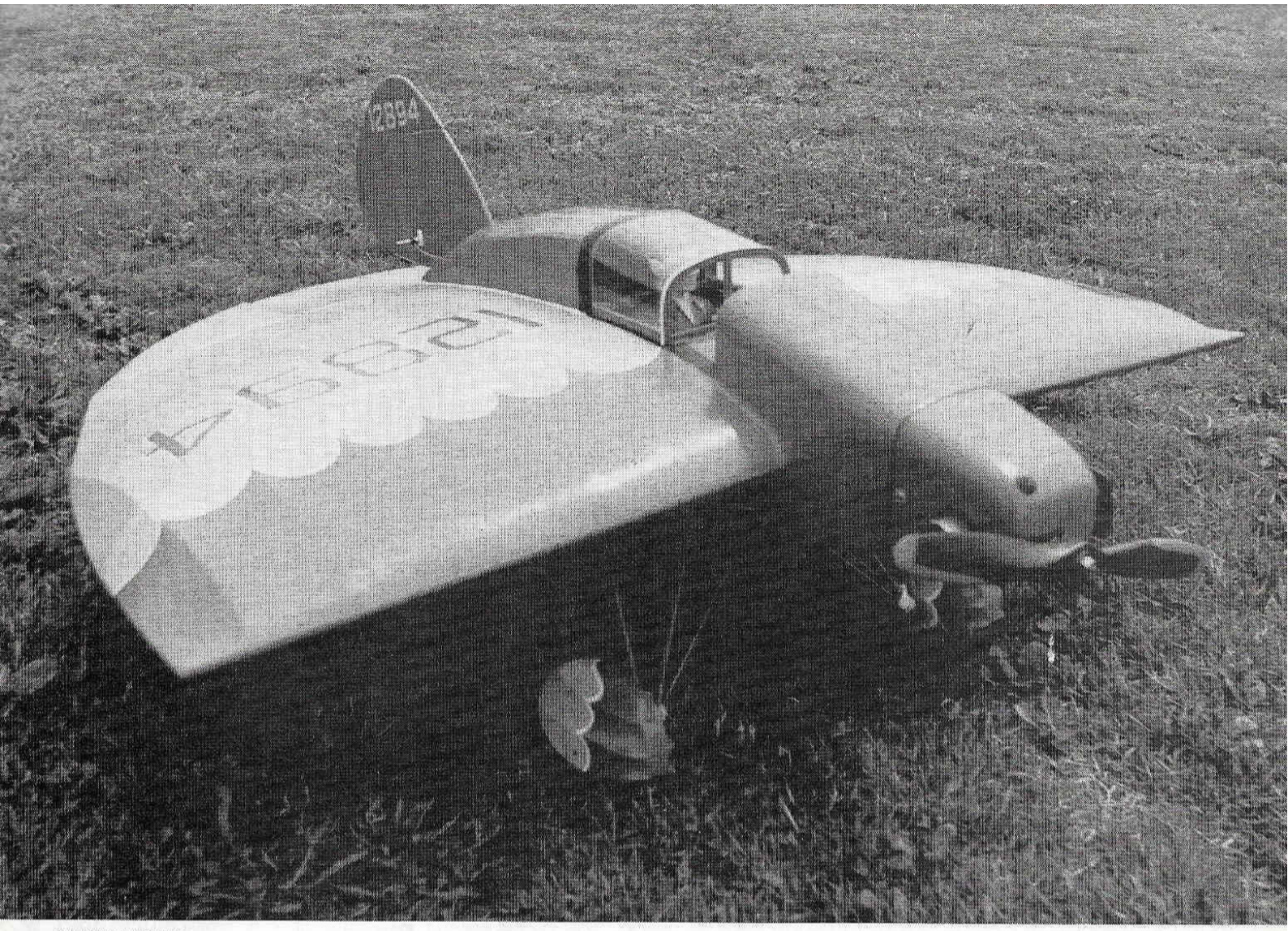


PHOTOGRAPHY: BOB HUNT

Though less than conventional, the unique Arup S-2 proved that it could fly quite well. The author's model recreates the ill-fated plane.

