JDT MINI-MAX LLC MODEL 1600 CONSTRUCTION MANUAL
ENCLOSED SPORT MINIMAX, ROTAX ENGINE

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MODIFICATIONS

JDT MINI-MAX LLC cannot sanction any modifications to the MINIMAX design from the published plans. We are aware that some individuals purchase plans with intent to modify them and we do not mean to abridge this freedom. However, any changes may create an unsafe aircraft and therefore void the use of the name MINIMAX in any form, such as "Smith MINIMAX". Persons modifying the aircraft must use another dissimilar name, particularly if the aircraft is to be registered as "Experimental", under the amateur built regulations. The intent of this policy is to protect our product image against another's experimentation, hence all parties are enjoined from the use of our product name in connection with such experimentation.

PLANS

Photo reduction processes make it impractical that drawings be scaled. The only exception is the wing rib drawing which is full scale. At first glance, the drawings may appear to be quite confusing, and may discourage the builder from even attempting to build this aircraft. However an aircraft can be built more simply from a very highly detailed set of plans than from plans that look very simple but give little information. The best procedure is to pick a plans sheet or sheets showing the details of one part that you wish to build first, such as the elevator and stabilizer assembly. Thoroughly study these details first to become familiar with the processes needed to build the part. Do not go on to the rest of the plans at this point. By the time you have built one or two pieces of the aircraft, the rest of the procedures will become much clearer and will readily fall into place.

Plans Only Customers: If you decide to order a miniMAX kit within 3 months of receipt of your Plans/Construction Manual, the cost of the Plans/Construction Manual will be deducted from the price of your kit.

WORKING AREA AND CONDITIONS

Building an airplane is not a single big job, but rather a large collection of small jobs whose degree of simplicity or difficulty independent of the builders skill is influenced to a large degree by the available work area and conditions. Airplanes similar to MINIMAX have been built in surprisingly illogical places, so the task can be done without formal shop facilities. However, a suitable space where the work can be left standing is desirable. Since the MINIMAX disassembles into components of convenient size, the standard one car garage with a workbench across one side is suitable for the entire job. The minimum bench area recommended is approximately four feet wide by fourteen feet long. The ideal workbench construction would be to build a frame of 2X4 s or 2X6 s to support two 4 foot by 8 foot panels of either plywood or particle board 5/8 or 3/4 inches thick that may be set on sawhorses to allow moving the entire assembly as required. In building the bench, it is very important that the surfaces be flat and true, that is, there should be no twist from end to end and no bow in the center of the bench. If these are present, you will build them into the wing structure, or the fuselage, which will result in a warped or twisted structure. We recommend that all structures be glued with epoxy supplied with the kit. This is a very simple, easy to mix, two-part resin that has very good gap filling properties and is not critical on temperature. Therefore, any temperature suitable or comfortable for the builder will be suitable for the glue. However, the resin will flow, mix, and spread in an optimum manner when kept at about 75 degrees F.

TOOLS

As with the work area, MINIMAX may be built with the minimum of tools, but the job will be greatly simplified and the plane will be built much faster by having a good selection of power equipment and hand tools. For minimum building effort and maximum speed, we recommend the use of, or access to, a table or radial arm saw, saber saw, band saw with metal cutting capability, drill press, electric hand drill, wood file or rotary rasp that may be used in the hand drill, numerous small C-clamps and spring clamps, vise, tack hammer, small hammer, screw drivers, tin snips, carpenters square, measuring tape, saw horses, open end wrenches, etc.

WORK PRACTICES

Many work hours may be saved and the various jobs simplified by organizing the work in an efficient manner. While circumstances will dictate different procedures for different people because of equipment, availability of materials, and so forth, a few time saving suggestions can be followed by almost everyone:

1. Cut as many pieces of a size as possible at one time. Much time is wasted resetting the tool (power saw, drill press, etc.) when pieces are cut singly or a few at a time on an as needed basis.

2. Mix glue with specific jobs in mind. Much glue is wasted by mixing too much for a particular job. Pot life of the epoxy is about 30 minutes, so it cannot be saved for another job. If quite a few items are to be glued over a fairly long continuous period, such as installing all of the wing ribs, etc., plan on mixing several small batches of glue over that period of time. Small batches are easier to mix and there is no question of approaching the pot life as the job goes on. Similarly, take precautions against running out of glue in the middle of a big job such as wing spars, and so forth. Mix small batches instead of one big one, or have a helper mixing glue as you are using it. The best applicator for applying the epoxy is a small stick cut from Lexan plastic about 1/16 inch thick, 3/8 inch wide and about 3 inches long. Taper the end and thin it with a sandpaper block to make the end flexible. This mixing and spreading stick may be used over and over by sanding off the cured glue.

3. Use systematic work habits. Try to plan the work on individual jobs ahead for several days so as to have all the materials on hand and organize the most efficient sequence for doing things. Much time can be lost by wondering what to do next and then figuring out how to go about it. Try to work on related jobs in sequence so that wood parts for several can be cut at one time, etc. Try to set up specific times for working, with an ideal objective of being able to get some little thing done every day, even if it is just removing clamps from the previous day's work.

4. Avoid obstacles to progress. One of the major roadblocks of any shop project is the objection by family members that domestic obligations and relations are neglected for the project. This is an internal matter beyond the scope of this document, but is still a major item for consideration. Other than the family situation, there are three major human causes of wasted time in construction projects. The first is the eager friend who is anxious to be helpful but doesn't know anything about building airplanes or even handling tools. By the time you show him how, check his work, and usually do it over, you could have done it several times yourself in addition to the job you are working on. The exact and highly desirable opposite to this type, and unfortunately very rare, is the experienced person that can be handed a job and be forgotten for a while as he gets the job done with no fuss. The second time killer, more often plural than singular, is the curious and friendly type who comes around from time to time to see how you're doing, and brings a friend along who has to have the whole project explained in detail from the beginning. No work can be done at all during most of these visits and the visitors are very seldom inclined or qualified to help. A sub-category of this type is the one with whom a little knowledge is a dangerous thing and who is always trying to improve your design to death by suggesting all sorts of things - from little refinements to major rearrangements - that will be made with your time, money, and materials. One unforeseen by-product of both categories is the added expense to the overall job resulting from the amount of your groceries, beer, coffee, etc. that they consume while sitting around keeping you from working. The third major theft of your working time is yourself. As the plane begins to go together, it is entirely too easy to gaze dreamily at it by the hour admiring your own handiwork and engaging in all sorts of flights of fantasy while sitting in the cockpit of an unfinished fuselage perched on a couple of sawhorses. Even if you don't feel particularly ambitious when you go out to the shop, or time is short, try to make some tangible progress. Don't goof off for the whole work period by kidding yourself with the thought that you will really bear down tomorrow, or next week. Overdoing the improvements can often be a problem, although in some cases it stems from improved skills as the job progresses. There may be a big difference between the first rib build and the last so that it may be desirable to scrap the first few and do them over. Your own standards and cost considerations will be your only guide here.

