DREAM MACHINE

This classy little .25 powered low wing tail dragger will give you the performance in the air that you have been looking for. By James H. Rice, Jr.

Unlike a lot of other models, the Dream Machine was not developed and refined over a period of years and numerous design changes. Several years ago while visiting our son and his family, our 6 year old grandson, Gary, asked me to build a radio controlled airplane for him. Not having time to build it while visiting, I told him I would build a plane for him when I returned home.

Since Gary had flown my RCM Trainer .40, with help from his dad, I decided to scale down this design to a size more suitable for a .25 engine. I settled on 90% the size of the RCM Trainer .40, giving a wingspan of just under 48". (Subsequently plans for an RCM Trainer .20 were published in R/C Modeler, which is almost exactly the same size as the one I scaled down.) While building the trainer for my grandson I thought the wing would make a good low wing sport plane so, using the same wing plan, the Dream Machine plans were drawn. By the time I got around to building it, O.S. had introduced the O.S. Max .25 FSR and this engine was used in the prototype — this proved to be an excellent choice.

You often read, and hear, that a new design "flew off the drawing board"; this one did. On the first flight no adjustments of any kind were needed and the plane "flew like a dream." The wide stance of the main landing gear makes ground handling excellent for a tail dragger and no problems have been encountered on the ground. The prototype suffered a near fatal accident when it was flown into a pine tree in Florida.

That's enough rhetoric — let's build a Dream Machine.

CONSTRUCTION

Wing:

Like so many others, I prefer making other parts of the plane, but since the wing is necessary, let's build it first.

Wing ribs are 1/16" balsa. I cut all 20 ribs the same then modify 6 ribs (R-2) to accommodate the landing gear blocks. Spars can be 1/4" spruce or hard balsa. Leading and trailing edges are 1/4" square medium balsa. If you are using a wing jig, follow instructions for your jig. If you are building the wing on a building board, fasten the plan sheet to the building board and protect it with waxpaper or clear plastic sheet. Fasten a 1/4" spar in the proper place, measure 4½" from the spar toward the trailing edge and pin down a length of 1/4" square balsa, making sure it is equal distance from the spar along the full length. Glue the ribs to the spar in their proper place and pin each rib to the extra 1/4" square balsa, keeping ribs aligned with the plan. This will insure that ribs are kept even laterally while the glue is drying.

After all the ribs are glued in place, insert the other spar in the slots and glue in place. The 1/4" square leading edge can now be glued in place. After the glue has set, the wing frame can be removed from the building board and the trailing edge installed. To prepare the trailing edge, mark each rib position on 1/4" x 3/8" balsa and cut slots 1/8" deep for rib trailing edges to fit into. To cut these slots I tape two hacksaw blades together; to get the depth of the slots equal I place a piece of 1/8" landing gear wire on each side of the balsa and cut until the hacksaw blades just touch the 1/8" wire. After the trailing edge is glued in place it is tapered to match the rib contour.

The second wing panel is made the same except that wing ribs are turned upside down over the plan, giving you a right and a left wing panel.

1/16" x 1½" trailing edge sheeting is installed on the top and bottom of each wing panel and trimmed flush with the end ribs.

Using epoxy, glue R-3 (1/16" plywood reinforcing) to the second and fourth ribs from center ribs. 1/16" balsa vertical shear webbing is glued between upper and lower spars from center rib to at least one rib bay outboard of the landing gear block openings.

Glue 1/16" x 3" leading edge sheeting to the top of each wing panel. Trim flush with end ribs. Check for warps and, if present, straighten them before proceeding.

Since we want 1" dihedral in each wing panel, a tapered rib is installed between the two wing panels when they are assembled. This tapered rib starts out as a piece of 3/16" x 2" x 9" balsa. It is tapered from 3/16" to zero to form a wedge. It is not cut to an airfoiled shape until after the two wing halves are joined and the sheeting is all installed.

Glue the wing halves to the tapered center rib, blocking up each wing tip to give 1" dihedral to each panel. When gluing the panels together be sure no twist is formed in the wing. A true straight wing is the secret of a good flying airplane. After the glue is thoroughly dry (I let it set overnight), the 3/8" x 3/4" x 6¼" grooved hardware landing gear blocks are installed. Since these will take quite a beating, I use slow cure epoxy to glue them in place.

