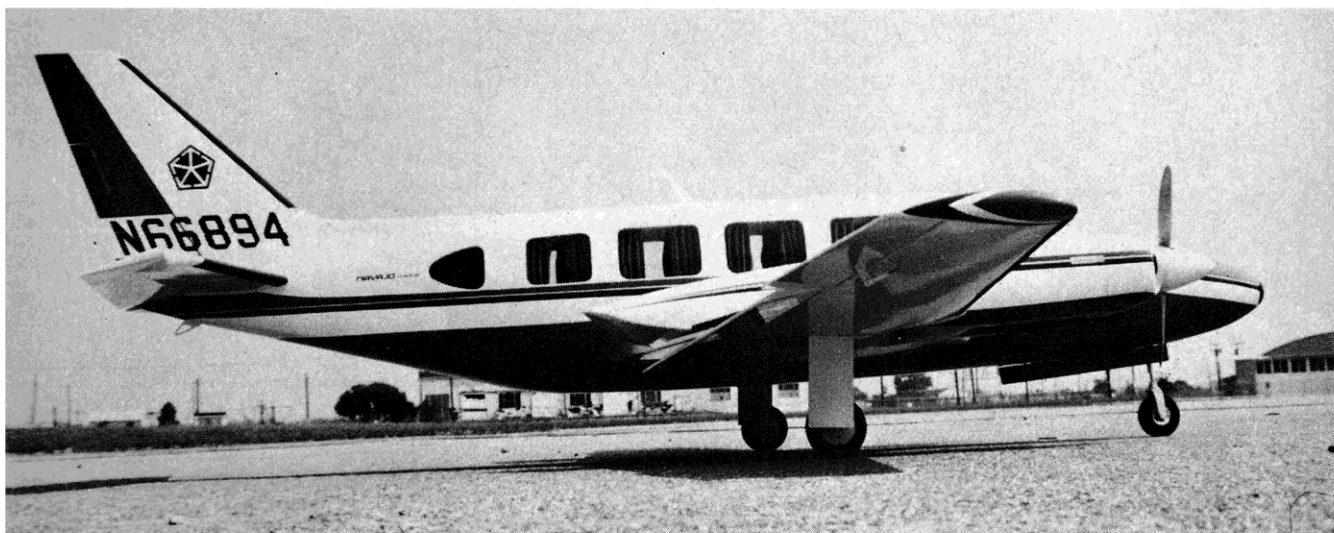


# PIPER NAVAJO CHIEFTAIN

Ever since it was first published two years ago, the Navajo Chieftain has been one of our most-requested plans. And no wonder; with its 75" wing, it makes for a big and beautiful scale project for two .40s.

Model and construction article by Jerry Bugni



## INTRODUCTION

**T**HE ONE QUESTION I hear most frequently is "Why did you choose the Navajo Chieftain to build when there are so many other fine business twins around that would make good modeling subjects?" Personal taste aside, it possessed several inherent qualities that made it suitable for modeling. These are: acceptable tail movement, adequate wing area, rectangular windows (easier to cut and install than round or oval), engine location relatively close to the fuselage, and straight forward construction requirements.

On the personal taste side of the coin, the "tiger shark" wing locker nacelles were the first item to catch my eye, and the overall aircraft possesses a beauty hard to find in any other business twin.

Full scale blueprints of the basic aircraft contours and an accurate three-view drawing gave me the information needed to design an aircraft that is

essentially full scale in dimensions except for a chord-wise 10% increase in wing area and a corresponding 10% chord wise increase in horizontal stab area, most of it in the elevators. And of course, brochures and actual pictures of the Navajo Chieftain were a great help on this project.

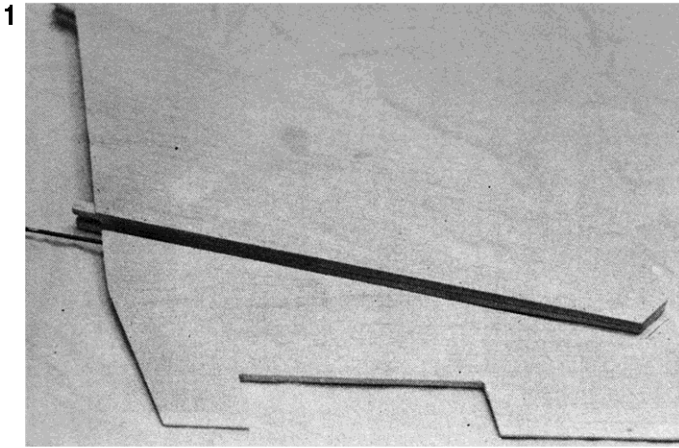
This model project should not be undertaken by the inexperienced builder, most obvious when one sees the plans. I built the fuselage first as an inspiration for the more complex wing. I used *Hot Stuff* for the basic framing of the horizontal and vertical stabilizer, framing of the elevator and rudder, joining balsa planks and strips, and other areas that aren't subject to heavy stress. Titebond was used for installation of all planking and general construction. *Formula 1 Hobby Pox*y was used on areas such as firewalls, wing spar ply joiners, installation of nose gear ply bulkhead, main gear bearers, etc. For brevity's sake, all wood sizes are shown on the plans

so I won't necessarily mention all sizes in the construction text.

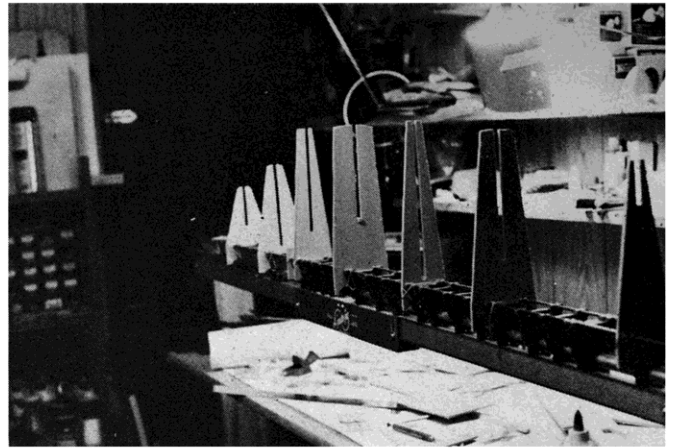
## CONSTRUCTION

**VERTICAL STAB**—Start by cutting out the leading and trailing edges of the vertical stabilizer and rudder. All ribs are from 3/32" sheet. Frame up the vertical stab and rudder using *Hot Stuff*. Insure precise angles of the ribs. Using a sanding block, go over both structures to insure a smooth and true rib surface and then plank the vertical stab with 1/16" balsa using Titebond glue. Install the 3/32" horn wire into the rudder using *Formula 1 Epoxy*. Be sure to secure with a bass wood or hardwood block. The rudder should now be planked with 1/16" balsa. After planking using Titebond, bevel the rudder L. E. to allow it to turn when hinged. Install block tips and sand the vertical stab leading edge (construction photo #1).