RECORDS AND PAPERWORK

It is a very good idea to keep track of all purchases of material, whether it is from the kit or from the hardware store, as you build the aircraft. Also, keep track of the time involved in making various components, so that you will be able to pass this information on to those who will ask you just how long it took you to build the aircraft. It is best to start a logbook on both cost of materials and time , especially if the aircraft is to be registered as a homebuilt with the FAA, since they will require that you keep records and receipts of the materials used in the aircraft.

CONSTRUCTION PROCEDURES

Those who are generally familiar with aircraft construction and repair should have no problem at all with any phase of building MINIMAX. Those unfamiliar with aircraft practice or skilled in only one specialized field should consult with their more experienced friends before proceeding if at all possible. In any case, it is strongly recommended that anyone building MINIMAX or any other aircraft obtain information from the Experimental Aircraft Association regarding the many manuals and publications available related to procedures for construction of aircraft. It is impossible here to detail procedures down to the fundamental level of how to hold a hammer. The drawings and instructions, by necessity, presuppose a certain level of competency. There are, however, certain construction procedures associated with aircraft construction that should be mentioned as follows:

WOOD:

Wood aircraft construction differs considerably from traditional wood furniture or cabinet making procedures. There are no mortise, tenon, or dovetail joints in aircraft. All wood to wood joints are by glue in shear or by bolting. Bolt heads or nuts bearing against the wood opposite a metal fitting should be backed up by large diameter wood washers. Wood screws are never used as a primary means of joining parts. Small nails are used only to hold glue joints together under pressure while drying and then become entirely redundant. Wood surfaces should be protected from damage during clamping by means of back up blocks to distribute the load. If you are cutting your own wood parts from scratch such as longerons and spar caps and are not familiar with the grades used for certified aircraft, it is recommended that you use wood certified for aircraft use, available from reputable suppliers, or that you get publications detailing how to select proper grain, grain runout, annular rings per inch, etc., and get expert assistance before attempting to make parts for these critical areas. If you have no prior experience in this field, do not try to grade wood from your local lumber company yourself. Before cutting any wood, select the longest, straightest pieces to be used for the spar caps and longerons and cut smaller pieces from the remainder. Some of the parts included in your kit, such as Spar Caps and Longerons, are specifically selected and cut for grain quality. DO NOT use these pieces for any other parts or attempt to substitute other wood in the kit for them.

METAL:

There is very little metal, with the exception of tubing, used in MINIMAX. Most of the fittings are cut from aluminum bar, angle, and tubing. A small number of fittings are cut from 4130 steel. Very little bending is required. No welding is necessary. Make every effort to hold dimensions on the metal parts as closely as possible since several of the parts must fit together. It is highly recommended that holes be drilled slightly undersized (about 1/64 inch smaller than specified) so that as the parts are assembled they may be line drilled to ensure that they will line up properly for bolting purposes.

HARDWARE:

Aircraft are assembled with special high strength fasteners manufactured to close tolerances, therefore never use hardware store items. Plans call out all hardware by an "AN" number, "AN" meaning "Army-Navy" standard . Use of other than AN hardware unless otherwise stated on the drawings is unacceptable.

RAW STOCK NUMBERS

All of the material used in this aircraft has been given a "raw stock" (RS) number. This indicates that you will use that numbered material to fabricate the part where the given number is indicated on the plan. Several different shaped parts may be made from the same basic RS number. In the case of most solid wood and plywood parts the indicated RS number will be for material cut to thickness and width. You will cut to length as required. Note from the following list that each material has a series number - for example, all aluminum angle will have numbers from 200 through 299, steel tubing will have 600 series numbers, etc.

To help you better identify pre-cut material, the following list is provided:

RS-0	Uncut Pine lumber, 3/4 inch thick
RS-1 thru RS-50	Cut Pine.
RS-51 thru RS-99	Cut Plywood.
RS-100 thru RS-199	Aluminum Bar.
RS-200 thru RS-299	Aluminum Angle.
RS-300 thru RS-399	Aluminum Channel.
RS-400 thru RS-499	Aluminum Tubing.
RS-500 thru RS-599	Aluminum Sheet.
RS-600 thru RS-699	Steel Tubing.
RS-700 thru RS-799	Steel Sheet, Bar, Etc.
RS-800 thru RS-899	Misc. Materials, Plastics, Etc.

FUSELAGE

Fuselage Sides:

1. Per drawing 1, snap a chalk line at the top edge of your work bench. Nail down a 3/4 " thick strip per print. Be sure it is perfectly straight as it will be used throughout the entire construction and assembly of the aircraft.

2. Draw in the reference line at 90 degrees to the strip. From this line and the 3/4 " strip locate the various dimensioned points and draw all connecting lines.

3. Draw in all vertical and diagonal members. Note that members 2 and 4 are not quite vertical.

4. Roll heavy duty wax paper across the fixture to cover all areas where glue joints will be located.

5. Cut locating blocks from 1/2" plywood about 1" X 2".

6. Place the top longeron in the fixture with the diagonal scarf joint between station 3 and 4.

7. Place 2 or 3 plywood blocks to hold longeron in place.

8. Install lower longerons and locate with plywood blocks.

9. Cut all vertical and diagonal members and block in place. Don't overdo the blocking, as many of the members will stay in place by themselves.

Note: Try to keep all joints as accurate and tight as possible. On of the best ways to do this is as follows: Lay the RS piece on the fixture and mark only one end at the correct angle. Cut this end and fit into place. Now mark the other end at the correct cut off angle and cut it slightly over length. Check for fit and trim as necessary using a belt or disc sander. If members tend to slide out of position during fit up, hold in place with a staple.

10. After all parts have been cut and fitted, began the gluing operation. Remove one part at a time, starting with the upper longeron scarf joint, and glue. Next add verticals and diagonals. A few staples will hold joints tight until the glue dries, then remove staples.

11. Allow the assembly to dry overnight. Pull staples and sand joints to remove the glue "squeeze out". Do not remove from the fixture.

12. Build another side directly over the first. Place small strips of wax paper between the sides at all glue joints. Locate members over each other with small wood blocks and C-clamps, and staple as required.

13. Remove the sides when dry and clamp plywood sides (RS-657) in position. Draw pencil lines all around outside edges per drawing 1. Cut to shape and reclamp to the side frame.

14. Now with soft pencil draw around all uprights, diagonals, longerons, etc. Remove and reclamp on opposite side of frame. Again, draw around all the members. This permits you to know exactly where to scuff sand plywood before gluing, where to place glue, and on the opposite side, where staples and nails are to be placed.

15. Side plywood panels may now be glued permanently in place. Use 5/16 staples on the centerline of members, about 1" to 2" apart.