The 5/32" landing gear legs are bent as shown on the plan sheet and installed in the landing gear blocks using Du-Bro steel or Goldberg nylon landing gear straps to hold in place. Be sure the landing gear legs are pitched forward so the axles are just behind the wing leading edge. Also, be sure the landing gear legs are at the same angle so the plane will track properly on the ground. A very slight amount of toe-in is required — I set mine so the measurement between the rear of the wheels is 1/16" greater than between the front of the wheels — this has been about the proper toe-in for good ground handling.

1/16" x 3" leading edge sheeting is now installed on the bottom of each wing panel. I glue the sheeting over the landing gear blocks while some prefer to leave the blocks accessible — you can do it either way. The center section is sheeted out to the fourth rib and the center tapered rib is trimmed flush with the sheeting. 1/16" x 1/4" cap strips are glued to the top and bottom of all the remaining ribs. The wing tips are 1/4" balsa sheet with balsa blocks glued to the leading and trailing edges and sanded to shape. Round off the leading edge and sand the entire wing frame. Assemble the 3/32" wire aileron horns in 3/32" I.D. brass tubing and fit into 3/8" x 3/4" hard balsa or grooved hardwood blocks. Glue this assembly in place at the center of the wing trailing edge. The center section can now be fiberglassed with 3½" wide 4 to 6 oz. fiberglass tape. After the fiberglass resin has cured, it can be sanded smooth and the exact center of the leading edge drilled to accept a length of dowel for the front wing hold-down. The wing is covered with MonoKote, or your favorite plastic covering material. Ailerons are made from 3/8" aileron or trailing edge stock and are 1" wide — these may have to be cut down from 3/8" x 1½" stock. Don't make them the full 1½" width as this makes the ailerons too sensitive.

DREAM MACHINE

Designed By:
Jim Rice

TYPE AIRCRAFT
Sport

WINGSPAN
47½ Inches

WING CHORD
9¾ Inches

TOTAL WING AREA
463 Sq. In.

WING LOCATION
Low Wing

AIRFOIL
Symmetrical

WING PLANFORM
Constant Chord

DIHEDRAL EACH TIP
1 Inch

O.A. LENGTH
33¾ Inches

RADIO COMPARTMENT SIZE
(L) 9" X (W) 2¾" X (H) 4"
(Less Cockpit Area)

STABILIZER SPAN
20 Inches

STABILIZER CHORD (inc. ele.)
4¾ Inches

STABILIZER AREA
95 Sq. In.

STAB AIRFOIL SECTION
Flat

STABILIZER LOCATION
Top of Fuselage

VERTICAL FIN HEIGHT
5½ Inches

VERTICAL FIN WIDTH (inc. rud.)
5½ Inches

REC. ENGINE SIZE
.25 Cu. In.

FUEL TANK SIZE
4-6 Ounce

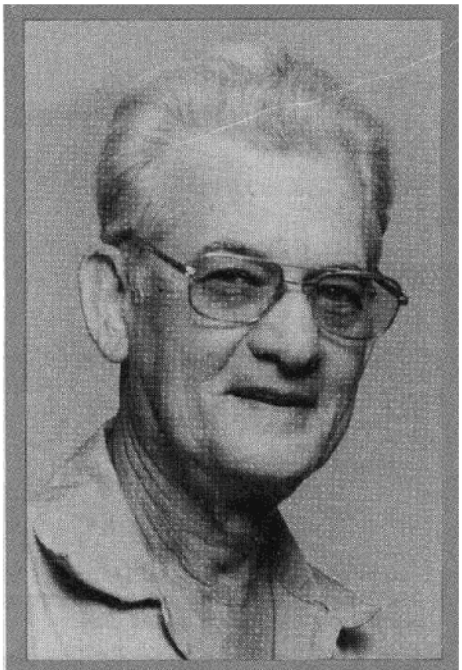
LANDING GEAR
Conventional

REC. NO. RADIO CHANNELS
4

CONTROL FUNCTIONS
Rud., Elev., Throt., Ail.

