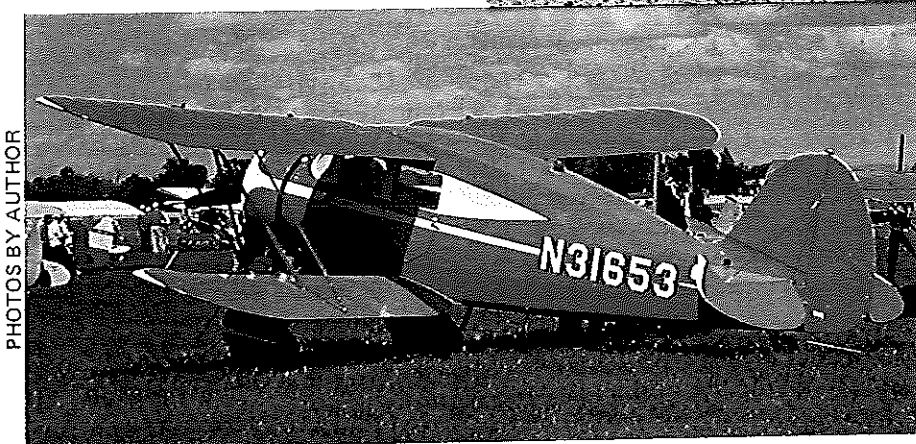


## 1936 Classic

# WACO YKS-6



By JOHN BURNS . . . Who can resist the charm and appeal of the cabin Wacos of the 1930's? Our author couldn't, and ultimately came up with this 1/8-scale replica that has proven to be a fine flier. Original model is powered by an O.S. Wankel, but conventional engines of .25 to .40 cu. in. displacement could also be used . . . a shame to have a cylinder sticking out of that cowl, though!



Vince Mariani, also a modeler, is the proud owner of this immaculate full-size VKS-7. It was this aircraft that inspired Jack Burns to do the YKS-6 model presented on these pages.

• Another biplane that is built like an overgrown Peanut Scale model and powered with a Wankel rotary engine? Of course!

I'd been bugging Mr. Northrop for some time to publish another article, when I finally realized I had to get his attention. I don't want to give away any trade secrets, but those three color photos of my Waco YKS-6 biplane model were like flashing the green light at the drag strip. Hence, this article. To quote a famous expression, "If it has two wings, it's got to be good."

Every modeler has his favorite planes . . . warbird, classic, current . . . so when

I saw this beautiful red-and-white VKS-7 at Oshkosh in 1970 and again at a couple of EAA conventions, I had to build a model Waco. Naturally, several photos were taken of the VKS-7 and of other cabin Wacos.

The Waco cabin airplane article in *Historical Aviation Album* Volume II was memorized, and drawings of the YKS-6 were obtained and used as the basis for the model drawings.

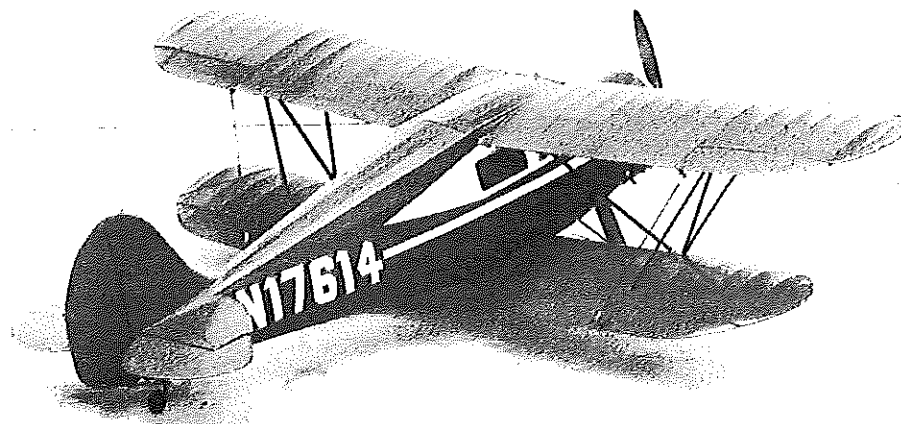
My pile of magazines was ransacked to find the January 1956 *M.A.N.* and June 1970 *A.A.M.* articles on Waco models. Wm. Wylam's drawing of the C-6 Waco was obtained, and several *EAA Sport*

*Aviation* magazines were cut apart to extract pictures of Waco cabin airplanes.

