T&J Models

R/C Model Designs By Jim Young

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Gloster Meteor T.7 1/2

"World's Oldest Operational Jet"

Introduction

The Gloster Meteor was Britain's first jet fighter, and the Allies' first operation jet. It started service in 1944 and served the RAF and other air forces for several decades. Initially, the Meteor was used to knock down V-1 flying bombs. The Meteor was forbidden to fly over German held territory for fear of it falling into enemy hands. Later its mission was armed reconnaissance and ground attack where it took out enemy aircraft still on the ground. A few Meteors were lost due to friendly fire as it was mistaken as a Me-262. A new white paint job was specified to help with this. The Meteor also saw action in the Korean War at the hands of Australian pilots.

The Meteor is a rarely modeled plane and presented several engineering challenges in the design. The cruciform tail and engine nacelles embedded in the wings not only had to be designed to be strong, but also easy to build. Using the power of CAD and laser cutting, I design several features into the parts and several jigs to aid construction.

Construction

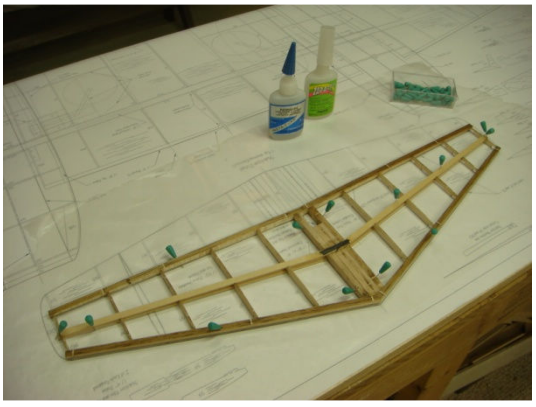
This design is not for beginning builders or flyers. The construction requires some advanced building techniques including planking, fiberglassing, and retracts installation. All of the major parts are laser cut, and the builder is left to select wood and hardware to complete the model.

Materials List:

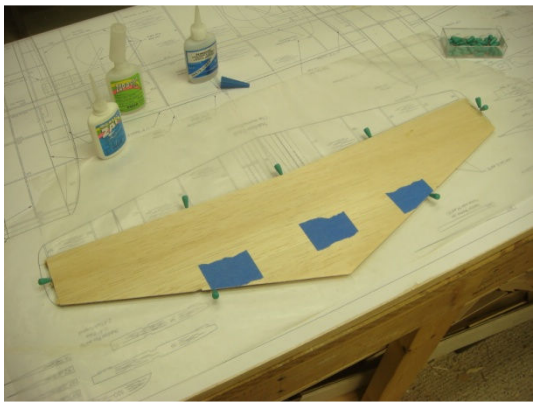
Wood:
(20) 1/16”x4”x36” Balsa
(3) 1/32x4”x36” Balsa
(1) 1/8”x3”x36” Balsa
(4) 1/8”x1/4”x36” Balsa
(3) 1/8”x1/2”x36” Spruce
(2) 1/8”x1/4”x36” Spruce
(2) 1/16”x1/4”x24” Basswood
(1) 1/16”x1/2”x24” Basswood
(2) 9”x24” Cardboard or Plastic
(2) 1”x1”x8” Balsa Block
Scrap 1/64” Plywood
Depron or Foamcore for Jigs

Hardware:
(2) 36” Long Pushrods
(1) 1/6”x36” Music Wire
(1) Robart 510W1 Retracts
(2) 2.75” Wheels
(1) 2.5” Wheel

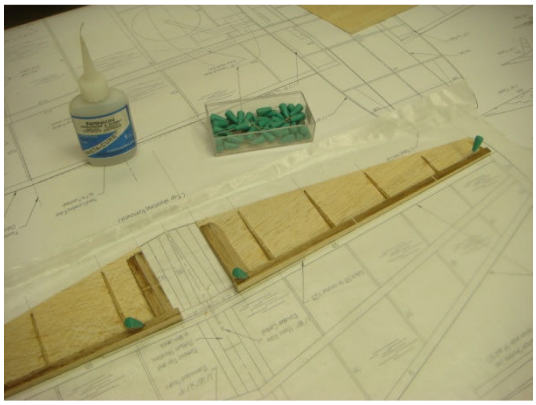
Tail Feathers



The stabilizer is built up over the plans. Position two basswood spars over the plans and glue the ribs in place. The spar will not be flat on the board. Glue the top spars, and the leading edges (L.E.) and trailing edges (T.E.) to the ribs. Sand the T.E. to match the ribs. Sheet the top of the stab with 1/32” balsa.

