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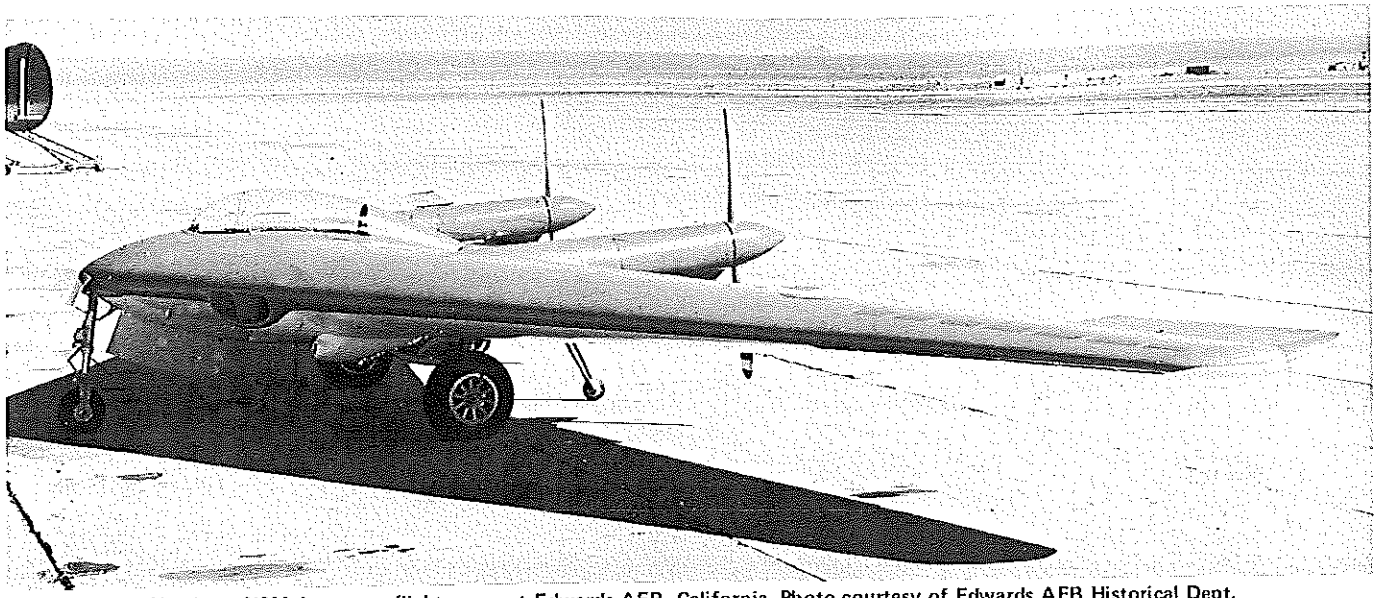


Northrop N9M-A rests on flight apron at Edwards AFB, California. Photo courtesy of Edwards AFB Historical Dept.

NORTHROP N9M FLYING WING

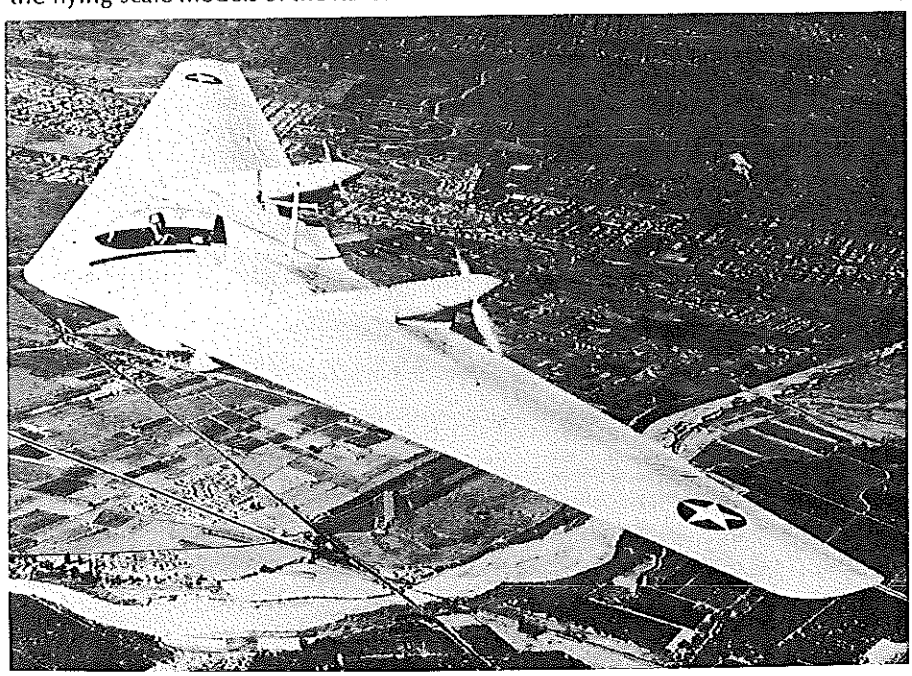
By BILL YOUNG . . . Here is a fabulous scale subject for the modeler looking for "something different." The Northrop N9M series of flying wings differed mainly in detail only. Bill chose the N9M-A model.

