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Q-200 Supplement (details on LS1 Canard and fuselage mods)

ADDITIONAL Q2 DOCUMENTATION

TITLE	CONTENTS	DATE OF FIRST PUBLICATION
Q2 Pilot's Manual	Flight and maintenance manual includes normal and emergency procedures, weight and balance, check lists, detailed flying qualities descriptions, operating limitations, performance charts, first flight test procedures, pilot checkout procedures, and systems descriptions.	1 May, 1981
Quickie Newsletter	Published quarterly (Jan, April, July, and October); includes plans changes, builder tips, options, current and future developments, and dates and information on future seminars.	25 May, 1978
Q2 Information Package	Provides general information on the Q2, including performance, construction techniques, and a poster.	9 February, 1981
Quickie & Q2 Composite Materials Introductory Package (Link)	Provides an education in the techniques required in the building of a Q2. Includes a booklet, and sufficient materials for several suggested projects. Somewhat redundant with Chapter 3 of the Q2 Construction Plans.	8 April, 1981

The QUICKIE Q2 kit, properly constructed, will reproduce the successful original QUICKIE Q2 designed, and tested by QUICKIE AIRCRAFT CORPORATION. QUICKIE AIRCRAFT CORPORATION is not responsible, and makes no warranties, express or implied whatsoever, regarding the structural integrity, performance, flight characteristics, or safety of the Buyer's completed aircraft and its component parts. QUICKIE AIRCRAFT CORPORATION has no control and assumes no control over the Buyer's ability to successfully construct and test the QUICKIE Q2 AIRCRAFT. Buyer expressly waives any and all claims arising from structural integrity, performance, flight characteristics, mechanical failures, and safety against QUICKIE AIRCRAFT CORPORATION. Buyer acknowledges awareness of the risks of flying a homebuilt aircraft. Buyer acknowledges that the FAA must inspect the aircraft at construction intervals, as well as the completed project, prior to flight and should work with his local FAA representative regarding the construction and licensing of the aircraft.

QUICKIE AIRCRAFT CORPORATION reserves the right to make recommended revisions in the plans and construction of the aircraft at any time without liability to QUICKIE AIRCRAFT CORPORATION, as such revisions or changes may be deemed advisable from time to time.

DESCRIPTION AND INTRODUCTION

DESCRIPTION AND INTRODUCTION

The Q2 is a high performance, homebuilt aircraft. Its compact external size and extremely efficient design results in superb performance and unequalled fuel economy using a low horsepower engine. Inside, it provides side-by-side seating comfort for a pilot up to 6'8" tall and 250 lbs, plus passenger, as well as some baggage in the roomy compartment behind the seat. Its canard configuration was designed not only for performance, but to provide improved flying qualities and safety as compared to the conventional light plane.

The origin of the Q2 dates back to 1977. Although the Q2 has much in common with the QUICKIE, considerable progress has been made since that earlier effort. As a result, the Q2 has lower drag than any other two place aircraft available to the public. Likewise, it has proven to be the most fuel efficient two-place aircraft ever offered to the public.

The Q2's high-lift canard (forward wing) is fitted with a plain elevator that controls the aircraft's pitch attitude. The canard also serves as the main landing gear spring since the main gear is mounted on the tips of the canard. This feature results in a remarkably smooth ride as well as outstanding ground stability during taxiing, takeoff, and landing.

Roll capability is provided by ailerons on the inboard protion of the main wing.

Yaw control is provided by a rudder mounted on the vertical fin, and is actuated by conventional rudder pedals.

The pitch and roll capability is provided by a side stick controller in the center of the cockpit. This feature permits precise control of the Q2 while reducing pilot fatigue and cockpit clutter.

Optional dual controls provide the option of pilot checkout and instruction.

The tailwheel is actuated directly from the rudder pedals, without any springs, thus providing positive steering at all times while on the ground. Since the tailwheel is not raised on takeoff roll like other taildraggers, this positive steering is available until the aircraft is airborne, making for very safe takeoff and landing characteristics.

Even though the Q2 has low horsepower, it can outperform most general aviation aircraft while retaining unequalled fuel economy. The maximum speed is actually faster than most retractable gear aircraft, such as the Piper Arrow, and the fuel economy exceeds 60 miles per gallon.

The Q2 obtains this remarkable performance without resorting to retractable landing gear, without flaps, without turbochargers, and without variable pitch propellers.

Further, the Q2 was designed to be built by the inexperienced builder, so these Q2 Construction Plans and the Q2 kit contents have been developed for ease of construction. Construction time should require only 500 manhours spread over less than one year of the builders spare time, with no special tools required.

The composite structure of your Q2 provides some important advantages over conventional metal, wood, or fabric construction. It has been tested to loads far in excess of those required for FAA certification. Fatigue margins are higher. Contour is maintained underload, the structure does not "oil can," buckle, or distort. It provides excellent insulation and damps noise. It has no hidden joints, no water traps, and is far less susceptible to corrosion. It is easier to inspect, more redundant, and easier to repair. It is not susceptible to thermal stress due to temperature changes. Properly protected from UV, it has an unlimited life.

Perspective

The builder of an amateur-built aircraft is the manufacturer; he is responsible for quality control on all parts, all construction, and the conduct of his flight tests. While Quickie Aircraft Corporation is not the manufacturer of your aircraft, we do, through these plans and services, provide you with information about how our Q2 was built and what we feel is the best way for you to build a safe, reliable airplane. We do encourage you to build the airplane as shown on the plans because we have found that our airplane provides us with reliability and safety, and any problems that we experience with our aircraft are documented and reported in "The Quickie Newsletter". We have gone to a considerable effort in developing the design, the structure, and the systems, and proving their adequacy with appropriate tests.

If you modify the airplane and then ask us if your modification will work, we cannot give you an answer without conducting the appropriate tests and totally qualifying the modification. This would obviously be quite expensive. Our concern then, is that if your modification is not successful, and causes an incident or accident, this would be attributed to our design, the Q2. Because of this, we must insist that if you modify the airplane with any major change such as an aerodynamic change, primary structural change, or using a non-approved engine installation, that you call your airplane a different name, rather than a Q2. If you make a major change, you must consider yourself involved in basic aircraft design and development, an extremely risky business. As such it is not fair for us to be associated with any results of your development. We state this, not to discourage inventiveness and progress, but to release any connection of your new development efforts with our proven design, the Q2.

We are particularly concerned about individuals using alternate engines to power their Q2's. The Q2 was designed around the engine; any change would require an exhaustive test program to determine not only the new engine's suitability as an aircraft powerplant, but also its suitability as a Q2 powerplant.***

These Q2 Construction Plans have been specifically designed to educate you in the construction materials, their use, and to guide you through each step of assembly in the most efficient manner possible. It is our intent to drastically reduce the non-completion rate* common to homebuilt aircraft. With that in mind, we have:

1. Preceded the plans with an education section intended to thoroughly acquaint you with the tools and materials, and how to use them.
2. Laid out the plans in a detailed, step-by-step format to answer the questions of "what do I do next?"
3. Provided all appropriate information to each step adjacent to the words.
4. Provided full-size templates, ready to cutout and use, to avoid the work and confusion associated with scaling up drawings.
5. Provided a complete kit from one source to eliminate time spent looking for materials.
6. Identified the difficult to build items, and included them (prefabricated and ready to install) with the basic Q2 Kit.
7. Set up our newsletter, "The Quickie Newsletter" as a continuing plans updating/correcting system.**

*** N8WQ is powered by the Jabriru J3300A engine. At the time of construction, this engine has been tested and flown on several Q2 aircraft in the US and internationally. The engine/airframe combination is now proven airworthy. The Jabiru engine also has advantages in weight and power over the original Revmaster and Continental O-200 engines. In addition, this J3300A installation (in N8WQ) includes liquid cooled heads and other upgrades that further improve reliability by contolling cooling, improving valve train life and alternator performance.

* Over 80% of homebuilt airplane construction projects started, are never finished and flown.

** Because plans updates occasionally are of a mandatory nature, a subscription to "The Quickie Newsletter" is mandatory for those building a Q2.

Building Sequence

The nature of the Q2 structure requires that a part be left alone to cure for a longer period of time than that required to build it. Thus, you will find that when following the step-by-step order, you will often find yourself out of work, waiting for a cure. In most cases, you can skip to another chapter and build another part while waiting. With a little planning and familiarity with the entire manual, you should be able to use all of your time productively.

Questions?

Please use the procedure detailed here if you do not understand something and need an answer. First of all, do not be concerned if you do not understand everything the first time you read through the plans. Many things that may not be obvious just reading the drawings, will be obvious when you have that portion of the airplane in front of you or have built a similar part in a previous chapter. Also, we will be able to help you better if you are looking at that portion of your airplane. So, do not ask for clairfication until you are really working on that particular chapter. We have found through our Quickie and Q2 experience that the majority of questions that the homebuilder asks are already answered somewhere in the plans. We have made considerable effort in the Q2 Construction Plans to make the information visible. If you do not understand something, study the words in the step, study the sketches and all related sections/views/ photos, then look through the fullsize drawings and components that show that portion of the airplane. If the answer is still not found, it may be that the item is covered in detail in another chapter (there is some necessary overlap). It is possible that a question related to the operation of a part of the airplane or its maintenance is answered in your Q2 Pilot's Manual. Also, check your back issues of "The Quickie Newsletter" for plans updates or clarifications. OK, if you have checked everything and you are still stumped, you can do one of three things:

1. Ask a friend. Often a description of an item is unclear to one individual and clear to another.
2. Write to Quickie Aircraft Corporation, leaving room on the paper under each question for our answer. INCLUDE A SELF-ADDRESSED, STAMPED ENVELOPE and INCLUDE YOUR AIRCRAFT SERIAL NUMBER. We do our best to answer all such questions within two days of receipt. We cannot answer questions regarding the application of non-recommemded materials or regarding non-approved modifications.
   Quickie Aircraft Corporation
   P.O. Box 786
   Mojave, CA 93501
3. Call Quickie Aircraft Corporation:
   805-824-4313

Also, let us know if you have found a better way of doing something. If we agree, we'll publish it in "The Quickie Newsletter" so that all Quickie builders can benefit. If it is not a good idea, we'll tell you why, if you include a self-addressed stamped envelope.

Do keep us up to date on the progress of your project. Send us a black and white snap shot of your airplane for publication in "The Quickie Newsletter". Photos in the newsletter are particularly beneficial if they are of an area of the airplane that's not clearly shown with photos or sketches in the plans. Remember, the primary purpose of "The Quickie Newsletter" is to support your airplane project.

If you are not a member of The Experimental Aircraft Association (EAA), do join. This is the only organization who looks out for the homebuilder as far as FAA regulations are concerned. Membership in your local EAA can be extremely beneficial both in building your airplane and in meeting people who share your interests. Their monthly publication, "Sport Aviation," is worth the membership fee in itself.

EAA
Box 229
Hales Corners, Wisconsin 53130

EAA often publishes reports on builder's projects, so send them photos and some words on your progress.

FAA LICENSING PROCEDURES

This procedure applies in the U.S.A. only. The Federal Aviation Administration (FAA) has a definite procedure for registering and licensing homebuilt aircraft. There is nothing complicated about it, but they insist that you follow each step carefully.

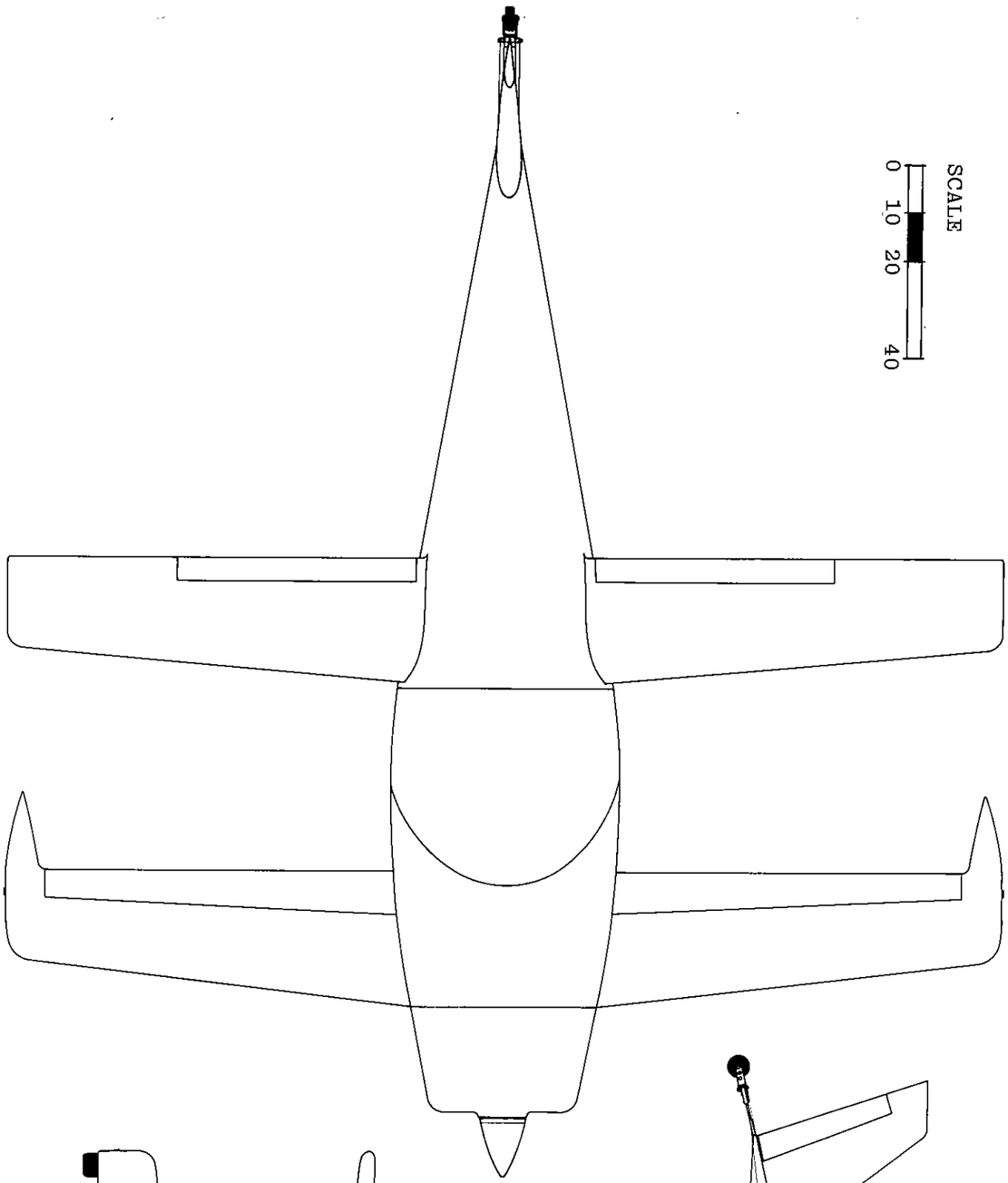
1. Contact your local FAA Engineering and Manufacturing District Office or FAA General Aviation District Office. Tell them you are building a Q2 homebuilt. Give them the following information:
   - 3-View drawing of the Q2
   - Aircraft serial number
   - Aircraft registration number, if available (see step #2)
   - Approximate date of starting construction
   - Engine-type

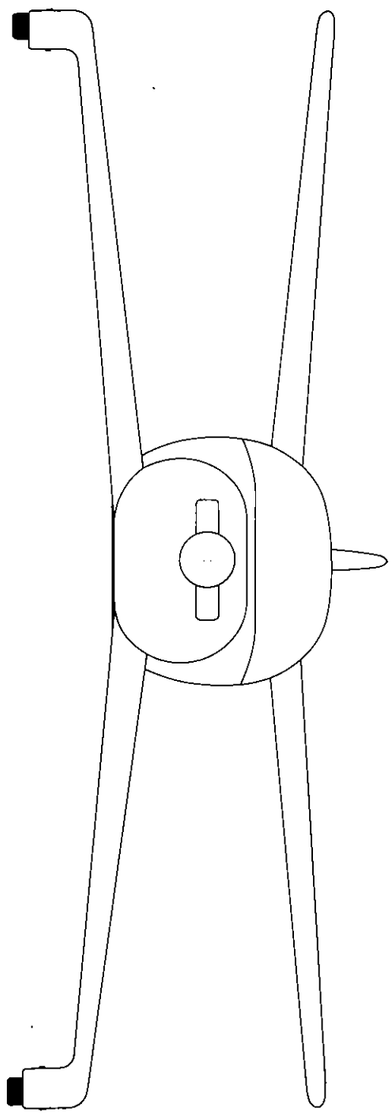
   FAA will then answer you, and tell you when they want to inspect your airplane, where the approved test areas are, etc.
2. This step is optional, and applies only if you want to reserve a specific registration number (the number you will paint on the tail). You can ask for all numbers, numbers followed by a single letter, or numbers followed by two letters. They are preceded by the letter "N". (For example, N77Q, N8490P, etc.). Be sure to give them your second and third choice, in case the number you want is already taken. Send $10 to reserve your special number to:
   FAA Aircraft Registry
   Box 25082
   Oklahoma City, OK. 73125

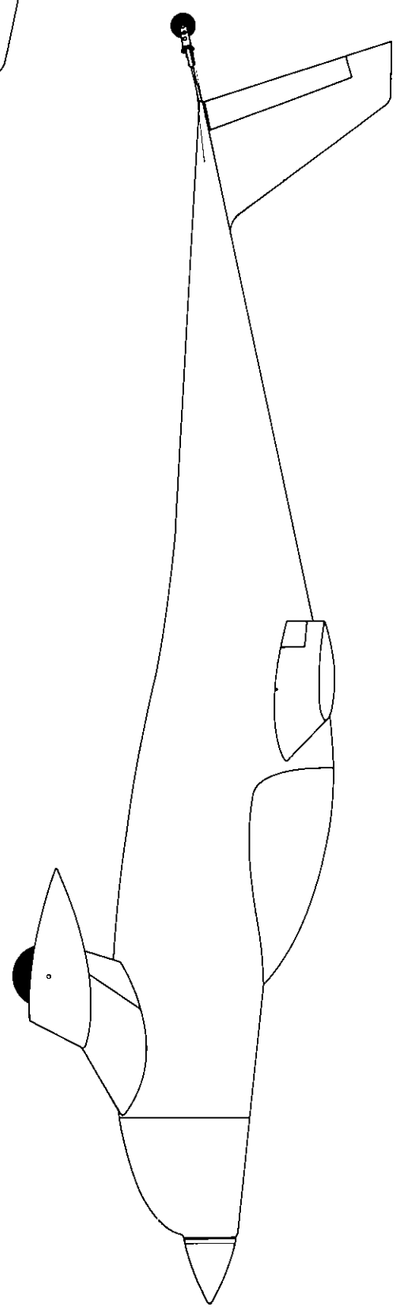
   Do not register your aircraft yet, since you don't need to pay registration fees, property taxes, etc., until your airplane is ready to fly. If you do not desire a special number, then the FAA will assign you a random number.
3. When you are ready for inspection* contact your local FAA office. Be sure you have an airframe log book (available from EAA) so that FAA can make an inspection entry.
4. To prepare for your final inspection, be sure you have: The "N" number painted on, the "Experimental" sign (2" high letters) on the canopy frame, the ID plate, and an airframe log book and an engine log book.

   Before final inspection, fill out an application for registration (FAA form #AC8050-1), a notarized affidavit that you built the airplane from parts that you bought yourself, and include $5 registration fee, along with copies of your sales agreement and invoice signed by Quickie Aircraft Corporation. Send those things tp:
   FAA Registry
   Box 25082
   Oklahoma City, OK 73125
5. After you have made a final inspection of your aircraft, run the engine, etc., but prior to any taxi tests or flights, contact your local FAA office and tell them you are ready to fly. They will have you fill out an application for airworthiness (form #8130-6), inspect your airplane, and issue you an airworthiness certificate and a list of operating limitations. When you have completed your initial test period, contact FAA to get your operating limitations amended so you can fly outside your test area.

* Refer to education section - inspection is done to major areas (wing, canard, and fuselage) after the glass is applied, but before the area is painted with any primer, etc., so that the glass structure can be inspected. The FAA office has been supplied with the same inspection criteria that you are given in your Composite Materials Education Chapter.







END OF CHAPTER

BILL OF MATERIALS

TOOLS

There are certain tools which are necessary to complete the aircraft. Three lists of tools are provided here. The first is the absolute bare minimum required, sacrificing efficiency; the second is a recommended list for the best compromise of cost and work efficiency; the third is a list for the "Cadillac" of shops where ease of construction is more important than money. The non-common items are stocked by Aircraft Spruce and Specialty.

FIRST LIST - BASIC REQUIRED TOOLS

- Common household butcher knife
- Coping saw
- 1/4" drive socket set
- Small open-end wrenches
- Sandpaper
  - 50 sheets, 40-grit, 3M Production Paper D-wt.
  - 50 Sheets, 80-grit, 3M Production Paper D-wt.
  - 20 sheets, 240-grit, 3M Wet or Dry Tri-M-Ite Paper A-wt. Silicon Carbide Waterproof.
  - 20 sheets, 320-grit, 3M Wet or Dry Tri-M-Ite Paper A-wt. Silicon Carbide Waterproof.
- Small Weights - Approx. 150 lbs in 5-15 lb pieces
- 6 - 6" C-Clamps
- Square and half-round files
- Pliers
- 1" putty knife
- Hacksaw
- Blade & Phillips screwdrivers
- Box of single-edge razor blades
- 24" carpenter's level
- Carpenter's square
- Felt marking pens
- 3-ft straightedge
- 12-ft decimal steel tape (Stanley #61-112)
- 1/4" drill with set of fraction and number bits, #30, #32, #10, 1/4" and #12 bits
- Taps; 1/4-28, 10-32, 1/8 NPT (Pipe Tap)
- Roll of grey duct tape
- Sabersaw
- Cheap holesaw set or flycutter
- Pop rivet puller
- Homemade balance for rationing epoxy
- Wall thermometer 50 to 100°F
- 6-ft straightedge
- Small set of X-Acto knives
- Dremel-type miniature high-speed hand grinder with saw and router bits

SECOND LIST - RECOMMENDED TOOLS (In addition to those in the first list

- 6" to 9" disc-type hand sander
- Set of 1/4", 1/2" and 1" chisels (wood)
- 1/2"-dia 100° counter sink (piloted)
- 6" machinist steel ruler
- X-Acto razor saw
- 3/8" variable-speed hand drill
- Hand broom/brush
- Bench-mounted belt sander
- Stanley surform plane
- Vacuum cleaner (shop type)
- Dovetail saw
- Epoxy Ratio Pump
- Plumb bob

THIRD LIST - FOR THE FIRST CLASS SHOP (In addition to those in the first and second list

- Drill press
- 18-inch bandsaw
- Vernier Caliper
- 90° drill adapter
- Air compressor with blow nozzle
- Orbital sander
- Nicopress sleeve tool
- Clecos - one dozen 1/8"
- Hotwire Voltage Control

ITEMS USED ONLY OCCASIONALLY AND CAN BE BORROWED

- 1 dozen 1/8" Clecos
- Hotwire Voltage Control
- 5/8" Spotface

PACKING LISTS

Upon receiving your Q2 kit, you should immediately match the packing list in each shipment against the actual contents of each box. Any descrepancies should be reported immediately to Quickie Aircraft Corporation. We will not be responsible for shortages that go unreported for longer than 30 days after receipt of the materials.

Quickie Aircraft Corporation maintains a close liaison with Q2 subcontractors to assure proper materials specification and quality control. Do not make substitutions for the materials provided. The materials provided were selected, developed, tested, and optimized for ease of construction and structural integrity. If you insist on making non-approved substitutions for replacement and spoilage, we insist that you do not call your aircraft a Q2. Quickie Aircraft Corporation will not provide assistance in the application of substitute materials or components.

In addition to the materials provided in the kit, you will need to furnish a few items that are readily available locally. We do this to save you some money. These items are as follows:

- Lumber for a workbench and jigging
- Masonite, hardboard, plywood, etc. for jigging templates, rigging templates, and hot-wire templates
- 12" piece of 1/4" diameter wood dowell
- 6" x 6" piece of aluminum screen door screen
- Battery for electrical system
- Finishing materials: Dupont 70S dark gray laquer primer surfacer, Acrylic laquer paint in the color of your choice
- 1 piece shock cord, 3-4" unstretched length

END OF CHAPTER

INDIVIDUAL PART CONSTRUCTION

INTRODUCTION

The first task in the construction of your Q2 is to make many of the small, individual parts required for assembly later. Quickie Aircraft Corporation has found that making these parts at one time is most efficient and will also give the builder a chance to gain experience working with his hands on small pieces that can be easily remade.

The parts include templates that are used for jigging and rigging various portions of your aircraft. Drawings are provided within this chapter, but primarily the templates are provided in a series of large Appendix drawings included with these plans. All templates are printed full size.

Jigging and rigging templates should be constructed from material such as hardboard, plywood, or masonite of 1/4" thickness. Aircraft quality materials are not required. The hot-wiring templates for the main wing, canard, and vertical fin, as well as the control surfaces, should be made out of thin aluminum, masonite, or aircraft quality plywood. These templates must be smooth and wave free, so spend considerable time on each one and sight frequently along the line to check for waves or notches. Any wave or notch will be reflected directly in the shape of your wing, etc. and will be difficult and heavy to correct later on; so do a good job in the beginning.

Template drawings provided for parts made as a sandwich composite (glass-foam-glass) should still be made on the hardboard, plywood, or masonite of 1/4" thickness. It will be much easier to transfer the complicated curves and lines to the actual part if you have a material more durable than heavy paper.

The phonolic bearing block comes delivered to you with all of the important precision holes already drilled and reamed to the proper size. The remaining holes are for bonding strength and are non-critical on a precise diameter and position.

Be sure to identify and number each template and part so that it can be identified easily later when it is needed. Further, group all parts of the same family (e.g. Control System (CS), fuselage female jigging templates, etc.) together.

The drawings may be glued directly onto the material with Contact Cement. Be careful, however, that you do not paste up the drawings crooked. Smooth out all ripples before the glue sets. Do not use a glue that will cause excessive shrinkish.

The drawings are reproduced to within 1% accuracy; in most cases, the accuracy is closer to 0.1%. However, in the final analysis, you must build your aircraft and allow for tolerances and errors during construction. Therefore, you may expect not all templates to fit exactly as the drawings indicate. Large differences, however, are reason to check thoroughly on your previous work to see if you have followed the plans exactly.

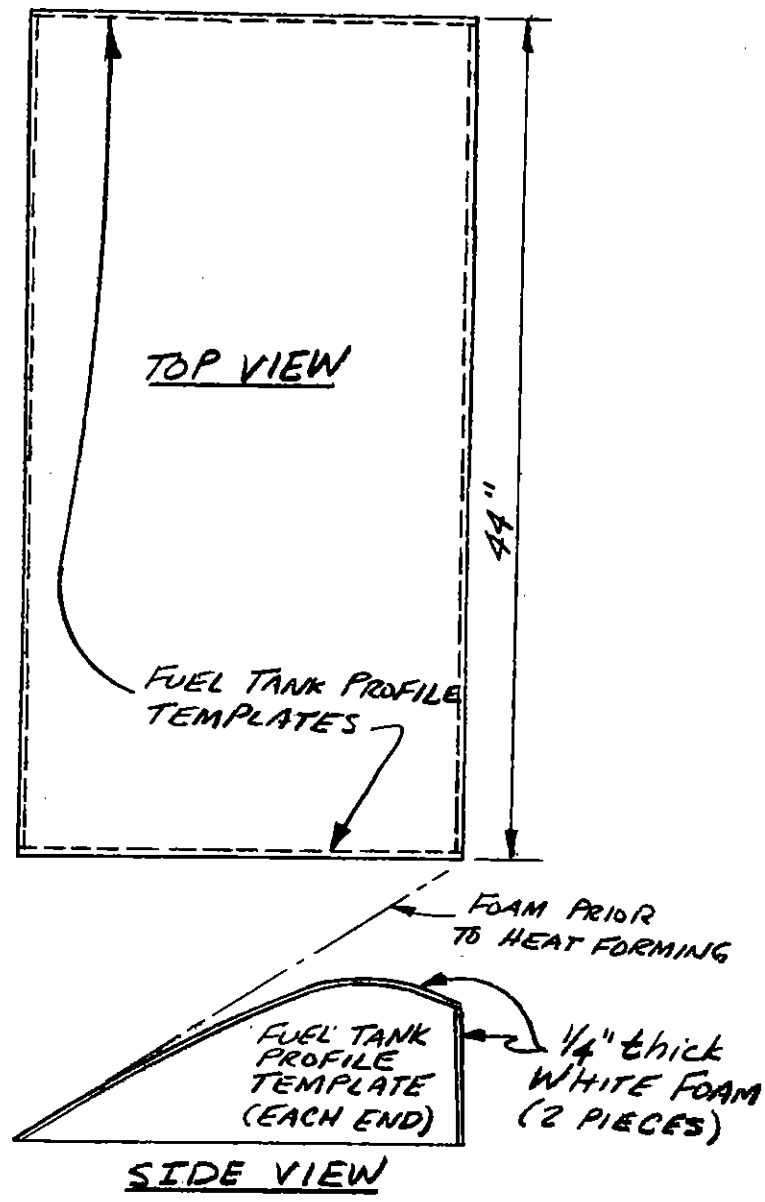
One last comment; we have replacement copies of all of the template drawings in case you destroy one accidentally. Don't be bashful about spending a few bucks for a replacement rather than to soldier on incorrectly trying to piece together a drawing that looks like your dog ate it.

MAIN FUEL TANK CONSTRUCTION (Link)

The main fuel tank is a sandwich composite structure that attaches to the bottom of the fuselage for installation in Chapter 14. In this section, you will make the basic main fuel tank, and then set it aside until later.

Find the Fuel Tank Profile Template on Appendix Sheet 2. Basically, to create the main fuel tank shape, you will heat form two pieces of the 1/4" thick white foam around the templates, glass the top main fuel tank surface, and finally glass the inside main fuel tank surface after the first lamination has cured.

The main fuel tank is 44 inches wide, so begin by placing the two Fuel Tank Profile Templates that distance apart on a table. Take an appropriate size piece of the white foam, begin at the trailing edge of the templates, and bend it around the forms until you reach the forward edge of the templates. Carefully heat the foam with a hair-dryer or heat gun until it will hold the shape reasonably well, and then use some 5-MIN to attach the foam to the templates at a few locations. Try to keep the foam from becoming too wavy as you form it.



FUEL TANK CONSTRUCTION

At the leading edge of the templates, another piece of 1/4" thick white foam is fitted vertically until it meets the first piece of white foam; it too is attached with 5-MIN dabs.

Round the joint slightly where the two pieces of foam meet. Next, laminate 2 BID on the outside of the foam oriented 45 degrees to the trailing edge of the white foam.

After allowing the lamination to cure, the next step is to remove the Fuel Tank Profile Templates, turn the foam over, and glass 1 BID at 45 degrees on the inside foam surface. Be careful that the main fuel tank doesn't warp and change shape during this process.

If you have trouble with waves in the center of the tank, additional Fuel Tank Profile Templates may be used; if the hot forming operation does not go well, you may cut-and-join several straight line segments.

Of course, the easiest way to build the Q2 main fuel tank is to buy it prefabricated from Quickie Aircraft Corporation or one of its dealers.

COCKPIT CONSOLE PIECE CONSTRUCTION (Link)

Many pieces go into assembling the center and side consoles on your Q2. You will make the individual pieces now, and then assemble them to the fuselage in Chapter 14.

Full-size templates are provided on Appendix Sheets 1,2,&5 for the center and side console vertical pieces, as will as for the top side console pieces. Make 2 of each from the 3/8" thick white foam and number them left, right, and center, to identify where they are assembled in the aircraft. (In airplane talk, left is the pilot's left as he sets in the cockpit.)

Fiberglass 1 BID on the inside face of each piece. The inside face is the side that does not show after the consoles are assembled. Do not glass the other side.

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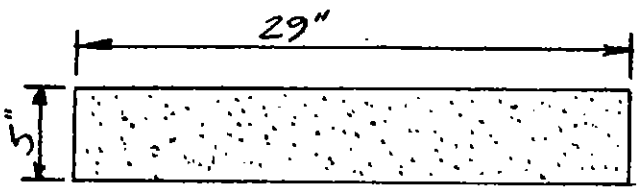


TOP CENTER CONSOLE PIECE

MAKE 1

3/8" thick WHITE FOAM

1 BID; ONE SIDE ONLY

It is important to note that if you modify either your Seatback Bulkhead angle (see Chapter 8) or Instrument panel location, or if you are wider and bigger than normal in the hips, you may wish to change the geometry of the pieces somewhat. If that is the case, wait until later to make these pieces.

INSTRUMENT PANEL Custom built panel components built after Fuselage is completed

The template provided for the instrument panel on Appendix Sheet 3 is intended to be used with the 1/8" thick aircraft quality plywood provided with the kit. It is suggested that the panel not be mounted in the fuselage permanently until cutouts for all instrument panel gauges, radios, and equipment have been made.

It will at times be useful to install the panel temporarily with Bondo to assist in jigging parts of the fuselage.

PLYWOOD PARTS Cut from marine grade plywood provided in Q2 kit according to full size templates in Q2, and Q200 plans

In this section, you will construct the following pieces: firewall, LG4, CS10, CS19, CS22, BS2, and BS3. All parts are constructed from 1/4" Marine grade plywood. See Appendix Sheet 3 for the full size template drawings, which can be pasted on the plywood itself.

As indicated previously, the writing on the template drawings can be read when the part is right side up. Also, the drawings indicate the number of each piece to be made.

ALUMINUM PARTS Cut from Aluminum plate provided in Q2 kit according to plans tempplates in Q2, Q200 and Tri-Q supplement

On Appendix Sheet 2, you will find the full size template for the 0.125" thick 2024T3 Aluminum supplied. Other parts, not detailed here will be made at a later time from aluminum.

PHENOLIC BEARING BLOCK Cut from phenolic provided with Q-2 kit according to full size templates in Q2 and Q200 supplements

On Appendix Sheet 2, you will also find the full size template for the predrilled Phenolic bearing block Q2CSP. Refer to the "Introduction" of this chapter for information.

FEMALE JIGGING TEMPLATES Cut from 1/4' plywood per full size templates

These full-size templates provide the basis for jigging the vertical fin, fuselage, main wing, and canard. They are found on Appendix Sheets 2, 4, and 5. Make 2 of each, except make 1 of each of the vertical fin jigging templates.

RIGGING TEMPLATES Built per full size templates from masonite

Rigging templates allow the builder to accurately rig the ailerons, elevator, and rudder for proper travel. These full-size templates may be found on Appendix Sheets 1 and 5; make 1 of each.

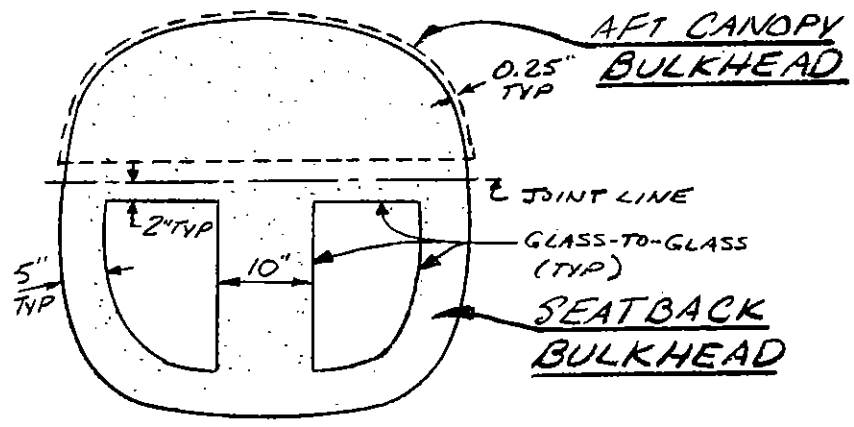
WHEEL PANT PIECES N/A (Tri-Q conversion)

On Appendix Sheets 1 and 3 you will find full-size templates for the pieces that comprise the wheel pants, including the templates to assist in carving the shape. Thickness of LG1, the wheel pant cores, is 6.7 inches each. The 4 LG2's are made from the / " thick white foam. The 3 carving templates are made from hardboard, plywood, masonite, etc.

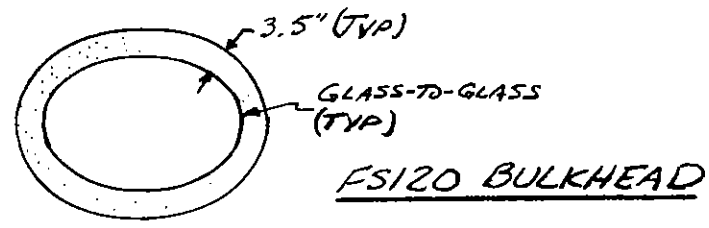
FUSELAGE BULKHEADS (Link)

In this section, you will construct the following bulkheads: FS120, FS94, Seatback Bulkhead, and aft canopy bulkhead. All bulkheads are made from the 3/8" thick white foam.

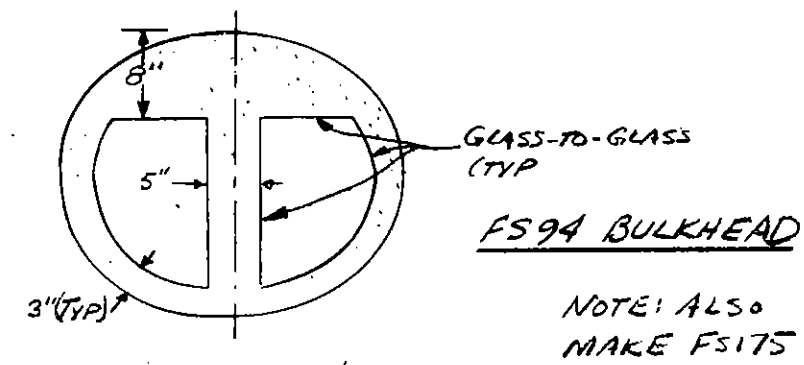
You will find full size template outlines on the large Appendix Sheets 1 and 2. On this sheet, you will find sketches showing the foam layouts. Where two full size template outlines are overlaid with one another, work your way in toward the middle by making the outside template bulkhead first, then trimming the template down so that the inside bulkhead can be made. (e.g. make FS94 bulkhead first, then make the FS120 bulkhead).



1 BID FRONT & REAR



1 BID FRONT & REAR



1 BID FRONT & REAR

Each full size template outline has a forward face marked on it. Also, the words describing the template are always written so that they can be read when the template is right side up and facing forward. Be sure to mark each bulkhead upon completion with the proper information so that you don't forget which way it is jigged. Each bulkhead will jig into the fuselage only one correct way.

The Seatback Bulkhead is made in two pieces and joined together upon assembly of the fuselage. On Appendix Sheet 2, you will find the full size templates for both the canted piece (i.e. lower piece) and the vertical piece (i.e. upper piece). In order to conserve space, the templates are laid out with the joint between the two pieces as the common line at the top of the template. This is the only case in these template drawings where the presentation is not consistant. Note also that the template drawing for the vertical piece calls it out as being used for the aft canopy bulkhead. To make the aft canopy bulkhead, use the vertical piece of the Seatback Bulkhead and reduce its height to 15 inches by cutting off the bottom of the template. Also, since the canopy is much thinner than the fuselage core, make the vertical piece template curve "fuller" by approximately 0.25 inches. The result will be that when compared to the vertical piece of the Seatback Bulkhead, the aft canopy bulkhead will be not as tall, but will have a larger radius of curvature by about 0.25 inches.

END OF CHAPTER

HOT-WIRING

INTRODUCTION

In this section, you will hot-wire the foam cores for the wing, canard, rudder, vertical fin, ailerons, and elevators.

Begin by reviewing the COMPOSITE MATERIALS EDUCATION chapter. That means more than just glancing through the chapter; study it thoroughly until you can recite it in your sleep.

Hot-Wiring is not difficult, but will require two people and a precise, careful approach to obtain good quality cores.

Before we continue, let's emphasize a few important points that you have already read in the COMPOSITE. MATERIALS EDUCATION chapter:

1. Always hot-wire cut from the leading edge back to the trailing edge to minimize wire lag; always go slowly around the leading edge of any airfoil.
2. Pause at any notches in the templates to let any wire lag catch up.
3. Retain all scraps; they may be used later.
4. All foam blocks must be weighted down carefully; all template level lines must be re-checked just prior to hot-wiring.
5. Hot-wire cores at the top of each block first, to make weighting the cores down easier.
6. Any part of the template projecting aft of the "eventual trim lines" may extend beyond the edge of the foam block; many template locations are critical, so strive to minimuze wasted foam - it will all be used later.
7. Mark level lines on each foam core with a felt tipped marker.
8. Smile! This is one of the funnest jobs in the whole aircraft.

MAIN WING CORES

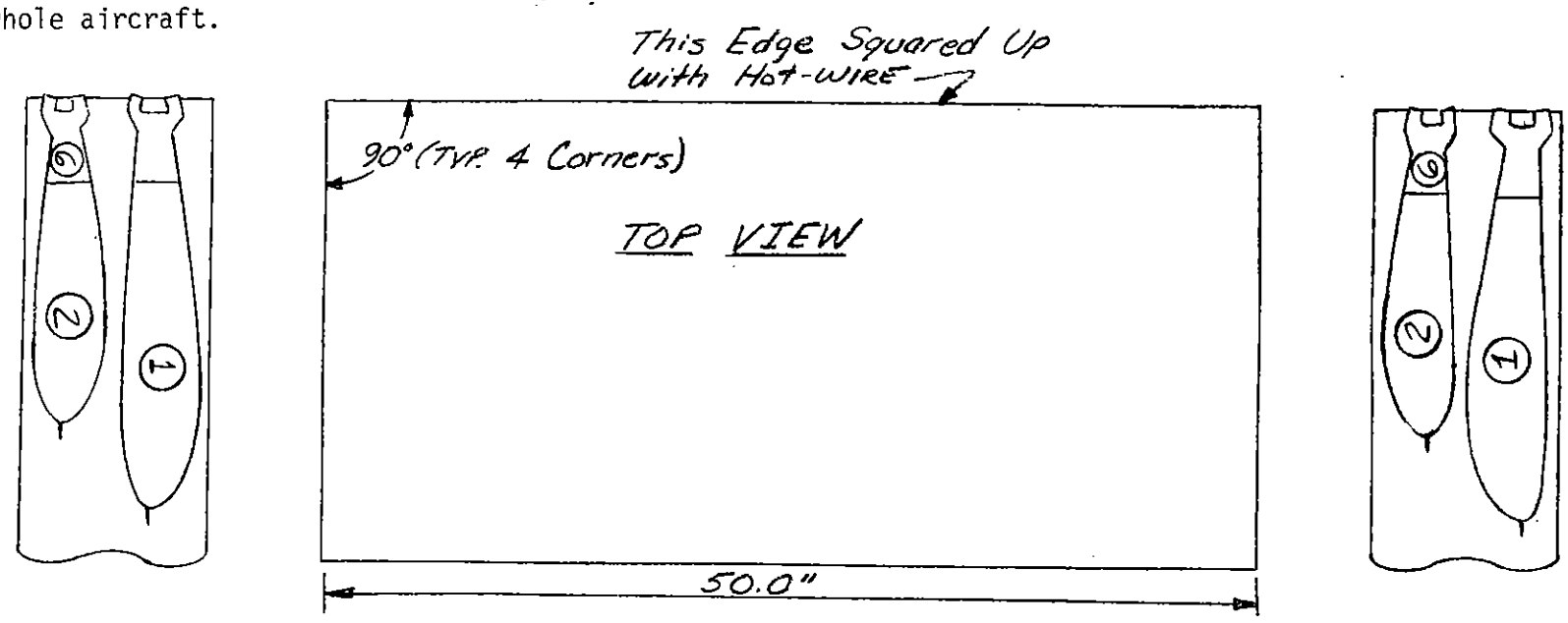
Find the two 10" x 24" x 96" nominal dimension blocks of polystyrene foam.

Using straightedged trim templates, square up three sides of one block to generate a core 50.0" long. The fourth edge (along the 50" side - see sketch) can remain scalloped. The sketch shows the positioning of the appropriate templates on each end of the block. Note that the sketch end views are oriented to duplicate the "picture" one sees looking at each end of the block.

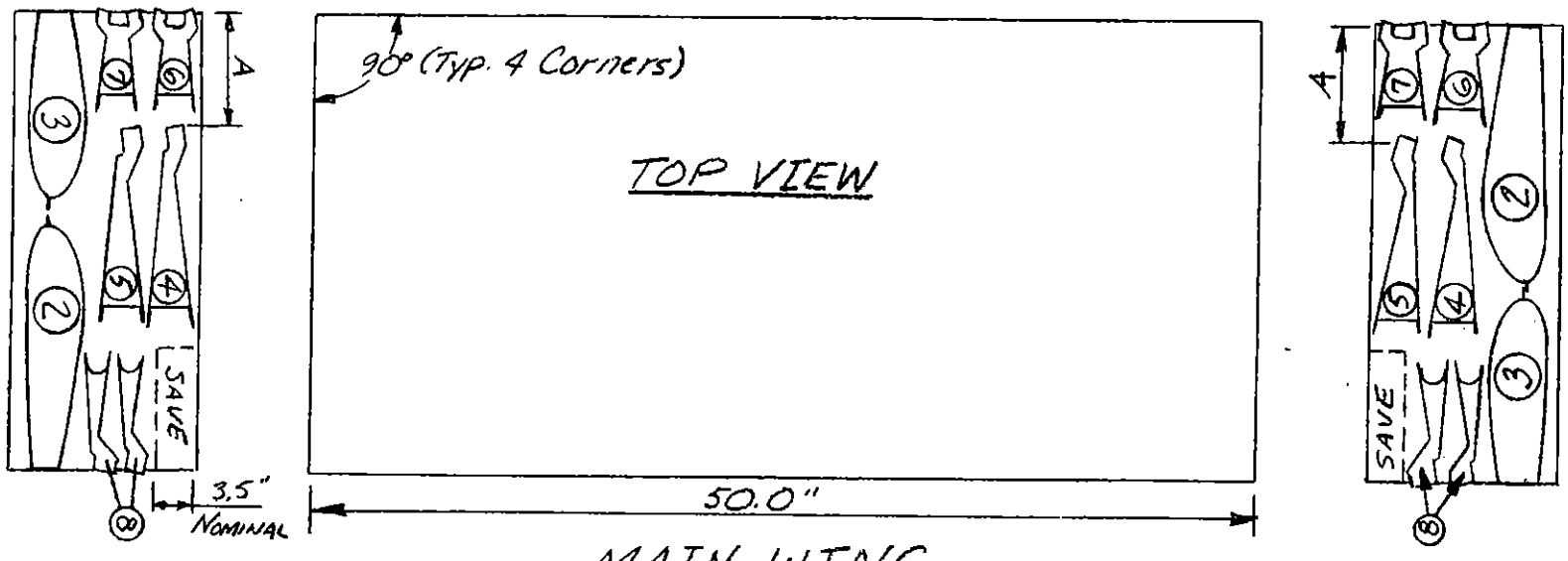
The second block is prepared identically, except the fourth side along the 50" edge needs to be squared up also. Follow the layout sketch to obtain the appropriate cores. Be sure that templates 2 and 3 can face each other without running out of width on the block.

The trailing edge of each template, unless otherwise indicated, must be lined up with the edge of the polystyrene foam. This gives the core the proper geometry for assembly into the main wing female jigging templates.

The aileron cores must be trimmed on either end after hot-wiring to 48" length. Both the Trailing Edge Foam Cores and the Aileron Slot Foam Cores (outboard) are cut considerably oversized, and will be trimmed to the proper length during installation.



