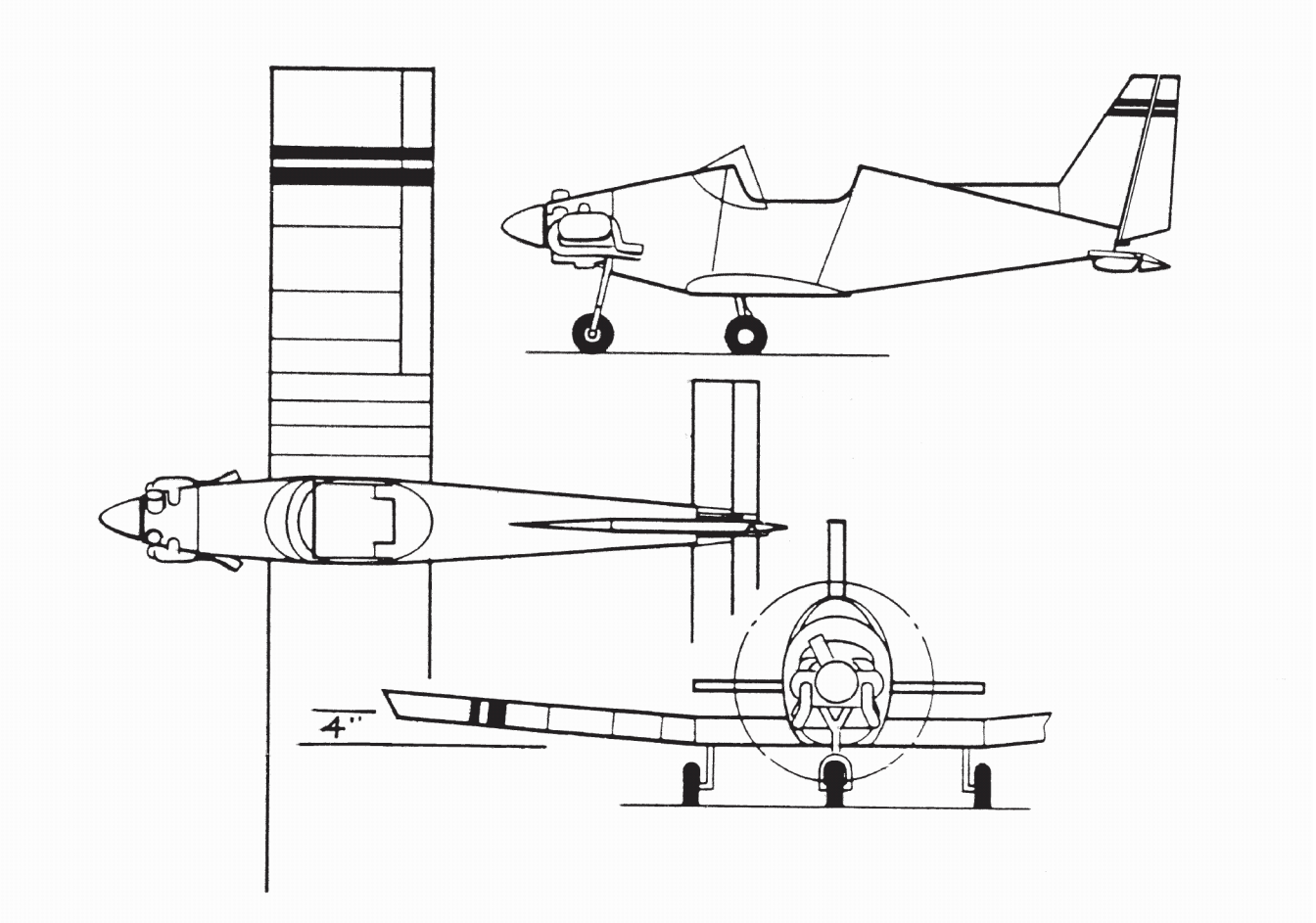
Teenie Two

N328WD



Manual constructed by
William L. Day

Teenie Two Construction Manual

This is a part of the Teenie Two construction plans. Any deviation from the handbook or the construction drawings, and fabrication assembly or operation shall be regarded as willful negligence on the part of the user and will invalidate all performance predictions claimed. These plans grant the purchaser only a non-exclusive license to make and use one aircraft or its components solely for his personal experimental purposes. Manufacture or sale of any part of the Teenie Two for profit or reward by anyone other than the Teenie Company is prohibited. Violators will be prosecuted.

In the United States, the Federal Aviation Administration (FAA) is the sole licensing authority for aircraft, and should be consulted for applicable regulations before construction begins. The seller makes no warranty of any kind, expressed or implied, except the material sold hereunder shall be of seller standard quality. Buyer and user assume all risk and liability whatsoever resulting from the use of such materials.

We recommend only the VW engine conversion as used on the original Teenie Two. Although other conversions might work, our experience has been that the baffling and manifold are more important than simply adding a propeller to the VW engine. Therefore only a tried and proven system for the particular airframe must be used for the safest operation.

NOTE: The methods of construction outlined in this manual are protected and are not to be used on any other aircraft.

Special Construction Precautions.

AILERON control arm length behind bulkhead ñCò is 3ò.

AILERONS: Control stick movement in cabin is 4ò total right to left. Neutral position is 2ò from right side skin. Ailerons move up 1ò and down 1ò total. During flight, about ¼ò movement of aileron is normal for turns or rough air. More aileron movement is needed only during strong crosswind landings or vertical bank turns.

CONTROL STICK linkage measurements are 11ò total, ¾ò between mount hole and linkage hole.

CONTROL STICK location in cabin. Control stick and aileron torque tube is on the right side of cabin, mounted between bulkheads ñBò and ñCò. The aileron movement of control stick is short enough not to interfere with the right side of pilotôs leg. If control stick is mounted in center of cabin it will be difficult to enter and exit from cabin and will also cost at least 4ò of headroom. Pilots flying Teenie Two have not experienced any difficulty with stick position. Left-hand pilots can mount stick on left side of cabin and reverse rudder control tubing.

SET BACK of main gear: Min. 6ò, Max 7ò behind vertical front of .040 spar channel. Measured with plumb at ground level contact of wheel.

ELEVATOR from neutral up 3-1/4ò and down 1-1/4ò. Adjust horizontal stabilizer for slight leading edge downward position to start. Control stick movement 4ò forward and 6ò rearward measured at top of stick.

NOSE GEAR LONG STEERING ARM dimensions between actuating holes is 5ò total.

WINDSHIELD A full size pattern is on plans. It is advisable to make this simple windshield and fly T-2 a few hours first, then make a simple plexiglas sheet wrap over the cabin. That is most economical way. However a blown canopy is available from several sources but, costs a lot more.

METHOD OF INSTALLING TOP ANGLES FROM BULKHEAD ñAò TO ñCò. Top angles fasten to bulkhead ñCò and to instrument panel ñBò. Wrap a piece of wire or rope around forward ends and with a screwdriver, twist to pull together enough to fit firewall ñAò. They will slant downward and if the ends canôt be pulled together enough, cut 2 or 3 places in horizontal part with hacksaw 2ò ahead of instrument panel. Cut in as much as ¾ò if required to

give smooth curve to sides. Add a piece of angle .040, ½ò wide and long enough to cover saw cuts at one end and 1ò high at the other end to keep gas tank from sliding back against instruments; use two rivets.

GENERAL INFORMATION.

Please read and study this instruction booklet and plans thoroughly before starting construction or writing the designer.

This aircraft is just about the ñmost minimumò airplane you can build in metal. It is almost entirely handmade and with handheld tools, so great care should be taken in cutting, shaping and drilling each part.

Less than this might leave your airplane below minimum and lead to trouble with the Federal Aviation Administration, if not with your own life.

In putting together these instructions and plans I have tried to make them as simple as possible. I have tried to make them clear to a beginner, without talking down too much to a more experienced builder. In doing so, I have had to take some shortcuts. For instance, I give you a basic list of tools, but I have to assume that you know how to use them. I have been very specific about most materials and dimensions, yet when I am not specific I have to assume that common sense should tell you what to do. Otherwise, these instructions would run to hundreds of pages.

Some examples: When you cut or drill metal, smooth down the rough edges. When you bend metal over a wood template, smooth down the rough edges of the wood before bending the metal over it. I have not repeated this in the instructions each time I tell you to cut, drill or bend a piece of metal. Also, when mating the parts, the areas where metal touches metal should be sprayed or brushed with zinc chromate. Under certain conditions aluminum may corrode. The chromate will help prevent it. Itôs best to put it on at the last minute, just before you rivet or bolt two pieces together permanently, while the chromate is still wet. I have not repeated this each time you have to mate two pieces.

Perhaps the biggest problem, however, especially if you have not worked with metal before, is the metal itself. It can be contrary. My best advice is, ñBe gentle!ò A too-sharp bend in aluminum will make the aluminum hard at that point, and easily cracked. When bending aluminum, take it easy. Bend no more than 30 ºs at a time, and no more than an inch or so at a time. In other words, when making a 90º bend, go over it at least three times, and bend no more than the width of the hammer with each stroke. Also, keep the strokes even, so that each complete pass down a strip will produce an evenly bent strip, with no waves in the metal.

WARNING!!!!!!!!!!

Note: Order of construction should be

1. **Build entire 3 sections of wing and ailerons. Install both main top gear legs and bulkhead “B” and “C” sides before final top skins are riveted.**
2. **Fuselage and nose gear.**
3. **Tail group.**
4. **All controls and connections.**
5. **Instruments, gas tank, engine, windshield and cowling.**

WARNING!!!!!!!!!!
If you deviate from above sequence, expect to take a lot of extra time and work. In addition, it will not go together straight.

Even if this is your first attempt at building your own airplane there is enough flexibility built into design to accommodate even a rank beginner. Some details are deliberately vague, because if you follow them verbatim you might think there is no other way and youôll learn nothing. I have spent several years and much thought developing this ñminimum designò and there is enough built-in variation, in dimensions and workmanship, to accommodate anyone whoôs reasonably conscientious. And for the more experienced builder, this is about as inexpensive as you can go in an all-metal craft.

All things being equal, however, itôs best to come as close to the instructions as possible. And where extreme care should be taken Iôve said so. After all, the essential purpose of the experimental category under FAA regulations is ñeducation and recreationò. Youôll get more education if you extend yourself in building your airplane, and youôll get more recreation from it if you build it as well as you can.

TOOLS YOU'LL NEED

HACKSAW
Need one that takes interchangeable blades, with
18-tooth blades (for wood)
24-tooth blades (for metal)

TIN SNIPS
One 14ò duck-bill snips (for straight cuts and slight curves)
One right-cutting snips and one left-cutting snips (for short, sharp curves)

FILES
Large, coarse metal file (for rounding sharp edges on extruded angles)
Small, fine metal file (for smoothing extruded angles)
Sandpaper (for smoothing rough edges on aluminum sheets)

HAMMER
1lb. or 2lb., double-faced, plastic-tip hammer will do 99 percent of work. Use softer side for main bending, harder side for finishing.

DRILL
Variable-speed electric drill is best, with
1/8, 3/16, ¼ and 3/8 steel bits

CLECO SET (used to hold metal together after drilling and before riveting)
Cleco pliers with at least 25 clecos, 1/8ò hole size (available through standard aircraft supply catalogs). If clecos are not available, use No. 40 drill and self-tapping metal screws to hold while drilling. When ready to assemble, remove alternate screws, use No. 30 or 1/8ò and drill.

POP RIVETS (regular rivets wonôt work on this design without extensive changes)
Standard Pop riveter, with
1000 1/8ò diameter short-length steel rivets, 1/8ò grip length.
500 1/8ò diameter medium-length steel rivets, ¼ò grip length.
500 1/8ò diameter long-length rivets, 3/8ò grip length.

FUEL TANK
To filter sediment and drain water; use finger strainer at outlet, inside tank.

Saw off neck (with cap) from an automobile tank from a junk yard, drill and notch and bend flaps, pop rivet to top of your tank then soft-solder.

Drill hole in gas cap, put loose-fitting welding rod with cork at bottom and sharp bend at top through hole; file markings on rod for use as gas gauge; drill 1/8ò hole off center for vent.

Add shutoff valve to bottom of tank and quick-drain filter between tank and carburetor (for draining water); this is very important.

Quick-drain filter should be at lowest point in fuel system.

ENGINE (prefer minimum of 53 hp, 1600 cc VW)
This airplane was built to accommodate any existing Volkswagen engines up to 65 horsepower; no other engine has been tried or should be used.
Ideally, if you have experience, you can purchase VW parts from a dealer, machine your own propeller hub and put the engine together yourself.

NUTS, BOLTS, AND BUSHINGS
I used certified aircraft bolts, Army-Navy specifications, and Shakeproof plastic lock nuts; moving bolts need cotter pins or other safety lock.
Various assortments, at reduced prices, are available from various aircraft supply houses.