BASIC MATERIALS USED

Fuselage	Balsa, Ply
Wing	Balsa, Ply
Empennage	Balsa
Wt. Ready To Fly	**37 Oz.**
Wing Loading	**11½ Oz./Sq. Ft.**



James Henry Rice, Jr. has been married to Ellen Lucile Ackenbom for almost 50 years. They have two daughters and one son, all of whom have flown model airplanes in the past and his son Maj. Jim Rice, with the Air Defense Command stationed in Germany, still flies models and is an excellect R/C pilot. Jim started building models in 1924; was a member of the American Boy Magazine sponsored Aircraft Model League of America and has been a member, on and off, of AMA since shortly after its inception. He has flown rubber powered models, gliders, powered free flight, control line and started radio control flying in 1952 upon legalization of citizens radio on 27.255 MHz (was cycles in those days). He prefers scratch-building, either his own designs or from magazine plans. Jim is charter member of the Borger Model Airplane Club; he is a past president of the club and currently holds the office of Vice President.

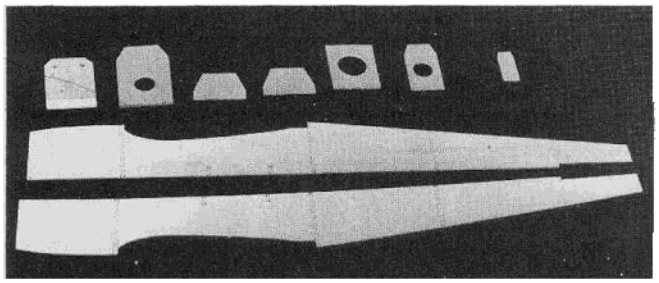
Ailerons are covered with the same material used to cover the wing and are hinged to the wing panels with four hinges on each aileron. An opening is cut in the top of the wing center section to accept the aileron servo and the servo mount is installed. The wing is now completed.

Tail Feathers:

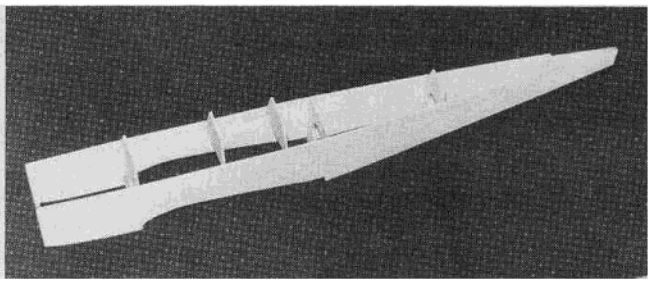
The tail surfaces are made from firm 3/16" balsa with the leading and trailing edges rounded. A 3/16" plywood or hardwood insert is placed in the rudder and one elevator where the control horns are installed. Elevators are two separate pieces connected with a 3/16" hardwood dowel. The rudder is hinged to the fin with three hinges and the elevators are hinged to the stabilizer with three hinges for each elevator.

Fuselage:

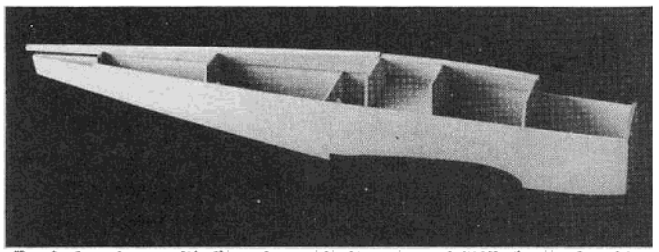
The basic fuselage is a box with 1/4" balsa added to the tapered sides and top and then rounded. Sides are 1/8" poplar plywood, sold by Sig and Balsa USA as "Lite Ply." Sufficient strength



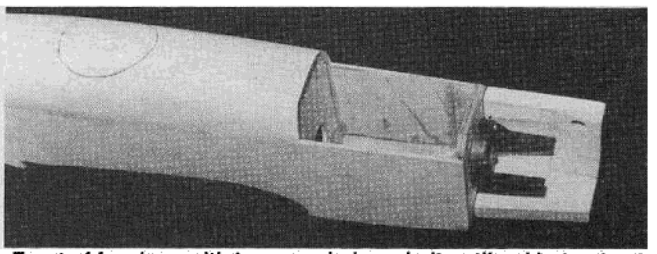
Fuselage sides and bulkheads all cut and ready to start assembly.



