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FOR SCALE LOOKS AND PATTERN SMOOTHNESS, TRY

MOONEY EXECUTIVE

Story by Mark Frankel and photography by James Lipschutz

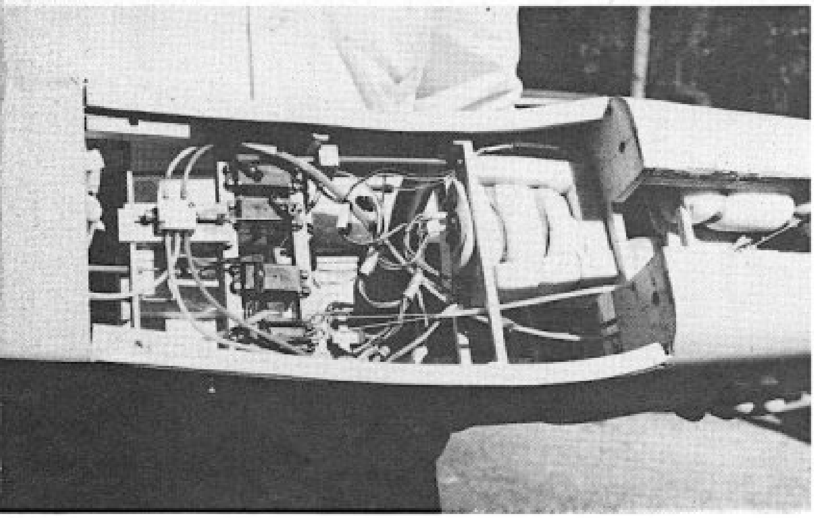
After several years of considerable success with its Mark 21 design, Mooney Aircraft introduced the Executive in 1966. With its increased horsepower and stretched fuselage, the Executive soon surpassed the Mark 21 in sales. One factor which clearly helped the Executive gain acceptance was its elegant appearance. The 10-inch lengthening of the fuselage and the addition of another cabin window, removed any hint of the Mark 21's economy look. To my mind, the Executive remains the only light aircraft that was enhanced in appearance by the addition of fuselage length. Other "extended" aircraft, such as the Cherokee Six or the Bonanza 36, seem diminished in appearance by the addition of more fuselage.

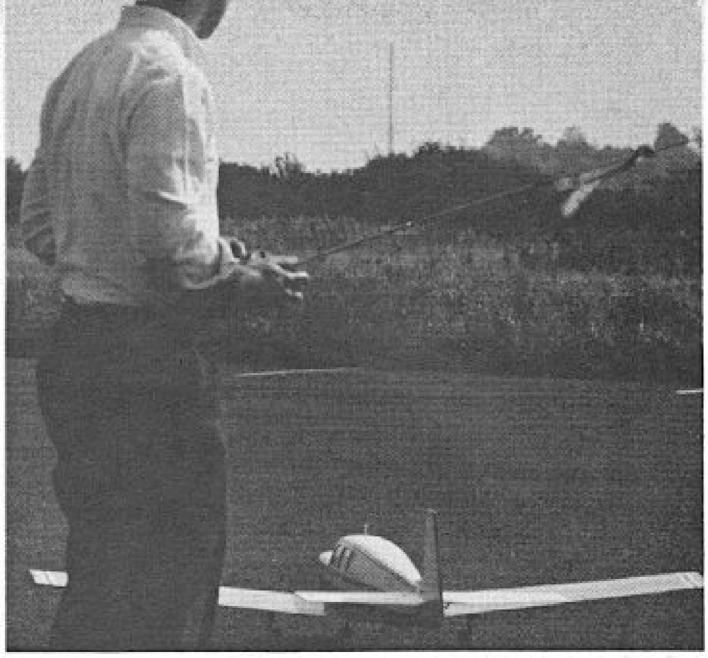
I chose to model the Mooney Executive partially because of it's lengthened fuselage. About four years ago I built a stand-off scale Mark 21. The model was originally intended to be a test platform for a new set of mechanical retracts. At the time, retracts were just approaching their current refinement and most retract experience was confined to relatively light pattern models. I was curious to determine how these retracts would hold up in a heavier scale type model. Rather than test the retracts in a marginally flyable "serious" scale model, I chose to build the Mark 21 with only cursory reference to the full-size Mooney's dimensions. The model employed the areas and moments found on several popular pattern aircraft. Its shapes were copied from photographs rather than three-view drawings.