Full-size N9M photos courtesy of Northrop Corporation, Edwards AFB, and Jerry Balzer. Model N9M photos by author.

• I think that a little background might help other modelers to understand what goes on when trying to document, build, and fly an unusual subject. I have been interested in flying wings for many years, and in November of 1980, I attended the flying wing contest at Mile Square, in California. I immediately began looking for a scale subject to fly in 1981.

Well, I found what I wanted in the Northrop N9M. It was propeller driven, simple, esthetic, multi-engined, and had a pretty color scheme. The N9M's were the flying scale models of the XB-35 and YB-49 flying wing bombers made by Northrop Corporation. They were exact, 1/3-aero-dynamic equivalents of the big wings. All of the control systems, control surface sizes, shapes and locations, flying techniques, and training of pilots were carried out on these aircraft in the same manner as the larger aircraft. Three N9M's were contracted for, and a fourth was built, to replace the N9M-1 which crashed in May of 1943. Approval of the first contract was in October of 1941, and the first flight was in December of 1942.

The aircraft were of mixed wood and metal construction. The outer wing panels were all wood and the center section was a welded steel tube frame covered with wood or metal. The first three aircraft N9M-1, N9M-2 and N9M-A were powered by Menasco Super Buccaneer engines, and the last aircraft (the N9M-B) was powered by special Franklin flat sixes. The N9M-B still exists, and is currently being rebuilt at Planes of Fame Museum in Chino, California.



Wouldn't you love to have seen the N9M-2 flying wing up this close on one of its flight tests over Southern California? Note lack of L.E. slots or slats to prevent tip stall.

First, I built a 45-inch glider to test the feasibility of the layout, and to see if I could fly the airplane. This model flew unexpectedly well, and is still flying.

Next came a twin Astro 02, 60-inch version, which flew well until I tried to load it to 18 oz. per sq. ft., and managed to get the CG too far back. Scratch one wing . . . and the 1981 contest.

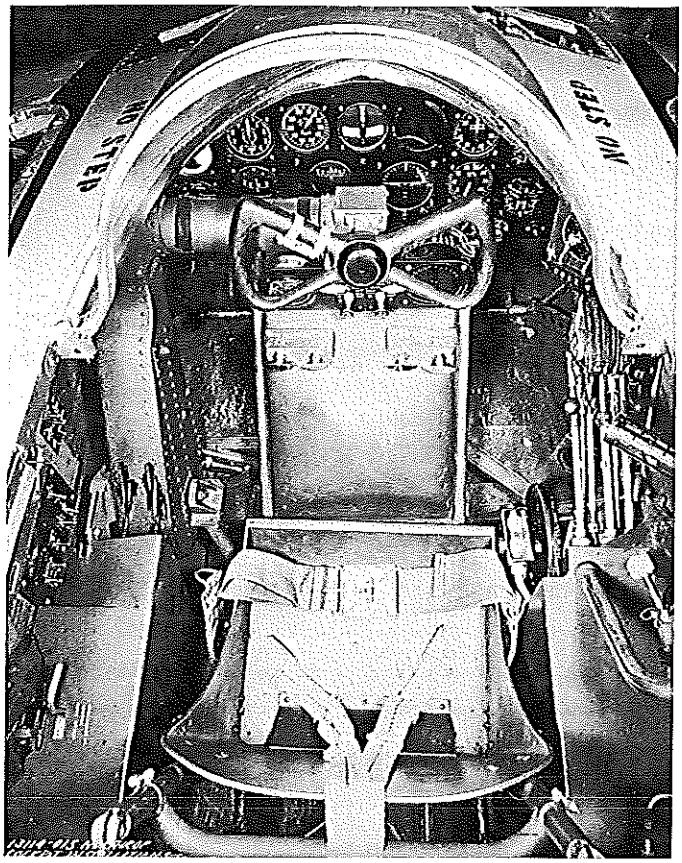
Meanwhile, I was still gathering scale data from many sources, and finding that the data was extremely scarce. I finally approached Northrop Corporation and Wright-Patterson AFB Museum. This yielded a few more pieces. It was becoming obvious that all the existing drawings were inaccurate in many ways, and lacked important details.

I began to draw a set of scale plans from which to build a stand-off scale model. I began construction in June of 1982. It was scheduled to fly the following November. (Scale drawings are available from the author.)

Now remember, at this point there were two previously built and flown models (one of which was still flying) thus insuring that the basic airplane was sound. However, sometimes the builder isn't. I experienced a series of frustrations:

First outing: Flight is best described as high speed taxiing. I forgot to bring different props to test. Try again later.

Northrop public relations rep. Cindy Macha poses with author and N9M "Wings." Smaller model is glider, larger is twin 05 cobalt.