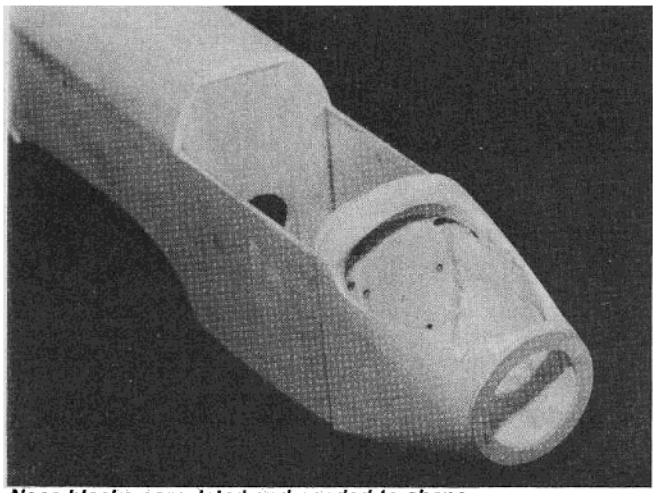
Basic fuselage structure completed.



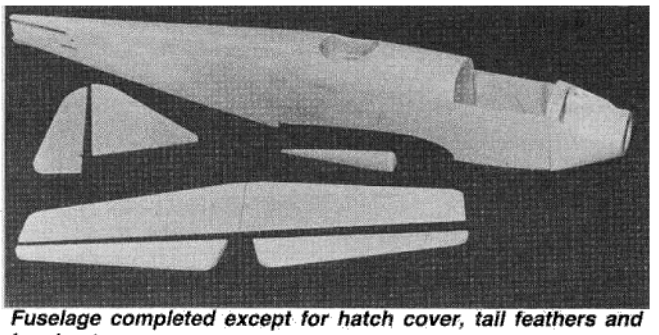
Basic fuselage with floor in cockpit area and 1/4" sheet glued to slanted top bulkheads on left side.



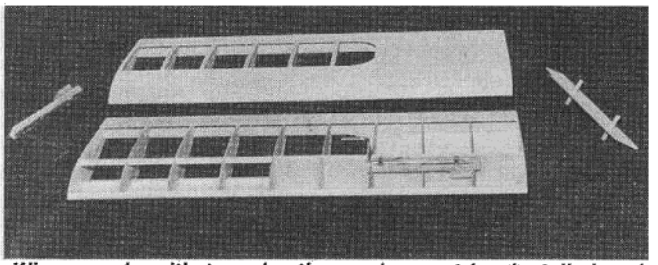
Front of fuselage with top rounded, cockpit outlined but not cut out. Left side and bottom nose blocks assembled.



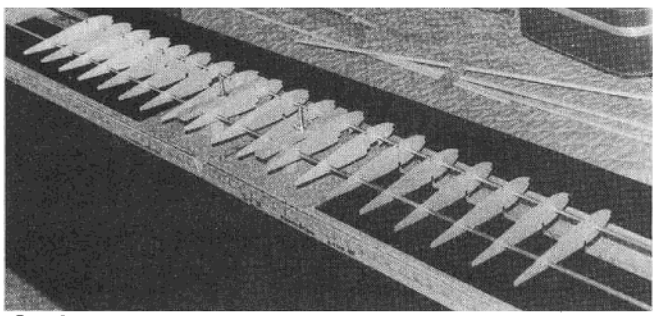
Nose blocks completed and sanded to shape.



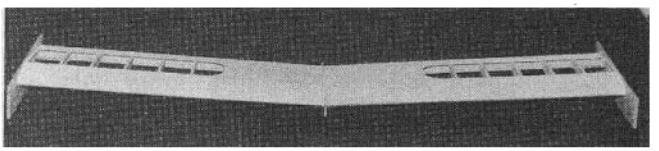
Fuselage completed except for hatch cover, tail feathers and headrest.



