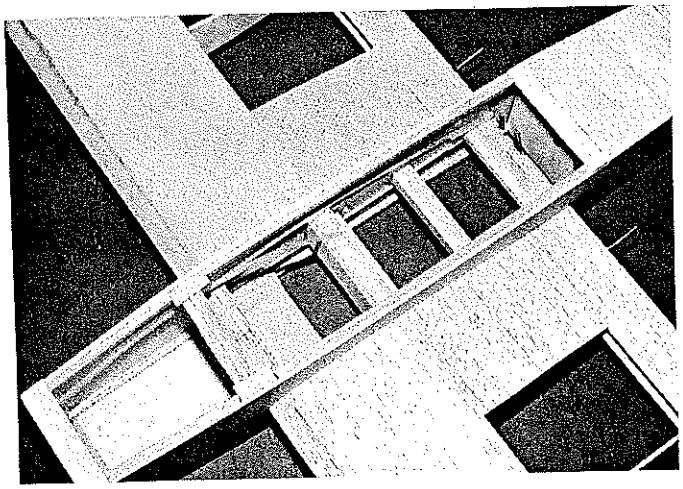
Check your hatches for proper fitting. Trim them if necessary. Attach the tongues to the hatches; fit them in place, and carefully drill the screw holes through the hatch and maple blocks using a 1/16 bit. Tap the blocks for a 4-40 screw, and enlarge the hatch holes to 1/8-in. diameter.

For the landing gear I chose a Hallco Temper-Lock rated at 4.5 to 6.0 lb. A gear rated at 4.0 to 4.5 lb. would probably suffice, but a sturdier one is needed for those slam-and-goes. The gear is drilled out to accept two 1/4-20 nylon bolts. The 1/4-in. ply landing gear plate is drilled to match with a 5/32 bit and tapped for 1/4-20. Coat the threads with thin Zap, and run the tap back through. Plywood tends to splinter, and this will help to reinforce the threads. Should the threads eventually strip out, just drill the holes out to 1/4 in. and use 1/4-20 blind nuts.

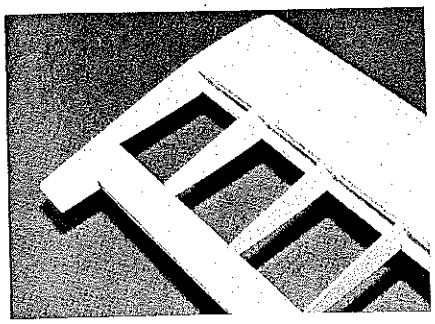
The last steps before covering are to put in place and glue the throttle pushrod guide and fuel-proof the firewall and fuel tank compartment. Any butyrate dope will do nicely. For the throttle I prefer to use the Sullivan Products Gold-N-Rod throttle cable rather than fool with music wire.

Finish the wings by gluing on the 1/4-in. W4 balsa tips and the TE tips which are cut from 1 1/2 x 3/8-in. TE stock. Be sure to re-

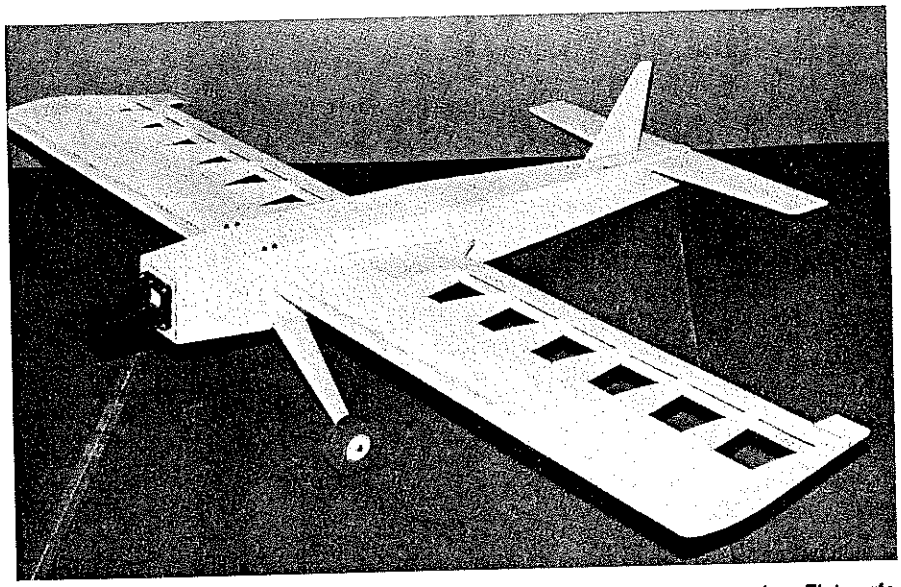




Left: Install a section of the yellow Nyrod to act as a bearing for the tail wheel wire. After the glue sets on the Nyrod, install the tail wheel plate. Use a piece of scrap music wire to keep the Nyrod aligned while the glue dries on the plate. Right: Install the throttle cable guide and the aileron torque rod assembly. Notch the trailing edge stock as needed so that the torque rods can move freely through their entire range.



The wing tip and trailing edge tip are the final touches to assembling the wing. Sand the glue surface on the trailing edge tip so that it follows the airfoil shape; otherwise, the bevel that is cut into the wood will cause the tip to droop down, or to reflex upward.



Holes drilled, hatches in place, and sanding done, this plane is ready for covering. Flat surfaces and square corners make covering this model a breeze. The control surfaces and tail wheel will be added last. Don't be misled by the solid surfaces; the plane comes out very light.

move the beveled edge so that the TE tips don't reflex or droop. Remember that the wing is symmetrical.