INSTRUMENTS. (See full-size pattern)
These are the basic instruments required by FAA. Purchase your instruments (see Trade-A-Plane) before cutting holes in instrument panel. In general, put larger instruments in center of panel, and smaller instruments toward outer edges.

AIRSPEED INDICATOR
Includes pitot tube and tubing to indicator; pitot tube can be ¼ò diameter aluminum tubing.
Place pitot tube under leading edge of wing. Should be outside main landing gear and stick out 6ò in front of wing and 4ò below leading edge at center section outer rib.
¼ò metal or plastic tubing to indicator should be used.

ALTIMETER (no hookup necessary)

COMPASS
Just install, but as far away from tachometer (which has a magnet) as possible.

The following instruments are on our VW conversion plans: Oil-pressure gauge; Oil-temperature gauge; Tachometer.

RIVET SPACING AND METAL HANDLING
Be patient, be accurate in bending and drilling metal. If in doubt about spacing rivets where not specified, space as much as 2ò apart on main spar on outer wing panels, for instance, but come down to 1ò apart nearer wing roots. Wing skin to ribs ï 2ò spacing. 1ò spacing is preferable elsewhere, although you should come down even ½ò apart near motor mount and around bulkhead ñEò. Clecos are used to maintain alignment for drilling or riveting. Use your own judgment about how many to install for each operation but itôs best to cleco parts together at each end and as many at the center as is necessary. Youõll learn as you go along, as the metal begins to ripple slightly, where to make exceptions to the general rule. A minimum of 25 clecos will be needed.

WINGS

OUTER PANELS

Ribs

Use .020 aluminum sheet.

First make plywood templates, tracing drawing in plans. Save the outer section of the plywood to use as clamp when fitting leading edges. Cut 23 blanks from aluminum stock to make ribs; 5 are for each outer panel. Allow at least ¾ò for tabs. The end rib in each outer panel becomes the wing tip, and can be made later, even after the rest of the airplane is complete.

Place all 23 ribs together between plywood templates, clamp together and drill at least two guide holes through them. Bolt everything together through these holes, then complete drilling, including remaining guide holes, flange holes (make sure you use holes indicated for outer panel) and holes around the edges where tabs will be made.

Remove ribs from templates. With tin snips, make tabs by cutting toward holes on slant as shown on drawing. Replace ribs, one at a time, between template. Bend tabs in one direction on one-half ribs and in opposite direction on other-half. They will be used on opposite panels, with tabs facing away from fuselage.

Remove rib, cut out main spar flange, starting with holes, and bend in same direction as rear tab, except center tab and rear tab should be bent same way as top and bottom tabs for panel end ribs. To bend the flange, make a small wood block that will fit flush against base of flange. Using guide holes, drill holes through block and bolt in place. Then bend flange over end of block.

To make outer rib (the wing tip), finish wing, then cut the end in such a way that the wing tip will be on a slant, at least 2ò farther inboard at the bottom than at the top.

Cut the skin with a tin snips, and make a bent flange at the end of the main spar so it will fit snugly against the wing tip. Make a template, placing plywood or even cardboard pressed against the wing end. Proceed as with other ribs, except that no guide holes or spar flange have to be made. Tabs will fit inside, not outside, wing end.

MAIN SPAR

Use .040 aluminum sheet.

This is a major part and should be made with care. The spar should match up snugly with flange openings cut in ribs. It should slide in the ribs with a little friction. It will curve as much as 2ò in 6-foot length when removed from 2 x 4s. Donôt worry because curve is pulled out when ribs and angles are added. Cut spar to size, then place between 2 x 4s. Clamp together then begin tapping to make bends. When bent, slide ribs on and space them according to drawings. Drill two holes through each rib flange and spar, and cleco ribs in place.

Make aluminum angles. Use .040 aluminum sheet.

These cover hole in rib made by flange, and strengthen connection, mount vertical.

Make angles long enough to fit inside main spar on opposite side from flanges, and wide enough after bending to cover flange opening, and attach to spar and rib behind opening (about 3ò). Bend to shape, drill and cleco. The extended angles can be put on and drilled along with operations described above, or afterward, using holes already drilled as guides. The extruded angles, 1/8ò thickness on outer panels and 3/16ò on inner panel, go on top and bottom, with lengths shown on plans. Toward the wing tip, the vertical sections are cut back as shown to reduce too much stiffness toward the outer edge. A little ñflapò in the wing prevents cracking. Another way to do the same thing is to cut off the vertical section about 2ò from the outer end, rounding off the corners, leaving a 2ò horizontal lip. Toward the wing root of outer wing panels, the spar and the angles top and bottom, stick out 2ò beyond the outer wing skin. This is your wing connection. First make a flange of the center web of the spar, between the top and bottom angles, and rivet it to the root rib. Now cut out the horizontal sections of the spar and angles, top and bottom, about ¼ò from the bend and about 2ò deep, rounding off the corners, so the angles will slide neatly into the center section spar in the space cut out of rib.

BOTTOM SKIN AND REAR SPAR WEB

Use .020 aluminum sheet.

Cut to size, then make bends to create rear spar. Place between 2 x 4s and make smallest end first (about ¾ò), then larger bend. The first bend forms the overhanging lip on the trailing edge and the second bend is made to fit neatly on rear edge of ribs. Now begin drilling, clecoing and riveting, using your own judgement. I prefer drilling and clecoing front holes on each rib, then working toward center, starting at main spar.

LEADING EDGE

Use .020 aluminum sheet.

Cut to size to overlap both top and bottom of main spar, C-clamp 2 x 4s to center of sheet, lengthwise. Work on carpet or cardboard to prevent scratches.

With 2 x 4s firmly in place, pretend the metal is a 6-foot long envelope, and youôre trying to bend the flap over. Kneel at the center, take the piece in both hands by one edge, and rest the other edge on the floor. Now push down gently, firm enough to start it bending, but not enough to crease it; about 45º. Remove 2 x 4s and place one on top. Now finish folding. The 2 x 4s will keep top edge from developing waves. Push to bend about 90º, but no more. Place piece on ribs, clamping in place with plywood pieces left over from making rib templates. Be *sure* leading edge radius bend matches rib shape.

Just prior to drilling leading edge skin you should make pencil marks along tabs on ribs. These lines, made with straight edge or string, and close to bend in tabs as possible (about 3/16ò), will help you line up the ribs for drilling blind through leading edge. Donôt drill yet. Sight along leading edge lengthwise, and line up tabs again, drawing pencil marks for each set of tabs. (You can do this easily because ribs are exposed at either end.) Now you can start drilling, because tabs will be cross-marked. Even so, you may miss one or two on each rib. Ribs, in spite of being riveted to main spar, still have some play in them at this point. Tap rib into place until pencil mark on it lines up under hole drilled in leading edge skin. Drill through, and cleco. When you have lined up and clecoed at least two tabs, the rest of the tabs will fall into place. Drill and cleco rest of the tabs through leading edge, except through spar. Top skin has to slip under this. It is riveted after wing is mostly finished and plumbed straight.

TOP SKIN

Use .020 aluminum sheet.

This skin underlaps, not overlaps, leading edge skin. Slip skin under leading edge, and mark top skin the same way, lengthwise, as the leading edge. Line up rear of each rib. Drill and cleco in front, and pencil in line on top skin.

AILERONS

Use .020 aluminum sheet.

Use 2 x 4s again, clamped near the center of the cut piece, then start bending. But this time go ahead and make a sharp crease for the trailing edge. In fact, after you take the boards off, use one of the 2 x 4s to press down on the trailing edge to crease down the bent edge firmly. You may need help to jump on the 2 x 4s to bend edge thin enough. Spread the leading edges apart slightly, slip a 2 x 4 between them and spread out sides. Clamp 2 x 4s together with about ¾ò showing; tap this strip down, then do the same with the other edge, tapping it up so the two strips overlap as shown in the drawing. The dimensions of the ailerons should match up neatly with the trailing edge of the wing, including slanted outer end cap. Rivet the piano hinges to ailerons and trailing edge.

EXTRUDED ANGLE

Rear spar attach point for outer wing panels.

Use 1ò x 1-1/2ò x 1/8ò. Its length should extend beyond second rib only from wing root. Angle should stick out 2ò beyond rear skin. This is your connection to rear spar of center section. Cut notch in horizontal top section of angle 2ò deep, so angle will fit neatly into space made by spacers on center section rear spar. Angle is held by rivets that hold aileron strip hinge (inboard) and two inboard rib tabs. After you have completed the outer panels, you should know a lot more about metal than when you started. I wonôt go into as much detail for the rest of the airplane, because much of the cutting, bending, lining up and drilling follow patterns already established.

CENTER SECTION

The center section, basically, is what supports your airplane in the air. Everything else is attached to it or depends on it for support, so great care should be taken in its construction. Generally, the center section is made just about the same way as the outer panels, except that you use a full-length 1/8ò angle for for rear spar. And the main gear and fuselage are attached to the center section.

RIBS

Use .020 aluminum sheet. Use 13 that youôve previously cut out.

Bend tabs one way on six, and in the opposite direction on others. On outer ribs, tabs will face in toward fuselage. Use guide holes on drawing for center section. Actually, except for the flange holes, offset, and rear tab, these could have been made along with the first 13 ribs. NOTE: The main spar opening is spaced forward by thickness of outer wing spar.

MAIN SPAR

Use .040 aluminum sheet and 3/16ò extruded angle.

NOTE: Bulkheads ñBò and ñCò sides should be made and drilled before skin is attached. Remove and rivet after skinning. Bend main spar to fit rib snugly. Make two 6-foot angles for top and bottom of spar, and use four 6-inch angles, two for each end.

Make enough flat aluminum spaces (5/8ò total, approximately) to accommodate 2ò protrusion of outer panel spar and angles, and cut out notch in top and bottom of center-section spar and angles to accommodate this 2ò protrusion. Use two bolts, top and bottom, to bolt together 6ò angle, spacers and 6ô angle. Brace outer two bolts with vertical extruded angle as shown. Top inner bolt also goes through top tube of landing gear. Holes for taper pins and bolts are about 2-1/2ò apart, but make sure all holes are centered away from any edges by at least one bolt diameter.

REAR SPAR, CENTER SECTION

Make like outer panels, from bends on bottom skin. Use .020 aluminum sheet and 1/8ò extruded angle. Make rear spar to size and shape shown, and rivet 6ô section of 1/8ò extruded angle to top at same time trailing edge is attached. Bulkhead ñCò and safety belt attach to rear spar, so you need the extra strength on top. Also, bolt 6ò sections of 1/8ò angles, outer end. Youôll need about ¼ò of spacers. Use two 3/16ò bolts to bolt together. Taper-pin hole and two boltholes will be about 1ò apart.

TRAILING EDGE, CENTERSECTION

Bend like aileron but only one bed. Front edge of top slides under top skin, back edges. Same rivets hold top skin, 1/8ò angles, and flange bent on bottom skin to top of trailing edge. Bottom of trailing edge is lapped ½ò outside on bottom skin and riveted, using 2ò spacing.

REMOVABLE WINGS

For removable wings, make notches in horizontal sections of spars and angles as shown in drawings, and slide the outer panel into place. It should fit snugly. Tilt the outer-panel wing up 4ò (measured with straight edge or string across bottom of center wing, for level) and prop it there while you drill your taper-pin holes. Use a No. 8 reamer, and ream just enough so a No. 8 taper pin goes through all angles yet still sticks out far enough behind for springs to be effective; about ½ò of the tip should show at most. Use two No. 8 taper pins, 5ò long on main spar, one No. 8 taper pin, 5ò long on rear spar, and two ¼ò diameter springs.

AILERON CONTROL HORN LINK

3 views are shown on planes. They take sideways movement from control stick and convert that movement to front and back movement to make aileron move up 1ò and down 3/4ò.

ACCESS DOOR

For removable wing, cut an access door in bottom skin large enough to accommodate your hand when slipping the taper pins in place for flight. The taper pins slip in from the rear on the main spar, and from the front on the rear spar, so you can reach all three from the same door. Hinge door or use inspection cover plate. No wing walk is used because of weight, extra work, and drag of bracing. A 2ò square of nonslip wing-walk grit can be painted on rear spar to use as step. I simply taped a 2ò piece of coarse sandpaper over rear spar at rib intersection, close to fuselage.

FUSELAGE

BOTTOM SKIN

Use .020 aluminum sheet.

Bottom skin is 6ô long, and tapered back to match bulkheads, with enough left over at each side to bend ¾ò flanges, as shown in drawing. While attaching to center section, you will have to support rear end of bottom skin with T-bar or some other brace. Bulkhead ñCò and top skin of center wing are all riveted to rear spar. A supporting piece should be made for bottom skin using .040 aluminum sheet. Make aluminum .040 angle long enough to reach across bottom skin from first rivet at trailing edge on one side, then cross bottom skin at 45º angle to opposite side of fuselage at bulkhead ñDò. This cross-bar will help prevent bottom skin from buckling on hard landings. Also, two gussets, one on each side, should be installed on fuselage skin C-D at point where bottom skin meets trailing edge. These will give added support to fuselage in this area. About 3ò high they should extend about 6ò on either side of bend, or far enough forward to meet bulkhead ñCò, and about same distance behind trailing edge. Bend flange on flat upper edge of gusset for added strength. Rivet to bulkhead ñCò and along bottom of skin C-D. See full-size pattern in drawings.