ARUP!

By Al Wolsky

Offbeat inspiration created this novel airplane which, surprisingly, translates into a nice flying model.

One of the most interesting airplanes to come out of the 1930s was the *Arup,* (pronounced AIR-UP). The idea and shape was conceived in South Bend, Indiana by a Dr. Snyder, who was a foot doctor. One day in 1926 he tossed a felt heeled lift towards his desk and noticed that it glided. This intrigued him so much that he built model gliders and rubber band powered low aspect ratio elliptical winged planformed models which he flew. They all showed remarkable stability. Next came a glider of 20 foot span that was at first towed by a car and made many flights. After some 50 flights, a 26 HP Henderson Heath motorcycle engine was installed. After more powered test flights it was decided to build a new design.

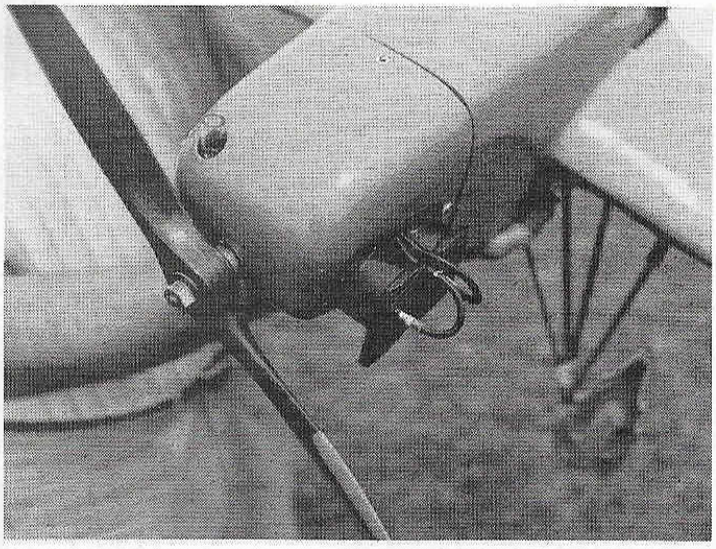
The Arup Mfg. Co. was formed and in 1933 a new design designated *Arup S-2* was built. Specifications were 16 foot span, chord was 14 feet, power was a Continental four cylinder model A-40. Top speed was 97 MPH, stall was at a 35 degree angle, and take-off was in 4 to 5 seconds.

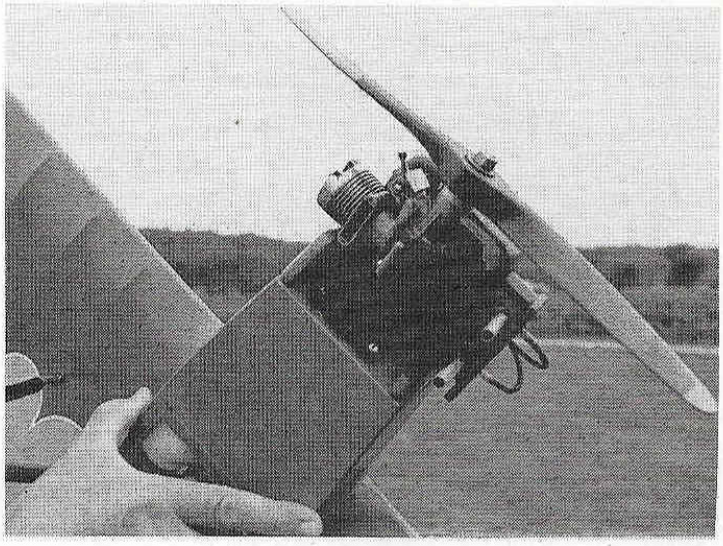
Trying to stall it would result in it slowing down to a point where it would mush along while losing altitude. Applying rudder would result in a wallowing turn but no spin. The S-2 was quite an airplane. It had several hundred hours of flight time including some around the Washington, DC area. At this time it was demonstrated to the NACA, CAA, and the Army.