This done, cut the ailerons from 1½ x ⅜-in. TE stock and the rudder and elevator from 3/16 balsa as per the plans. Bevel all hinge surfaces as shown. Go ahead and bore the torque rod holes in the ailerons, and coat them inside with thin CyA to harden the balsa, but be careful not to clog up the holes!

All parts should be given a final sanding before covering. My preference is to cover the plane before attaching the ailerons, elevator, and rudder. This technique allows for a more thorough covering job, especially along the hinge lines and on the ends of the aileron stock. All Snapdragons so far have been covered with Top Flite Super MonoKote. The plane's design lends itself well to a glossy finish, and Super MonoKote was my preference.

My covering jobs have been kept simple and consistent. Yellow was chosen for the main color, while the darker colors have varied—though usually metallics. When covering it is important to remember that your color scheme should aid you in telling the top of the model from the bottom, especially with a plane this quick and this small. Trying to see a fin or landing gear is no fun when you get disoriented; that's where the dragon on the wing and the dark underbelly help out.

Finish up by hinging all control surfaces. My preference is for the Lake Hobbies Easy Hinges, which bond securely with a few drops of thin Zap. The hinge slot for these is easily made with a #11 X-Acto blade, and these hinges require no pinning.

To mount the rudder, first bend the 1/16 tail wheel wire to accept a 1-in.-dia. tail wheel. A Carl Goldberg nylon tail wheel bracket was mounted in the slot on the tail wheel plate and aligned with the Nyrod sleeve. Insert the tail wheel wire up through the mount and sleeve, bend it at a right angle, and cut as shown on the side view of the plan. Bore out a 1/16 hole in the rudder to accept the music wire, and hinge the rudder in place. Mount the ailerons and elevator as shown.

Mount the landing gear with two ¼-20 bolts ⅝ in. long. These will shear off during rough landings. For wheels I decided upon 2½-in.-dia. Dave Brown Products Lite Flite Wheels bored out to accept a 3/16 axle.

Carl Goldberg Long Nylon Control Horns and Snap-Links round out the control linkage. When attaching the control horn to the rudder, I recommend attaching it over the hole where the tail wheel wire inserts into the rudder—for added strength.

For the business end of this bird, I recommend a Du-Bro 6-oz. fuel tank and a Hayes P/N AL-25 engine mount. The Du-Bro tank fits perfectly. The fuel and vent lines run straight out through the firewall with no bends or kinks. I've learned through experience that the Hayes mount is very strong and is long enough to allow you to move the engine forward or aft to help with balancing the model.

Our flying has been done using Zinger 9-5 props, and they have performed well on the .25 and .29 engines. The best prop that I have found for the S-29 engine is the 9-5.5 Glass Nylon Prop manufactured by Yoshioka Model Factory. I don't recommend trying a low pitch 10-in. prop on a .29 engine in this model due to lack of prop clearance. Please remember that safe flying is the rule. Like all RC aircraft, the Snapdragon can and will bite if you stick your fingers in the prop.

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As stated before, the Supertigre S-29 with the Tiger's Paw muffler is faster than the .25 engines. It requires roughly 1 oz. of tail weight and one more washer of downthrust. With this combination the plane will literally pull itself vertically out of your hands (but don't try it!). The Enya .25XTV combo seems to be the best. The plane moves out quickly and doesn't require added weight. The O.S. Max .25FP is a solid performer, but the ones I've seen don't have quite the power of the Enya.

Install the radio of your choice. I have used the Futaba Conquest 4NL and the Airtronics SR4R and find both of them excellent. Note that the elevator and rudder servos are mounted a bit offset to prevent crowding the pushrods. The on-off switch and charging jack are mounted on the fuselage side opposite the engine exhaust in the receiver and battery area. Route your receiver antenna outside of the fuselage away from the engine exhaust. I usually attach mine to the fin and incorporate a rubberband for a shock cord. Always wrap your receiver and battery pack in foam rubber to prevent damage from vibration and impact. Also enclose both in plastic wrap to prevent exposure to raw fuel should the fuel tank leak.

For your first flight, set up the ailerons with ¼ in. of throw each way. The rudder should begin with 1 in. and the elevator with ⅜ in. You can crank them up later if you like. If you set up the throws too hot, this plane can get away from you. Right now we are flying with about 1⅛ in. of rudder travel, ½ in. on the elevator, and ⅜ in. on the ailerons. This combination is plenty hot and still controllable.

For help and encouragement in the development and testing of this plane, special thanks go to Charles Downing, Patrick O'Connell, and Jeff Stoltz—all fellow members of the RAMS RC club in the Winston-Salem and King area of North Carolina.

Charlie contributed much advice on the aerodynamics and structure of the plane. He's also great for a story or two about his adventures with RC. Charlie was the one who encouraged me to write up this article about the Snapdragon.

Patrick and I spent many hours discussing how to improve upon the more popular Fun Fly designs, and many of his ideas were incorporated into the Snapdragon. Patrick, your plane awaits you.

Jeff has put the plane through its paces and stamped it with his seal of approval. On any clear day he can be found on the banks of the Yadkin River making shoestring-high inverted passes down the runway.

To the other members of the RAMS who have bitten their lips during some of my earlier fiascoes, gentlemen I am grateful. But please keep it quiet!

SAFE FLYING IS NO ACCIDENT