BULKHEAD ñAò

Use .016 stainless steel, 20 gauge.

This is the firewall and is made of different material than the other bulkheads. Make a template from plans, then make bulkhead. Crimp at corners. Use 3/16ò extruded angles for cross braces as shown, riveting to firewall with as close as ½ò spacing. Make bolt holes for mounting engine as shown. Be sure to use stress gussets under extruded angle; see full-size pattern.

BULKHEAD ñBò

Use .040 aluminum sheet, and make aluminum angles by bending inside edges forward on side pieces as per drawings.

This is the instrument-panel bulkhead, and can be made from the plans as shown. Bend tabs forward, away from cockpit, to prevent any sharp edges showing. Cut out holes for instruments, after measuring instruments carefully, with special cutout drill mounted on your electric drill (called a circle cutter), or drill holes and use tin snips and round file to smooth holes.

BULKHEAD ñCò

Use .040 aluminum sheet.

This is the bulkhead behind the pilot, and can be made from drawings as shown, bending tabs toward front on side pieces, toward read on top piece. Height is flexible, and can be made to suit pilot. Bulkhead ñCò is riveted to front surface of rear spar of center section. Cut hole on top skin forward of rear spar in order to rivet ñCò sides, and cover hole with plate. Safety belt bracket is also bolted to rear spar. Cut hole in trailing edge top skin, behind rear spar, for aileron control arm.

BULKHEAD ñDò

Use .040 aluminum sheet and .040 angles.

If ñCò is built higher than plans, make sides of ñDò to match. Support rear of fuselage with T-bar made of wood strips when riveting: this insures proper kickup as measured from flat bottom of wing.

BULKHEAD ñEò

Use .040 aluminum sheet.

Make from plans as shown, or wait until fuselage is complete and make your own template from final shape of D-D.

FUSELAGE SKIN

Fuselage skin is cut to fit bulkheads, and in all cases it overlaps front to rear or top to bottom. All skins are identified by bulkhead letters.

SKIN A-B

BOTTOM SKIN

Use .020 aluminum sheet.

First install extruded angles (1/8ò), pulling together forward ends to attach to angles on firewall, as shown. The bottom angles are installed with horizontal sections on bottom, and the top angles with the horizontal sections on top, to match with the angles on the firewall, as shown. Now attach to firewall, propping it up. Cut bottom skin from template and bend, using technique described earlier, and cleco to wing, angles and firewall. The others are cut to fit bulkheads as you go along.

SIDE SKINS

Use .020 aluminum sheet.

Cut to fit, and overlap bottom sheet.

TOP SKIN A TO B

Use .020 aluminum sheet.

Cut to fit, but drill separate holes for installing and use metal screws. This will give you easier access to fuel tank. Overlap side skins, and cut out hole for fuel tank filler neck.

SKIN B-C

Use .020 aluminum sheet.

This is your cockpit skin. Space ribs under side skin while wing is constructed, to match bulkheads. Do this before wing is skinned.

SKIN C-D

Use .020 aluminum sheet.

This is the most important skin in the fuselage, and probably should be installed first, as it may shape the rest of the fuselage. Wrap between bulkheads ñCò and ñDò, exactly 3ô wide all the way around, and begin drilling and clecoing from top center and down each side, one hole at a time. Watch to see that fuselage isnôt twisted out of shape. One clue is whether rear of bottom skin lifts ott T-bar support on one side or the other as skin is drilled and fastened.

SKIN D-E

Use .020 aluminum sheet. One piece wrap around.

Small gussets, made of 1/8ò aluminum cut from scrap angles, should be used to reinforce spot where bolt for control surfaces goes through. They can be installed inside skin D-E before these skins are installed, or outside after fuselage is complete.

LANDING GEAR

All 75 hours of test flying were made from rough sod field.

NOSE GEAR

Use 1-1/2ô .058 tubing for top, and 1-3/8ò for bottom with neoprene hose, well greased, plus spring. Bottom rod is cut, shaped and welded as shown. This is a tricycle-geared plane, so the nose wheel is tilted forward as per drawings, measured from lower edge of firewall. Nose gear tubing size behind the engine is 1ò .095 wall. It measures 8-1/2ò below bottom engine mount boltholes to end of weld of the 1-1/2ò tubing.

MAIN GEAR

Use same materials as nose gear.

The major gear tubing length is 11ò at the top and 9ò at the bottom. Top of top tube is cut as shown to fit neatly against top extruded angles on main spar, and is bolted to top inner spacer-bolt. Lock plate is welded to top tube as shown and bolted to bottom horizontal angles and spacers on main spar. Lock plate is against bottom skin, outside flush as per drawings. Main gear is tilted behind center of gravity 6ò behind main spar at ground contact point. Set up gear so bottom of wing is level and 15ò from ground.

SHOCK ABSORBER

Neoprene can be obtained from industrial supply house. Saturated with grease, it gives enough shock-absorbing quality in a plane the size of the Teenie to absorb the initial shock without transferring most to the airplane. Use Cadillac valve spring as per drawings. Put the bolt holes all the way through so they hold the tubing solidly, but ride up and down in the slot in the bottom rod. The slot is larger on nose gear to allow bottom tube to rotate enough for turning. You can use bushings around the bolts, after signs of wear, if any. The top and bottom bolts hold the neoprene hose in place, the middle bolt lets it ride up and down in the slot without wheel twisting.

TAIL ASSEMBLY

The tail assembly can be put on after the airplane is complete. Itôs better to make the control surfaces to fit the airplane rather than vice versa. Generally, they can be shaped the same way you made the aileron trailing edges.

VERTICAL STABILIZER

Use .020 aluminum sheet. (.040 for vertical spar.)

Use pieces for vertical stabilizer spar, as shown, bending of aluminum angles. Cut and shape vertical stabilizer spar to fit. Add a small clip of .040 bent to 90º, with 2 rivets at each end to fasten front edge of stabilizer to skin before dorsal fin is added.

RUDDER

Use .020 aluminum sheet.

Bend and shape as you did ailerons, to dimensions shown. Attach to vertical stabilizer spar with piano hinges 6ò long, rivet 1ò spacing. Rudder horn length is 2-7/8ò from hinge to bolt. Offset of rudder push-pull tube at rudder bar is 3ò to 4ò to meet rudder movement dimensions of 4ò each side of center.

DORSAL FIN

Use .020 aluminum sheet.

This is an important piece, absorbing some of the loads on the vertical stabilizer and eliminating another bulkhead. When riveting to bulkhead ñDò itôs best to follow this order of overlap: Starting from the bottom, bulkhead ñDò tab,

lips from two skins D-E, skin C-D, and dorsal fin on top. The dorsal fin should have 6 rivets per side on vertical stabilizer and 2ò rivet spacing on fuselage, to distribute load, plus .040 tab inside as per drawings.

ELEVATOR

Use .020 aluminum sheet and bend same as ailerons, be sure and build control horn as per drawings. Mount to horizontal stabilizer with 3 strip hinges, 1ò rivet spacing.

HORIZONTAL STABILIZER CONNECTIONS

Use 1ò x 1-1/2ò x 1/8ò extruded angle 2-1/2ô and .020 channel inside for spar. Hacksaw to shape and file down, smoothing to shapes shown. This eliminates excess weight. Add turn-buckles for adjustment as per drawings.

RUDDER AND ELEVATOR ALUMINUM PUSH-PULL TUBES

They are flattened to 3/8ò thick for about 1-1/2ò at rear ends. A slot ¼ò wide is cut on one edge about 1ò long so they will slide over the control horns. A ¼ò diameter hole is drilled through both sides and control horns. At least ½ò edge distance from hole edge to outside edge should be maintained. The tube is removed from over control horn and the ¼ò hole in horn is drilled to 3/8ò diameter. BALL JOINTS SHOULD NOT BE USED ON REAR ENDS IN PLACE OF SLOTS.

A piece of Teflon or neoprene 3/8ò diameter is drilled ¼ò which makes a tube which is cut about 1/8ò long. This is the bearing to use in control horn. A flat piece of Teflon or neoprene with ¼ò hole is used on each side as a washer between horn and tube. This forms a fail-safe joint at low cost, which is self-lubricated and will allow a slight universal movement. IF slack develops, a slight tightening of ¼ò bolt will remove it. In fact, Teflon or neoprene can be used at any wear or bushed surface on Teenie if desired.

Front ends are flattened just enough to fit universal ball joint ends with ¼ò bolt holes, maintaining ½ò from edge of bolthole to end of tube. Tubes may have to be bent slightly at center to clear bulkhead ñDò sides.

CLAMPS

Three C-clamps, 6ò or 8ò

2 x 4ôs

Two pieces fir, 7ô long.

TAPER REAMER

Optional, but necessary for removable wings. You can rent or borrow a set.
Get No. 8 reamer, and No. 8 5ò long 15 to 1 taper pins, 6 each.

ALUMINUM SHEETS

10 sheets, 3 x 12ô, .020 thickness, 2024-T3 Alclad (for skin, ribs, control surfaces)
1 sheet, 4 x 12ô, .040 thickness, 2024-T3 Alclad (for main spar, bulkheads, control surfaces spars, self-bent .040 aluminum angles)

STEEL SHEET

1 sheet, 9 x 19ò, .090 thickness 4130 chromolly (for main-gear mount, control bearing plates)

EXTRUDED ANGLES

75ô, 1-1/2 x 1-1/2 x 1/8ò thick, 6061-T6 structural aluminum angle.
(Basically, the extruded angles are used for stiffness, to keep the other metal from bending. File down and smooth the sharp edge at the outside center point of the angles before placing against the softer bends in the aluminum. File radius to match bends. Also, you will note that you have to make some angles yourself. All are made of aluminum.

To avoid confusion, I will refer to the angles you make as ñaluminum anglesò and the angles you purchase as ñextruded anglesò.)

STEEL TUBING MATERIAL

8ô, ½ò diameter, .035 wall 4130 chromolloy steel tubing.
5ô, 3/4ò diameter, .035 wall 4130 chromolloy steel tubing.
7ô, 5/8ò diameter, .035 wall 4130 chromolloy steel tubing.
3ô,1-½ò diameter, .058 wall 4130 chromolloy steel tubing.
3ô,1-3/8ò diameter, .058 wall 4130 chromolloy steel tubing.
1ô, 7/8ò diameter, .058 wall 4130 chromolloy steel tubing.
1ô, 3/4ò diameter, .120 wall 4130 chromolloy steel tubing.
5ô, 1ò diameter, .095 wall 4130 chromolloy steel tubing.

ALUMINUM TUBING

Two 8ôlong, 1ò diameter, .049 wall half-hard aluminum tubing for rudder and elevator push-pull rods, cut to length when installing. (Get at Sears or local hardware Reynolds aluminum rack.)

FIREWALL

22ò x 16ò .016 stainless.

HINGES

9 piano or strip hinges, 1-1/2ò wide (3/4ò each side) cut to 6ò lengths.
Steel cadmium plated hinges are least expensive.
But can use machined aluminum aircraft hinges.

FUEL TANK

Use galvanized sheet steel, usually gutter flashing, 28 gauge; drill and rivet sections together, using 2ò spacing, then soft solder seams together.
Make sure drain outlet is at bottom front.
DO NOT USE FIBERGLASS!

A piece of angle 1ò x 1-1/2ò x 1/8ò, is used from firewall. Alongside bottom rudder bar bearing, it extends back to where bottom skin rivets to bottom of wing leading edge. At the center rib, about 3ò of the vertical part is cut off. Rivet to center rib nose skin.

ADDITIONAL INFORMATION

FEDERAL AVIATION ADMINISTRATION

An inspector from the FAA must examine your airplane before it can be certified for flight.

CENTER OF GRAVITY TEST

The FAA will require a center-of-gravity (CG) test. There are several ways of doing it, but here is a simple test I used. Take two 2 x 6 planks and make a cross of them; the fore-and-aft plank on the bottom, the side-to-side plank on top. Nail them together lying flat. Place the plane on the planks, the main gear on the side-to-side plank. Using the main gear as a guide, mark the spot where the main-spar web should fall, using a plumb line. Chock the wheels. Take the plane off. Place a ¾ò straight piece of pipe under the planks and under the mark spotting the main-spar web. Now balance the planks so that they ride evenly on the pipe under the mark, either by weighing down either the fore or aft end of the bottom plank, or by sawing off either its fore and aft ends. This will give the planks neutral balance. Now put the plane back on in the same spot, and run two tests. At maximum load ï with large pilot, baggage and minimum fuel (1/3 tank) ï the plane and the planks should balance no more the 1ò behind main spar center web. At minimum load ï a 135-lb. pilot, full fuel tank, no baggage, and largest VW engine ï it should

balance no more than 3ò in front of the center web mark. In other words, the CG limits are 1ò behind the main spar to 3ò forward of the main spar, or anywhere in between.