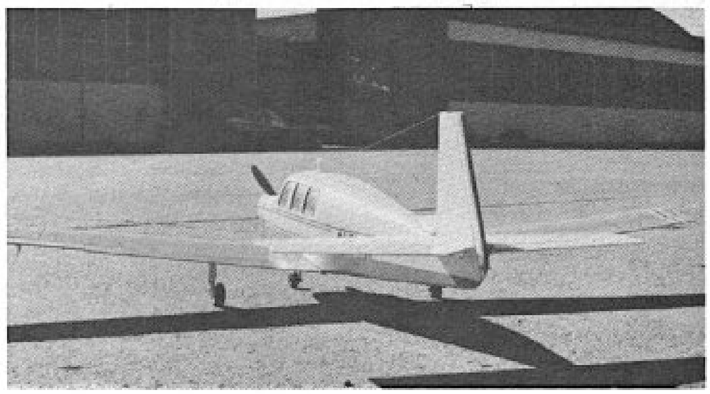
The Mark 21 flew reasonably well with one exception—it fish-tailed noticeably, even in the slightest breeze. Since the fin area seemed generous, I reasoned that the tail moment must have been too short. So I decided to build a second Mooney with increased fuselage length—thus the Executive. This second Mooney was to employ Rhom retracts since the mechanical nose gear proved inadequate for the large model. It would collapse upon landing unless a perfect nose-high touch-down was executed.

It was fortunate that I started the second model when I did because the first was about to become a source of parts for the second. During a particularly gusty flying session I ran out of fuel while upwind of the runway. I was in perfect position for an easy deadstick landing; however, I was suffering from extreme overconfidence at the time. I allowed the model to glide too far downwind for a breathtaking "center-of-the-runway" landing. Upon realizing this, I made the classic mistake of entering a steep turn while trying to extend the glide. Of course, there was insufficient altitude to recover from the resulting spin, but there was plenty of altitude to insure the model's total devastation. Maybe washout in the wing could have prevented that lightning fast stall-spin. However, it was too late to try washout in the second Mooney since the wing was already completed. Washout was an idea that would be saved for the third Mooney.

The second Mooney (the first Executive) turned out considerably overweight. This was aggravated by the addition of lead weight in the cowl to off-set the Executive's tail-heavy condition. This tail heaviness was eliminated in later models by the use of lighter wood. Notwithstanding the Executive's 11-pound flying weight, it performed well and the Rhom landing gear proved more than equal to the task. In fact, I remember a landing on a hard surfaced runway that should have







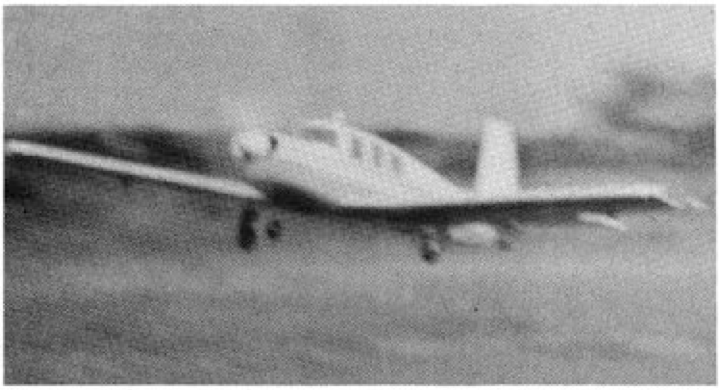
TOP[The author shows off one of his Mooney "fleet." ABOVE LEFT: Plenty of room in the radio compartment. Note 4 EK servos side by side and plenty of room between. Also, lots of room for the Rhom Air "plumbing." TOP RIGHT: The author taxies for takeoff. ABOVE RIGHT: Three-quarter view of the Mooney's distinctive tail feathers.

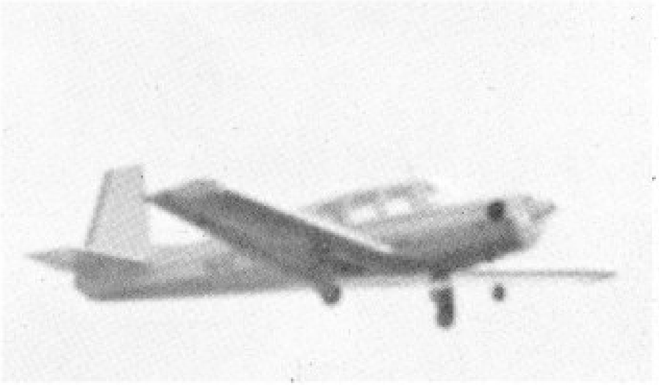
demolished the gear but the Rhoms were unaffected. During this particular landing, which was made in gusty conditions, I lowered the model's nose to regain some speed lost to an earlier gust when suddenly the model encountered another gust. The model had about 10 feet of altitude and it was in a slight nose-down altitude. The gust literally slammed the Executive onto the runway, nose gear first. Just before impact I was certain that the gear would fold, however, it didn't. In fact, the prop wasn't even nicked. That landing sold me on the utility of Rhom retracts in heavy models.