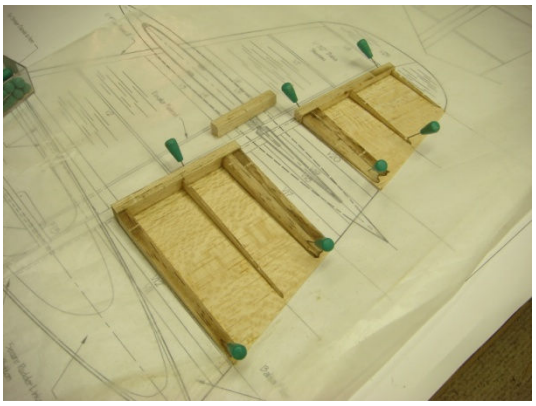


Remove the assembly from the board, flip it over, and use jigs 5 and 6 to support it while the bottom is sheeted. Remove the sheeting between the S4’s and S5’s. Glue the stab tip blocks in place and sand to shape. Recess the T.E. of the stab to accept the cross brace.

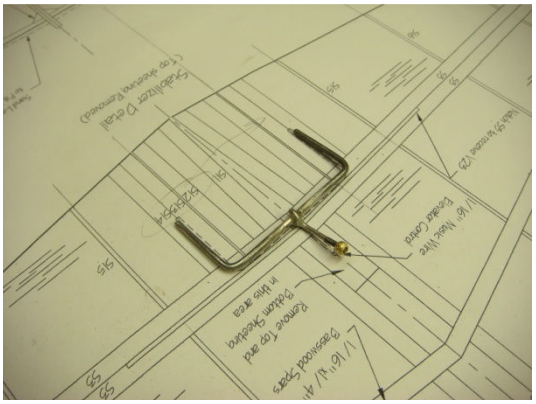


Cut the elevator L.E. to length and save the extra. Cut the rudder L.E. into three pieces, and save the center piece. Cut 1/32” balsa for the sheeting of the

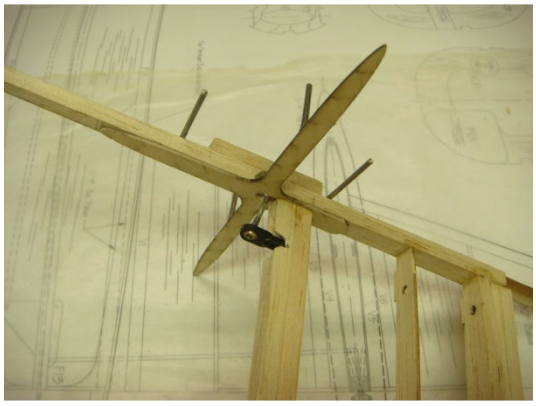
elevators and rudders and pin it over the plans.



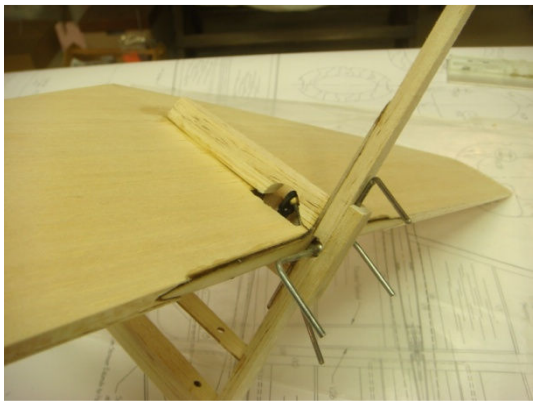
Build the elevators and rudder on top of the sheeting.



Bend the elevator control rod from 1/16” dia. music wire. Solder a control rod to the center and fix a ball joint to the end. Cut an elevator push rod to length as shown on the plans. Bend the rudder linkage from 1/16” music wire.

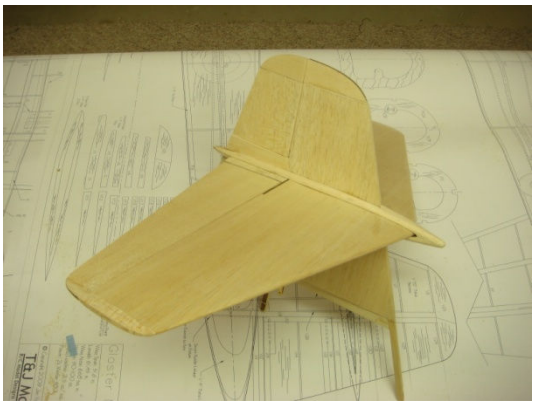


Start the vertical fin by gluing V3 and V4 together, and V5 and V6 together. Glue balsa to each side of V4 and V5 and sand it to match V3 and V6 respectively. Glue two 1/4" sq. balsa sticks to the bottom of V1 and drill a hole through them for the elevator control linkage. Pin V1 and V2 over the plans. Glue the 1/4” sq. L.E. and the V9 to them. Mark the location of the remaining ribs and F13 on the T.E. Mark the location of F12 on the L.E. Remove the structure from the board. Fit the elevator control rod in place and glue the cross brace V23 in place. Glue the V3/V4 assembly in place.