Cockpit details of the N9M-B. Cockpit details for A model should be the same. Photo courtesy of Jerry Balzer.

Second outing: Again, hi speed taxiing. Insufficient power to take off with Astro 05XLs and eight cells.

Third outing: Astro 05 Cobalts installed in the place of XLs. Take-off is OK, and stable flight is achieved out to 300 yards. Radio loss. Minor crash.

Fourth outing: Scene is the flying wing contest. I have returned the radio, tested the batteries, moved the antennas, and range-checked the model. Net result: crash.

Fifth outing: With a new radio, extensive testing, range-checking, etc., the net result was the same . . . a crash!

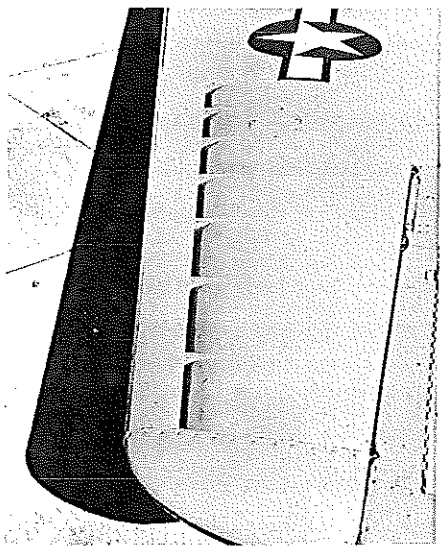
Nuts!!! The glider is still flying perfectly well, and I now have a second 035 powered craft which is flying well. I am sure that the stand-off scale aircraft is OK, and I plan to keep going with it until I find the gremlin.

By this time, enough scale documentation had been accumulated to go ahead with the *scale* version of the N9M. It was the next project, and the subject of this construction article.

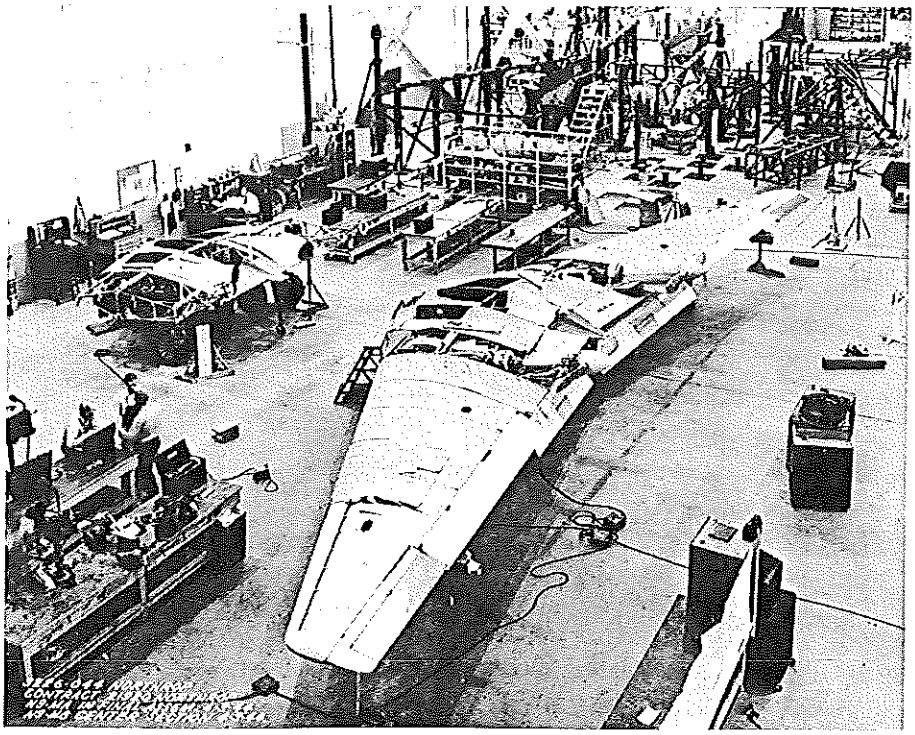
So much for the fun part of scale modeling. If you still want an N9M, and I'm certain that it will fly well (as is my pilot, Tony Nacarrato), then let's proceed.