16. Trim plywood end panel (RS-655) to shape shown in drawing 1 and locate on side frame.

17. Cut ply strips from RS-651 and fit to sides.

18. These parts may now be glued in place. Be sure to make one left and one right hand side.

19. Glue RS-654 to inside of forward fuselage. These will be the insides of the engine compartment. Cut and glue RS-562 seat belt doublers to inside of both sides, per detail "D", drawing 1.

Time to take a break!

Fuselage bulkheads:

1. On plywood panel RS-668, locate notches, the access opening, etc., and cut, per drawing 2.

2. Glue RS-9 member to bottom as shown. When dry, set table saw blade to 9 degrees and bevel cut as shown, or use a block plane if a table saw is not available.

3. Next, build up rear spar carry through and motor mount base per drawing 2.

4. Check all corner notches for fit by placing on fuselage sides.

Fuselage assembly:

1. Snap a chalk line down the center of the workbench. This is the centerline shown on drawing 3.

2. Place sides on the bench top with top longeron against bench top.

3. Slide station 4 member into position between sides. Note straight area between stations 2 and 4 shown on drawing 3.

4. Nail wood strips into bench on the outside of the fuselage sides to maintain this straight section.

5. RS-11 cross member at station 2 is 22-3/4 inches long. Cut to length and bevel the bottom at 2 degree angle per DWG.#14. Glue in place, per drawing 4.

6. Cut two members the same length from RS-8 per drawing 3 and drill holes as shown. Locate these on lower longeron at 43-3/8 and 52-1/8 inches.

7. Glue all of the above in place. Glue the rear spar carry through to the back of the station 4 bulkhead per drawing 2. Note that the fuselage side uprights are sandwiched between the plywood bulkheads.

8. A couple of crank-up bar clamps will hold sides together while the glue cures. Staple and/or nail plywood bulkheads to uprights as required.

9. When dry, fit motor mount base into front of fuselage and bend sides inward until contact is made. Base will rest on the horizontal RS-8 members located about 1/3 of the way up on either fuselage side.

10. If fit is OK, glue in place. Again note straight section in drawing 3. Pull the fuselage side panels tight against the motor mount base sides using wood screws with a flat washer under the heads. When dry remove screws and plug holes with glued in wood plugs.

11. Cut top cross members (located at 17-1/2 inches and 31 inches), and bottom cross member (located at 17-1/2 inches) from RS-6 and install. Also cut and install RS-8 and RS-9 member at the front edge. Allow to dry. Use framing square to make sure fuselage sides are perpendicular to bench top at all times throughout assembly.

12. Locate plywood panel RS-670 over bottom of fuselage per drawing 3. Draw around side and end and cut to shape.

13. Glue and staple into position.

14. When assembly is dry, join both rear ends together with RS-0 blocks, as shown in drawing 3.

15. Use locating blocks nailed to bench to ensure longerons are straight from station 5 to rear.

16. Cut all cross members from RS-6 and fit in place on both top and bottom of fuselage.

17. Glue all members in place. Be sure to place scraps of wax paper under all joints in contact with work bench.

18. Cut slots in RS-651 as required to permit bend in area between station 4 and 5. Glue in place, as shown in drawing 3 and 4.

19. At the top of drawing 3 are views of stations 5, 6, and 7. Note gussets in corners. Cut them at 45 degrees from RS-652, and glue in place per the figure. Due to fuselage taper, the gussets will not lay flat on both uprights and crossmembers. Use small 'C' clamps and/or staples to pull them in as tight as possible.

20. Now add the diagonals cut from RS-6 shown on bottom view, drawing 3. Also glue in the diagonals across the fuselage, as shown in the views of stations 5, 6, and 7.

21. When dry, remove from bench top and turn upright.

22. Cut cockpit opening pieces shown on drawing 4.

23. Glue RS-8 doublers to longerons along the cockpit sides. Glue RS-6, RS-9, and RS-5 cockpit corner bracing members in place. Let glue cure.

24. Glue RS-651 strips to top longerons and doublers. Glue 1/8 inch plywood triangular reinforcements as shown.

25. Cut and fit but do not glue plywood RS-670 over front end of fuselage. The short section behind the seat back may be glued in place.

26. Cut plywood front seat support bulkhead from RS-661 per drawing 4. Add RS-8 and RS-5 upper and lower crossmembers. Bevel top to match the seat angle and install in fuselage.

27. Cut seat board RS-592, but do not glue into fuselage. It is held in place with two wood screws so that it may be removed for inspection of the control assembly. Attach seat back, RS-676, to seat board with aluminum hinge and 3/16" bolts and nuts (from local hardware store).

28. Cut RS-654 plywood panel to dimensions shown at top left of drawing 3 and glue to rear end of motor mount base. Notch top corners to clear the upper longerons.

29. Sand or plane the front end of fuselage sides square or straight across so that the plywood nose skin, RS-664, may be glued in place, as shown on drawing 3.

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FUSELAGE GAS TANK (OPTIONAL)

The plastic tank is located just behind the engine compartment.

1. To mount tank fitting, drill a hole in tank 1/2" diameter minimum, 17/32" maximum.

2. Cut four tank mount brackets from RS-10, per drawing 4.

3. With the fuselage top deck, RS-670, removed, locate the tank in position. The tank top will slide under fuselage longerons, about 4" from the engine compartment.

4. Carefully measure location of tank filler neck. Transfer this location to plywood top deck and cut an opening just large enough for the neck to slip through.

5. Next, place tank on top deck with filler neck through opening. Locate two of the tank brackets between the tank and top deck as shown on drawing 4. Mark the locations, then remove tank and glue brackets to the top deck.

6. Temporarily mount the top deck on the fuselage. Locate the tank and hold in place with braces, tape, or whatever is handy.

7. Measure the width between the fuselage sides beneath the tank. Make the tank support platform of RS-589 braced with RS-8 to fit, per the figure.

8. Locate this platform and the two lower tank mount brackets, and mark the location of the brackets on the inside fuselage sides.

9. Remove tank and top deck. Relocate the lower tank mount brackets (if you removed them) and drill through the 3/16" holes and through the fuselage sides.

10. The tank can now be installed after the top deck is installed by fitting up against the upper tank mount brackets and installing the tank support platform and lower mount brackets with AN-3 bolts.

Fuselage Turtledecks and canopy:

1. Follow instructions on drawing 5 and 6 for the front and rear turtle deck and windshield. Full size patterns are given on drawing 7.

2. All edges of the fuselage are rounded off by planing and sanding, or with a router. The exception to this is where the landing gear legs mount, directly under the stabilizer, and a small area where the top of the airfoil meets the top edge of the fuselage. Just let the radius run out to square edges in those areas.

EMPENNAGE

There is no way to build a structure of this size that is very light, very strong, and also very simple without some compromise. Ultralights require components that are both strong and light. The problem is to make it as simple as possible.

FIN AND RUDDER

1. Perhaps the best part to build first is the vertical fin. On paper, plywood, or cardboard, lay out F(full size) the dimensions for both fin and rudder, per drawing 9. Draw in the location of all members.