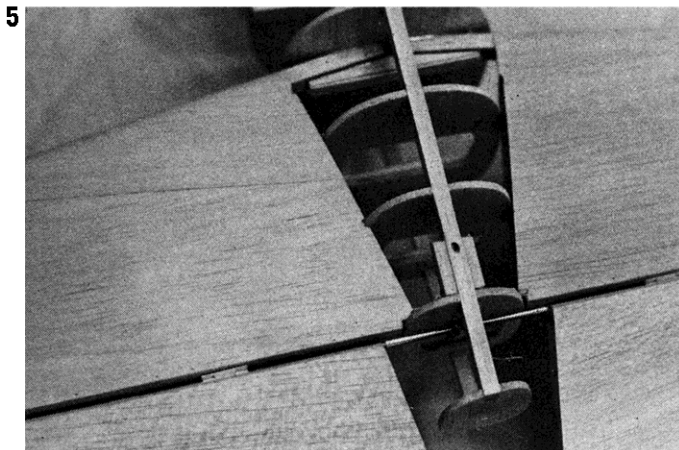
**HORIZONTAL STAB**—The horizontal stab and elevator use virtually the same



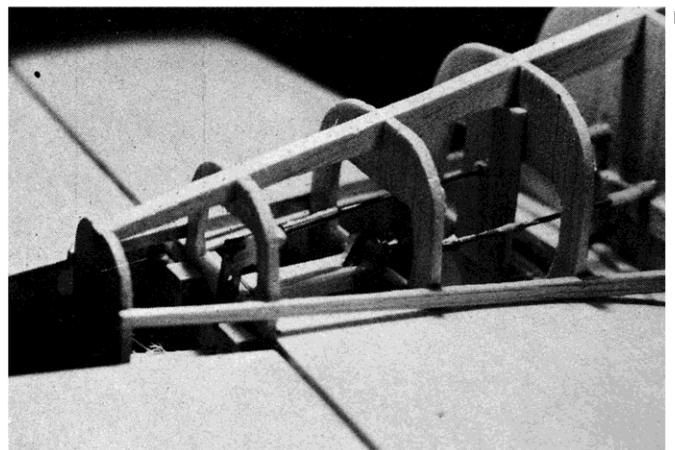
**1** The Navajo Chieftain's vertical stabilizer after planking. Bevel the rudder leading edge to allow it to turn freely when hinged.



**2** Adjusto-Jig with jig extensions used to frame up a perfectly aligned fuselage. The extensions are cut from 3/16" balsa.



**5** Horizontal stabilizer installation to the fuselage requires that the leading edge be beveled slightly where it cements against the bulkhead. Note also that the trailing edge is notched.



**6** Visible here are the elevator support blocks which have been epoxied over the elevator horn brass bushings. The elevator linkage has been installed. Also note that the rudder linkage complete with ball and socket are in place forward of the elevator linkage.

Photography by Jay Miller and George Jenkins  
Artwork courtesy Piper Aircraft

construction techniques. Build the horizontal stab in halves which will later be mated with the fuselage. After the elevators have been framed up and block sanded, install a Midwest 6" elevator horn, insuring that elevator halves are secured on a flat surface while drying. The elevator horn should be slightly offset to one side to make room for rudder horn operation. Plank the elevator and then bevel the elevator L. E. Set aside the horizontal stab, elevators, vertical stab and rudder for later use.

**FUSELAGE**—I framed up and partially planked the fuselage while it was still on the Adjusto Jig. Construction photo #2 shows how the jig was set up. I used 3/16" balsa sheet cut to the fuselage jig extension shapes shown in the photos. These pieces had the holes cut in them for jig insertion and notches cut to accept the fuselage crutch parts. The placement of these jig extension pieces was somewhat arbitrary with the objective of keeping the fuselage as stiff as possible while planking . . . this

method provides perfect alignment and an absolutely true fuselage.

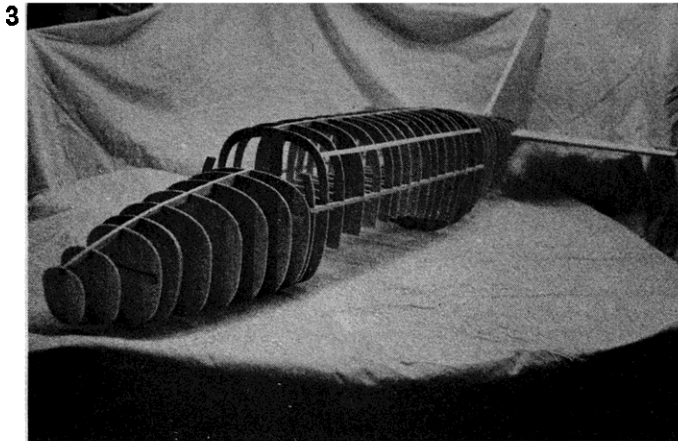
Cut the fuselage crutch parts from 1/4" sheet. Join 1/8" fuselage former sheets. I used four 1/8" x 6" x 36" sheets with a 1.5" piece glued on both sides for the wider formers. Two 1/8" x 4" x 36" sheets glued together can be used for all other formers.

In the plans, I drew all main center formers more for my own satisfaction and reference than for any other reason. When cutting these main center formers it's actually simpler to use the former shape for F-23 and stack cut F-13—F-23 from this one shape. F-24 is cut separately. The distance between the floor line and bottom of each wing saddle former varies. After F-13—F-23 have been stack cut, this adjustment must be made. The former bottom pieces that form the underwing fuselage portion can be cut later. Use Hot Stuff (Titebond will cause formers to warp) to glue 1/8" strip stiffeners to the former floor line and across the very top of the former. Splice the fuselage crutch pieces to-

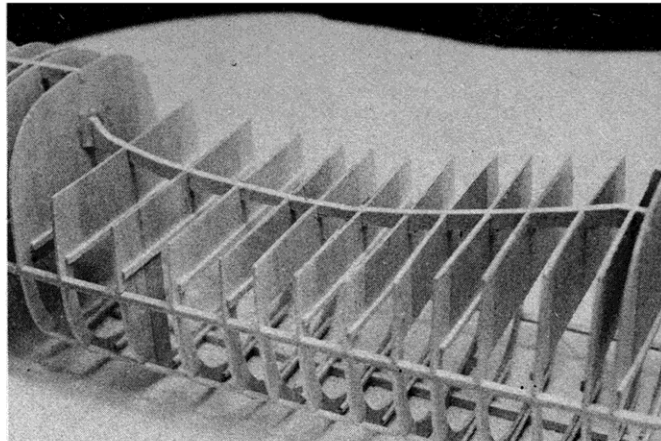
gether. (Jig extension pieces should be placed at the end of each assembled crutch length to insure accurate crutch placement in jig.) The crutches, after assembly, should be placed over the plans so that former positions can be marked on the crutch pieces. Slip the bottom crutches insuring perpendicular alignment (except F-4) with the Adjusto Jig base. Glue top crutches in place (Construction photos #3 and #4). Do not glue F-37 in place until after the stab and elevator have been installed.

Glue 1/4" square or 3/8" scrap pieces where the rudder horn wire passes through the crutch center. Using stab alignment marks for 0 degrees incidence that were predrawn on formers F-33 and F-36, install stab halves using Titebond. Note how stab L. E. is cut to fit against F-33 and how stab T. E. is notched to fit against F-36. (Construction photo #5). This notch provides the needed space between the elevator horn and F-36.

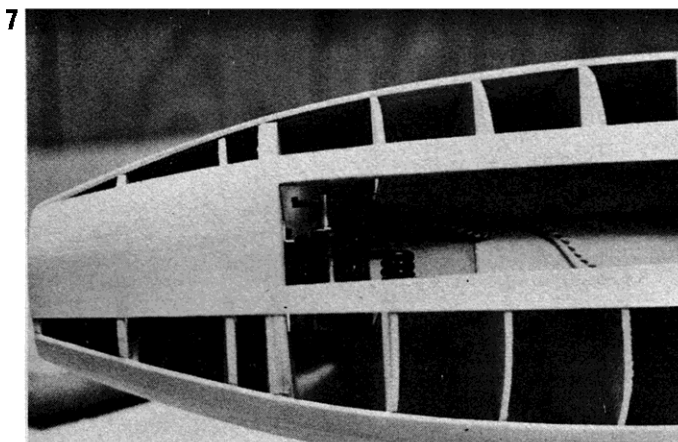
Install "filler" block at stab L. E. joint and 3/32" ply joiner at stab T. E.