NOTE: THE ABOVE METHOD IS ONLY SAFE WEIGHT AND BALANCE TO USE ON THIS AIRPLANE. IF BUILT TO PLANS, THE CG WILL BE WITHIN LIMITS.

FLIGHT PRECAUTIONS

AILERONS

Should be leveled with bottom of wing at the tips by laying a straight edge along bottom of wing 1ôinboard of tips. The straight edge should extend a foot or two behind ailerons. A spirit level should show any difference in twist between wings.

LANDING

Start a flare-out as you come across a fence at runway end. The glide should be maintained without pulling on stick until the wing is down into ground effect, or 3 to 5 feet high. A fairly quick flare-out will touch main gear; relaxing the stick slightly will lower nose gear onto runway. 10% above stall will give a quick and smooth touch-down without ballooning or the necessity to kill off excess speed. During 20 or 30 mile cross-wind or rough thermals, a slightly higher approach speed should be used. Avoid unnecessary quick movements close to ground with elevator. This plane is so stable it will sink without any tendency to drop off on higher wing when in full stall, which may mislead you into thinking it is still flying if the flare is too high or above ground effect. This causes a hard drop landing but a slight increase of throttle or slight relaxing of stick will catch the flare.

I will be glad to answer any questions regarding the construction of this airplane from purchasers of plans; however, we will not answer questions on design changes.

NOTE: ANY ALTERATIONS TO THIS AIRCRAFT DESIGN DOES NOT MAKE IT A NEW DESIGN TO MARKET UNDER A DIFFERENT NAME. ANY ATTEMPT TO DO SO WILL BE DEALT WITH. CHANGING ENGINES, WHEELS, OR MINOR AIRFRAME AND COSMETIC ALTERATIONS, DOES NOT ENTITLE ANYONE TO THE PROPRIETORY AIRFRAME DESIGN. PROVEN FO 30 YEARS.

Finally, although great pains have been taken to design plans to make this minimum airplane as safe as possible, neither myself nor the suppliers of materials can assume any liability for the construction or use of any airplane based on these plans.

Calvin Y. Parker

ANNOUNCEMENTS

The fuselage skins from Bulkhead ñCò to ñDò will be easier to build by making them in three (3) pieces. Bend ¾ò flanges inside top edge of lower pieces at baggage compartment. Lap top skin over and rivet. Wonôt look as good, but a lot less work.

A WORD ON RIVETS:
The Teenie Two is designed to have full strength using Hollow steel rivets ï cadmium or zinc plated (which is same corrosion protection that is used on aircraft bolts) and dipped in zinc chromate or Aluminum paint and push them in and pop with tool, wipe off excess paint before it dries. I used zinc chromate on all bottom surfaces and painted in Red with Sears Alkyd paint in spray cans, also used Alum. paint on top rivets, because I wanted the Teenie Two to look Aluminum.

We reserve the right to discontinue or change design without obligation to update plans sold in the past.

There have been NO crackups by airframes built according to our plans. All reported accidents have been pilot error and illogical overweight alterations.

The only allowable alteration is widening cabin 1ò each side at Bulkhead ñBò and ñCò. Adjust width of Bulkhead ñDò to fit. Adding canopy, cowl and wheel fairing is NOT an alteration and is allowable. A finger strainer screen MUST be used in all gas tanks at fuel outlet.

There have been some complaints from inspectors about the spar warping or curving after bending with 2 x 4s and 2 lbs. plastic hammer. The ribs also look warped. But be assured that this is normal and all will pull out as ribs and bottom skin is added to spar.

Shoulder Harness Hard Points are at bottom back corners of baggage compartment. A 3ò piece of 1/8ò aluminum or steel is riveted to backside, lapped under corner. At least ¼ò bolt with washers are used to hold shoulder harness.

WARNINGS!

THE VERTICAL .040 BENT ANGLES ON REAR OF MAIN SPAR CHANNELS TO HOLD RIBS IS ABOUT 5 ½ò LONG. THERE IS NO NEED FOR A CENTER RIVET EXCEPT LAST 2 RIBS ON OUTER WING TIPS.

Build wings first. Then instrument panel sides should be attached to forward face of main spar by cutting slots in top of leading edge skin. Rivet by drilling from rear after skin is cut from seat bottom.

THE T-2 LANDING GEAR IS DESIGNED TO BEND ON AN EXTRA HARD LANDING. IT IS A SAFETY FACTOR TO WING DAMAGE. THE CENTER WING IS PART OF GEAR DESIGN. IT IS THE LIGHTEST AND LEAST EXPENSIVE TYPE FOR THIS AIRPLANE.

IT IS ALSO A LIMITED MOVEMENT SHOCK TO CONTROL BOUNCE, AND THE SLOT ACTS AS A CROSSWIND GEAR. DO NOT MAKE ANY CHANGES IF YOU EXPECT TO HANDLE THIS SIZE AIRCRAFT.

THE WHEELS WE USE ARE THE PROPER SIZE RATIO FOR ROUGH FIELDS. ALUMINUM WHEELS SHOULD NOT BE SUBSTITUTED BECAUSE SIDE LOADS ARE MOST IMPORTANT.

THE CONTROL SYSTEM IS A LITTLE QUICK, BUT IS NOT TRICKY. IT IS DESIGNED THAT WAY FOR AEROBATICS AND HAVE CONTROL UNDER SEVERE FLIGHT CONDITIONS. NO NOT DEVIATE FROM LINKAGE RATIOS LISTED IN PLANS.

MY TEENIE TWO HAS HANDLED 60 MPH CROSSWIND SQUALLS AND ROUGH GRASS FIELDS FOR 30 YEARS, BUT WILL NOT IF ANY CHANGES ARE MADE.

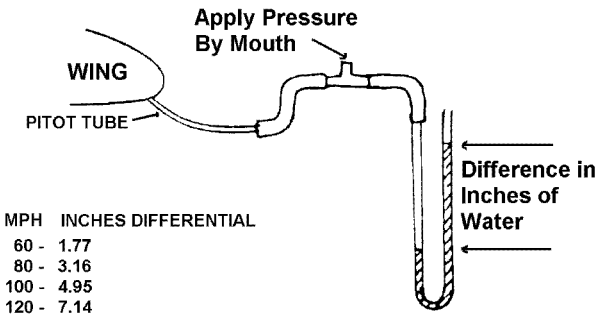
Horizontal stabilizer mount angles should be long enough to set leading edge behind and touching Bulkhead ñEò. Bottom of stabilizer is level with bottom skin.

Slant of horizontal stabilizer should be adjusted before first flights ï so a line drawn through center of end cap will reach top of wing between front main and rear spars. This will assure a reference level to adjust the elevator up and down limits.

Nose Gear: Welded patches shown on plans are not needed as shown by field experience and the nose gear is designed to fold at steering arm.

Nose gear steering arm linkage may be easier to hook up if fork is rotated to put steering arm on front. Cut slot so sides will limit steering to match rudder movement limits.

AIRSPEED INDICATOR CHECK



MPH	INCHES DIFFERENTIAL
60 -	1.77
80 -	3.16
100 -	4.95
120 -	7.14
140 -	9.73
160 -	12.70

Rudder bar is 4ò from bottom skin at firewall.

Aileron end caps will have longer life and be safer if bent from .035 steel. Control arm tabs are welded on before final installation of end caps.

Aileron bell crank outboard ends are inboard of aileron end cap. Cut short angle and skin at bottom to clear movement as shown on plans.

Bottom angles between Bulkhead ñAò and ñBò at top of main spar:

The rear end vertical side is cut back 1-1/2ò, which will leave a horizontal tab. The horizontal tab is then trimmed to ½ò wide, which is then fitted in the notch in ñBò side level to top of main spar. Two (2) rivets are used to fasten to top main spar to hold until skins are riveted on. Bend ends to align flat.

Bulkhead ñDò, Top Pattern, is narrow by width of the tabs. Bend line should be at the tab width. Then add ¾ò each side for tabs to match straight line between Bulkhead ñCò and ñEò.

Control Stops. Downward movement of ailerons and elevator is limited by balance weights touching rear spars. Hole cut in top of trailing edge where aileron actuating arm goes down behind seat will limit movement. In fact, ¾ò up and 1ò down are the usual limits because of the limited movement of arm. Elevator up limits are set at control stick bottom. Rudder movement is limited by rudder bar touching firewall on each side.

ADDENDUM June 9, 1989

I have long been a great fan of doing things on the cheap. The sole purpose of building homebuilt aircraft is to get all the flying that you are after to show up reasonably well using the minimum possible time, cost, and effort.

I have seen countless projects ruined or changed into something entirely different and totally out of control by trying to redesign a proven design.

One of the main features of this design is utilizing the minimum sheet sizes. Measure wing skins first by using rib drawing.

Wing ribs are made from leftovers after cutting skins.

Build all three wings first. Before final riveting, skin bottoms, leading edges, and tops, join together and cut slot ahead of main spar at instrument panel sides. Drill and rivet from backside of main spar at seat bottom opening.

As stated on these blueprints and instruction book, these prints are a permit to build one airplane. The prints must be kept with the completed airplane and have a valid serial number and are not to be sold or copied and sold.

That is why others advertising used or new Teenie Two plans is not valid.

I will not talk about building unless you have a serial number.

A fee will be charged for paperwork to transfer serial number from one person to another.

To eliminate using 4 rod ends and a lot of welding, flatten ends of ½ò .035 chromolly tubing that is used from rear of control stick to push-pull aileron cranks. Flatten ¾ò in vice with taper. Use nylon or teflon rod 3/8ò diameter drilled 3/16ò to fill in after wear or slack shows up in future.

ADDENDUM Nov 2, 1993

Page 7 Plans ï Aileron horn horizontal arm should clear rear spar taper pin.

Main Gear on sheet 6 ï Upper shock bolt is shown close to top end of inside tube. Drawing is half scale and looks close to top end of inside tube. It should be high enough to clear inside tube by ½ò.

Nose gear shock and steering damper hose should be tight fit on bolt in slots.

Steering arm should be turned to front of strut.

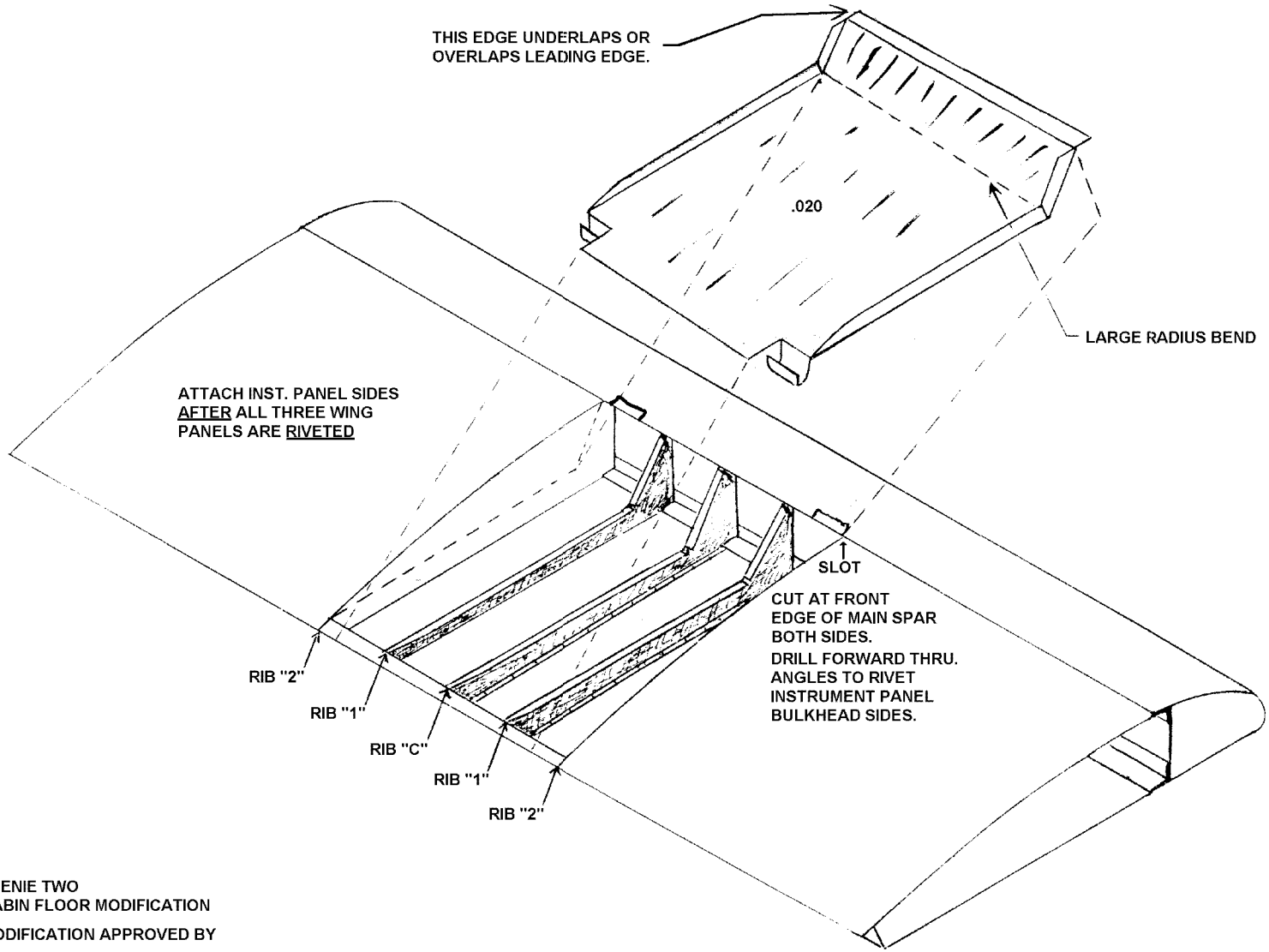
Springs in push tubes should be of strong enough to control steering on bumps in rough fields.