If you have been listening carefully, you just noted several sources for data and documentation so necessary for a scale model, not just for contest use but to draw and build it in the first place.

When this model was designed, the object was to have a model that could be handled fully assembled, so 1/8 scale was chosen. That puts it in the approximate wing area range of the Falcon 56, Skylark, and similar models that perform well on .30 to .40 size engines. Imagine my joy when I found my Wankel engine fit perfectly inside the scale fiberglass cowl! A round-engined airplane needs a round engine, right?

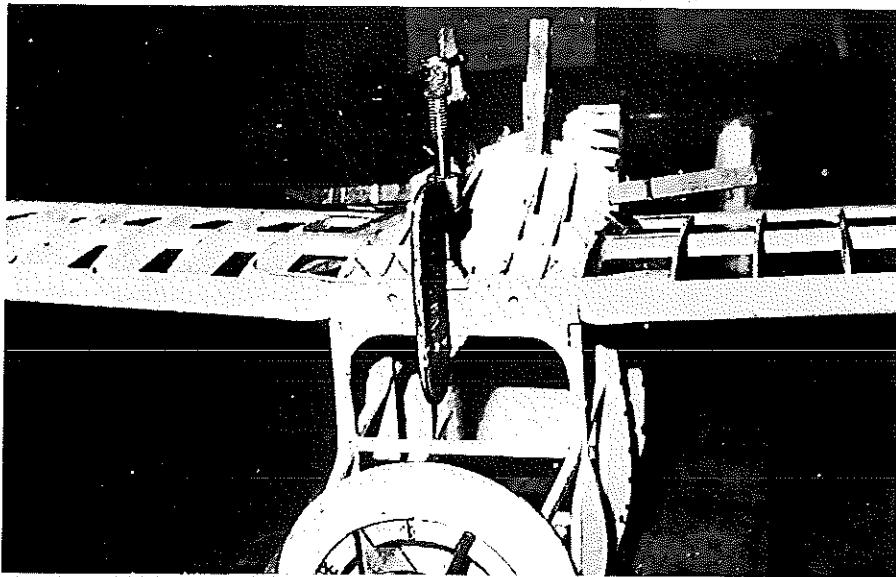
Another good reason, besides its



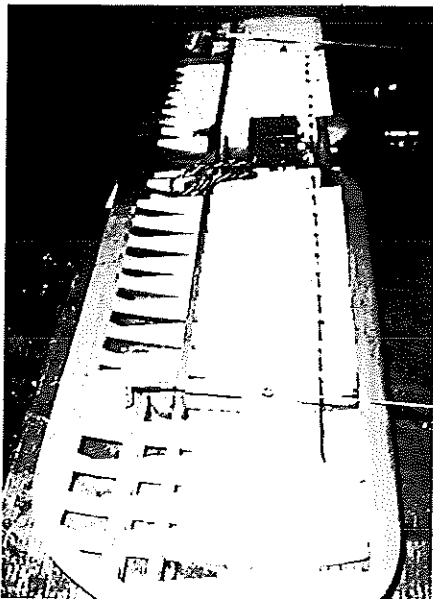
Cabin Wacos had distinctive lines when viewed from any angle. Realistic finish is good ol' silk and dope, finished with Aerogloss paints. YKS-6's were powered by 225-hp Jacobs engines.