3 Fuselage construction is shown to good advantage in this view. An ample number of formers insure strength and rigidity.



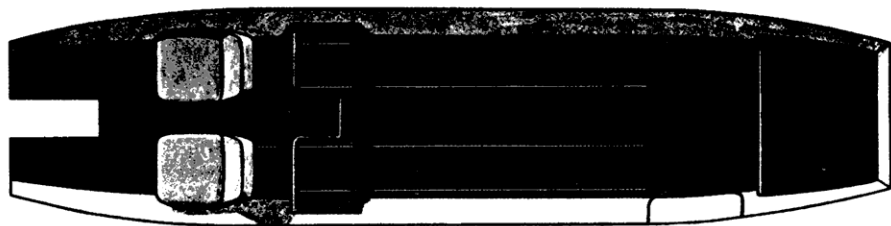
4 Another view during the fuselage frameup stage shows what will be the wing saddle area. Obviously the dimension between the floor line and the bottom of each wing saddle former varies. These pieces are first stack cut and then adjusted accordingly.



7 Shown here is the cutout for the nose wheel well with Multicon nose gear installed. Author liked the simplicity of its installation.

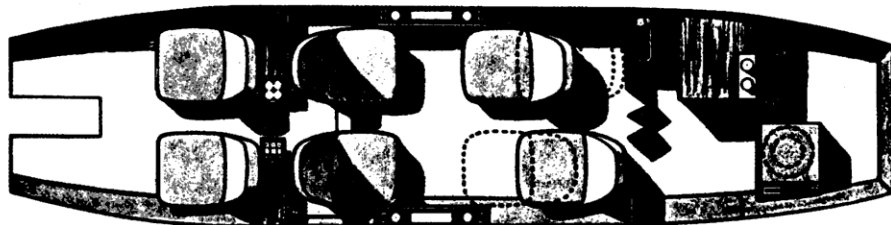


8 This photo shows the fuselage after being completely planked at the time the wing fillets are built up. Small balsa blocks and Sig Epoxolite accomplish the smooth fairing.



Basic Chieftain cabin arrangement with pilot and co-pilot seats in place.

Executive Interior with hot/cold refreshment and storage provisions in forward cabin divider, conference style seating with folding tables, aft cabin folding door and refreshment/comfort unit with forward facing toilet.

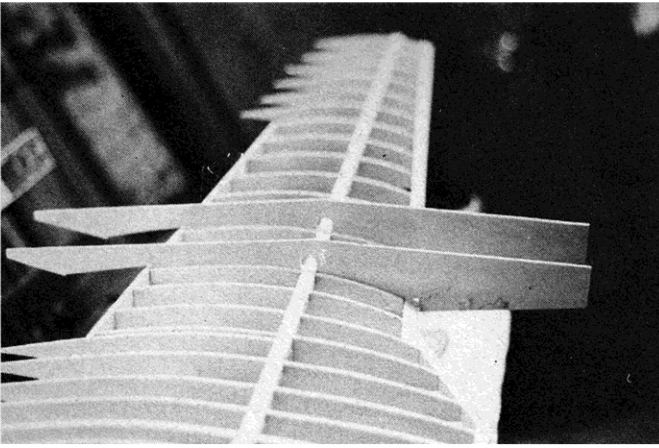


joint. Hinge and permanently install the elevator horn support blocks epoxied over elevator horn brass bushings (Construction photo #6). Ace R/C, 1/4" centerline hinges were used. Also note that the unused tip of the elevator control horn is clipped off.

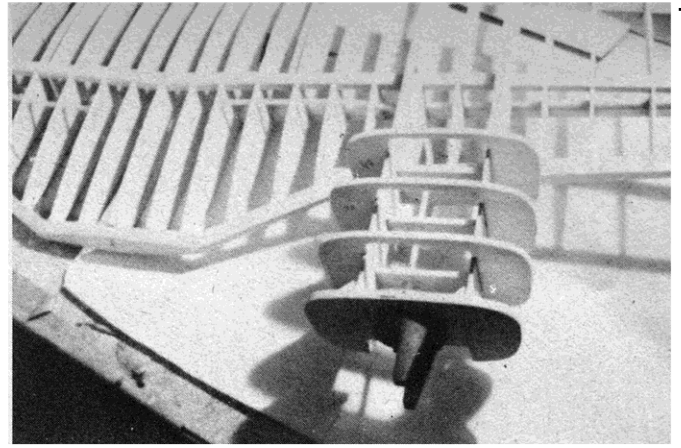
After partially planking the top of the rear fuselage, install the pre-joined rudder and vertical stab with Formula 1. Insure that a 3/32" inside diameter brass bushing is epoxied into the hole for the rudder horn wire. Plank as much of the fuselage as possible using 3/32" balsa being sure to leave enough working space for installing the elevator and rudder pushrods and to solder the rudder horn. Remove the fuselage from the jig. Plank the cabin floor with 3/32" balsa before installing servos. (See photo #9).

Plank about 3/4 of the nose area before cutting out the nose wheel well (F-5—F-8 should be premarked). Next use brass tubing bent to shape and silver solder to the rudder horn. Note spruce rudder horn support block. (See construction photo #6

9



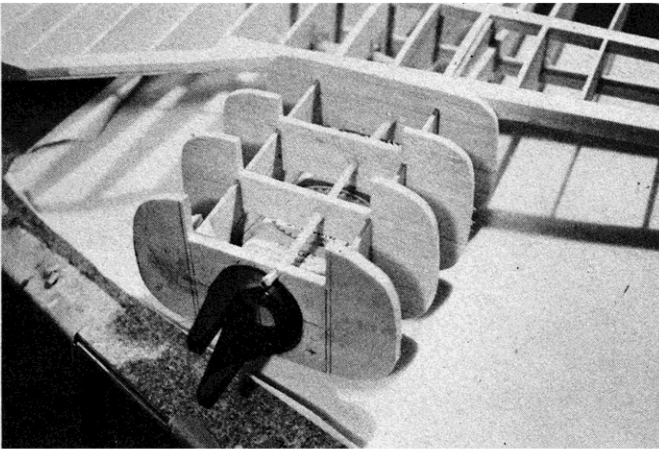
Early construction of the left wing shows ribs in place along with main nacelle crutches. It is vital that these crutches be perpendicular to the wing to avoid a canted nacelle.



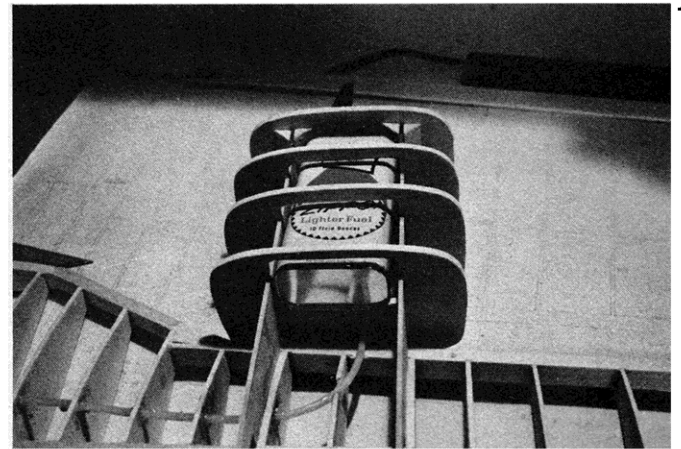
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Forward nacelle formers are in place over the nacelle crutches in this shot of the left wing area.