2. The fin spar is RS-10, and the leading edge is RS-17. NOTE THE LEADING EDGE IS LAMINATED FROM 4 PIECES OF RS-17. ROUND LEADING EDGE AS SHOWN ON DWG. NO. 10.

3. Cut the fin leading edge and spar to length. Cut two slots in the spar for the hinges, per detail "F". Note that the slots should be just long enough for the hinges to fit.

4. Lay leading edge and spar on the drawing. Cut lengths of RS- 17 for ribs and diagonals.

5. Cut upper and lower ribs to length from RS-10. After cutting lower rib to length, drill two 3/16" holes as shown.

6. Install anchor nuts with small wood screws and epoxy, per detail "J" on drawing 10.

7. Cut gussets from RS-533, except for the lower rear gusset (see detail "J"), which is cut from RS-535, per the cutting diagram in the upper right of the drawing. You might as well cut the lower rudder gussets at the same time, since they are cut from the same piece of RS-535.

8. Lay all components on the layout drawing. Glue and staple all the components together, along with the gussets on the top side. Also cut and glue the RS-11 corner block, per the drawing.

9. When glue has cured, remove from the layout and turn over. Glue and staple gussets to the other side.

10. Build rudder in a similar manner, except that the trailing edge is made of RS-15 tapered stock. Before assembly, slot the rudder spar for the hinge like you did the fin spar. Also, drill two 3/16" holes in the bottom rib to attach the rudder horn, per detail "J". The lower gusset can also be slotted for the rudder horn at this time, as shown.

11. Taper the rudder ribs toward the trailing edge as shown in drawing 10. Cut one rib as a pattern to mark the others.

12. After fin and rudder assemblies are dry, lay both on the full size layout, with the hinges inserted in the slots (detail "F"). Don't forget the 1/32" spacers, so that the fin and rudder spars will be spaced 3/8" apart.

13. Make sure the pieces are held securely with blocks or clamps, and carefully mark and drill 3/16" holes through the spars and hinges as shown in detail "F".

Now take a break and admire your handiwork.

STABILIZER AND ELEVATOR:

1. Construction of the stabilizer and elevator is similar to the fin and rudder. Lay out all dimensions full size, per drawing 9, including location of all members.

2. The stabilizer spar is cut from RS-10 and reinforced with RS-10 doublers as shown in detail "E" on drawing 10.

3. Cut four slots in the stabilizer spar for hinges, as you did for the fin spar (detail "F" on the fin and rudder drawing).

4. LAMINATE LEADING EDGE (RS-17) AS SHOWN. Lay leading edges and spar on the drawing.

5. Cut lengths of RS-17 for ribs and diagonals.

6. The center rib is RS-10. Cut to length and glue on RS-17 reinforcements as shown in detail "C".

7. Cut lengths of RS-10 for the nose reinforcements, as shown in detail "A".

8. Most gussets are cut from RS-533. The triangular leading edge gussets are cut from RS-661. Note the top centerline gusset, of RS-651, extends only to just behind the center rib reinforcement, as shown.

9. Lay all components on the full size layout - glue and staple together, along with the gussets on the top side. Glue in the RS-11 corner blocks on each side.

10. When glue is cured, remove from drawing, turn over, and glue and staple gussets on the bottom. Note the centerline gusset on the bottom extends the full length of the rib and mates with the RS-652 gusset at the rear.

11. Elevator is similar to the rudder. Before beginning assembly, glue the elevator spar doubler as you did for the stabilizer. Also, slot the elevator spar for the hinges.

12. Note the ribs are tapered, just like for the rudder.

13. After both assemblies are dry, lay both on the full size layout, with the hinges inserted in the slots (detail "F"). Don't forget the 1/32" spacers, so that the stabilizer and elevator will be placed 3/8" apart.

14. Make sure the pieces are held securely with blocks or clamps, and carefully mark and drill 3/16" holes through the spars and hinges as you did for the fin and rudder.

LANDING GEAR

The landing gear is both simple and rugged. It may be quickly removed by simply pulling the hinge pins from the mounts.

1. Begin construction by gluing up the two "V" legs from RS wood and plywood, per drawing 15.

2. Before gluing on the second plywood side, mark all areas that will be glue surfaces. The remaining area that will be on the "inside" of the leg is sealed with polyurethane varnish.

3. After assembly, the top edge of the leg is cut at 37 degrees to fit against the fuselage bottom. This is best done on a table saw, however, with care and the use of a clamped on wood strip guide, it can be cut with a saber saw.

4. Next cut four aluminum mounting brackets from RS-200 per the drawing. Transfer holes in angles to the leg and drill. Temporarily bolt angles in place.

5. Cut and drill the axle hole locating block, as shown in drawing 15. Place it between the angle brackets. Be sure the pencil center-line shows through the 1/4 inch diameter hole on its center, then "C" clamp in place.

6. Use a long 1/4 inch drill bit and drill through the guide hole in the block into gear leg.

7. Remove locating block and angle brackets.

8. Cut the 1-1/8 inch diameter hole with a hole saw in your drill motor, using the hole you just drilled as a guide. Cut from both sides until through.

9. Locate the hinge on the gear "V". Allow the other half of the hinge to fold over the slanted edge of the leg.

10. Hold hinge tight against leg and drill bolt holes. Bolt temporally in place.

11. Nail two 3/4" by 2" by 16" wood strips to bench top with outside edges exactly 24-1/4 " apart and parallel to each other. These are to simulate the fuselage bottom.

12. Place legs on strips with loose hinge half lying against outside vertical surface of strip.

13. Temporally attach hinge to wood strips with 2 or 3 wood screws.

14. Mark and drill the axle as shown at the bottom of drawing 15.

15. Slide axle tube through gear legs and insert bolts through angles and axles.

16. Check to insure each end of axle is exactly the same height above bench and at right angles to centerline between strips.

17. Insert an eyebolt in each leg per drawing 15.

18. Cut and flatten the 1/2" diameter aluminum tubes to fit eyebolts as shown. Drill 3/16" hole in flattened end and bolt to eyebolts.

19. Square up axle centerline to bench centerline and locate other end of 3/8" tubes over the holes in tube at axle center per drawing.

20. Drill 3/16" holes through the 3/8" tubes to match holes in the axle. Bolt both tubes to axle.

21. You now have an inverted landing gear assembly on the bench.

22. Before removing, slide on the two 5/16" spacer collars. Next slide on both wheels, then the outer 1" long collar.

23. Push this collar on until assembly is tight and rotate wheel. Note exact distance of edge of collar to end of axle, measure and mark collar and axle. This is necessary, since the wheel must be removed to drill end holes for the wing strut attachment, which is done with wing installed on aircraft and front strut tubes in place.

24. One way to do this is to wrap a radiator hose clamp around the axle where the wheel was located, and slide it against inside face of the 1" wide collar.