Steering bushing on bottom of rudder tube is drilled ¾ò apart and should be ¾ò from center of vertical tube.

Elevator horn on sheet 7 is vertical and tube hole is 2ò high and 1ò behind elevator hinge pin. With elevator horizontal position.

WIND SHIELD PATTERN
On page 3 of plans drawings are not marked clear. The arrow is pointing up on full size windshield pattern.

Mark off and point arrow down on plans pattern. It will fit both ways, but will not match the headrest curve on bulkhead C. Unless turned the right way. Then the .090 lexan will fit for winter cabin closure.

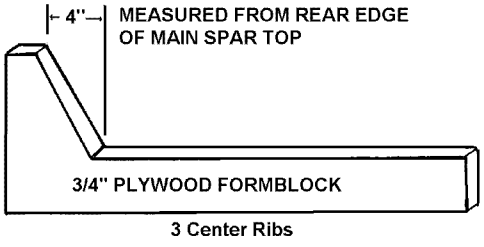


TEENIE TWO
CABIN FLOOR MODIFICATION

MODIFICATION APPROVED BY

C. Parker

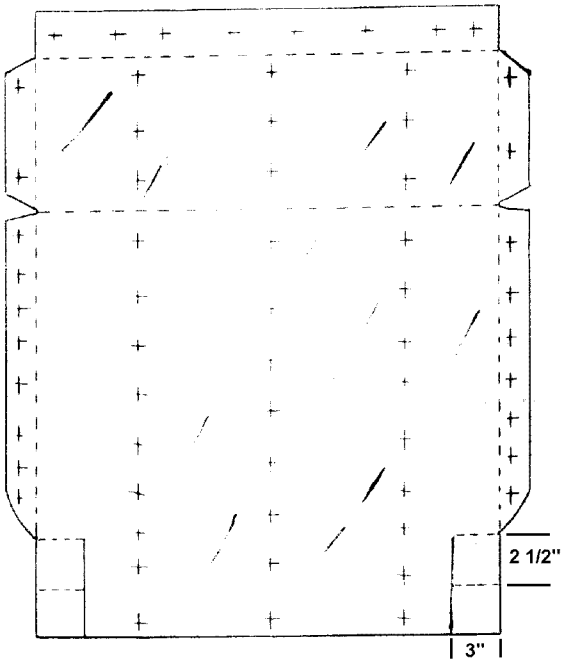
DRWG. BY R.W.S. 6/25/73
MOD. 12 - 1 - 91



3 Center Ribs

TEENIE TWO CABIN FLOOR MODIFICATION

1. CUT TOP WING SKINS FLUSH WITH RIB "2" AND MAIN SPAR
2. CUT DOWN THREE RIBS "1 & C" ALLOWING FOR FLANGE. LEAVE RIBS OUT AND PUT IN SUPPORTS AFTER CUTOUT.
3. BEND FLANGE USING 3/4 PLY FORMBLOCK.
4. MAKE BOTTOM PAN AS PER DWG. USE DIMENSIONS OF YOUR ACFT.
5. RIVET WITH 2" SPACING EXCEPT MAIN SPAR 1" SPACING
6. USE 1/4" "AN" BOLT FOR SEAT BELT.



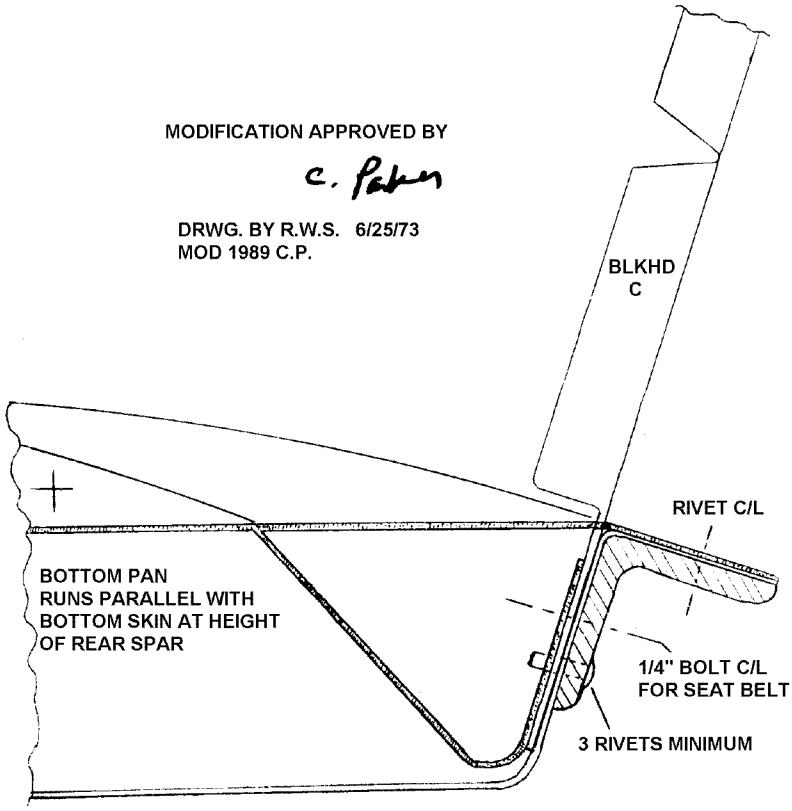
ADD THESE 3 RIBS AFTER TOP SKIN IS CUT OUT!

"+" DENOTES AREAS TO BE RIVETED

MODIFICATION APPROVED BY

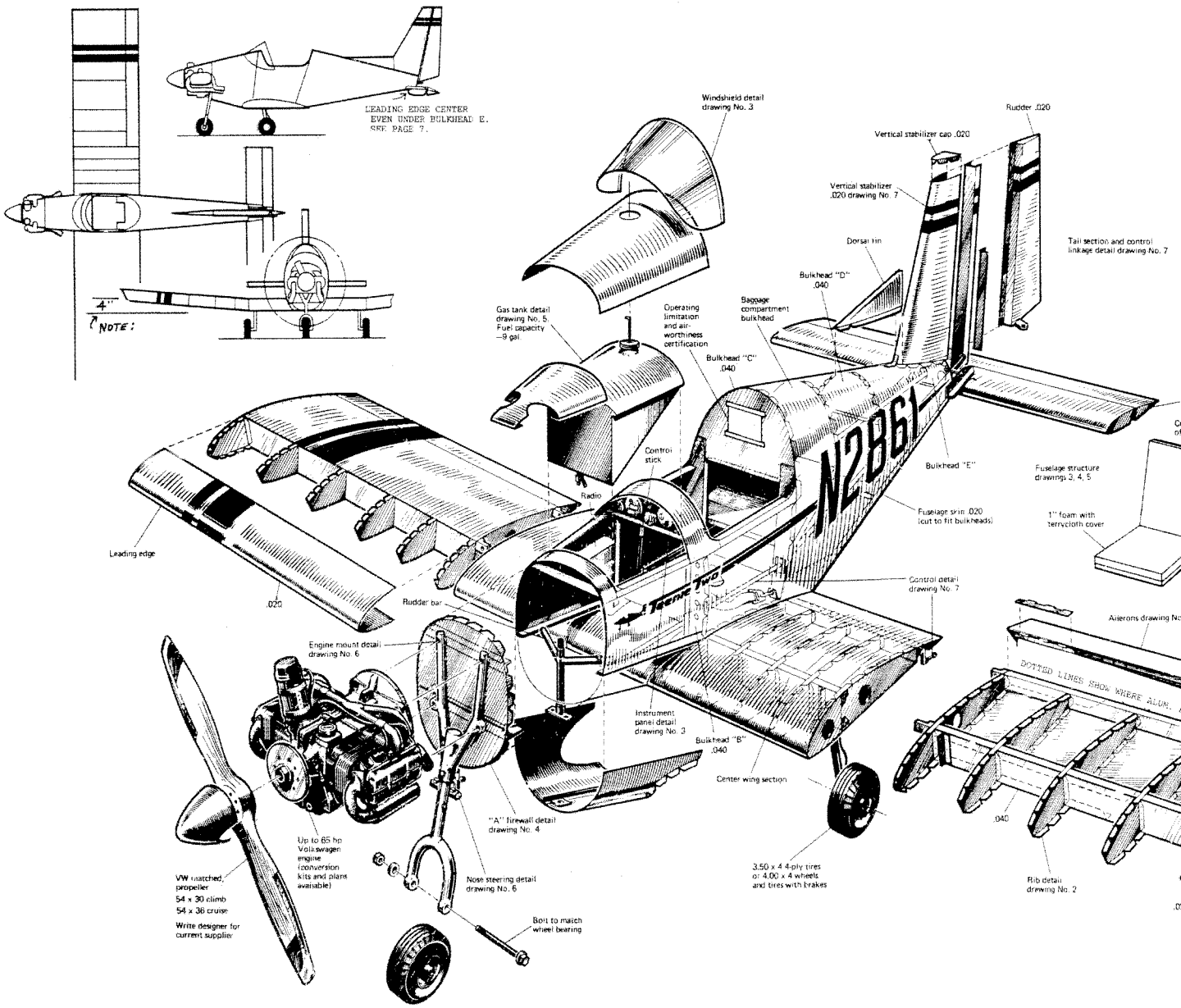
C. Parker

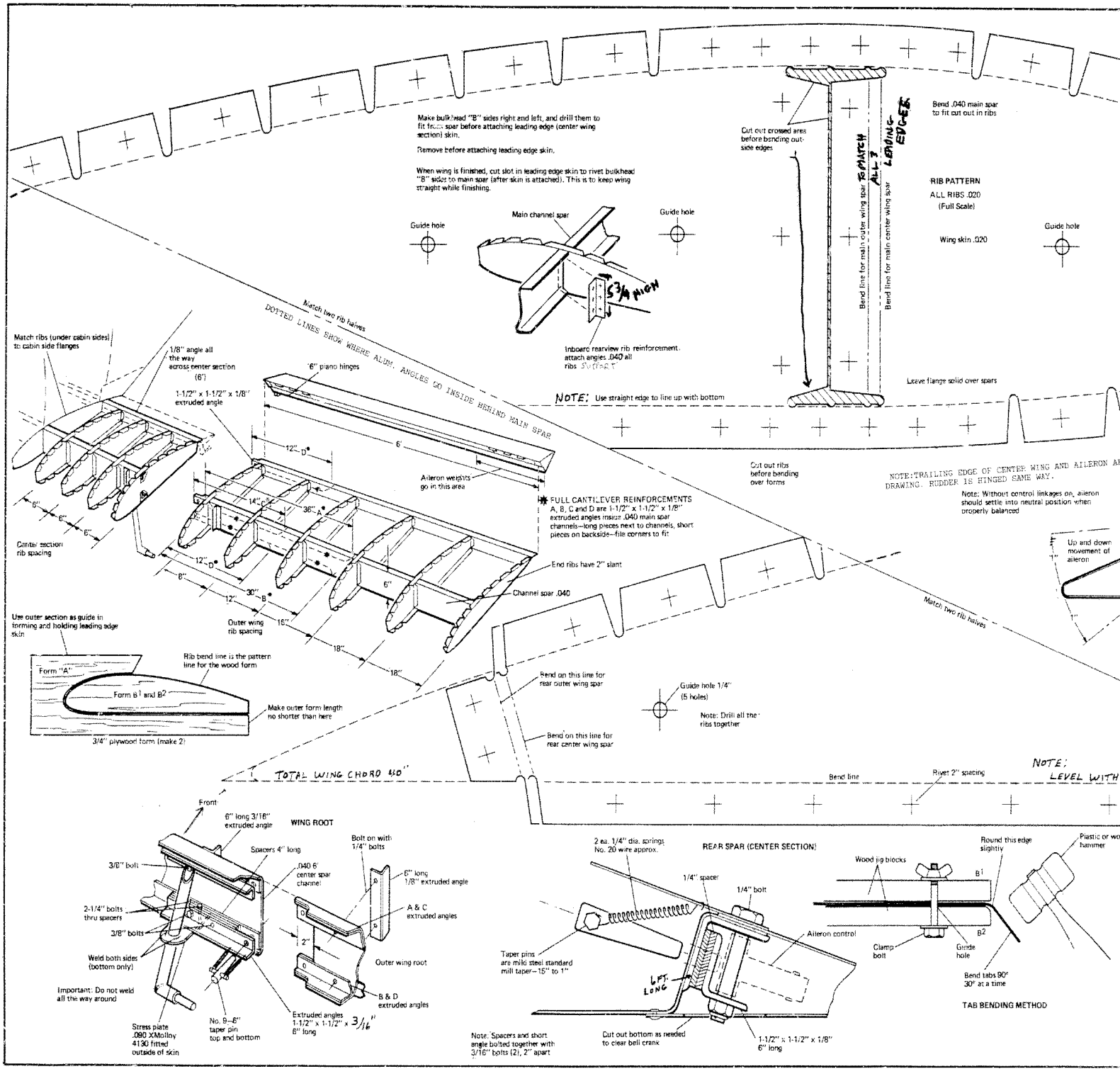
DRWG. BY R.W.S. 6/25/73
MOD 1989 C.P.