11



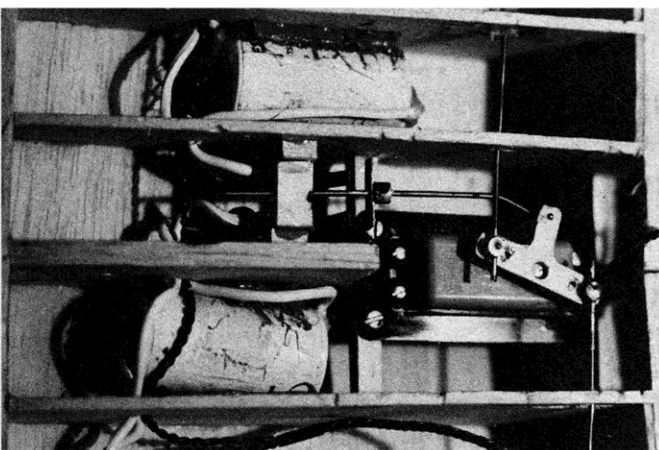
This view shows the bottom of the right wing nacelle during early construction with the forward nacelle formers in place. Engine mount is installed for position only.



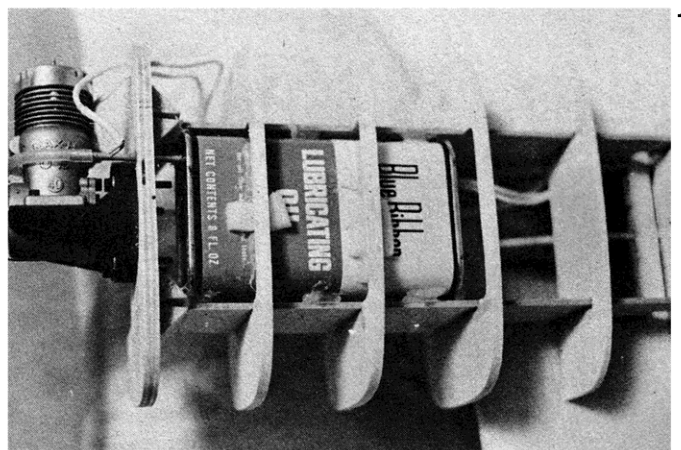
12

Photograph of the right wing nacelle shows the route of nyrod throttle control cable. Also shown is the right engine fuel tank set in place for position check. Tanks are made from 8 oz. lighter fluid or oil cans—a common enough item.

13



Mid-wing installation of the glow plug booster batteries is shown in this photograph. Silicone rubber cement holds the cells in place. The glow plug booster switch is connected directly to the throttle servo and energizes the plugs in the idle to 1/4 power range for more dependable engine operation.



14

Fuel tank has been permanently installed in this shot of the left wing nacelle. Note the dangling glow plug booster wire.

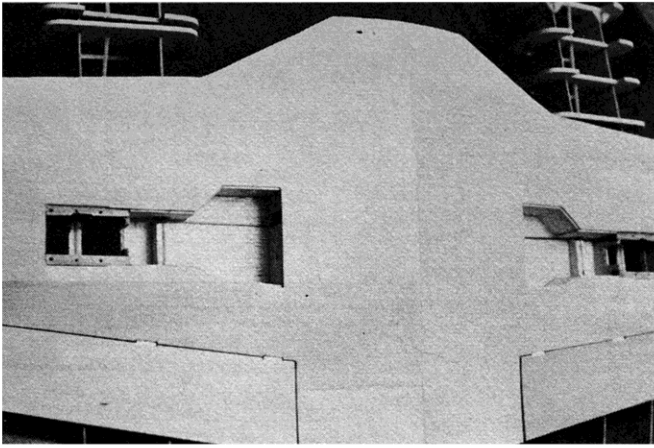




A production Navajo Chieftain displays one of the alternate yellow and white paint schemes as compared to the red and white shown on the model.

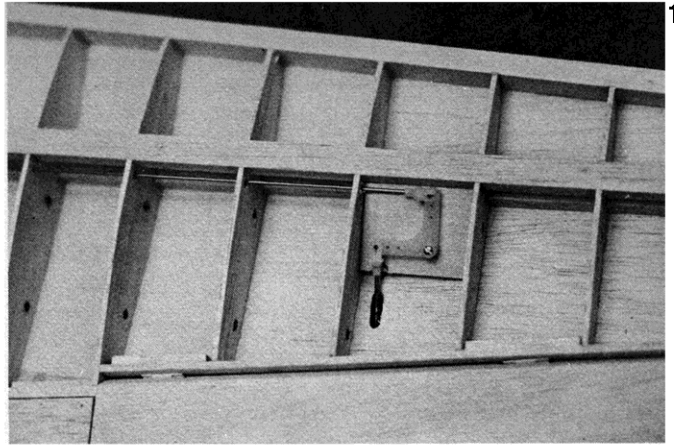
The Navajo Chieftain on indoor display at the 1975 Nationals with scale props in place for static judging. (George Jenkins photo)

15



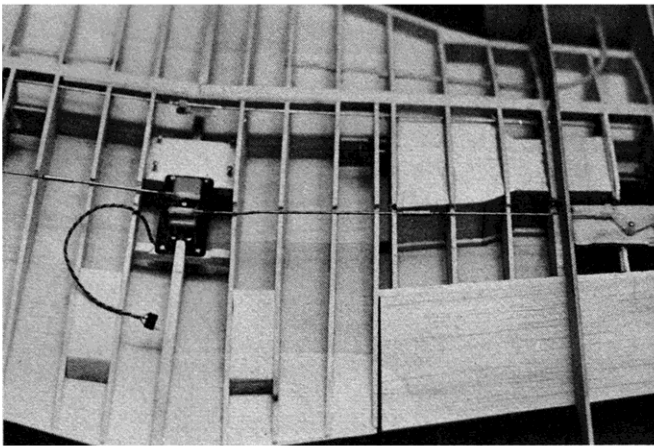
Landing gear installation is fairly straightforward. Virtually any type of retract on the market would be suitable.

16



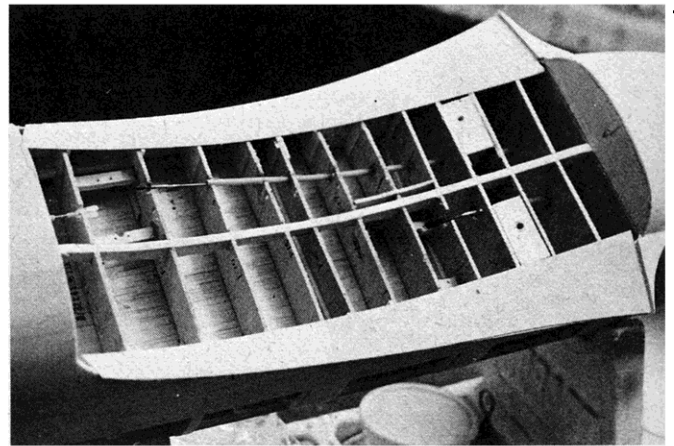
With the lower portion of the wing sheeted, the ailerons and flaps are installed. Shown here is the aileron bellcrank arrangement on the right wing.

17



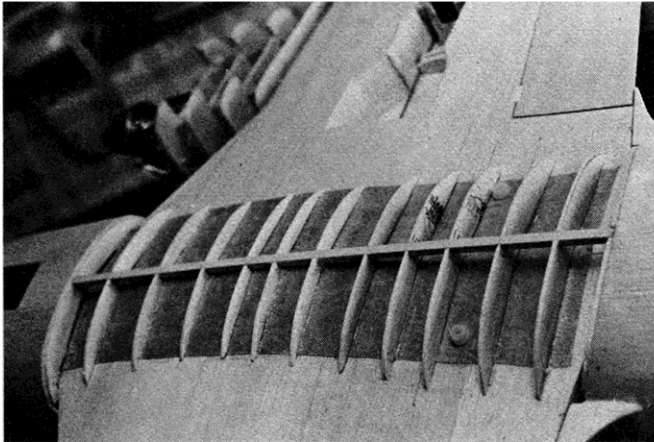
This photo shows flap installation and accompanying linkage running to the flap servo in the mid-wing area.