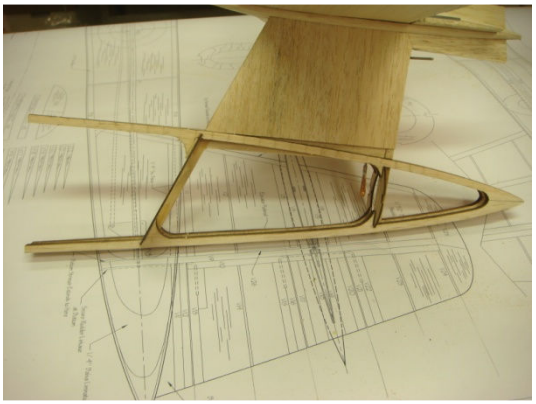


Glue the stab assembly in place on the fin assembly. Make sure it is square to the fin. Connect the elevator linkage and make any adjustments for smooth operation. Glue the V5/V6 assembly and

remaining ribs in place. Sand the T.E. to match the ribs.

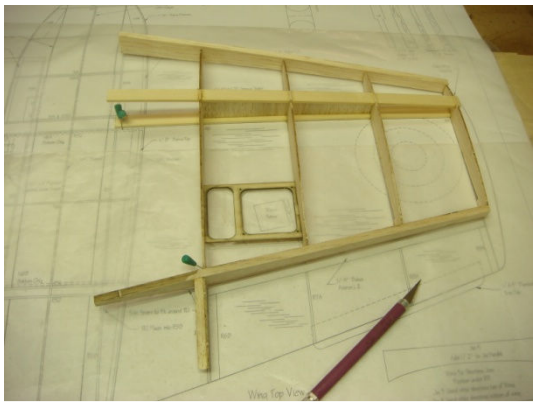


Notch the center piece of V10 to accept the rudder linkage and glue in place. Glue V17through V20 in place. Sheet the fin with 1/32" balsa. Glue the fin tip block in place and sand to shape.

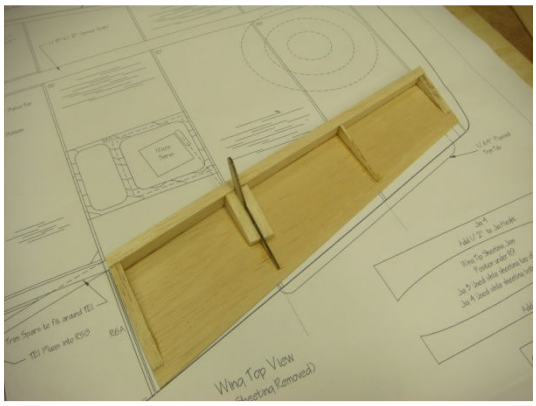


Glue the leftover pieces of S3 to the T.E. of the stabilizer. Glue S11 through S14 in place and sheet this structure. Rough sand the T1 tail reinforcements to shape and glue them on each side of the fin. Glue F12 through F15 to the tail assembly. Fit the rudder control linkage. The control linkage should be firmly supported above and below the control arm. Fill the space aft of F13 between F14 and F15 with ¼" balsa. Balsa block completes the tail once it is joined to the fuselage. Set aside the tail assembly.

Wings

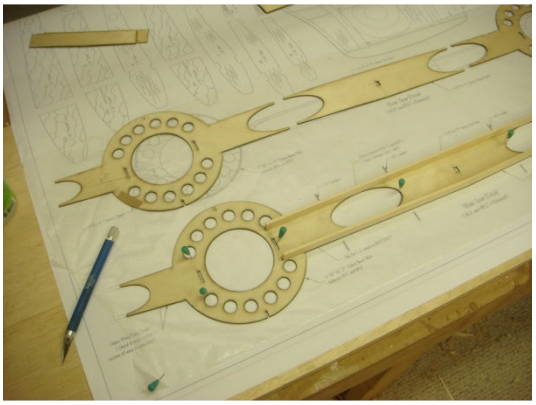


Build the outer wing panels first. Pin the lower spar over the plans and frame up R6 through R9, the top spar, and leading and trailing edges. Glue R6A to the rear of the T.E. Glue the servo hatch mount in place. Add vertical grain sheer webs between the spars from R6 to R8.

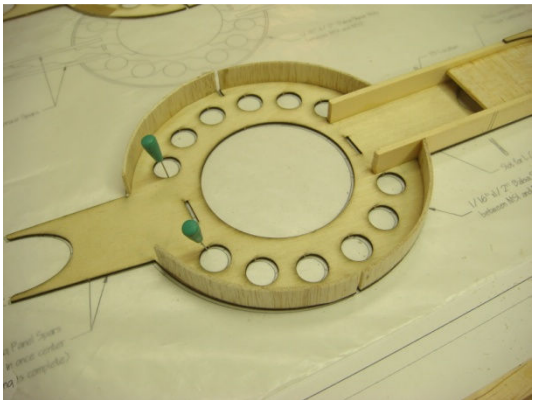


Cut the top sheeting for the ailerons from 1/16" balsa. Assemble the ailerons up-side-down over the top sheeting.