MAIN WING
BL00-BL50 LT
BL00-BL50 RT



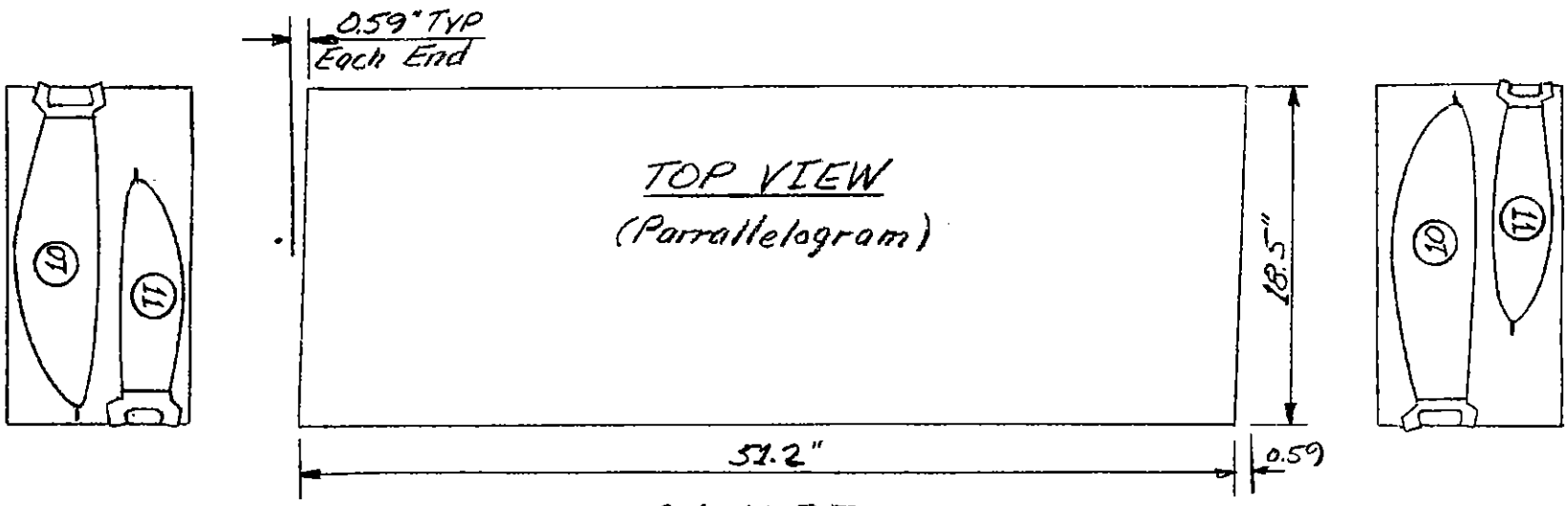
MAIN WING
BL50-BL100 LT
BL50-BL100 RT
AILERON (2)

NOTE: A is nominal 5"

CANARD CORES

The outboard and inboard canard cores are cut from skewed, parallelogram style blocks, with the exception of the canard center section. The reason for this is to obtain the proper sweep of the canard when the cores are jigged together later.

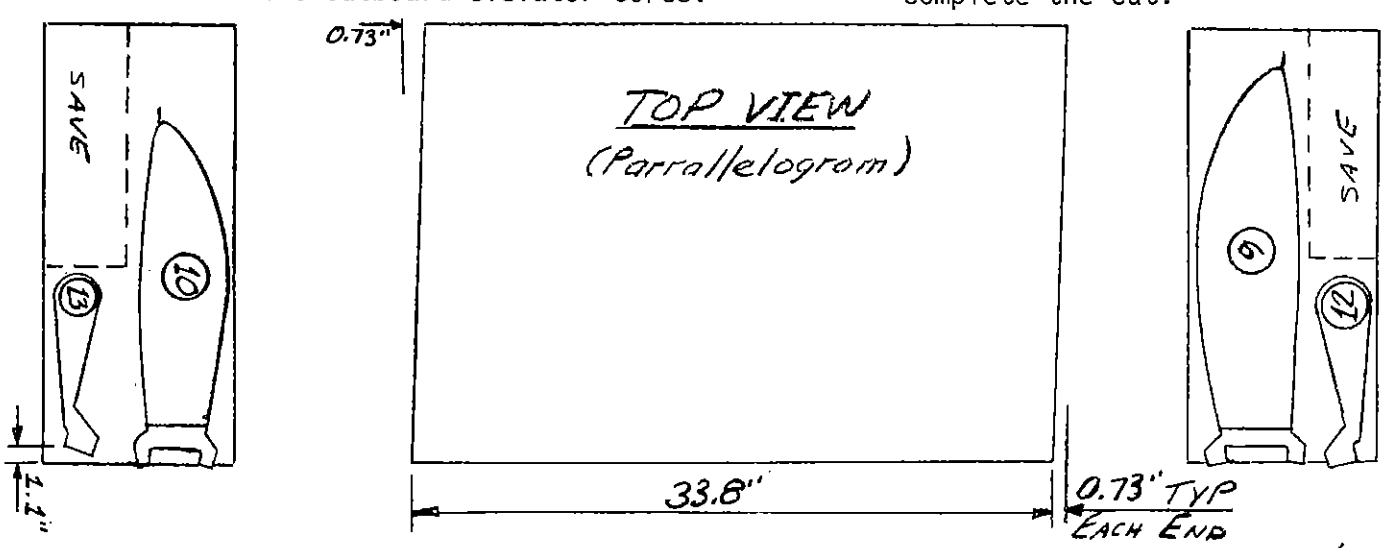
Begin by squaring up the 10" x 20" x 96" nominal dimension block of polystyrene foam to obtain a length of 51.2", with the skew as indicated. Next, using the sketch provided, hot-wire the outboard canard foam cores. Note that the bottom set of templates are up-side down, so as to obtain the proper geometry upon jigging.



CANARD
BL48.8 - BL100 LT
BL48.8 - BL100 RT

Next, find the extra pieces from the 10" x 24" blocks (2) and face them up to the dimensions shown. These two blocks are used for the inboard elevator cores and inboard canard cores. The portions not used will be used later for the outboard elevator cores.

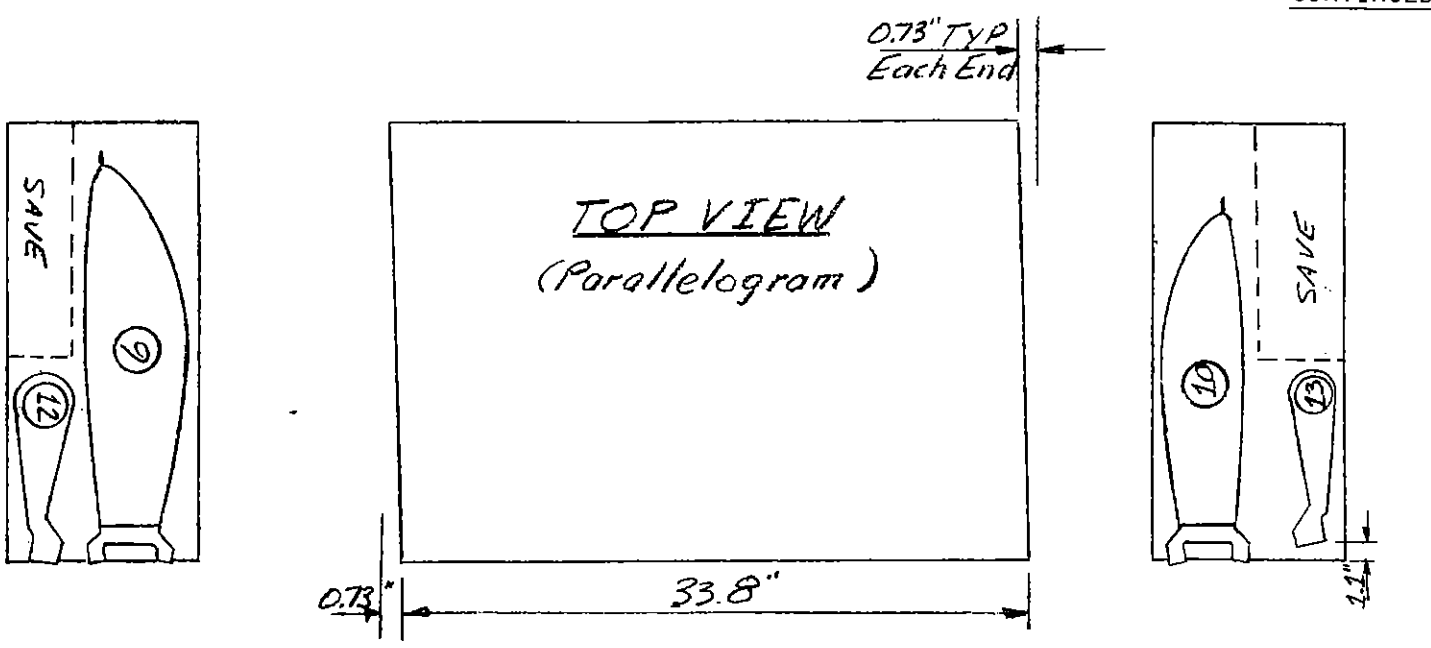
Don't forget the cutouts for the elevator torque tubes. After the elevator cores have been hot-wired, cut along one of the lines (e.g.4-A-B) and hot wire down that slot and around the inside (e.g. 4-A-B-C-D-E-F-G-H-I-B-A-4) and out again. Then cut along the other line (e.g. 4-F) and hot-wire along that slot to complete the cut.



CANARD
BL15 - BL48.8 LT
INC ELEVATOR

NOTE: DON'T FORGET STIFFENER!

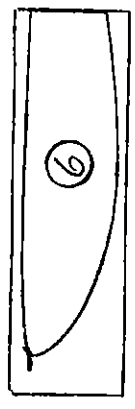
CONTINUED ON NEXT PAGE

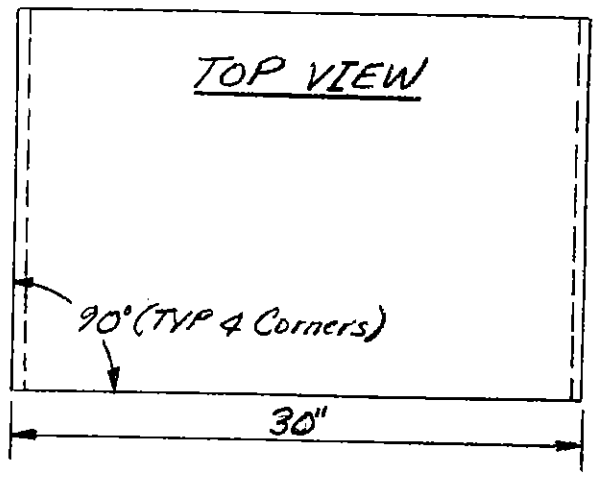


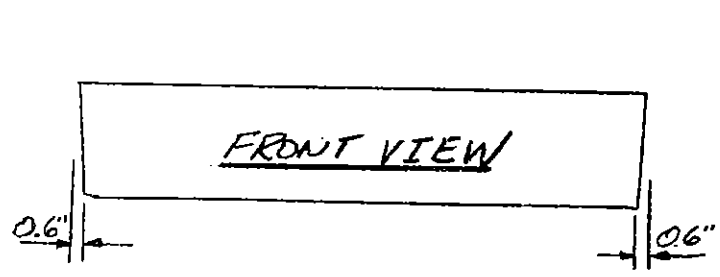
CANARD
BL15 - BL48.8 RT
INC ELEVATOR

NOTE: DON'T FORGET STIFFENER!

Finally, locate the remaining part of the 10" x 20" block and size it as shown, in order to make the canard center section. Keep the unused portion for cutting the vertical fin, so don't make the height over 6.0". Note the the 0.6" taper dimension is to allow for the proper anhedral angle upon assembly in the canard female jigging templates.

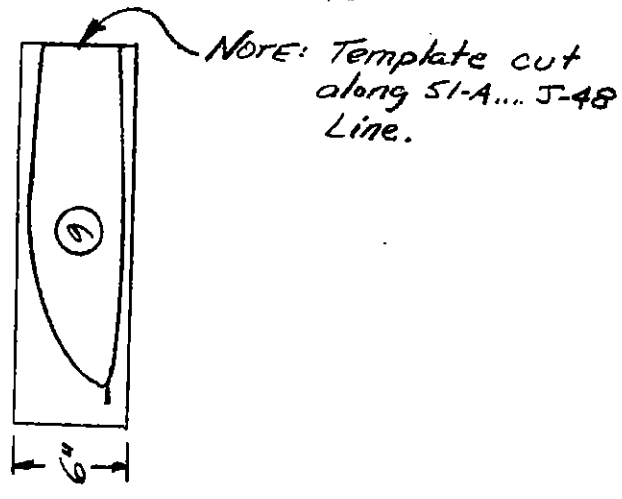






CANARD
BL15LT-BL15RT

Take the two canard template BL48.8 and BL15 and remove the 33-A-B-C-D-E-F-38 notch in each template. Then, hot-wire the canard stiffener out of each inboard canard and canard center section foam core, being careful to line the templates up properly. Store the stiffeners carefully to avoid damage.

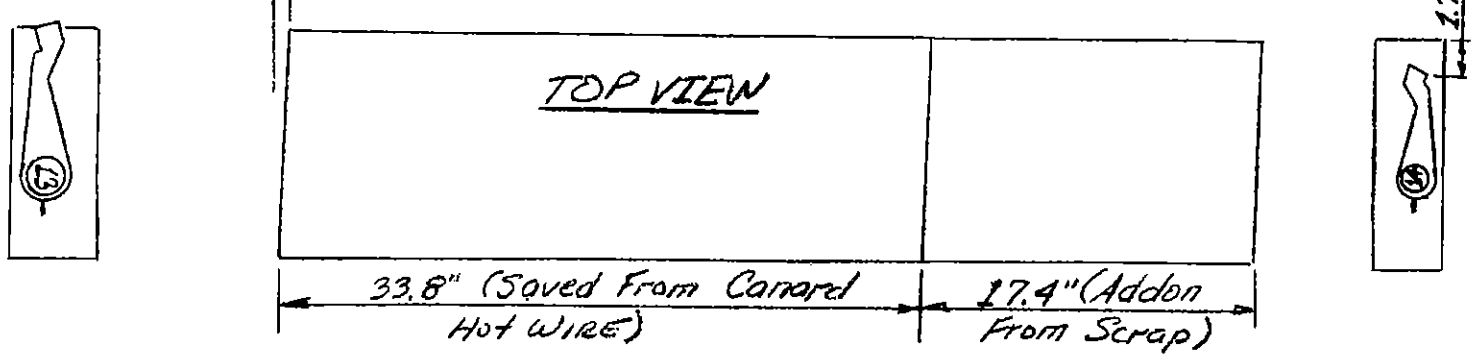


NOTE: DON'T FORGET STIFFENER!

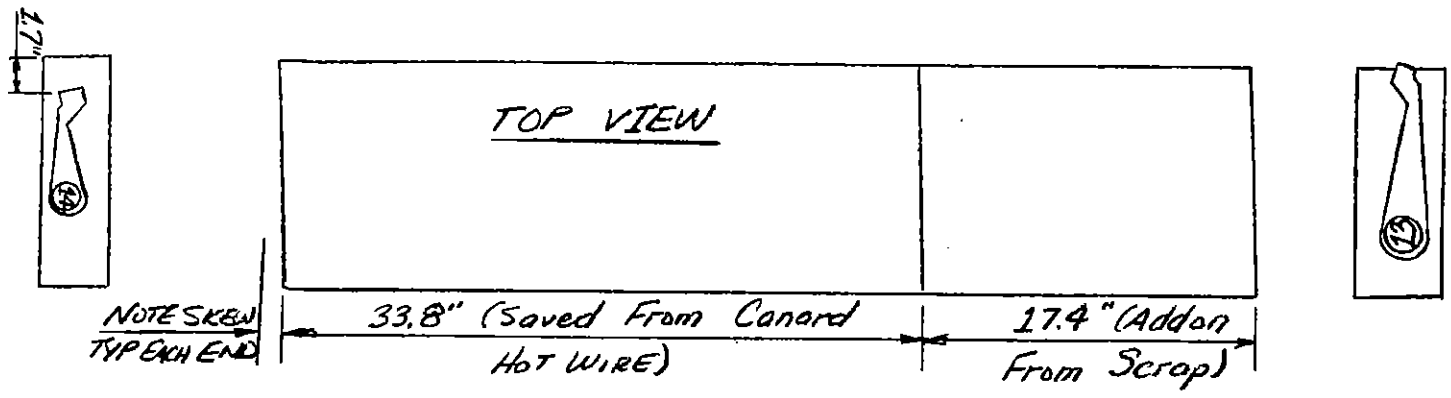
OUTBOARD ELEVATOR CORES

Find the two pieces of foam that you saved after hot-wiring the inboard canard cores. (The areas are marked 'save' on the sketches). Add some additional scrap pieces, being careful to obtain proper skew throughout the setup, and make the inboard elevator cores. The template offsets are necessary to obtain the proper geometry.

Hot wire for the elevator torque tubes like you did on the inboard elevator cores.



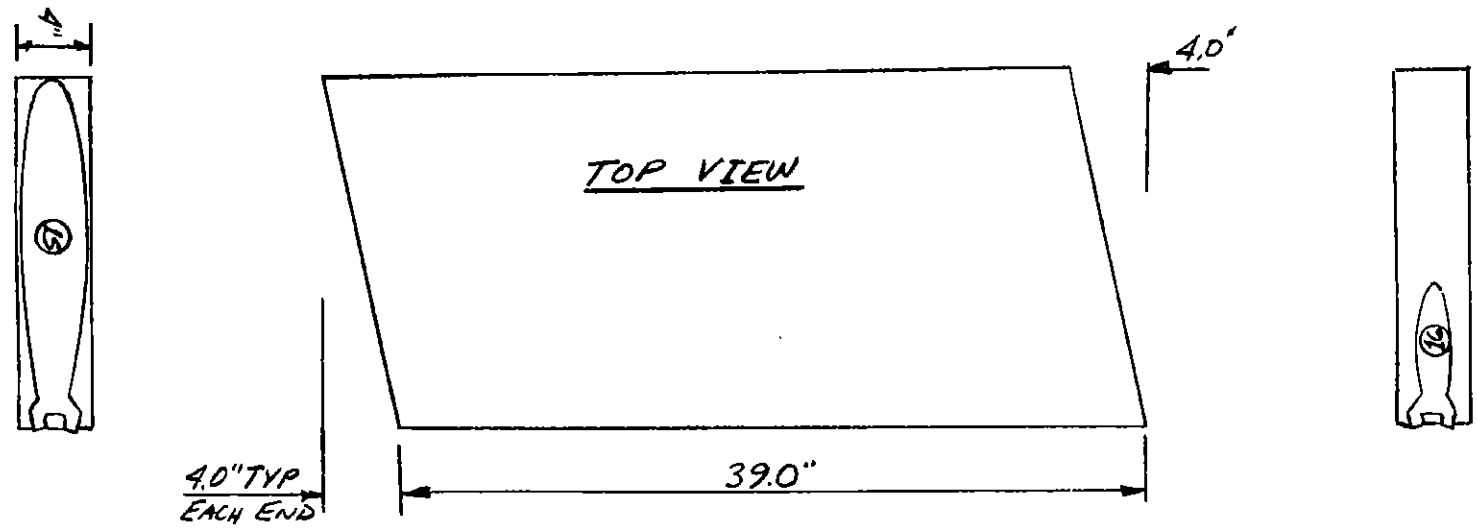
ELEVATOR
BL48.8- BL100 LT



ELEVATOR
BL48.8 - BL100 RT

VERTICAL FIN

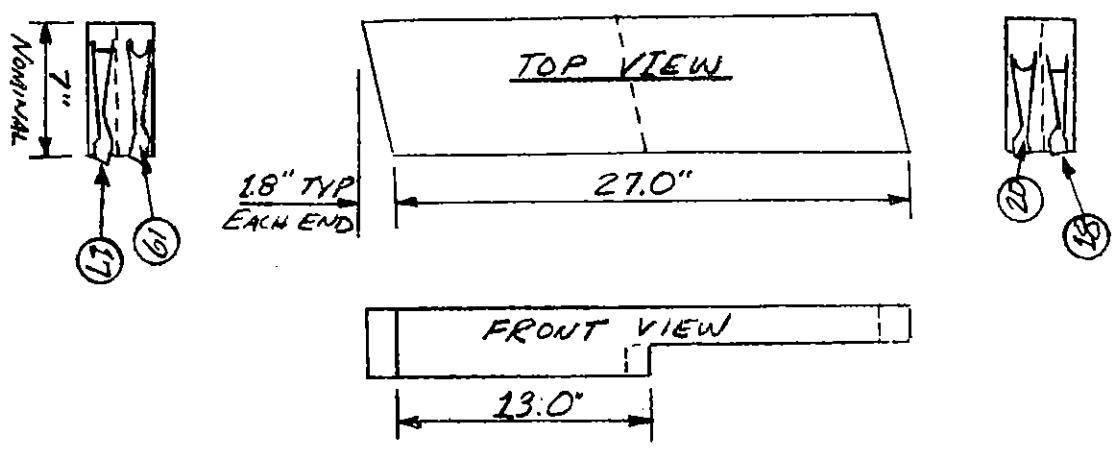
The vertical fin is cut out of the remains of the piece that you used to make the canard center section core. (Remember, the one we told you to keep and not throw away). The sketch is self-explanatory.



VERTICAL FIN

RUDDER AND VERTICAL FIN TRAILING EDGE

These two cores are made from the piece marked 'save' that was left over after hot-wiring the main wing, BL50-100 cores. The stagger shown on the front view is necessary because the rudder core is 27" long, while the remaining trailing edge length is only about 13". It is suggested that you cut the rudder core first, and then reduce the block length to 13" for the trailing edge core. As a note of explanation, the rudder extends up the vertical fin only part way. (Similar to the way that the aileron extends outboard on the main wing only part way).



RUDDER

VERTICAL FIN T.E. CORE

WHEEL PANT CORES

The wheel pant cores are cut out from the scrap pieces that you now have laying around. They needn't be hot-wired, except to obtain the proper thickness, but rather can be cut out by bandsaw or coping saw.

MISCELLANEOUS USES

The remaining scrap can be used for many miscellaneous purposes, such as supporting major components to avoid damage, soft sanding blocks, filets to clean up airflow, etc.: use your imagination.

END OF CHAPTER

AILERONS, RUDDER, AND ELEVATORS CONSTRUCTION

AILERON CONSTRUCTION

Both ailerons may be constructed at the same time. These instructions will only cover the construction of the left aileron, but the right aileron is a mirror image.

Begin by finding CS9, which is a 48" length of 1" O.D. x 0.035" wall 2024T3 Aluminum tubing. You have already hot-wired the aileron foam core, so find it also. The aileron foam core should be trimmed to a 48" length.

Basically, you will join CS9 to the aileron foam core; sand the joints to remove bumps and joggles; layup the bottom skin; layup the top skin; and, finally, trim the trailing edge after installation on the main wing.

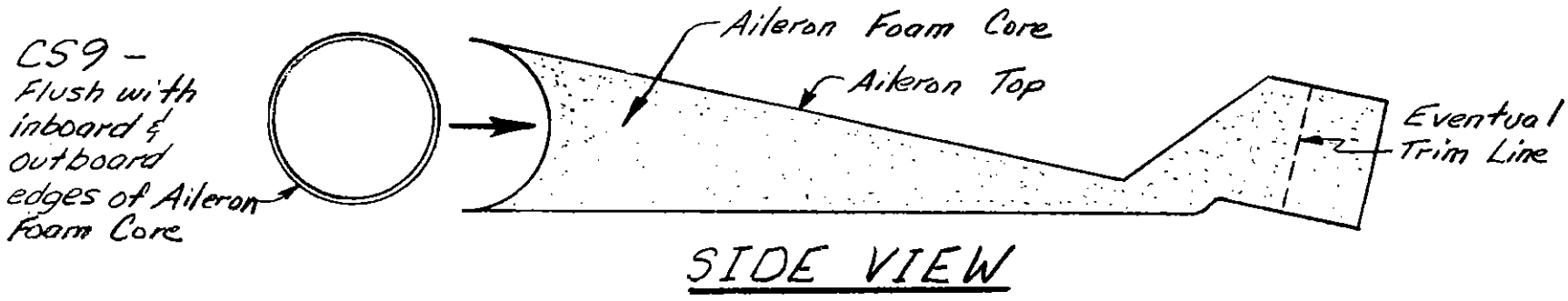
Begin by sanding CS9 to remove grease, finger prints, and the oxidation layer on the aluminum. Trial fit CS9 to the aileron foam core; mix up some micro slurry, and then join CS9 to the aileron foam core on a flat surface. Use nails to hold the two pieces together.

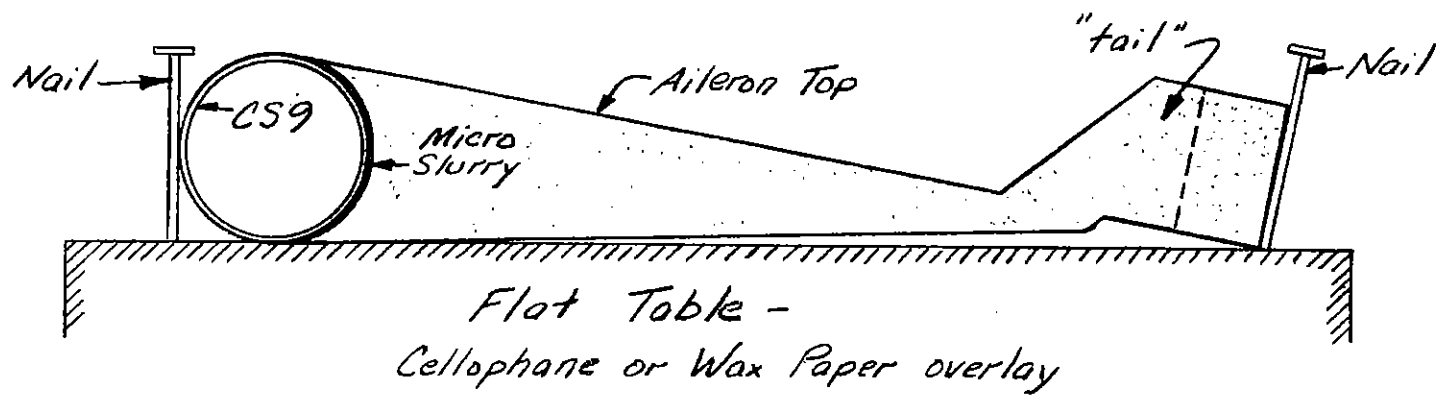
Once this combination has cured, sand away all of the bumps and joggles. Next, turn the aileron over and lay it flat on the table, bottom side up. Put Peel Ply along the trailing edge using small tacks to hold it in place. Layup 2 UNI at 45 Deg. to the trailing edge (T.E.) At the leading edge (L.E.) let the cloth drop vertically to the table and knife trim at the point tangent to CS9. Trim the trailing edge to within ½" of the foam core trailing edge.

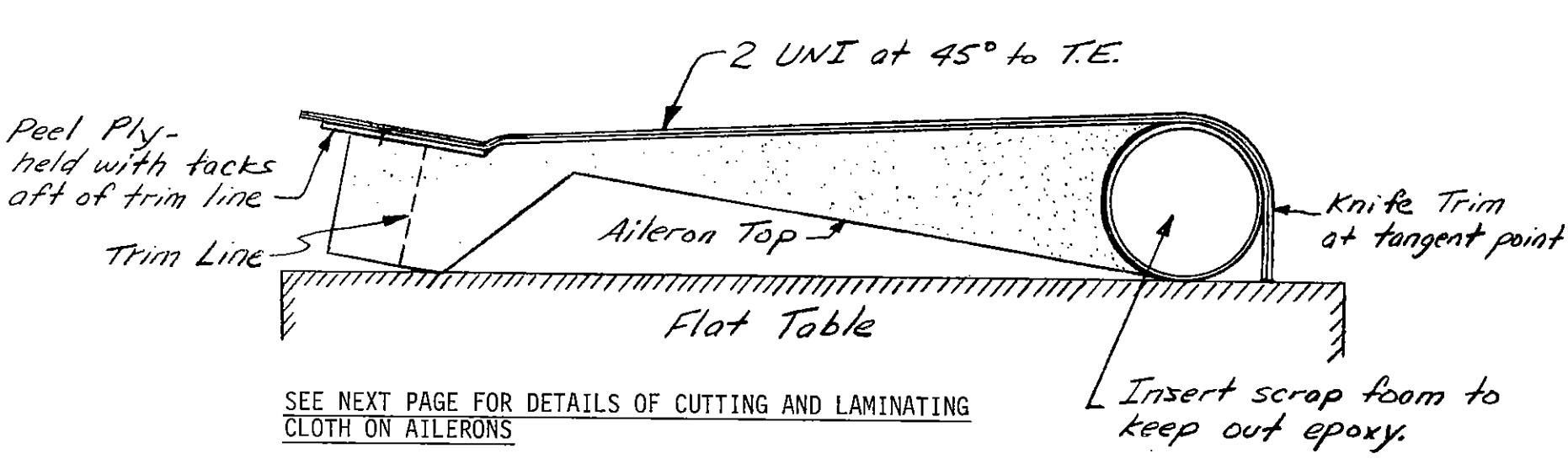
When this layup has cured, turn the aileron over and lay it flat on the table. At the leading edge, feather the UNI plies to the foam to remove the joggle. At the trailing edge, sand off the "tail" until you reach the Peel Ply. Remove the Peel Ply, and sand away any bumps and joggles. Layup 2 UNI at 45 deg. to the trailing edge. At the leading edge, overlap a minimum of 0.5" onto the previous bottom layup. At the trailing edge, layup glass to glass. Leave the aileron alone until it has cured to avoid changing the alignment, and then feather the top surface UNI plies to remove the leading edge (L.E.) joggle.

Leave the trailing edge untrimmed until after the aileron is mounted on the main wing, so that it can be made to match the trailing edge of the wing.

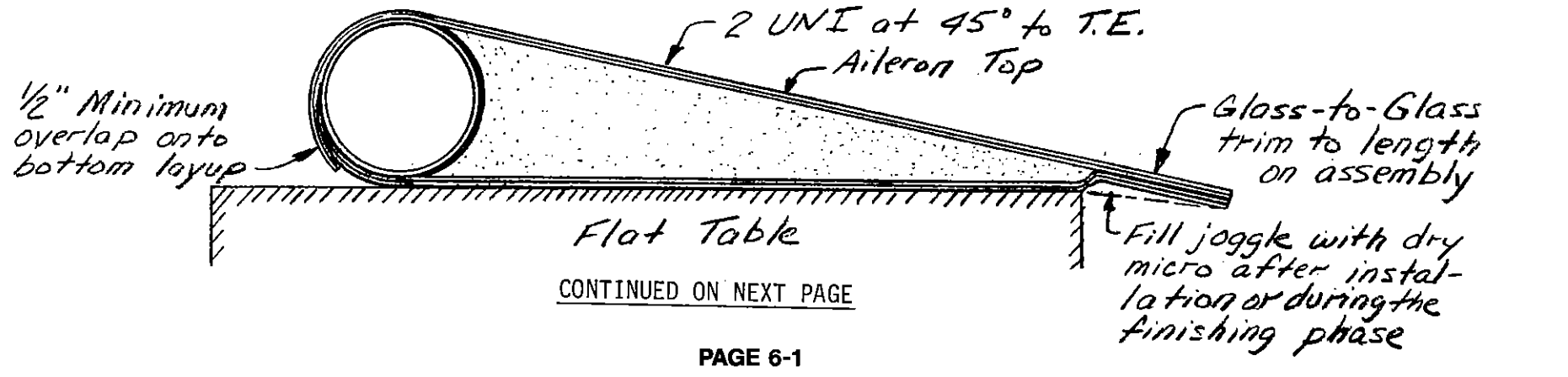
The joggle on the bottom of the ailerons (as well as the joggles on the bottom of the rudder and elevators) is filled with dry micro after installation of the aileron on the wing or during the finishing phase.







SEE NEXT PAGE FOR DETAILS OF CUTTING AND LAMINATING CLOTH ON AILERONS



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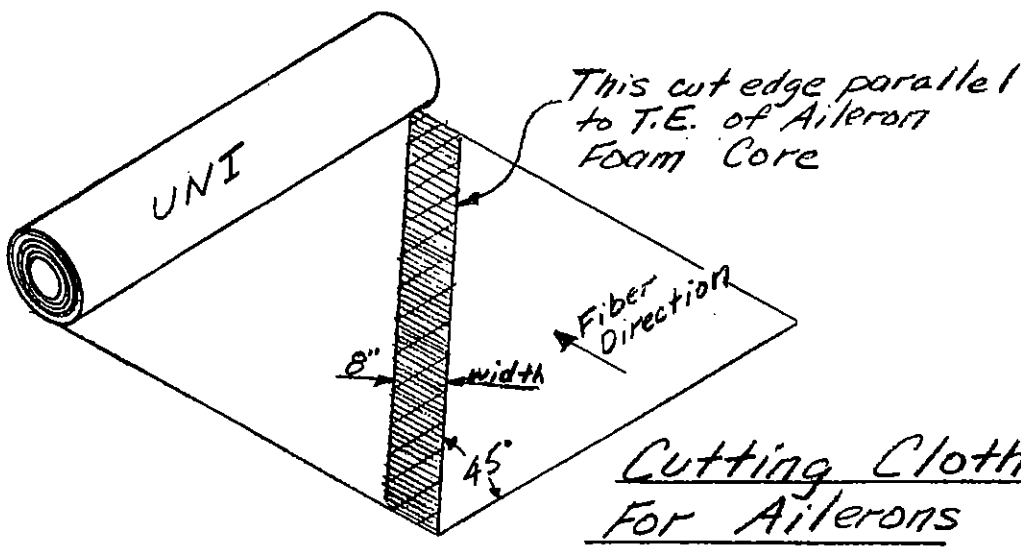
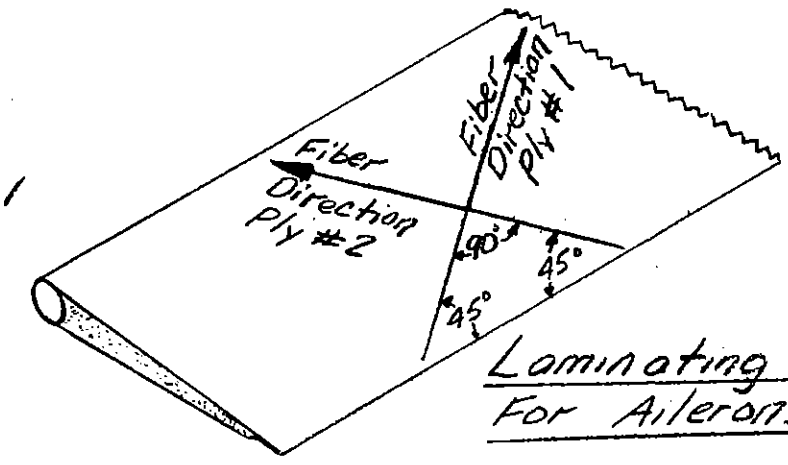


Cutting Cloth For Ailerons



Laminating Cloth For Ailerons

Notes: ① 4 pieces (2 top & 2 bottom) required per aileron

② Turn piece over to change Fiber direction 90° for Ply #2.

③ Sizing correct only for Aileron.

RUDDER CONSTRUCTION

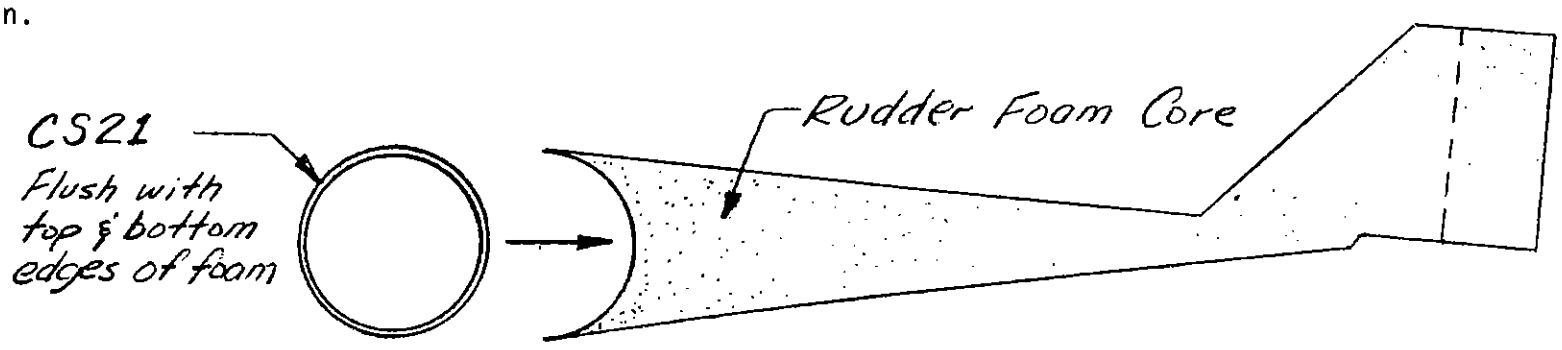
The rudder construction is very similar to the aileron construction that you have already completed. Re-read the AILERON CONSTRUCTION section before proceeding further.

Unlike the aileron, the rudder is a tapered chord, symmetrical surface.

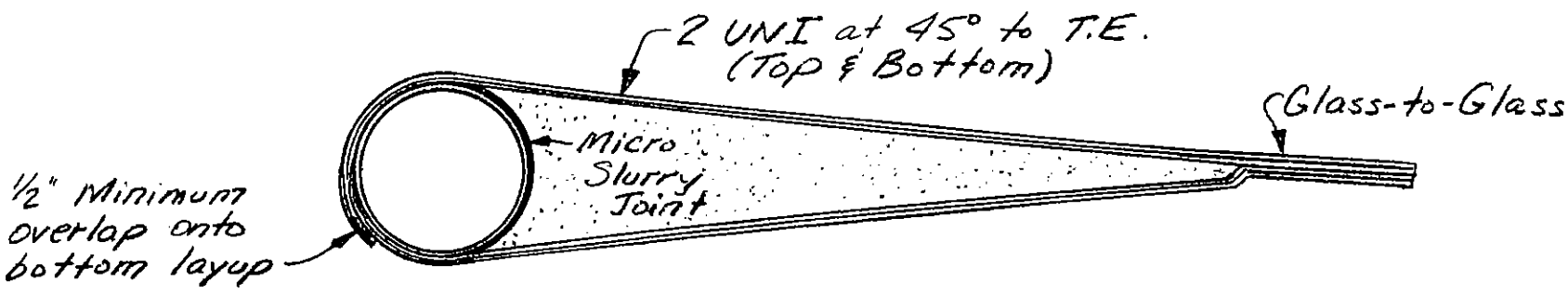
Begin by finding CS21, which is a 27" length of 1"O.D. x 0.035" wall 2024T3 aluminum tubing. You have already hot wired the rudder foam core, so gather that piece also. The rudder foam core should be trimmed to 27" length.

Basically, you will join CS21 to the rudder foam core; sand the joints to remove bumps and joggles; layup the bottom skin; layup the top skin; and, finally, trim the trailing edge (T.E.) after installation on the vertical fin.

The lamination schedule on the rudder is 2 UNI on either side at 45° to the T.E., just like the aileron. Measure the rudder foam core and cut the UNI cloth to the proper size. Follow the AILERON CONSTRUCTION procedures to join CS21 and the rudder foam core, as well as to do the lamination. Because you have already performed the sequences once; guard against becoming sloppy. The finished rudder should look much better than the first aileron because of the practice you have had.



SIDE VIEW



RUDDER COMPLETE

ELEVATOR CONSTRUCTION

The elevator construction is very similar to the aileron construction that you have already completed. Reread the AILERON CONSTRUCTION section before proceeding further.

These instructions cover only the construction of the left elevator, but the right elevator is a mirror image. It is suggested that both elevators be constructed simultaneously. Since the elevator has a tapered chord, BE SURE TO MAKE ONE LEFT ELEVATOR AND ONE RIGHT ELEVATOR.

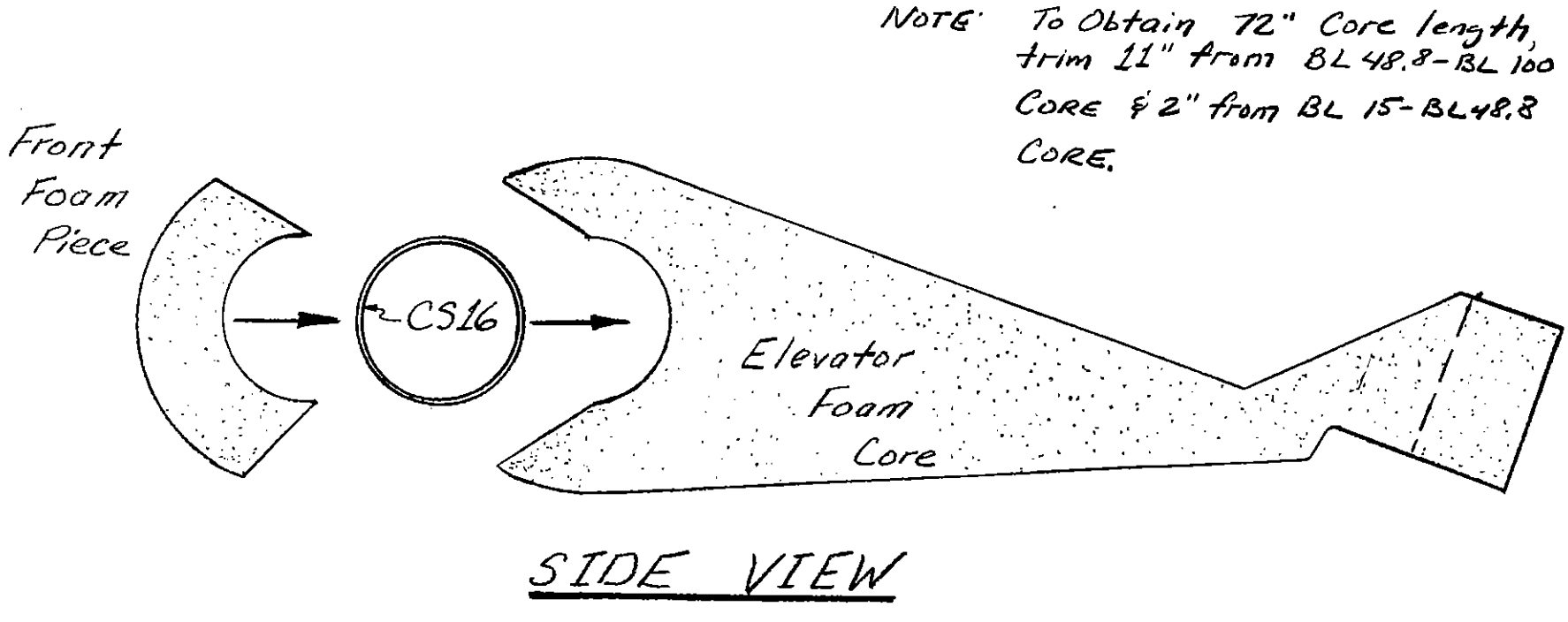
Begin by finding CS16, which is a 72" length of 1" O.D. x 0.035" wall 2024T3 aluminum tubing. You have already hot wired the inboard and outboard elevator cores, so gather these together also. When the cores are joined they should total 6 ft. in length.

Basically, you will join the inboard and outboard core together, insert CS16, replace the front foam pieces, sand the combination after it has cured to remove bumps and joggles, layup the bottom skin, layup the top skin, and final trim the trailing edge after installation.

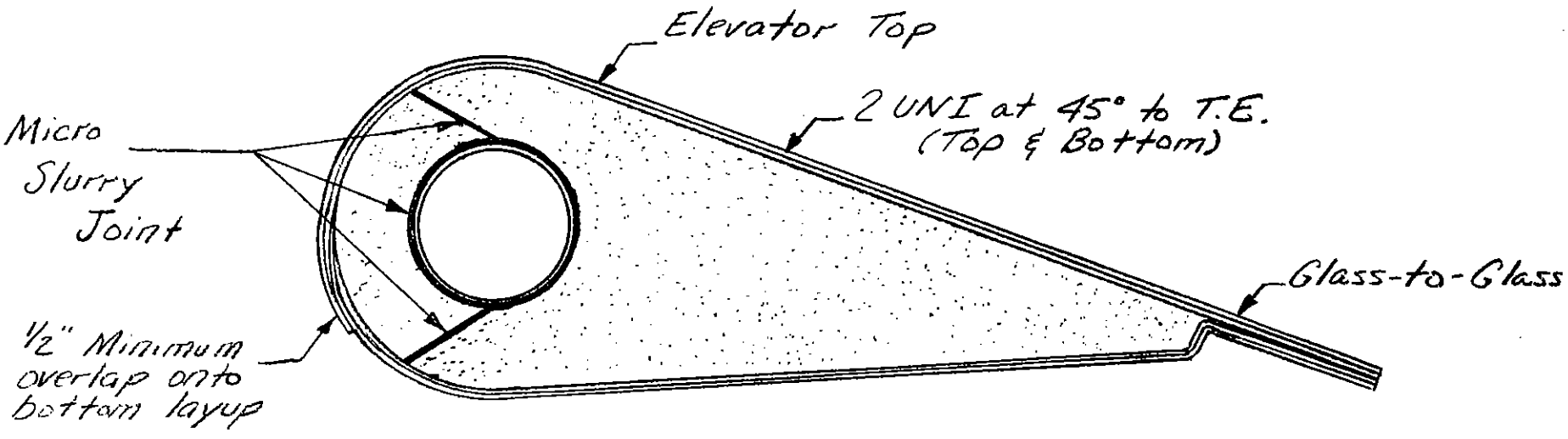
First, verify that the circular cutout for CS16 hot wired in the foam cores is large enough by putting the cores, CS16, and the front foam piece together dry. If the front piece won't clamp up against the core easily, carefully enlarge the cutout for CS16 until it will. The micro slurry will require approximately 1/32 gap.

Next sand CS16. Mix up micro slurry; paint it both on CS16 and on the foam wherever CS16 comes in contact with foam. Join the inboard and outboard foam cores together with micro slurry; insert CS16; then insert the front foam peice. Do not telescope CS16 into the core by pushing it from one end; this will cause voids in the bond. Instead, it should be inserted all along the span at one time. Use nails to hold everything in place while it cures (see AILERON CONSTRUCTION),and verify that both ends of CS16 are flush with the ends of the elevator foam cores.

The elevator lamination is 2 UNI bottom and top at 45 deg. to the trailing edge, just like the aileron. Measure the elevator foam cores and then cut the UNI cloth to the proper size. More than one piece of UNI will be required to cover the entire 72" elevator span. Where the UNI pieces join, no overlap is needed, (i.e. butt joint is OK) but stagger the joints on Ply #2 so that the foam along the butt joint line is covered. Lay up these plies exactly like you did on the ailerons. Don't forget the foam scraps in the end of CS16. Do not trim the trailing edge until after the elevators are mounted on the canard.



SIDE VIEW



ELEVATOR COMPLETE

END OF CHAPTER

VERTICAL FIN CONSTRUCTION

INTRODUCTION

The vertical fin is a symmetrical sandwich composite structure with solid foam core, two layers of UNI at 45 degrees to the trailing dege of the vertical fin for torsional stiffness and surface durability, and spanwise tapes of UNI for bending strength. The skills that you learn in this chapter will come in handy on the more complicated structures like the main wing and canard.

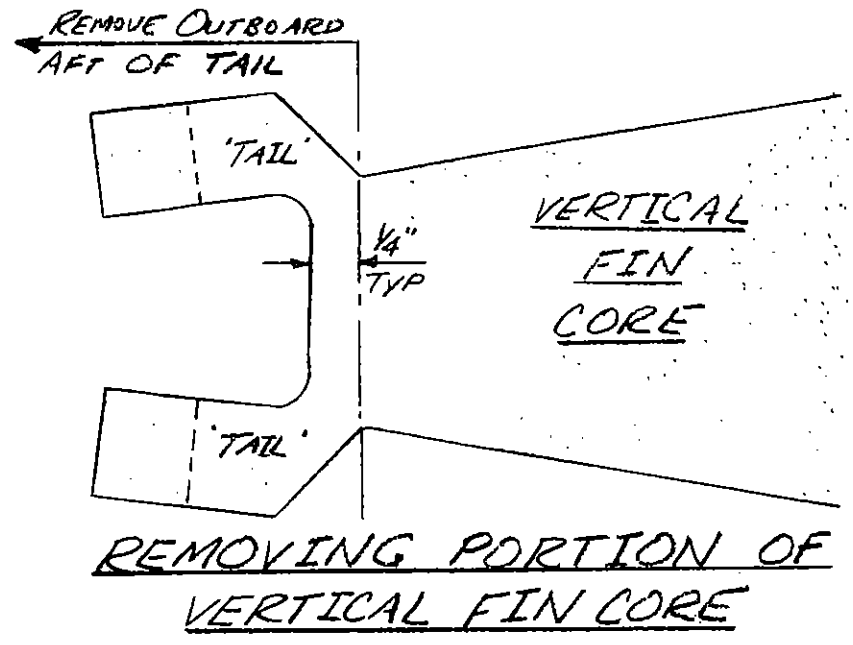
JIGGING THE VERTICAL FIN

Construction begins by jigging the vertical fin core on the jigging table. Locate the vertical fin core that you previously hot-wired, along with the vertical fin trailing edge core.