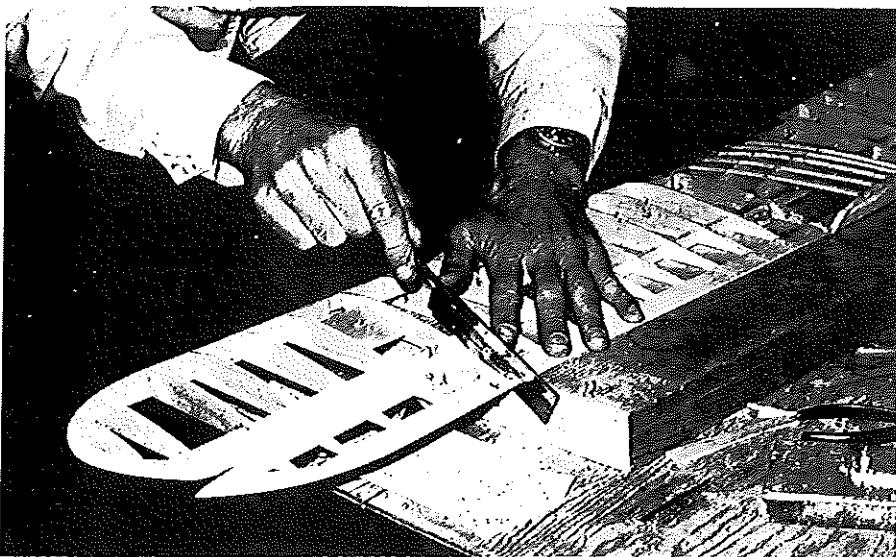
OK, OK, so it's not a scale Jacobs radial under that cowl. At least it's round!



The section of the fuselage over the top wing is built with the wing clamped in place. Also provides perfect alignment for drilling the holes for the front wing hold-down dowels.



Aileron servo is in the top wing, top ailerons drive bottom ones by means of pushrods.



Ailerons are built as part of the wing structure, then carefully cut loose after the pushrods, bellcranks, horns, etc. have been installed. The last step before preparing the wing for covering.

power, for using the Wankel is that biplanes tend to be tail heavy, and the extra weight of the rotary over a conventional .30 or .40 engine is just right to balance this model. Also, no cylinder head sticks through the cowl.

This model has one-piece wings fastened with dowels and two screws for the top and one screw for the bottom wing. However, there are twelve little screws that hold the wing interplane struts, so the model is left assembled most of the time. It is definitely *not* a field assembly project. Besides, has your screwdriver ever slipped and gone through your beautifully doped silk covering? #@%\*!!

Because the plane is a smooth and stable flier, a quarter-scale version would be great. Additional design to make the four wing panels removable is needed, and socket head screws for the strut fastenings would simplify that problem. All you need is to get the plans, double the drawing sizes, and have a vehicle that can handle the 75-3/4 inch

overall fuselage/tail length. No, there is no Wankel engine that size. I'd recommend an engine rated at three horsepower, swinging a 22x14 prop.

#### CONSTRUCTION

This model is built like an overgrown Peanut Scale model with a structure like the full-scale steel tube construction. The major fuselage material is 3/16 square spruce, which is strong, tough and not that much heavier than balsa. Even a quarter-scale version could be built with 1/4 square spruce with 1/8x1/4 stringers. It would be light but strong and durable.

The only sheet material is in the front, to help support the firewall and a few gadgets. The forward bottom is a thick balsa block which is easier to shape and more durable than sheeting.

Appropriate use is made of plywood for the firewall, a unique engine mount for the Wankel, bulkheads for the wing dowels and fastening screws, the landing gear base, the dihedral braces, and all the places where the wing struts are attached.

The main landing gear wire is formed like on many control line models, with a large "U" loop J-bolted to the ply base. The rear struts float in the fuselage at the rear end. The large balsa fairings on the main struts are epoxied, wrapped, etc. to the wire. Mine still split after a while.

The tailwheel was made steerable with two small springs from a horn on the bottom of the rudder, but experience dictated replacing one spring with 1/16-inch wire for better steering.

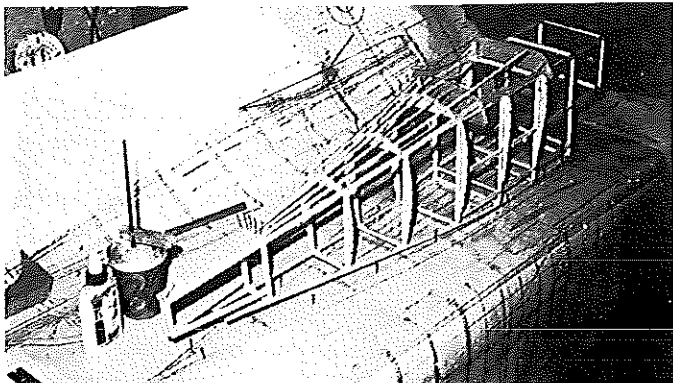
Wings and tail are conventional balsa, spruce and plywood construction with the components in their approximate scale positions. The four ailerons were *not* done in the corrugated skin method used on the full-size planes. There were 34 corrugations in 67 inches, about two inches per corrugation.