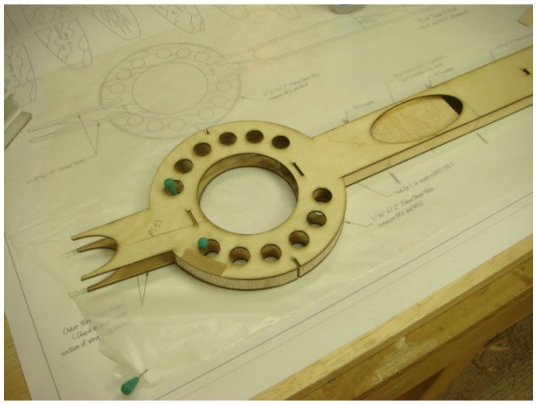
Prepare the 1/16" balsa sheeting for the center and outer wing sections.

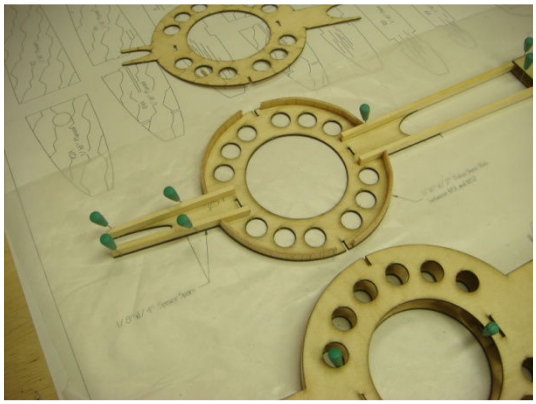


The center section of the wing starts by constructing the main and rear spars. Mark the locations of R2 and R3 on the plywood spar pieces. Cut 1/8”x1/2” spruce spars for the main spars as shown on the plans. Pin the MS1’s and a WJ1 over the plans and glue the spars in place. Glue 1/8” balsa vertical grain sheer web between the spars between R2 and R3.

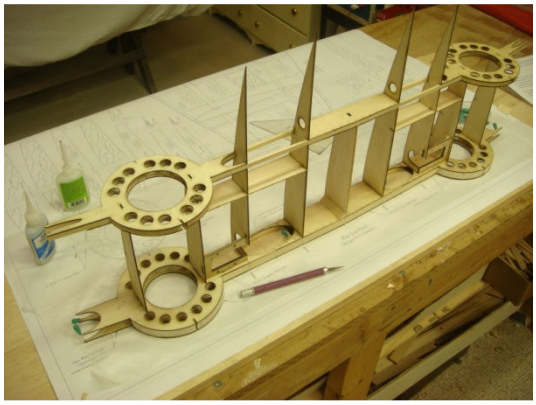


Cut several strips of 1/16”x1/2” balsa for sheer webs between MS1 and MS2. Glue them in place and sand them flush with the spruce spars. Glue MS2A to MS2. Glue the MS2’s and the other WJ1 in place.



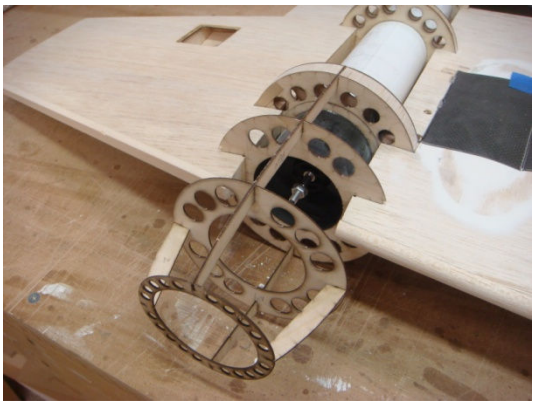


The rear spar is assembled in a similar fashion with 1/8”x 1/4” spruce spars. Leave the main spar pinned to the board.

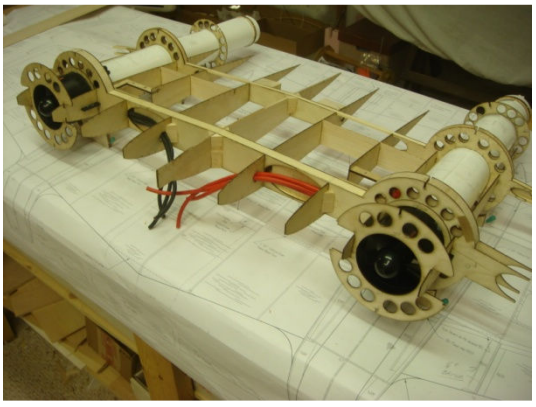


Glue R1 through R5 in place on the main spar. Glue the landing gear (L.G.) plates and R3C in place. Glue the rear spar assembly in place with RS2 up. Glue triangle stock around the L.G. plates and R1. Glue vertical grain balsa blocks to

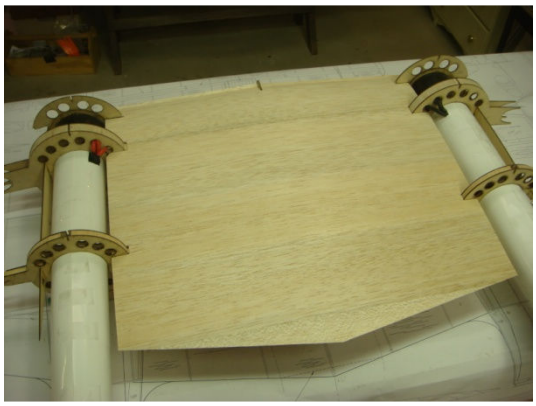
the rear of the rear spar for the wing mounting bolts.