25. Locate collar on mark, then slide out approximately .020 to .030 " for wheel bearing clearance. Relocate hose clamp and tighten. Be sure collar cannot slide in.

26. Now remove assembly from bench and fit onto inverted fuselage in the position shown on drawing 15.

27. Check to see that the axle is perpendicular to fuselage centerline.

28. Before drilling hinge holes in fuselage, be sure the 37 degree surface is tight against the bottom of the fuselage.

29. Drill and temporally bolt gear to fuselage. Fuselage may now be turned right side up.

CONTROL SYSTEM

The elevator is actuated by a push-pull cable and housing system. Ailerons are similarly operated by push-pull cables. Flaps are by direct lever connection, and the rudder is controlled by wire cables.

1. Drawing 8 gives details on building the control stick assembly. Parts are cut from aluminum and steel. When drilling holes in parts that rotate, be careful to keep clearance to a minimum.

2. Bushing stock, RS-601 and 602, is mild steel tubing. The I.D. is slightly undersized and the O.D. slightly oversized.

3. When making bushings, two methods may be used. Leave the O.D. as is and ream the hole it fits for proper fit, or chuck bushing into lathe or drill press and reduce the O.D. with a fine file and emery paper. Only a few thousanths of an inch must be removed.

4. Drill out I.D. for bolt size required. These operations are performed before cutting bushings to length.

5. Torque tube bearing blocks are cut from plastic bar. Use care in boring out the 1" diameter hole to avoid excessive clearance.

6. End play in the torque tube is taken up by the thrust collar. Tube should rotate without undue effort, but with no end play.

7. Drawing 8 also gives details on aileron hook-up.

8. After aileron control assembly has been installed and hooked up to aileron, adjust cables for equal travel (after assembly).

9. Remove entire assembly for sealing wood with varnish.

10. Drawings 11, 12 and 13 show hook-up of rudder and elevator systems.

11. After elevator push-pull cable is installed, cut a "U" shaped piece of 1/8" plywood, place over cable, and glue to the diagonal brace at station 5. This is to prevent the cable from swinging around inside the fuselage.

12. Rudder pedals are shown on drawing 11. Fore and aft mounting distance for proper leg room is best determined by trial before mounting pedal hinges to floor board.

13. Note that two cables are used. One set goes to the rudder horns and the other to the tailwheel steering arm.

14. Also note that one length of cable is used, by attaching thimble and sleeve near the center, as shown on drawing 11.

15. Make a plastic cable guide or fairlead, as shown in drawing 11. This is attached to the station 4 bulkhead and is the point where the two cables separate going to the tail.

16. Tailwheel cable is routed through two plastic pipe fittings which make excellent guides. Drill a hole in each lower triangular gusset at station 8 and thread fitting in place. Epoxy threads to ensure guide does not loosen. A slot in the 1/8" plywood side strip is necessary to allow cable to pass through. Once installed permanently, the cable assembly cannot be removed, therefore, attach to steering bar with temporary cable clamps until after all varnishing is done. Steering bar must also be painted.

17. Rudder cable is installed in about the same way, except cable guide is threaded into an aluminum angle bracket, and the cable end terminates in a turnbuckle.

18. Mount two springs in front of the rudder pedals to keep them from falling backwards when the pilot's feet are removed. Access for hooking up springs or adjustment is through inspection hole in nose.

19. Adjust elevator cable to give approximately 25° -30° up and 10° -15° down elevator travel.

WING RIBS AND RIB FIXTURE

The Wright Brothers undoubtedly used some type of rib fixture to assemble their wing ribs, and so has nearly everyone since. Much has been written about how to do this, and you may have your own pet method. If so, use the method that best suits you. A fixture may be as simple or as complex as you wish. The one described here is probably a bit above average.

1. Obtain a board about 10" by 60" by 1/2" to 3/4" thick. Particle board shelving, available at most building supply houses, is preferred over wood boards, since it does not tend to curl or bow. The board must be flat.

2. Place the full size drawing (last page in plans package) on the surface and tape down. Refer to drawing 16 for details.

3. Over this, put a sheet of thin transparent plastic. Wax paper will do, but not very well. Staple it down and rub on two coats of paste wax.

4. At the bottom edge of the rib, nail down a straight length of RS-6 strip. Use a metal straight edge for accuracy.

5. Cut more lengths of RS-6 and locate where shown. Do not drive nails all the way in, in case the piece must be moved for alignment. Note that the locating strips must have the ends cut at angles to permit gussets to fit.

6. The "cam action" fasteners shown are a simple, quick method of holding parts in position. Just cut short lengths of wood dowel and drill slightly off center.

7. Place a length of 1/4" square rib stock, RS-1, in place on top of rib drawing and check curve. Adjust locating blocks until wood cap strip follows drawing smoothly.

8. Cut 1/16" (or 1.5 mm) thick gussets to the appropriate length as shown on the rib drawing. Two methods may be used. The ends may be left square, which is simplest and quickest, or you can save a little weight and material by cutting ends at the angles shown. Gussets may be cut one at a time with ordinary tin snips or a modelers saw. To cut many at one time, nail up a "U" channel mitre box and stack several strips at once. This method also works will for the 1/4" square rib parts.

9. Cut the 1/4" square vertical and diagonal parts and the upper and lower cap strips to length and place in the fixture. The diagonal members may have square cut ends, since the gussets support all the load in shear. The front end of the upper cap strip must be extended about 4" forward. This is only required until the glue dries, after which it is cut off and used on another rib for verticals or diagonals.

10. Glue the 1/4" square doublers near the rear part of the rib to the upper and lower cap strips as shown. Part of the cap strips will be cut away when the ailerons are separated. This is the reason that these doublers are glued for only a part of their length. Glue and staple the gussets to the upper side of the rib. The drawing shows the location and number of staples used on each gusset.

11. After gluing and stapling gussets on one side, carefully remove rib from fixture. Lay gusset side down on bench and glue and staple on another set of gussets directly opposite the lower set.

12. After glue has cured, cut front cap extension off and sand off edges of gussets that may extend outside of caps.

13. Take the first sanded rib and check it against the drawing. If it is out of line or mis-curved, adjust the fixture as necessary.

14. With everything working properly, you can assemble a rib in as little as 20 minutes. After the glue has cured, the staples should be pulled, both to save weight and to prevent rust from weakening the joint.

15. Root and tip ribs will have one side completely covered with plywood. Since right and left hand sides are required, one end rib may have the plywood stapled on after removing from fixture, but the other requires that the first set of gussets be stapled in place without glue. Only glue the ends of the 1/4" square strips. Remove gently from the fixture and glue and staple on the second set of gussets. Now turn over, remove the unglued gussets, and replace with the plywood sheet. Note that root and tip ribs have 1/8" thick plywood on ends of wing, but aileron ends are 1/16" plywood.

16. Make up 20 standard ribs and two each of the right and left end ribs, for a total of 24 ribs. Drawing 19 shows rib numbers for all ribs except root and tip ribs.