OUTER WING PANELS

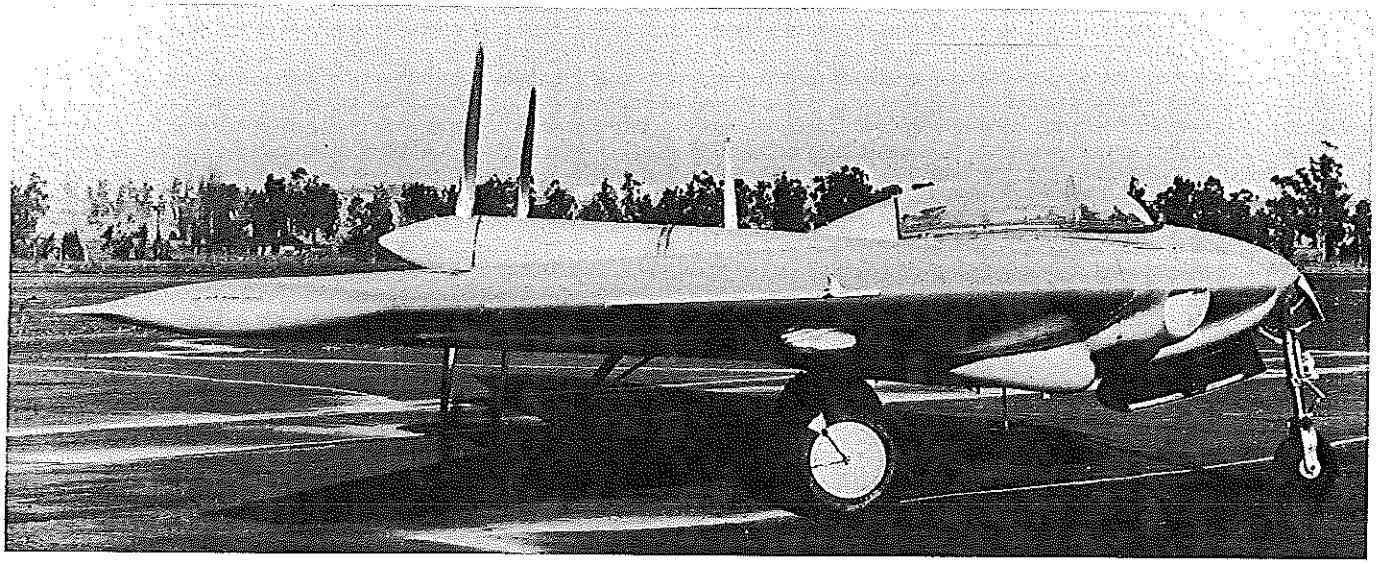
Cut out all of the parts before attempting assembly. Mark the appropriate ribs



N9M-A wing tip slots. N9M-B had automatic door which opened slots at low speed.



The N9M-A in final assembly, N9M-B center section (4-3-44). Outer control panels controlled pitch when landing flaps were deployed, and split apart to cause yaw. Elevons between the two.

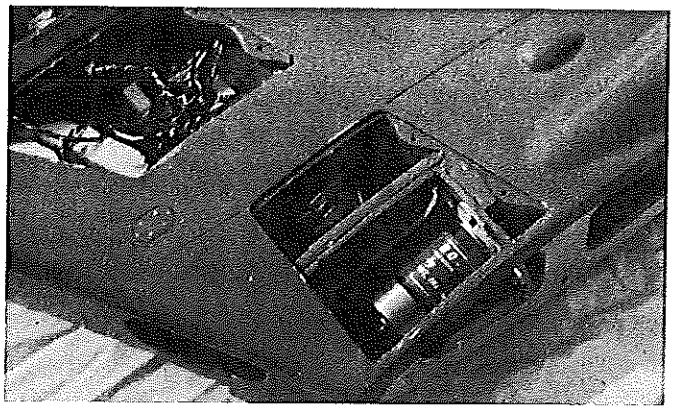


Right side view of N9M-2 at Northrop Field, Hawthorne, California. Slats were added to leading edge later in flight testing to cure slow speed/high attack angle tip stall. N9M-A and -B featured built-in slots.

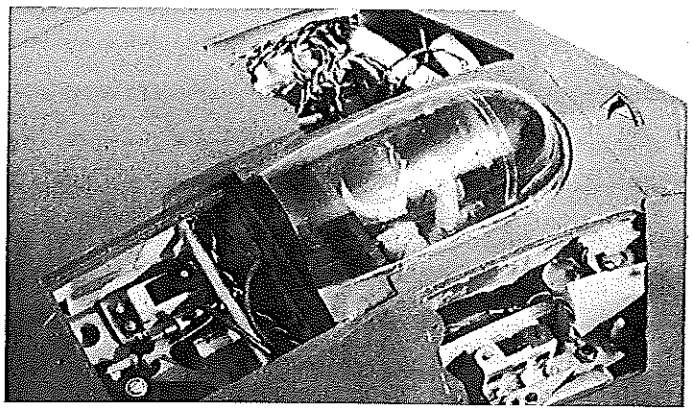
near the tip for the cut-outs for the tip slot. Please note that there is a continuous twist in the wings totaling five degrees of washout. Make a jig to hold the root and tip ribs in their proper alignment (upside down) from scraps of balsa tack-glued to the workbench and the parts. Now, add the leading edge, the rear spar, and the top main spar. Carefully add the ribs in between, checking for alignment as you go. Install the main spar webbing and the bottom main spar. Sheet the forward part of the wing and the root section next. Now, add the rear spar and rib cap strips. Be careful to include the sheeting in the landing flap area. The root rib is doubled with 1/32 plywood. Install the bellcrank mounts and the bellcranks. Cut and fit the push rods. Make a mount for your favorite servo, and install it between the first two ribs. Cut the slot ribs now, and make a cut-out in the bottom sheeting. Install sheeting on the front and back of the slot. Cut and fit false ribs in the slot. Leave the top sheeting off to allow any last minute adjustments to the internal structure.