18



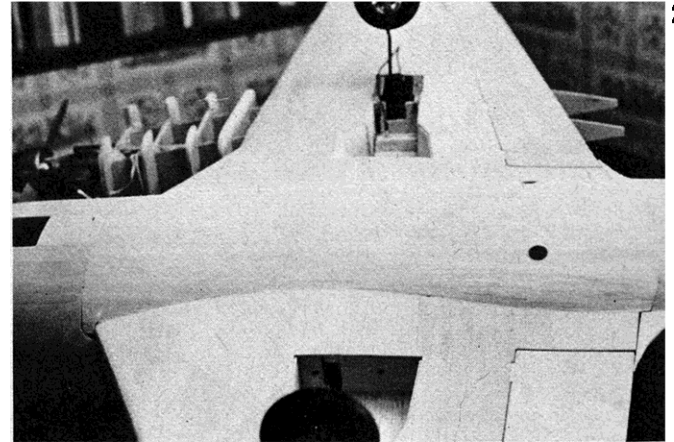
It is important to achieve a proper fitting, all-surface-bearing wing saddle. Note the placement of the wing hold-down bolt blocks.

19



With the wing properly mated to the fuselage, the small underwing fuselage ribs are cut out and cemented in place.

20



Plank over the underwing ribs and fare both ends to the lower main fuselage sections.

again). I used a Hi-Johnson metal ball and socket link for the rudder linkage. This was silver soldered to a 2/56 Nyrodapter. Blue nyrod was used with 1/16" music wire inside the yellow portion for both the elevator and rudder.

The servo installation requirements are fairly flexible. There is plenty of room beneath the cabin floor to install servos, battery pack, switch and receiver. The antenna is permanently installed in the cabin ceiling and utilizes a connector at the receiver. Using a Multicon nosegear greatly simplified the nose gear installation (construction photo #7).

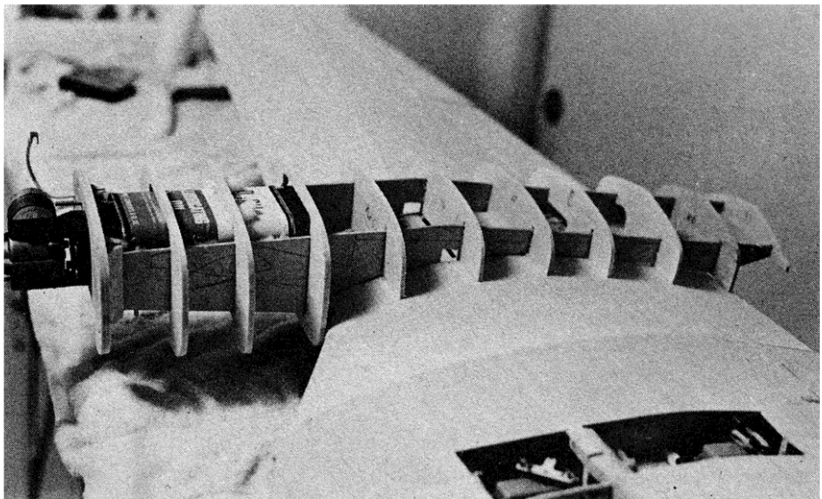
Wing fillets were built using ribs and planking with the very front of the fillets being Sig Epoxolite and the portion behind the wings being blocks. After the fuselage has been completely planked and generally sanded, the rear windows can be cut and corner rounding installed in the main fuselage windows (construction photo #8). I trimmed the formers inside the cabin and planked the inside with 1/16" balsa and Hot Stuff. The average guy can get an arm and a hand into the cabin through the windows to do this inside work.

Install the nose and tail blocks and sand to shape. I used Titebond for the inside area of these blocks and Hot Stuff along the outside seam to facilitate immediate sanding. Install the block under the rudder and fillets between the elevators.

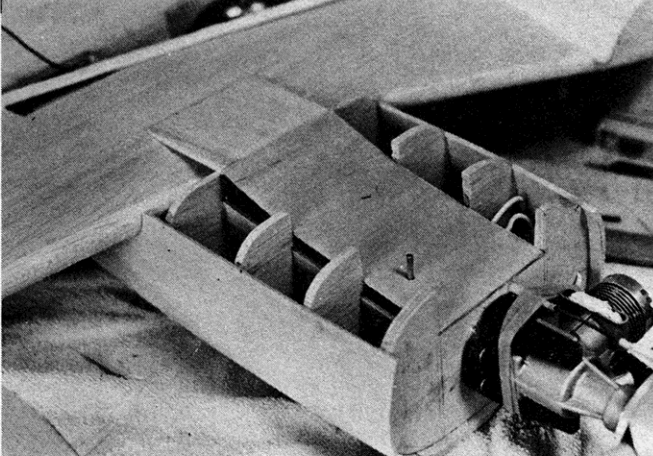
**WING CONSTRUCTION**—Here's the fun part, not that it is difficult, just time consuming. Cut out all ribs, using 3/32" sheet for W12—W22. 1/8" sheet is used for W2 through W7 and W9. 3/16" sheet is used for W8 and W10. W1 is 1/4" sheet. Cut the nacelle crutches from 3/32" ply. All nacelle crutches can be cut from a 12" x 24" x 3/32" ply sheet. Use a sheet that is fairly warp free.

Begin construction by setting up the Adjusto-Jig with four degrees dihedral. Extra rib holders will have to be purchased because of the great number of ribs. The tip rib is added without the aid of a jig rib holder. Punch rod holes in all ribs and nacelle crutches with the Adjusto-Jig tool provided. Install all ribs and nacelle crutches. *Make sure that W-8 and W-10 are exactly perpendicular to the jig rib holder pipe.* If they aren't square you run the risk of a canted engine nacelle.

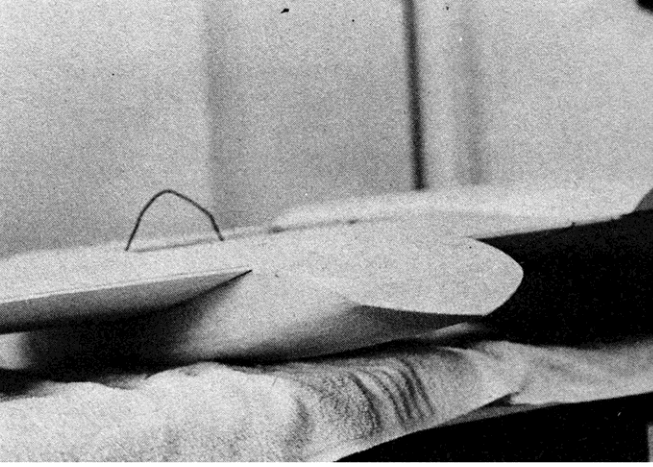
Splice one end of four 3/8" x 1/2" x 36" balsa spars, adding the extra length at the tip. After they are dry, apply glue to all of the rib spar notches. Slide the top spars through