17. Each end rib requires that three 1/4" pieces of plywood be glued in for reinforcement. This is also true for rib #5 (see drawing 16).

18. Next glue the 5" long pieces, cut from RS-9, to both root and tip ribs. They are for mounting bearings and aileron horns.

19. Mark aileron end covers with exact centerline of pivot point, per the rib drawing. Drill a 1/4" hole through rib on pivot point, per drawing 16, section A-A.

20. Bolt end of bearing bracket through this hole. With bracket parallel to bottom of rib, drill the two 3/16" mounting holes. Insert two AN3-6A bolts and thread on the anchor nuts. Mount the nuts permanently with small wood screws.

21. Rib #5 is used as a center bearing support for the aileron. Install another bearing bracket as on end ribs.

22. Bearing brackets may be left on ribs throughout wing assembly. They will support the aileron as it is cut away from wing.

WING SPARS

Both spars are built up on the work bench, using the same "straight-edge" strip used for the fuselage. Build the main spars first, per drawing 17:

1. Locate the specially selected and marked spar caps. Place the lower spar cap, RS-9, against the reference strip. Measure and mark the location of all vertical compression members on the cap.

2. Cut these vertical members from RS-5 and RS-9 and locate on the lower cap.

3. Place the top RS-9 spar cap over these verticals.

4. At the root end cut and fit the RS-8 members.

5. Cut the diagonal member from RS-11 and install near the center of the spar.

6. Note that the root is angled at 3 degrees so the root rib will fit flush against the fuselage.

7. Before gluing, place a strip of wax paper under the spar to prevent the assembly from sticking to the bench.

8. Glue all members between the upper and lower caps. Nail small blocks into bench top to hold caps in place.

9. Cut spar webs, RS-538, to length, and glue to caps and verticals.

10. After glue is dry, the top edge of the upper cap must be cut at 10-1/2 degrees, per the drawing. This is best done on a table saw, but it can be done with a plane.

11. Cut plywood strips from RS-561 for assembly at wing center (at diagonals) and at root. Note that these are installed on both sides of spar.

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12. When laying up parts for the second spar, be sure to make (1) right hand and (1) left hand spar, and also be sure you cut the 10-1/2 degree angle on the correct side. This is an easy mistake to make!

13. Fittings are cut from RS-100 aluminum bar.

14. Locate fittings on spar and drill. This is best done on a drill press if available. One way to insure that the root fittings will be exactly 2-3/16" from the root end is to cut a scrap wood block 1" by 2-1/2" by about 6" long. Near one end, drill a 1/4" hole exactly 2-3/16" from the edge. Place fittings on each side and insert bolt. Hold the block against the root end to mark and drill mounting holes in spar.

15. It is recommended that as you drill and temporally install fittings that they be marked as to exactly where they go. They will not be installed again until the wing is assembled and varnished.

16. The rear spar assembly is almost identical to the front, except the upper cap has a RS-8 doubler in the area of the diagonal.

17. After the glue has cured, the rear spar is also bevel cut at 10-1/2 degrees. Again, be careful to cut the bevel on the correct side.

18. Note, RS-561 strips at root are not permanently glued into place until ribs are installed.

WING ASSEMBLY

Drawing 19 shows details of the wing assembly. If you are installing the optional wing tanks, refer to drawing 18 before beginning assembly. Before the wing can be assembled, several details must be attended to.

1. Cut the front end of all rib caps flush with the vertical member, sand smooth but do not sand away any of the vertical.

2. Lay the rib on a board or bench top and nail a strip along bottom edge of rib into board. Cut a 8" length and nail at trimmed front end of rib. This strip should be at a 90 degree angle to the first.

3. The trailing edge cut off point is 46 inches from this vertical member. See full size rib drawing.

4. Cut all ribs at this length. On plywood covered root and tip ribs, cut only the 1/4" square caps, not the plywood. The plywood should extend beyond the rib trailing edge.

5. Be sure all rib gussets are sanded flush with the outer edge of caps.

6. Test slide ribs onto rear spar to ensure the opening is not too tight.

7. Place the front spar (right side up) on bench top with web side against the wood strip fence. Hold in place by nailing small blocks into bench.

8. Set rear spar on bench and slide on rib #5 from root end. Next, rib #6 from tip end, rib #4 from root, etc.

9. Use small spring clamps or spring type clothespins to hold rib verticals to spar during assembly.

10. On rib drawing, note location of nails that hold rib to spar while glue dries. Pre-set nails into rib before gluing. Where diagonals prevent using a tack hammer, hold nail with needle nose pliers and tap nail into wood by hitting on plier jaws.

11. Slide ribs off center and apply glue, reposition and nail. Do not glue end ribs at this time. Hold in position with staples only.

12. Square up ends of wing to front spar. All ribs should be at 90 degrees to spars.

13. Four anti-drag diagonals are installed to keep wing square. The inboard two are cut from RS-9, the outer two from RS-8. See drawing 19, area "D". Cut and glue to lower caps of spars.

14. Compression members are required on ribs #3, 5, 7, and 9. They are lengths of RS-5 or RS-7 stock glued to the inboard surfaces of the ribs, as shown on drawing 19.

15. Glue corner blocks cut from RS-11 to reinforce the anti-drag diagonals and compression members, per drawing 18.

16. Cut spacers from scrap 1/4" thick wood and glue between lower rib cap and anti-drag diagonals. See drawing 19, Section View C-C.

17. Allow this assembly to dry, then remove from bench and turn around so that the trailing edge will now be against the wood fence. Place wax paper between wing and bench.

18. Place trailing edge stock, RS-15, against fence and lightly tack nail into bench top. Mark off location of ribs with a pencil. Push wing assembly up against trailing edge and line up rib ends with pencil marks. Check wing ends for squareness and that ribs are straight.

19. Swing rib ends to one side and spread glue. Square plywood gussets cut from RS-533 are glued and stapled over all rib ends except #1 and #10.

20. Aileron spar webs are cut from RS-653, per drawing 20. Trim ends as shown.

21. Remove root and tip ribs from wing and slide in aileron spar webs. Glue them to 1/4"square rib verticals per drawing 20.

22. End ribs are now replaced and glued.

23. Glue lengths of RS-3 stock between each rib and against web rear face. They will be about 14-5/8" long, however, cut to fit accurately. Only the top strips can be installed at this time.

24. Glue the 1/8" plywood aileron nose ribs on all ribs except rib #5.

25. 1/4" square diagonals cut from RS-1 are glued between each rib bay, per drawing 19 and 20. Only the upper members can be installed at this time.

26. Wing end ribs and rib #1 and 10 are "boxed in" with plywood strips cut from RS-534. Glue them to top surface of ribs. Allow assembly to dry.

27. Pencil mark exact position of trailing edge on bench top. Remove hold down nails from trailing edge and invert wing. Now go back and glue 14-5/8" lengths between ribs and against aileron web face.