One of the NACA men who observed the flight was a Charles Zimmerman who a number of years later obtained a patent on a similar type of aircraft. It was probably during 1942 that he became project engineer on the Chance-Vought XF 50-1, which was the Navy's *Flying Flapjack* of 1944. Had it been successful, every big ship in the Navy would have carried one, increasing the fleet's striking range and power.

In early 1934 a new commercial design, the *Arup S-3,* was started. This model, 22 feet in span, had two-place side-by-side seatings. Power was by a LeBlond engine of 70 HP. The sleekness of the S-2 was lost in the cabin design of the S-3 along with a long tricycle gear, a squared-off nose, and windshield made it look like a bug.

One test flight revealed it did not perform as well as expected. It was fast but did not seem to have much lift. The day after the one and only test flight it was discovered that someone had removed cotter pins from the elevator clevis bolts. After this happened it was decided to guard the plane at night. After a few quiet nights, tired from working both day and night, the man on night watch got bored and left. A few hours later the plane was doused with gasoline and ignited.





Those cylinder heads on the model **(above left)** are scaled after the 4-cylinder Continental A-40 that powered the real plane. Tucked behind the dummy engine is the author's Enya .40 **(above right).** Just about any decent .35-.40 engine will probably have it off the ground in 30 feet.

The arsonist was never apprehended, and the loss of the S-3 was a severe blow to the company. Not only did they lose a $10,000 airplane (uninsured), but they did not get sufficient flight time in to test this latest design.

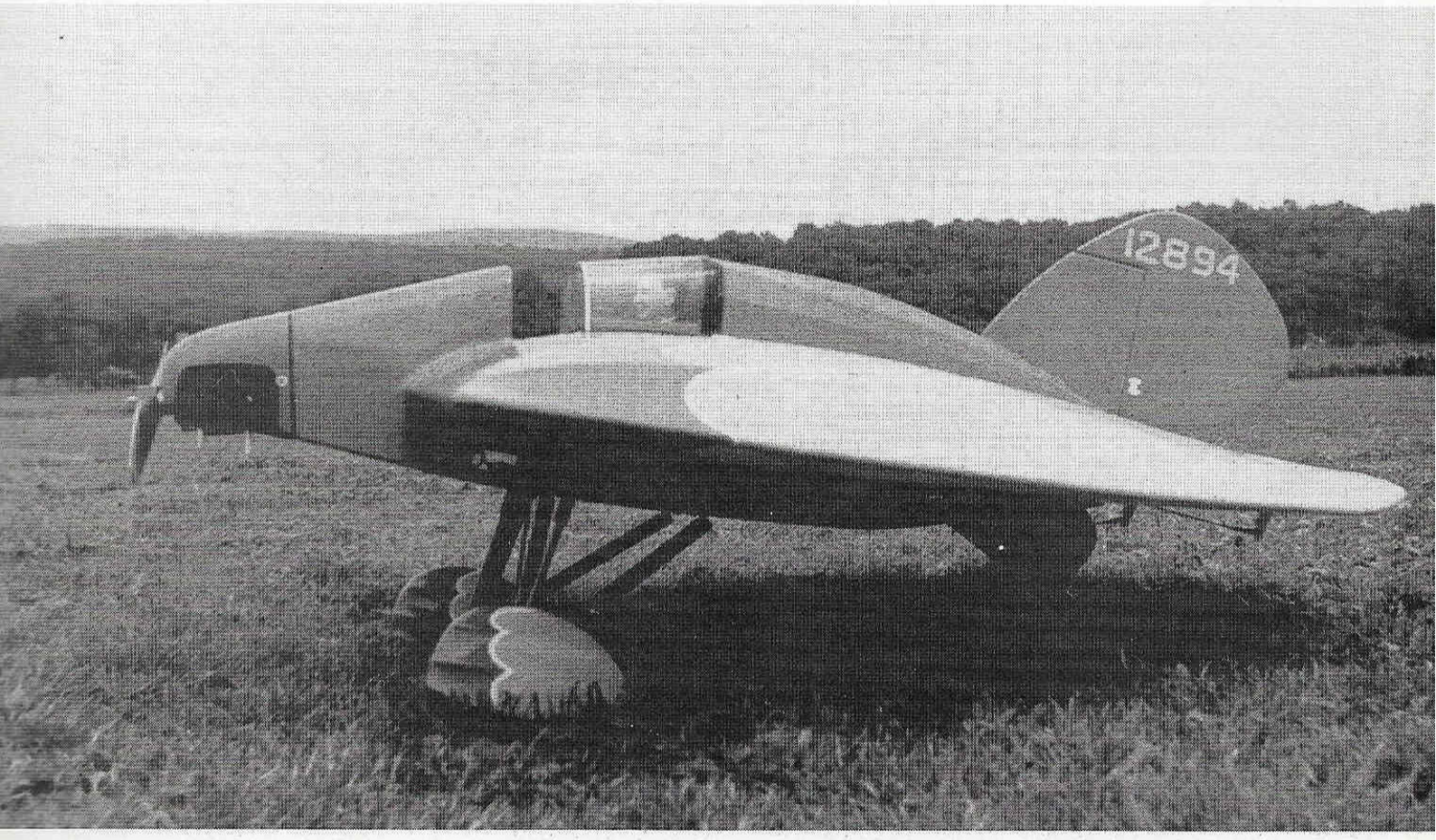
After the loss of the S-3 some new people were brought into the company and shop was set up in Indianapolis. At this time the company started work on a new model, the S-4. This took to the air in the spring of 1935. Demonstration flights were made all over the Midwest to entice buyers, but to no avail. By now the company was in bad financial trouble. What happened to the S-2 and S-4, no one knows for sure.