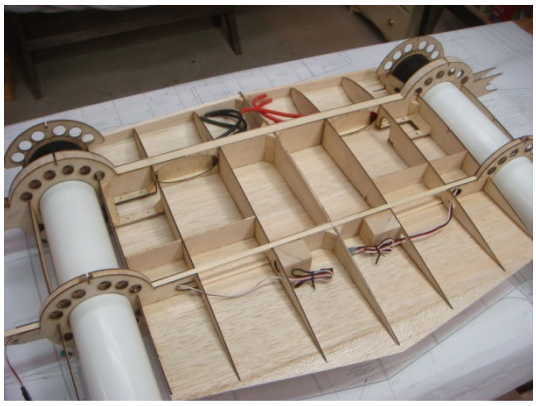
Remove the wing assembly from the board. Temporarily shim the radius in the wing jigs 1 and 2 with 1/16" balsa to compensate for the lack of nacelle sheeting. Support the wing assembly, up-side-down over the plan in the wing jig blocks. Cut two forward ducts from plastic, or cardboard. Assemble the front of the nacelles with R4A, R5A, N3, N4, N5, and N9B. With everything lined up, glue the nacelle framework together. Trim the duct flush with N3 and MS2. Install the fan units and route the motor wires through the main spar. The fronts of the fans are held by MS2A, and the rear tabs are captured by R4 and R5. Glue R1A through R4A and the balsa leading edge in place. Glue R1B, R4B, and R5B to the rear spar.



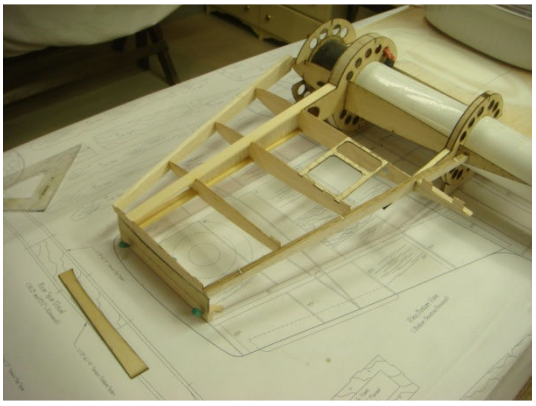
The landing gear installation is laid out for Robart 510W1 retracts. These air up/spring down units require less plumbing and have the safety feature of extending the gear in the event of an air leak. Install the main retract units and route the air lines. Glue ¼" sq. balsa from R3 to the main spar where the gear doors are angled.



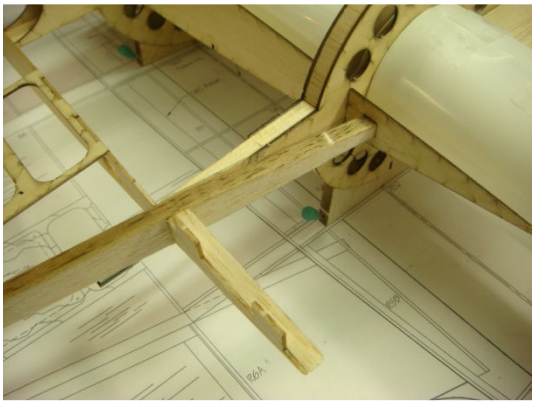
Sheet the bottom, center section of the wing with 1/16" balsa. Flip the wing assembly over, and support it in the jig blocks. Poke pins through the sheeting to mark the corners of the L.G. doors. Do not cut the door out at this time.



Route the aileron servo leads through the holes in R2 and through the rear spar. Sheet the top center section of the wing with 1/16" balsa. Carve and sand the L.E. to shape.

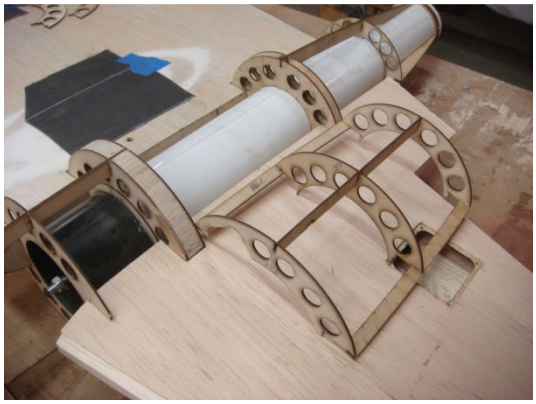


With the wing assembly securely supported in the jig blocks, fit the outer wing panels. The bottom of the wing tip jig 4 is supported 1/2” above the board.