28. Glue 1-1/4" square gussets on the bottom surface rib ends and trailing edge.

29. Turn wing back over, reposition wing on pencil marks and re-tack down trailing edge. Use scrap plywood shims under trailing edge to allow for thickness of gussets.

30. Cut and glue in opposite set of 1/4" square diagonals.

31. When dry, remove and glue RS-534 strips to the bottom of the end ribs.

32. Leading edge ribs are cut from 1/8" and 1/4" plywood, per the full size rib drawing. Slot front for RS-4 stringer. All ribs must be cut exactly the same, except the 1/4" ribs are trimmed by 1/4" at the rear, per the drawing. Glue 1/4" square pieces cut from RS-1 stock to the 1/8" ribs. The 1/4" Square member allows the rib to be glued and nailed to the front spar. Note that there will be right and left hand ribs.

33. Glue a 1/4" plywood rib (no 1/8" square required on these) on inside of each end of wing. This doubler will give more glue area for attaching the plywood leading edge skin.

34. Glue a 1/4" plywood rib doubler to the 1/8" ribs at position 4 and 7. The ribs at these positions are now 3/8" thick.

35. Before glue has time to set, line up all nose ribs and glue in the RS-4 nose stringer.

36. Plywood skin is wrapped around the nose ribs. Skin one length at a time, starting at the tip. The plywood skin sections are butted together over the centerline of ribs 4 and 7.

37. Before attaching RS-539 plywood leading edge skin, place wing on bench top, with about 10" of leading edge extending over edge. Tack nail trailing edge in 3 or 4 places and place weights on wing in ensure it is flat against bench top. Any twist or bow in the wing or bench surface will probably be built in during the next operation, so take care.

38. Sand ribs, caps, etc, so the skin will wrap smoothly. Starting at tip end, clamp edge of plywood skin to front spar upper cap. Wrap around rib and clamp to lower cap. To pull skin tight against ribs and nose stringer, cut scrap pieces of wood 3/8" to 1/2" square and about 8-1/2" long. Most any size scrap will do here.

39. Obtain a box of rubber bands about 1/4" wide. Place a stick at rear face of front spar with ends extending equally above and below. Hook one end of band over stick and stretch band around plywood to other end of stick. If edges of skin extend beyond rear edge of spar cap, place a wood shim between stick and spar. Use a rubber band clamp at each rib.

40. With a pencil, mark, from the inside, the location of ribs and nose stringer on the plywood skin.

41. Remove skin and trim ends. Transfer stringer centerline from the inside surface to the outside of the plywood. This line is used for stapling to stringer.

42. Scuff-sand the plywood on inside where glue will be. Varnish the remaining plywood to within 1/4" of the glue lines. Apply glue to skin and wing and re-assemble as before, using your rubber bands to help hold the skin in place. Be sure that all the plywood area you did not varnish has a good coat of glue. Staple along the center line of the leading edge stringer first, then along the upper and lower spar cap, starting at the center of the panel and working toward the ends. Staple into caps every inch or less. Do not staple to 1/8" plywood ribs.

43. Repeat for each of the plywood leading edge sections.

44. With leading edge complete, the ailerons can be cut off. Refer to full size rib drawing for details. Use a fine tooth modeler's saw to cut 1/4" square members. Cut end rib skins top and bottom. Aileron should now be free and held only by the tip hinges. Remove aileron from wing.

45. Stringers of RS-17 stock are now glued on top and bottom of wing, per drawing 20. A 45 degree bevel is required on the inside edges. They may be cut before gluing or planed down after.

46. Trim off all 1/4" square rib cap strips extending beyond edges of aileron nose ribs. Sand smooth so plywood will wrap tightly.

47. Glue on rib #5A, and 1/8" doublers on ribs #4 and 7.

48. Aileron leading edge "D" box skin is installed similarly to wing leading edge. Begin by tack nailing trailing edge to bench top with front edge overhanging bench. Again, weight assembly down to ensure no twist.

49. Glue skin on as before, except that no inside marking is necessary. It may be necessary to wet the skin to get it to bend smoothly around the ribs.

WING CENTER SECTION CARRY THROUGH DETAILS

Since all wing loads must be transferred to the fuselage, it is important to have a structurally sound system. Yet it is also important to easily and quickly remove and re-install the wing without disturbing the rigging angles, control adjustments, etc.

1. The front spar carry-through is an aluminum channel. Make from RS-300, per drawing 14.

2. The rear spar carry-through is the fuselage bulkhead at station 4.

3. To determine the location of holes for wing mounting pins, refer to drawing 14.

4. Make a stiff paper pattern of the wing root rib. Cut slots in pattern where spar fittings come through. Staple pattern against fuselage side and mark slot cut-outs on plywood. Do not over cut slots since they may have to be recut up or down later.

5. Place front spar channel in position and lightly "C" clamp.

6. Place wing against fuselage with a scrap 1/16" plywood spacer between the wing and fuselage (this is to prevent too snug a fit and to allow for the fabric thickness). Adjust front spar up or down until fitting holes line up vertically with the centerline of the carry-through channel. It may be necessary to move channel fore or aft slightly and clamp again. Firmly clamp the wing fittings to the channel.

7. Carefully match drill a 1/4" hole through the carry- through channel using the pin holes in the wing fitting as a guide. Insert a steel spar pull pin through wing fittings and channel. Adjust wing tip up or down for a 3 degree dihedral angle.

8. Draw a line down the centerline of the fuselage vertical member under the channel, per drawing 14. At the point where the bottom edge of the wing root rib crosses this centerline, make another mark. This will give you the location of distance "X".

9. Draw another centerline down fuselage at station 4. Measure distance "X" and add 1".

10. Adjust rear spar of wing vertically until bottom surface of wing root is on this mark. Clamp rear spar fittings to bulkhead.

11. Very carefully drill through rear spar fittings into bulkhead at station 4, with a 1/4" drill.

12. Remove wing. Carefully re-drill bulkhead hole out to 3/8" diameter.

13. Cut a 1" length of RS-401 tubing and chamfer I.D. of ends. Press bushings into bulkhead, per drawing 14.

14. The front spar channel may now be mounted to fuselage by drilling through the pre-drilled holes in the channel up through RS-11 and bolting.

15. The front pull pins should be retained by hooking a small coil spring over the pin ends as shown in drawing 14. The rear pins are held in place by clips made from RS-700 and installed per the drawing.

TAIL WHEEL

The steerable tail wheel is mounted on an aluminum spring leaf. See drawing 12 for the details.

1. The tailwheel spring is supplied in the kit precut and bent. If you are building from plans, saw the spring leaf from RS-103 stock. Grind or sand all saw marks from edges. Corners should be rounded and the edges buffed or polished.

2. Cut steering bar from RS-701 material.

3. Two bolts hold leaf to fuselage. The clamp up bushing should be just long enough to allow steering bar to turn freely, but not be sloppy.