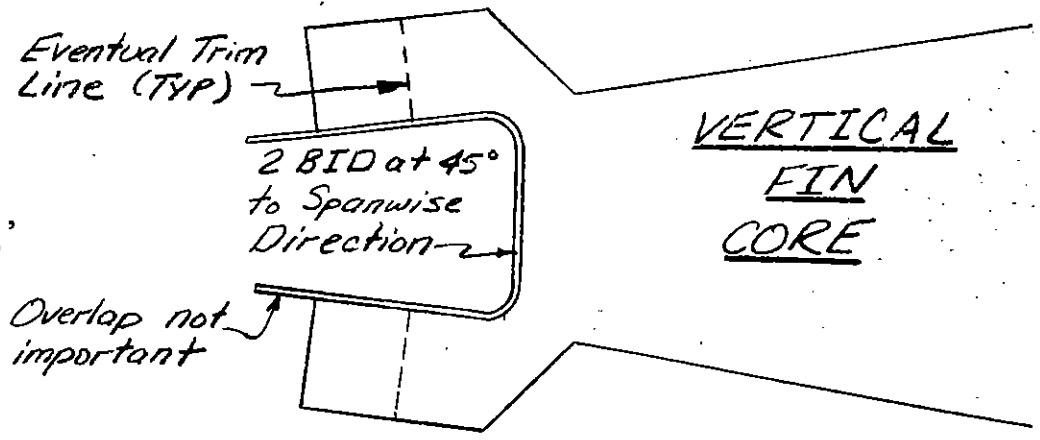
Find the vertical fin female jigging templates(2).

Measure 10.0" down the trailing edge from the tip of the vertical fin (the small chord end) and make a mark. Remove the portion of the vertical fin core shown. This is done because the rudder extends only partway up the vertical fin. Trial fit the vertical fin trailing edge core against the vertical fin core where the surgery had been performed. Note that the vertical fin trailing edge core was hot-wired longer than necessary, and will have to be trimmed to fit properly. When the cores are dry fit together, they should make a smooth transition. If not, any depressions must be filled with micro prior to glassing, and any bumps and joggles can be sanded away. Join the vertical fin core to the vertical fin trailing edge core with micro slurry and a few dabs of 5-MIN to hold the two together. Since the vertical fin is symmetrical, verify upon assembly that the vertical fin trailing edge core is not attached cocked to one side.

Next, glass the vertical fin slot with 2 BID at 45 degrees to the spanwise direction. This will be easier if you support the vertical fin core vertically temporarily.



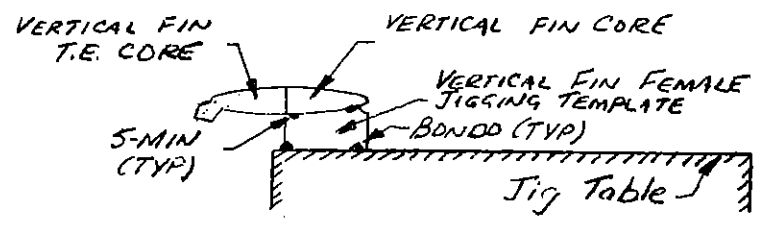
REMOVING PORTION OF VERTICAL FIN CORE



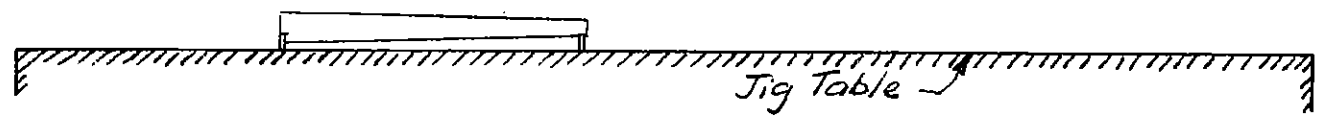
VERTICAL FIN SLOT LAMINATION

Now, study the sketches and jig the vertical fin core to the vertical fin female jigging templates with the 'tail' of the vertical fin trailing edge core pointing down toward the jigging table. Make sure that all level lines are level. Sand the 'tail' of the vertical fin core so that when you laminate the skin, you will obtain a glass-to-glass bond at the vertical fin slot.

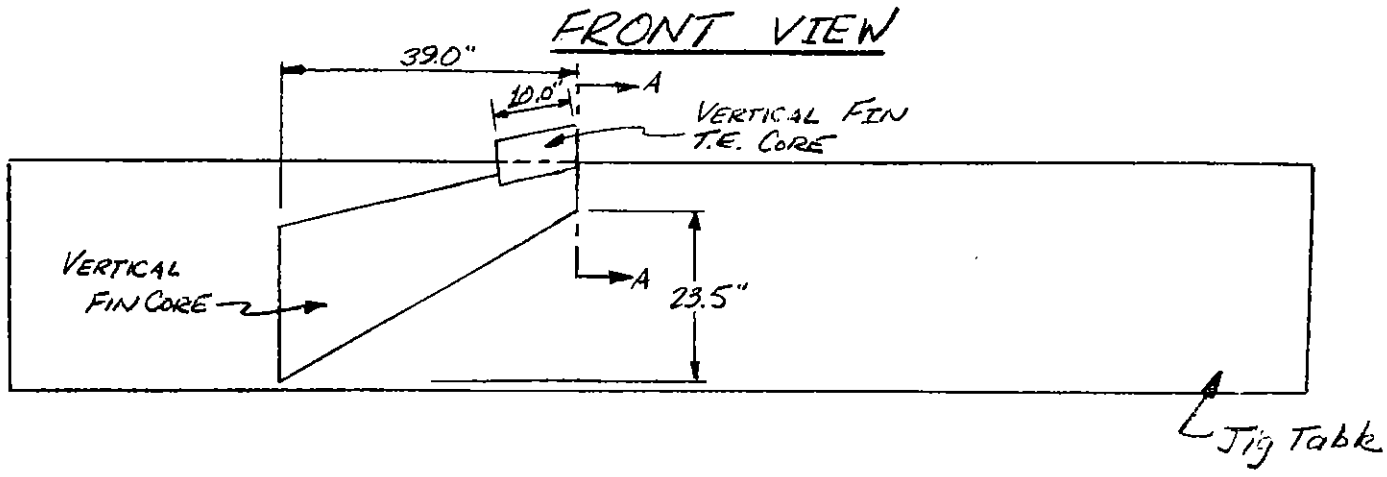
The lamination of the skin and spar caps is very similar to what you have previously accomplished in making the ailerons, elevators, and rudder. It would perhaps be wise to review that chapter at this time.



SECTION A-A



FRONT VIEW



TOP VIEW

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Cut all of the UNI cloth for the skin and spar caps.

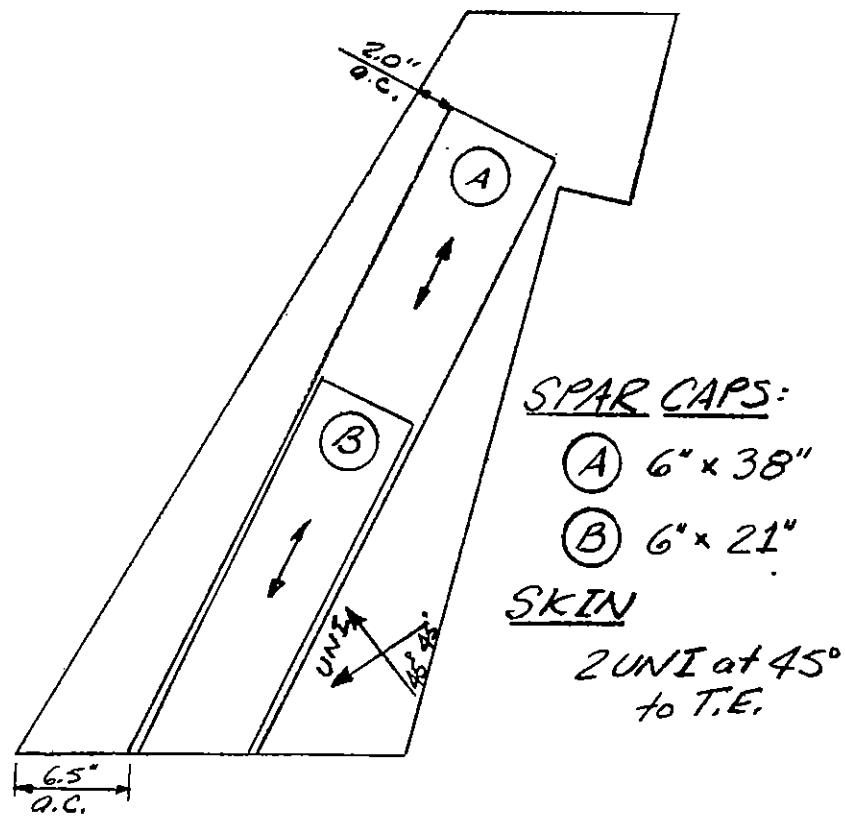
Laminate 2 UNI at 45 degrees to the trailing edge of the vertical fin. Don't forget the peel ply tape on the trailing edge of the vertical fin trailing edge core, and remember to knife trim the leading edge at the tangent point,and to obtain glass-to-glass bonding in the vertical fin slot area. Next, laminate the two spar caps. Permit the lamination to set unbothered for at least 24 hours.

After allowing the lamination to cure, you are now ready to turn the vertical fin over and laminate the other side. If you are careful when removing the vertical fin from the vertical fin female jigging template, you will be able to use the templates again in the following lamination. Check all level lines again and again before completing the jigging.

The lamination for the other side of the vertical fin is identical to what you previously accomplished. Remember to sand down the 'tails' on both the vertical fin trailing edge core and the vertical fin slot area. At the leading edge of the vertical fin, feather the previous glass layup. Laminate the skin first (2 UNI at 45 degrees to the trailing edge), overlapping at the leading edge a minimum of 1" and making a glass-to-glass bond at the trailing edges, and then laminate the spar caps. Let the vertical fin cure for at least 24 hours.

Later on, you will modify the shape at the vertical fin root so that it can 'plug into' the aft fuselage. For now, content yourself with adding a small piece of Urethane to the tip, carving it to a pleasing shape, and glassing with 1 BID, overlapping onto the vertical fin.

END OF CHAPTER



VERTICAL FIN LAMINATION

NOTE: a.c. means along contour

BASIC FUSELAGE ASSEMBLY

INTRODUCTION

Jigging the fuselage is your first major assembly task on the Q2. Because the Q2 fuselage shells are provided you in a prefabricated form, jigging is simplified, and there is no messy carving of urethane foam, as is the case with other homebuilts. Perhaps more important, the average builder will find that with the prefabricated fuselage shells, a smoother, aesthetically more pleasing shape will result (carving foam puts the final shape and beauty in the eyes of the carver) and that the final weight will be as much as 30 lbs lighter since all excess material is removed through the prefabrication process and the vast majority of finishing weight is eliminated. But most important probably, is that you can be sitting in the cockpit making airplane noises in a very short time - a most definite incentive to finish the rest of the aircraft!

PRELIMINARY TRIMMING AND JIGGING OF THE SHELLS

The fuselage shells are shipped to you in four sections - upper and lower forward fuselage and upper and lower rear fuselage. The upper/lower longitudinal cut line is arbitrary; the cut line that separates the forward fuselage from the rear fuselage coincides with the fuselage cut line used for making your Q2 trailerable.

The shells are long, and must first be trimmed back to the proper length using the trim lines on the parts. If a particular trim line is difficult to read, trimming the part during jigging will yield the best fit. The parts should be inspected by the builder for quality control using the Composite Materials Education chapter as a guide. In addition, if you measured carefully, you would find that although the shells will look symmetrical left to right, that there is some assymetry from left to right. This is nothing to worry about, just note for future reference.

Locate the 5 fuselage female jigging templates and the bulkheads that you made previously. Study the sketches to obtain a feel for where jigging templates were setup to jig the fuselage approximately level with WL15 when the jigging table is level; note that the longitudinal fuselage spit line does not coincide with a WL. Establishing a WL is important so that the main wing and canard can be mounted later at the proper angle of incidence.

First, you should setup the fuselage female jigging templates at the FS locations called out on the templates. Use some triangular corner blocks made from scrap lumber to hold them vertically temporarily. Next, set the lower fuselage shells into the fuselage female jigging templates. Do not be concerned if you find it necessary to move the fuselage female jigging templates fore and aft to achieve a good fit; remember that you are not looking for a perfect fit, just a resting place for the shells while you assemble the fuselage. Once the locations of the fuselage female jigging templates have been astablished, Bondo them in place so that they will not shift position and rest the two lower shells into them.

Trail fit the upper fuselage shells onto the bottom ones and make any trim line corrections at this time. It looks like an aircraft doesn't it?

PRELIMINARY TRIMMING OF THE CANOPY CUTOUT

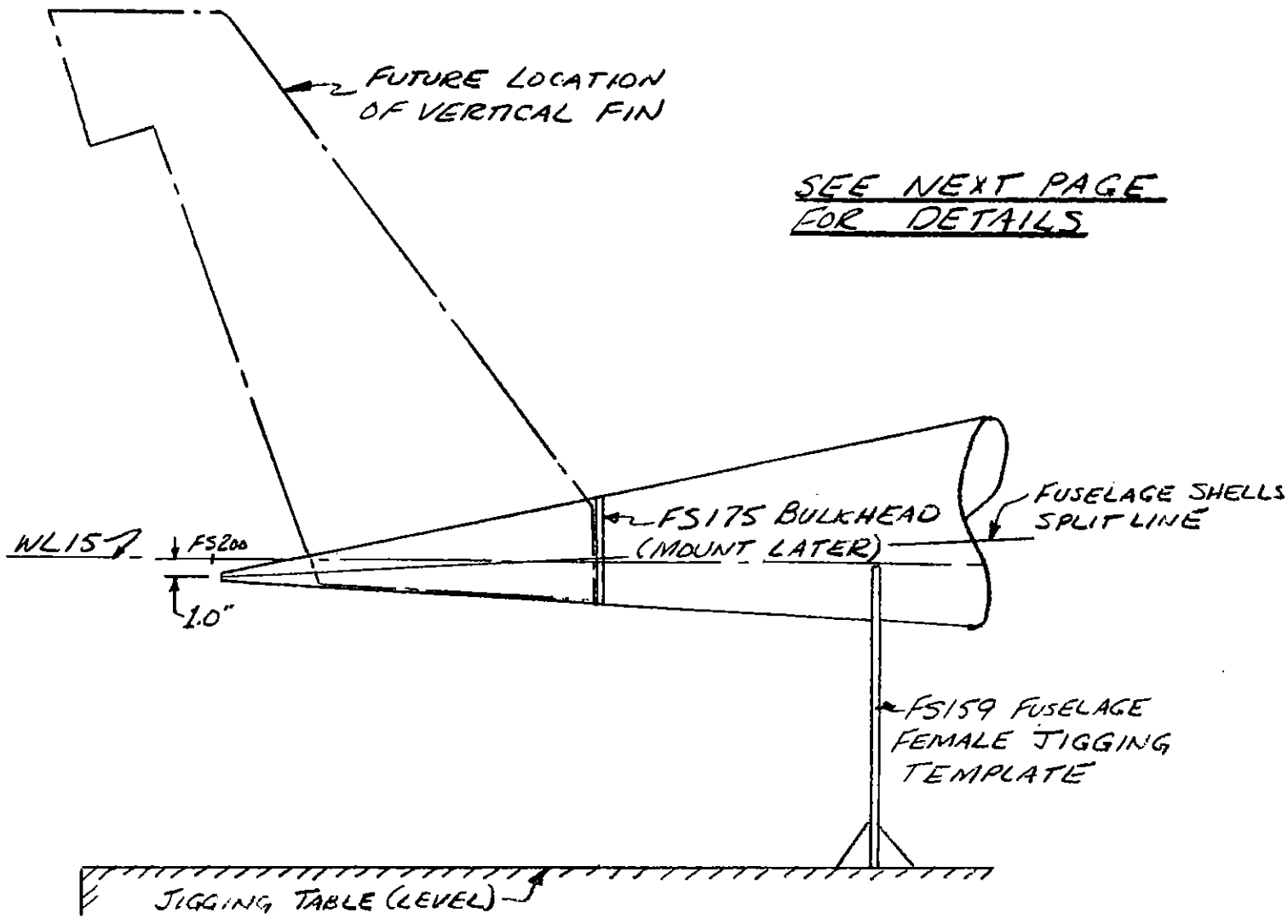
In order to provide access to the interior of the cockpit, you will need to digress for a moment and make a fitting of the pre-trimmed canopy to the upper forward fuselage so that a cutout can be made in the upper forward fuselage.

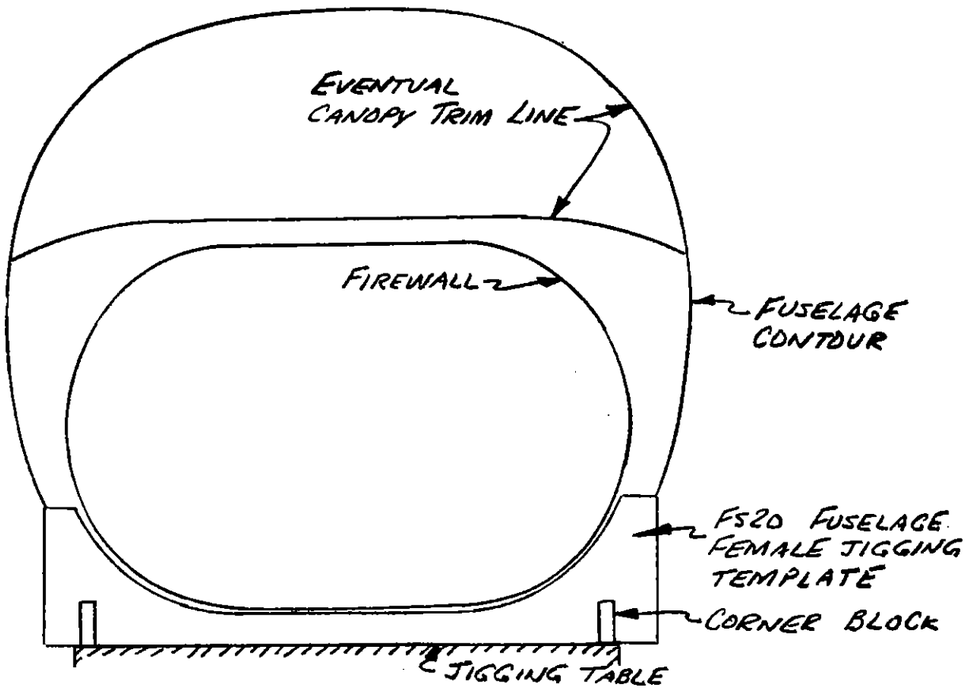
The forward face of the firewall is FS14.0; the forward face of the seatback bulkhead is FS78.0. Therefore, measure 64 inches from where the forward face of the firewall will be located along a WL to establish the aft edge of the canopy. Next, establish a preliminary BL00 line down the forward upper fuselage shell.

Drape the canopy, which is sent to your pre-trimmed to rough shape, over the forward fuselage. Even up the sides by measuring the distance on each side up from the longitudinal fuselage split line and adjusting the canopy until the distances match. Also, check for skewing.

Now, take a marking pen and draw a line around the outline of the canopy where it touches the fuselage. Some trimming of the canopy may be required to make it fit flush against the fuselage shell.

Remove the canopy and make a cut around the upper forward fuselage shell at the line. To be conservative at this point, you may wish to not cut quite all the way to the line, and then final trim the cutout later. All you are trying to do here is to gain access to the inside fuselage and to establish a rough fit on the canopy.





JIGGING OF THE FUSELAGE

In this step, you will want to trim for final fitting the following bulkheads: FS175, FS120, FS94, Seatback Bulkhead, and Firewall. All bulkheads, including the firewall, fit inside the shells, so that they rest against the inside skin of the shells. Begin by drawing BL00 down the bottom fuselage shells, forward and rear. Check the squareness of the lower forward fuselage shell where the firewall is located. It may be necessary to trim the forward edge of the lower forward fuselage shell to make the firewall set square. (i.e. perpendicular to BL00 and WL15). For now, you may assume that a level placed across the longitudinal split line at the firewall attachment point is correct for leveling the fuselage laterally. Don't forget that the firewall fits inside the shell. The FS120 bulkhead location is nominally at FS120 for the forward face, but is uncritical and can be moved plus or minus 1 inch for best fit. The FS94 bulkhead should not be trimmed until after the Seatback Bulkhead. The FS175 bulkhead aft face is located at FS175.

The location and angle of the seatback bulkhead is the prime consideration for comfortably accommodating different pilot sizes. If the primary pilot is over 6'6" tall or less than 5'5" tall, then Quickie Aircraft Corporation should be contacted for assistance in creating a comfortable fit. Basically, moving the break point in the Seatback Bulkhead lower allows the

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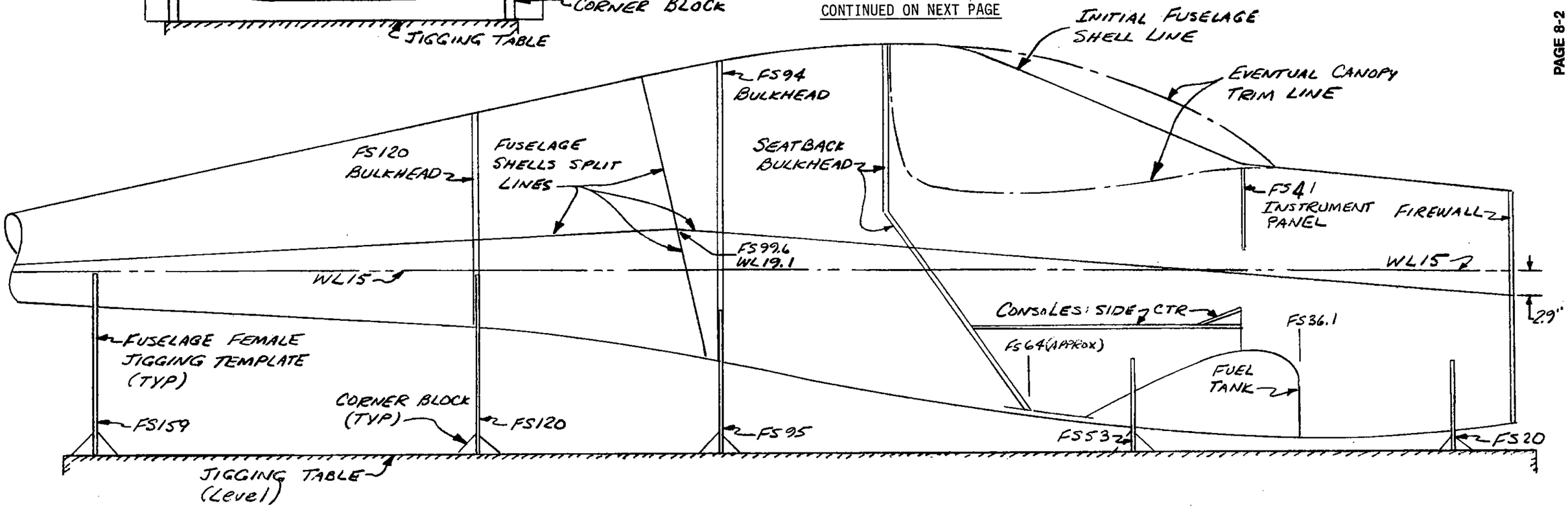


canted portion to be moved aft, which increases cockpit room. Moving the break point up moves the canted portion of the Seatback Bulkhead forward, making the cockpit more comfortable for shorter people. The nominal FS64 shown on the sketch as the intersection of the forward edge of the seatback bulkhead and the fuselage bottom is optimum for people up to 6'6". The forward face of the Seatback Bulkhead must be at FS78.

Once the Seatback Bulkhead is trimmed for position, you may trim the FS94 bulkhead. For many reasons, this bulkhead does not go at FS94, and is the only exception to the relationship between fuselage stations and locations. The FS94 bulkhead should be located so that the forward face of the FS94 bulkhead is at FS95. This is to allow proper clearances and fitting for the main wing upon its installation later.

All bulkheads are mounted vertically (use a level) except for the canted part of the Seatback Bulkhead. When you feel comfortable with the fit, (no, we are not talking about all the cockpit time you've been giving yourself!) then bond the bulkheads to the lower fuselage shells. The FS120 and FS175 bulkheads receive 1 BID tape front and back around the joint with good micro squeeze out, the seatback bulkhead and FS94 bulkhead receive 2 BID tapes front and back, and BID tapes to join the canted and upright portions of the Seatback Bulkhead. (Be sure to bevel the intersection). The firewall is mounted with 3 BID tapes outside, wrapping around the corner (which means you will have to radius the edge) and 2 BID tapes on the inside. Gentlemen and Ladies, each BID tape must lap onto the fuselage and bulkhead a minimum of 1 inch for proper structural joining. Use the level to check for the vertical orientation, and check the squareness of each bulkhead with respect to BL00.

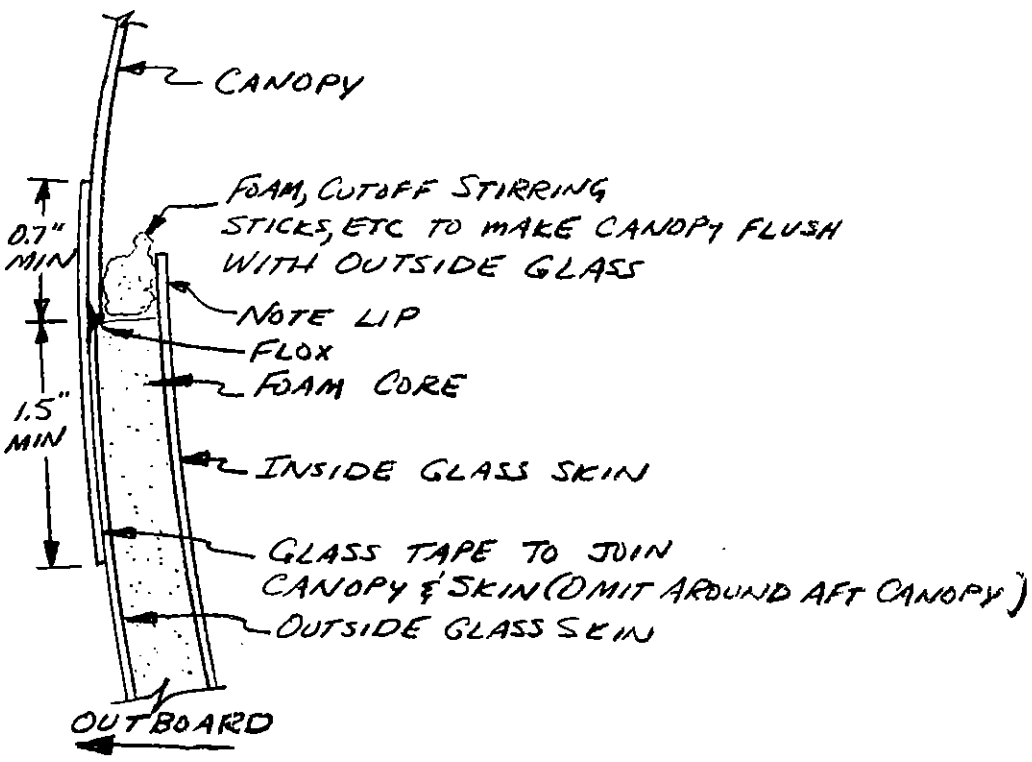
Do not install the instrument panel or fuel tank at this time.

MOUNTING THE CANOPY

Next on the agenda is to permanently attach the canopy to the upper forward fuselage, in preparation for cutting out the canopy frame. The procedures used are basically to final trim the cutout and canopy for fit, then to glass the outside canopy to the outside fuselage, and finally to fit the aft canopy bulkhead and glass the inside of the canopy to the inside of the fuselage.

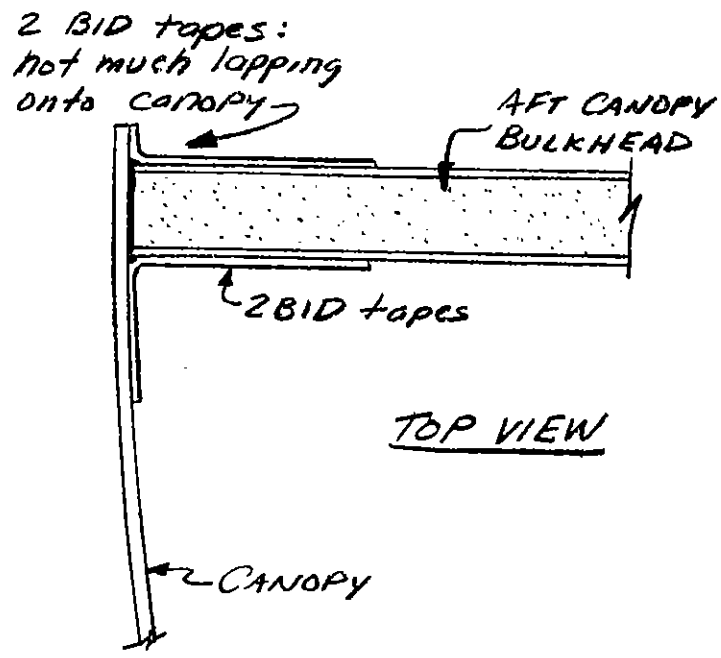
Note that the sketch shows a lip on the inside fuselage glass. This lip is to assist in jigging the canopy in position for those outside fuselage tapes. Since the canopy is much thinner than the fuselage core, stirring sticks, foam, etc. will need to be used to provide a firm surface to laminate the outside tapes against.

The canopy is joined to the outside fuselage with 2 BID tapes, overlapping the fuselage a minimum of 1.5 inches, and the canopy a minimum of 0.7". Liberal Flox is used to fill any voids prior to glassing; peel ply the lamination and allow it to cure 24 hours.



CANOPY MOUNT (OUTSIDE)

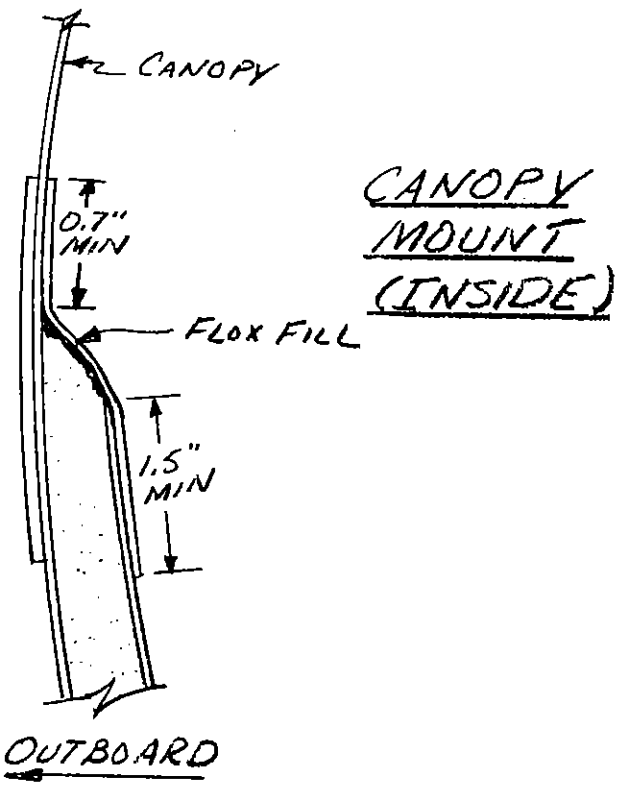
Next, the canopy mounted to the fuselage is turned over and the aft canopy bulkhead fitted into position. The aft face should be located a maximum of 1/8" forward of the forward face of the Seatback Bulkhead with a few dabs of 5-MIN. It is permanently mounted with flox and 2 BID tapes on either side, lapping onto the bulkhead and fuselage a minimum of 1.5 inches, and lapping onto the canopy a minimum of 0.7 inches.



AFT CANOPY BULKHEAD MOUNT

Also, sand down the lip in the inside fuselage skin lamination and contour the inside fuselage skin smoothly into the canopy. Then laminate 2 BID (with liberal Flox to fill the voids prior to glassing) with 0.7 inch minimum lapping onto the canopy and a minimum of 1.5 inches lapping on the existing fuselage inside skin.

Permit the laminations to cure for 24 hours.



CANOPY MOUNT (INSIDE)

JOINING THE FUSELAGE SHELLS

This step is very exiting; you are going to actually complete your first major structure - the fuselage.

In this section, you will join the top forward fuselage shell to the lower forward fuselage shell,and the top aft fuselage shell to the lower aft fuselage shell. Do not join the four shells at the fuselage cut line.

Also, each bulkhead must be joined to the shells with the same number of tapes used previously to attach the bulkheads to the lower fuselage shells.

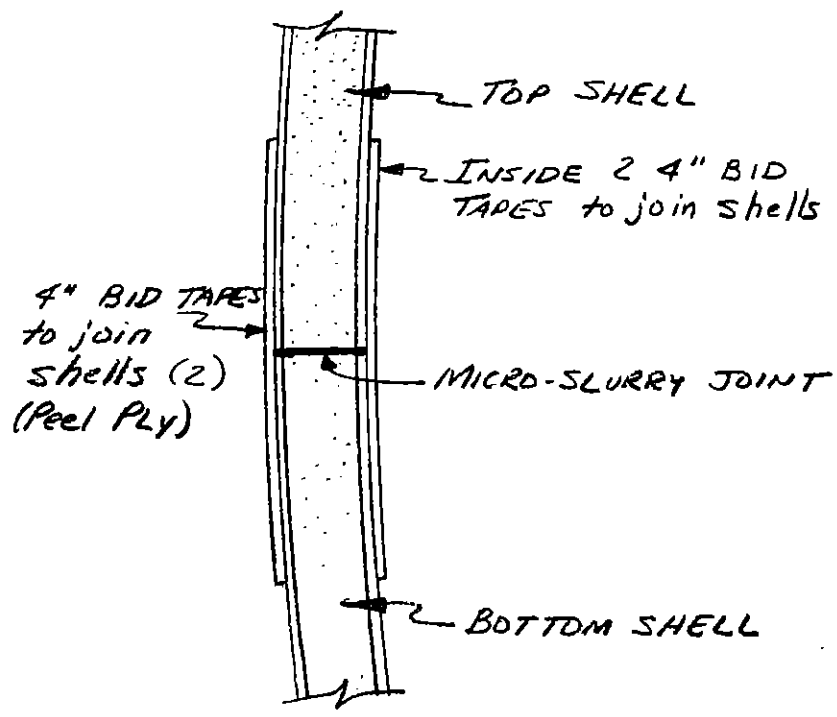
This section will require many cure cycles due to problems in accessing all area at one time.

Begin by joining the rear fuselage shells together. 2 BID tapes of at least 4 inches wide are used along the joints inside and out. 1 BID tape fore and aft is used to join the FS120 and FS175 bulkheads to the top aft fuselage shell. You will have difficulty reaching back into the rear fuselage to laminate the tapes. You may elect to skip ahead to Chapter 14 and cut out the aft top fuselage where the vertical fin assembly is inserted so that you can reach the aft face of the FS175 bulkhead and the inside of the seam. If you elect to do that later, don't forget about it. Of course, micro slurry is used between the parts.

Joining the forward fuselage shells is somewhat more difficult because of the access to the forward fuselage area. Whatever area you cannot reach at this time, can be accomplished after you cut out the canopy frame and thus reestablish access to the forward cockpit area.

The forward fuselage shells also receive 2 BID tapes at least 4 inches wide along the joints on both the inside and outside. 2 BID tapes fore and aft are used to attach the FS94 and Seatback Bulkheads to the top forward fuselage shell. 2 BID tapes, inside, and 3 BID tapes outside, are used to attach the firewall to the top forward fuselage shell. These last tapes should be at least 4 inches wide, and don't forget to round the outside edge of the firewall/shell junction prior to glassing. These firewall tapes are very important to keeping the engine attached to the rest of the aircraft, so do a careful job of laminating them. (Unlike the rest of the joints, the firewall-shell junction should be painted with epoxy, not micro-slurry).

This entire section will consume many hours of work and become very frustrating. Take pride in the fact that you will soon be able to sit in a completed fuselage!

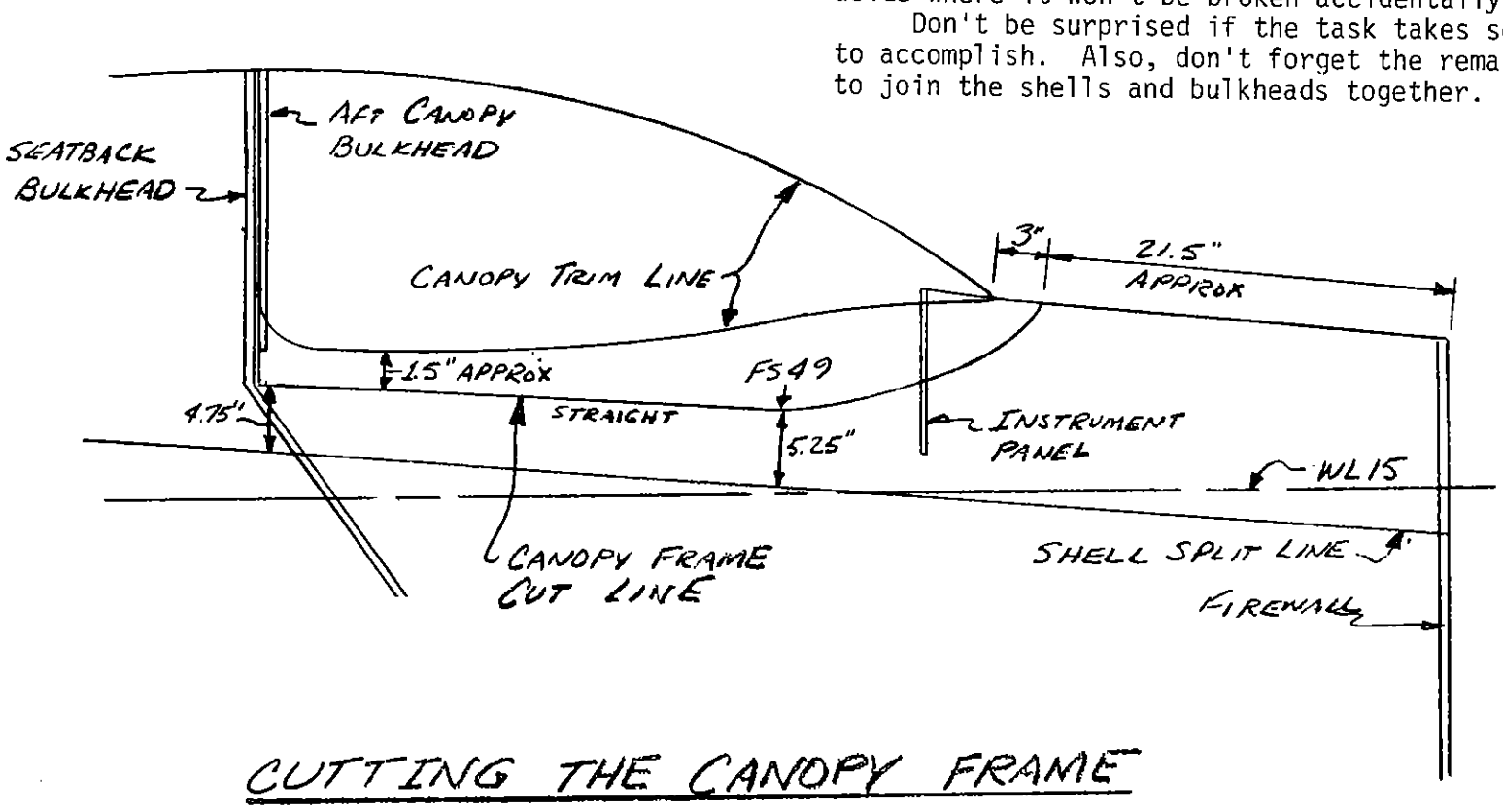


JOINING THE FUSELAGE SHELLS

CUTTING THE CANOPY FRAME

In this section, you regain access to the cockpit area and obtain your canopy frame at the same time. The sketches show the suggested cut line for the canopy frame. This line is somewhat arbitrary on our part, but the rest of the cockpit area is designed around it so be carefull of deviations. Mark the line with a felt tipped marker on the shells and check for symmetry. Use a fine tooth hacksaw blade to carefully cut through the sandwich. Put the canopy frame/canopy assembly aside where it won't be broken accidentally.

Don't be surprised if the task takes several hours to accomplish. Also, don't forget the remaining tapes to join the shells and bulkheads together.

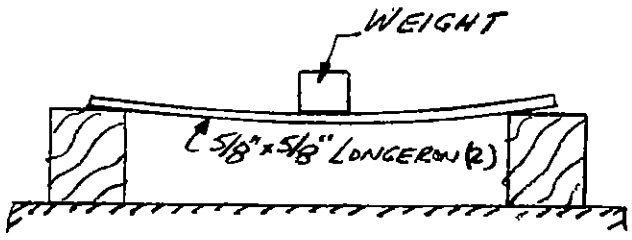


CUTTING THE CANOPY FRAME

INSTALLING THE LONGERONS

A longeron runs on each side of the cockpit forward from the Seatback Bulkhead to the instrument panel. These longerons are made of 5/8" square wood and must first be bowed to shape in order to fit the curvature of the fuselage side.

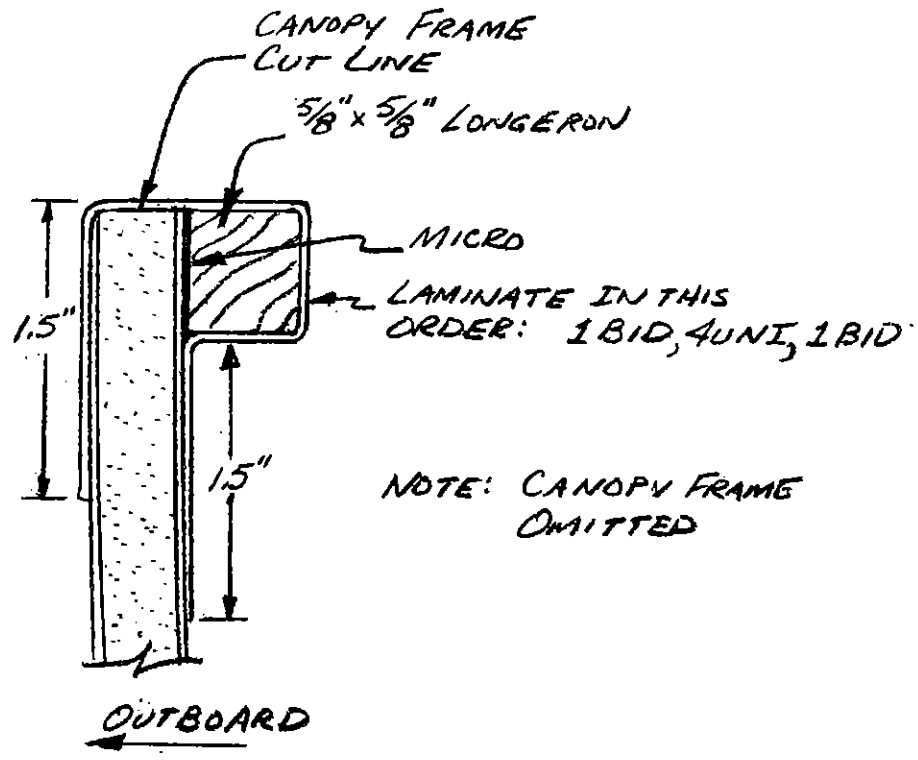
Support the longerons on each end and place weights in the middle, as shown. Permit them to stand this way for at least two days. The wood should bow in the center after a short while. If you wish to be very scientific, you may measure the amount of bow required by skipping ahead and checking the curvature on the fuselage sides where the longerons will be mounted.



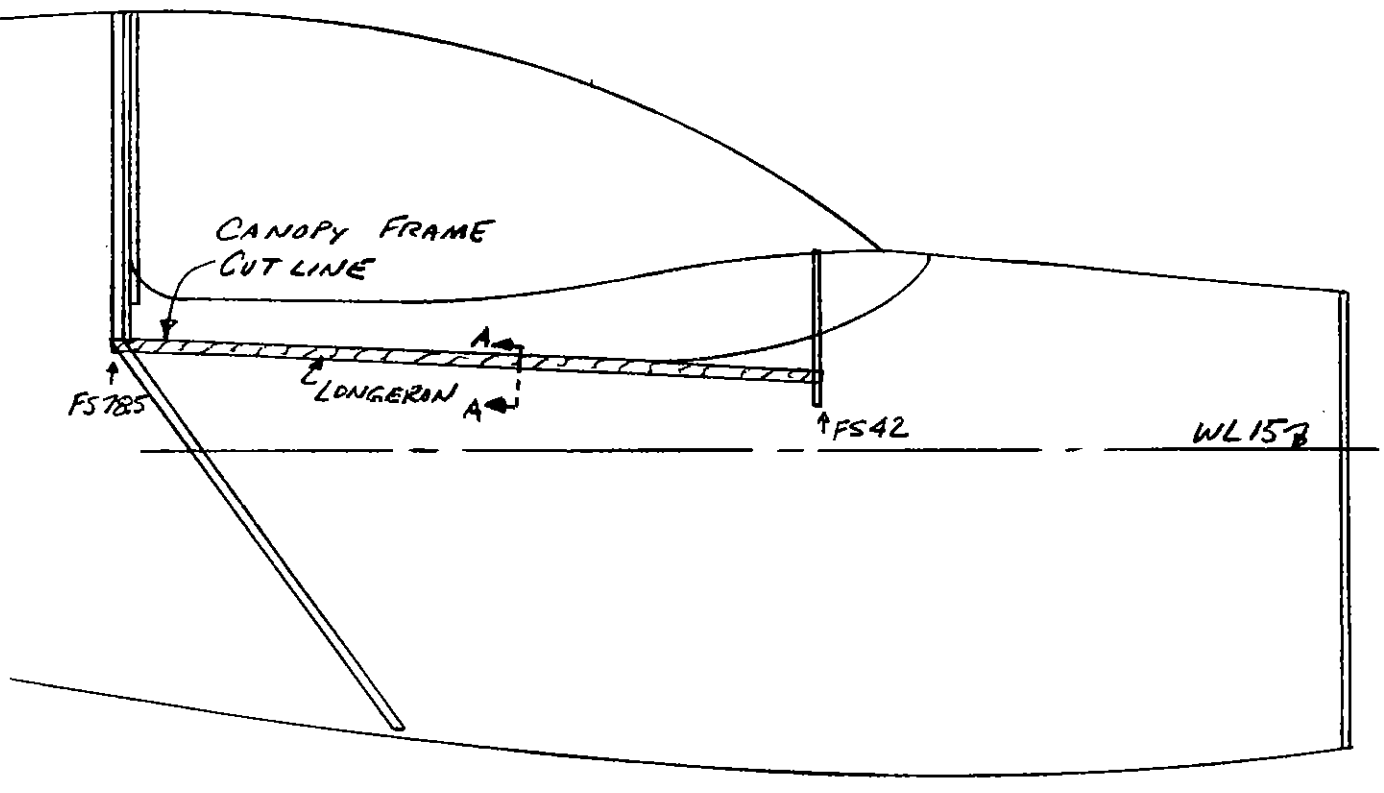
PRE-BENDING LONGEONS

Once the canopy frame has been cut out and the longerons bowed statically, then they should be mounted in the fuselage to increase the strength of the fuselage. The sketch included here shows the location of the longerons; note that they basically go just below the canopy frame cut out line. The longerons must be installed as shown here in order for the canopy hinges to be positioned correctly.

Also note the 4 UNI glass and 2 BID glass used to mount the longerons, in addition to the flox. These tapes significantly increase the stiffness of the longeron, and must be lapped onto the fuselage a minimum of 1.5 inches. The UNI orientation is along the longeron; the BID is laminated at 45 degrees to the longeron line. Do not use micro between the lamination and wood.



SECTION A-A



LONGERON INSTALLATION

END OF CHAPTER

MAIN WING CONSTRUCTION

INTRODUCTION

The main wing is a sandwich composite structure with solid foam core, two layers of UNI at 45 degrees to the trailing edge of the wing for torsional stiffness and surface durability, and spanwise tapes of UNI for bending strength. The T.E. of the wing is perpendicular to BL00. (i.e. the trailing edge of the wing has no sweep). The ailerons are on the inboard section of the wing, and are actuated by an aluminum torque tube. Shear loads are taken by a vertical shear web.