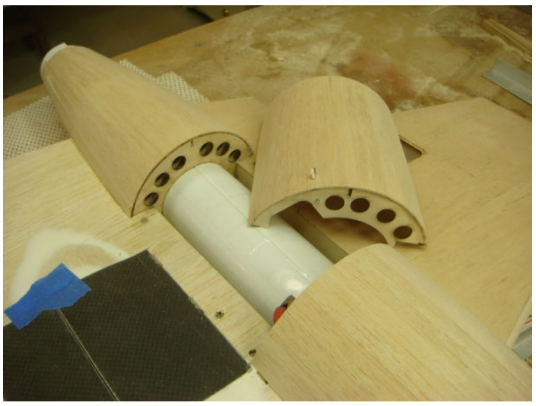


The rear spar is beveled to mate with TE1. With everything aligned, glue the outer wing panels in place. Sheet the bottoms of the outer wing panels with 1/16” balsa. Flip the wing over, and use jig 3 supported 3.5" above the board to support the wing tips while the tops of the wings are sheeted. Locate the aileron servo opening and use the servo hatch cover as a guide to cut the sheeting away.

Cut two rear ducts and fit the remainder of the nacelle pieces in place (N6, N7, N8, and N9). Protect the N6 pieces from the spars and wing sheeting with wax paper.

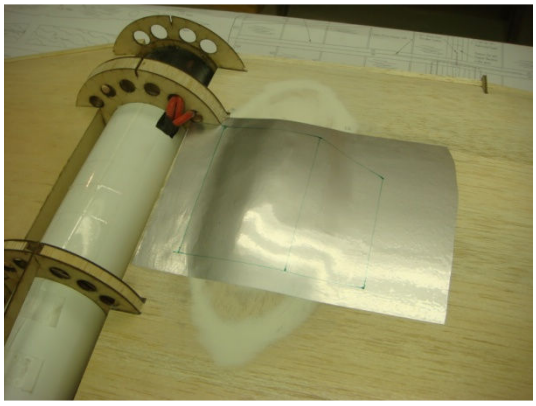


Plank the nacelles with 1/16” balsa. To help with this, a “gore” template is include on the plans. The shape of the gores will reduce the amount of trimming and fitting required.

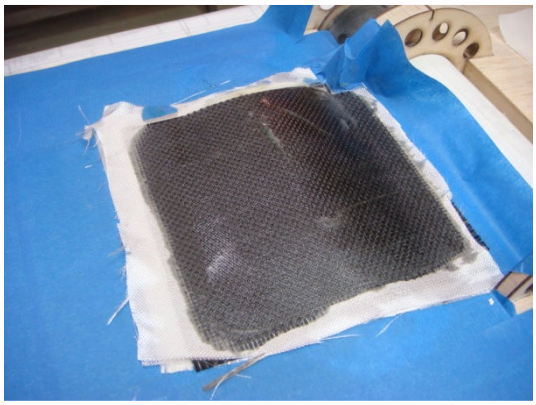


As the bottom is planked, cut between the main spar and N6A, and the rear spar and N6B to free the hatch. Glue N1 and N2 to the front of the nacelles and sand to shape. The inlet edge should have a smooth, round cross section to ensure good air flow into the fan.

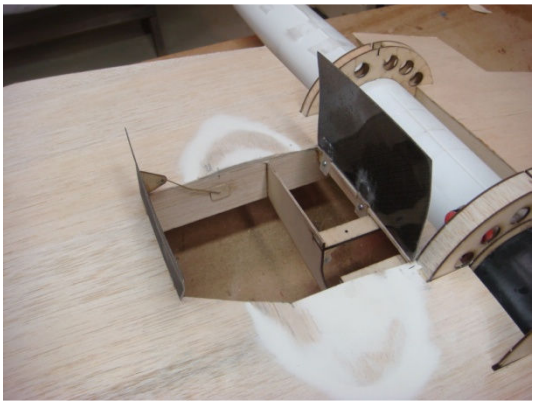
Depending on your flying field, you may want to omit the gear doors. I fly mostly off of grass, and the Meteor sits low on the gear and main doors catch in even the shortest grass. The nose door does help it slow down on landings, so at a minimum you should consider fabricating it. With that said, the gear doors are made of fiberglass and carbon laid up on the bottom of the wing.



The Meteor has a bump over each gear door and it is shown on the plans. This can be made of balsa block or filler and most will be cut off. Cover the bottom of the wing temporarily with iron on covering.