The first Executive continued to fly for almost a year until the fatal flight when I managed to shear the stab off during a very tight turn. The stabilizer, which the Executive inherited from the Mark 21, was a mere 1/4" "balsa slab", notched to receive the fin. Apparently, the notch removed most of the stab's strength, as it folded with a loud crack that could be heard over the screaming Webra. The Executive arced majestically into a 90° dive that resulted in a half hour search to find all the salvageable parts.

Mooney number three acquired an airfoiled stabilizer with spars to insure it's strength. In addition, I had received a set of Executive three-view drawings and I decided to make the model's outline conform more to scale. Surprisingly, my "eyeball" plans for the two previous Mooneys were very close to a 2¼-inch scale. A slight change in wing taper and aileron cord was about all that was needed for more realism. I elected to retain the fuselage width used on the previous Mooneys. This remains one of the major deviations from scale, as the fuselage is approximately 1½" narrower than scale. But this violation is difficult, if not impossible, to detect without a ruler. The Executive also employed two degrees of washout in each wingtip to prevent tip stalling at low airspeeds. The washout proved effective, allowing landings at a much lower airspeed than the earlier models. With this third Mooney, I was satisfied that no further improvements would be needed. The model flew extremely well with no noticeable flaws and it was built in approximately the same amount of time required for a competition pattern model. Furthermore, its appearance was authentic enough to cause several modelers and full-sized pilots to believe that it was a "serious" attempt at scale.

Currently, the second and third Executives are flying and I am tempted to build another with full cabin and surface detail just to bring Dave Platt, Maxey Hester,





TOP: With flaps down, the Mooney smoothly accelerates to takeoff. ABOVE LEFT: A typically smooth Mooney ROG. ABOVE RIGHT: The Mooney in flight—scale looks and "pattern" smoothness.

and Claude McCullough to their knees.

FUSELAGE CONSTRUCTION

The fuselage is begun by preparation of the basic sides. These are cut from medium weight 1/8" balsa and laminated with contact cement to the 1/16" plywood doublers. A length of 1/2" triangular balsa stock is epoxied exactly 1/4" from the forward edge of the fuselage side. This provides a gluing surface for the firewall, F1. A ¼" x ¼" longron is cemented to the lower edge of the fuselage side running from the trailing edge of the wing root cut-out to the end of the fuselage side. This longron provides a gluing surface for the edges of the lower fuselage skin. All formers are cut out and F3, F5, and F6 are assembled with the appropriate spruce cross members.

Mark the proper former positions on both fuselage sides and begin assembly of the fuselage by gluing formers F3, F5, and F6 in position. When dry, add F1 (firewall), F2, and F4 followed by the aft formers F7 through F10. The fuselage roof, which is laminated from two layers of very light 3/8" balsa, is glued temporarily in place. Since the roof follows a curved contour of the cabin area, it will be necessary to score the roof on the lines where it contacts F6 and F5. This will allow the roof to seat properly on all cabin formers. Carve the roof to its approximate shape; then remove it from the fuselage and hollow to the dotted line shown on the plans. After hollowing, the roof can be glued permanently to the fuselage formers and the 1/8" turtle-deck sheeting can be added between F8 and F10. The fuel tank is installed, followed by the 1/8" sheeting between F1 and F2. Blind nuts for the engine mounts should be imbedded in the rear of F1 at this point and the balsa block running between F1 and F4, as well as the lower fuselage sheeting running between F7 and F10 is glued in place.

