

BUILDING THE AEROSTAR

First a little history. It is not a Piper Aerostar! It was built by four companies, Piper being the last, ending about 1984. A total of 1010 built. Ted Smith was the project engineer of the Douglas A-20 bomber in the mid 1940's. He got some guys together and after work they designed and built the Aero Commander. Kind of a smaller version of the A-20 and they sold it. Then came the Jet Commander, a mid-wing, swept tail, lengthened fuselage, jet powered Aero Commander. Ted left Rockwell in 1963 with the Aerostar idea, a shortened fuselage, swept forward wing version powered by piston engines instead of jets, based on the Jet Commander. Ted Smith Aircraft Company was established in the beginning of 1965 to design the structure and produce the proto type. I was employee number 7 designing structure. I left in 1966 to fly for TWA. I designed and built a wood and composite homebuilt while at TWA. This model uses my knowledge of the real aircraft and design and building my homebuilt. You will notice I use real aircraft materials, spruce, foam, epoxy and balsa. I used programs to calculate the wing spar and servo requirements at 75 mph. The main spar is good for minimum of 15 G's at a wing loading of 32 ounces per square foot and 10 G's at a loading of 48 ounces. I have flown the Aerostar and it is great! The Aerostar is about the fastest piston twin even at more than 30 years old. Ted wanted it fast and used the low drag 64A212 airfoil, no twist wing and no side or down thrust for the engines. I use the same 12% airfoil at the cost of a heavier main spar. I have not flown my Aerostar yet, but should fly it this year, 2015.

So let's get to it! I will tell you how I did it, but you may have a different way of doing it.

FUSELAGE:

I built the fuselage in two halves on a building table. I used aluminum angle screwed to the table at the frame locations. I clamped the frames to the angles with cleco's, but you could use 4-40 or 6-32 screws. I split the fuselage for transporting and getting to a good place for pneumatic tank, sequencer, servo and electric stuff. At the split the frames should be spaced with 1/32 to 1/16 so later a saw will be guided to split the halves. These frames should be match drilled for dowels and two screws for assembly. The stringers are added and then the foam in the window area. Add one window sheet to the fuselage and then plank with 1/8 by 3/8 balsa strips up to the window sheet, leaving about one inch from the table open, so the cleco's or screws can be removed. Slide a hack saw blade between the split frames and saw about one inch, so later you can find the split. The Plexiglas and second window sheet will be added much later after the halves are joined and interior access is not required. Remove the half from the table, trim the inside foam in the cabin and sheet with 1/64 birch plywood. Using the "window sheet" as a guide now cut out the windows. I now painted the inside walls and around the window cut outs. Now build the opposite side leaving the frames in the same horizontal fuselage station location except for the top and bottom fuselage lines. This must be accurate to mate up. The floor can be added to each side and paper tubes to run air and electric lines to the nose gear and landing lights. Seats and painting can be done before mating the sides. The Aerostar has two batteries in the tail cone for balance and I expected the model to be nose heavy, BUT my model came out tail heavy with the CG at 35%. SO, don't be afraid of structure weight forward of the wing. Mate the sides together and add the frame joiners to the top and bottom of the frames. Complete the top and bottom planking. Some marks on the planking, as you go along, will help when cutting the holes for the wing and gear and separation of fuselage halves. The fuselage can be sanded now. I made the fiberglass gear and baggage doors over the fuselage BEFORE cutting the holes. The wing center section should be mated to the fuselage BEFORE making the main gear wing and fuselage doors. Use a separator on the fuselage like Monokote before laying the fiberglass. You can add the interior now if you want. I added pilots,

Instrument panel, throttle quadrant, ceiling air ducts and aft cabin bulkhead ducting. I went to aerostaraircraft.com, aircraft for sale, and found an instrument panel I liked, down loaded it to the size I required and glued it to the panel. I went to Hobby Lobby and got the yokes, ¼ scale instruments and switches and glued these to the panel. Aerostaraircraft.com is a good place to see details and interiors. Another good place is Google: Aerostar Aircraft and click on "images". After the interior is done, wing center section mated, and doors are shaped, cut out the gear areas and finish the wells. Note the center of the main gear area on the F5 frame drawing. The small hinges were hard to find and I show the reference on the fuselage drawing.