The fact that four *Arups* were built and flown for a total of over 1000 hours without an incident is testimony to the fact that the concept was a success.

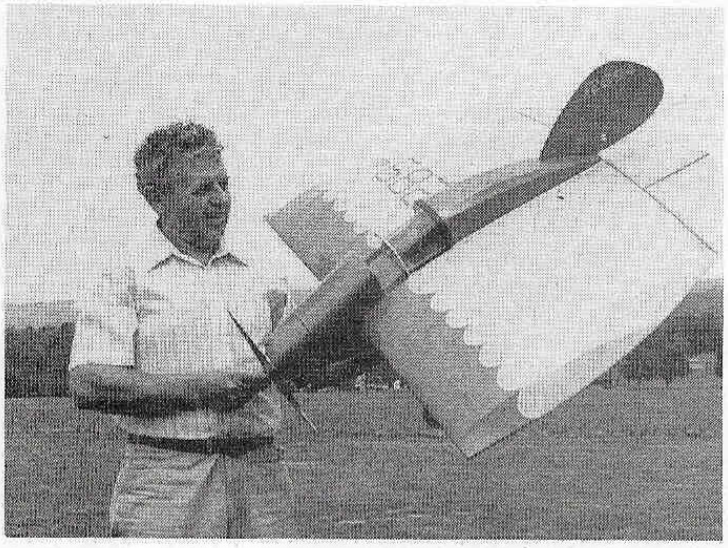
Model construction

The wing has to be built first, as the fuselage is built on to it later. Start by cutting out all 14 wing ribs from 1/8 inch sheet balsa; it will be necessary to butt glue sheets together (use Hot Stuff) since rib #1 is over 4 inches in width. Next cut the main spar from 1/4 inch thick hardwood. I used a piece of pine; however, spruce would be a better material if you can get the piece required. Now position the main hardwood spar, the rear bottom 1/4 inch square spar, and the rear S-2 balsa spar over the plan. At the same time you can also construct the rear section of the wing which is the elevator and the two ailerons. This assembly is built as a single unit and when complete, the elevator and both ailerons are cut apart.