The engine cowl should be formed next. I employed a variation on the easy-does-it method to fabricate the cowl. Of course, any fiberglassing technique should be acceptable; in fact, a balsa block cowl could be substituted for fiberglass. However, the following procedure offers a quick and inexpensive method of producing molded parts. A rough male form is shaped from styrofoam block (not polystyrene foam which is used for wing cores, but styrofoam which is available from floral supply houses). Styrofoam is relatively inexpensive and it carves and sands to shape with a minimum of effort. The styrofoam mold should be tack glued to F1 (with the engine mounts removed) for final shaping. The mold is sanded approximately 1/16" undersized in all dimensions to allow for the thickness of the fiberglass cloth. After shaping the mold, remove it from F1 and insert a balsa or bass wood strip approximately ½" x 1" x 4" into its rear. This strip acts as a stem to support the mold while the fiberglass cloth is applied. Heavy glass cloth is cut into strips approximately 3" wide and 6" long. These strips are applied to the mold with a spray adhesive such as 3M's 77. The strips should overlap and form at least three complete layers on the mold. Hobbypoxy formula II is spread over the glass cloth taking care to work it into the weave. The Hobbypoxy will seep to the lower layers of the cloth as it cures; therefore, the cowl should be recoated at least once more during the curing process. Allow 24 hours before removing the mold. This can be accomplished by melting it out with lacquer thinner or the heat of a soldering gun. Install the engine mounts and bolt the engine in place. Fit the cowl in place after marking the appropriate cut-outs for the cylinder head, needle valve, and cooling inlet. The cowl is mounted on three ½" x ½" maple blocks which are attached to the firewall with sheet-metal screws. After fitting the cowl, the engine is removed and the cowl is replaced in its proper position. A layer of Sig Epoxolite is spread over the cowl to fill the low spots and bumps left in the outer layer of glass cloth. When cured the Epoxolite is sanded smooth to achieve a perfectly filled, paintable surface. The job of sanding the cowl can be eased considerably by using a powered sander, but be careful to avoid deep cuts in the adjacent balsa areas.

The final step in fuselage construction is the addition of the cabin windows and windshield. These are formed from .015 clear plastic. The cabin windows are glued with Ambroid to the edges of F3, F5, and F6 and are further supported by a ledge of 1/8" x 3/32" balsa glued to the inside of the fuselage sides and roof. After the windows and windshield are glued in place, the outer window frames are added. The upper and lower portions of the windows are framed by 1/8" x 3/32" strips, while the window posts of 3/32" balsa are glued in position over F3, F5, F6, and just forward of F8. The entire fuselage is sanded to its final shape and set aside for finishing.

WING AND TAIL SURFACES

Both the wing and stabilizer are fabricated from a polystyrene foam core covered with light 1/16" balsa skin. As I mentioned earlier, the surviving Mooneys fly with 2 degrees of washout in each wingtip. The technique for achieving this washout and the aerodynamic advantage it provides can be found in Claude McCullough's "Scale" column in the July 1975 issue of *R/C Sportsman*. The two degrees of washout will automatically appear in the foam core if the trailing edge of the tip template is placed 3/8 of an inch above the foam core cord line, while the root template is located parallel to the cord line. After cutting the wing and stabilizer cores, prepare the wing for its internal plumbing. This consists of making grooves for the aileron pushrods and bellcranks, removing a 1/4" layer of foam to seat the main landing gear plate, cutting slots for the forward and rear dihedral braces, and cutting a channel for the Rhom pressure lines. Before sheeting the wing and stabilizer panels, glue a 1/8" sub-leading edge to the forward edge of each panel. This will provide a solid gluing base for the forward edges of the sheeting. Without the sub-leading edge, the sheeting tends to split away from the true leading edge after several months of service. Now install the pushrods, bellcranks, and landing gear mounts, followed by the wing skin. I used Sig Core-Bond to attach the skin. This is an extremely easy cement to apply and it leaves very little weight when dry. The flaps and ailerons are cut from the wing after the sheeting is applied. Since the control surfaces and the wing are faced with 1/4" balsa, be sure to remove an additional 1/4" strip from each to compensate for the thickness of the facing. The 1/4" facing is thick enough to provide a solid mount for the control surface hinges which are added after painting. A 1/2" soft balsa leading edge and root fairing is glued onto the wing panels and sanded to shape. The stabilizer leading edge is formed from 1/4" balsa.

After shaping the leading edges, join the wing panels to the center section by sliding the panels onto the dihedral braces and epoxying the root joint liberally. When cured, wrap the root joint with a layer of glass cloth and epoxy. Be sure that both panels have 3½ inches of dihedral under each tip. The stabilizer is joined to the wing by sliding the stabilizer spars in place and cementing with epoxy. Cut a 1/4" slit between the two stabilizer spars to receive a tab from the fin.

The fin and rudder are formed from 1/4" balsa, while the elevators are carved from 3/8" balsa. Light balsa is essential in the tail components to avoid a tail heavy condition. Epoxy the fin to the top of the stabilizer and epoxy the stabilizer into position on the fuselage. Like the wing control surfaces, the rudder and elevators are hinged after painting. If Rhom retracts are used, the wing center section will have to be notched at the leading edge to clear the nose gear when retracted.