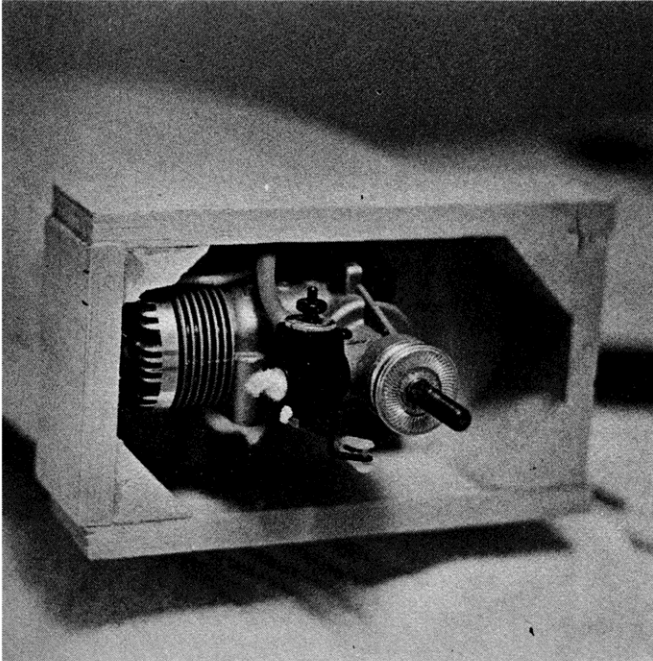
Rear nacelle formers set in place. Positioning of flap bellcrank allows it to be hidden by the nacelle.



1/16" ply is used for the curved exhaust cutout floor. The sides of the cutout channel are planked with 3/32" balsa.



This photo shows the finished configuration for the rear of the nacelle. Note that the tip is shaped from a small block.



the nacelle crutch spar cut outs and press the spars down into position. Rotate the jig and install the bottom spars.

Apply the L. E. and then the flap and aileron cutout facings. The wing ribs should be premarked showing the proper aileron/flap cutout lines (construction photo #9). Add the 1/8" ply spar jointers. Now remove the wing from jig. Cut out all nacelle formers at this time. N-1 is 1/4" ply, N-2—N-4 are 3/16" balsa and N-5 through N-11 are 1/8" balsa.

Install N-2—N-4, gluing N-2 and N-3. N-4 is glued after the wing has been planked and leading edge sanded. N-1 is attached using Formula 1 epoxy and 1/2" hard balsa corner stock. Be sure to pre-mark N-1, indicating the center position of the engine mount and where the nacelle crutches attach (construction photos #10 and #11).

Install the throttle control using cable or nyrod. The throttle servo should be centered and mounted just forward of the spar (construction photo #12).

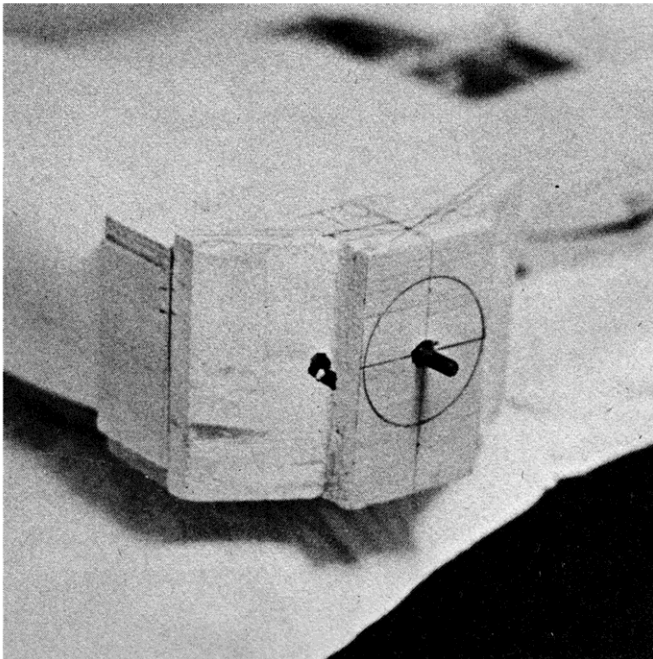
With a big twin like the Navajo Chief-tain I opted for on-board glow plug boosters for whatever added engine reliability this might afford. For the boosters I used 1.5 amp. batteries (one for each plug) secured with silicone rubber. When wiring this system, use regular household extension cord wire as the smaller diameter wire causes an excessive amperage drop at the glow plugs. I used Radio Shack micro-switches (Cat. No. 275-016) that have a lever arm. The glow-plug operates in a range from idle to 1/4 power (construction photo #13).

I used 8 oz. fuel tanks fabricated from every day lighter fluid cans, lube oil cans, etc. I used the soft brass tubing for the fuel feed line and for the overflow line. Silicon tubing with a clunk is used inside the tank because fuel won't rot silicone line. The tanks were permanently installed once their correct positions in the nacelles were determined. The tank opening, which is facing the rear, is silver soldered shut. Secure the tank with silicone rubber (construction photo #14).

The plans show only gear door shapes and gear strut center of rotation. Because of the numerous choices of landing gear units available, I decided to omit installation detail. I chose Kraft Multicons for my model (construction photo #15) but whatever your choice, now is the time to install the landing gear.

Plank the entire wing bottom with 3/32" balsa. Reinforce the wing center section with your favorite materials. Be sure to install the balsa blocks between the ribs where the wing bolts will pass.

The ailerons and flaps were constructed in the same manner as the rudder and elevator. Again, use Hot Stuff to frame them up. Don't forget





George Jenkins photo

the 1/8" ply horn mounting plate. The ailerons have this piece installed on the bottom while the flaps have it on the top. The flaps were hinged using Ace R/C 1/4" top edge hinges. Bell crank installation for the ailerons and flaps is straight forward (construction photos #16 and #17). I used a standard KPS-14 servo for flap operation, however, a 180-degree servo can also be used. (40 degrees of flap is sufficient).

The wing top surface is planked next. Do the center section inboard of the nacelles first and then the outer wing panels. Place a 3/8" square block under the tip rib T. E. in order to introduce washout while the outer panel is being planked. Be sure to plank these outer panels on a flat surface.

True up the wing saddle to insure a smooth fit (construction photo #18). Install the wing bolt blocks between formers F-20 and F-21. Line the inside of these formers with 1/16" ply before bolt block installation. Mate the wing to the fuselage being careful

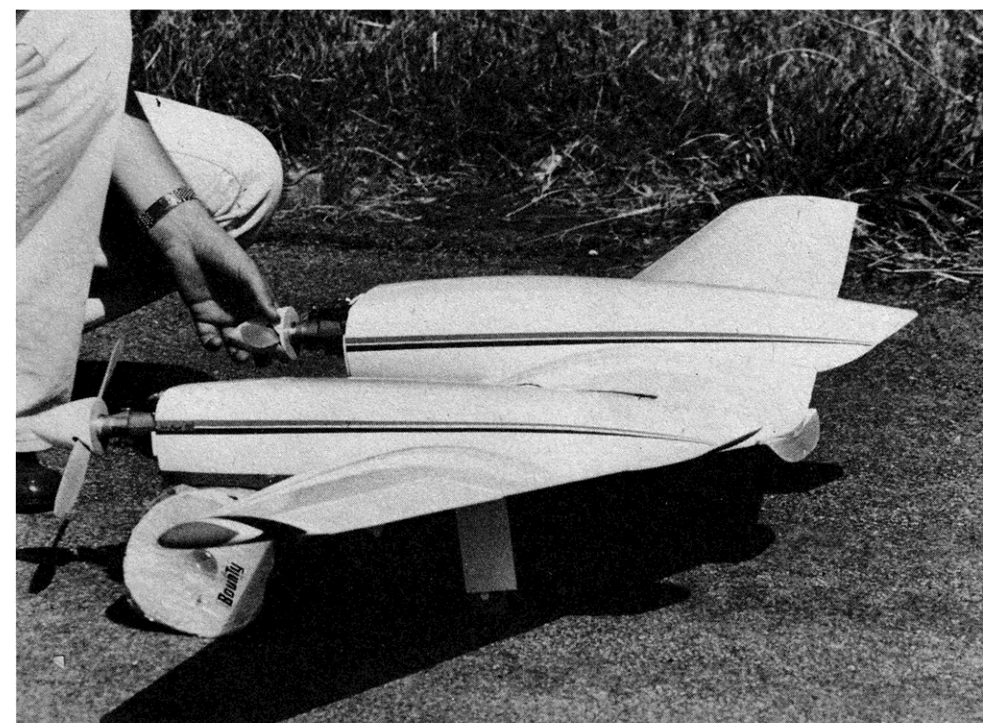
to maintain proper fuselage alignment. Wing Mfg. 1/4 x 20 allen head bolts were used to bolt the wing to the fuselage. With the wing securely mounted, construct the fuselage portion under the wing (construction photos #19 and #20).