The main wing is constructed in one piece from tip to tip for strength, lightness, and ease of construction.

CUTTING THE SPAR CAPS

Begin by cutting the UNI spar caps using the suggested layout on this page. Letter each one of them with a felt tipped marker for identification later, in addition to marking a centerline in the middle, (where the cap will cross BL00 when installed on the main wing). The technique for cutting the spar caps is described in the Composite Materials Education Chapter and should be reviewed at this time. Be sure to carefully roll up and store the spar caps after cutting to prevent damage.

JIGGING THE MAIN WING

Construction begins by jigging the main wing on the jig table. Locate the main wing cores that you have previously hot-wired. It is not necessary to use either the aileron slot foam cores, or the main wing trailing edge cores, at this time.

Find the main wing core female jigging templates (6).

Now study the sketches. The main wing cores are jigged upside down on the jigging table using the main wing core female jigging templates. If your table is not at least 200 inches long, you will have to extend it with a few 2x4's using bando, in order to locate the BL00 main wing core female jigging templates. Note that the shear web is perpendicular to BL00, and that the main wing core female jigging templates have leading and trailing edges that are tangent, respectively, with the leading edges of the main wing cores, and the main wing shear web.

Begin by drawing a straight line along your jigging table and marking the locations (BL's) of the main wing core female jigging templates. Next, temporarily set the main wing core female jigging templates on the table so that their trailing edges are along that straight line and their positions coincide with the appropriate BL locations. A string stretched spanwise with a weight attached at either end (see CANARD chapter) may be useful.

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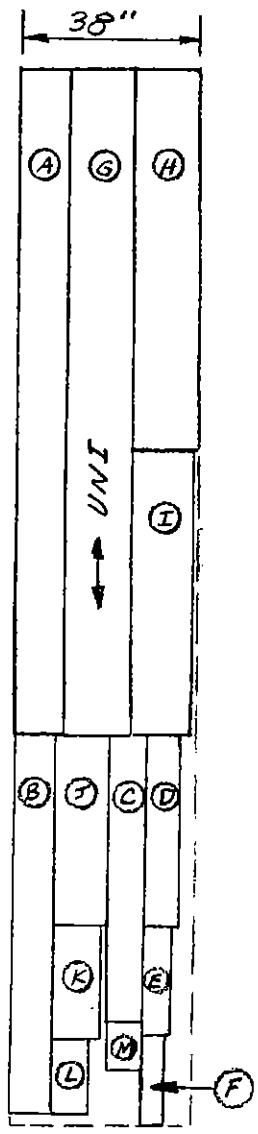
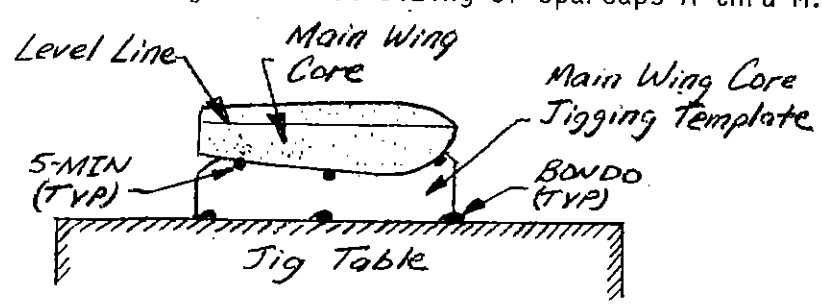
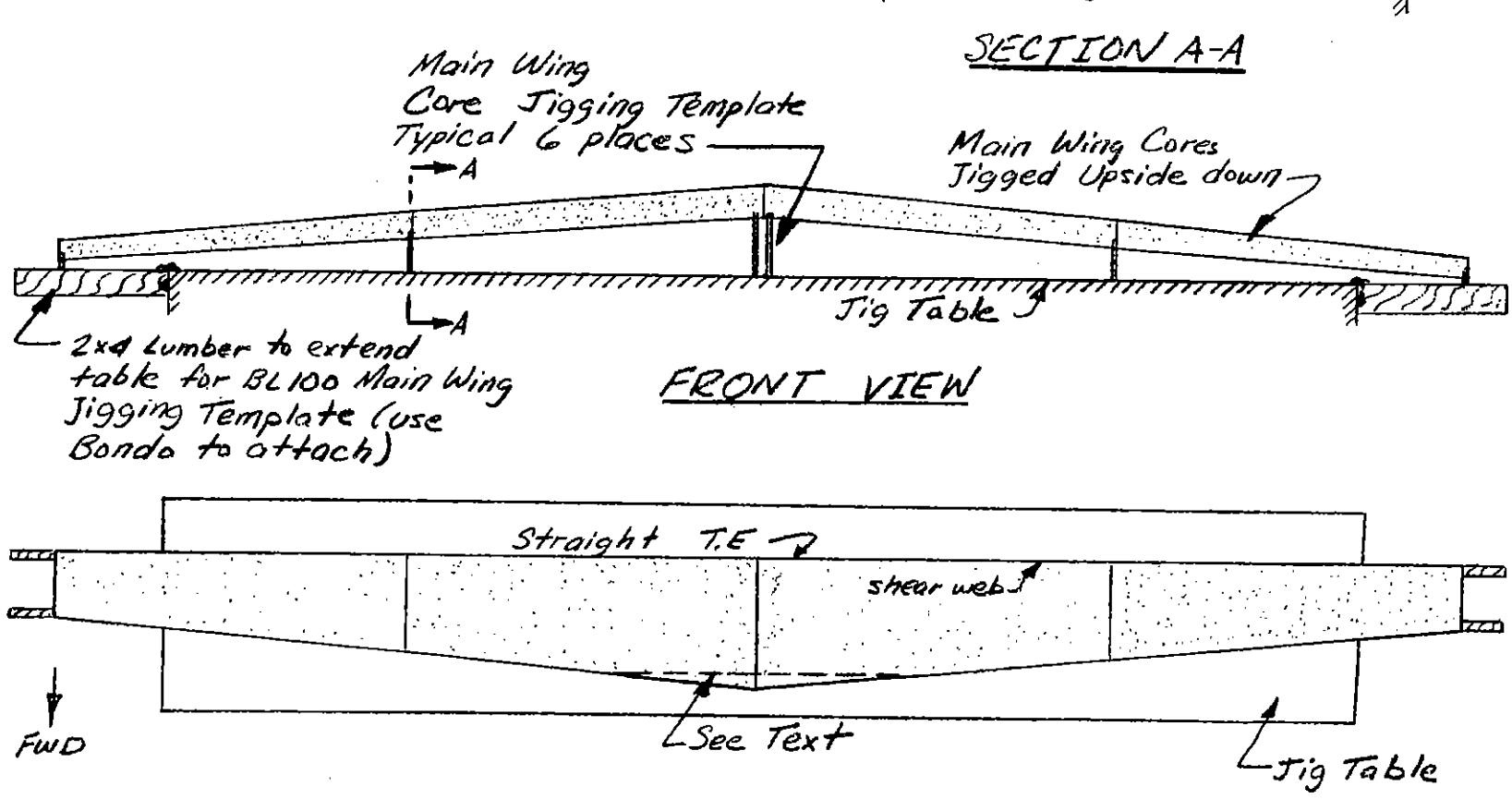


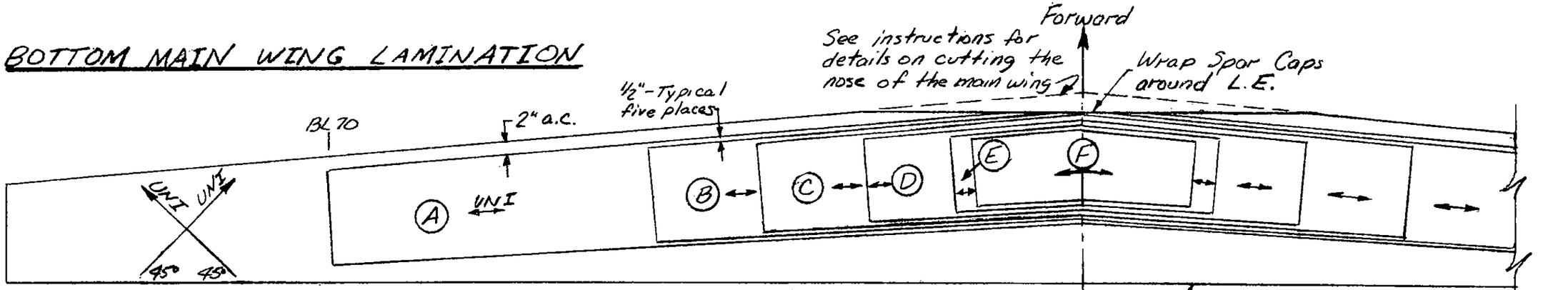
MAIN WING SPAR CAP CUTTING LAYOUT

NOTE: See Bottom and Top Main Wing Lamination Drawing for exact sizing of sparcaps A thru M.





BOTTOM MAIN WING LAMINATION



WING SKIN:

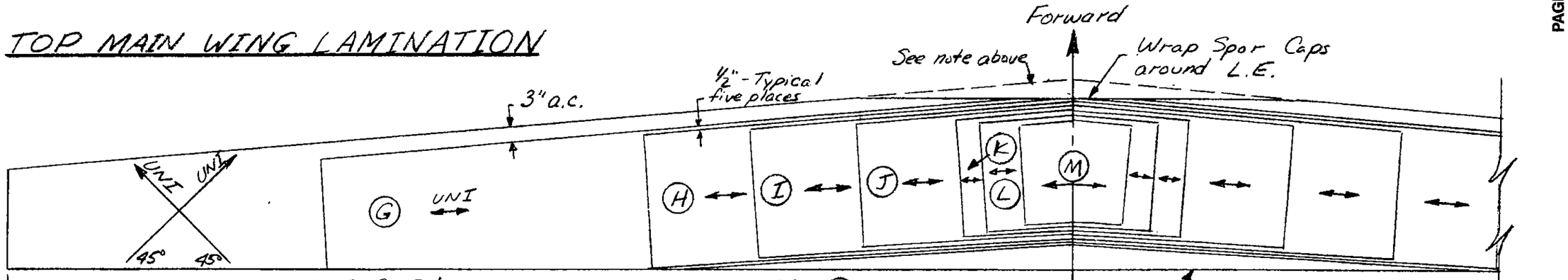
- 2 UNI at 45° to T.E.;
- Drape down shear web face to bottom

SPAR CAPS:

(A)	10" x 140"
(B)	9" x 80"
(C)	8" x 60"
(D)	7" x 40"
(E)	6" x 25"
(F)	5" x 20"

a.c. is "along contour"

TOP MAIN WING LAMINATION



WING SKIN:

- 2 UNI at 45° to T.E.;
- Drape down shear web face to bottom

SPAR CAPS:

(G)	14" x 140"
(H)	13" x 80"
(I)	12" x 60"
(J)	11" x 40"
(K)	10" x 22"
(L)	9" x 18"
(M)	8" x 10"

Now begin to trial fit the four main wing cores into position. Be careful not to put too much pressure on the foam cores and damage them. The two inboard cores will have to be beveled at BL00 by sanding because of the main wing dihedral and the other core joints may have to be sanded to make the cores fit within the maximum tolerance of 1/16". The level lines on all cores must remain level at all times. This is important, so take your time.

Stand back and sight spanwise along the main wing to verify that the main wing is straight, and is not bowed or kinked. Verify that the leading edge is straight from each tip to BL00, and that the trailing edge is straight from tip to tip.

Don't be concerned if the main wing core female jigging templates need to be moved inboard or outboard to remove any bows or kinks. Also, a long straight edge will help you looking for kinks and joggles.

When everything is perfect, mix up some bondo and carefully bondo the main wing core female jigging templates to the table top in the necessary locations. Next, rest the main wing foam cores on the main wing core female jigging templates. Check the alignment and individual level lines again. Then RECHECK the alignment and the individual level lines. Then RE-RECHECK them again; get the message? Stirring sticks, scrap wood, etc. can be used as shims to locate everything properly.

The next step is to join the foam cores together with micro slurry after verifying that the core fit is within 1/16". Check, recheck, and re-recheck each core level line and alignment as the cores are joined.

Finally, attach the main wing foam cores to the main wing core female jigging templates with small dabs of 5-MIN, being careful not to move the cores after the final level line and alignment check.

CAUTION

The main wing foam cores must fit within 1/16" or exotherm damage may result.

TRIMMING THE MAIN WING FOAM CORES

When the main wing is attached to the fuselage, it must fit between the FS78 bulkhead and the FS94 bulkhead. As can be seen from the sketch, this requires that the forward "nose" of the main wing cores be removed. You may wish to skip ahead and read the section on MAIN WING MOUNTING to have a clear understanding how the mating is accomplished.

Go to your fuselage which is laying in the corner and sit in it. This "cockpit time" will help give you confidence that you really can build an aircraft. Don't forget to make airplane engine noises and move the imaginary controls; it helps with the illusion.

When you are tired of this, get out of the cockpit and measure the distance on your aircraft from the aft face of the FS78 bulkhead to the forward face of the FS94 bulkhead. Make these two measurements at WL30, outboard at either fuselage side at the FS78 bulkhead. They should be the same - about 16.3". since you are only human, they will probably each be a little different, end either more, or less, than 16.3". Also measure the width between the two points that you took the measurements at.

You are now ready to transfer the information onto the main wing foam cores with a felt tipped marker pen. Using the main wing shear web and the BL00 foam core joint as the reference mark the two points on the foam cores, and connect them with a line. That line should represent where the FS78 bulkhead will meet the main wing core. Verify by making measurements that this line intersects the main wing leading edge inside the fuselage once the main wing has been mounted. If it doesn't, then you will have to taper and round the main wing core area outside the fuselage sides to avoid an ugly looking flat spot on your main wing. Next, move the line aft about 0.10" to allow for the glass build-up as you laminate the main wing skins and spar caps. This second line on the main wing cores is the trim line.

NOTE

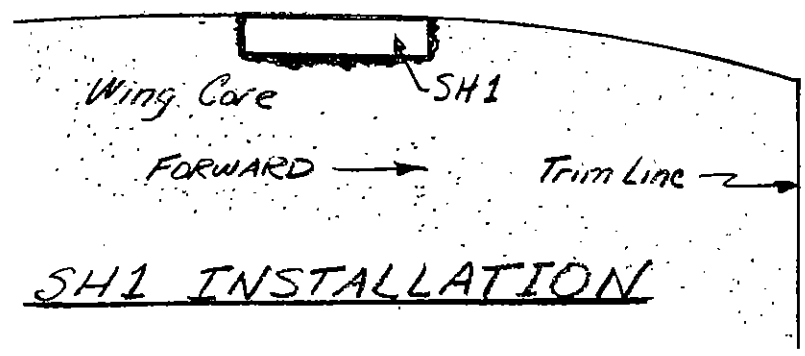
All measurements indicated above should be made along a WL, not along the contour of the wing.

SHOULDER HARNESS INSERT INSTALLATION

Each shoulder harness is installed in a Y fashion to the lower main wing. Prior to glassing the bottom of the main wing, the shoulder harness inserts (2) must be installed.

Find the two 1" square by 3/16" thick mild steel plates provided (SH1).

Install one of them with flox at about BL9 left, about 2" along contour (ac) from the trim line, flush to the surface of the main wing foam core. Install the second SH1 similarly at BL9 right.



PREPARING THE MAIN WING CORES FOR GLASSING

At this point, the main wing cores should be jigged on your jigging table upside down, 5-minuted and bondoed in place, and not about to move under anything short of an earthquake.

Use a hard block to clean up all joggles, excess micro, and any bumps on the main wing cores. At BL00, round the joint so that the glass will flow smoothly across the joint. At the T.E. (shear web), round the corner so that the glass will flow smoothly down the face of the shear web.

This is your last chance to determine the shape of your main wing, so make the main wing cores as perfect as you know how. And, oh yes, RE-RE-RECHECK THE MAIN WING TIP LEVEL LINES. If you are not proud of everything that you have accomplished on the main wing so far, don't go on to the next step until you are.

LAMINATING THE BOTTOM SKIN AND BOTTOM SPAR CAPS

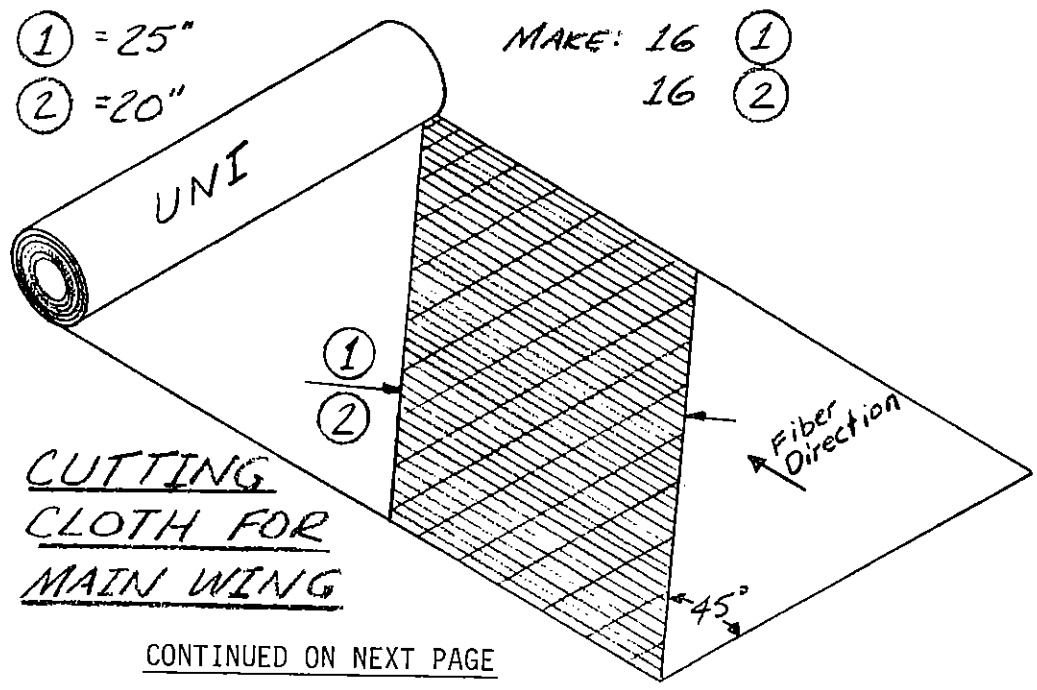
Study the two sketches labled "Bottom Main Wing Lamination" and "Top Main Wing Lamination" very carefully.

Today, you will only be doing the "Bottom Main Wing Lamination", but that one is enough, and will take 3 individuals about 2.5 hours to complete. (The third individual mixes epoxy while the other two do the lamination).

To summarize the lamination, first you will laminate the wing skin, which is 2 plies of UNI at 45 degrees to the main wing T.E., and then you will laminate spar caps A thru F.

Begin by getting your shop organized for a big lay-up. Next, cut the UNI for the main wing skins as indicated on the sketch, labling each one so that you will know where it goes.

Once you start this lamination, you will have to continue it until you finish, so if you want lunch, a cup of coffee, or a nap, now is the time to do it.



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The first UNI ply is put on at 45 degrees to the main wing T.E.. The fibers must be straight, so take your time getting the wrinkles and kinks out. Don't get ahead of yourself on pouring microfoam slurry on the foam; otherwise, by the time you are ready to place the UNI over a particular area, you will have a messy, hard lump of slurry. Work with one piece of cloth at a time, and with small batches of slurry and epoxy. Also, unrolling the UNI cloth as needed is advised to reduce the ackwardness of the large pieces. Scrap UNI can be used to fill in any small spots not covered by the large pieces of UNI.

At the leading edge of the main wing cores, let the UNI cloth hang vertically down. Trim to within 1" of the tangent point, just like you did on the ailerons. At the trailing edge, allow the cloth to drape around the corner and down to the bottom of the shear web so that the UNI is at 45 degrees to the T.E. on that face also. Trim the main wing tip UNI to within ½" of the main wing core. Inboard, along the trim line, also allow the UNI to drape over the edge and down to the bottom.

No overlap is required on the UNI wing skin; just butt fit the skins together. You must, however, squeegee the cloth well to avoid building up excess epoxy in the lamination.

The second ply of UNI is also placed at 45 degrees to the T.E. of the main wing cores but in the other direction from the first ply, so that the two plies of UNI will have their major fiber orientations at 90 degrees to each other. The second ply will be easier because it is being layed up over glass and not the foam. Try to avoid having the butt joints from the first ply of UNI coincide with the butt joints from the second ply of UNI. The second ply of UNI is also draped around the corner and down to the bottom of the shear web, so that the shear web has two plies of UNI at 45 degrees to the T.E. and at 90 degrees to each other. Trim all edges like you did on the first ply.

Spar Caps A thru F are laminated in that order, with the widest cap going on first. To pick up a spar cap and place it on the main wing, use three people. While one person holds each end of the spar cap, the third removes any frazzles, being careful not to reduce the width below what is called out for the particular spar cap. That third person then stands at BL00 and positions the spar cap in the proper location (centerline on BL00 and proper distance from the leading edge of the main wing) while the other two individuals keep the cloth off of the foam so that it won't stick. When the center (third) person is ready, one of the individuals holding an end lays it down spanwise on the main wing in the proper position (in relation to the main wing L.E.) and removes any wrinkles and kinks. This can be a slow process, so stay patient. Then the man (or woman) on the other end does likewise. The center individual makes sure that the spar cap smoothly "turns the corner" at BL00.

Squeegee each spar cap from BL00 outboard to keep the UNI fibers straight. Work out any wrinkles or kinks by pulling carefully on the fibers.

The remaining spar caps are each put on in a similar fashion. We know you are getting tired, but you must squeegee each cap well to avoid building up considerable epoxy on the bottom plies. Use extra epoxy very sparingly on the last spar cap.

Locate the places where you bonded in the two SH1's (the 1" x 1" mild steel plates) and laminate a pad of 20 plies of BID over each one. The BID cloth should be about 2" x 2" dimensionally.

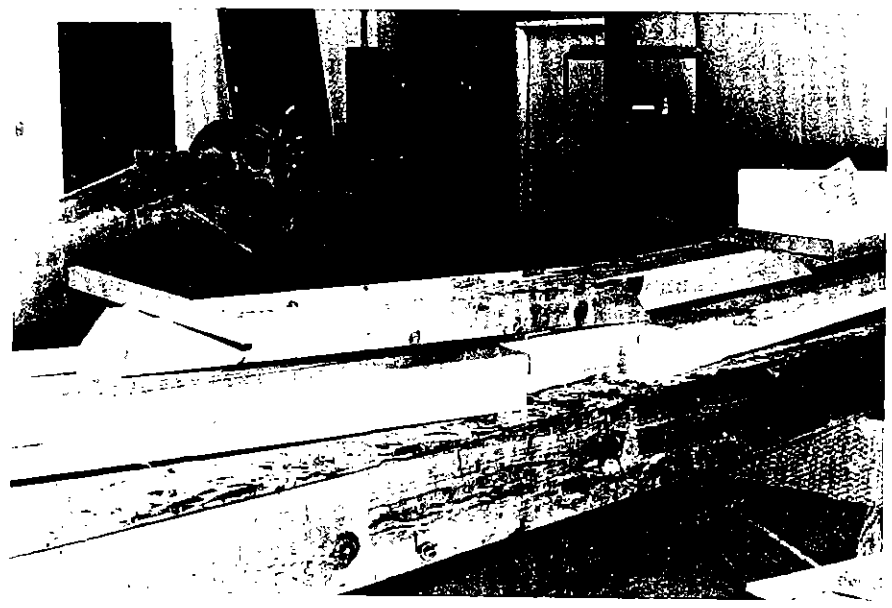
Before quitting, peel ply all joints, and the first two inches of the main wing L.E.. Also, knife trim the L.E. at the tangent point, just like you did on the aileron. Then, clean up your mess and go celebrate your wizardtry as a laminator. DON"T TOUCH THE MAIN WING FOR AT LEAST 24 HOURS.

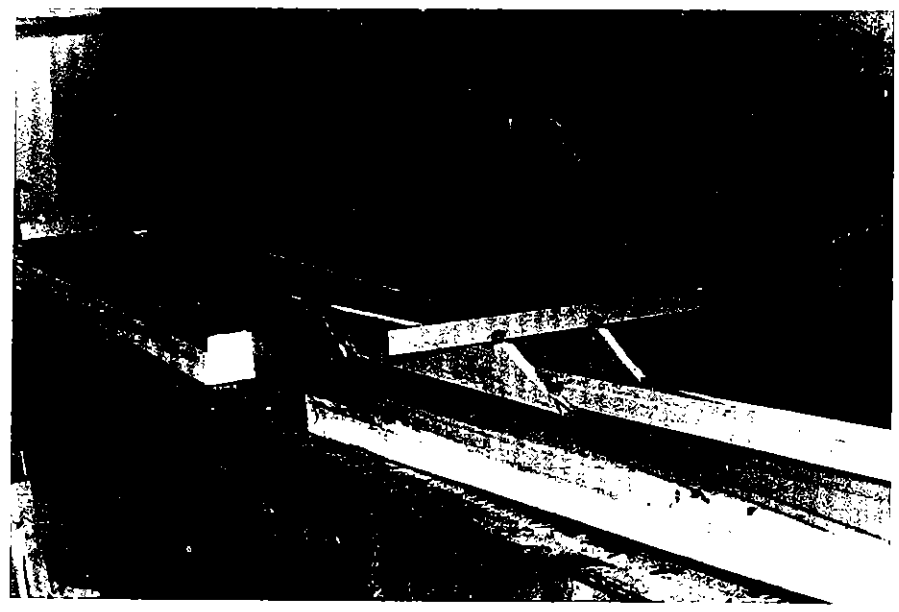
NOTE

If you have room and can be patient, it would be better to permit the bottom main wing lamination to cure for 48 hours plus. In the meantime, you could skip ahead and perhaps do the aileron slot foam core slot laminations. But, if your like everyone else, you won't be able to resist making that jigging table into a main wing for your Q2 as quickly as possible.

LAMINATING THE TOP SKIN AND TOP SPAR CAPS

Build a framework out of scrap lumber and bondo to hold the main wing jigged in place while you turn it over. As shown in the pictures, we suggest that lumber run from tip to tip with a few cross pieces. Don't get fancy, just tie everything together so that the main wing won't move, (and, yes, we know the pictures show the canard, but we forgot to take some of the main wing jigging).





Next, when you are sure of your framework, break loose the main wing core female jigging templates with a hammer (they won't be needed again), and turn the main wing over so that the unglassed cores are upward. Set the main wing on the jigging table once again.

Check the main wing tip level lines. Jig, and shim, and bondo until the main wing tip level lines are perfect; almost doesn't count. Then bondo the heck out of the jigging as if you were expecting a few kids to use your shop for playing cowboys and Indians.

At the leading edge, feather the bottom skin to a feather edge at the tangent point just like you did with the ailerons. Prepare the main wing core top surface just like you did the main wing core bottom surface. (See "Preparing The Main Wing Cores For Glassing")

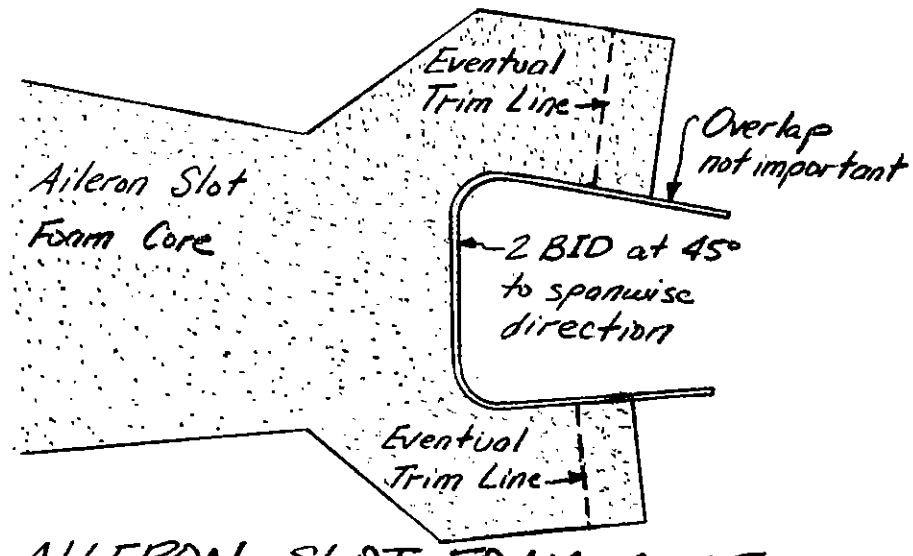
You are now ready to laminate the top main wing skins and top spar caps. Do it similarly to the bottom lamination. The skin is the same two UNI at 45 degrees to the T.E., draping over the T.E. down to the bottom of the shear web and the spar caps are G thru M this time. At the leading edge of the main wing, overlap the bottom skin with the top skin a minimum of 1". Rather than let the spar caps drape over the T.E. and down the shear web, trim the caps at the T.E.

Peel ply the shear web and all joints.

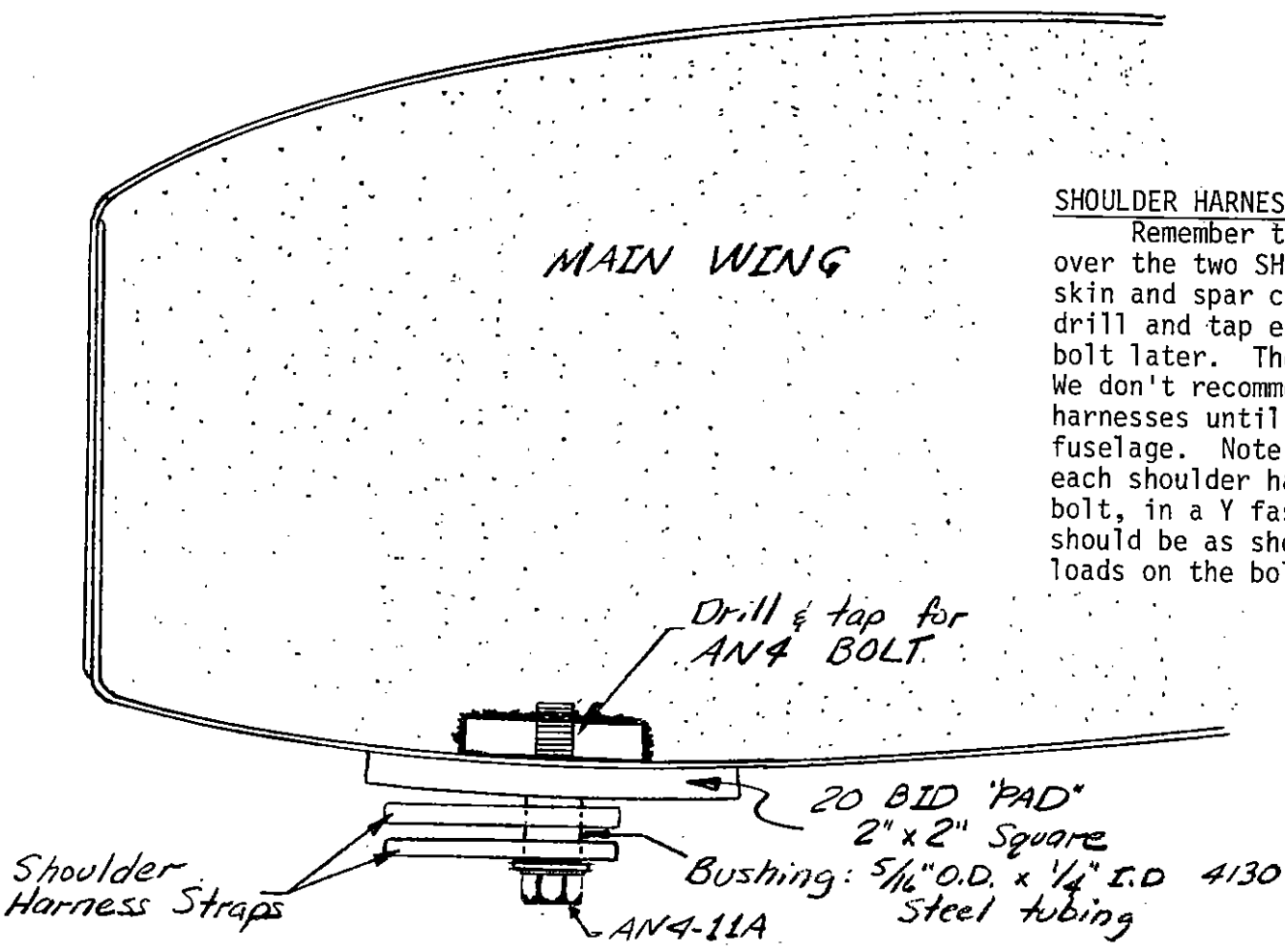
Don't touch the wing for 48 hours after you have finished it. Instead, go sit in the fuselage some more to pass the time, or else skip ahead and keep working. Before removing the lumber, bondo a level board at about midspan on each wing half. This is to help in attaching the main wing to the fuselage later. Attach the level boards carefully, so that they will agree.

GLASSING THE AILERON SLOT FOAM CORE SLOTS

The aileron slot foam core inside slots are glassed with 2 BID at 45 degrees to the spanwise direction. (i.e. T.E.). Knife trim to the edge of the foam core, as shown on the sketch.



AILERON SLOT FOAM CORE INSIDE LAMINATION



SHOULDER HARNESS INSTALLATION

Remember those 20 BID plies that you laminated over the two SH1's when you performed the "BOTTOM" skin and spar cap lamination? Now is the time to drill and tap each SH1 with a ¼ x 28 tap for a AN4 bolt later. The sketch shows the complete assembly. We don't recommend actually attaching the shoulder harnesses until after the main wing is mounted to the fuselage. Note that both shoulder harness straps of each shoulder harness assembly are attached to one bolt, in a Y fashion. Also, the 4130 Steel Bushing should be as short as possible, to reduce bending loads on the bolt.

SHOULDER HARNESS INSTALLATION

INSTALLING THE AILERON SLOT FOAM CORES

This step is critical to having a nice looking main wing and aileron union, so follow the directions carefully.

To start out with, the aileron slot foam cores that you hot-wired way back when were purposely made longer than necessary. Your first task is to size them for the correct length. To do this, you must measure your fuselage width at the fuselage/aileron slot foam core junction. Take measurements of the main wing, skip ahead to the section on "Mounting The Main Wing To The Fuselage", and determine that dimension, on either side of BL00. Mark the proper points on the main wing. Wait to trim the inboard aileron slot foam cores until after they have been installed on the main wing.

Next, determine where to trim the outboard aileron slot foam cores. Since each elevator was made 48" long, measure 48" plus 1 inch (for aileron/fuselage clearance) from your first mark outboard and place another mark. This is where the outboard aileron slot foam core will be trimmed, but, as before, wait until after installation to do it.

Skip ahead to the CANARD chapter, "Installing The Elevator Slot Foam Cores" section for a sketch showing the geometry of the attachment.

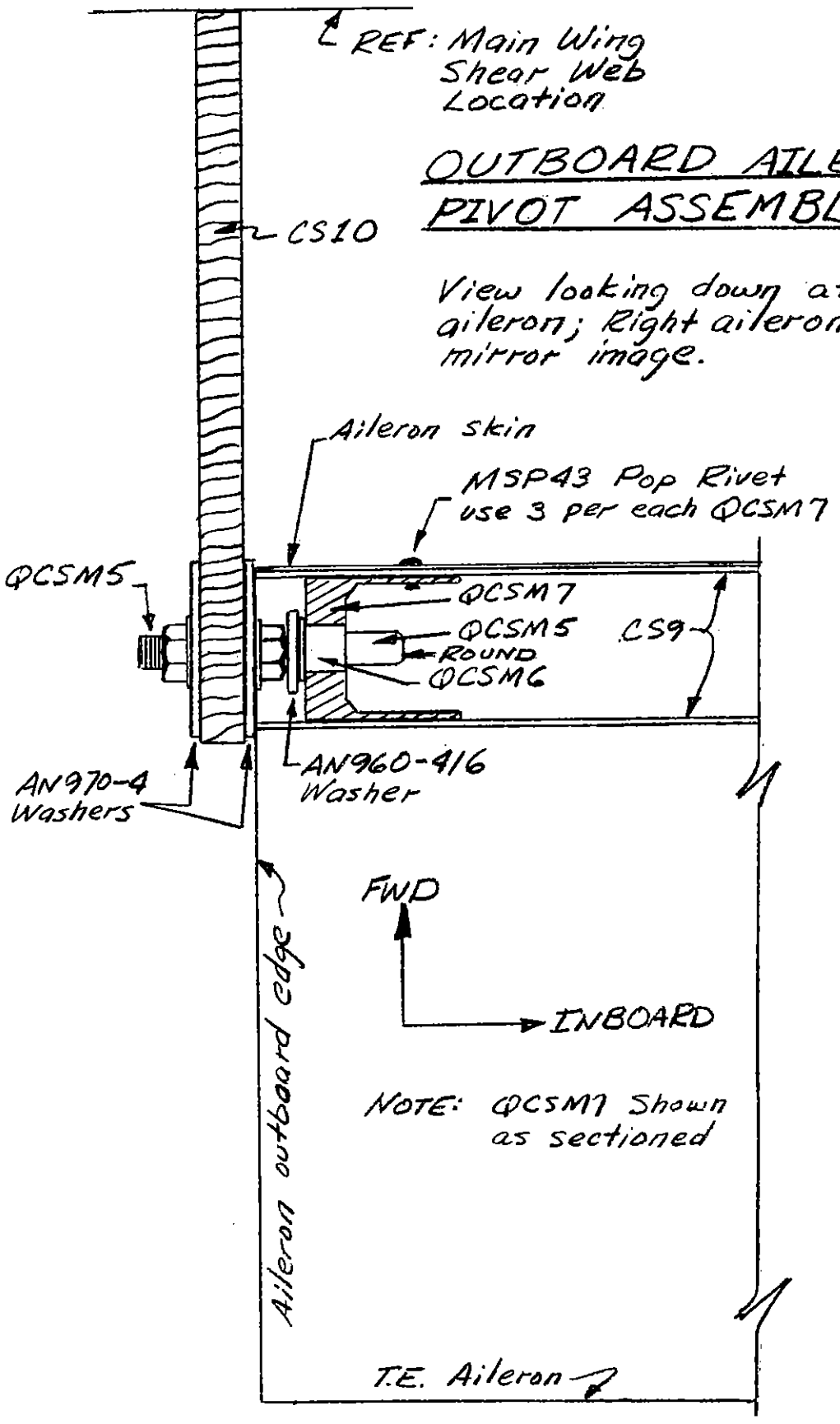
It is easier to check clearances top and bottom if the main wing is jigged vertically on the jig table. This will also keep the joint from running. A few scrap pieces of lumber and bondo should be sufficient.

The important point to remember is that at the shear web attach point along the span, the top and bottom of the aileron slot foam cores should flow smoothly into the top and bottom surfaces of the main wing, respectively. If the aileron slot foam cores want to stick up a little bit, this is OK since that can be sanded later. Any dip, however, will have to be filled with micro. This fit is important cosmetically, so take you time.

Once the attachment has cured, trim the aileron slot foam cores back to the "Eventual Trim Line". (See CANARD chapter, "Installing The Elevator Slot Foam Cores" section for a sketch showing the detail). Next, sand down the "tails" so that you can achieve a minimum of 0.4" of glass-to-glass bond with the inside slot lamination, while at the same time fairing everything nicely into the main wing contour forward of the shear web. At the glass-to-glass bond area, you must sand away all micro and epoxy and get down to the glass. Spend some time looking at the surfaces getting the alignment the best that you can. When everything is ready, laminate 2 BID at 45 degrees to the main wing shear web on the aileron slot foam cores, top and bottom, being sure to achieve at least 0.4" of glass-to-glass bond, and lapping up onto the main wing at least 1". Note that the sketch in the CANARD chapter calls out dry-micro fill if required at the top and bottom of the shear web joint. Trim the inboard and outboard aileron slot foam cores at the marks previously made on the canard.

Once the attachment has cured, trim the aileron slot foam cores back to the "Eventual Trim Line". (See CANARD chapter, "Installing The Elevator Slot Foam Cores" section for a sketch showing the detail). Next, sand down the "tails" so that you can achieve a minimum of 0.4" of glass-to-glass bond with the inside slot lamination, while at the same time fairing everything nicely into the main wing contour forward of the shear web. At the glass-to-glass bond area, you must sand away all micro and epoxy and get down to the glass. Spend some time looking at the surfaces getting the alignment the best that you can. When everything is ready, laminate 2 BID at 45 degrees to the main wing shear web on the aileron slot foam cores, top and bottom, being sure to achieve at least 0.4" of glass-to-glass bond, and lapping up onto the main wing at least 1". Note that the sketch in the CANARD chapter calls out dry-micro fill if required at the top and bottom of the shear web joint. Trim the inboard and outboard aileron slot foam cores at the marks previously made on the canard.

The aileron slot foam cores are installed to the main wing shear web with micro-slurry on the foam cores and epoxy on the shear web (don't forget to remove the Peel Ply!), plus a few dabs of 5-MIN to keep the two attached during cure.



OUTBOARD AILERON PIVOT ASSEMBLY

OUTBOARD AILERON PIVOT ASSEMBLY

These instructions cover only the assembly of the left outboard aileron pivot, but the right outboard aileron pivot is a mirror image, and may be accomplished at the same time.

First, find a QCSM7 pivot and position it about 0.25" inboard of the outboard end of the aileron using 3 MSP43 cherry rivets spaced radially at least 0.4" apart.

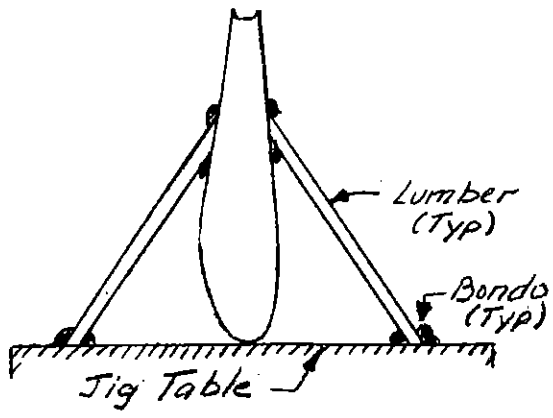
Find CS10, and insert a QCSM5 stud as shown with the 3 washers and the 2 AN363-428 nuts. There must be a minimum of 0.6" from the AN960-4 washer inboard to the end of the QCSM5 stud. This is to require the aileron to be moved inboard at least 1/4" before it "falls off" the QCSM5 stud for dissassembly. Finally, round the end of the QCSM5 stud slightly to assist in mounting the aileron.

The sketch shows the outboard aileron pivot assembly as it will look later when installed on the main wing shear web. Although not shown, at that time, the aileron slot foam core and aileron trailing edge foam core will be trimmed so that CS10 will fit flush against the main wing shear web.

AILERON INSTALLATION

In this section, you will mount the ailerons to the main wing. After the main wing is attached to the fuselage, it will only be necessary to connect the CS5 and CS12 push-pull tubes in order to have a functioning aileron control system. This section is very important, so take your time and read through the entire section several times prior to starting any of the procedures.

Begin by jigging the main wing vertically on your jig table with the L.E. pointed down. This will make it much easier to rig the ailerons.



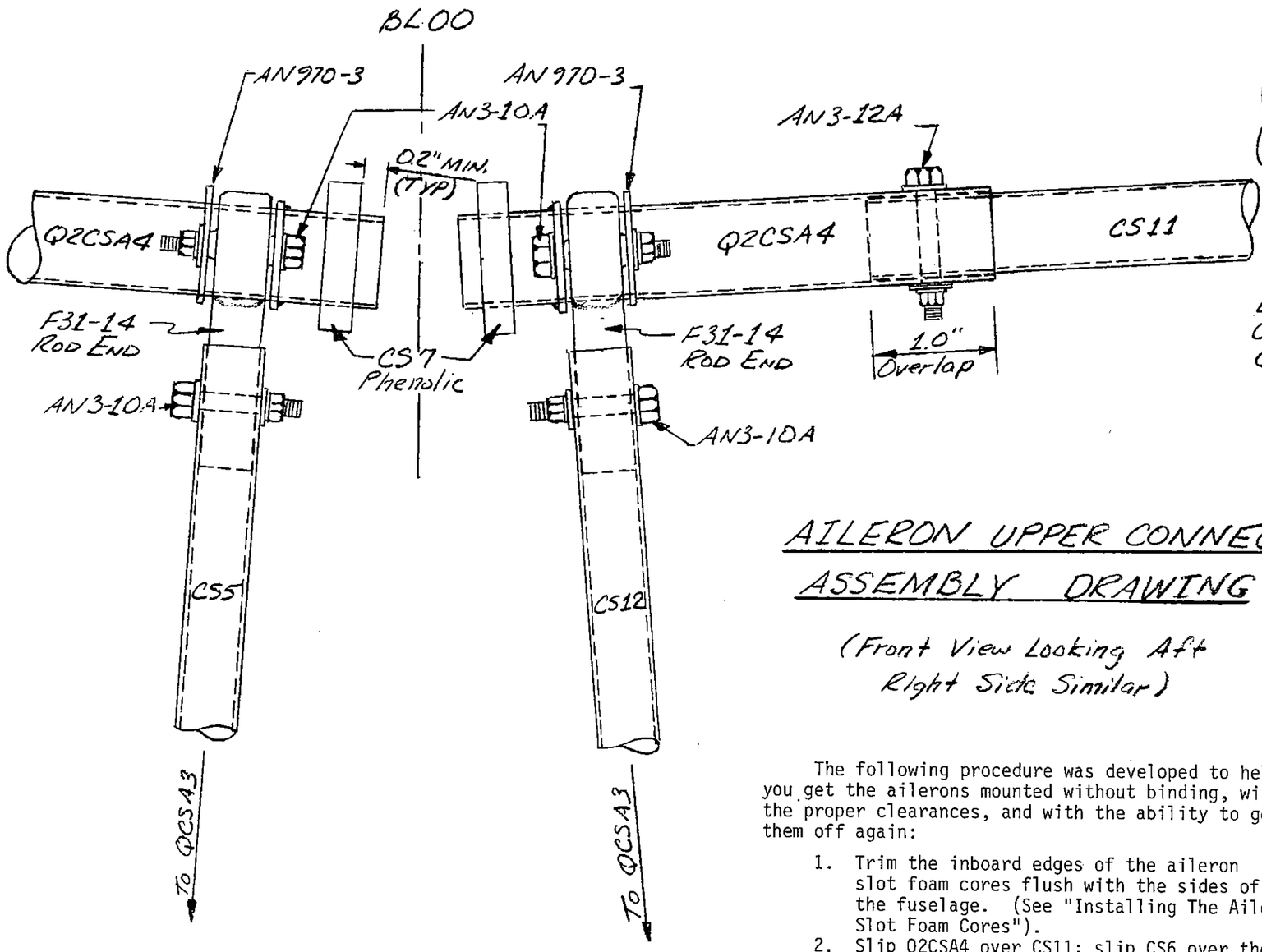
JIGGING MAIN WING VERTICALLY

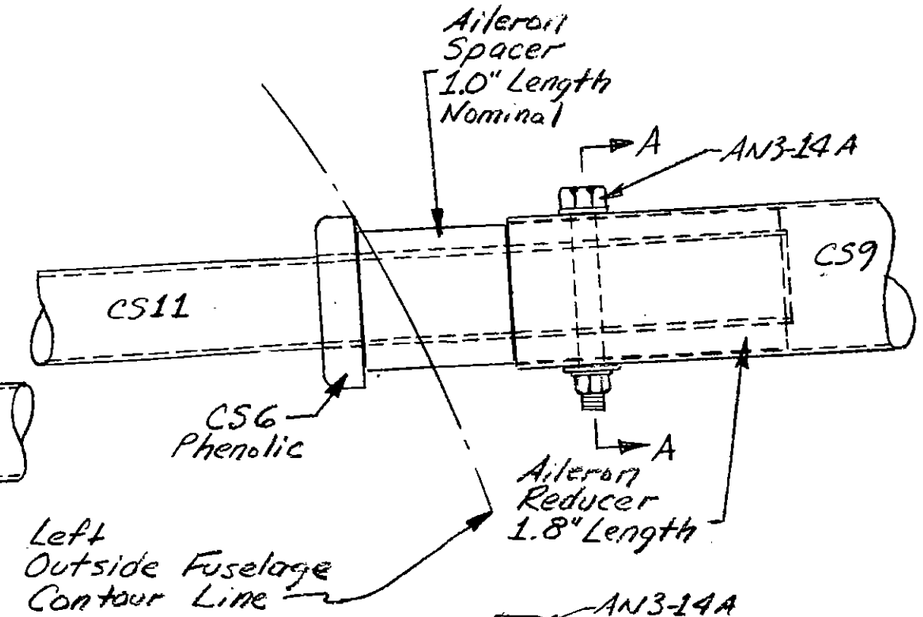
Take a piece of QCSM1 and make two 1.8" length pieces to use as aileron reducers. A sawcut and perhaps some light sanding will be necessary to make them fit snugly and flush with the inboard ends of the two ailerons.