Back to the main assembly: glue in place all ribs, add 1/8 inch square balsa uprights to each side of all ribs at S-2, and check the ribs for squareness to your building board. The 3/8 diameter dowel leading edge should now be glued to the ribs. The outer outlines are 1/4 inch square spruce or 1/4 diameter dowel; the



From this side view, it's easy to see how the fuselage can be built right on the top and on the bottom of the wing.



The author reflects on the more than ample wing area of the *Arup* **(above left).** In the underside shot **(above right)** you can see the pushrod linkage for the two ailerons. These pushrods are simply used to adjust aileron trim on the ground. The rudder effectively steers the *Arup* in the air.

choice is yours. I used the dowel and this has held up well so I suggest this method. Whichever method will require soaking in water to allow it to bend, especially at the trailing edge of the ailerons and elevator. At this point remove this half of the wing. Turn the plan over and build the left wing in the same manner.

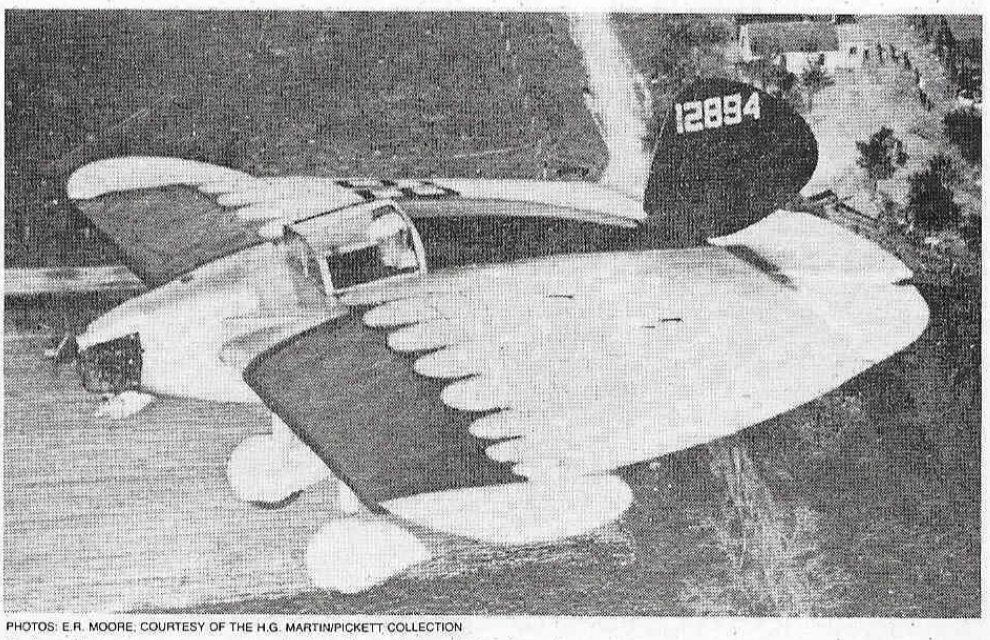
When this is completed, cut the two 1/8 inch plywood fuselage sides. These are glued to the inside of ribs #1. Check for proper position. The 1/4 inch plywood firewall should next be cut out and epoxied in place, and the corner bracing added behind firewall. Glue the 1/16 inch sheeting at the top and bottom of the center section, and leave the area open that will be the cabin area. Next cut all formers #F-1 to F-7 and mark a center line on each former. Now mark a center line on the sheeted center section of the wing at the top and bottom. The fuselage formers F-1 through F-7 are glued on this marked line.

Plank the nose area, glue in place the two landing gear mounting blocks, add plywood sheeting to lower the nose back to former F-5. Next glue in place the 1/4 inch square balsa strips to the lower formers, and also add the top stringers. The 1/16 inch sheeting at the top of the leading edge is glued in place hold ing it in position with pins. The removable cabin frame is made of plywood, the two lower sides are of balsa, shaped to fit the rib contour in this area.

Paint the frame before covering with clear plastic canopy sheet material. It is held in place by a small screw at the front. The landing gear is formed of 5/32 diameter wire; solder all joints neatly. The gear sit in the grooved blocks and are held in place with metal plates and screws.