4. Tail wheel assembly is a weldment. A steel steering arm is welded to castor fork, and the ends bent up.

5. Connect the steering bar to the tailwheel steering arm with the steering rod assembly, built per the drawing.

6. After assembly on aircraft, check king-pin bolt angle of castor to ground. It must be about 85 degrees, or slanted 5 degrees from vertical.

WING STRUTS AND WING ALIGNMENT

The "V" struts are of aluminum tubing assembled with fittings of aluminum bar and channel. The strut may be semi-finished and then assembled on aircraft for final adjustment. Note that the landing gear and fuselage must be completed before starting this section.

1. Make up all small fittings and short lengths of tubing per drawing 21.

2. Wherever possible, line up and match drill fittings and tubes. You may wish to keep these sets together until permanent assembly.

3. Cut and drill the front strut tube per print.

4. Bolt on the strut bracket (RS-301) and strap fitting (RS-100) at lower (axle) end of front spar tube. Bolt the RS-701 rear strut strap fittings to the rear strut tube.

5. Attach wing panels to fuselage. After wing root fittings and pull-pins are in place, block up wing tip to 3 degrees dihedral.

6. Install front strut tube and sleeve assembly in wing fittings. Next slide outer end of strut over this assembly.

7. Slip lower end of strut fittings over 1" long outer collar on end of axle. Be sure the collar is properly located (see section on landing gear) or else the wheel will not fit properly.

8. Line up fitting holes with hole in collar and drill through axle from both sides.

9. Recheck the 3 degree dihedral angle, then carefully drill through the holes in the outer strut end and through the sliding tube, and bolt in place as shown on the drawing.

10. With the front tube now bolted in place, attach the RS-410 block to the rear strut wing fittings.

11. Attach the rear strut outer end to the block, per the drawing.

12. The rear strut tube controls the amount of wing twist. No twist or washout is used on the aircraft. To set the wing tip angle, hold a board or plywood sheet against the lower section of the wing at the root rib. Have a helper place a carpenters level on the side of the board and adjust the level until the bubble centers.

13. Draw a line on the board along the top of the level.

14. Next move this assembly to the tip end of the wing and hold in the same position as at the root. Adjust the wing twist until the carpenters level again indicates the reference line on the board is level. If necessary, lift or push down on the trailing edge. There is now no twist in the wing.

15. With the rear strut outer end bolted to wing fitting, swing the lower end to the channel fitting. It may require several trim and fit operations until the end of the strut will slide into the fitting.

16. Before drilling through channel into tube, check once more that the fuselage has not moved and is still level, and that the wing still has no twist. Now drill and bolt.

17.. Now repeat the procedure for the other wing.

TAIL BRACE STRUTS AND ASSEMBLY

1. Make four brackets from 3/4" x 3/4" x 1/8" aluminum channel, per drawing 9.

2. Bolt stabilizer and fin together with AN-3 bolts.

3. Bolt brackets to fin and stabilizer as shown on the drawing.

4. Clamp stabilizer flat to bench. Be sure stabilizer spar is straight.

5. Use a carpenters square to ensure fin is perpendicular to stabilizer.

6. Cut RS-402 tail brace tube slightly longer than needed. Drill 3/16" hole in one end, as shown in drawing 9.

7. Attach tube to bracket on fin. Make sure fin is still perpendicular to stabilizer. Insert lower end of tube in bracket on stabilizer. You will have to trim and fit several times to get it to fit.

8. Drill 3/16" hole through tube. Drill carefully from both sides, using holes in bracket as a guide.

COVERING

Minimax is covered with a lightweight polyester fabric ("Dacron"), commonly referred to as "glider" fabric, which weighs 1.6 ounces per square yard. A specially formulated fabric cement is used to glue the fabric to the structure. The method of finishing the aircraft is optional and is not covered here. The Experimental Aircraft Association publishes several manuals, including "Aircraft Dope and Fabric", and "How to Install and Finish Synthetic Aircraft Fabric", along with many others. Also, Stits Poly-Fiber Aircraft Coatings, Post Office Box 3084, Riverside, CA. 92519, provides excellent finishing materials and instructional pamphlets which are highly recommended. Whichever finishing method you use, be sure to include an ultraviolet barrier, such as Stits "Ultraviolet blocked Poly-Tone". Otherwise, the fabric can deteriorate in direct sunlight in as little as four months.

1. All wood surfaces, including the surfaces to which the fabric is to be glued, should be varnished with polyurethane varnish before covering. One thinned coat followed by one full strength coat should be sufficient.

2. If you are a beginner, start with a small item, such as the vertical fin.

3. Cut the cloth for one side slightly oversized. There should be a minimum of one inch overlap around all corners and trailing edges.

4. Pre-coat all surfaces to which the fabric is to be glued with a heavy coat of cement. Note that the fabric should also be glued to all the rib caps.

5. Apply a coat of cement to the frame about 12 inches at a time. Lay the fabric on top of the wet cement and press and rub the fabric until the weave is saturated. If necessary, a little cement may be brushed on top of the fabric.

6. You may develop your own technique, but this one works for us. Begin at one end of the frame to be covered, for example, the root rib of the fin, and glue the fabric down. Now work up both sides about 12 inches at a time until the fabric is attached all around the outside of the frame. The fabric should not be excessively taut at this time, just enough to prevent bunching up. If you make a mistake, the fabric cement may be loosened with solvent.

7. Cover the other side similarly, but allow a minimum of one inch overlap over the fabric on the back side. This fabric-to-fabric bond is strongest.

8. Now shrink the fabric lightly with an iron set at about 250 degrees. Examine the frame for warping or "pulling in". Continue shrinking until the fabric is lightly "Drum" taut. It is best to have someone knowledgeable check your work and judge the appropriate tautness. Note, however, that this is an ultralight airframe, and the fabric should not be quite as taut as on a typical production aircraft.

9. Now glue the fabric to the ribs by brushing a thinned coat of cement through the fabric to dissolve the pre-coat of glue. Ensure that the fabric weave is saturated with cement and well bonded to the underlying wood.

10. All surfaces, including the wing leading edge plywood and fuselage plywood should be covered in a similar manner, however, when covering large areas of plywood, the fabric should be glued only to the outer edges of the area.

11. Flight tests up to the design flight conditions have indicated no tendency for the fabric to separate from the ribs. If you desire, and especially if you are using a larger engine and planning to operate outside the ultralight category as an "experimental" category aircraft, it is recommended that the fabric be ribstitched. The EAA manuals can instruct you in this procedure.

12. Drain grommets supplied with the kit should be installed to ensure the structure is adequately drained. A general guide to determining where to install these grommets is to imagine the aircraft completely submerged in water. When the aircraft is removed from the water and set on its landing gear in the normal ground attitude, the grommets should be placed so that all the water drains out. Areas of particular importance are the fuselage rear and the wing, stabilizer, and elevator trailing edges. The grommets are installed by gluing to the fabric with the fabric cement and punching out the fabric in the center.

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