PITCH FLAPS AND ELEVONS

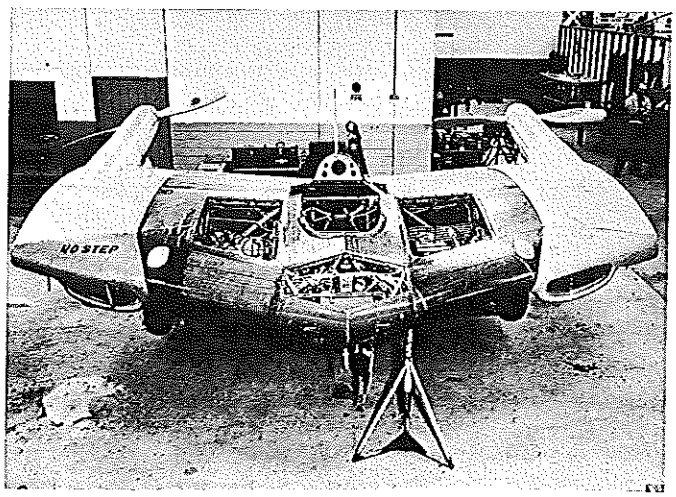
Lay down the bottom sheeting, and install the ribs in place. Use 3/32 sheeting between the hinge ribs. The hinge ribs are 1/32 ply. Be sure the hinge ribs



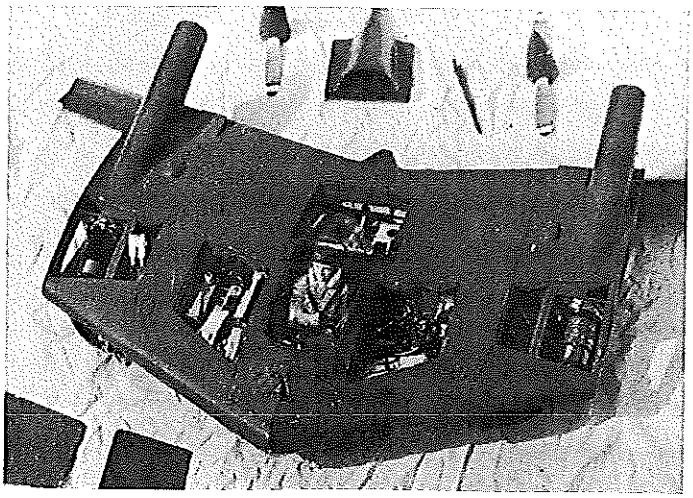
The N9M-A model uses two Astro 05 cobalt motors with long drive shafts. Scale airfoil yields lots of room inside.



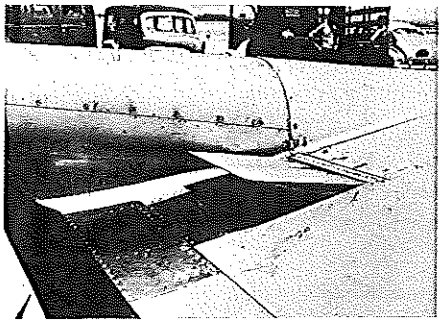
Installation details. Y-connector from aileron output of receiver goes to nose gear servo (visible) and to electronic mixer for elevons.



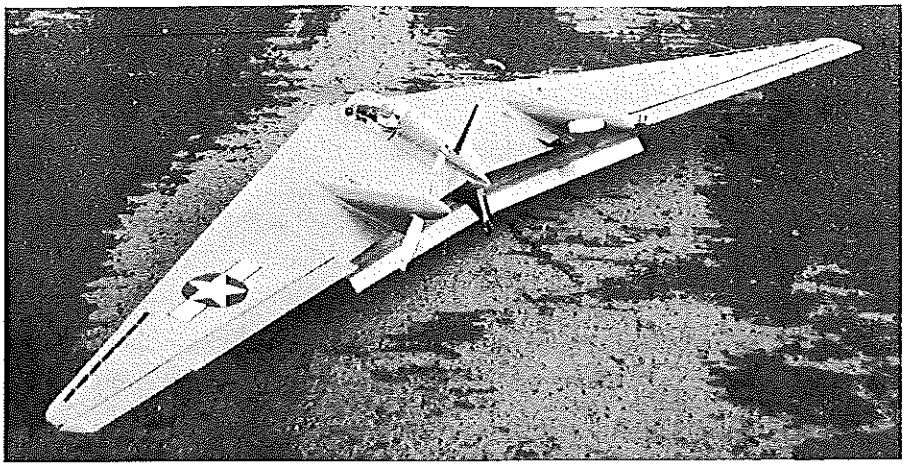
If you think the model was complex . . . take a look at the full-size N9M-A! Photo taken by Northrop, February 18, 1944.