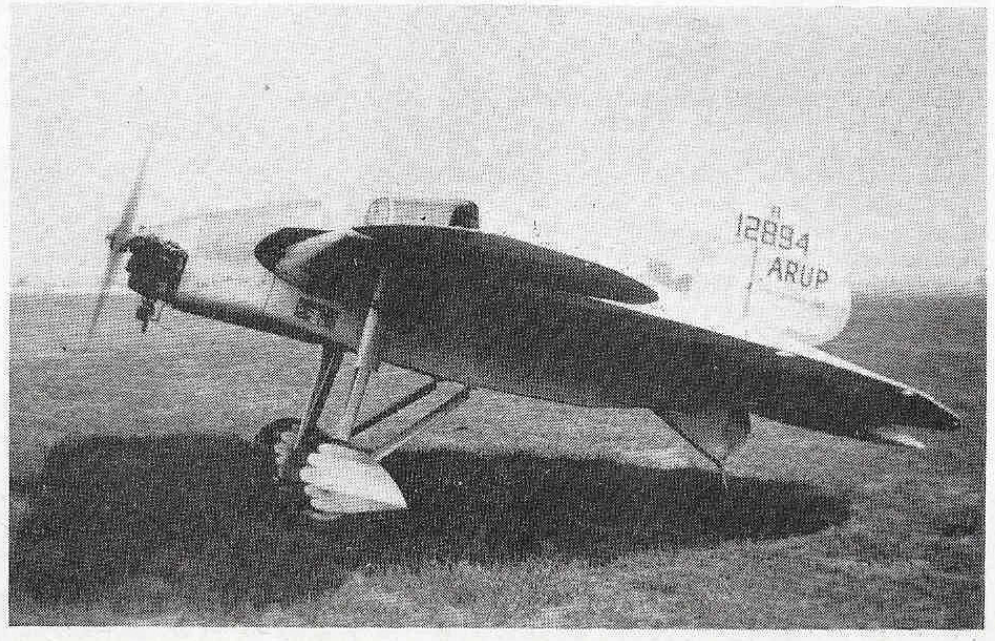
The cowling can be made of 3/8 inch balsa sheet and blocks; carve and sand to shape.

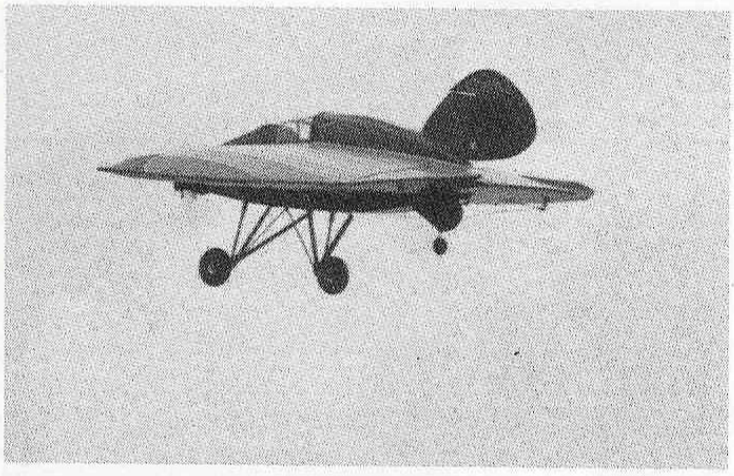
The fin and rudder are made of 1/4 inch balsa. Note that the lower part of the fin is cut so it sits in place on the center section sheeting. The wheel pants are built up of 3/4 inch thick balsa core which is tapered towards the rear (see the top view). To this glue the 3/32 inch thick plywood pices which form the pants shape. Plywood blocks of 1/4 inch thickness are located for the axle wire to pass through. Fox flanged wheel retainers hold the pants in place on the axle. The pants are