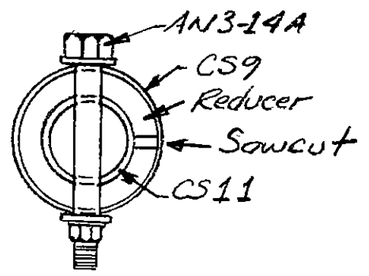
Find the phenolic bearings CS6 (2) and CS7 (2). Dull the phenolic completely with sandpaper except inside the reamed 5/8" diameter holes. Be sure that the other 1/2" diameter holes have been drilled out. These are non-critical on diameter, but must be there to assist bonding of the phenolic to the structure. They are NOT lightening holes.

Find Q2CSA4 (2). Make CS11 (2) from 0.625" O.D. x 0.065" wall 4130 steel tubing. The length of CS11, which can be critical for disassembly, should be about 3/4" less than half the width of the fuselage at the aileron torque tube (CS9)/ fuselage junction.

The right and left aileron mountings are mirror images of one another. Each aileron has an outboard hinge (CS10), an inboard hinge (CS6), and a center fuselage hinge (CS7). The Q2CSA4 slips over a CS11, which passes through the CS6 phenolic and slips into the aileron reducer, which is mounted on the inboard end of the aileron. Clear, heh?







SECTION A-A

AILERON UPPER CONNECT ASSEMBLY DRAWING

(Front View Looking Aft
Right Side Similar)

The following procedure was developed to help you get the ailerons mounted without binding, with the proper clearances, and with the ability to get them off again:

1. Trim the inboard edges of the aileron slot foam cores flush with the sides of the fuselage. (See "Installing The Aileron Slot Foam Cores").
2. Slip Q2CSA4 over CS11; slip CS6 over the other end of CS11, and slip that same end of CS6 into the aileron reducer, which you have already mounted flush with the inboard end of CS9, the aileron torque tube - looks like a shiskabob doesn't it?
3. Slip CS7 on the end of Q2CSA4.
4. What follows is a very qualitative fitting process. Using at least two people, dry fit CS10, CS6 and CS7 firmly against the main wing shear web in the appropriate postions (CS10 against inboard end of outboard main wing trailing edge core, CS6, and CS7 held in place) and check for binding. Work slowly, correct any binding or clearance problem by modifying CS10, CS6, and CS7. Please, do one thing at a time.

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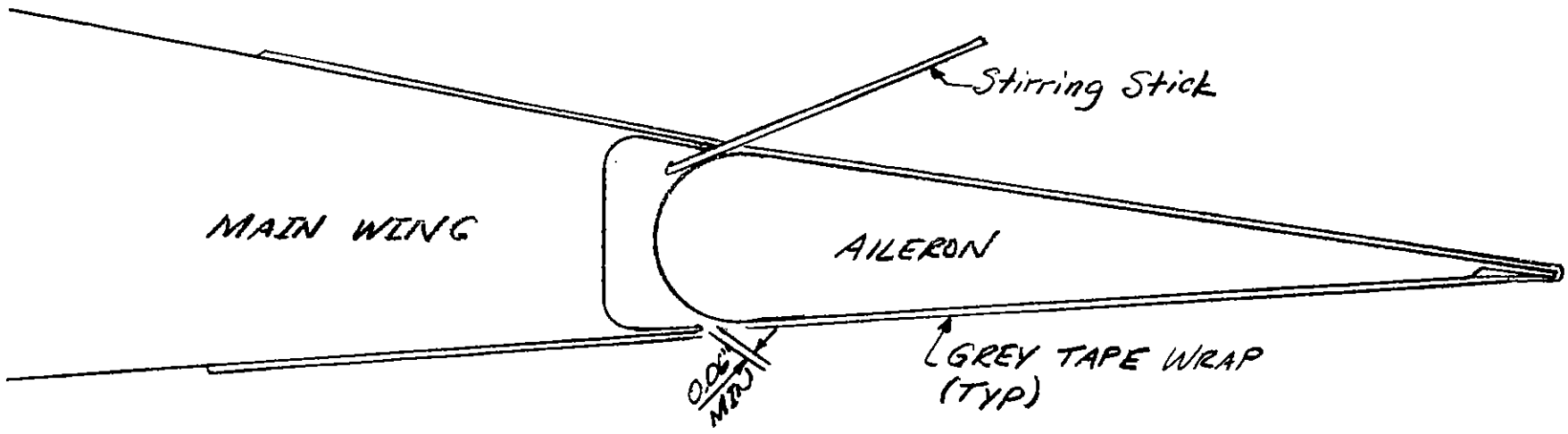
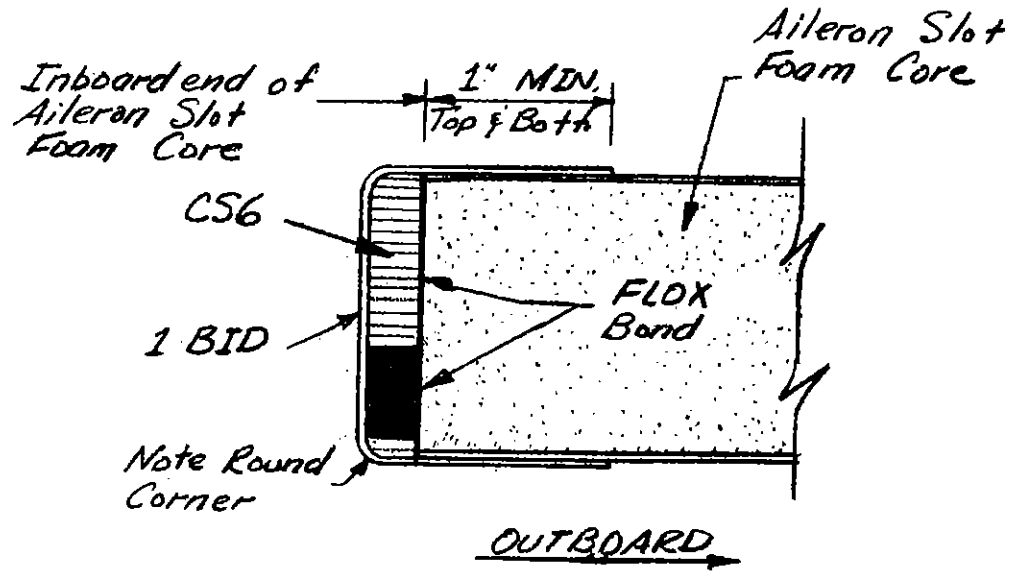
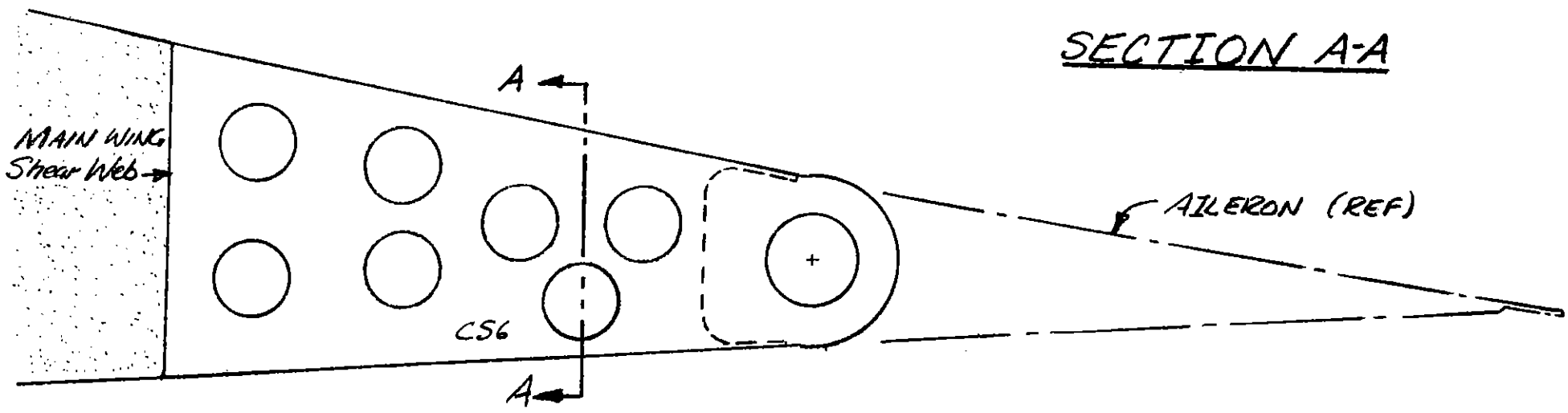


AILERON / MAIN WING CLEARANCE

5. When the complete aileron assembly fits well, and rotates freely, mix up some 5-MIN with flox and temporaily mount CS10, CS6, and CS7 in place against the main wing shear web, again checking for alignment, clearances, and binding.
6. If you haven't already done so, repeat for the other aileron.
7. Remove all of the pieces except CS10, CS6, and CS7. Carefully lay up the BID cloth that permanently holds CS10, CS6, and CS7 in place. These parts must be solidly mounted so that they cannot be accidentally broken off while in service.
8. Once the laminations in step 7 have cured, you are ready to drill in the aileron assemblies. Find your aileron rigging template, reassemble everything and set the ailerons at 0 degrees. Also, the "ear" on each A2CSA4 should point forward and be parrallel to a WL. Verify that the aileron is pushed outboard against CS10. Verify that CS11 overlaps 1.0" into A2CSA4 and 1.8" into the aileron reducer. Now drill in very carefully the two bolts on each side that fasten Q2CSA4, CS11, and CS9/aileron reducer together. BE CAREFUL! Don't let the holes elongate; use a small drill and work up in size.



SECTION A-A



CS6 INSTALLATION (Looking Outboard From Fuselage)

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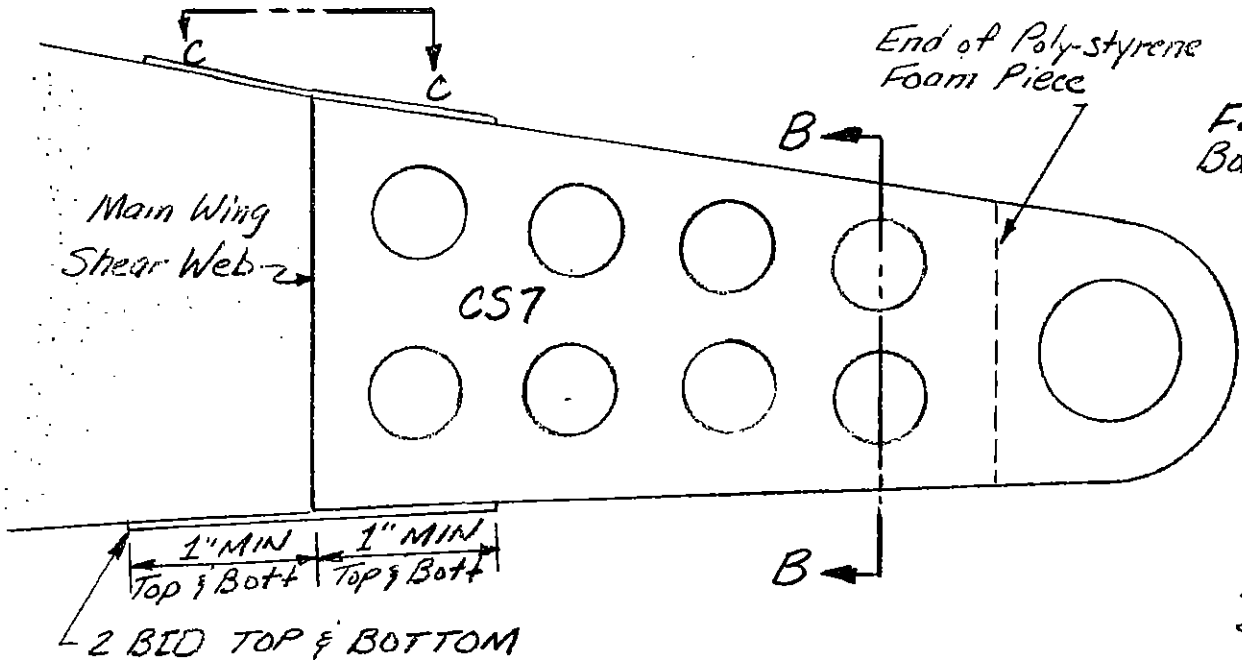
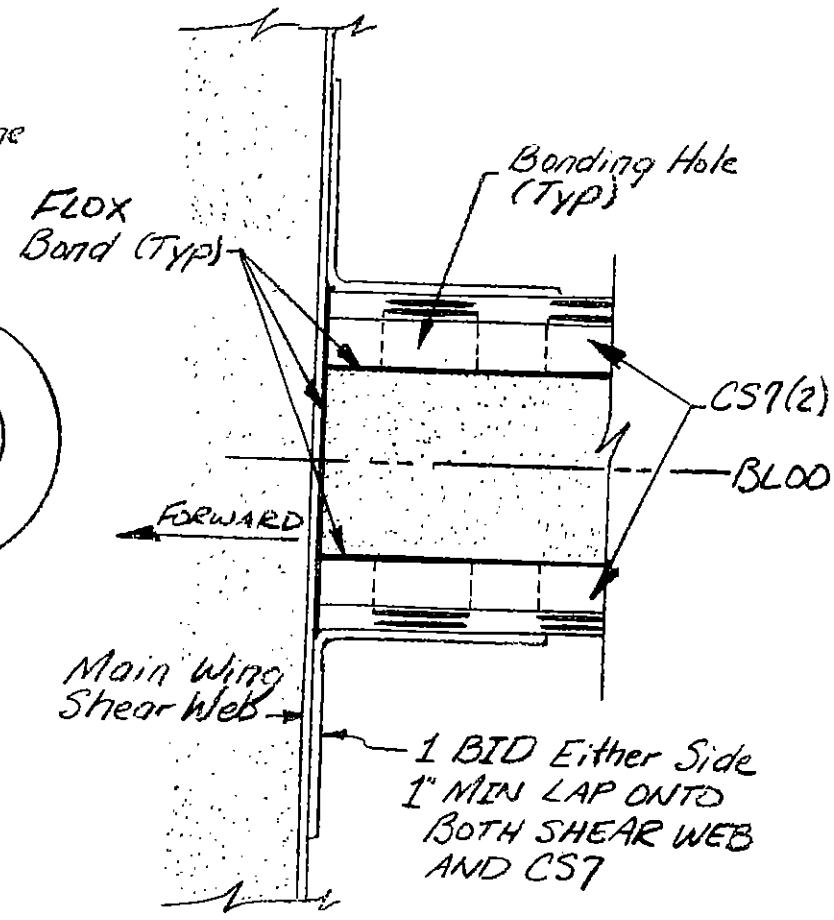
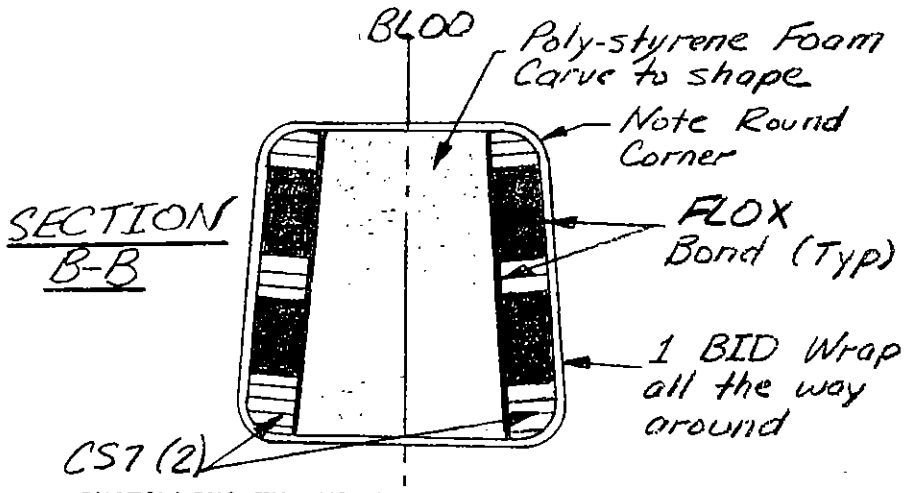


CS7 INSTALLATION (Side View)



SECTION C-C



SECTION B-B

INSTALLING THE MAIN WING TRAILING EDGE CORES

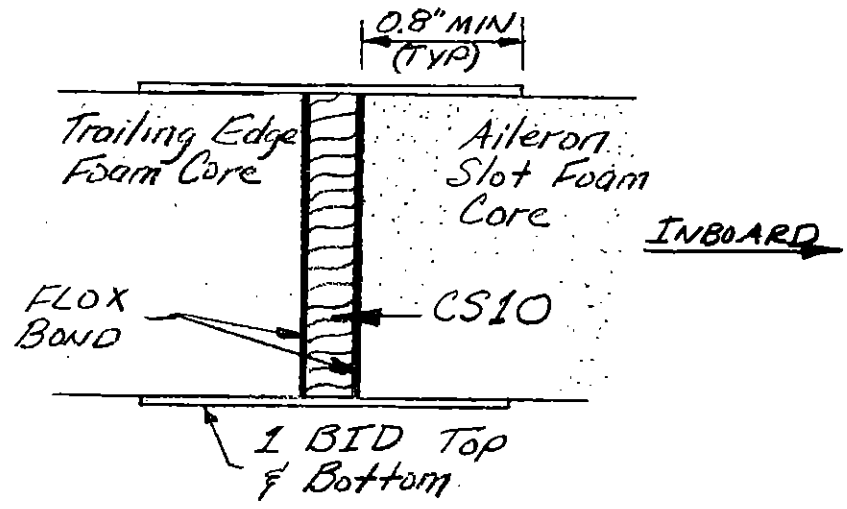
These cores begin at the outboard end of each CS10, and run outboard to the main wing tip. When originally hot wired, they were made longer than necessary on the inboard end, so fit each one into position and trim away the excess.

The bonding and laminating process is very similar to what you have accomplished previously on the aileron slot foam cores. Attach the cores to the main wing with micro slurry on the cores and epoxy on the main wing shear web (remembering to remove the peel ply), making sure that the top and bottom surfaces make a smooth transition to the main wing curvature. Next, laminate 2 BID on the lower surface of the main wing trailing edge cores, overlapping onto the main wing cores a minimum of 1". When cured, laminate 2 BID on the top surfaces, using a glass-to-glass trailing edge treatment exactly like you did on the aileron. If you are careful, you may be able to accomplish the laminations with the wing jigged vertically, to save time; however, beware of epoxy runoff yielding dry lamination. An alternative method would be to do each surface on the flat, instead.

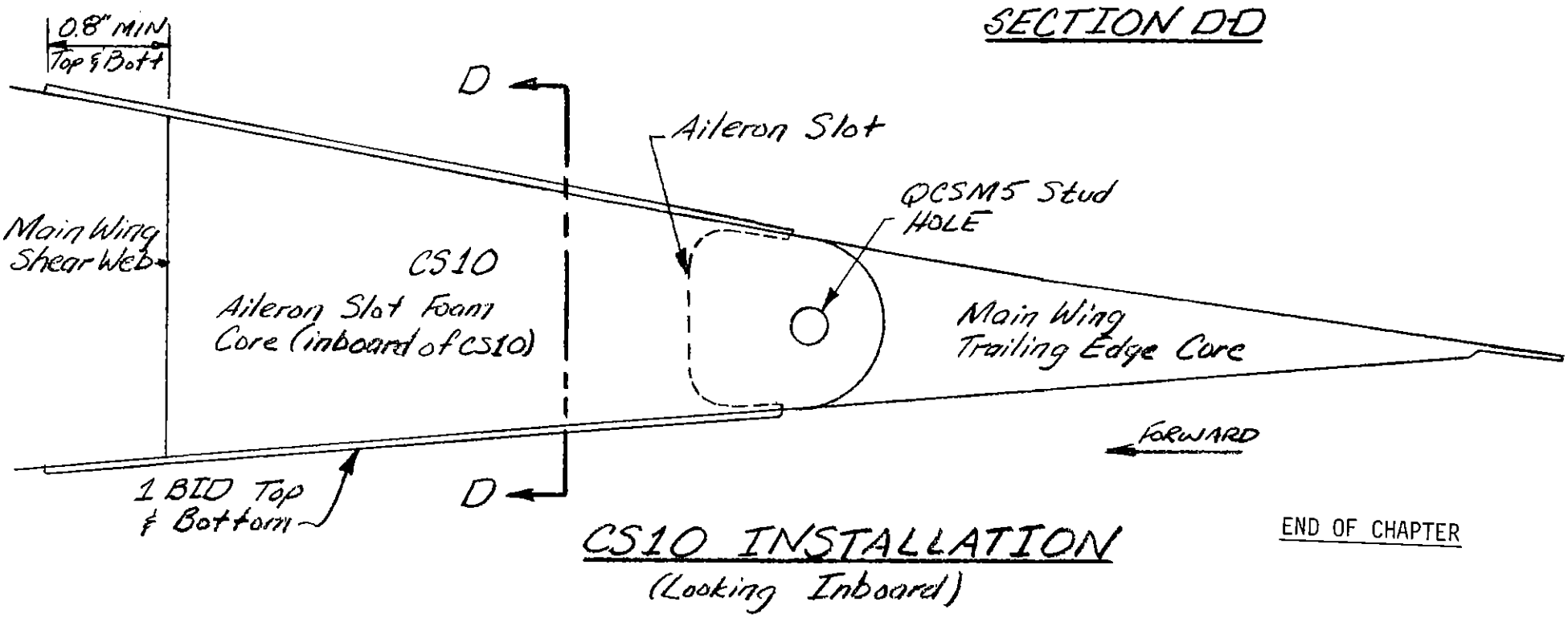
9. Finally, make the aileron spacer, which has a nominal 1.0" length. This spacer should be sized lengthwise to allow the aileron to have a lateral freeplay (i.e. inboard to outboard) of about 0.05". Assemble each aileron, and again check for binding, misalignment, or excessive freeplay.

Note the attachment of each CS10 wedged between the main wing trailing edge core and the aileron slot foam core.

The main wing tips are carved and glassed later on, as an option.



SECTION D-D



CS10 INSTALLATION
(Looking Inboard)

END OF CHAPTER

CANARD CONSTRUCTION

INTRODUCTION

The Q2 canard has a swept leading edge, swept trailing edge, anhedral, a plain elevator which also effectively serves as a flap, and, in addition to carrying about 65% of the aircraft's weight, also provides the energy absorption (i.e. "spring") for the main landing gear that is mounted at the canard tips. It is a sandwich composite structure with solid foam core, two layers of UNI at 45 degrees to the trailing edge of the canard for torsional stiffness and surface durability, and spanwise tapes of UNI for bending strength. Shear loads are taken by a vertical shear web, and the elevators are essentially full-span, being actuated by an aluminum torque tube.

The canard is constructed in one piece from tip to tip for strength, lightness, and ease of construction.

Because of these factors, the canard is more complex and more critical than the main wing. However, the basic procedures are identical, and the experience you have gained in completing the main wing for your Q2 should allow you to construct the canard in the same amount of time. You may wish to reread the chapter on the MAIN WING to review the procedures.

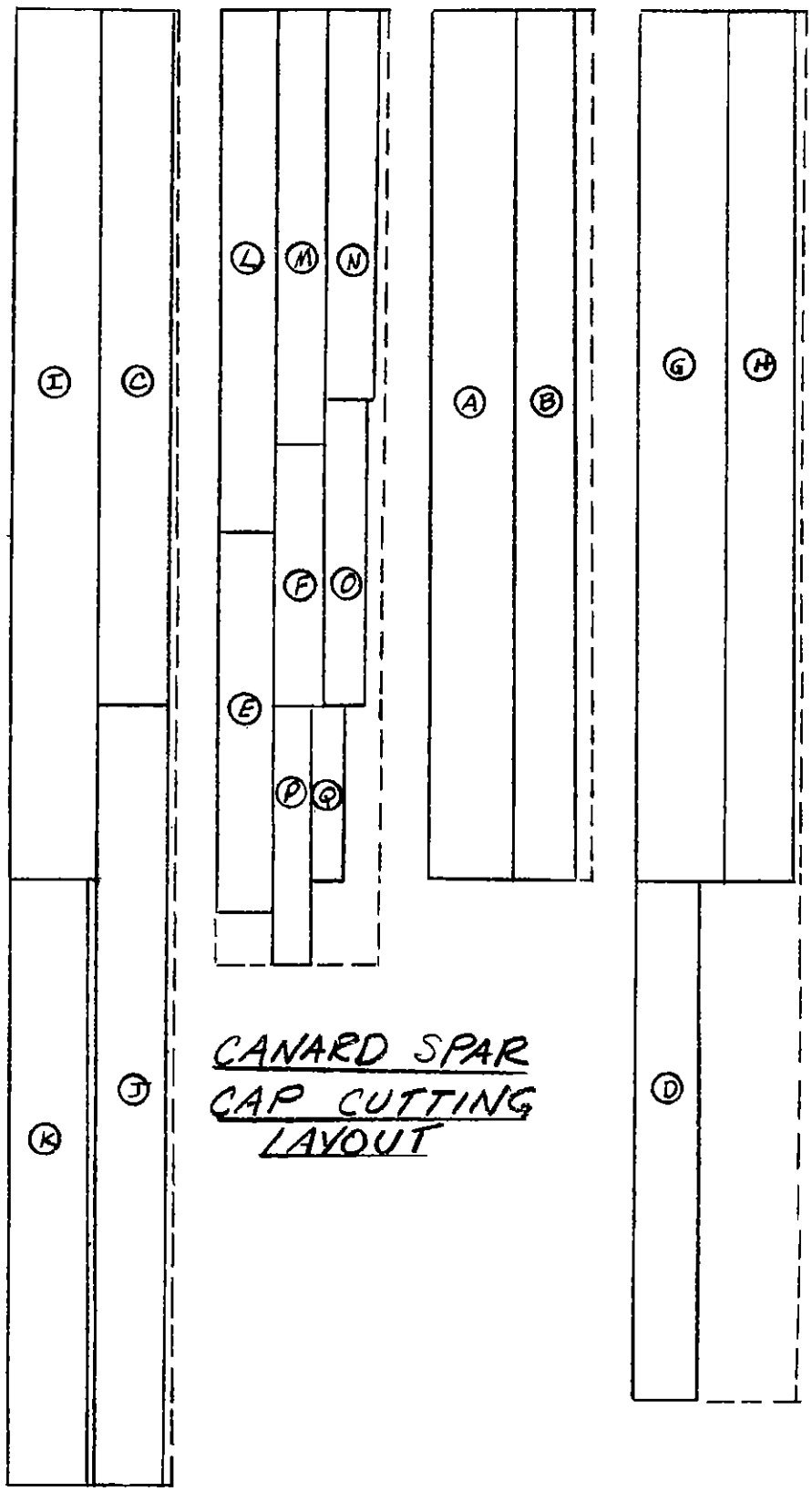
CUTTING THE SPAR CAPS

Begin by cutting the UNI spar caps using the suggested layout on this page. Letter each one of them with a felt tipped marker for identification later, in addition to marking a centerline in the middle (where the cap will cross BLOO when installed on the canard. Be sure to carefully roll up and store the spar caps after cutting to prevent damage.

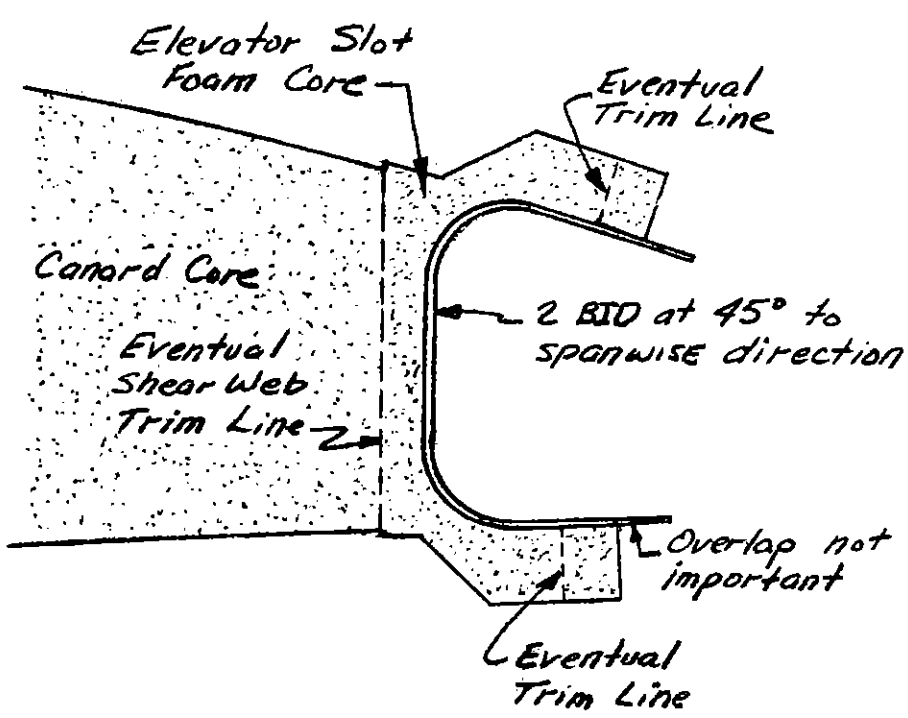
GLASSING THE ELEVATOR SLOT FOAM CORE SLOTS

Construction begins by glassing the inside slot of the elevator slot foam cores with 2 BID at 45 degrees to the spanwise direction (i.e. T.E.). Knife trim to the edge of the foam core.

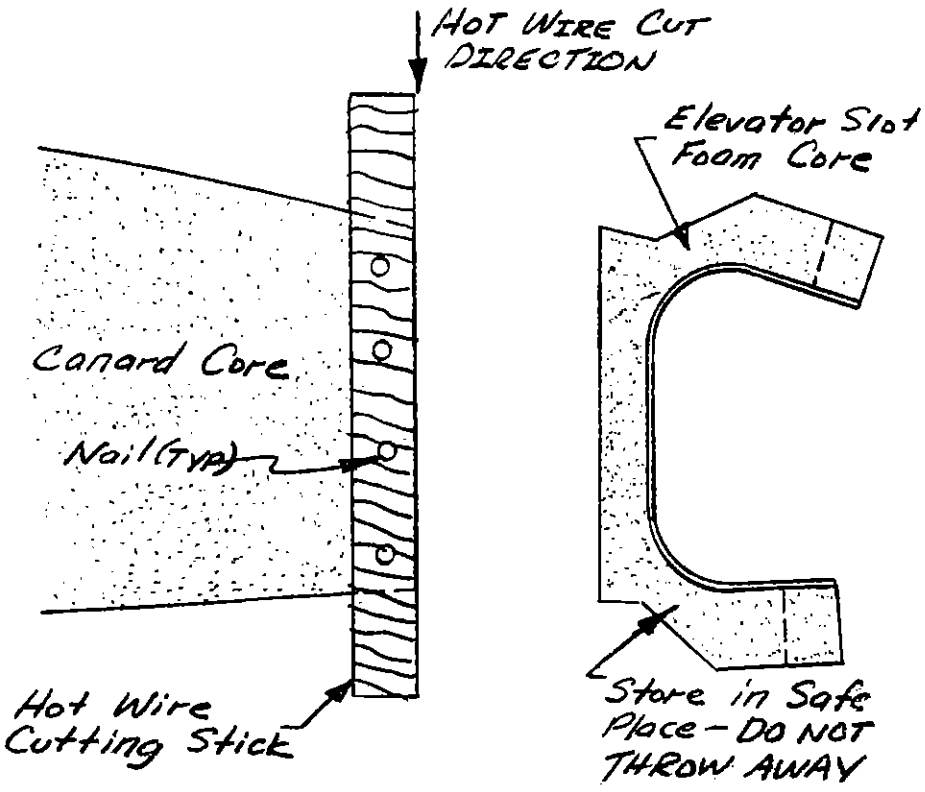
Next, get out your hot-wire cutting equipment and set it up. Take the forward part of each canard core templates, and nail them back onto the already hot-wired cores, being sure to check the level lines and to weight down the cores. Then, hot-wire the 51-A-B-C-...-H-I-J-48 sections on all canard foam cores. Store the elevator slot foam cores for later use.



CANARD SPAR CAP CUTTING LAYOUT



ELEVATOR SLOT FOAM CORE INSIDE LAMINATION



JIGGING THE CANARD

Next, you will need to jig the canard cores on the jig table. It would probably be a good idea to clean off the jig table of any bondo chips, wood, epoxy, etc., so that you start with a clean surface.

Find the canard core female jigging templates (6)

Now study the sketches. The canard cores are jigged upside down on the jigging table using the canard core female jigging templates. If your table is not at least 200 inches long, you will have to extend it like you did on jigging the main wing. As on the main wing, the shear web is perpendicular to WL00, and the canard core female jigging templates have leading and trailing edges that are tangent, respectively, with the leading edges of the canard, and the canard shear web.

Begin by drawing a straight line along your jigging table and marking the locations (BL's) of the canard core female jigging templates. Next, temporarily set the canard core female jigging templates on the jigging table so that their trailing edges are the distances from the straight line, called out in the accompanying illustrations. Note that the outboard canard core female jigging templates (the ones at BL100 right and BL100 left) are right on the straight line. A string stretched spanwise with a weight attached at either end may be helpful in establishing and keeping the straight line.

Now begin to trial fit the five canard cores into position. Be careful in handling the foam cores to prevent damage to the foam. All cores may have to be sanded in order to make them fit together within the maximum tolerance of 1/16". The canard center section core is already beveled to compensate for the anhedral angle, but it may still have to be trimmed and sanded to obtain the fit on the joint within 1/16". The level lines on all cores must remain level at all times. This is important, so take your time.

Stand back and sight spanwise along the canard to verify that the canard is straight, and is not bowed or kinked. Verify that the leading edges are straight, and that the trailing edges are straight also.

Don't be concerned if the canard core female jigging templates need to be moved inboard or outboard to remove any bows or kinks. Also, a long straight edge will help you looking for kinks and joggles, or dips.

When everything is perfect, mix up some bondo and carefully bondo the canard core female jigging templates to the table top in the necessary location. Next, rest the canard cores on the canard core female jigging templates. Check the alignment and individual level lines again; then again and again until every thing is Perfect, with a capital P. The next step is to join the foam cores together with micro slurry after verifying that the core fit is within 1/16". Check, recheck, and re-recheck each core level line and alignment as the cores are joined. Note that the canard center section foam core gets a glass rib of 2 BID and flox corners at each end of the canard center section foam core. The flox corner should be added after the entire series of canard cores have been joined and cured.

CAUTION

The canard foam cores must fit within 1/16" or exotherm damage may result.

Core preparation is the single most important factor in obtaining an accurate, strong, and lightweight canard, so don't hurry through this section unless you don't mind regretting it for years to come.

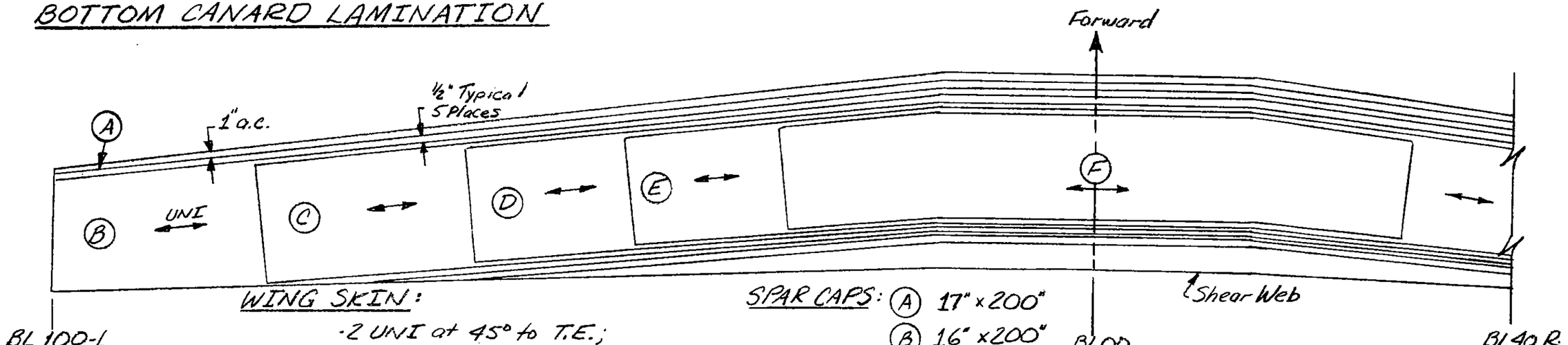
PREPARING THE CANARD CORES FOR GLASSING

At this point, the canard cores should be jigged on your jigging table upside down, 5-minuted and bondoed in place, and able to take a direct hit from a 88 mm howitzer without budging from its location.

Use a hard block to clean up all joggles, excess micro, and any bumps on the canard cores. At either end of the canard center section core, round the joint so that the glass will flow smoothly across the joint. At the T.E. (shear web), round the corner so that the glass will flow smoothly down the face of the shear web.

This is your last chance to do it right, so spend at least another hour making these cores as perfect as you know how. While your at it, check, recheck, and re-recheck all the canard level lines that you can see until you can do it in your sleep. If you are not proud of everything sitting on that jig table, don't go on to the next step until you are.

BOTTOM CANARD LAMINATION



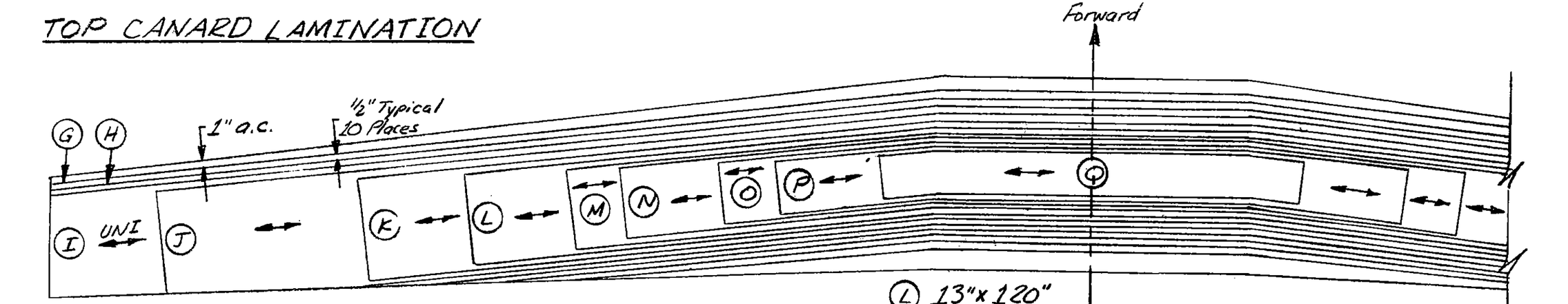
WING SKIN:

- 2 UNI at 45° to T.E.;
- Drape down shear web face to bottom

SPAR CAPS:

- (A) 17" x 200"
- (B) 16" x 200"
- (C) 15" x 160"
- (D) 14" x 120"
- (E) 13" x 90"
- (F) 12" x 60"

TOP CANARD LAMINATION



WING SKIN:

- 2 UNI at 45° to T.E.
- Drape down shear web face to bottom

SPAR CAPS:

- (G) 18" x 200"
- (H) 17" x 200"
- (I) 16" x 200"
- (J) 15" x 180"
- (K) 14" x 140"
- (L) 13" x 120"
- (M) 12" x 100"
- (N) 11" x 90"
- (O) 10" x 70"
- (P) 9" x 60"
- (Q) 8" x 40"

LAMINATING THE BOTTOM SKIN AND BOTTOM SPAR CAPS

Study the two sketches labed "Bottom Canard Lamination", and "Top Canard Lamination" very carefully.

In this section, you will only be doing the "Bottom Canard Lamination", but that one should keep you and two others busy for about 3 hours. (The third individual mixes epoxy while the other two do the lamination).

To summarize the lamination, first you will laminate the wing skin, which is 2 plies of UNI at 45 degrees to the canard shear web, and then you will laminate spar caps A thru F .

Organize your shop for the big layup. Measure the canard cores, and cut the UNI for the main wing skins, labeling each one for identification.

Rather than have you reread and use the section on "Laminating the Bottom Skin and Bottom Spar Caps" that you used for the main wing, we are going to reprint and rewrite it here. (It helps make the plans look more complex).

The first UNI ply is put on at 45 degrees to the canard shear web T.E.. The fibers must be straight, so take your time getting the wrinkles and kinks out. Don't get ahead of yourself on pouring micro slurry on the foam; otherwise, by the time you are ready to place the UNI over a particular area, you will have a messy, hard, lump of slurry. On the other hand, with the experience you have had on the main wing, you should be within 10% of the miximum laminating speed that you will ever obtain. Work with one piece of cloth at a time, and with small batches of slurry and epoxy. Unrolling the UNI cloth as needed is advised to reduce the awkwardness of the large pieces. Scrap UNI can be used to fill in any small spots not covered by the large pieces of UNI.

At the leading edge of the canard cores, let the UNI cloth hang down vertically. Trim to within 1" of the tangent point, just like you did on the main wing. At the trailing edge (T.E.), allow the cloth to drape around the corner and down to the bottom of the shear web so that the UNI is at 45 degrees to the T.E. on that face also. Trim the canard tip UNI to within ½" of the canard core.

No overlap is required on the UNI wing skin; just use a butt joint.

The second ply of UNI is also place at 45 degrees to the T.E. of the canard core, but in the other direction from the first ply, so that the two plies of UNI will have their major fiber orientations at 90 degrees to each other. Try to avoid having the butt joints from the first ply of UNI coincide with the butt joints from the second ply of UNI. The second ply of UNI is also draped around the corner and down to the bottom of the shear web, so that the shear web has two plies of UNI at 45 degrees to the T.E. and at 90 degrees to each other. Trim all edges like you did on the first ply. As good laminators you will, of course, squeegee to the nth degree to remove any excess epoxy. By this time, if your floor does not contain enough hardened epoxy to build the Q3, you are either very accurate at mixing epoxy, or else you are not working hard enough at squeegeeing off excess epoxy.

Spar caps A thru F are laminated in that order, with the widest caps going on first. To pick up a spar cap and place it on the canard, use three people. While one person holds each end of the spar cap, the third removes any frazzles, being careful not to reduce the width below what is called out for the particular spar cap. That third person then stands at BL00 and positions the spar cap in the proper location (centerline on BL00 and proper distance from the leading edge of the canard) while the other two individuals keep the cloth off of the foam so that it won't stick. When the center (third) person is ready, one of the individuals holding an end lays it down spanwise on the canard in the proper postion (in relation to the canard L.E.) and removes any wrinkles and kinks. This can be a slow process, so keep your cool. Then the individual on the other end does likewise. The center individual makes sure that the spar cap smoothly "turns the corner on either end of the canard center section core.

Squeegee each spar cap from BL00 outboard. Work out any wrinkles by pulling carefully on the fibers.

The remaining spar caps are each put on in a similar fashion. Although you may be getting tired, you must rise up to the occasion and concentrate on squeeging each spar cap well to avoid excess epoxy which leads to excess weight. Use extra epoxy very sparingly on the last spar cap. Every other spar cap (i.e. A, C, E, etc.) is allowed to drape over the T.E. and down the shear web to the bottom. Trim B, D, F, etc. at the T.E.

Before quitting, peel ply all joints, and the first two inches of the canard L.E.. Also, knife trim the L.E. at the tangent point, just like you did on the main wing. Finally, clean up the mess, and DON'T TOUCH THE CANARD FOR AT LEAST 24 HOURS.

NOTE

If you have room, and can be patient, it would be better to permit the bottom main wing lamination to cure for 48 hours plus. In the meantime, you could skip ahead and work on fuel system, canopy installation, etc.

INSTALLING THE CANARD STIFFENER

Build a framework out of scrap lumber and bondo to hold the canard jigged in place while you turn it over. As shown in the pictures in the MAIN WING chapter in the "Laminating The Top Skin And Top Spar Caps" section, we suggest that the lumber run from tip to tip with a few cross pieces. Don't get fancy, just tie everything together so that the main wing won't move.

Next, when you are sure of your framework,break loose the canard core female jigging templates with a hammer (they won't be needed again), and turn the canard over so that the unglassed cores are upward. Set the canard on the jigging table once again.

Check the canard tip level lines. Jig, and shim, and bondo until the canard tip level lines are absolutely perfect; almost, or maybe, doesn't count. Then use bondo to secure all of the jigging so that a jackhammer will be required to remove the canard from the jigging table.

You are now ready to install the canard stiffener. That stiffener runs along the top of the inboard canard foam cores and across the canard center section core. This foam stiffener that you previously hotwired out of the canard cores will be flimsy, so be careful with it. Clean up the canard slot that the stiffener rests in with a hard block and sand paper, so that the lamination you will be doing will transverse the joints smoothly. The glass ribs at either end of the canard center section will have to be trimmed back so as not to interfer with the stiffener. The lamination schedule, as called out in the sketch, is to layup 1 UNI first, then 2 BID, and then 1 UNI on top for the final ply. Take your time, and make the fibers straight. The 2 BID are laminated at 45 degrees to the spanwise direction. Knife trim the lamination flush with the top surface of the canard cores and let the lamination cure.

Next, install the foam stiffener with micro slurry. It is best to dry fit the part first, since it may be necessary to do some trimming, or else use dry micro to obtain a smooth fit. Don't worry if the top of the foam stiffener projects above the top canard surface a small amount; this can be trimmed back after cure.

Once the foam stiffener installation has cured, dig out the foam as shown and install two flox corners flush with the top canard surface. Also, install the flox corners on either end of the canard center section core.