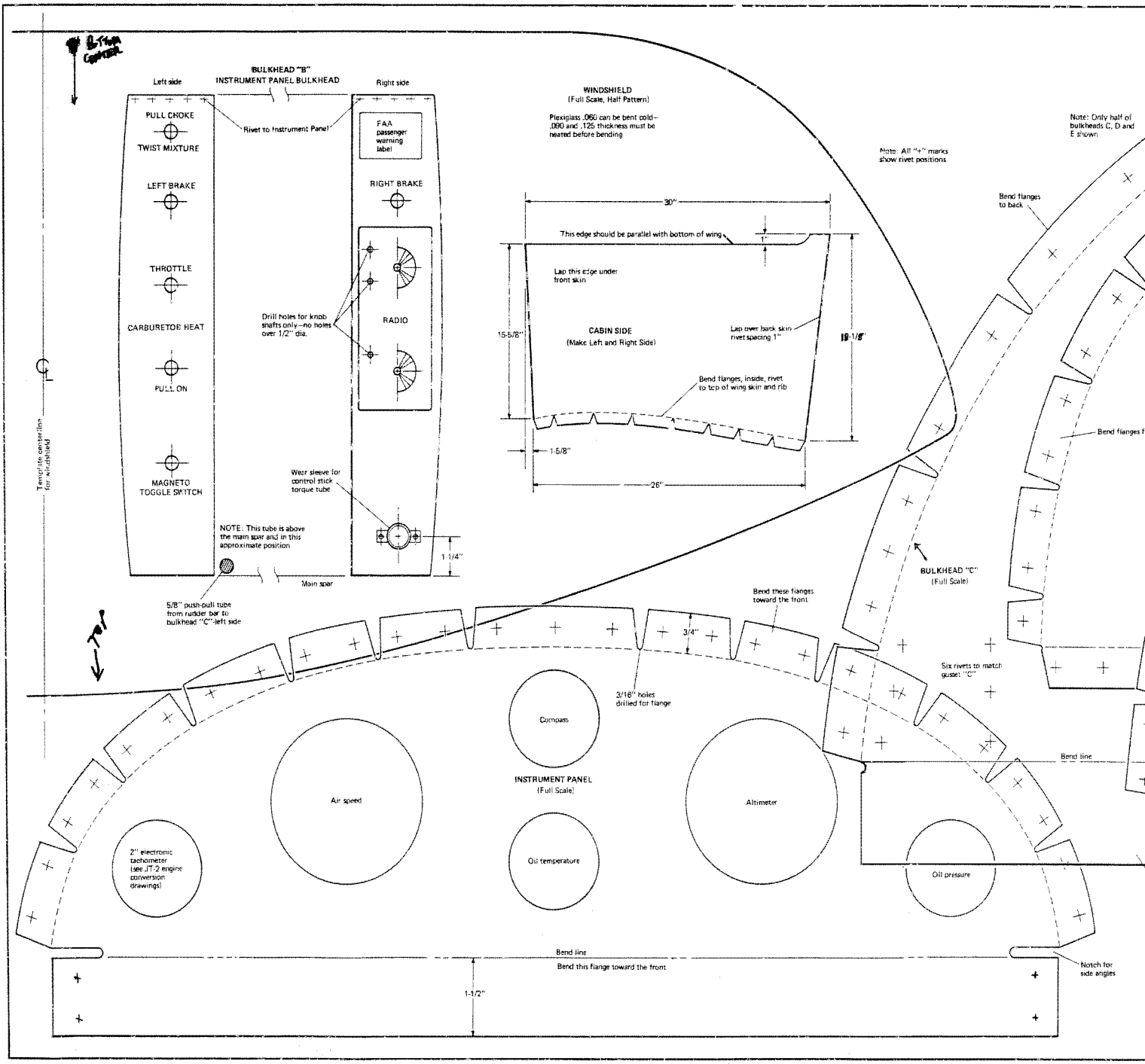


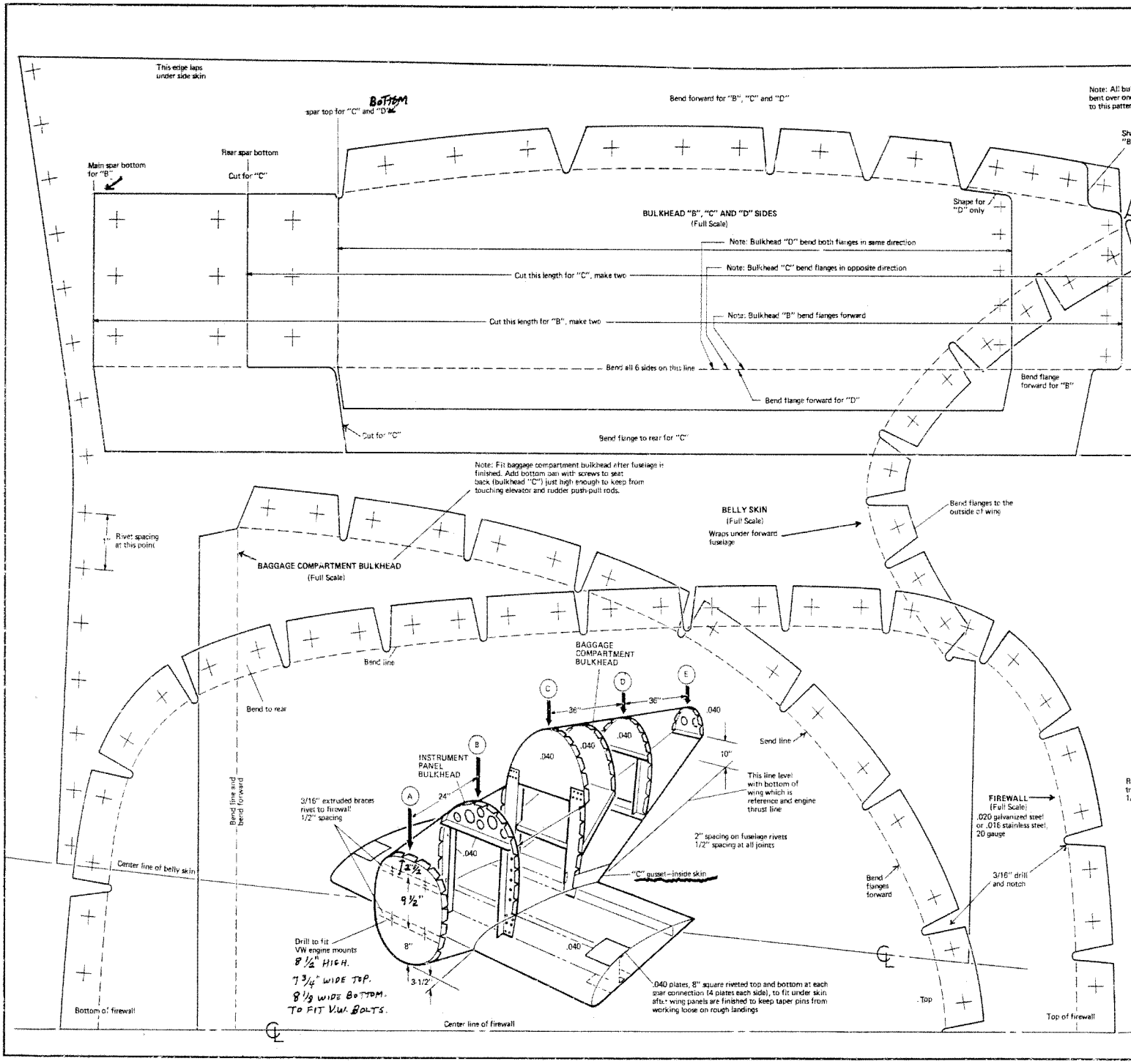
DWGS. ARE NOT TO SCALE

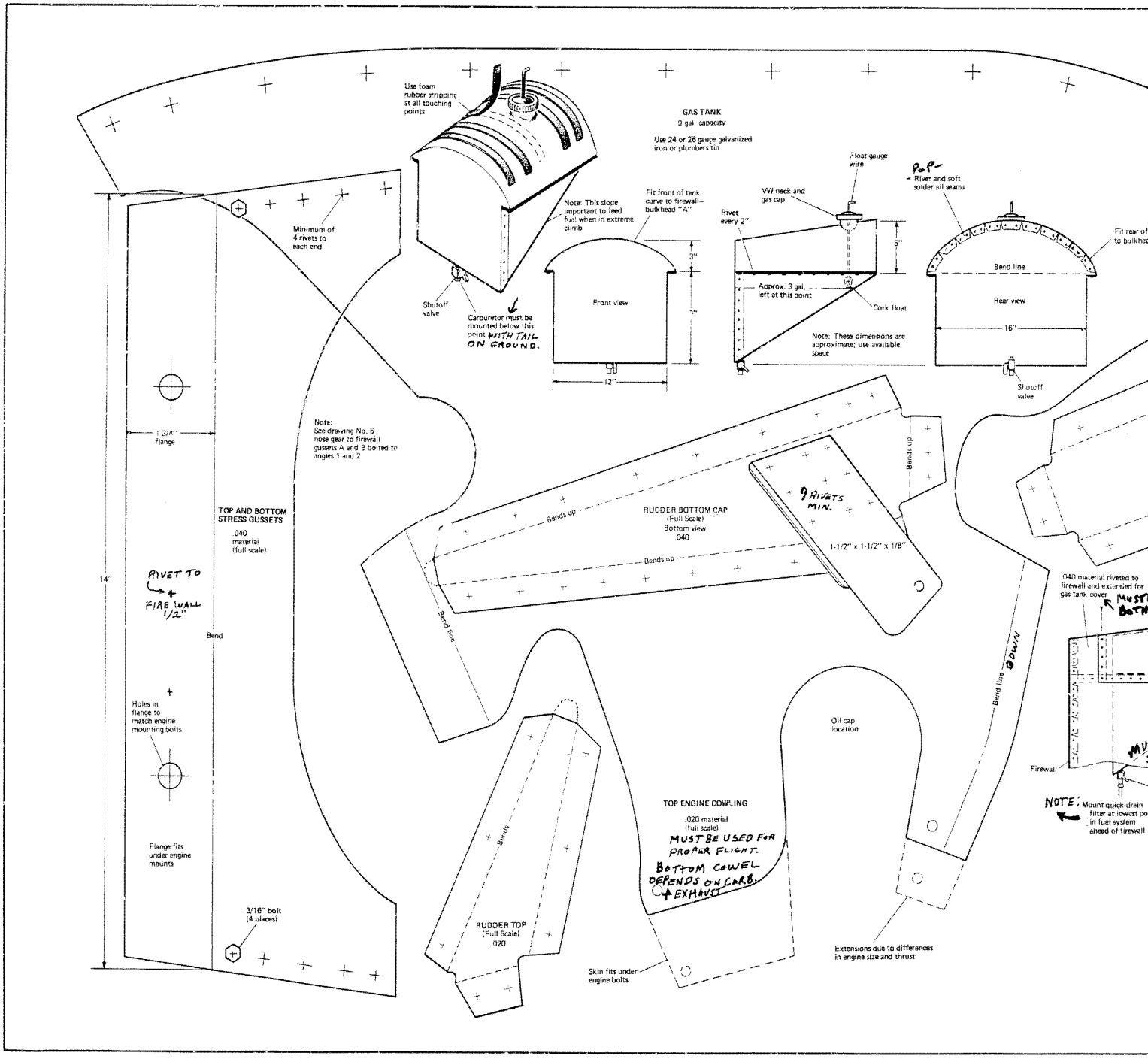
MOD 12 -

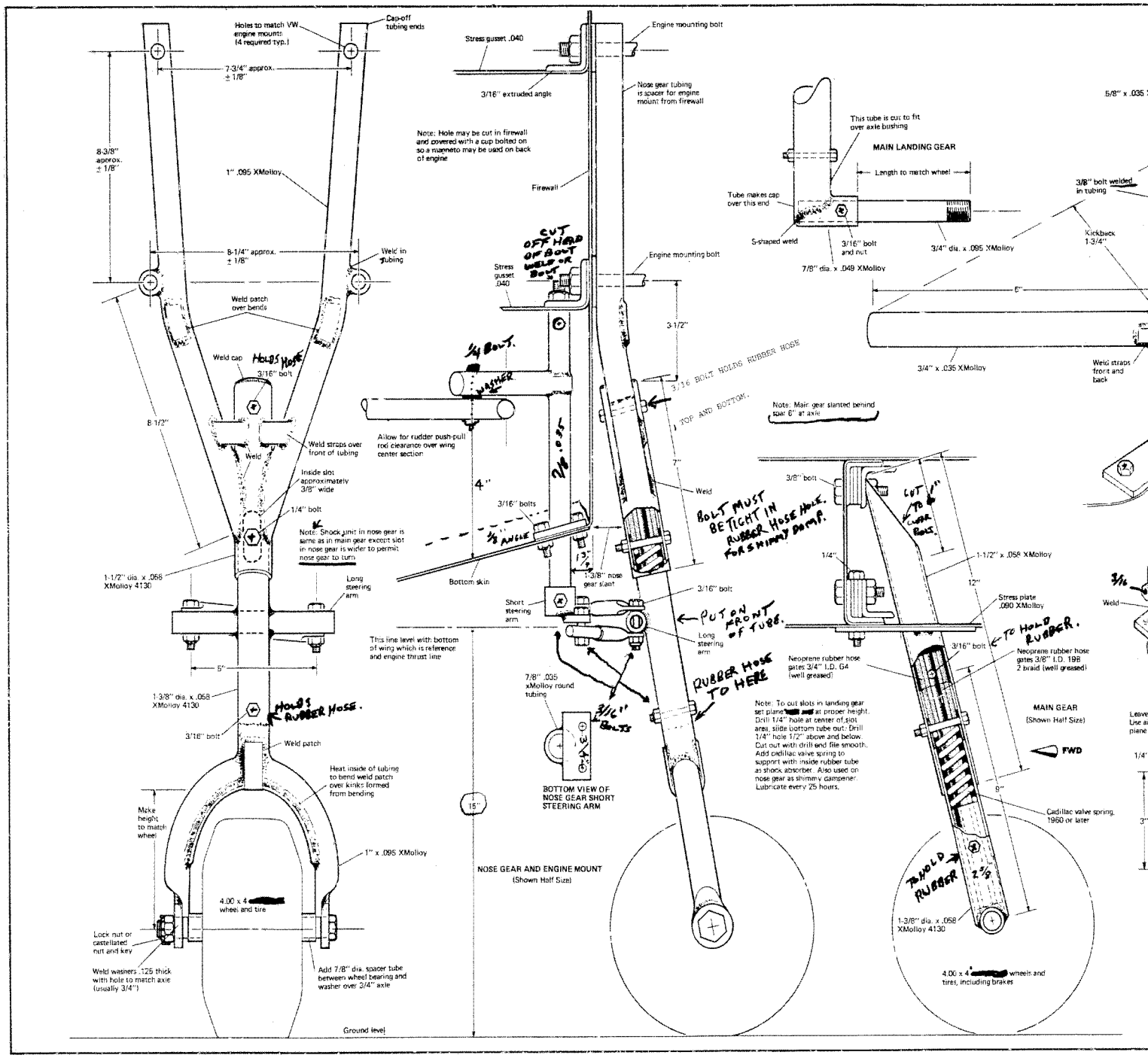

LEADING EDGE CENTER
EVEN UNDER BULKHEAD E.
SEE PAGE 7.
4"
NOTE:
Windshield detail drawing No. 3
Rudder .020
Vertical stabilizer cap .020
Vertical stabilizer .020 drawing No. 7
Dorsal fin
Tail section and control linkage detail drawing No. 7
Bulkhead "D" .040
Baggage compartment bulkhead
Gas tank detail drawing No. 5 Fuel capacity —9 gal.
Operating limitation and air-worthiness certification
Bulkhead "C" .040
N2861
Control stick
Bulkhead "E"
Fuselage structure drawings 3, 4, 5
Radio
Fuselage skin .020 (cut to fit bulkheads)
1" foam with terrycloth cover
Leading edge
.020
Rudder bar
Control detail drawing No. 7
Ailerons drawing No
Engine mount detail drawing No. 6
DOTTED LINES SHOW WHERE ALUM.
Instrument panel detail drawing No. 3
Bulkhead "B" .040
Center wing section
"A" firewall detail drawing No. 4
.040
Up to 65 hp Volkswagen engine (conversion kits and plans available)
3.50 x 4 4-ply tires or 4.00 x 4 wheels and tires with brakes
Rib detail drawing No. 2
Nose steering detail drawing No. 6
VW matched propeller
54 x 30 climb
54 x 36 cruise
Write designer for current supplier
Bolt to match wheel bearing

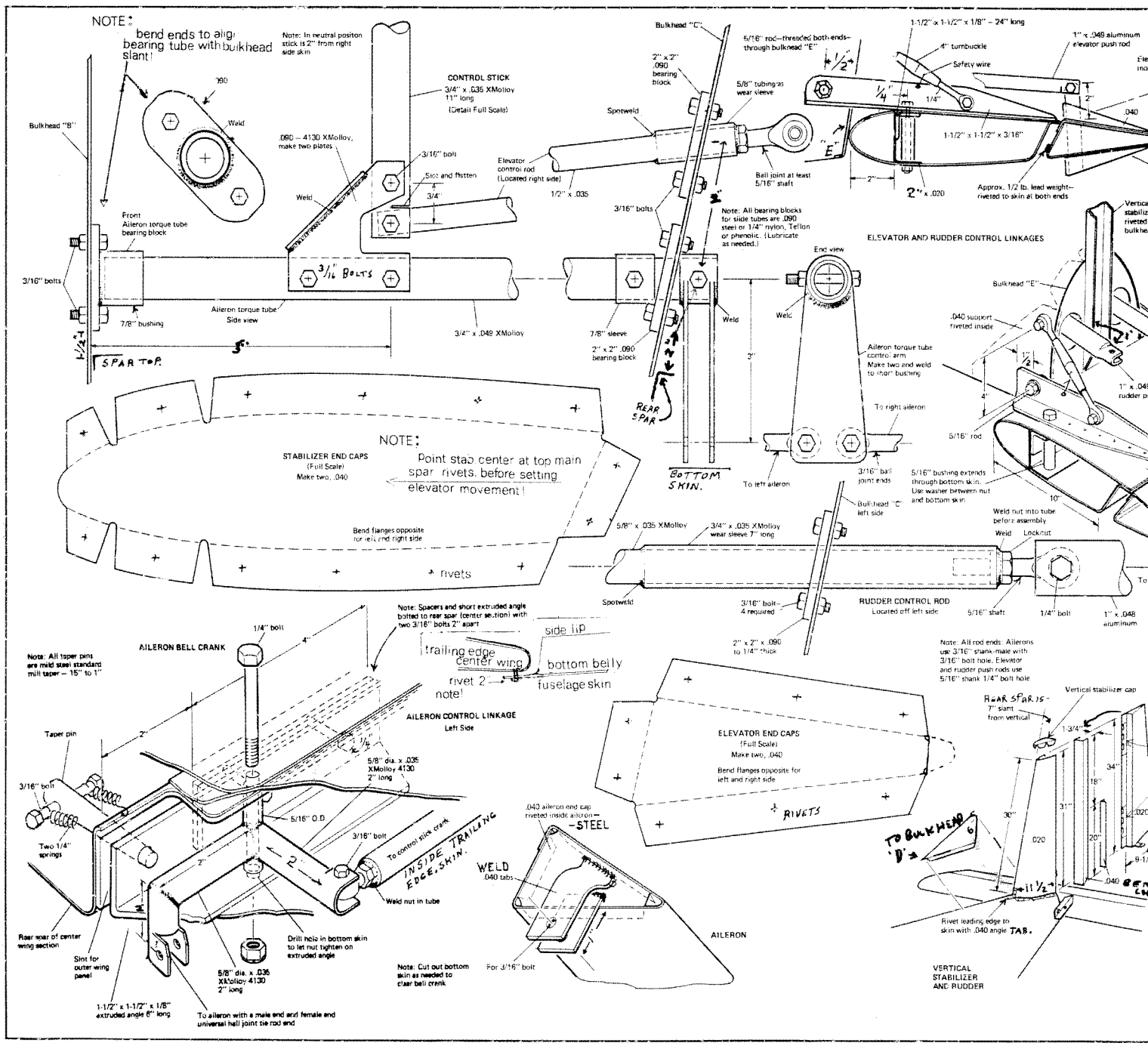

Make bulkhead "B" sides right and left, and drill them to fit from spar before attaching leading edge (center wing section) skin.
Remove before attaching leading edge skin.
When wing is finished, cut slot in leading edge skin to rivet bulkhead "B" sides to main spar (after skin is attached). This is to keep wing straight while finishing.
Guide hole
Main channel spar
Guide hole
5 3/4 HIGH
Inboard rearview rib reinforcement. attach angles .040 all ribs SURFACE
Cut out crossed area before bending outside edges
Bend .040 main spar to fit cut out in ribs
TO MATCH ALL 3
LEADING EDGES
Bend line for main outer wing spar
Bend line for main center wing spar
RIB PATTERN
ALL RIBS .020
(Full Scale)
Wing skin .020
Guide hole
Leave flange solid over spars
NOTE: Use straight edge to line up with bottom
Match two rib halves