Five hatches cover all of the model N9M-A's innards. Let's see . . . 05 motors, fuses, retracts, motor control switch, nose gear servo . . .



Drive shaft housing and exhaust port. Flap restricted hot gasses to warm cold engine.



N9M-A model on static display with landing flaps deflected. Top of the aircraft is a medium blue, the bottom is orange-yellow. Model does not feature the split surface yaw control.

are square with the L.E., and vertical to prevent binding. Install 1/16 ID aluminum tubing between the hinge ribs to act as a hinge pin guide, and support with scrap balsa. One of the hinge ribs has the control horn integrally mounted. On the pitch flaps, the control connector is within the envelope, and a false rib will need to be installed so that when the clearance cutout is made there will be sides in place. Check the alignment of the top surface with that of the wing, and then install the top sheeting. Note that the elevon is hinged on the centerline, and that the pitch flap is hinged near the top. Cut out the hinge tongues that fit into the wing from 1/16 ply, and insert 1/32 hinge wire to hold them in place. Make the tongue locations on the rear spar, and make cut outs. Glue in the tongues, and brace with scraps of balsa. Make cut-outs where necessary in the sheeting and the rear spar to clear push rods. Cut and install the push rods. Remove the control surfaces.

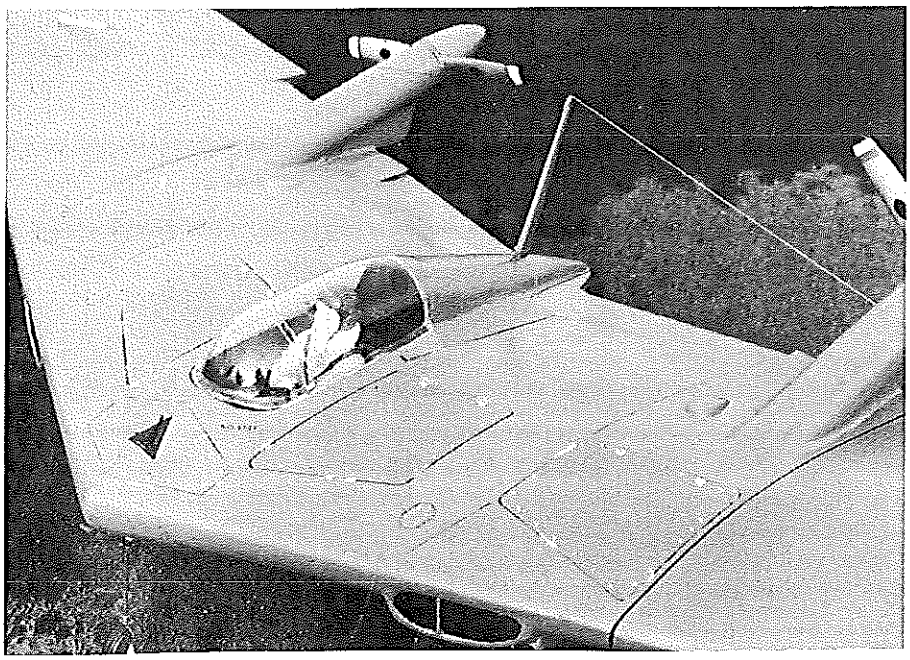
CENTER SECTION

Cut out all parts for the center section before beginning construction. Begin by assembling the center ribs to the center cross bulkheads. Make a jig to hold this assembly upside down, and locate the outer ribs in their proper alignment with two degrees washout. The top spar is flat from wing tip to wing tip. Make this jig from scraps of balsa wood tack-glued to the building board and to the parts. Check this layout with the outer wing panels for a match of LE and rib alignment. Install the LE and the rear spar. Install the top main spar and the remaining ribs. Install the main spar webbing, and the bottom main spar. Install 1/8 plywood mounts for the retracts and don't forget to install balsa reinforcement around these mounts. Plank the center section bottom, and sheet the wing stub on the bottom. Now is a good time to install the wing wires and locating tubes in the center section and the outer wing panels. Coat the wires with a petroleum jelly to prevent gluing them in. Make certain of the alignment and glue the tubes in place. Brace with scraps of balsa wood.