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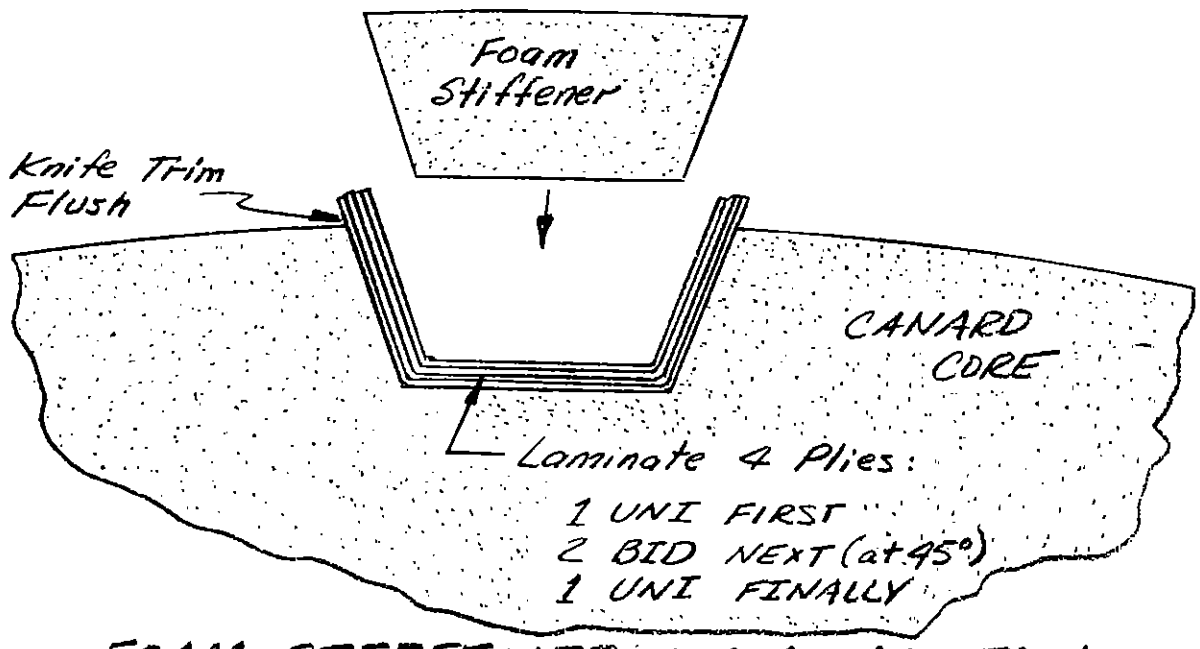
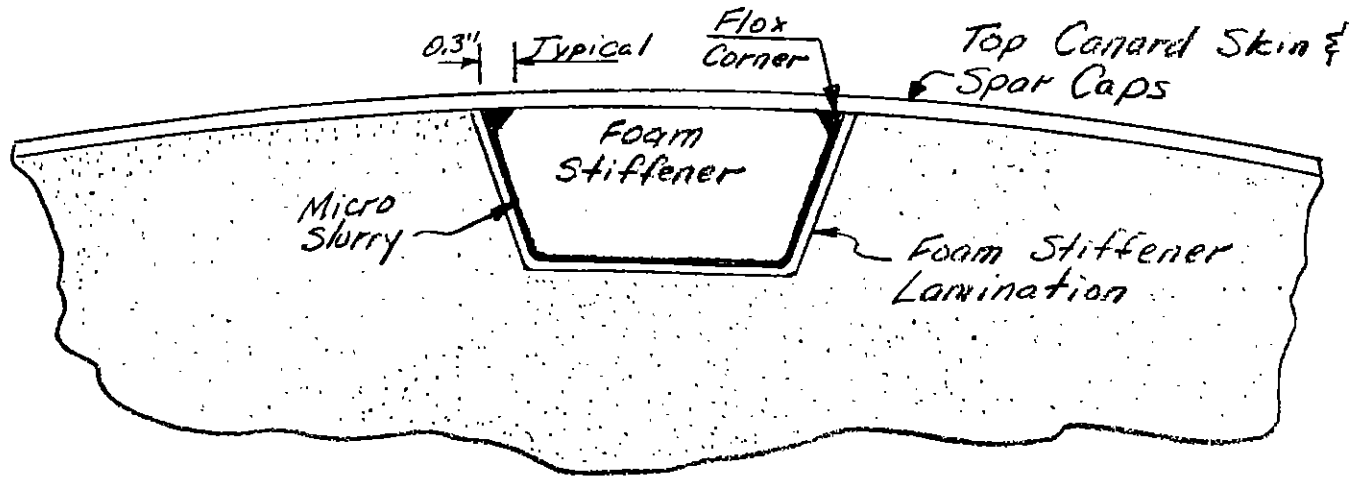


FOAM STIFFENER LAMINATION



FOAM STIFFENER INSTALLATION

PREPARING THE TOP CANARD FOAM CORES FOR GLASSING

At the leading edge, feather the bottom skin to a feather edge at the tangent point just like you did on the main wing. Prepare the canard top surface just like you did the canard bottom surface. (See "Preparing The Canard Cores For Glassing"). Be sure and spend time carefully smoothing out the canard stiffener area, and the flox corners on either end of the center section core. Remember that the flox corners are much harder than the foam surrounding them, so go easy.

You must really prepare the top canard surface well, and remove all bumps, joggles, and other irregularities if you want a pretty looking, lightweight canard on your aircraft. REMEMBER! If you are not satisfied with how the canard top surface foam cores look, Don't go on to the next step.

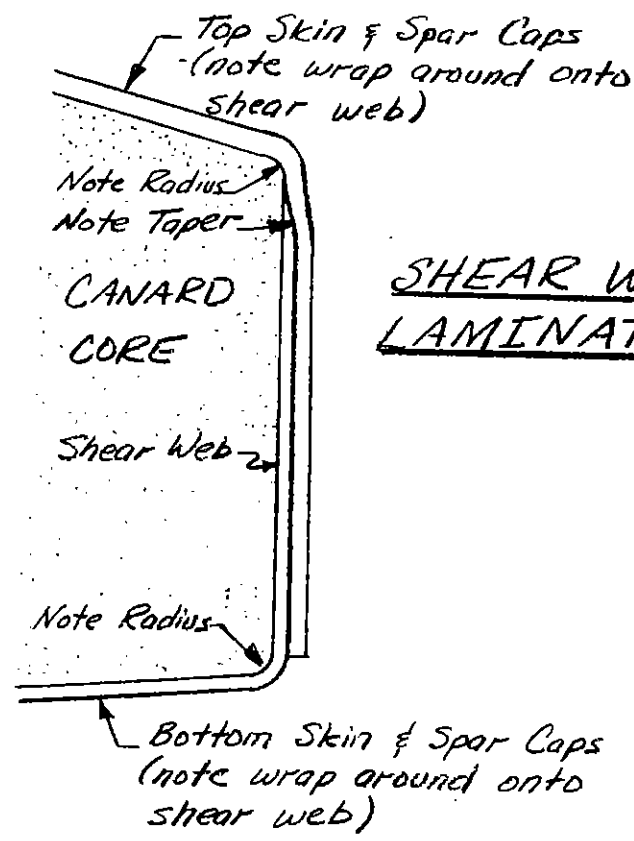
LAMINATING THE TOP SKIN AND TOP SPAR CAPS

Just to be sure, check the canard tip level lines one more time, and shim to get both of them absolutely level. (Have you noticed how they seem to shift by osmosis?)

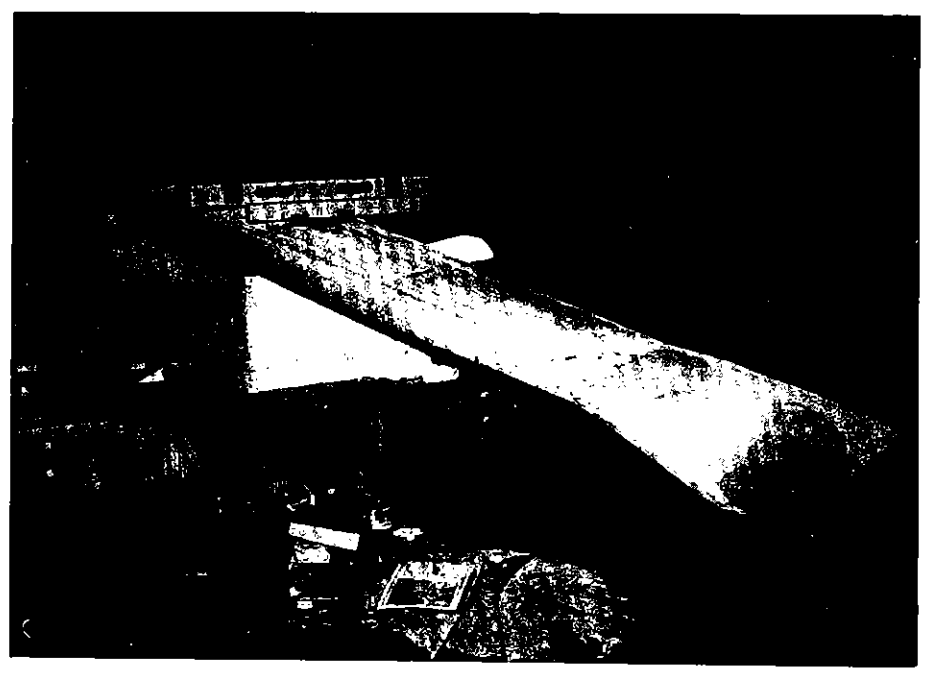
The top canard skins are laminated similarly to the bottom skin lamination. The skin is the same two UNI at 45 degrees to the T.E., draping over the T.E. down to the bottom of the shear web, and the spar caps are G thru Q this time. At the leading edge of the main wing, overlap the bottom skin with the top skin a minimum of 1". Rather than let all the spar caps drape over the T.E. and down the shear web, trim every other one off at the T.E.. Peel Ply the shear web and all joints.

Don't touch the canard for at least 48 hours. Before removing the lumber, bondo a level board at about midspan on each canard.

You now deserve to celebrate for two days straight; you have just finished the final MAJOR layup in your aircraft. By the way, that top canard lamination that you just completed was the most difficult and critical lamination in the whole aircraft, and yet we have such confidence in you at this point, that we only devoted a very few words to it.



SHEAR WEB LAMINATION



INSTALLING THE ELEVATOR SLOT FOAM CORES

This step is critical to having a nice looking canard and elevator union, so follow the directions carefully.

To start out with, the elevator slot foam cores that you hot-wired way back when were purposely made longer than necessary. Your first task is to size them for the correct length. To do this, you must measure your fuselage width at the fuselage/elevator slot foam core junction. Take measurements of the canard, skip ahead to the section on "Mounting The Canard To The Fuselage", and determine that dimension, on either side of BL00. Mark the proper points on the canard. Wait to trim the inboard elevator slot foam cores until after they have been installed on the canard.

Next, determine where to trim the outboard elevator slot foam cores. Since each elevator was made 72" long, measure 6 feet plus 1 inch (for elevator/fuselage clearance) from your first mark outboard and place another mark. This is where the outboard elevator slot foam core will be trimmed, but, as before, wait until after installation to do it.

The elevator slot foam cores are unique in that both the brake line conduit and the pitot tube must run through the lower, forward edge as shown on the sketch.

The pitot tube runs out the right canard, exits at about BL40, and is shaped as shown.

In the right canard, the brake line conduit enters the inboard end of the elevator slot foam core within 1/2" of the top edge, and continues all the way outboard to the end of the outboard elevator slot foam core on the right side of the aircraft. Let the Nylaflow tubing extend about 4" beyond the end of the slot foam core. On the left canard, do the same routing. You should use a router bit in the dremel to route out the foam. Any extra "room" in the foam is filled with dry micro. Both the brake line conduit and pitot tube are installed with 5-MIN dabs to hold them in place, and then surrounded with dry micro, as shown. Keep both lines, but particularly the brake line conduit, as straight as practical. The pitot tube tubing should extend into the fuselage about 12".

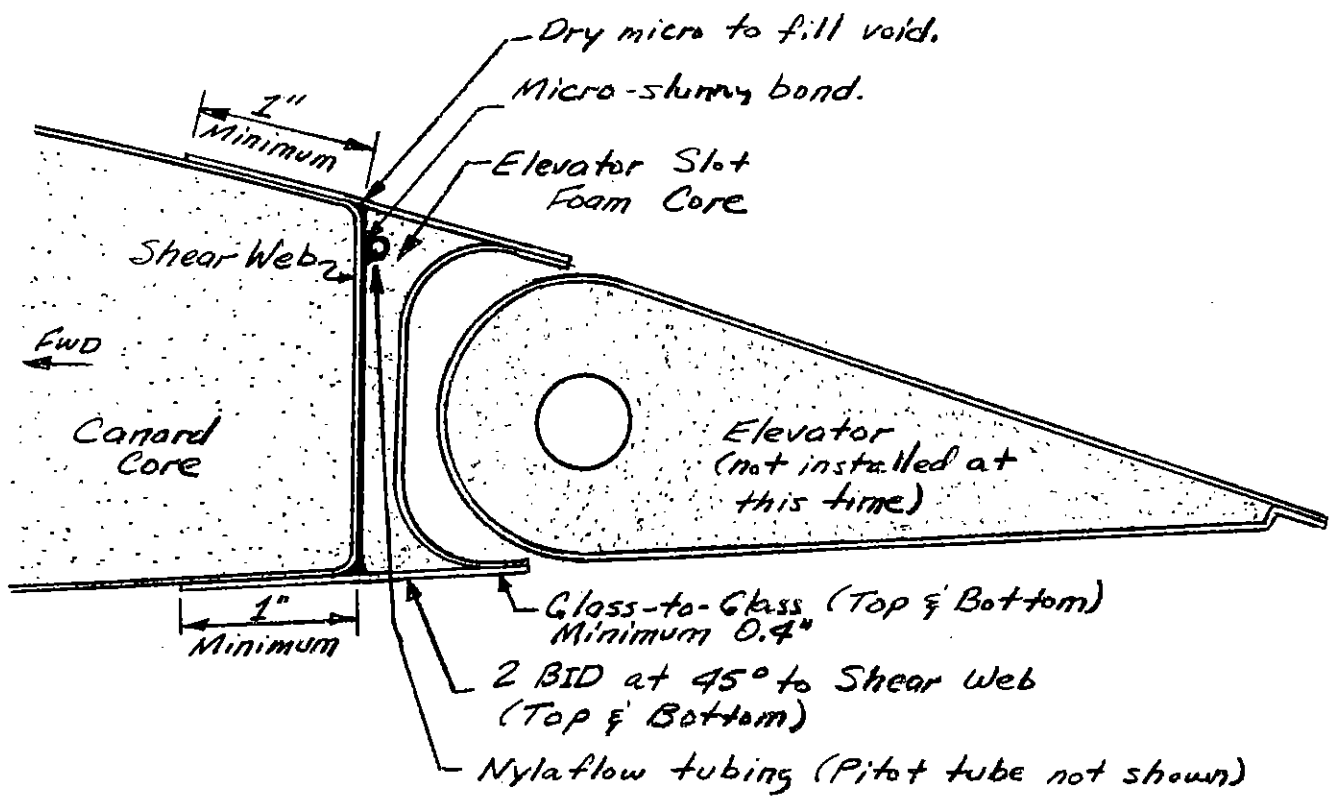
The elevator slot foam cores are installed to the canard shear web with micro-slurry on the foam cores and epoxy on the shear web (don't forget to remove the Peel Ply!), plus a few dabs of 5-MIN to keep the two attached during cure.

It is easier to check clearances top and bottom if the canard is jigged vertically on the jig table. This will also keep the joint from running. By this time, you should be so good at jigging, that we won't even talk about how to do it.

The important point to remember is that at the shear web attach point along the span, the top and bottom of the elevator slot foam cores should flow smoothly into the top and bottom surfaces of the canard, respectively. If the elevator slot foam cores want to stick up a little bit, this is OK since that can be sanded later. Any dip, however, will have to be filled with micro. When you have done your best to carefully fit the shear web joint top and bottom then mix up the micro-slurry and epoxy and join the elevator slot foam cores to the canard.

Once the attachment has cured, then the fun can begin. Trim the elevator slot foam cores back to the "Eventual Trim Line". Next, sand down the "tails" so that you can achieve a minimum of 0.4" of glass-to-glass bond with the inside lamination, while at the same time fairing everything nicely into the canard contour forward of the shear web. At the glass-to-glass bond area, you must sand away all micro and epoxy and get down to the glass. Spend some time looking at the surfaces getting the best alignment that you can. When everything is ready, laminate 2 BID at 45 degrees to the canard shear web on the elevator slot foam cores, being sure to achieve at least 0.4" of glass-to-glass bond, and lapping up onto the canard at least 1". Note that the sketch calls out dry-micro fill if required at the top and bottom of the shear web joint. Trim the inboard and outboard elevator slot foam cores at the marks previously made on the canard.

Your canard should now be looking more like a canard, and less like a lump of foam and glass.



INSTALLING THE ELEVATOR SLOT FOAM CORES ONTO THE CANARD CORES

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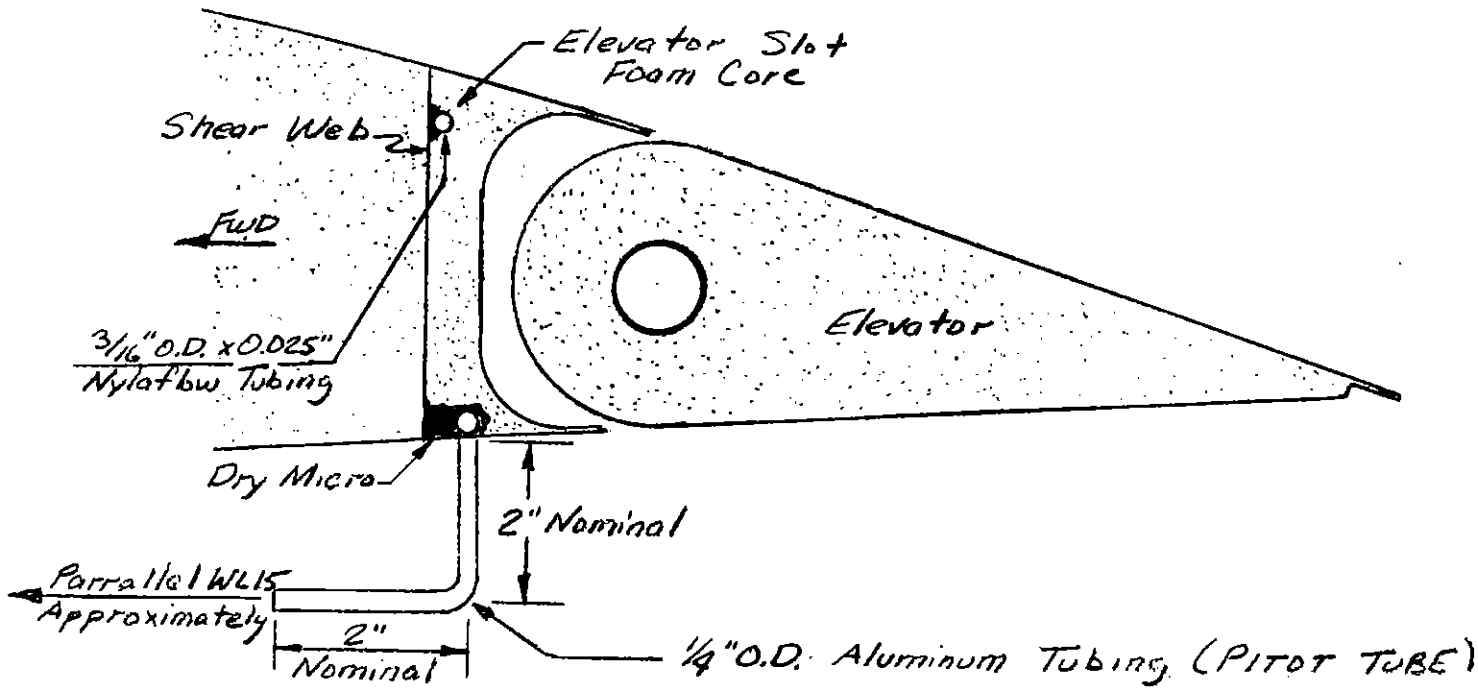


BRAKE LINE CONDUIT & PITOT TUBE INSTALLATION

OUTBOARD ELEVATOR PIVOT ASSEMBLY

These instructions cover only the assembly of the left outboard elevator pivot, but the right outboard elevator pivot is a mirror image, and may be accomplished at the same time.

First, review the MAIN WING chapter section on "Outboard Aileron Pivot Assembly". Except for the part number changes, you will be doing exactly the same operations.

Locate a QCSM7 pivot about 0.25" inboard of the outboard end of the elevator using 3 MSP43 cherry rivets spaced radially at least 0.4" apart. It will be necessary to "tunnel" through the elevator skin and elevator foam core in order to reach the CS16 elevator torque tube for riveting. The holes made by the tunneling operation should be filled after riveting with dry micro.

Find CS19, and insert a QCSM5 stud with the 2 AN970-4 washers, 1 AN960-4 washer, and 2 AN363-428 nuts, just as you did on the aileron outboard pivot assembly. Remember, there must be a minimum of 0.6" from the AN960-4 washer inboard to the end of the QCSM5 stud so that the elevator must be moved inboard at least 1/4" before it "falls off" the QCSM5 stud for dissassembly. Finally, round the end of the QCSM5 stud slightly to assist in mounting the elevator.

When the elevator is mounted, CS19 will fit flush against the canard shear web. At that time, the outboard elevator slot foam core will have to be trimmed to allow that.

Midspan Elevator support was redesigned to strengthen and prevent internal corrosion. (click for link)

MIDSPAN ELEVATOR PIVOT ASSEMBLY

Read this section carefully before doing anything, and take the time to visualize what the words are saying. Otherwise, you may find it difficult to install or remove your elevators!

These instructions will cover the left midspan elevator pivot assembly, but the right midspan elevator pivot assembly is a mirror image.

Find a QCSM3 stud and a QCSM2 pivot. Screw the QCSM3 stud into the QCSM2 pivot, retaining it with AN363-1032 locknut, making sure that the assembly is tight. Next, round the end of the QCSM3 stud slightly, as shown, to facillitate installation and removal of the elevator later.

Measure 30" outboard on the elevator from the inboard end and place a mark. Using a router bit, route out a slot 1/8" wide for about plus or minus 17 degree of elevator travel. (See sketch)

Next, insert the QCSM2 pivot assembly, complete with QCSM3 stud, into CS16, the elevator torque tube, with the stud pointing outboard. (See sketch) QCSM2 pivot assembly through the CS16 elevator torque tube with a small diameter stick until it just reaches flush with the slot that you routed out. Rivet the QCSM2 pivot assembly to CS16 using 3 MSP43 cherry rivets spaced radially at least 0.4" apart. Again, it will be necessary to "tunnel" through the elevator skin and the elevator foam core to reach the tube. Again, you will fill the holes with dry micro.

The routed slot must be expanded so that the CS17 hinge can slide off of the QCSM3 stud and out of the CS16 elevator torque tube while remaining perpendicular to CS16. This is to allow assembly and dissassembly of the elevator. Probably, you will have to open the routed slot up to about 0.6" wide. At the same time, verify that the CS17 hinge can rotate at least 17 degrees up and down to allow proper elevator movement. If not, make the routed slot bigger, as necessary. It is important, however, not to remove any more "meat" from the CS16 elevator torque tube than necessary, so work carefully.

Now we come to the 2 CS18 inserts. These inserts are positioned against the canard shear web on either side of the CS17 hinge, and provide a local beefup to take the hinge loads. To determine exactly which BL the CS18 inserts must go at, you will need to trial fit the elevator in position in the elevator slot foam core, making sure that the inboard end of the elevator coincides with the inboard end of the elevator slot foam core that you have previously trimmed to fit the fuselage.

CONTINUED ON NEXT PAGE

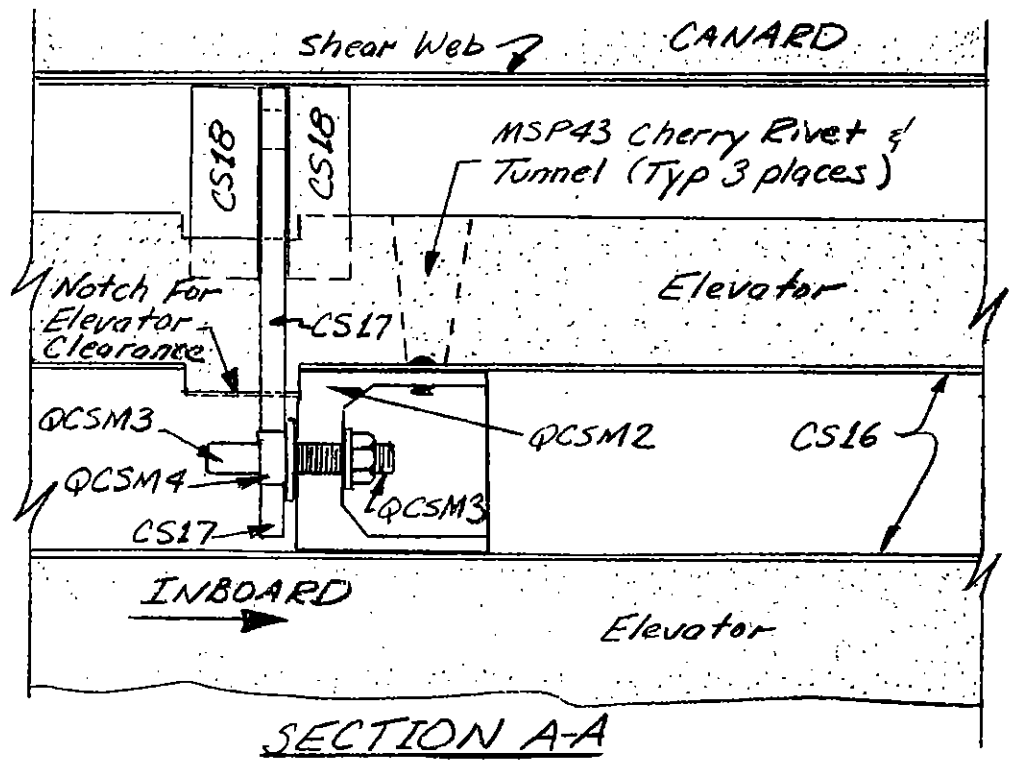
With the CS17 hinge mounted on the elevator up against the end of the QCSM2 pivot, and with the elevator in position in the elevator slot foam core, you can mark on the elevator slot foam core where the 2 CS18 inserts must go. Next, route out the foam in the elevator slot foam core in preparation for later bonding of the CS18 inserts in place. Any excess foam removed can be filled in later with flox during assembly.

Now, let's carefully review how the elevator is removed from the midspan elevator pivot. The elevator is moved inboard, resting on the QCSM3 stud, at least ¼" until it falls off the QCSM3 stud. During this movement, the CS17 hinge remains where it was, since it was permanently attached to the canard (between a sandwich of CS18 inserts) during assembly.

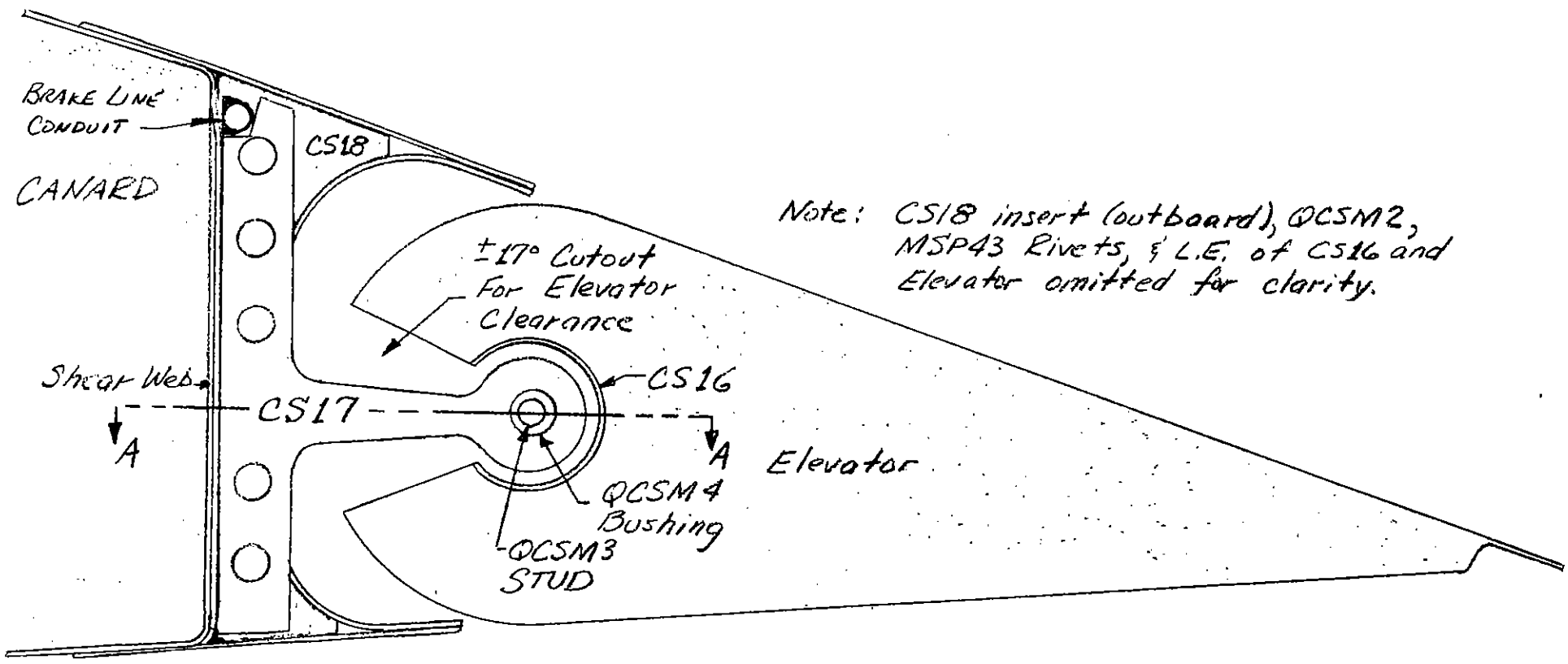
Do you understand? Good, read the above explanation again two times until it is indelibly etched in your memory.

Now you are ready to do the same thing for the right elevator. Remember that the QCSM2 pivot assembly, complete with QCSM3 stud, must be pushed into the CS16 elevator torque tube with the stud pointing OUTBOARD. (A mirror image of what you have already done). Be very careful in setting up the right madspan elevator pivot assembly, and verify that it, too, will function as described in the paragraph above.

It may seem that we are spending too much time on this setup, but it is the "voice of experience speaking".



SECTION A-A



ELEVATOR MIDSPAN PIVOT DETAIL

(Looking Inboard) Click here for link to mod summary

INSTALLATION OF THE ELEVATORS

The elevators are installed and rigged prior to the canard being mated to the fuselage. As a result, after mating only CS13 needs to be hooked up for a functioning pitch control system.

The procedures detailed here are similar in scope to what you have already accomplished in mounting the ailerons on the main wing, except that the elevators have a center pivot on each side.

Begin by jigging the canard vertically, with the leading edge at the table.

Take a piece of QCSM1 and make two 1.8" length pieces to use as elevator reducers. A sawcut and perhaps some light sanding will be necessary to make them fit snugly and flush with the inboard ends of the two elevators.

Find the phenolic bearings CS15 (2) and CS14 (1). Dull the phenolic completely with sandpaper except inside the reamed 5/8" diameter holes. Be sure that the other 1/2" diameter holes have been drilled out. These are non-critical on diameter, but must be there to assist bonding of the phenolic to the structure. They are NOT lightening holes.

Find Q2CSA8. Make CS20 from 0.625" O.D. x 0.065" wall 4130 steel tubing. The length of CS20 should be about 5" longer than 1/2 the width of the fuselage where the elevator matches up to the fuselage. The piece is made long initially, and then trimmed back as needed.

The right and left elevators are nearly mirror images of one another. Each elevator has an outboard hinge CS19, a midspan hinge CS17, and a inboard hinge CS15. Q2CSA8 slips into the elevator reducer at the elevator end, and over a AN271-B8 (or MS2071-B8) universal joint near BL00. On the right side, CS20 slips into the elevator reducer at the elevator end, and through CS14 and then over the same AN271-B8 (or MS20271-B8) universal joint near BL00. Clear, heh?

The following procedure was developed to help you get the elevators mounted without binding, with the proper clearances, and with the ability to get them off again:

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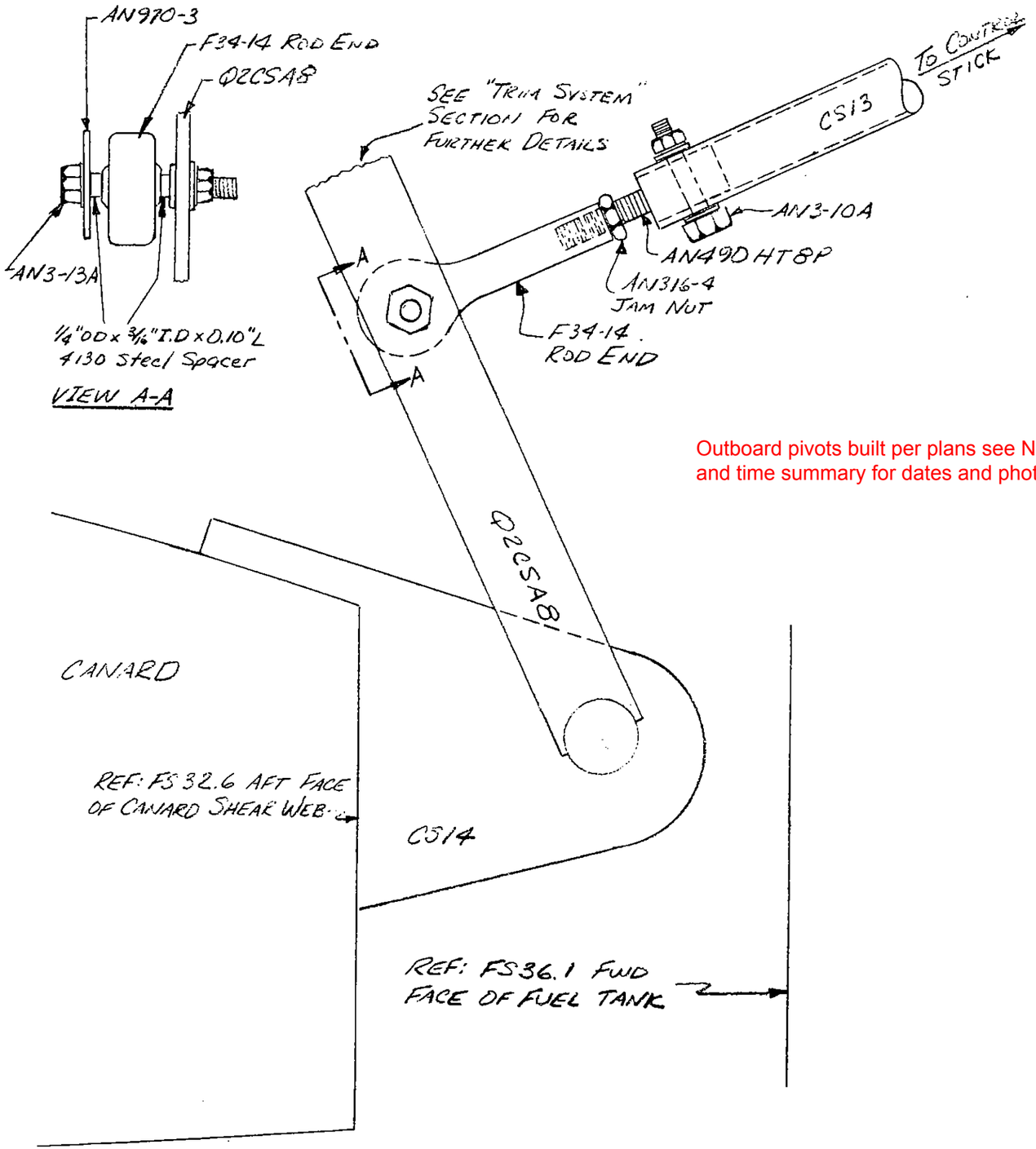

SIDE VIEW

Outboard pivots built per plans see N8WQ task and time summary for dates and photos

1. Trim the inboard edges of the elevator slot foam cores flush with the sides of the fuselage.
2. Slip CS15 over the outboard end of Q2CSA8, the universal joint into the inboard end of Q2CSA8, and then the outboard end of the Q2CSA8 assembly into the elevator reducer mounted in the inboard end of the left elevator.
3. Slip CS15 over the outboard end of CS20, the CS14 over the inboard end of CS20, then the universal joint into the inboard end of CS20, and then the outboard end of the CS20 assembly into the elevator reducer mounted in the inboard end of the right elevator.
4. What follows is a very qualitative fitting process. Using at least three people, dry fit CS19, CS17, CS15, and CS14 against the canard shear web in the appropriate positions (CS19 against outboard end of elevator slot foam core, CS17 at the midspan slot, CS15 against the inboard end of the elevator slot foam core, and CS14 against the shear web near BL1 Right), check for binding. Working slowly, correct any binding or clearance problem (1/16" MIN elevator clearance applies just like on the ailerons) by modifying CS19, CS17, CS15, and CS14. Please, do one thing at a time. The arm on Q2CSA8 should be at approximately BL00.
5. When the complete elevator assembly fits well, and rotates freely, mix up some 5-MIN with flox and temporarily mount CS19, CS15, and CS14. (DO NOT mount the CS17's).
6. Remove all of the pieces except CS19, CS15, and CS14. Carefully lay up the BID cloth that permanently holds CS19, CS15, and CS14 in place. These parts must be solidly mounted so that they cannot break off while in service. Use the "Aileron Installation" section of the MAIN WING chapter as a guide to the laminations.
7. Once the laminations indicated in step 6 have cured, you will want to install the CS17's permanently. Install the elevators on the inboard and outboard pivots; remember to leave at least a gap of 0.5" inboard for the elevator spacers. (If you haven't lost any inches anywhere up to this point, those spacers will be 1.0" in length). Install CS17 on QCSM3 against the face of QCSM2. Make CS17 the meat of a sandwich with a pair of CS18's as the bread, and trial fit the sandwich against the canard shear web dry through the slot made previously. When satisfied with the fit, and sure that the elevator clearance is a minimum of 1/16" top and bottom permanently mount CS17 and the CS18's with wet flox. It is very important to really pack the flox into the holes so that you get very good squeeze out, and not trapped air. If the flox doesn't ooze out when CS17 and CS18's are pushed into place, then you haven't got enough flox pushed into the holes. Use tape and stirring sticks to maintain the 1/16" elevator clearance top and bottom, while the setup is allowed to cure for at least 24 hours. Obviously, be careful that the excess flox does

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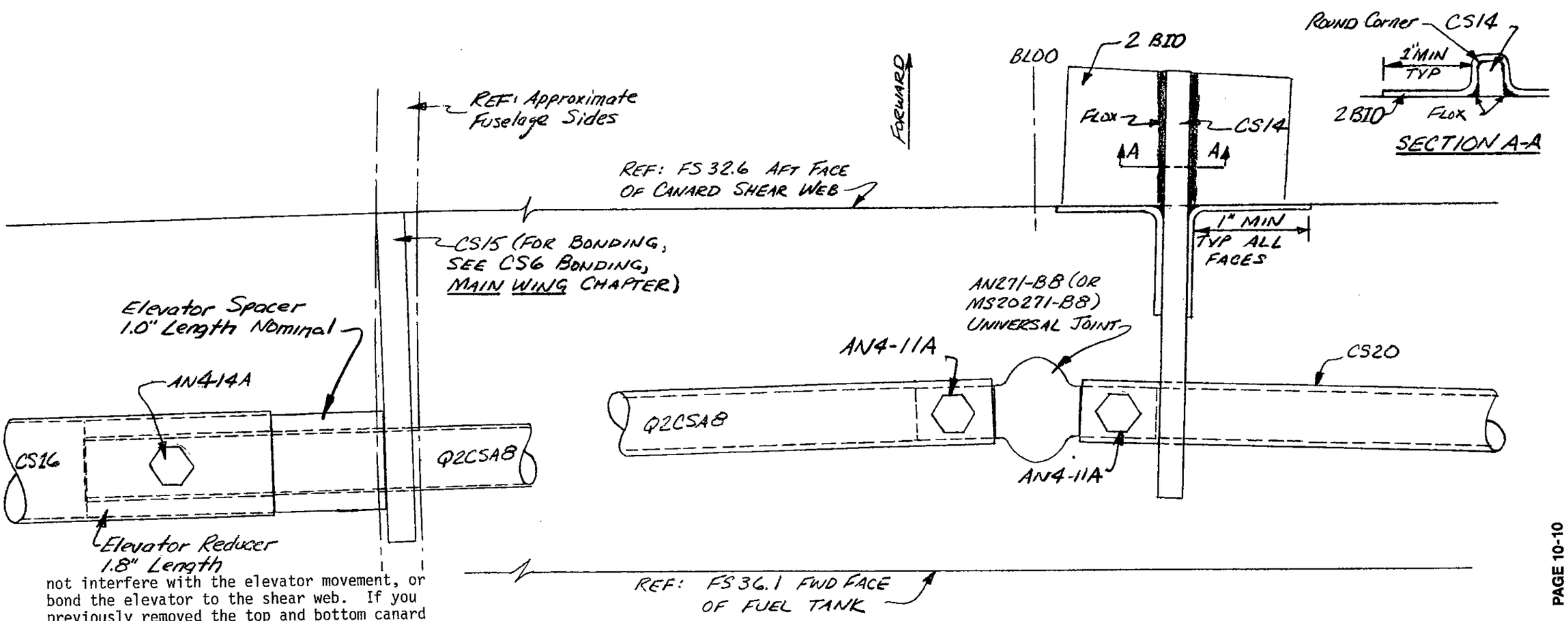


not interfere with the elevator movement, or bond the elevator to the shear web. If you previously removed the top and bottom canard skin where the slot was ground out, be sure to laminate 2 BID top and bottom once the laminations have cured. The above procedures are used with both elevators.

8. Once the laminations and installation have cured, you are ready to drill in the elevator assemblies. Find your elevator rigging template, reassemble everything, and set the elevators at 0 degrees. Also, verify that each elevator is pushed outboard against CS19. Verify that both Q2CSA8 and CS20 overlap into the elevator reducers a minimum of 1.8", and that both are pushed up tight onto the universal joint. Now drill in very carefully the four bolts that fasten Q2CSA8, CS20, universal joint, and CS16/ elevator reducer together. BE CAREFUL! Don't let the holes elongate; use a small drill and work up in size. Also, be absolutely sure that each elevator is at the same angle (i.e. no assymetry) and that full elevator deflection is available without any interference any where in the system.
9. Finally, make the elevator spacers, which have a nominal length of 1.0" each. The actual length should be sized to allow the elevator to have a lateral freeplay (i.e. inboard to outboard) of about 0.05". Assemble each elevator, and again check for binding, misalignment, or excessive freeplay.

TOP VIEW

POST-CURING THE CANARD STRUCTURE

In order to minimize creep in the canard, the canard should be post-cured prior to installing it on the aircraft.

Creep is the tendency for the epoxy to deform due to heat and load. In the case of your aircraft, the heat could be obtained on a hot day with the aircraft setting in the sun, and the load is always there when the aircraft is resting on its 'landing gear'. The loading through this means is both bending and torsional in nature.

Creep can be minimized by heating the structure to a higher temperature than it will see while in service. If you own a multi-million dollar corporation, you should use a very large oven with accurate temperature control throughout; if you are like the rest of us, you can obtain equal results by painting the canard black with primer and setting it in the bright sun to effect the post-cure.

If you desire, you may want to finish the canard up to the primer stage before post-curring it. (Note the surface waviness criteria in the finishing section of the Composite Materials Education chapter). However, if you desire to do all of the messy finishing work at one time, you can elect to just shoot some black primer on the canard, and clean it off later. It is important to remember that when you attach the canard to the fuselage later, wherever the BID tapes that secure the canard to the fuselage attach to the canard, the canard must be free of any paint, micro, feather fill, etc.; i.e. just the pristine structure.

The reason you will want to use black is that it makes the job easier by absorbing more heat, thus raising the temperature of the structure quicker.

The technique you will use is quite simple. Expose the top and bottom surfaces of the canard to the sun, changing the angle of the canard periodically to heat the entire surface. Check the temperature frequently by placing the palm of your hand on several locations. If you can hold your hand on the surface for about 5 seconds without screaming out in pain, the temperature is perfect. Permit the canard to set at that temperature for about 10 minutes. DO NOT PERMIT THE CANARD TO GET TOO HOT.

It is not necessary to post-cure any other structure on your aircraft.

END OF CHAPTER

MAIN WING AND CANARD MOUNTING

MOUNTING THE MAIN WING

The main wing is permanently attached to the fuselage with flox and a series of BID tapes.

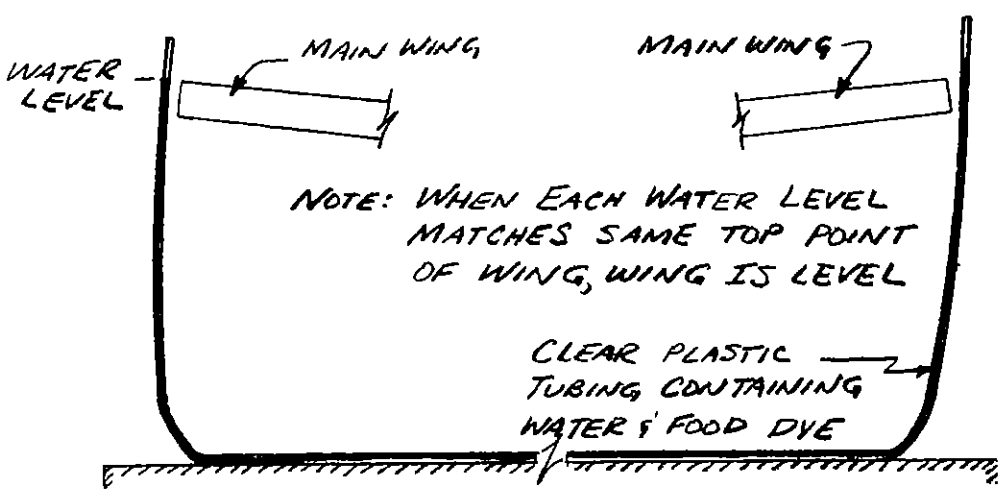
Begin by leveling the fuselage both longitudinally and laterally. Use several pieces of scrap lumber and Bondo to firmly hold the fuselage in position. It is preferable at this time to allow sufficient room for the canard to slip up into position later. (See Mounting The Canard.)

Locate WL30 on each side of the fuselage between the seatback bulkhead and the FS94 bulkhead. Refer to Page 8-2 for information detailing the location of the split line; this will assist in locating WL30.

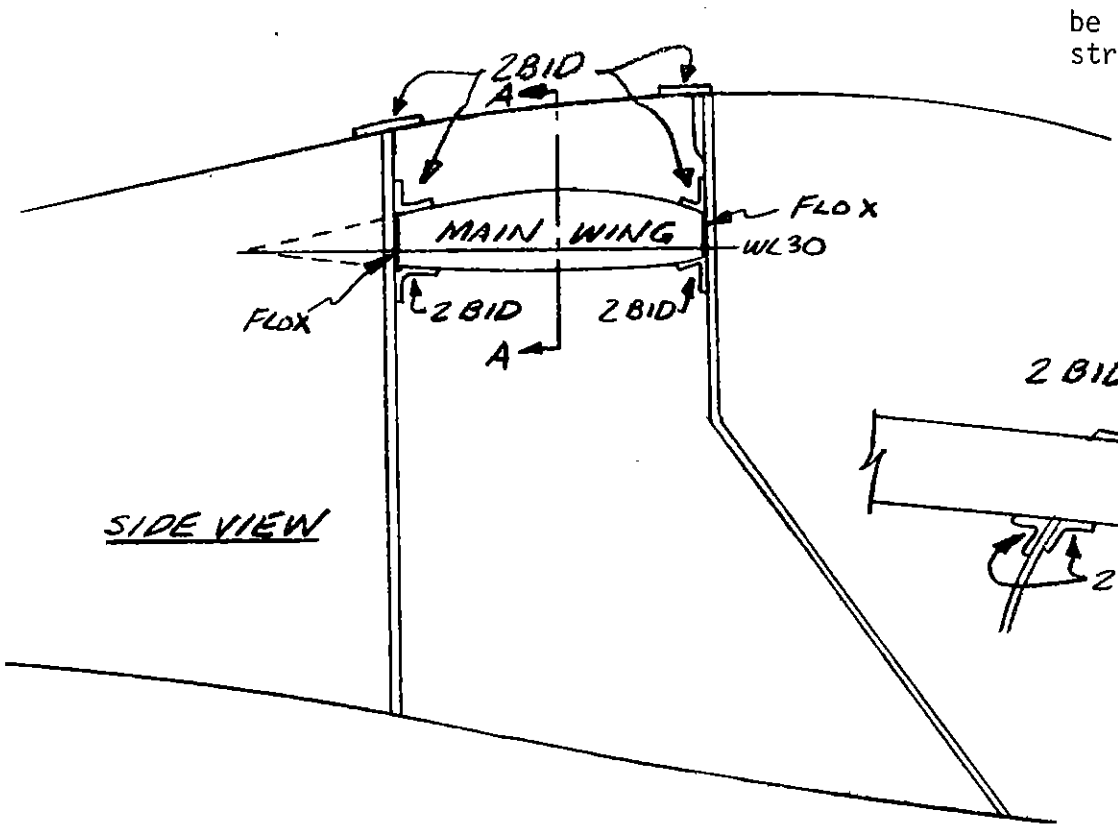
Remove the top portion of the fuselage shell between the seatback bulkhead and the FS94 bulkhead down to WL30. For convenience, allow 1" between your forward cut line and the aft face of the seatback bulkhead.

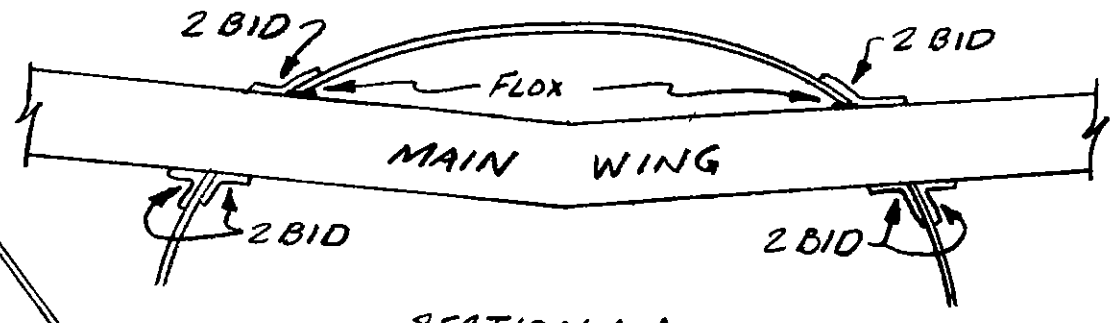
If you have previously mounted the aileron system on the main wing, you will notice that the inboard phenolic bearings and linkages interfere with the FS94 bulkhead as you attempt to install and fit the main wing onto the fuselage. It will, therefore, be necessary to remove part of the FS94 bulkhead until the main wing is mounted by cutting a slot in the bulkhead. Later, after the main wing has been attached permanently, the slot can be filled in and the phenolic bearings laminated to it.