Wing panels with top sheeting and cap strips installed and landing gear installed in maple blocks. On right is tapered center rib for connecting wing panels.



Starting to assemble wing on RCM wing jig. (Ed. Note: RCM Wing Jig is no longer available.)



Wing panels being connected with wedge between them. The blocks on each end are to hold panels straight while gluing and will be removed.

is gained by the use of Lite Ply eliminating doublers which would be necessary if 1/8" balsa is used. Also, Lite Ply weighs very little more than balsa and is almost as easy to work. Both sides can be cut from one sheet 6" wide ply.

Glue the sides and formers together, making sure that everything is kept square. After formers F-1, F-2 and F-4 are glued in place, pull the tail end of the fuselage sides together and glue them. When glue has set, install and glue in place the two F-3 formers and F-5 and F-6. 1/4" sheeting for the upper part of the fuselage is installed in sections. Bevel the edge of a piece of 1/4" balsa sheet so it fits flush against the top edge of the 1/8" Lite Ply side. Lay against the angled part of rear F-3, F-5 and F-6. Mark where the top of these formers meet the 1/4" sheet and, laying a straightedge along the marks, cut the sheeting to 1/16" to 1/8" oversize. Glue in place. By the same process, make a piece to fit from the rear F-3 to F-2 and glue in place. Do both sides of the fuselage, then, using 100 grit aluminum oxide or garnet paper, sand the top of these flush with the formers. Cut a piece of 1/4" balsa to go from rear F-3 to the tail of the fuselage and glue in place. Next, cut a

This is the reason I don't get as much done as I would like. Chicatoo is a Chihuahua who wants lots of attention and when I try to work she gets on or between me and my project or on my lap. As you can see in the background, my shop is a mess — it stays that way most of the time.

piece of 1/4" to go from rear to front F-3, glue in place. Last to be installed is front F-3 to F-2. After the glue is thoroughly dry, all overhanging 1/4" balsa is planed flush with mating parts using a small plane, such as a razor plane. Corners are roughly rounded with the plane, then sanded to a round contour. The best way I have found to do this is to clamp the fuselage between my knees and use a full sheet of 100 grit sandpaper like shining shoes. The back and forth motion cuts the balsa fast and gives a perfectly rounded contour. Don't get too carried away with this because balsa gets quite thin at the corners.

Temporarily install your motor mount and engine with a 2" Goldberg spinner on the prop shaft. Measure the distance from F-1 to the rear of the spinner backplate — subtract 3/32" from this measurement and you have the length of the blocks for forming the nose. Using the fuselage side plan for a pattern, cut the side blocks from 1/2" balsa. Cut a piece of 1/2" balsa for the bottom nose block and glue between the sides. A piece of 3/8" scrap balsa, approximately 1½" wide, is glued inside of, and flush with, the front of the side pieces. Sand this assembly flush, front and rear, and tack glue to F-1 with engine and mount installed. Place the 1/16" ply nose ring over the prop shaft, install the spinner backplate on the shaft and line up the nose ring with the backplate. Draw the outline of the nose ring on the front of the blocks. Remove the spinner, engine and mount. Separate the nose assembly where tack glued to F-1. Glue the nose ring in place where outlined on front of the blocks. Using a Dremel Moto Tool and a sanding drum, remove the excess wood inside the nose blocks so none of the holes in F-1 are covered and to give the throttle sufficient room to operate without dragging. Glue the nose assembly to F-1. Install the 1/2" balsa block to the top of F-1 and extend approximately 1" forward on the nose blocks. Rough cut to shape using a whittling blade in your X-Acto knife. Using a sandpaper block, finish shaping the nose to match the contour of the spinner. Cut out the top of the nose blocks to allow the engine and muffler to fit without touching. Make sure there is sufficient room between the engine and nose block sides to get a screwdriver in to motor mount bolts.

The bottom of the fuselage from F-4 to rear is sheeted with 3/32" balsa with the grain running across the fuselage. The bottom of the fuselage between F-1 and F-2 is sheeted with 1/8" balsa.