The interplane struts were made from streamlined aluminum tubing, epoxied together. The ends were carefully flattened, bent to the correct angle and drilled for the No. 2 screws that attach them to the wings. A simple jig was used to hold the wings in correct alignment while the struts were being fitted. This is a fussy, but most necessary procedure to assure true alignment. A quarter-scale version would need stronger strut construction since they would be fully functional with the four removable wing panels.

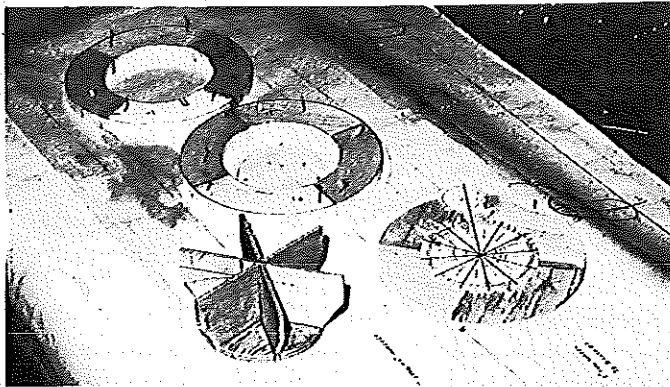
The fuel tank extends from the firewall to back of the instrument panel. It is easy to look down through the windshield to check the fuel in the tank. A streamlined Robart fitting on the upper right side aft of the cowling connects the tank fuel line through the fitting to the carburetor. Thus, the tank can be filled without disconnecting the fuel line at the carb.

The radio switch and charging jack are mounted on a ply panel on the left side above the lower wing leading edge. The jack must be on the outside skin to charge the airborne pack.

It would be a shame to beat a hole in



Basic fuselage structure is a simple 3/16 sq. box, with formers and mucho stringers to give the nicely rounded cross-section.



The O.S. Wankel required an extended motor mount to get the prop in the correct location; may be necessary with conventional engines.

the cowl for a glow plug connector, so a jack is installed on a ply panel on the lower forward left side. It is wired with two-strand lamp cord: one wire to the engine base and the other wire to a small insulated alligator clip on the top of the glow plug . . . all inside the cowl/fuselage. This requires a special cord from the field box glow plug battery. (Come to think of it, my first control line model eons ago was wired like that.)

The exhaust pipe for the Wankel was made from a brass tube bent to exit from a slot in the rear of the cowl. After many runs it is blackened just like the full-size stack. Although it was not possible to install the regular Wankel muffler inside the cowl, the long pipe plus the unique humming sound makes the Wankel quite tolerable, even to clubs with strict muffler rules.

The cowl is supported on four spruce posts epoxied to the engine support . . . not neat, but it works. There is a scale air gap all around the rear of the cowl, which is necessary to cool the Wankel (which runs very hot).

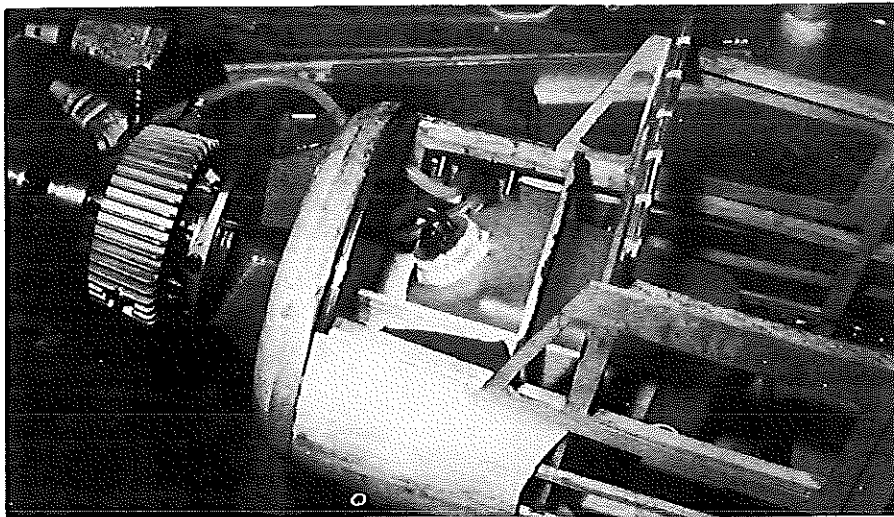
The propeller most commonly used for flying is a three-bladed 10x4 Tornado; not scale, but it holds down the rpm. This plane doesn't need the full 16,000 rpm the Wankel can turn on a 9x4 two-blade prop. An 11x4 painted black has worked nicely, too. A twelve-inch prop would be close to scale, but \$1.00 landings get to you after a while!