Next, trial fit the main wing into position and begin trimming away the fuselage sides (downward) until the main wing fits into position. Check the lateral level of the main wing using a water level system consisting of some clear plastic tubing and water colored with food dye. Check that the centerline of the main wing is on BL00.

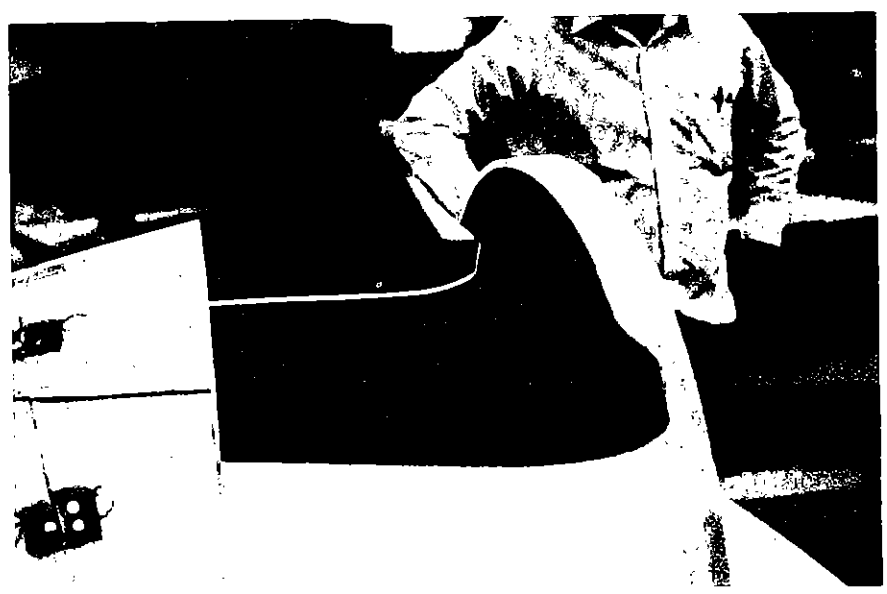


LEVELING THE MAIN WING





MOUNTING THE MAIN WING



Small variations (0.1" max) in fit between the main wing and the fuselage sides are acceptable and can be filled with flox. Expect this fitting process to consume several hours of intermittent work. Don't forget to verify the fit with the main wing levelled longitudinally using the level board on it.

Before mixing up the flox, recheck the fuselage and main wing level lines and blocks. It is very critical to your Q2's excellent flying qualities to have the proper incidences angles.

Check the skew of the main wing by measuring the distance from each wing tip to the base of the vertical fin. The two measurements should be the same. If not, some shifting within the confines of the FS94/Seatback bulkhead fit should be accomplished to make the main wing as skew free as possible.

Liberal quantities of flox should be placed wherever the main wing and fuselage will meet upon assembly. Verify good squeezeout of the flox upon assembly. Recheck all level lines and alignment. Permit the flox to cure prior to attaching the BID tapes shown. Two BID tapes are used everywhere, top and bottom, with a minimum width of 3 inches.

Finally, the top section of the fuselage shell that was removed to enable the mounting of the main wing should be trimmed to fit, and bonded in place with liberal quantities of flox. Then, BID tapes are used, as shown, on the outside of the fuselage shell to attach the main wing cover to the main wing and fuselage.

Also, any material removed to allow the aileron mechanism to clear should be replaced.

Remember, this assembly is critical and should be accomplished with great care. Tie all major structure together with BID tapes and flox.

MOUNTING THE CANARD

After mounting the main wing, you should find the canard easy. The canard fits forward against the aft face of the firewall with the leading edge area fairing into the lower part of the firewall. The aft section of the canard is allowed to end up wherever necessary, as long as it is above the bottom fuselage line at the shear web. The part of the lower forward fuselage shell that is removed to fit the canard, is discarded.

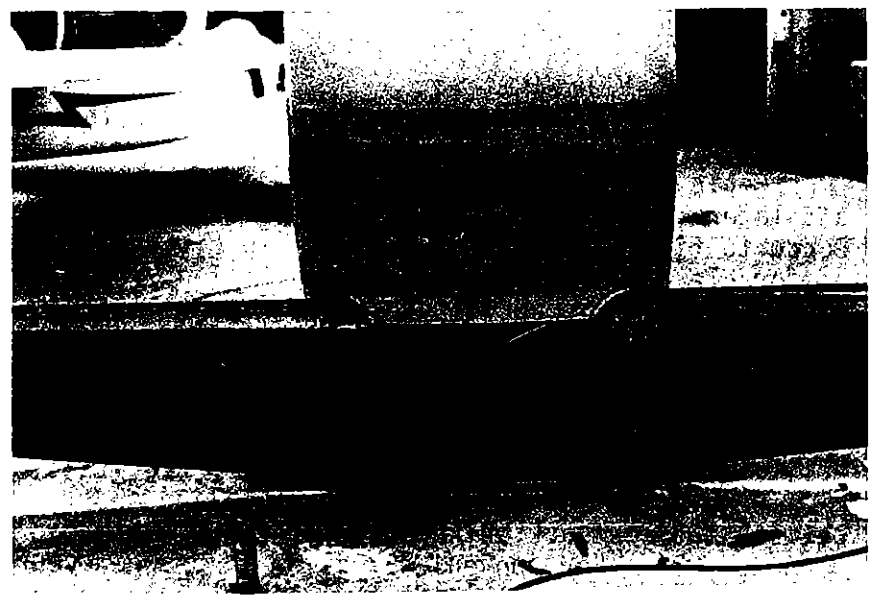
Begin by removing part of the lower forward fuselage shell and trial fitting the canard. Expect to consume several hours of cutting, fitting and retrimming before you have achieved a good fit. Check and recheck skew, and the fuselage and canard level lines. Use the water level system to check the lateral level of the canard. (It is suggested that you use the axle holes as the reference.) Verify that the centerline of the canard is at BL00.

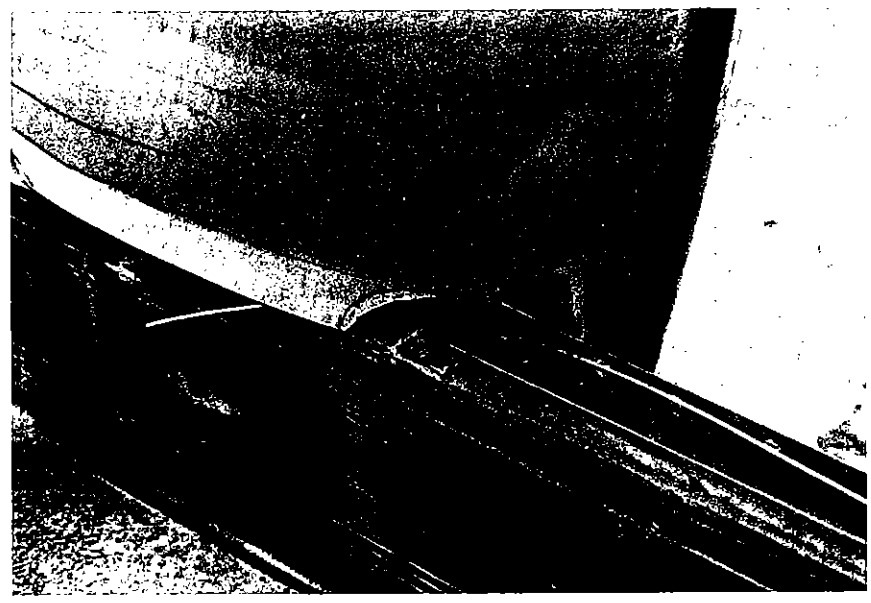
Be carefull that you do not remove a part of your main fuel tank while clearancing the canard! You should end up with about 1/2" clearance between the aft edge of the phenolic bearings and the forward face of the main fuel tank.

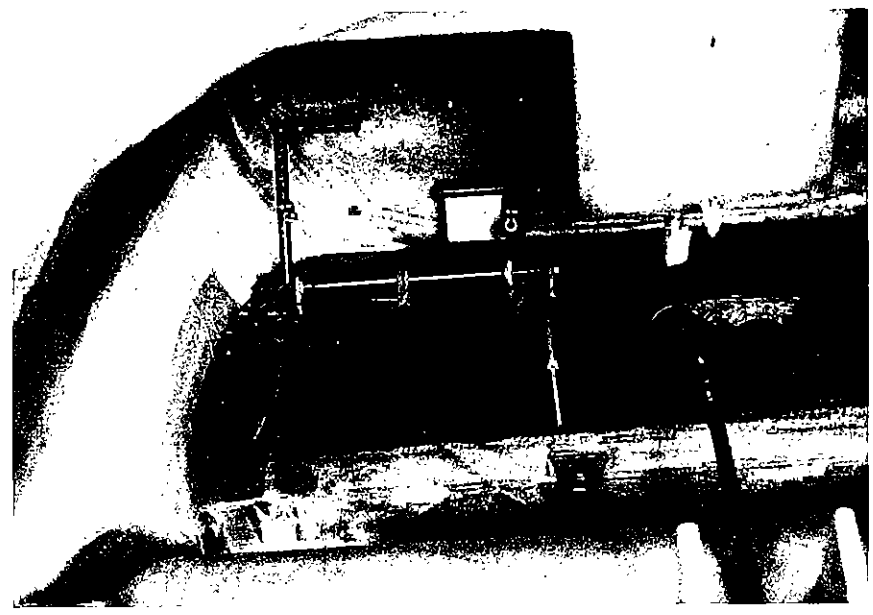
If the level board on the main wing is still installed, verify that the main wing is level prior to mixing up the flox for the canard.

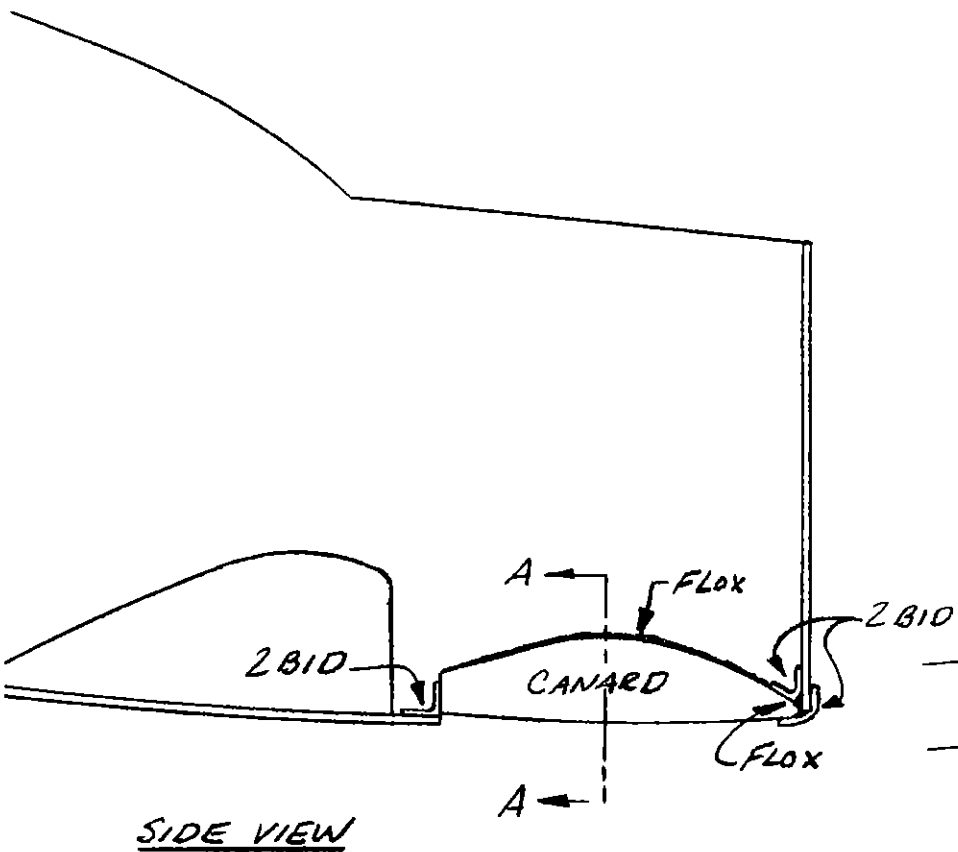
Attach the canard to the fuselage as shown in the illustrations. Be sure that you provide sufficient flox for good squeezeout everywhere. The flox should be allowed to cure prior to installing the BID tapes inside and out. Recheck the level lines and skew before leaving the canard alone to cure.

Later, you will construct fairings for the inboard elevators, ailerons, and for the lower part of the canard, in order to make your Q2 aerodynamically cleaner. For now, stand back and admire your Q2 setting on the landing gear; your over 50% completed at this point.

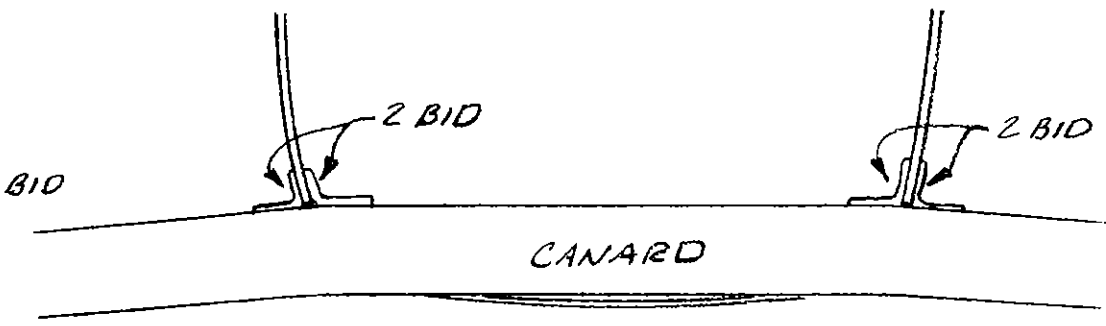








SIDE VIEW

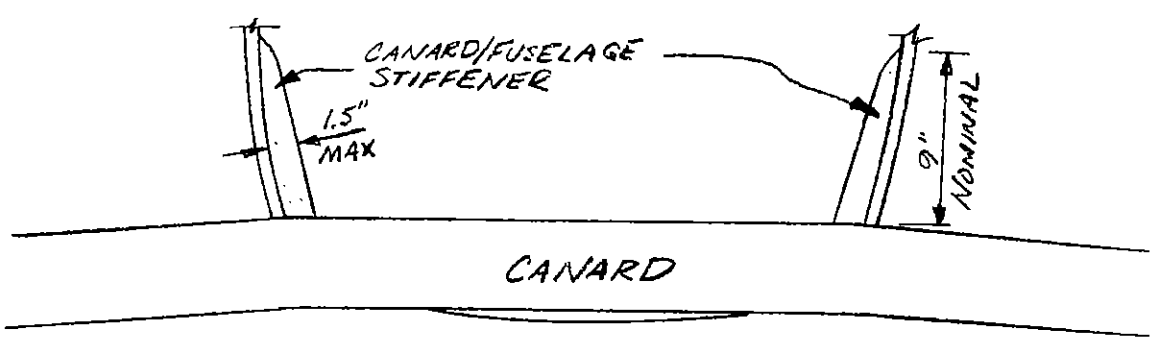


SECTION A-A

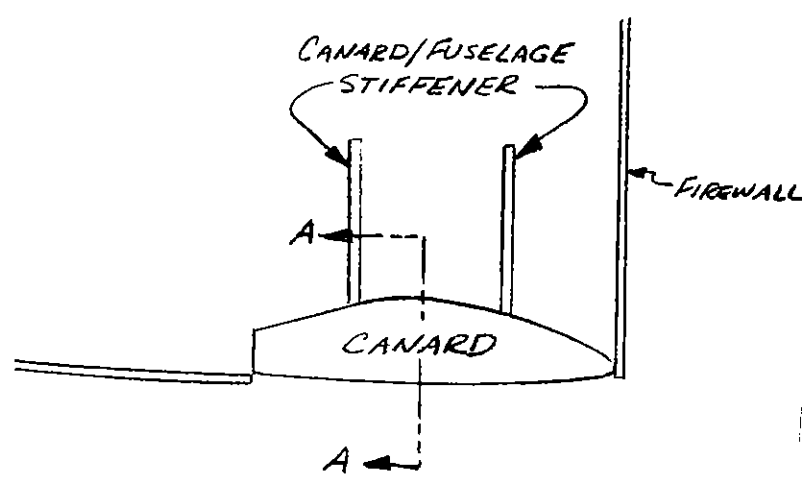
MOUNTING THE CANARD

INSTALLING THE FUSELAGE STIFFENERS

Two stiffeners, fabricated from the 3/8" thick white foam, are placed on each side of the fuselage above the canard. These stiffeners improve the stability of the fuselage sides during hard landings. The sketches show the positioning of the stiffeners. Two BID are laminated over each stiffener to attach it to the fuselage and canard.



SECTION A-A



CANARD/FUSELAGE STIFFENER

PERMANENT ATTACHMENT OF THE FORWARD AND AFT FUSELAGE SHELL

If you have decided not to make your Q2 trailerable, you should now complete the closeout of the fuselage by permanently attaching the forward and aft fuselage shells at the fuselage cut line, or joint.

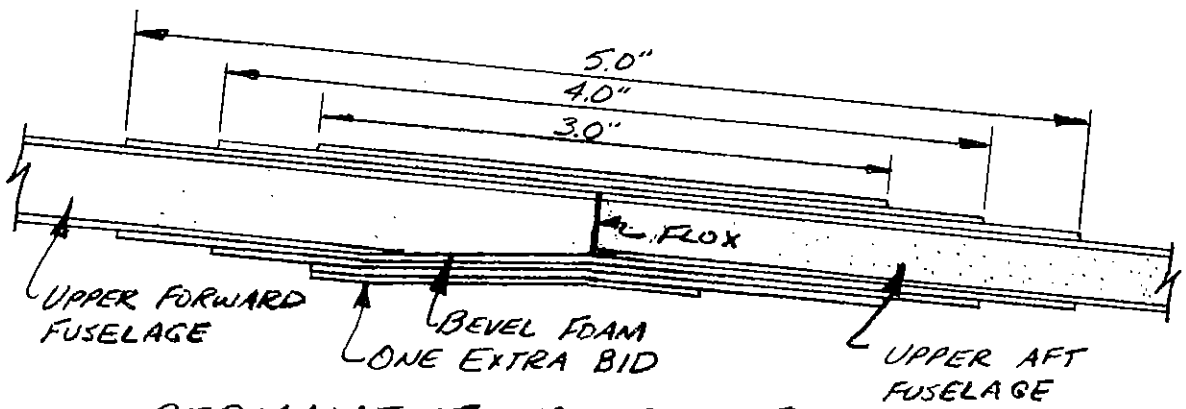
If, on the other hand, you intend for your Q2 to be trailerable, you should skip ahead in these plans to Chapter 15 and complete that work prior to mounting the vertical fin in Chapter 14.

The fuselage shells are permanently attached at the joint with flox and BID tapes on both the outside and inside. Begin by jigging the two shells together and checking for fit at the joint.

Then, since the core thickness of the forward shell is 3/8" and the rear shell core is only 1/4" thick, bevel the forward shell to match the aft core at the joint. Also, sand dull the inside skin glass within 2.5" of either side of the joint, in preparation for the inside joint lamination later. Prepare some scrap lumber for use in holding the jigged position. Mix up flox and spread it on both edges of the shells where they will join. Place the two shells together, hold them in position with the lumber and Bondo, and permit to cure.

Next, laminate the 3 BID tapes shown on the outside of the skin after you have sanded dull the existing glass. Note that the three tapes have the following widths: 5", 4", and 3" and that the orientation should be at 45 degrees to the joint itself. Wherever it is necessary to overlap BID in order to laminate around the entire circumfernce, overlap the BID by a minimum of 1.5".

Once that lamination has cured, crawl inside the fuselage and perform the inside skin lamination as shown, wherever possible. The 4 BID tapes have the following widths: 5", 4", 3", and 2" with a 45 degree orientation to the joint. The extra BID is to make up for the glass strength lost when the foam was bevelled.



PERMANENT FUSELAGE SHELL ATTACHMENT

END OF CHAPTER

CANOPY ASSEMBLY AND MOUNTING

INTRODUCTION

In this chapter, you will install the canopy that you previously mounted and cut out in Chapter 8. It is important to the passengers' safety to have a canopy that is strong, rigid, and securely fastened while in flight. Therefore, do not rush this section.

FORWARD EDGE LAMINATION

Laminate 3 UNI across the front edge of the canopy, with the orientation across the front of the canopy. This lamination of 3 inch wide tapes will increase the stiffness and strength of the canopy at the forward edge.

PROTECTING THE CANOPY PLEXIGLASS

The canopy was shipped to you with a protected coating applied on either side. You should be careful during construction that you do not remove this coating, exposing the canopy to scratches and abrasion. Once the aircraft is completely finished and painted, the coating may be peeled away in strips, exposing the canopy plexiglass itself. Whenever, you laminate onto the canopy surface, you will, however, need to remove the coating where the bond will take place. Protect the edge of canopy/lamination junction with grey tape. This will assist in providing a trim mask for knife-trimming.

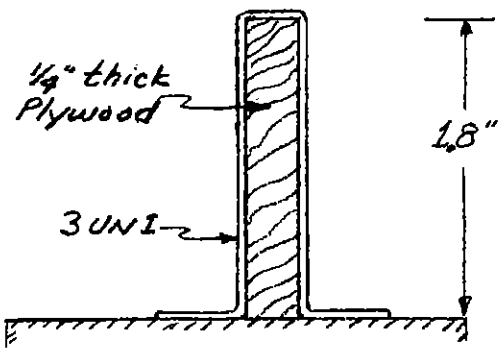
CANOPY FRAME STIFFENERS

Three stiffeners will be fabricated. One each will be installed on each side of the canopy frame longitudinally, and the third will be installed transversly across the bottom of the aft canopy bulkhead. At the lower aft left and right points of the canopy frame, these three stiffeners join together.

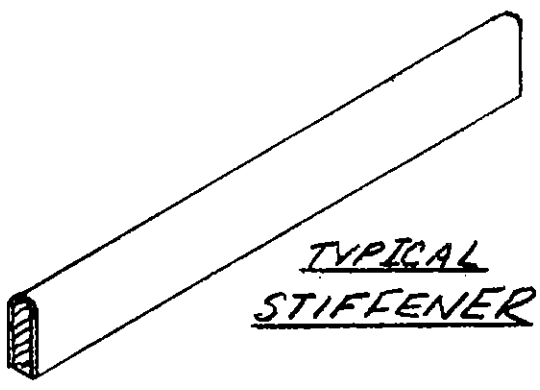
It is recommended that the core materials for these stiffeners be 1/4" thick plywood. An alternative is to use 1/4" thick white foam, but this alternative would require several plywood inserts for local beefup where bolts are inserted.

As installed, each stiffener should be approximately 1.3" wide. Because the canopy frame sides are curved as they travel forward, those two stiffeners should be made about 1.8" wide to allow for fitting. The third stiffener, the one fitted to the aft canopy bulkhead, can be made 1.3" wide.

To construct the stiffeners, cut three pieces of 1/4" plywood with the following sizes: 1.8" x 30", 1.8" x 30", and 1.3" x 44". Set them vertically on the jig table and hold them in place with a dab of 5-MIN on either end of each one. Round the top corners of the plywood so that the glass cloth will flow smoothly around the corners. Laminate 3 UNI with the orientation running lengthwise along the long dimension. The excess cloth that overlaps onto the table can be trimmed later.



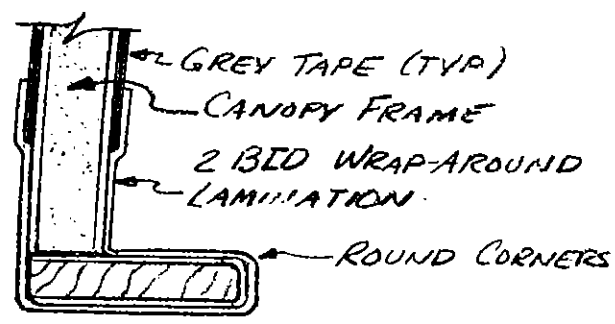
TYPICAL STIFFENER LAMINATION

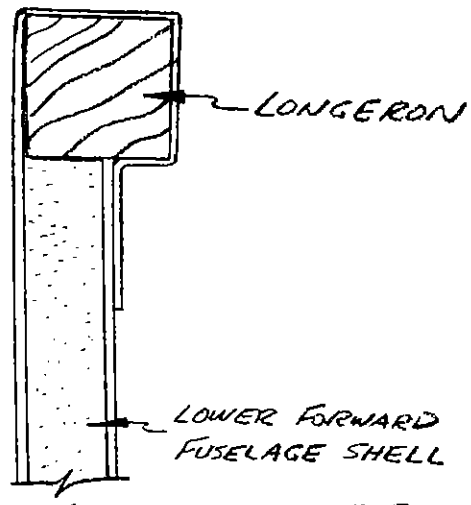


TYPICAL STIFFENER

Once the laminations have cured, it is time to mount the stiffeners to the canopy frame. Begin by setting the canopy on the fuselage and checking the general fit of the canopy on the airframe. There should not be any trimming required for a good fit.

The two stiffeners, one on each side, fit outboard to the outside skin line as shown. This will require removing a portion of the canopy frame as indicated on the sketch. There should be an approximately 0.1" gap between the bottom of each stiffener and the top of the longeron, to allow the future insertion of a flexible seal to minimize air leaks. Each stiffener runs from the aft edge of the canopy forward as far as practical.



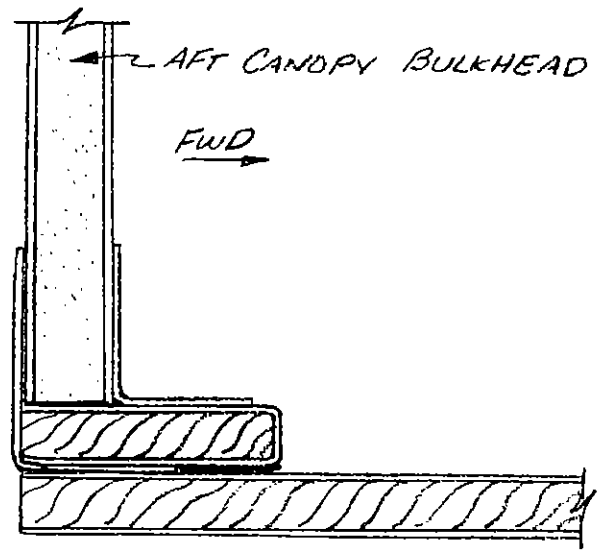


CANOPY STIFFENER FITTING

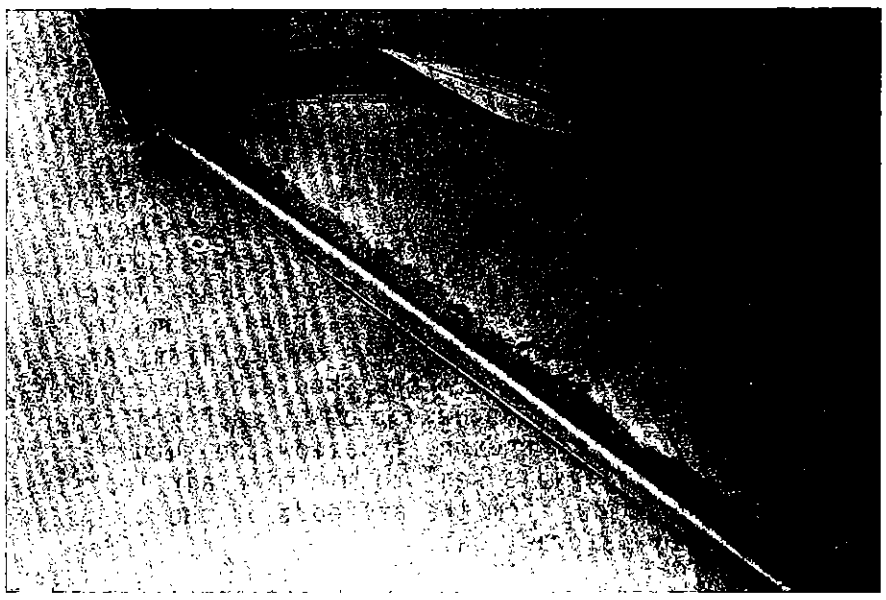
To join each stiffener to the canopy frame, use a 2 BID wrap-around lamination from the inside skin of the frame to the outside skin of the frame, with an overlap onto the frame of a minimum of 0.7". Grey tape may be used as shown to provide a cleaner edge for trimming later. Flox is used where the stiffener meets the frame.

The third stiffener is placed transversely at the aft canopy bulkhead. Ideally, this third stiffener should rest on the top of each side stiffener, and on the bottom of the aft canopy bulkhead. If necessary, a small piece of foam can be used to accomplish this. This third stiffener is likewise attached with flox and 2 BID tapes in a wrap-around configuration.

When completed, these stiffeners will form a very rigid box around the canopy frame to stiffen up the entire assembly considerably, as well as provide hard mounting points for the hinges, pins, latches, etc.



SIDE VIEW



CANOPY HINGE INSTALLATION

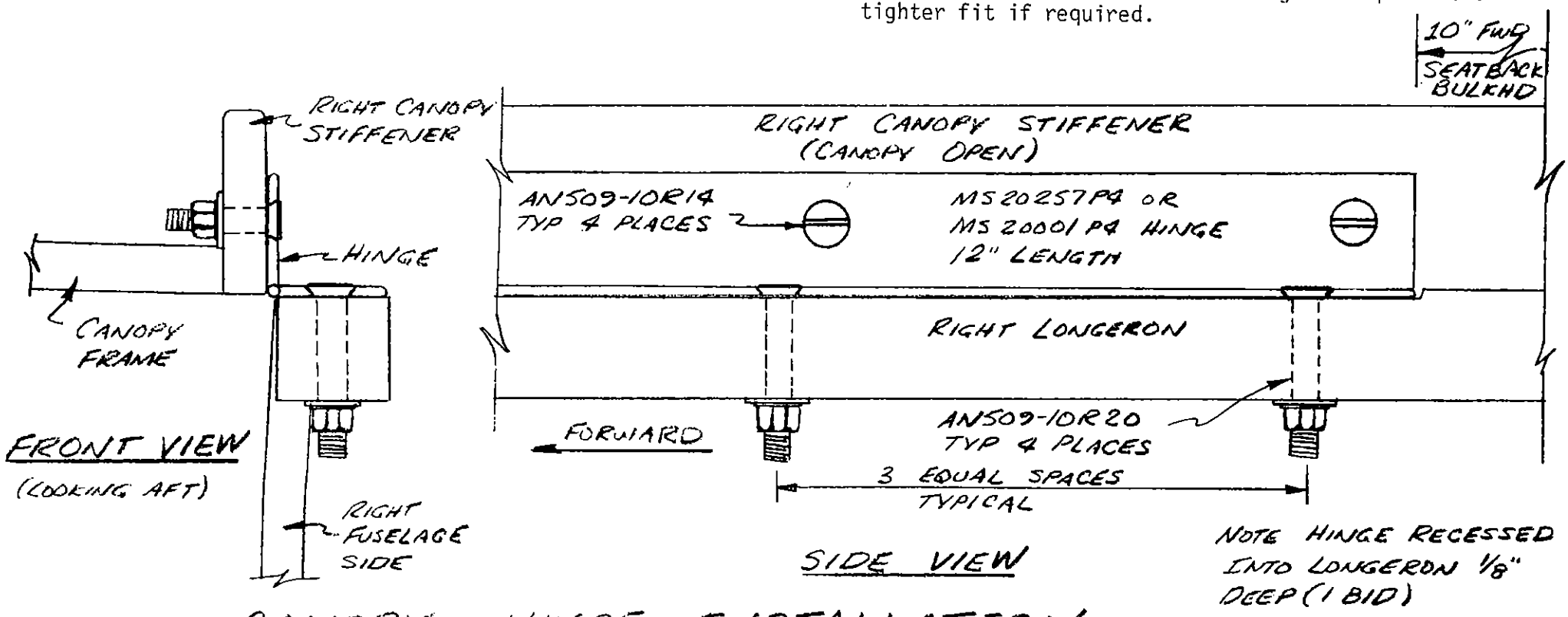
The canopy is hinged on the right side of the aircraft with one 12" length of MS20257P4 hinge. (Or alternative MS20001P4 hinge).

The accompanying drawings give the details of the attachment. Note that recessing of the hinge into the longeron is necessary to provide clearance.

Because the longeron line is curved, it is important to remember that the hinge must be oriented to provide the best compromise for opening and closing of the canopy. Some trimming of both the fuselage outboard skin and canopy frame outboard skin may be necessary to provide clearance for opening of the canopy.

The hinge is nominally located half way along the stiffener. If you have used foam to make the stiffener core, you will need to make and install some plywood inserts wherever the bolts are installed.

The alternative MS20001P4 hinge will provide a tighter fit if required.



CANOPY HINGE INSTALLATION

FORWARD CANOPY LIP

In order to provide a secure seal at the forward edge of the canopy frame, a fiberglass lip is fabricated from 4 BID and bonded to the inside of the upper forward fuselage shell as shown.

Since the forward edge of the canopy frame is curved, when viewed from above, the lip will also be curved.

To construct the lip, place some gray tape around the canopy frame cutout on the upper forward fuselage to protect the structure. Next, laminate 4 BID around the cutout with a minimum width of 2". Multiple pieces may be used to make the required curvature.

When the piece is cured, remove it and the grey tape, and bond it to the inside fuselage skin, At least 0.6" must project aft from the cutout to provide the lip. A 1 BID closeout ply is laminated to cover the exposed foam edge of the shell lapping onto the lip, and knife trimmed even with the outside skin of the shell.

FORWARD CANOPY LIP

CANOPY LATCH

The canopy latch is installed on the left side of the cockpit midway along the left stiffener.

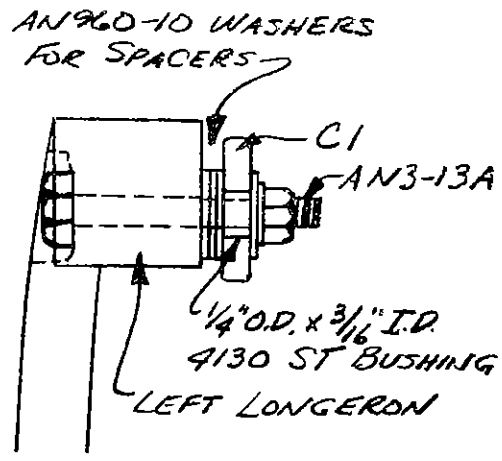
Find C1 and C2. Make C3.

Install C1 on the longeron. Next, take C3, a batch of Bondo, and climb into the cockpit. Close the canopy, and position C3 on the left canopy stiffener to match the position of C1, as shown. Hold C3 in position until the Bondo hardens, then gently open the canopy and drill in C3 as shown. It may be necessary to recess C3 into the canopy stiffener, depending on the location of C1.

Climb back inside the cockpit, close the canopy, and Bondo C2 into position so that the canopy is clamped down tight when the AN525-10R10 screw is slipped into the hole in C2. Drill in C2 while inside the cockpit.

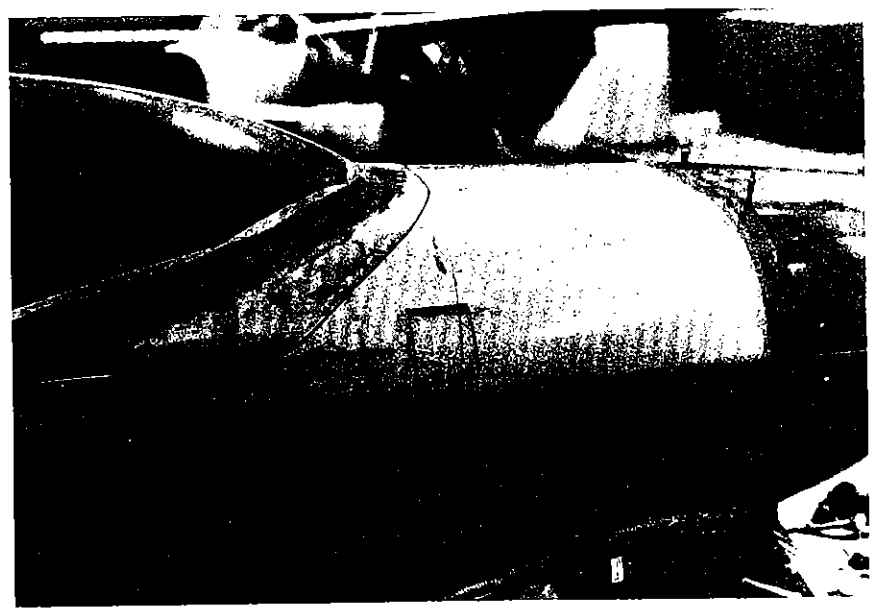
The canopy latch is very important. With some foam sealing material with adhesive backing in place around the canopy area on the fuselage, the latch should be adjusted so that the handle must be forced into the closed position. (Latch and handle rigged to preload toward each other.) In this fashion, it is impossible to inadvertently open the canopy by bumping against the handle. If you omit the foam seal, the canopy can rattle and wear the engaging surface of C1.

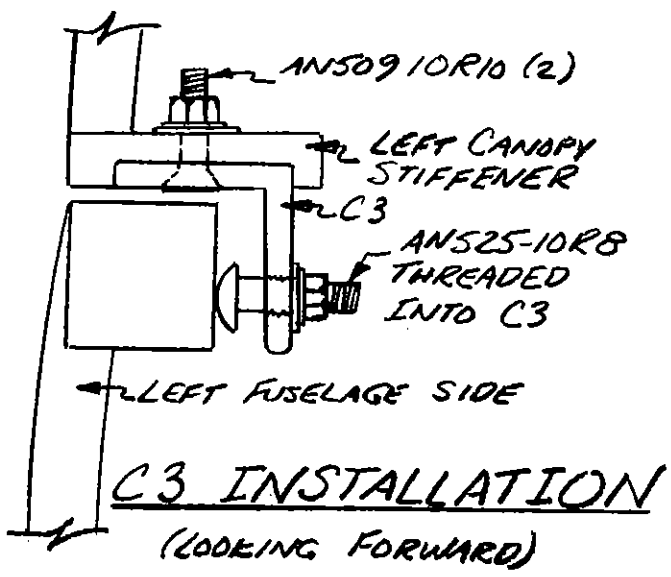
The macrame bead is available from nearly any variety store. The foam seal material recommended is MD Foam Tape of size 3/8" thick by 1/2" wide made by the Macklanburg-Duncaun company of Oklahoma City, OK., available at most hardware stores.



C1 INSTALLATION

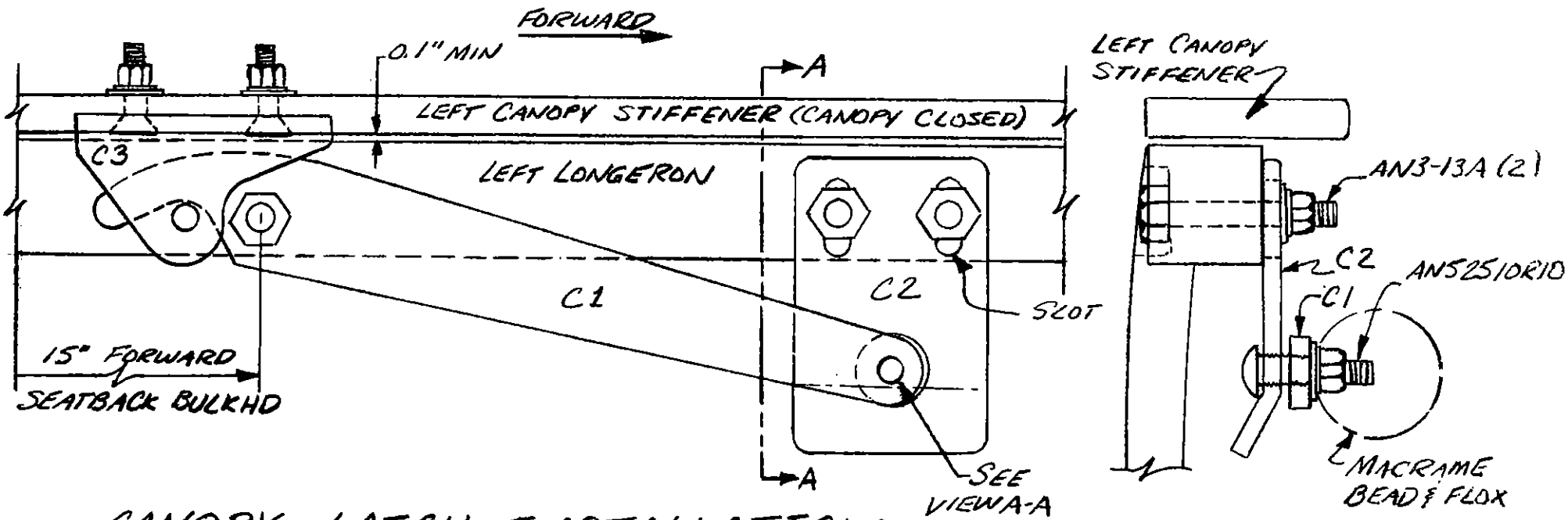
(LOOKING FORWARD)





C3 INSTALLATION

(LOOKING FORWARD)



CANOPY LATCH INSTALLATION

VIEW A-A

CANOPY GUIDE PINS

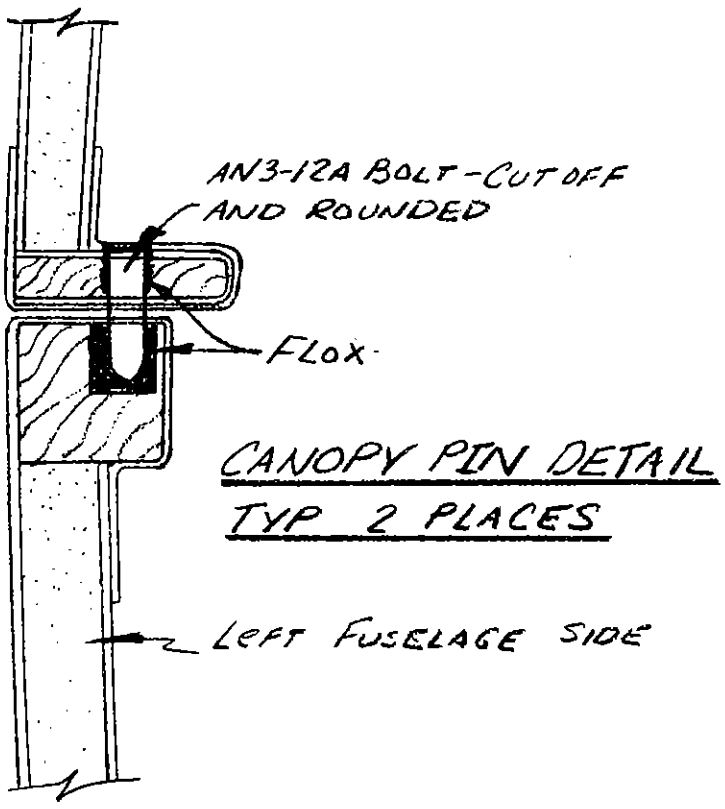
To maintain the canopy in position, and to increase the fuselage stiffness in flight, canopy guide pins are installed at both the front of the canopy and the rear of the canopy.

Begin by cutting the heads and shanks (the threaded part) off of two AN3-12A bolts. Next, round one end of each.

Drill a hole through the left canopy stiffener within three inches of both the forward end and aft end of the left canopy stiffener. Permanently mount the square end of the bolt into the stiffener with flox.

When the flox has cured, mark the location on the left longeron where each cutoff bolt contacts the longeron upon closing. Drill a 5/16" hole at each location, grease up the bolt and surrounding area with vaseline, fill the hole with flox, and close the canopy. Be very careful that the flox squeezeout does not permanently close the canopy!

When the flox has cured, open the canopy and clean up any rough edges.



CANOPY PIN DETAIL
TYP 2 PLACES

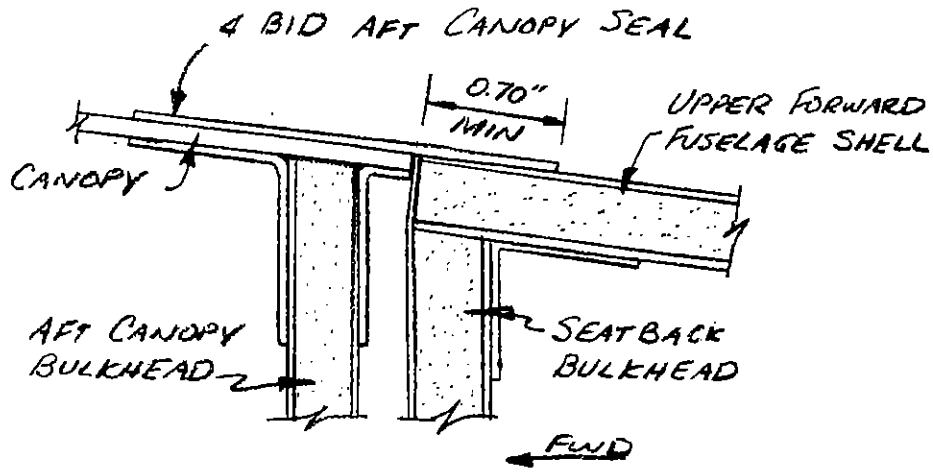
AFT CANOPY SEAL

The aft canopy seal can only be fabricated and installed after the canopy/canopy frame assembly has been carefully fitted to the fuselage, with the hinges, latches, and pins in position.

With the canopy in the closed position, place some grey tape along the outside fuselage skin at the seatback bulkhead location. This will protect the structure.

Next, laminate a 4 BID seal around the aft canopy only. This lamination should extend aft along the fuselage shell a minimum of 0.7", and should extend forward along the top of the canopy to match the inside lamination that attached the aft canopy bulkhead to the canopy. Grey tape is used to protect the plexiglass and to provide a trim edge.

After cure, remove the grey tape, and trim the sides of the seal as required to allow the canopy to open properly.