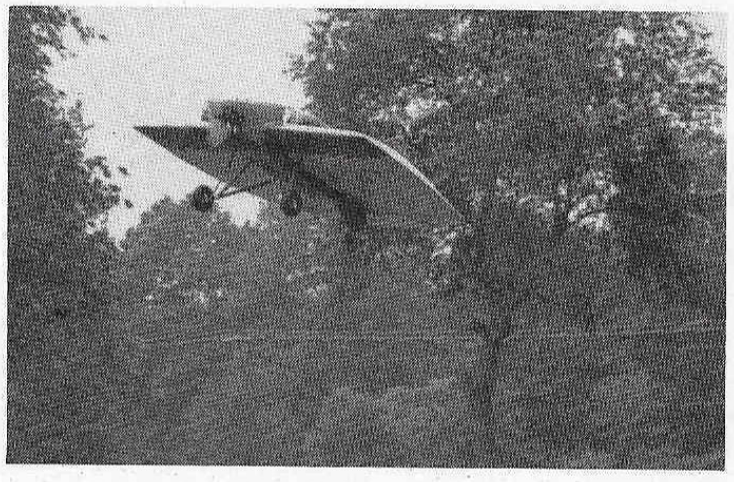


PHOTOS: E.R. MOORE, COURTESY OF THE H.G. MARTIN/PICKETT COLLECTION

Before the company succumbed to financial troubles, four *Arups* were built and logged over 1,000 hours of flight time, without a single incident. Shown in flight **(above)** the S-2 model spanned just 16 feet but had a wing chord of 14 feet. Top speed was 97 MPH. Because of its remarkable planform **(below)** the *Arup* was up in the air in only 4-5 seconds. Stalling was almost impossible since it only mushed along while losing altitude.







You'll definitely turn some heads at the field with the *Arup*. Engine RPM will help trim the model in flight *(above left)* and steering will be most effective if you have two inches of rudder throw. After a 30-foot takeoff roll, the model is up and climbing at a steep angle **(above right).**

covered with the same material as used on the model. They make the model look great but may have to be removed when flying from a grass field.

Completing the model

Hinge the ailerons and the elevator before covering the model, using epoxy to hold the hinges in place. Double coat the hinges on the insides of S-2 and S-3 so they will not pull loose in the future. Also make certain that the hinge line is in proper location, that is to say that the surfaces, when hinged, blend into the wing.

The ailerons can be used for directional control; however, I found they are best used for flight trimming of the model. During test flights they seemed to upset the trim of the model. So it was decided to make them ground adjustable only. A pushrod connected to a horn is installed on each aileron, the pushrod end is mounted to a plywood plate in the wing. The ailerons, along with the elevator, are trimmed using the mentioned pushrods to the one inch measurement shown on the side view of the fuselage. When mounting the control horns it will be necessary to use small wood screws into the plywood; also add small hardwood blocks at the insides to keep the screws from pulling loose in time.