Install the remaining nacelle formers (construction photo #21) cutting away a portion of N-8 and N-9 to make room for the flap bellcrank and horn. Plank the nacelle tops using two 1/8" x 22.5" x 2.5" sheets per nacelle top. Make one piece side planks and then strip plank the corners. Use 1/16" ply for the curved exhaust cutout floor (construction photo #22) and 3/32" balsa sheet for the exhaust channel sides. Install and shape nacelle rear block and bottom piece (construction photo #23). Rough sand the nacelle in preparation for attaching the nacelle cowl molds.

Build up the nacelle cowls around the engines (construction photos #24 and #25). The reason for this drawn out process is that if the engines

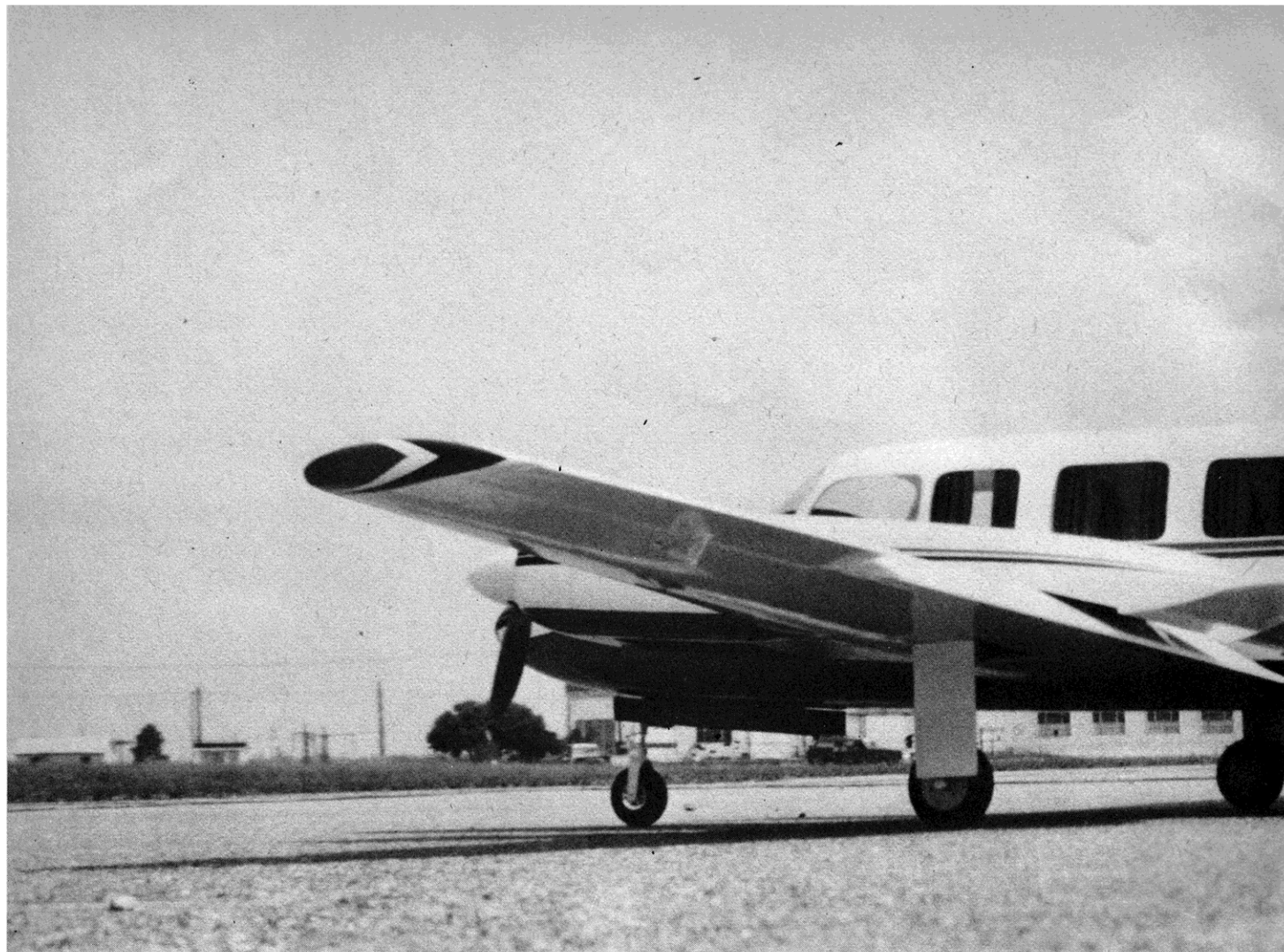
aren't mounted precisely the same, the cowl for one nacelle won't fit the other. Tack glue the basic nacelle box to the firewall using Hot Stuff. (A thin razor blade will easily separate the balsa cowl molds from the nacelle when they are completed). Follow standard fiberglass mold procedures for making the cowls. Attach the aluminum cowl mounting pieces to the inside of the cowl with Formula I and loose weave fiberglass cloth. Drill small holes in the mounting pieces to insure good adhesion to the cowl. Use small sheet metal screws for mounting. These screws are easily accessible through the front of the cowl with a long, thin, magnetized screwdriver. Building a partial lip around the firewall edge insures better cowl seating.

MISCELLANEOUS—After the cowls are properly installed, the engine should be baffled and exhaust manifolds attached. I used .016 sheet aluminum for the baffles and modified Tatone exhaust manifolds. Make sure that your version of manifold modifica-



Builder/author Bugni is seen here making the necessary servo-receiver connections prior to fuselage-wing bolt down. (Jay Miller photo)

Looking as if it could take off and fly by itself, the wing with its two mighty twins awaits the arrival of the fuselage at the flying site. (Jay Miller photo)