WING:

The wing is built as shown on the drawing, in three sections. I used aluminum joining tubes because I know the bending moments of them. Carbon fiber is another animal and I don't use it. The Joining tubes MUST be in line with the spruce cap strips and shear webs MUST be used. The spars are in the same location as the real airplane. Do not cut out the gear well UNTIL the wing is mounted on the fuselage and glass doors are pulled. The wing has no twist and 2 degrees dihedral, at the "wing reference plane (WRP)", that is the plane that the airfoil is drawn to, upper and lower ordinates. The bottom is more than 3 degrees and top is more than 1 degrees. A tip block spacer is shown on the drawing. Installing the wing is not easy! The outer halves should be done and mated to the center carry thru (same as the real one) on the work table. Epoxy the center carry thru to one side with epoxy. Cut holes in the fuselage, jig the center and outer wing panel to the fuselage and epoxy in place. The wing has 1 degree of incidence to the fuselage top reference line. When that is complete, the other wing panel can be epoxied in place. NOTE: the wing panels must be a good fit on the table to the carry thru scarf joints before assembly AND a good epoxy (T-88 or similar) used. Now the outer wing panels can be removed from the center section. There may be another way. Zirol, in his popular B-25 has the same problem and he mentions installing the whole center section from the bottom. I guess you could cut between frames F5 and F5A, wheel well, remove the wheel well, insert the wing center section, replace the wheel well fuselage section, blend in and then make the glass doors. NOTE: main gear and baggage doors overlap the fuselage by at least 3/16 inch. The nose gear doors are flush. I use ¼ diameter aluminum pins, and safety pins, to lock the outer wing tube to the center section. I did this at the inboard end. The problem is I have to remove the top cowl to access it. There must be a better way.

STABILIZER:

The horizontal and vertical stabilizers are the same part. The elevators and rudder are the same part. At Ted Smith Aircraft, I spent a lot of time designing the elevator/rudder part. Being the same part, for the rudder to fuselage gap, I used a fairing mounted to the fuselage, but later Piper mounted the fairing to the rudder. The critical part was the vertical stabilizer area and dictated a large horizontal area (using the same part). The large area horizontal moves the "neutral point (Np)" aft and allows a safe aft CG of 34%. The real aircraft uses a 25% aft CG, as it was hard to get it aft, being nose heavy. I would stick to 20% to 30%. The surfaces are built as per drawing. Build the horizontal as one piece. The vertical bottom stops at station 2.75, but continues inside the fuselage to mount to the horizontal. The pitot tube is mounted to the top of the vertical and looks like something off the old 707. It is in a spot to catch on something and so I made mine out of aluminum, on my lathe, and screwed it (4-40) onto the vertical and made it removable. Install as shown on the drawing.

CONES:

I made both nose and tail cones fiberglass. The tail cone mold was the fuselage. I built the aft fuselage all the way to the end, pulled a mold and then cut the aft cone off the fuselage. The nose cone mold was built of ¼ plywood forms, blue foam and fiberglass. I made the windshield mold the same way.

NACELLES:

I made male plugs to make the female molds and the nacelles were made of fiberglass. The top cover stops at the real firewall area of 35% cord. The aft section of the top nacelle is built of balsa onto the wing. The lower section I made full length to access the flap bell crank and linkage and servo wire tube for the throttle. The 14 ounce tank fits behind the firewall and the throttle servo is under the wing. The engine mount box shown is for the DLE35RA engines that I use. Adjust to your needs. I will put the ignition into the box. I split the paper tube, for the aileron servo wire, for inserting the engine servo wire also, under the wing and an access hole in the skin.

BITS AND PIECES:

I left the window installation as long as I could to avoid damage. After installing gear, doors, pneumatic stuff, servos, cockpit stuff and paint, etc., then I finished the windows and windshield. I used RC56 to glue on the Plexiglas and then to the outside 1/64 windshield sheet. WARNING! Blow out and vacuum the interior before closing up!! Guess how I know? You can mask the windows while you fill and sand the fuselage. I covered mine with ¾ ounce fiberglass and dope. I only use epoxy resin (West System) and find it heavy so I use dope for the finishing. I used 2 layers of carbon fiber for the doors and stiffening areas of the cowl. I used Rutan Bid for most of the nacelles and cones. I use spruce because it has been used in aircraft work since the beginning. It is stable and clear and well known properties. Birch is another aircraft wood. Remember the "Spruce Goose"? It is mostly Birch with Spruce too. Blue foam is used for homebuilt aircraft. It can be hot wired and sands good. When using aluminum, use 6061 and not some softer version. It is used a lot in RV aircraft. 2024 used to be the one, until it got expensive. Tubing in 2024 is reasonable.

QUESTIONS:

I am happy to help you for construction of the model, scale details or the real Aerostar.

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REFERENCES:

aerostaraircraft.com check out the "for sale" aircraft for details and interiors

google: aerostar aircraft, click, images

aircraftspruce.com spruce, foam, plywood, epoxy, aluminum tube

wicksaircraft.com spruce, foam, plywood, epoxy

leevalley.com 12MM and 20MM hinges