FINISHING

I used two methods to finish my Mooneys; each having their particular advantages. The first two Mooneys were prepared with surfacing resin followed by automotive paint. Surfacing resin provides a very smooth, hard base which is extremely resistant to dents and accepts an excellent finish, however, it will crack under stress, it will not cure over certain glues, and it does require an immense amount of elbow grease to achieve a smooth surface. The second method was to cover the model with Silkspun Coverite and paint with an automotive finish. This method is quicker and demands less effort. However, the Coverite requies a high temperature for application which can deform the foam cores and the resulting finish is not as resistant to dents.

In both cases I used Dupont Acrylic Lacquer for color. This paint is available in thousands of colors, allowing accurate duplication of any particular Mooney paint scheme. The acrylic lacquer must be plasticized with southern R/C Product's "Flex-All" to eliminate the brittleness of the finish. Furthermore the lacquer must be sprayed as it dries too quickly to brush.

I used rubbing compound to bring out the gloss of the lacquer on the first two Mooney's, however, this was a very time consuming task. The second two Mooney's were merely sprayed with a coat of clear

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SuperPoxy to achieve a similar result. While the hand-rubbed finish were clearly superior when viewed close up, the clear SuperPoxy provides an attractive shine with little effort. If you use SuperPoxy over lacquer be sure to allow at least a week for the color to dry and scuff the color coat with fine steel wool before adding the clear or it will not adhere properly.

EQUIPMENT INSTALLATION AND FLYING

The fuselage provides ample room for the installation of a six-channel system. The elevators cannot be actuated by a single pushrod because of their hinge line. Therefore I used two pushrods joined to a common Kwik-Link which runs to the elevator servo. The batteries are inserted as far forward as possible to achieve the center of gravity shown on the plans. Two of my models required nose weight to balance properly, while the others needed no additional weight; it all depends on the use of light materials in the tail. The flaps are activated by a 180 degree rotary output servo, using the pushrod and strip aileron horn arrangement shown on the plans. The flaps must extend and retract in unison and they should not exceed a 45 degree angle when fully deflected.

The landing gear doors are made from 1/16" plywood. The main gear doors are warped slightly to follow the camber of the wing when the gear is retracted. Two metal landing-gear retainers are silver soldered to each main-gear strut to receive the 2-56 bolts used to secure the gear doors in place. The nose-gear doors are hinged onto the lower-nose block and are activated by a light spring (taken from a ball-point pen) which is positioned between the two doors. When the nose-gear strut retracts, it pushes against the spring, closing the doors. When the nose gear extends, the tension on the spring is released and it pushes the doors into their open position. (A detailed discussion of this method of nose-gear door actuation can be found in the "Fakir I" article, *American Aircraft Modeler*, May 1974.)

My Mooneys have ranged in weight from 9¼ pounds to 11 pounds, the lighter models being easier to fly. I wouldn't recommend a flying weight in excess of 11 pounds. However, the most important consideration is the distribution of the weight. Your model should not be flown until it balances at, or slightly in front of, the center of gravity shown on the plans. Nothing is more difficult to fly than a scale model that is the least bit tail heavy. Adequate power is also essential. I used a Webra Blackhead .61 with a 12-6 propeller. The model is easily large enough to absorb the power of the most potent .60's to .80's.

When flying, avoid yanking the model into the air. Build up plenty of speed and rotate with just a nudge of up elevator. The aircraft should lift off easily. Once airborne, you will find that the Executive feels like a large pattern model. The Executive's speed envelope is its most impressive attribute. At full throttle with the gear retracted, it keeps pace with the hottest machines at our field. Yet with flaps and gear hanging in the breeze, it can be walked in for a landing. I employ the following procedure for landing: Enter the downwind leg of the landing pattern at about 50 feet of altitude, bleeding off speed by retarding the throttle and raising the nose; lower the gear and add enough power to prevent the model from sinking, add 1/2 flaps (about 10 degrees) while continuing downwind, enter the base leg by reducing the power to permit a mild descent, turn on final and add full flaps, use only enough power to insure reaching the runway, cross the runway threshold at about 10 feet while retarding the throttle to full idle and hold a positive nose-high attitude. Contact should be made with the main gear first.

I am sure you will enjoy building and flying the Executive. It is an impressive project that can be flown in most weather conditions week after week. My fleet of Mooneys have given me many hours of reliable service over the past four years and I expect many more years of the same. I would be most willing to help you with any problems you may encounter while building the Executive. Just state your problem in a letter addressed to me in care of *R/C Sportsman*. **RCS**