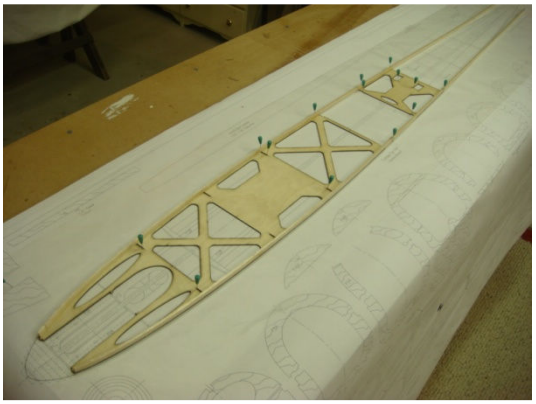
Wax the covering and lay up the gear doors. I used two layers of 1 oz. fiberglass with one layer of 6 oz. carbon sandwiched between them for stability. Use peel-ply or 100% polyester cloth over the layup to reduce the final sanding and finishing time. Once the layup has cured, it should pop off cleanly giving a perfect fitting gear door.



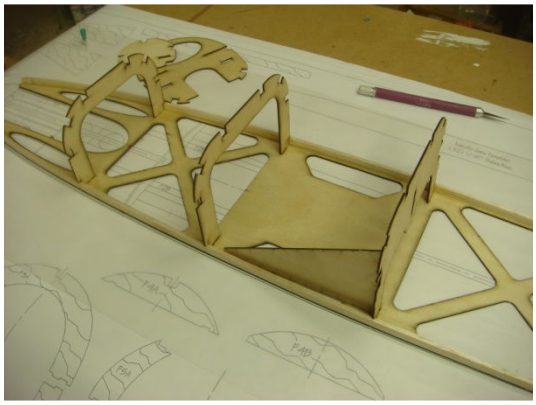
Cut the gear openings from the bottom sheeting. Cut the gear doors to shape and temporarily hinge them. The outer door will be secured to the gear strut and the inner door uses an over-center spring to hold it open and closed. The wheel hits a lever glued to the inside of the inner door to open and close it.

Fuselage

Laminate the LG1's, WM1's, and WS1 and WS2 together.

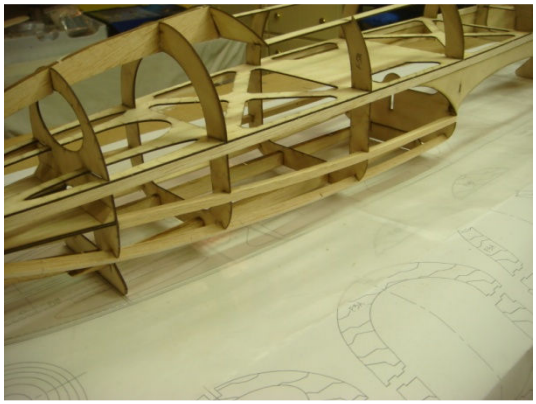


The fuselage is started by constructing the internal crutch. Position CR1 and CR2 over the plans. CR2 should be approximately 1/16" behind the location shown on the plans to account for the angle of the crutch relative to the board. Glue 1/8"x1/4" balsa stringers to the bottom of CR1 and CR2.



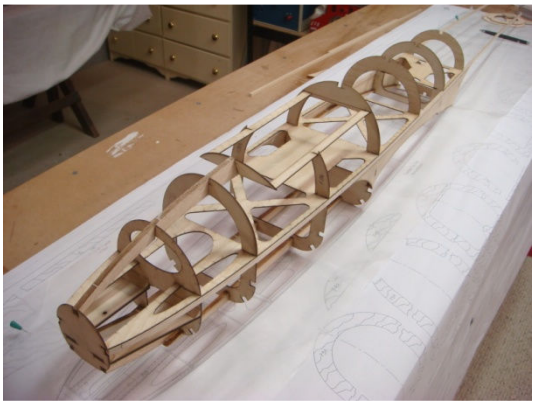
Glue F1 through F9 to the crutch, using the gauge to set them at the correct angle.

Glue the L.G. mount in place and reinforce it with triangle stock. Glue F1A, F1B, F2B, F4A, F4C, WS1, and WM1 in place.

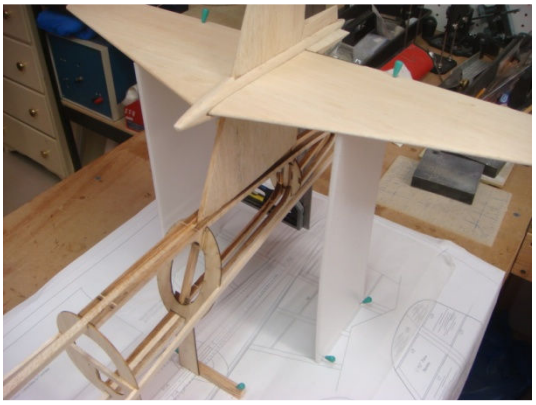


Using the building jigs at F2, F6, F9, and F12, secure the fuselage assembly over

the plans. Thread F10 and F11 on to the crutch. Cut 1/4" square balsa stringers to fit from F6 to F12 and from F9 to F12 and fit them to the top and bottom of the fuselage. Square up the formers to the plans and glue them in place. Bend the top of F6 at the score line and glue F6B to F6 and the top stringer.