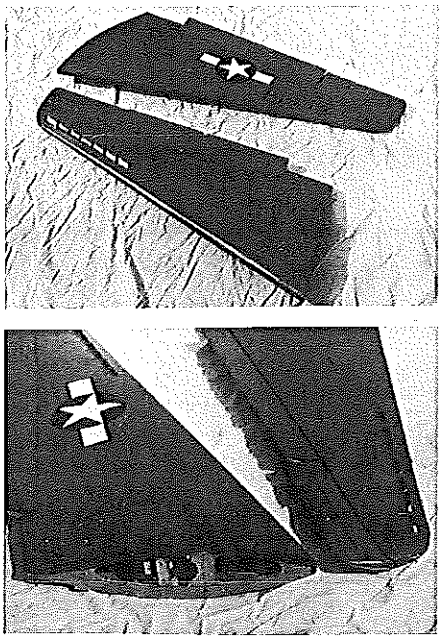
Now is a good time to install the retracts. Mark the mounting holes in the plywood mounts, and drill for blind nuts. Each gear will require a cut-out to be made in the bottom sheeting to clear the retracts and wheels. Mount the retracts. Locate and mount the retract bellcrank on the rear retract mounting plate. Now route push rods to each retract. Mount one Sonic Systems air cylinder to operate the bellcrank. Check that the whole system works freely, and insure that the gear-down, locking position is positive. Remove the retracts, and build the wheel wells at each location.

Install two servos in the left-hand opening in the wing stub. The servo nearest to the center will operate the retract valve and micro switch in the opposite opening. The remaining servo will operate the landing flaps. The receiver and electronic mixer go in this area also. Make up an actuating bar for the landing flaps from 1/4-inch ID aluminum tubing with 1/4-inch doweling inside, and 1/16 cranks where shown. Before putting on the end cranks, slip on two bearing tubes of the next larger size of tubing. Slide this whole assembly into

Continued on page 70



Here's a close-up shot of center section scale details. Canopy is cut-down Sig part. Props are 7x4 Rev-Ups. Northrop logo is red and black.



The N9M-A model's wings feature adjustable pitch control surfaces near tips (no servo), elevons, and true-to-scale L.E. slots.

"PHOTOS DO NOT BEND" on envelopes, but how about the postman who scrawled underneath, "Oh yes they do!" •

Flying Wing . . *Continued from page 21*

place and give the bearings a coat of petroleum jelly to prevent glue from getting into the bearing area. Reinforce the area around the bearings with scraps of balsa. Route the push rod to the servo and install.

Install battery tubes immediately behind the leading edge. Decide now where openings and/or guide tubes may need to be installed in the structure to facilitate radio installation and removal. Mount the micro switch and retract valve so that they can be operated by a single push rod. The operating sequence is: gear down . . . motor off . . . motor on . . . gear up. Install the air tank in the space between the motor opening and the valve/switch area. Mount charging jack, on/off switches, and air charging valve in the same area as the micro switch/valve. The receiver battery pack also mounts in this area.

Now, install the 1/4 x 1/16 spruce strips along the front edge of the hatch openings, and the 1/8 balsa hatch supports on the rib faces. Install the 1/8 ply screw plates along the rear edge of the hatch openings. Make the hatches from 1/16 plywood to fit the openings. You can now sheet the wing stubs on the top side. Make sure that everything is operational and complete inside before doing this. Make a small oval opening in this sheeting to allow access to the flap linkage.

Soak the 1/16 balsa motor tube blanks in ammonia for 20 minutes to soften them, and then wrap around the tube forms. These forms are made by wraping newspaper around doweling until the proper diameter and taper are achieved. Allow to dry, and then glue the seam. Carefully cut these tubes to match the curvature of the wing's airfoil, and mark their locations. Cut the top sheeting out inside these marks. Install the tubes with the webbing pieces.

Now is the time to make up the motor mounting plates and extension shafts. The extension shafts need to be assembled carefully to insure accuracy. After assembly, roll them on a flat surface to get a rough check on their accuracy. Mount the motors on the 1/8 ply motor mounting plates, and set into the motor areas. Slide the extension shaft assemblies down the drive shaft housings, and onto the motor shafts. When satisfied with the alignment, prop clearance, centering, etc., glue the motor mounts and the bearing suppoers in place. Now, hook up two cells to each motor, and check that all is true. If not, remove the shafts and try again. Remove the motors. Remove the shafts by cutting a small hole in the bottom sheeting under the LE stock, in the area of the air intake. Don't forget when wiring the motors to include fuses in each lead.

The area around the cockpit can be sheeted now. Make a hatch to fit the opening behind the cockpit. Carve and hollow a balsa block to form the rear cockpit fairing. Glue this fairing to the hatch. This whole assembly is held in place with one screw. The hatch mounting screw is also the mounting screw for the antenna mast. The bubble canopy is a highly cut-down Sig unit, and is glued in place after you have done as much cockpit detailing as you desire. Oh yes, don't forget to put in a pilot, even though mine seems to be on the blink.

At this point the air intakes can be carved from balsa blocks and installed. Back to the outer wings, install a 1/16 aluminum tube in the landing flap area to guide the elevon much easier. Sheet the tops of the wings, and install cap strips on the ribs and rear spar. If this is done correctly, the cap strip on the rear spar will overhang the elevon/pitch flap area. Now, check the wing fit to the center section, and gaze upon your work. Now is a good time for a little armchair flying also.