Since the Wankel has a 6mm shaft (0.236 in.) and props commonly have a 1/4-inch hole, a brass bushing was made from tubing to slip on the prop shaft to accommodate the 1/4-inch prop holes. An exactly centered and balanced prop is essential, especially at the rpm turned by the Wankel.

Wheel pants were optional on Wacos, but mine has flown from grass fields a lot, so no pants were fitted. The three-inch wheels are scale size.

The engine cowling was fitted almost an inch aft of the scale position for access to the needle valve and for priming the carburetor, an essential procedure in the Wankel starting routine, which also requires an electric starter.

The upper and lower ailerons are connected with DuBro ball link rods and fittings. After all, the full size planes had "ball joints on all (aileron) socket



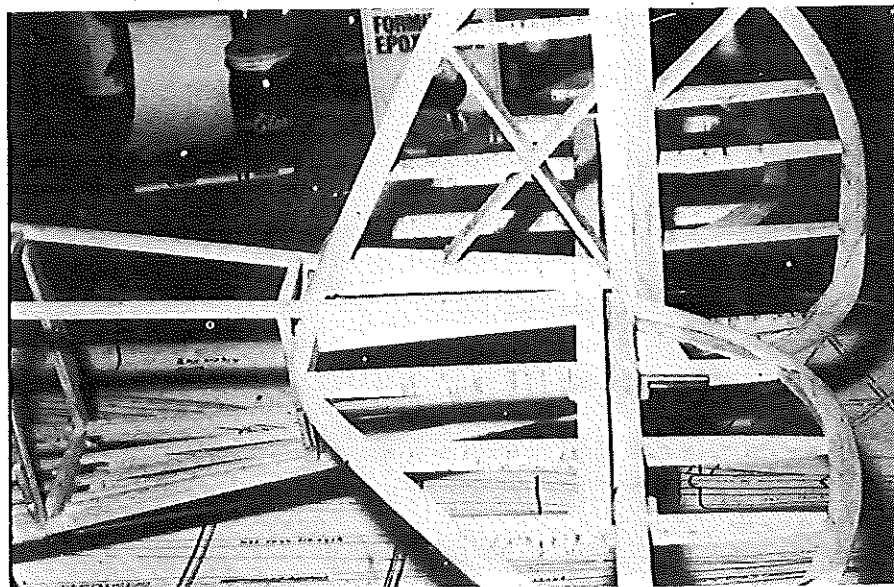
Tank and engine installation details. Tank is hooked up to a Robert "Super Fueler" mounted on the right side, so fuel line does not have to be disconnected from the carb during fueling.

linkage points" (ref. P. Matt). On my model, the aileron servo and drive linkage were installed in the upper wing so that the upper ailerons drive the lower ailerons. This is the reverse of full-size, but the fuselage area above the bottom wing is very busy with the other three servos. In a larger scale model, the three servos could be under the rear seat

and the lower wing would be large enough for the aileron servo(s) and linkage.