DOTTED LINES SHOW WHERE ALUM. ANGLES GO INSIDE BEHIND MAIN SPAR
Match ribs (under cabin sides) to cabin side flanges
1/8" angle all the way across center section (6')
1-1/2" x 1-1/2" x 1/8" extruded angle
6" piano hinges
6'
12" D
Aileron weights go in this area
14" C
36" A
6"
6"
6"
Center section rib spacing
12" D
8"
12"
30" B
16"
18"
18"
Outer wing rib spacing
FULL CANTILEVER REINFORCEMENTS
A, B, C and D are 1-1/2" x 1-1/2" x 1/8" extruded angles inside .040 main spar channels—long pieces next to channels, short pieces on backside—file corners to fit
End ribs have 2" slant
Channel spar .040
Cut out ribs before bending over forms
NOTE: TRAILING EDGE OF CENTER WING AND AILERON AR
DRAWING. RUDDER IS HINGED SAME WAY.
Note: Without control linkages on, aileron should settle into neutral position when properly balanced
Up and down movement of aileron
1"
1"
Match two rib halves
Use outer section as guide in forming and holding leading edge skin
Form "A"
Form B1 and B2
Rib bend line is the pattern line for the wood form
Make outer form length no shorter than here
3/4" plywood form (make 2)
Bend on this line for rear outer wing spar
Guide hole 1/4" (5 holes)
Note: Drill all the ribs together
Bend on this line for rear center wing spar
TOTAL WING CHORD 40"
Bend line
Rivet 2" spacing
NOTE: LEVEL WITH
Front
6" long 3/16" extruded angle
WING ROOT
Spacers 4" long
3/8" bolt
.040 6' center spar channel
Bolt on with 1/4" bolts
6" long 1/8" extruded angle
A & C extruded angles
2-1/4" bolts thru spacers
3/8" bolts
2"
Weld both sides (bottom only)
Outer wing root
Important: Do not weld all the way around
B & D extruded angles
Stress plate .090 XMolloy 4130 fitted outside of skin
No. 9—6" taper pin top and bottom
Extruded angles 1-1/2" x 1-1/2" x 3/16" 6" long
2 ea. 1/4" dia. springs No. 20 wire approx.
REAR SPAR (CENTER SECTION)
1/4" spacer
1/4" bolt
Taper pins are mild steel standard mill taper—15" to 1"
Aileron control
6" LONG
Note: Spacers and short angle bolted together with 3/16" bolts (2), 2" apart
Cut out bottom as needed to clear bell crank
1-1/2" x 1-1/2" x 1/8" 6" long
Wood jig blocks
B1
B2
Clamp bolt
Guide hole
Round this edge slightly
Plastic or wo hammer
Bend tabs 90° 30° at a time
TAB BENDING METHOD