LANDING FLAPS

I build these in place. Place the assembled aircraft upside down, and cover the landing flap area with thin, plastic film. Cut 1/16 sheeting to fit in place, and add the ribs. The rib containing the control arm will require a cutout to be made in the sheeting to clear it. Now continue adding sheeting, making sure that the flap surface matches the center section surface and the wing surface. Make the cuts to install hinges and check the fit.

FINISHING

I recommend a full assembly now before going on. This will allow you to make any last-minute corrections before finishing. I covered the entire aircraft with dope and silk with plenty of filling and sanding along the way. Install the landing flap before painting. Be sure to pin those hinges. The paint scheme is orange-yellow on the bottom, and medium blue on the top. The inside of the cockpit is brown. The finish on the real aircraft was glossy, and it was not perfectly true.

FLYING

Adjust the pitch flaps so that they are up about three degrees, and the elevons so that they are up about one degree. The flying propellers are 7x4 Rev-Ups. I used ten, 1.2 amp-hour cells with both motors in parallel to keep the weight down. Make sure that the aircraft rolls straight when the elevons are in neutral. I suggest that the slots be closed with clear tape during the first flights. The aircraft should lift off by itself, and climb away easily. Turns will be strange to watch. The aircraft will yaw in the correct direction, then bank and begin the turn. Be careful not to over control, as there is a slight delay in response. You will find that the aircraft accelerates quickly, and does not slow down very quickly.

If you want more information, the following references are given: *The Flying Wings of Northrop,* by Ed Maloney, World War II Publications; *Northrop, an Aeronautical History,* by Fred Anderson, a Northrop publication; Bill Young, scale drawings, color, and black and white photographs. There will be an article in the Spring 1984 *Journal of the American Aviation Historical Society,* and I will be publishing a profile on the N9M series sometime in 1984.

I hope you have as much fun with this aircraft as I have. Whenever I take it out,. it draws most of whatever crowd there is. •

BIG Birds . . . . *Continued from page 39*

You can obtain all three sheets of these Waco UPF-7 plans for $24.50 (postage paid) from Wagner's R/C, R.D. 1, Box 291, Owego, NY 13827. By the way, three-views are included, and cowl and wheel pants are available. If classic bipes are your thing, you're gonna want to make this into a labor of love . . . 'cause, after all, bipes are beautiful!

★ ★ ★

For frustrated, would-be cropdusters, C.J.M. Plans (13640 S. Wall Lake Rd., Delton, MI 49046) has the Piper PA-36, Brave-300 ag-plane plans drawn up and ready to ship. Not only are they extremely well done, but the plans also include a host of drawings and sketches that make duck soup of the many details. The instructions are equally well done, and in fact contain an update sheet for mods to the original; a very nice touch that tells me the Wasserman Boys really care.

CJM recommends something more than two cubic inches, "...if you're going to spray, or haul a payload." In fact, they used a 4.2 cubic incher when testing with a seven-pound payload of grass seeds and flour (the flour was added in order to be able to see the spray), but feel you should play it safe, and not go over a three-pound payload. With a standard Quadra, this bird should come in around 22 pounds, leaving a two- to three-pound hopper-full to play with.

No special cowl is required (the one in the pic is made of wood), and the wing is foam, with all the necessary templates drawn on the plan. This 94-inch Brave is touted as being stand-off scale, although I'm sure a lot of guys are going to dress her up with details and steal the show. According to the info that's filtered back to me, this bird does look and fly extremely well. Plans and instructions are $30, postage paid, from CJM.

★ ★ ★

Ken Runestrand, a very prolific designer, builder, and flyer, got the hots for Paul Poberezny's Pober Pixie . . . and to satisfy his lust, promptly built a ten-foot, 24-pound Pixie of his own.

Ken kept costs in mind, and designed this BIG Bird to utilize the less expensive cuts, like doorskins for fuse sides. Being an active flyer, Runestrand knows what it takes to make other BIG Bird lovers happy . . . and has plans and instructions for sale that supplement each other well. Once again, all pertinent info is readily available; you won't get frustrated and angry searching for data that should have been there, but wasn't. If you like to scratch-build and enjoy easy flying with a mildly aerobatic aircraft, this would be an excellent choice; she's stable . . . and very scale-like.

I'm definitely attracted to the Pixie because she's better suited for my now less energetic style of flying. I figure I shouldn't get in too much trouble with this kind of forgiving flying machine. Many others are drawn to her, also. According to Ken, this pretty parasol is equally graceful on the ground as it is in the air, and is an eyecatcher wherever she goes.

And if you want to get that added tingle of satisfaction running up and down your spine as your Pixie gets up on the step and skims along the top of the water, get Mr. Runestrand's plans for Giant Edo Floats; they're great . . . and well-proven.

Ken shows how to build either 45-inch floats for quarter-size airplanes up to 24 pounds, or 56-inch floats for third-size up to 30 pounds. There is even a 60-inch option. All vital information about installation angles and step location are right these on the plans. A somewhat different approach to steering shows a