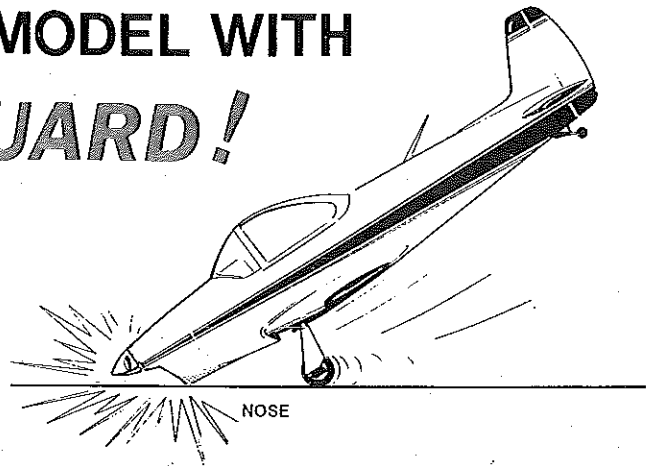
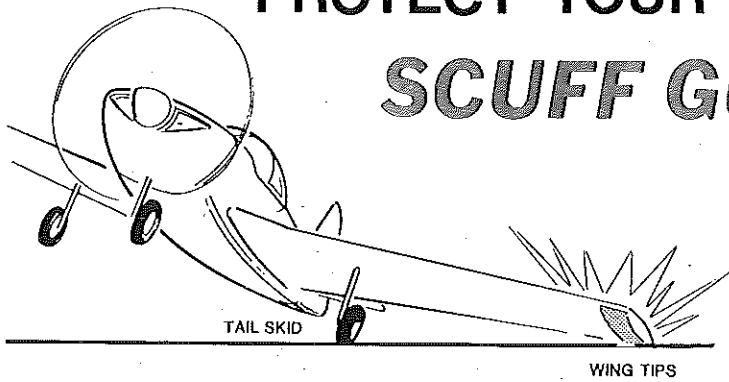
The model was covered mostly with red silk and doped eight to ten coats. I used clear, 50-50 clear and thinner, and 25-25-50 clear, pigmented and thinner at different stages in the painting, since it is

*Continued on page 75*



Tail surfaces are built from 3/8 balsa, sanded to a streamlined cross-section. Outlines could also be laminated out of 1/16 thick strips for higher strength at no increase in weight.

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"exhaust choking," in that too small an exhaust pipe or system will cause a considerable loss of power. The Quarter Headquarters unit is quite good in this respect.

\* \* \*

C.B. Associates (21658 Cloud Way, Hayward, CA 94545) has an exclusive line of extremely well-thought-out items for the giant scaler, and among the best are the tailwheels (three sizes) and their cable control systems.

The tailwheels are scale leaf-spring items, and cover the size requirements from small to very large. The medium size is perfect for the Nosen Champ/Cub size planes, while the quarter-scale size is a monster that will hold up even the

heaviest planes.

The cable control system is a fully developed system that has to be seen to be appreciated, and I strongly encourage anyone who doesn't want to use the servos located out close to the control surfaces to investigate the C.B. cable systems. I personally strongly advocate locating the servos at the control surfaces, and using very short, strong pushrods. If you don't want to do this, then the only recommendation that I have found satisfactory is the cable system as supplied by C.B. I DO NOT like long pushrods.

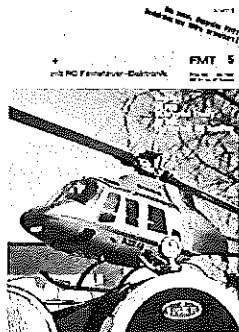
\* \* \*

That's about it for this month. If you have any questions, it is best to call me

personally, (916) 786-2725, EVENINGS ONLY. I do this column, the newsletter for IMAA, and also a newsletter for the EAA chapter here, so my writing overload is kind of extreme. If you do wish a written reply, please enclose a self-addressed, stamped envelope.

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Waco . . . . . Continued from page 17 relatively small and easily handled. White dope trim was painted on the cowl and around the cabin windows. The long white stripe and license numbers (my AMA number) on the fuselage are Trim Monokote, carefully over-coated with clear dope so the fuel



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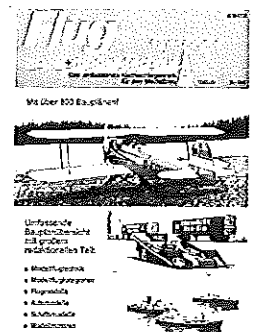
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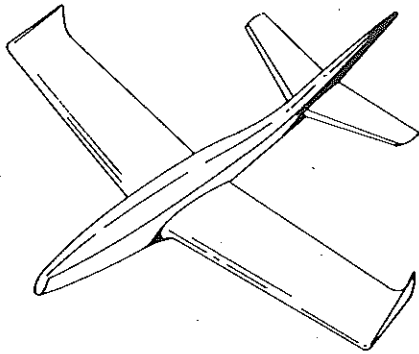
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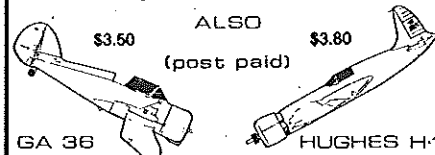
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exhaust won't remove them.