BULKHEAD "B"
INSTRUMENT PANEL BULKHEAD
Left side
Right side
PULL CHOKE
TWIST MIXTURE
LEFT BRAKE
THROTTLE
CARBURETOR HEAT
PULL ON
MAGNETO TOGGLE SWITCH
Rivet to Instrument Panel
FAA passenger warning label
RIGHT BRAKE
RADIO
Drill holes for knob shafts only—no holes over 1/2" dia.
Wear sleeve for control stick torque tube
NOTE: This tube is above the main spar and in this approximate position
1-1/4"
Main spar
5/8" push-pull tube from rudder bar to bulkhead "C"-left side
Template centerline for windshield
WINDSHIELD
(Full Scale, Half Pattern)
Plexiglass .060 can be bent cold—.090 and .125 thickness must be heated before bending
30"
This edge should be parallel with bottom of wing
1"
Lap this edge under front skin
CABIN SIDE
(Make Left and Right Side)
Lap over back skin rivet spacing 1"
15-5/8"
19-1/8"
Bend flanges, inside, rivet to top of wing skin and rib
1-5/8"
26"
Note: All "+" marks show rivet positions
Note: Only half of bulkheads C, D and E shown
Bend flanges to back
Bend flanges f
BULKHEAD "C"
(Full Scale)
Bend these flanges toward the front
3/4"
3/16" holes drilled for flange
Six rivets to match gusset "C"
Bend line
Compass
Air speed
Altimeter
INSTRUMENT PANEL
(Full Scale)
2" electronic tachometer (see JT-2 engine conversion drawings)
Oil temperature
Oil pressure
Bend line
Bend this flange toward the front
1-1/2"
Notch for side angles


This edge laps under side skin
Bottom
spar top for "C" and "D"
Bend forward for "B", "C" and "D"
Main spar bottom for "B"
Rear spar bottom
Cut for "C"
BULKHEAD "B", "C" AND "D" SIDES
(Full Scale)
Shape for "D" only
Note: Bulkhead "D" bend both flanges in same direction
Note: Bulkhead "C" bend flanges in opposite direction
Cut this length for "C", make two
Note: Bulkhead "B" bend flanges forward
Cut this length for "B", make two
Bend all 6 sides on this line
Bend flange forward for "D"
Bend flange forward for "B"
Cut for "C"
Bend flange to rear for "C"
Note: Fit baggage compartment bulkhead after fuselage is finished. Add bottom pan with screws to seat back (bulkhead "C") just high enough to keep from touching elevator and rudder push-pull rods.
BELLY SKIN
(Full Scale)
Wraps under forward fuselage
Bend flanges to the outside of wing
Rivet spacing at this point
BAGGAGE COMPARTMENT BULKHEAD
(Full Scale)
Bend line
Bend to rear
BAGGAGE COMPARTMENT BULKHEAD
C
D
E
36"
36"
.040
.040
.040
.040
Bend line
10"
This line level with bottom of wing which is reference and engine thrust line
B
INSTRUMENT PANEL BULKHEAD
A
24"
3/16" extruded braces rivet to firewall 1/2" spacing
Bend line and bend forward
2" spacing on fuselage rivets 1/2" spacing at all joints
FIREWALL
(Full Scale)
.020 galvanized steel or .016 stainless steel, 20 gauge
Center line of belly skin
2½
9½"
"C" gusset—inside skin
Bend flanges forward
3/16" drill and notch
Drill to fit VW engine mounts
8 ½" HIGH.
7 3/4" WIDE TOP.
8 1/8 WIDE BOTTOM.
TO FIT V.W. BOLTS.
8"
3-1/2"
.040
.040 plates, 8" square riveted top and bottom at each spar connection (4 plates each side), to fit under skin aft.• wing panels are finished to keep taper pins from working loose on rough landings
Top
Bottom of firewall
Center line of firewall
Top of firewall


GAS TANK
9 gal. capacity
Use 24 or 26 gauge galvanized iron or plumbers tin
Use foam rubber stripping at all touching points
Shutoff valve
Carburetor must be mounted below this point WITH TAIL ON GROUND.
Note: This slope important to feed fuel when in extreme climb
Fit front of tank curve to firewall–bulkhead "A"
Front view
12"
3"
7"
Float gauge wire
Vent neck and gas cap
Rivet every 2"
5"
Approx. 3 gal. left at this point
Cork float
Note: These dimensions are approximate; use available space
Rivet and soft solder all seams
Bend line
Rear view
16"
Shutoff valve
Fit rear of to bulkhea
Minimum of 4 rivets to each end
1 3/4" flange
14"
Bend
Holes in flange to match engine mounting bolts
Flange fits under engine mounts
3/16" bolt (4 places)
TOP AND BOTTOM STRESS GUSSETS
.040 material (full scale)
RIVET TO 4 FIRE WALL 1/2"
Note: See drawing No. 6 nose gear to firewall gussets A and B bolted to angles 1 and 2
RUDDER BOTTOM CAP
(Full Scale)
Bottom view
.040
Bends up
Bends up
Bends up
9 RIVETS MIN.
1-1/2" x 1-1/2" x 1/8"
Bend line
Bend line
DOWN
.040 material riveted to firewall and extended for gas tank cover
Firewall
NOTE: Mount quick-drain filter at lowest po in fuel system ahead of firewall
Oil cap location
TOP ENGINE COWLING
.020 material (full scale)
MUST BE USED FOR PROPER FLIGHT.
BOTTOM COWEL DEPENDS ON CARB. & EXHAUST
RUDDER TOP
(Full Scale)
.020
Bends
Skin fits under engine bolts
Extensions due to differences in engine size and thrust


Holes to match VW engine mounts (4 required typ.)
Cap-off tubing ends
7-3/4" approx. ± 1/8"
8-3/8" approx. ± 1/8"
1" .095 XMolloy
8-1/4" approx. ± 1/8"
Weld in tubing
Weld patch over bends
Weld cap
HOLDS HOSE
3/16" bolt
8-1/2"
Weld straps over front of tubing
Weld
Inside slot approximately 3/8" wide
1/4" bolt
Note: Shock unit in nose gear is same as in main gear except slot in nose gear is wider to permit nose gear to turn
1-1/2" dia. x .058 XMolloy 4130
Long steering arm
5"
1-3/8" dia. x .058 XMolloy 4130
HOLDS RUBBER HOSE.
3/16" bolt
Weld patch
Heat inside of tubing to bend weld patch over kinks formed from bending
Make height to match wheel
1" x .095 XMolloy
4.00 x 4 wheel and tire
Lock nut or castellated nut and key
Weld washers .125 thick with hole to match axle (usually 3/4")
Add 7/8" dia. spacer tube between wheel bearing and washer over 3/4" axle
Ground level
Stress gusset .040
3/16" extruded angle
Engine mounting bolt
Nose gear tubing is spacer for engine mount from firewall
Note: Hole may be cut in firewall and covered with a cup bolted on so a magneto may be used on back of engine
Firewall
CUT OFF HEAD OF BOLT WELD OR BOLT
Engine mounting bolt
Stress gusset .040
3-1/2"
1/4 BOLT.
WASHER
3/16 BOLT HOLDS RUBBER HOSE
TOP AND BOTTOM.
Allow for rudder push-pull rod clearance over wing center section
4"
7"
Weld
3/16" bolts
1/8" ANGLE
Bottom skin
1-3/8" nose gear slant
3/16" bolt
Short steering arm
Long steering arm
PUT ON FRONT OF TUBE.
This line level with bottom of wing which is reference and engine thrust line
7/8" .035 xMolloy round tubing
3/16" Bolts
RUBBER HOSE TO HERE
15"
BOTTOM VIEW OF NOSE GEAR SHORT STEERING ARM
NOSE GEAR AND ENGINE MOUNT
(Shown Half Size)
Note: Main gear slanted behind spar 6° at axle
BOLT MUST BE TIGHT IN RUBBER HOSE HOLE. FOR SHIMMY DAMP.
3/8" bolt
CUT 1" TO CLEAR BOLT
1/4"
1-1/2" x .058 XMolloy
12"
Stress plate .090 XMolloy
TO HOLD RUBBER.
3/16" bolt
Neoprene rubber hose gates 3/8" I.D. 19B 2 braid (well greased)
Neoprene rubber hose gates 3/4" I.D. G4 (well greased)
Note: To cut slots in landing gear set plane at proper height. Drill 1/4" hole at center of slot area, slide bottom tube out. Drill 1/4" hole 1/2" above and below. Cut out with drill and file smooth. Add cadillac valve spring to support with inside rubber tube as shock absorber. Also used on nose gear as shimmy dampener. Lubricate every 25 hours.
MAIN GEAR
(Shown Half Size)
FWD
9"
Cadillac valve spring, 1960 or later
HOLD RUBBER
2 5/8
1-3/8" dia. x .058 XMolloy 4130
4.00 x 4 wheels and tires, including brakes
This tube is cut to fit over axle bushing
MAIN LANDING GEAR
Length to match wheel
Tube makes cap over this end
S-shaped weld
3/16" bolt and nut
7/8" dia. x .049 XMolloy
3/4" dia. x .095 XMolloy
3/8" bolt welded in tubing
Kickback 1-3/4"
6"
3/4" x .035 XMolloy
Weld straps front and back
5/8" x .035


NOTE:
bend ends to align bearing tube with bulkhead slant!
Bulkhead "B"
.190
Weld
Front Aileron torque tube bearing block
3/16" bolts
7/8" bushing
Aileron torque tube
Side view
1-1/2"
SPAR TOP
Note: In neutral positon stick is 2" from right side skin
CONTROL STICK
3/4" x .036 XMolloy
11" long
(Detail Full Scale)
.090 – 4130 XMolloy, make two plates
3/16" bolt
Slot and flatten
3/4"
Weld
3/16" bolts
3/4" x .049 XMolloy
Bulkhead "C"
2" x 2" .090 bearing block
5/16" rod—threaded both ends—through bulkhead "E"
5/8" tubing as wear sleeve
Spotweld
Elevator control rod (Located right side)
1/2" x .035
Ball joint at least 5/16" shaft
Note: All bearing blocks for slide tubes are .090 steel or 1/4" nylon, Teflon or phenolic. (Lubricate as needed.)
7/8" sleeve
2" x 2" .090 bearing block
REAR SPAR
BOTTOM SKIN.
Weld
End view
Aileron torque tube control arm
Make two and weld to short bushing
To right aileron
To left aileron
3/16" ball joint ends
Bulkhead "C" left side
1-1/2" x 1-1/2" x 1/8" – 24" long
1" x .049 aluminum elevator push rod
4" turnbuckle
Safety wire
1/4"
1-1/2" x 1-1/2" x 3/16"
2" x .020
Approx. 1/2 lb. lead weight—riveted to skin at both ends
ELEVATOR AND RUDDER CONTROL LINKAGES
Bulkhead "E"
.040 support riveted inside
5/16" rod
5/16" bushing extends through bottom skin. Use washer between nut and bottom skin
Weld nut into tube before assembly
Weld
Lockout
1" x .049 aluminum
NOTE:
STABILIZER END CAPS
(Full Scale)
Make two, .040
Point stab center at top main spar rivets before setting elevator movement!
Bend flanges opposite for left and right side
rivets
5/8" x .035 XMolloy
3/4" x .035 XMolloy wear sleeve 7" long
Spotweld
3/16" bolt– 4 required
2" x 2" x .090 to 1/4" thick
RUDDER CONTROL ROD
Located off left side
5/16" shaft
1/4" bolt
1" x .049 aluminum
Note: All rod ends: Ailerons use 3/16" shank-male with 3/16" bolt hole. Elevator and rudder push rods use 5/16" shank 1/4" bolt hole
AILERON BELL CRANK
Note: All taper pins are mild steel standard mill taper – 15" to 1"
1/4" bolt
4"
Taper pin
2"
3/16" bolt
Two 1/4" springs
5/8" dia. x .035 XMolloy 4130 2" long
5/16" O.D.
3/16" bolt
To control stick crank
2"
Weld nut in tube
Rear spar of center wing section
Slot for outer wing panel
Drill hole in bottom skin to let nut tighten on extruded angle
5/8" dia. x .036 XMolloy 4130 2" long
1-1/2" x 1-1/2" x 1/8" extruded angle 8" long
To aileron with a male end and female end universal ball joint tie rod end
Note: Spacers and short extruded angle bolted to rear spar (center section) with two 3/16" bolts 2" apart
side lip
trailing edge
center wing
bottom belly
rivet 2
fuselage skin
note!
AILERON CONTROL LINKAGE
Left Side
.040 aileron end cap riveted inside aileron
STEEL
WELD .040 tabs
AILERON
Note: Cut out bottom skin as needed to clear bell crank
For 3/16" bolt
ELEVATOR END CAPS
(Full Scale)
Make two, .040
Bend flanges opposite for left and right side
RIVETS
REAR SPARS – 7° slant from vertical
Vertical stabilizer cap
1-3/4"
34"
18"
31"
30"
20"
.020
.040
TO BULKHEAD "D"
11 1/2"
Rivet leading edge to skin with .040 angle TAB.
VERTICAL STABILIZER AND RUDDER

NOTE: Hooks are bent past center so pull will not open