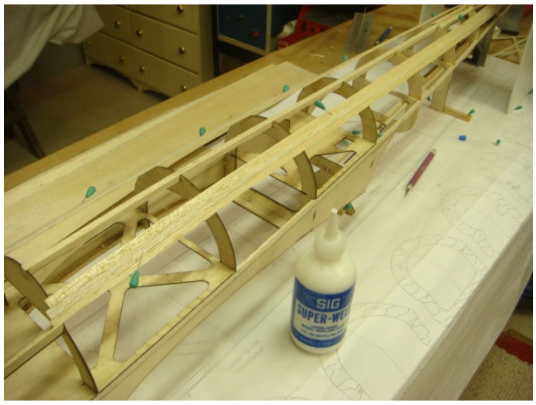


Cut 1/16” basswood to fit from F4A to F6 along the edge of F4C. These pieces should extend above the edges of the formers and will be sanded down after the fuselage is sheeted.



Cut two stabilizer support jigs from foam board to support each side of the stab during construction. Slide the tail assembly on to the fuselage assembly. F14 and F15 should butt up against F11. Glue V11 and V12 in place and fill in between V11 and F14 with balsa.

Install the rudder and elevator control rods.



Plank/sheet the fuselage with 1/16” balsa. This one sentence will take some time.

When the top and sides are done, the fuselage is removed from the board to finish up the bottom. Glue balsa block to the front of the fuselage and sand to shape.

Rough trim the canopy to shape. Glue F6A in place and frame up the turtle deck. It is sheeted/planked with 1/16" balsa. Cut a floor for the cockpit and install the canopy as shown on the plans.

The front L.G. doors are laid up from fiberglass and carbon similar to the main gear doors.

Square the wing to the fuselage and drill a hole for the mounting bolts. Glue F6C, F7A, and F8A to the bottom of the wing. Add 1/4" sq. balsa stringers and sheet/plank with 1/16" balsa.

The wing fillet starts at the high point of the airfoil and flairs out about 1" on to the wing. I used some 1/64" plywood to set the outline on the wing and filled it in with some balsa block and epoxy/micro-balloon filler.

At this point the Meteor should be ready for finishing. The prototype was fiberglassed with 0.5 oz. cloth and painted. This is a short step on paper, but it took several weeks of sanding, filling, and priming to get ready for paint. I've come across several color schemes for a T.7 including scarlet red, Israeli camouflage, and the gloss black one that originally inspired me. This design could easily be bashed into one of the many other variants of the Gloster Meteor.

For the radio setup, I used HS-85's on the rudder and elevator, HS-65's on the ailerons, and a HS-55 on the retract valve. I chose to use separate power packs, and ESC's for each motor. The ESC's used have switching BECs, so one was used to power the Rx. In general, it is not wise to connect the outputs of two switching regulators together. Power comes from two Mega 16/15/3's motors, each running on a 4S 5000mAhr packs. There are many possible motor/battery options possible that will work in the mini fan units.

Flying

The Meteor is an honest airplane, and needs to be flown as such. The Meteor can be flown from grass or a paved runway. For takeoffs, the Meteor tracks straight and the nose will get light when it is ready to fly. A moderate amount of elevator gets the nose off the ground. The gear adds considerable drag, so I try to get them up as soon as it is solidly in the air. The Meteor climbs out with authority and as you level out you can hear the twin fan units get on step (there is a definite pitch change). Once on step, hang on as this slick airframe starts to cook.

The stall is very gentle. With the throttle off and full up elevator, the stabilizer stalls before the wing and you get a series of "micro porpoise" motions until you relax the elevator or add power.

The Meteor is not a "bank and yank" type of airplane, so I try to fly it smoothly with large turns and maneuvers. The Meteor flies fine at half throttle, so you don't have to waste all of you power just staying in the air. On high speed passes it is very stable.

Mild aerobatics are well within its capabilities including loops, Cuban-8's, and point rolls. I haven't attempted a Zurabatic Cartwheel yet, but I'd be lying if I said I don't have the mix setup for it. Inverted flight requires about a ¼ down elevator. Other than that, I just love watching it cruise by.

For landings, drop the gear on the downwind leg. The controls do get a little soft with the gear down, so just be aware of it. I make a long low approach and can cut power once on final. The Meteor does come in a bit hot, but it will stay down once it touches down. If you have to abort a landing attempt, retract the gear. It takes a considerable amount of power to get the Meteor back up to speed with the gear extended.

I'd like to thank Keith Shaw for his expert help in developing this design and taking the controls for the maiden flight. Also, a special note of thanks goes to Roy Thompson for providing some up close photos of the actual Meteor WA638.

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