The "five-piece" windshield is made from one piece of plastic with the bends in the proper places. I used a plain piece of paper to cut, fit, bend, redo, etc. until it was correct before cutting the piece from plastic. The windshield "joints" are narrow strips of Trim Monokote.

**FLYING THE WACO**

Like any taildragger (and) biplane, the takeoff is the most interesting part. This plane definitely does not like crosswinds, especially from the left. A conscientious use of some right rudder must be applied while opening the throttle, and don't firewall it! Just a touch of up elevator at the right moment and it is

flying. When your heart stops going 240, full throttle will make the Wankel Waco climb like a homesick angel.

Very often, half-throttle takeoffs are the best, and most flying is done around half or even one-third throttle. Those low passes at a slower airspeed are beautiful! It is amazing how many R/C pilots think they must fly full bore all the time. (Full "bore" on a Wankel? Maybe, Mr. Chinn, we should say "full epitrochoidal chamber"?)

Unlike the open cockpit Wacos which were often used as trainers, the cabin planes were not meant to be kicked around the sky. Scale judges take note. The model can loop, do a Cuban eight, do a poor roll (me?), and even fly inverted, but the long diagonal struts complain... they bend.

I was surprised and pleased with the landing characteristics. The approach is honest and steady and it often sets down without a bounce. Dead-stick landings are OK, too, as long as the nose is kept down and the airspeed up. Sounds like full-size instructions, doesn't it? This should come as no surprise because scale models very often duplicate the habits of the big bird... and that is why we build them.

Hannan . . . . Continued from page 50.

but eligible for other appropriate categories, are canards, pushers, and flying wings, which have proven their ability to equal or exceed performance of the more conventional machines.)

In the words of Doc Martin, "Now is the time to start looking forward to participation at the Second World Peanut Gran Prix (either in person or by proxy) . . . If you think it is a bit premature to have all these plans, you are wrong. Model builders are the worst procrastinators I have ever seen. I'll bet many will be staying up late next June 25, trying to finish a Peanut for the contest."

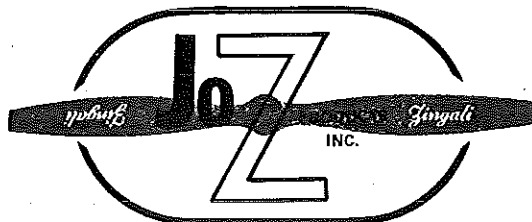
The 6th annual National Indoor Model Airplane Society Record Trials will also be held on June 24 through 26, with classes for virtually every category. Full details and entry forms may be obtained by sending a stamped envelope to; Dr. John Martin, 3227 Darwin Street, Miami, FL 33133.

**GREASY KID STUFF?**

The shift away from internal combustion engines in Free Flight Scale continues; witness the remarkable rebirth in interest for rubber power, and the increasing popularity of electric motors and CO<sub>2</sub> powerplants. (First and second places at the U.S. Nats this year were taken by electric and CO<sub>2</sub> powered models, respectively.)

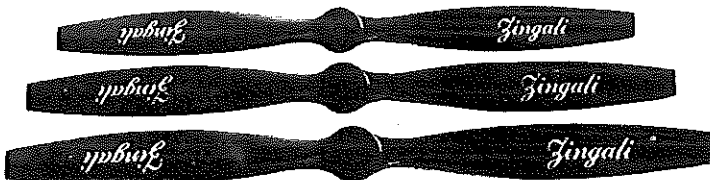
However, interest in "real engines" seems never to have been lost by youngsters, who according to Dave Linstrum, in speaking of his 12-year old son, Carl says: "...he loves 'em! Something about the mystique of lotsa noise, racing fuel, the fast climb, etc. Half-A has always been his favorite event, sometimes flown with .051 as Class A. He is looking forward to next year, when I will

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