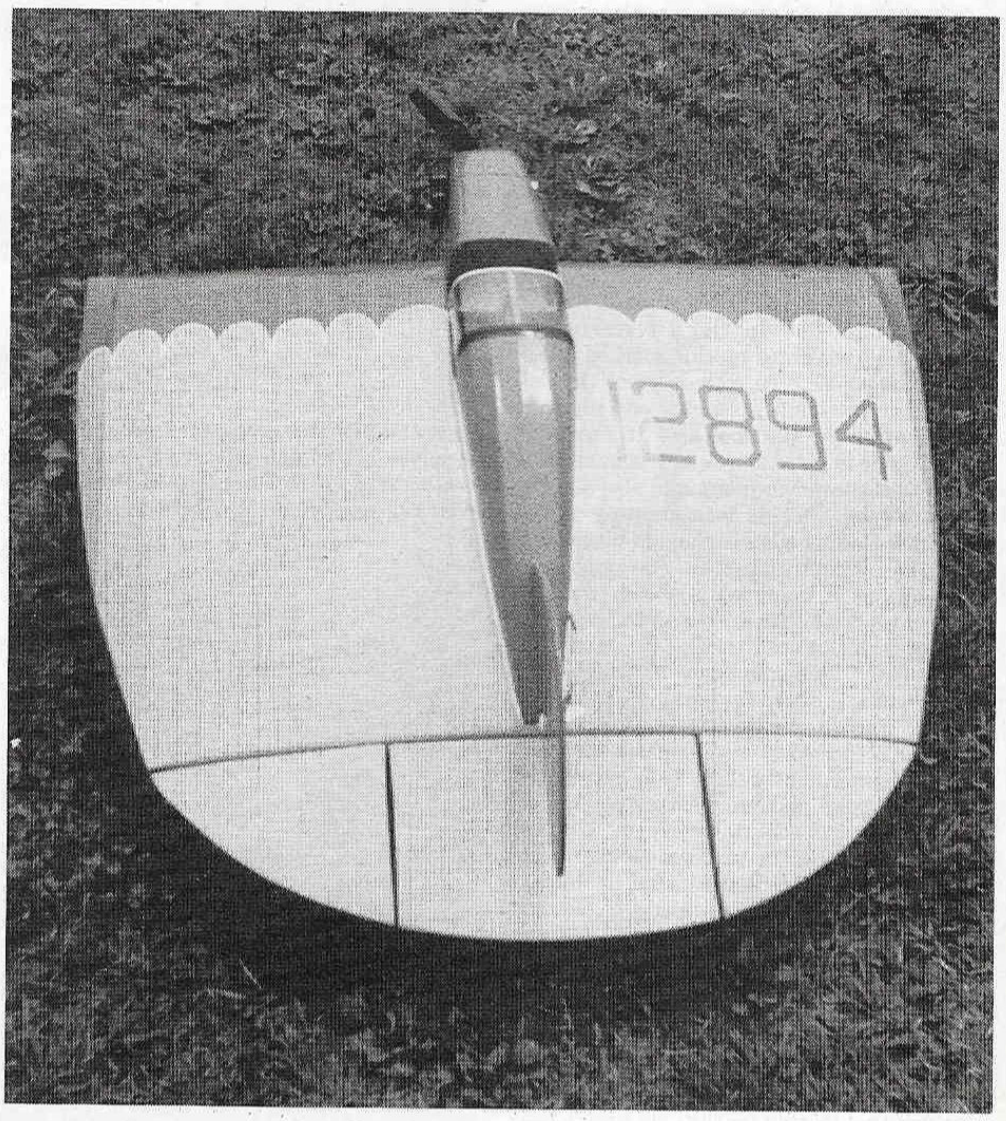
At this time install your radio, pushrods, motor, landing gear, etc. Locate your radio system to balance the model at the C.G. shown on the side view. Next go over the entire model and sand all edges smooth and prepare it for covering. I covered my model with a polyester material, which is very strong. Sealing the covering was five coats of clear dope brushed on, followed by spraying on the yellow. The red dope was brushed on using a soft brush; all dope used was Randolph's which I buy direct from the factory, since they are located here in New Jersey within driving distance.

Flying

Power the model with any .35 to .40 engine that idles well and does not cut out when going from low to high speed. Ready to fly weight will be about 6 pounds; slightly more will not matter as this wing has a lot of area. One fact I must mention: set up the rudder deflection so you have at least two inches measured at the rudder end. This means using the outermost hole on your rudder servo arm and the first or second hole of the horn at the rudder. You'll need this much since this model will not turn on a dime.

Also I have not flown my model in a stiff breeze, so I cannot report how it would handle. My flights have been on days with little wind; however, early morning or evening is also a good time to feel out the model. One thing for sure, this model is different and will attract attention. Some will doubt that it will fly, but fly it will. It handles much like a trainer, and will take off in about 30 feet. In fact it is stable enough that it can be hand launched, since I have already done this many times. Once in the air, feel out the model and adjust engine speed to maintain your flight. Landing is about as simple as any other model. Set up your approach and by using the engine speed it will settle in.

I wish all of my fellow modelers who build the model the best of luck with it.



Top side shot of the *Arup* shows the "heel lift" planform which was the original inspiration for Dr. Snyder who conceived the idea of the plane. The single elevator in the center controls the pitch of the model.