The tail wheel bracket is installed and 1/16" tail wheel wire is bent as shown on plan. This wire mates with the bottom of the rudder so the tail wheel moves from left to right with the rudder for ground steering. I drill a hole in the rudder, from front to rear, and glue in a piece of 3/32" O.D. brass tubing into which the 1/16" tail wheel tongue is inserted. You may use this method or make a wire or thin sheet metal loop to go around the 1/16" wire tongue and fasten to the bottom of the rudder with a 2-56 screw and nut.

The hardwood wing bolt blocks are glued in place at the rear of the wing opening. Place the wing in place and drill through the wing and blocks at the same time so the holes will match. I use a #20 drill bit and tap the hardwood blocks with a 10-24 tap to accommodate 10-24 nylon bolts.

Cut the cockpit opening, using the outlines on plan for a pattern. Using the centerline drawn on F-3 as one point and the center of the fuselage rear as the other, draw a line down back of the fuselage. Cut slot for rudder, using this centerline as a guide. Make the headrest from a balsa block and glue to the fuselage, using the centerline as a guide. Glue the stabilizer and elevators in place and install the vertical fin, using a drafting triangle or a tri-square to get it perpendicular to the stabilizer. The rudder is now hinged to the vertical fin and tail wheel wire connected to the rudder.

The entire fuselage and tail assembly is lightly sanded with 400 wet or dry paper, used dry, and any dings and dents filled with spackling paste, Hobbypoxy Stuff, or Micro-balloons, and sanded. Use your favorite method of finishing. I used a sanding sealer made by mixing talcum powder with clear butyrate dope and acrylic lacquer thinner. After each of the three coats it was sanded with 320 wet or dry paper, used wet. After the fourth coat it was sanded with 400 wet or dry paper, used wet. The color was butyrate pigmented dope, sprayed on, two coats of each color. After all the dope was sprayed on, the plane was put up for about a week to allow thinners to evaporate. The entire plane was then rubbed with DuPont Rubbing Compound, followed by Polishing Compound, then waxed. This gave the plane an extremely smooth, high gloss finish. A Williams Brothers standard pilot makes the cockpit look lived in. Glue the windshield in place.

Flying:

Install your radio equipment, making sure all control surfaces move the proper directions. I used Futaba S-26 servos and there was plenty of room for them. Smaller servos would give a more compact installation.

A Sullivan SS-6 tank was installed and this gives 15 to 18 minutes flying

time with the O.S. Max .25 FSR engine turning a 9/4½ propeller.

My son, Maj. Jim Rice, III, flew the prototype on its first flight. The tank was filled with 10% nitro fuel, the engine started and tuned, and then taxied onto the runway. Ground handling was excellent. The plane was turned into the wind, controls checked — all okay. Throttle was advanced and the tail came up almost immediately. After a run of approximately 15 to 20 feet, the plane lifted off and flew straight away. Several turns were made to check control response then the little ship was "wrung out." It did everything asked of it and came back for more. Numerous touch-and-go landings were made — some at full bore and some with engine throttled down and the plane moving at about the speed of a slow walk. Although no washout is built in the wings, no tip stall was evidenced.

Other fliers at the field took a turn at flying the plane and all were impressed with it. This was at an R/C flying field in Florida which was close to sea level. The plane was brought home and all flying since has been at an elevation above 3000'. Everyone who has flown one of the three planes built has remarked that it flies like a dream so my wife named it "The Dream Machine." If you build one, I think you will find it a dream.

Conclusion:

Control surface throws used on the prototype are a good place to start. You may increase or decrease to suit your flying ability. Ailerons — 5/16" each side of neutral; elevators — 3/8" each side of neutral; rudder — 7/8" each side of neutral. Increasing these throws makes the plane extremely maneuverable in the hands of an expert pilot.

The wing is set at 1 degree positive incidence. One plane was rebuilt after a crash and, when flown, it had no longitudinal neutral — it was either climbing or diving. Wing incidence was checked and found to be 1/2 degree negative.

The plane in the cover photo was being flown close to Mother Earth to obtain flight photos and was severely damaged when it hit the ground. It is rebuildable but will have to wait because I have a number of other projects ahead of it.

I want to give credit and a special "Thank You" to the following for their invaluable contributions to this project — it couldn't have been accomplished without them: Don Rice for the photography; Jim Davenport for the drafting. □

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