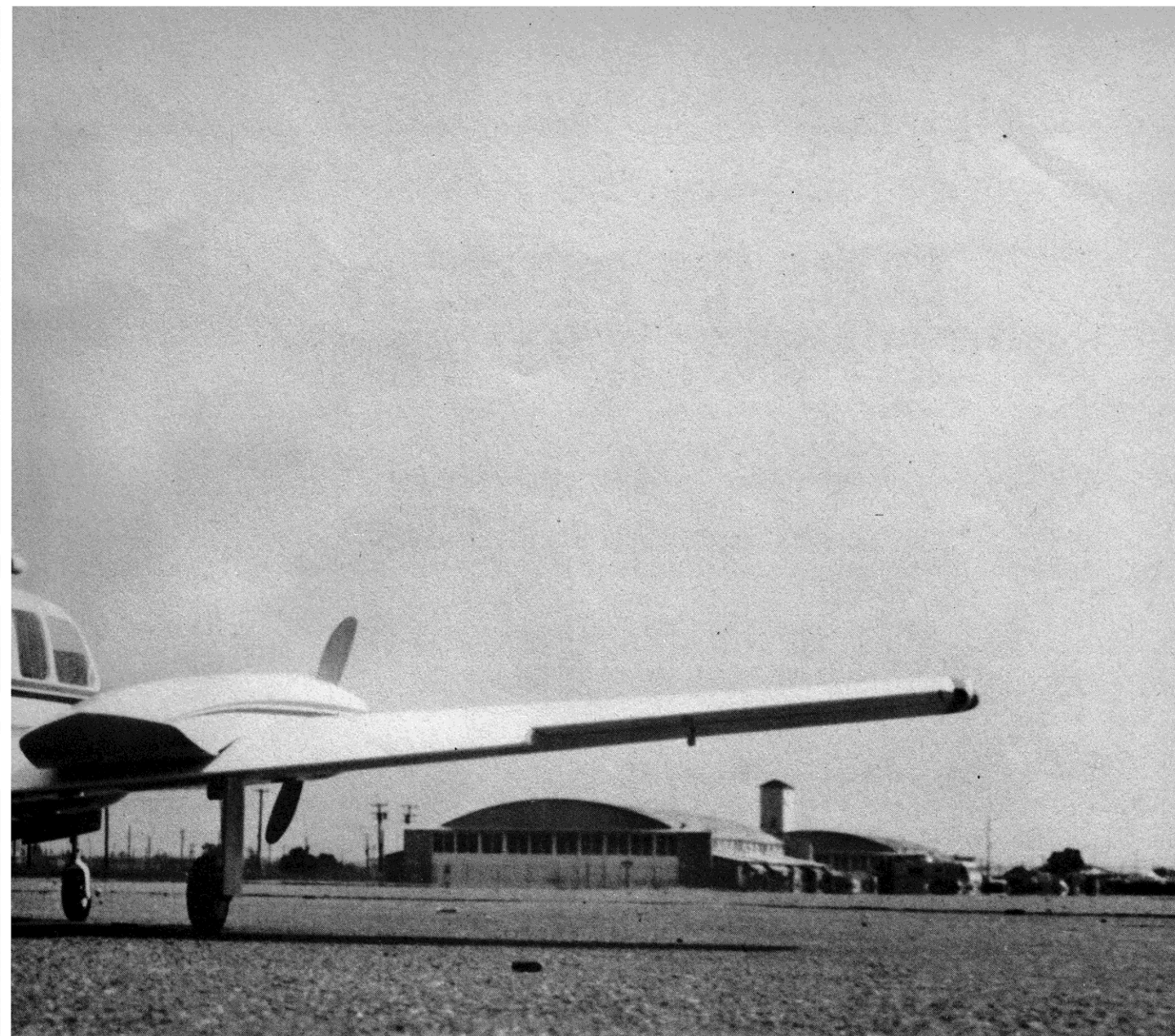
George Jenkins photo



Engine tuning run-up sans cowlings prior to flight. Fiberglass cowlings are from one mold and are interchangeable. (Jay Miller photo)

Tuned up, buttoned up and ready to go. Head-on view of the Navajo Chieftain shows off well the sleek lines that make it one of the most popular business aircraft on the market. (Jay Miller photo)





George Jenkins photo

tion is feasible because welding aluminum is too expensive for mistakes.

Finish the fuselage cabin as desired and then install the curtains and windows. For the fuselage side windows and windshield, I used heat formed 1/16" buytrate. The windows were cut and sanded to a press fit, polished and then installed with Hot Stuff.

Fully functional landing gear doors were made using small Kleet hinges for installation. Kraft Multicon gear units made gear door installation relatively simple.

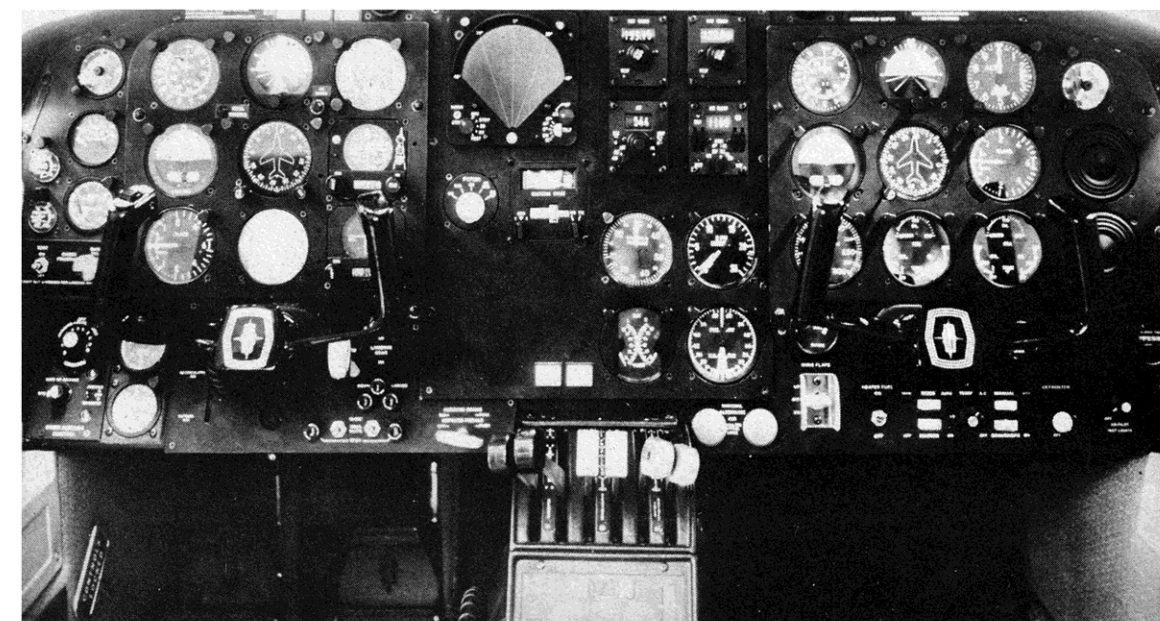
FINISH—Fabricate the antennae, tail skid and any other scale detail before applying the finish. I covered the entire airplane with 10 heavy coats of K&B clear and 12 heavy coats of K&B primer. The final finish was K&B color. The empty weight (that includes all equipment) should be in the vicinity of 13.5 pounds. Depending upon

equipment selection, the weight of your model will probably fall in the 12.5-14 lb. range.

FLYING—The first flight (a case of nerves) went well except for cosmetic damage from a stall just before touchdown caused by a lack of experience with high wing loadings. Subsequent flights went very well with no problems encountered. The Navajo taxis well on one engine and has very positive ground handling characteristics. Takeoffs are smooth and predictable. The airplane "grooves" at high or low speeds. The use of flaps should be restricted to slow speeds as they tend to cause heavy nose down pitch at higher speeds. About 20% power, 10 degrees of flaps and a slight nose down attitude is sufficient for landing up to the flare. If you should land dead stick get the nose down and apply about 20 degrees of flap. *Don't,*

under any circumstances, try to stretch a glide as it will result in a stall. Because of wing washout, the Navajo can become deceptively slow before stalling. A power off stall at altitude will demonstrate stall characteristics which are gentle. Two 40's provide plenty of power in case you're thinking of using 60's. In fact, single engine landings can be accomplished if you are good on the rudder and ailerons. Elevator control deflection should NOT exceed 1/2" up or down. Although the plans show the center of gravity on the spar, a slightly nose heavy condition is more desirable as this makes the aircraft less sensitive to pitch control inputs.

Building this aircraft was a real challenge which gave me a lot of personal satisfaction. I'm sure anyone who undertakes this project will find it to be a rewarding one. Good Luck! □



Instrument panel layout on a real Navajo.