AFT CANOPY SEAL

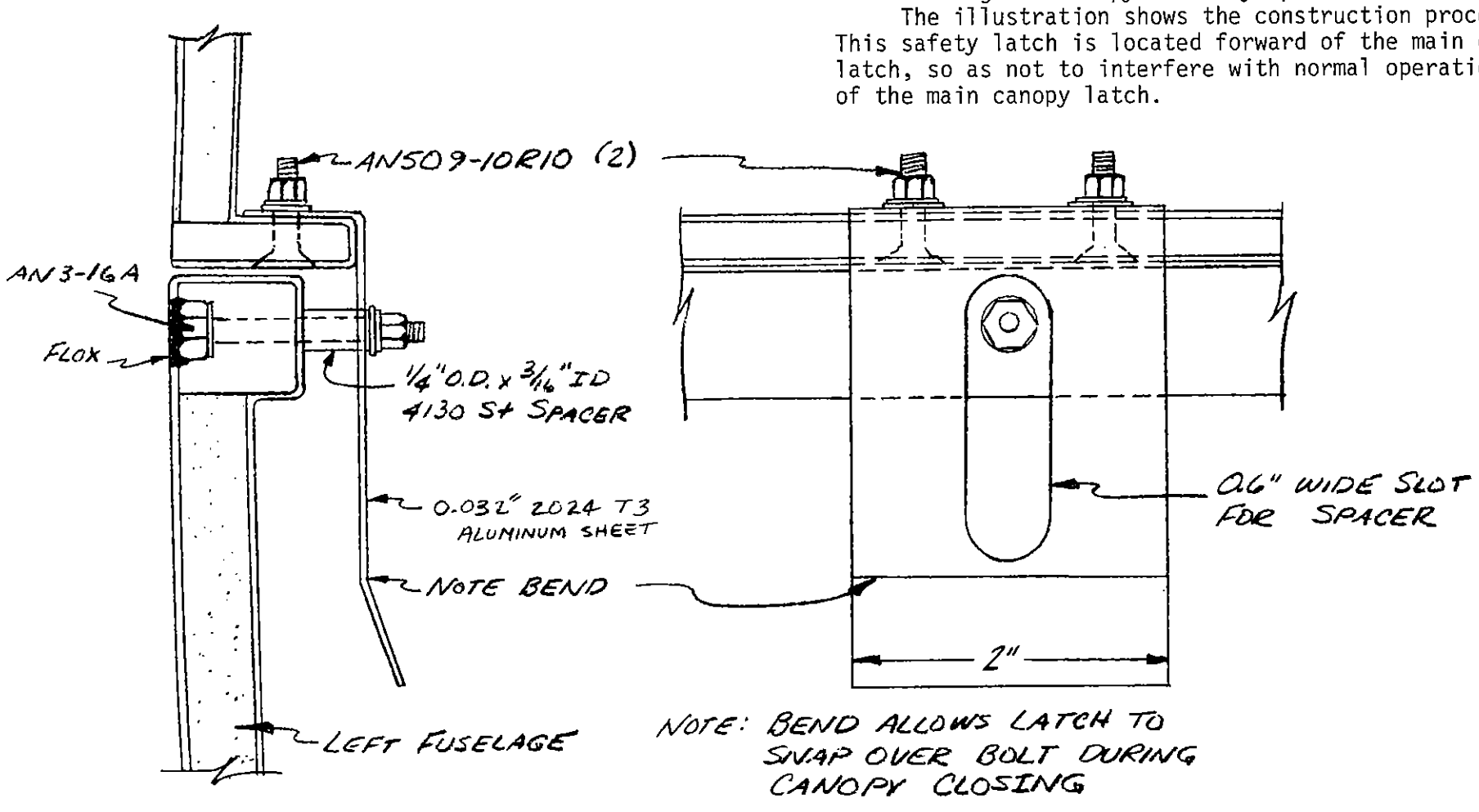
SAFETY LATCH

Failure to properly secure the canopy latch prior to takeoff will allow the canopy to open in flight. The flight characteristics of the Q2 with a partially open canopy have not been explored. A safety latch is assembled to prevent this potentially lethal situation from developing.

Make sure that you install this safety latch, even if you think that "It won't happen to me".

This safety latch catches the canopy in case the pilot forgets to latch the main canopy latch prior to takeoff. To open the canopy, raise the canopy 2" and push in on the safety latch, thus releasing the latch and allowing the canopy to fully open.

The illustration shows the construction procedures. This safety latch is located forward of the main canopy latch, so as not to interfere with normal operation of the main canopy latch.



LOOKING FORWARD

SIDE VIEW

SAFETY LATCH

END OF CHAPTER

FUSELAGE DETAIL ASSEMBLY

WRAPPING THE TAILSPRING

The tailspring provided is a molded S-Glass roving tailspring with extremely good bending strength along the length. Because of the production method, however, the tailspring does not yet have sufficient strength torsionally, to provent torquing up in a tight taxi turn.

To provide this torsional strength you must wrap a piece of BID at 45 degrees to the length of the tailspring, around the tailspring until you obtain 3 layers of the BID. Needless to say, you will prepare the tailspring by sanding the surface. Pure epoxy is used for the lamination.

MOUNTING THE VERTICAL FIN

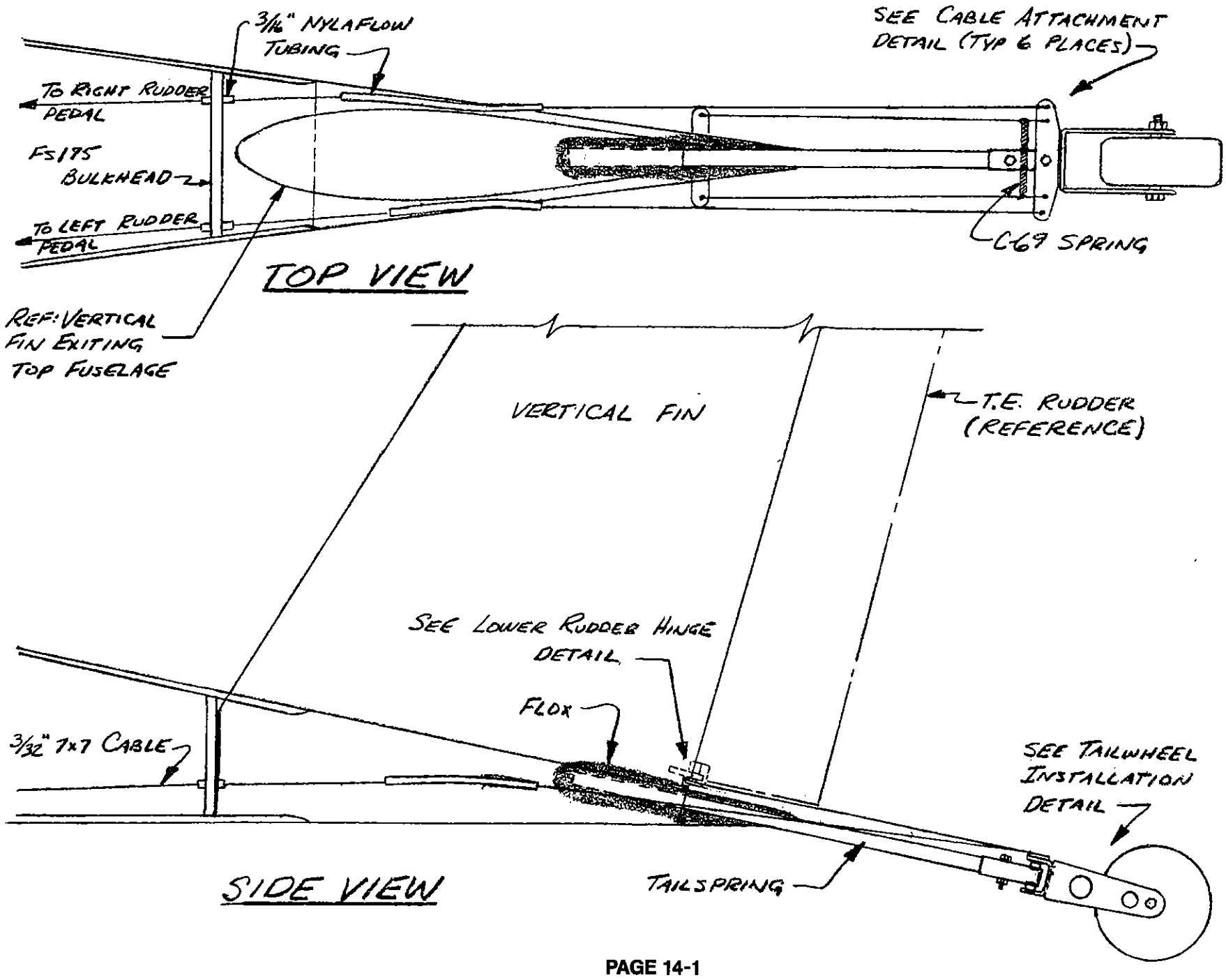
The vertical fin is mounted to the fuselage only after the rear fuselage shells are bonded together.

The vertical fin sets down into the fuselage with the vertical fin root end resting against the bottom of the fuselage. This necessitates considerable trimming of the top fuselage to permit the vertical fin to drop down through. Also, the nose of the vertical fin below the top fuselage is trimmed back so that the vertical fin will rest flush against the bulkhead. Trim slowly so as to avoid making a bigger hole than necessary. The general arrangement drawing included here gives the mounting arrangement. The vertical fin slot is located approximately 5" forward of the tail of the fuselage, so that the nose of the vertical fin can fit snugly against that bulkhead.

Use a plumb bob hanging from the trailing edge of the top of the vertical fin, with the fuselage levelled laterally, to verify that the vertical fin is positioned vertically. Your eyeball from a distance is used for a second check.

When the vertical fin fits into the fuselage properly, you are then ready to prepare for mounting the tailspring. The core foam on the vertical fin is hollowed out as shown, so that the tailspring can slide forward from the aft end of the fuselage. The aft fuselage may have to be trimmed forward until the width is 0.75" MIN, which is needed for the tailspring to slip through. The bottom fuselage can be slotted as shown to insert the tailspring. Do not worry about removing excess foam as you tunnel through the vertical fin core. It is necessary to have a minimum of 0.8" of space in all directions around the tailspring in preparation for mounting. Allow approximately 9" of tailspring length to protrude aft of the end of the fuselage.

The vertical fin core foam is not dense enough to withstand the tailspring loads. Therefore, when you are ready to insert the tailspring permanently into position, you will mix up a substantial quantity of flox to fill the hole first, so that when the tailspring is inserted, generous squeeze-out will result. Remember, at least 0.8" of flox must be around the tailspring to spread the loads. Note from the drawing that the flox completely fills the fuselage aft of the vertical fin. Before the flox has an opportunity to set up, verify that the tailspring will cure with its length parallel to the aft top fuselage line, and that it is not crooked laterally.



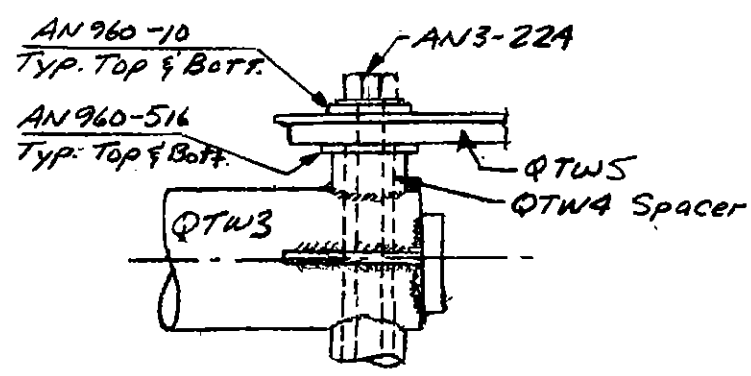
TAILWHEEL INSTALLATION

Once the tailspring has been installed in the fuselage permanently, then you are ready to install the tailwheel.

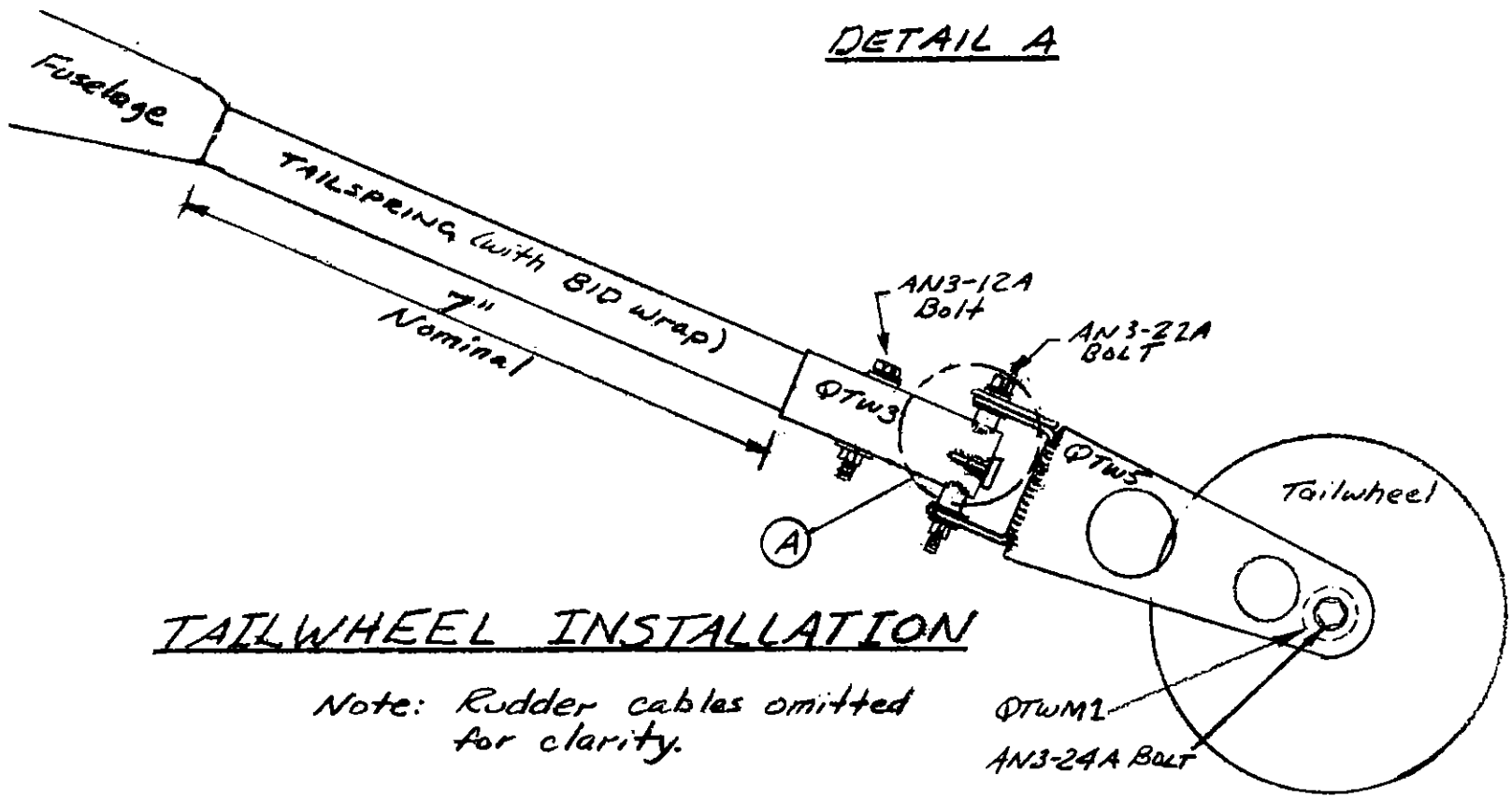
Locate the following parts: QTW3, QTW4, QTW5, QTWM1, and the tailwheel. Insert the QTW4 spacer into the QTW3 weldment as shown. Trial fit QTW5 to the QTW3 assembly with a AN3-21A bolt. It may be necessary to sand QTW3 in order to allow a small amount of vertical freeplay between QTW3 and QTW5. Once all the parts fit together smoothly, assemble as shown.

Next, mount the tailwheel to the QTW5 fork as shown, using the QTWM1 axle and AN3-24A bolt.

The next task is to mount the entire tailwheel assembly to the tailspring. Start by leveling the fuselage laterally, and then trial fit QTW3 onto the end of the tailspring. Trim the tailspring if necessary to permit QTW3 to fit, or to obtain the nominal 7" length from the forward edge of QTW3 to the fuselage. Drill in the single AN3-12A bolt holding QTW3 to the tailspring after making sure that the vertical face of the tailwheel is indeed vertical. (Otherwise the tailwheel will wear unevenly). To mount the Tailwheel assembly permanently to the tailspring, mix up some flox and obtain good squeeze out of the flox upon assembly of QTW3 to the tailspring.



DETAIL A



TAILWHEEL INSTALLATION

Note: Rudder cables omitted for clarity.

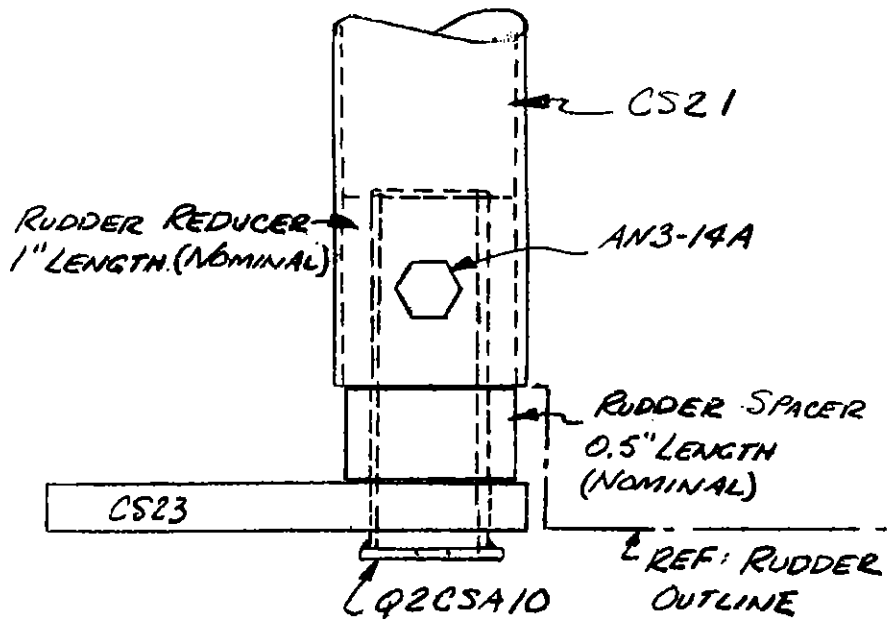
RUDDER INSTALLATION

The rudder hinge assemblies are very similar to those of the ailerons, so review the section on mounting the ailerons before proceeding further.

The upper rudder hinge consists of the CS22 plywood mount, which is bonded to the vertical fin core, and the same hardware and fittings called out in the Main Wing chapter section on 'Outboard Aileron Pivot Assembly', so follow those directions.

The lower rudder hinge is detailed in the accompanying sketch. The QCSM1 material is used for a 1.0" length rudder reducer and a 0.5" length for a rudder spacer. The rudder reducer is pushed into the CS21 rudder torque tube. CS23 is the lower rudder phenolic bearing. CS23 is bonded to the vertical fin foam core with liberal quantities of flox generating good squeeze out. Q2CSA10 is the rudder bellcrank, which is attached to CS21 with a AN3-14A bolt.

Assembly is performed by trial and error fitting of the rudder, complete with all pivots, to the vertical fin until a satisfactory fit is obtained. The clearance on either side of the vertical fin slot should not be less than 0.06". The rudder should be trimmed top and bottom so that a minimum gap between the fuselage and rudder, and between the rudder top and vertical fin exists. When everything is ready, mix up flox and also some 5-MIN and jig the rudder into place and permit it to cure. Stirring sticks and some scrap lumber can be used to hold the rudder in position.



LOWER RUDDER HINGE

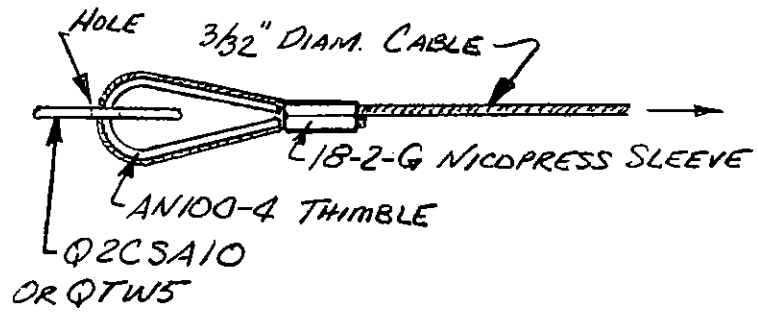
RIGGING THE RUDDER/TAILWHEEL CABLE

The sketch on page 14-1 shows the cable layout to actuate the tailwheel and rudder. Note that from the rudder pedals, the 3/32" cable travels aft through 3/16" Nylaflow tubing fairleads at each bulkhead, exits the fuselage about 10" forward of the tail of the aircraft, and then goes directly to the tailwheel weldment, QTW5, where it is attached to the outboard hole using a thimble and nicopress sleeve attachment. The inboard holes on QTW5 are used to attach cable (using the same type of attachment) that runs forward to Q2CSA10, the rudder bellcrank, where the cable is attached with another thimble and nicopress sleeve arrangement. The left and right sides are mirror images. The C-69 spring is used between the cables traveling to the rudder, to provide tension on the cables at all times.

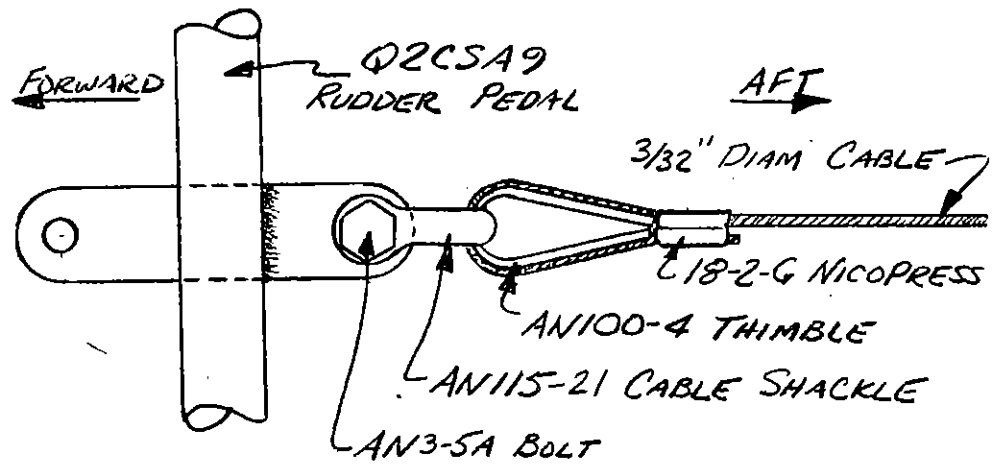
Cable attachments should be accomplished with no weight on the tailwheel, and with the rudder and tailwheel in the neutral position. (Use the rudder rigging template.) It is recommended that the QTW5-Q2CSA10 hookup be accompished first. Those cables must be as tight as practical. Then, hookup the rudder cables to the outboard holes of QTW5. Since there will be a quick disconnect later at the fuselage cut point, just cut enough cable to reach the fuselage cut point. The stop on QTW5 may need to be modified by filing it back in order to reach the limits of rudder travel indicated on the rudder rigging template.

RIGGING THE RUDDER PEDAL CABLE

The 3/32" cable is attached to the rudder pedal using a cable shackle, thimble and nicopress sleeve, as shown. You may wish to wait until after the quick disconnect fittings are assembled at the fuselage cut point, in order to better set up the angle of the rudder pedals.



CABLE ATTACHMENT
(TYP 6 PLACES ON QTW5 & Q2CSA10)



RUDDER PEDAL ATTACHMENT
(TYP 2 PLACES)

MAIN FUEL TANK INSTALLATION

Once installed, the main fuel tank also serves as a support for the legs of the pilot and passenger. The geometry of the tank was, therefore, laid out to provide not only fuel volume, but also adequate support.

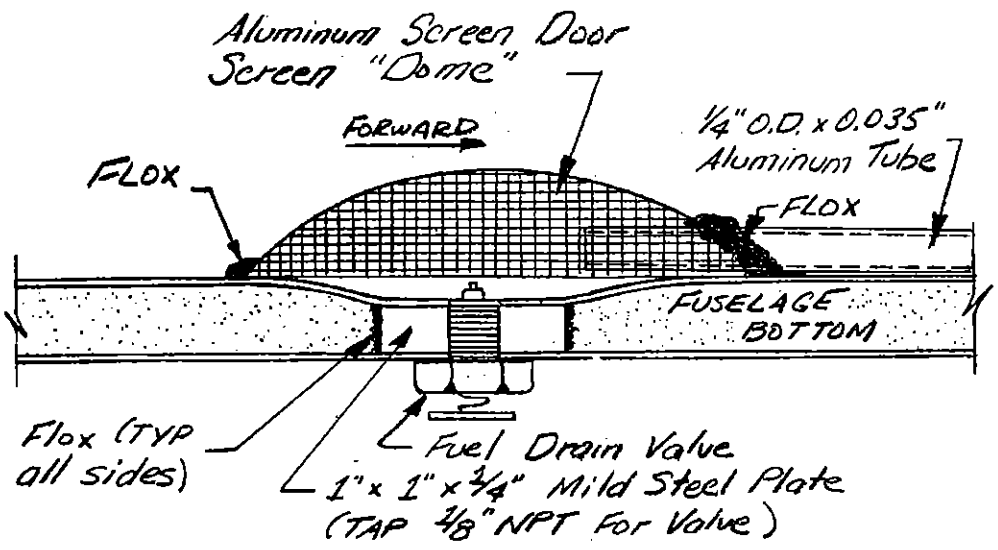
A fuel drain valve must first be installed in the bottom fuselage at the approximate low point of the fuel as part of the normal preflight checklist.

Begin by locating FS45 at BL00. Draw a 2" diameter circle around that point and contour a depression in the center of the circle that is 1" square and results in a foam thickness of 1/4". A toothpick is useful for gauging depth. Make a smooth transition around the area.

Bond in with Flox the 1" x 1" x 1/4" mild steel plate and then laminate 2 BID over the entire depression overlapping a minimum of 1" onto the inside bottom fuselage skin.

Once that lamination has cured, make a 'dome' from some aluminum screen door screen that covers about a 2.5" diameter circle, and attach the dome to the bottom fuselage over the depression with flox all around the perimeter.

From underneath the fuselage, tap a 1/8" NPT hole into the mild steel plate for the fuel drain valve, which then may be inserted and tightened.



Finally, find a piece of Versatube Aluminum tubing of 1/4" O.D. and 20" in length and locate it as shown. The tubing pierces the aluminum screen and points forward, being afixed with liberal quantities of flox at the junction with the screen. Be careful not to flex the tubing unnecessarily to prevent fatigue of the tubing.

The fuel tank must be trimmed to fit your fuselage. Refer back to the chapter on Basic Fuselage Assembly for a sketch showing the fuel tank positioning. The leading edge of the fuel tank is nominally at FS36.1; the trailing edge should be at about FS58.1 in order to provide a nominal 6 inches of clearance between the fuel tank and the Seatback Bulkhead. You will find that the sides of the fuel tank need to be trimmed back to allow the fuel tank to sit down against the fuselage bottom. Verify that the elevator control rod CS13 does not interfere with the top of the main fuel tank as it runs forward to the elevator by skipping ahead in this chapter. If it does, you must trim down the height of the main fuel tank to clear by a minimum of 3/8", or laminate a slot into the fuel tank for this CS13 clearance.

Baffles are used to prevent excessive sloshing of the fuel within the tank, as well as to increase the stiffness of the fuel tank so that it may be stepped on during entry and exit from the aircraft.

Three baffles are used; one spanwise baffle about 18" wide, and two longitudinal baffles that extend from the landing edge of the fuel tank to within 4 inches of the trailing edge of the fuel tank. The sketches illustrate positioning and size. Note that openings are left regularly along the baffles to allow fuel to move back and forth slowly. Particularly note the opening at the top which is part of the venting system. Those openings should be about 2 inches in length and about 1" in height, and need not be accurately shaped.

The baffles are fitted using trial and error until they fit both against the fuel tank and also against the fuselage bottom when the tank is inserted into place. Each baffle should have 1 BID on each side, and the 1/4" thick white foam is used for the core material. Once each baffle is properly trimmed, it should be mounted permanently to the fuel tank with micro and a BID tape on either side with a minimum 1" lapping onto each surface. Upon installation of the fuel tank permanently to the fuselage, these baffles will be coated liberally with flox so that they bond to the fuselage bottom.

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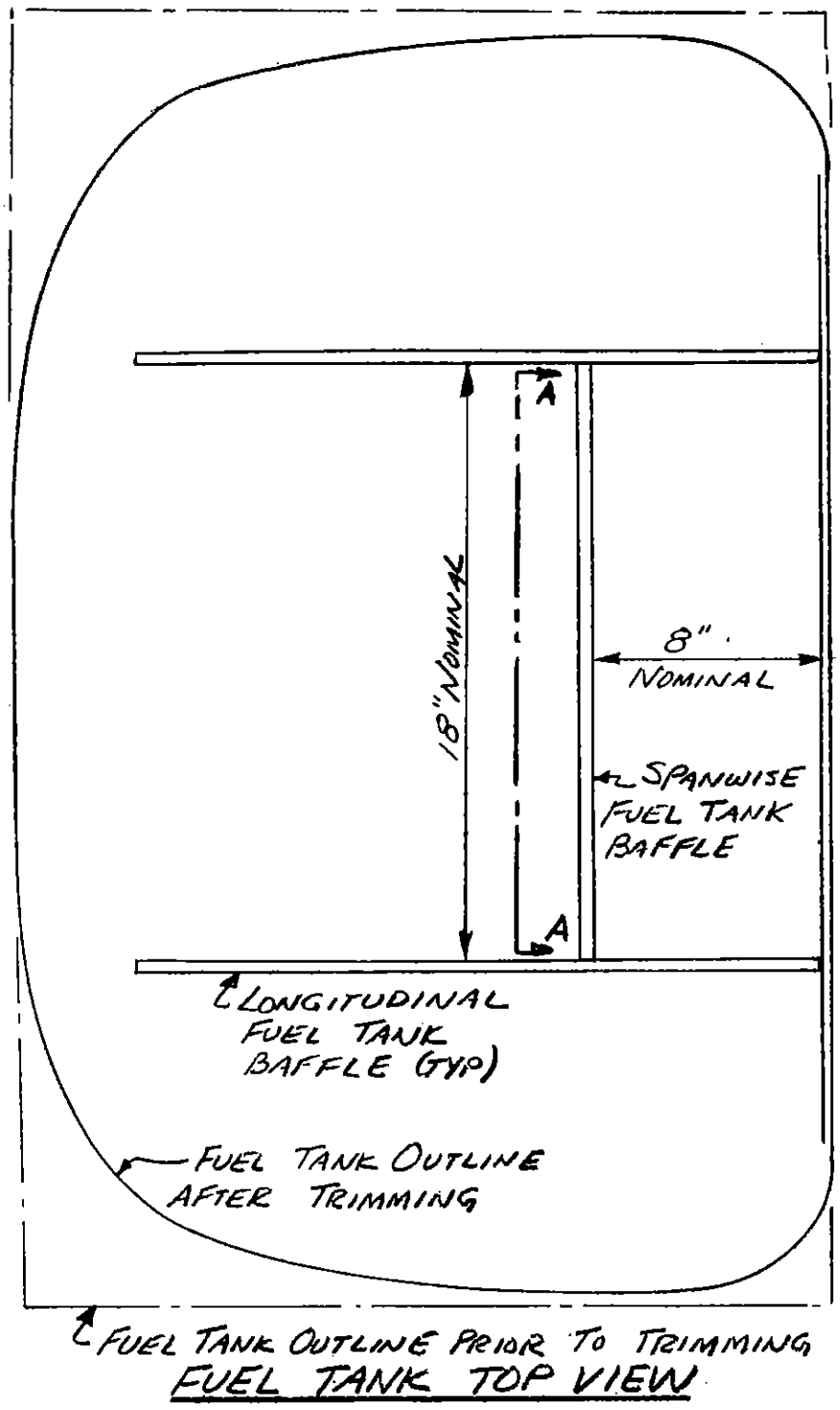
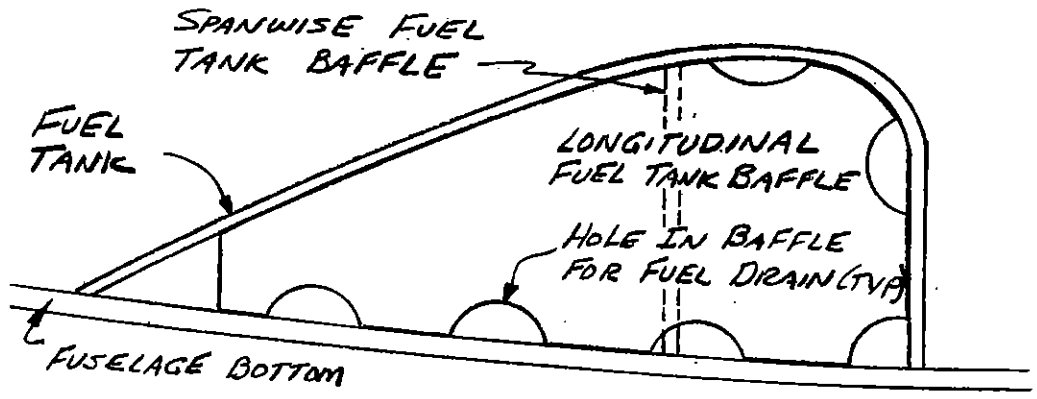
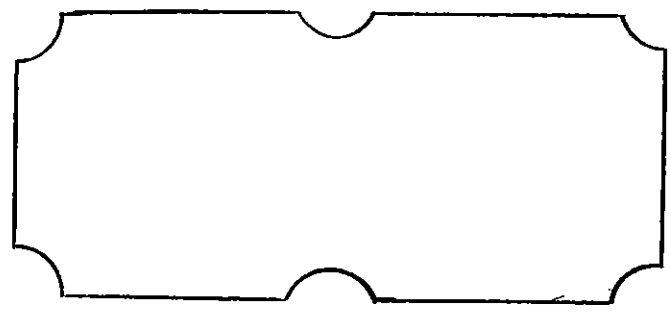


FUEL TANK TOP VIEW



FUEL TANK
(SIDE VIEW)



SPANWISE FUEL TANK BAFFLE
VIEW A-A

The fuel gauge consists of a direct reading float type mounted near the centerline of the aircraft. Before installing the guage permanently, you should make sure that it will not interfere with the elevator control rod CS13 which runs from the control stick to elevators.

A length of 1/4" wood dowel obtained from a hardware store is bonded with epoxy into a carved urethane foam float nominally 1" diameter by 1.25" high. This float assembly will float up and down with the fuel level. It rides inside a clear PVC pipe tube that you will calibrate with marks showing fuel quantity. Some points to remember are that the wood dowel should extend about 1.5" above the top of the main fuel tank, that the length of the clear PVC pipe is governed by the travel of the wood dowel, and that the float assembly should be fitted to the fuel tank prior to mounting the fuel tank in the fuselage permanently.

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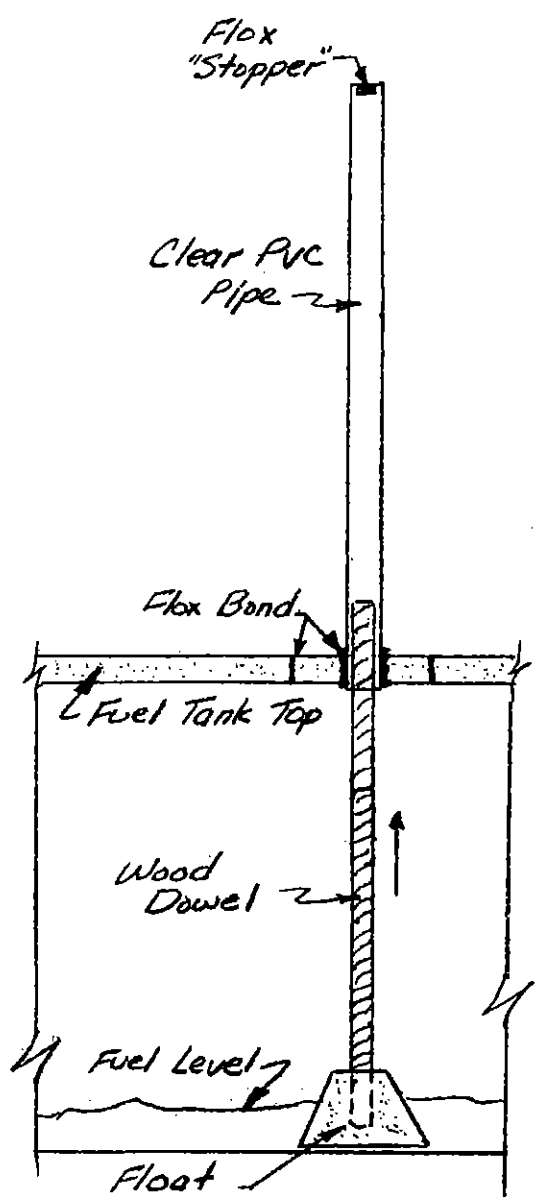
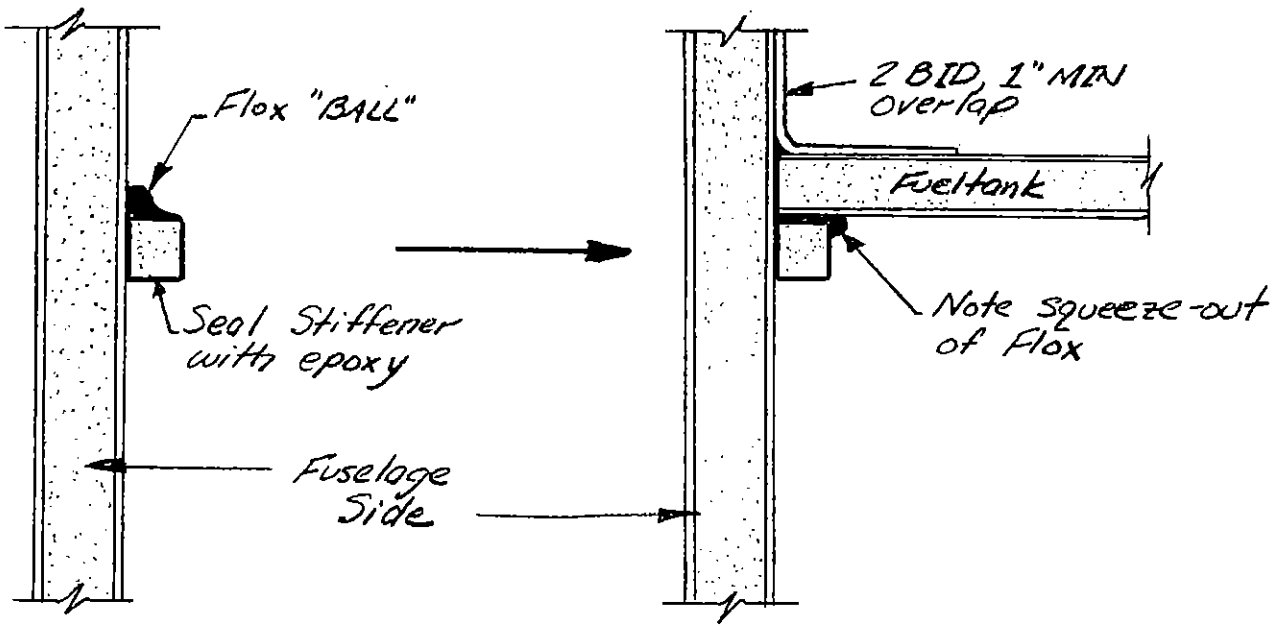


FUEL GUAGE INSTALLATION

In order to provide a leakproof seal around the main fuel tank after installation, small stiffeners are placed along the fuselage sides so that, when installed, the main fuel tank will set down on these stiffeners, thus assuring good squeeze out of the flox and a good seal. These stiffeners are nominally of 1/4" square cross section, and made from the thin sheets of white foam. They are positioned by dry fitting the fuel tank in place, tracing around the main fuel tank on the fuselage side, and then lowering the traced lines the thickness of the main fuel tank after removing the tank. The stiffeners are installed with flox, and allowed to cure completely prior to mounting the main fuel tank permanently. Do not be concerned at the number of seperate stiffeners required to cover the tank perimeter.

To install the main fuel tank permanently, it will first be necessary to notch the forward lower edge of the main fuel tank at BL00 so that the fuel line tubing will exit the tank there. Next, mix up both pure epoxy and flox. Paint pure epoxy liberally on all exposed areas of the stiffeners, to prevent contamination of the fuel later. Trough flox liberally on the top of the stiffeners, as well as on the fuselage bottom where the forward and aft edges of the main fuel tank will rest upon assembly. Next, trough flox around the edges of the main fuel tank that will come into contact with either the stiffeners or the fuselage.

Insert the tank in place, and verify that you have good squeeze out of the flox everywhere to assure a good seal. Wipe off the excess flox on the top side as you make a flox radius between the tank and the fuselage. Laminate 2 BID tapes with a 1" minimum overlap to join the man fuel tank to the fuselage. Liberally apply flox around the exit of the fuel line to prevent leaks.



FUEL TANK INSTALLATION

SEATBELT ATTACHMENTS

A very important safety feature of your Q2 is the individual seatbelt/shoulder harness assembly provided for each occupant. Previously, you have mounted the attachments for the shoulder harness in the main wing. In this section, you will install the mounts for the seatbelts, and, finally, install the seatbelts in your aircraft. Do all of the procedures exactly like these plans state; this section is your first line of defense in the event of a mishap.

The seatbelt mounts are installed in the fuselage between the aft edge of the fuel tank and the forward edge of the seatback bulkhead. There is one outboard seatbelt attachment on each side of the cockpit, and a double seatbelt attachment of BL00.

The outboard seatbelt attachment is straightforward and illustrated herein. A piece of 1/4" plywood about 2.2" x 1.2" is sanded to fit the fuselage contour and beveled for the lamination of 7 BID over it; between the plywood and the fuselage skin use epoxy. The 0.7" MIN overlap onto the fuselage is very important, as is making sure that the glass does not turn any sharp corners. The two holes for the AN525-416R14 screws may be drilled from the inside of the fuselage all the way through to the outside; the holes for the screws can be filled with dry micro later. The aluminum angle should be about 1.25" in length, and permit at least 3/8" from the center of each hole to the outside edge. The angle should be installed permanently, and then the hole for the AN4-5A bolt holding the seatbelt itself drilled afterwards, so that the hardware does not interfere. Note that the seatbelt pulls off at about a 45 degree angle. You may wish to sit in the aircraft and pick the optimum FS for the seatbelt fittings prior to bonding the plywood in place. The other side is a mirror image of the one illustrated.

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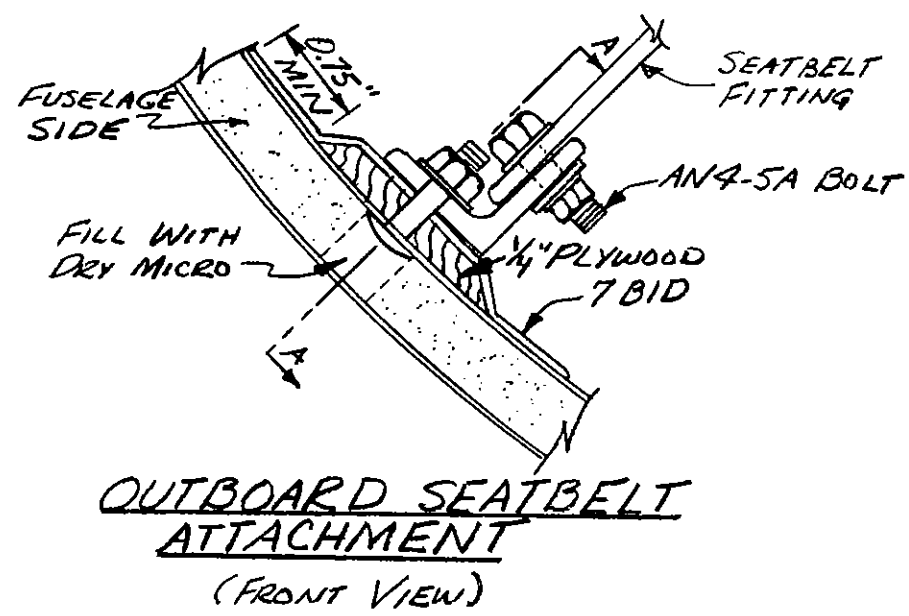
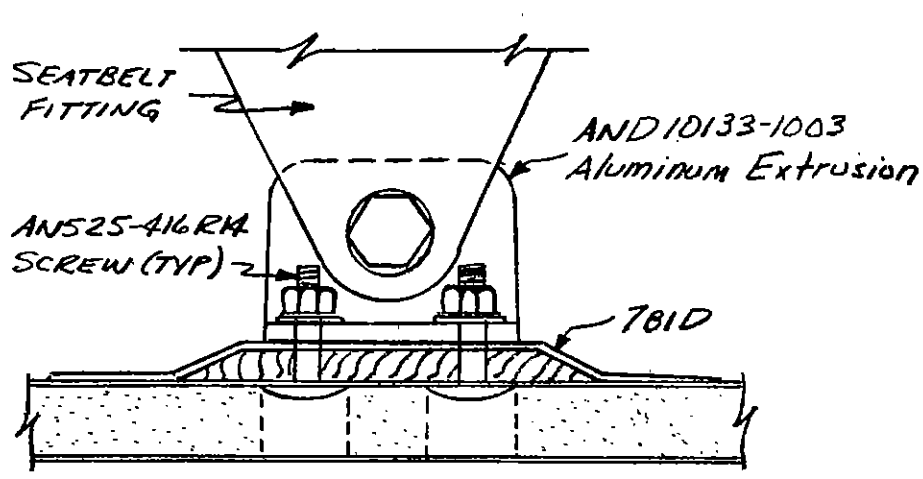
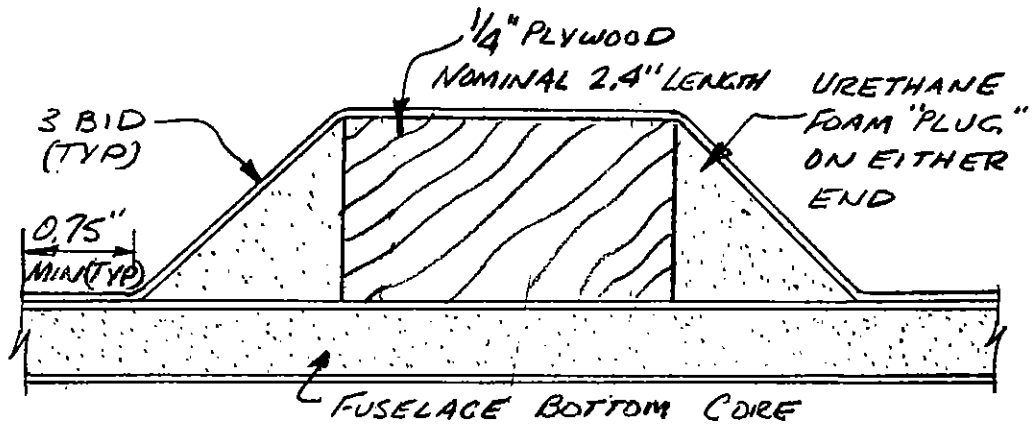


OUTBOARD SEATBELT ATTACHMENT
(FRONT VIEW)



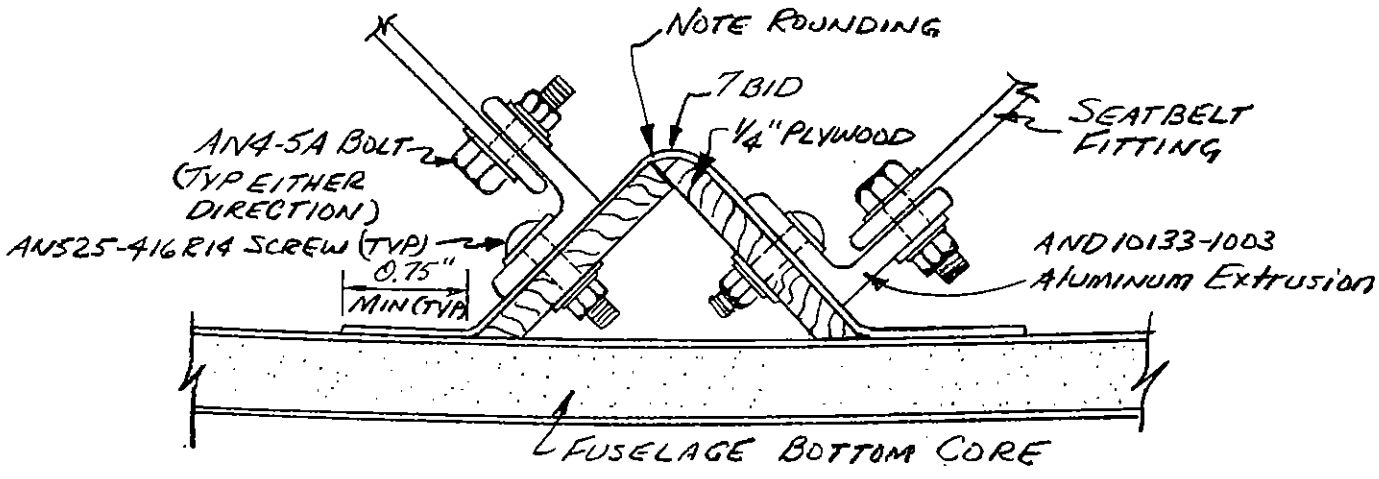
SECTION A-A

At BL00, a common attachment is used. The plywood should be about 2.4" x 1.5" and is beveled to form an A-frame arrangement, so that the aluminum extrusion can again pull off at about 45 degrees. The 7 BID is again laminated in place with the 0.75" MIN overlap onto the fuselage. Next, in order to close out the front and rear parts of the 'tent', carve some urethane for two 'plugs', one on either end; these are installed after the extrusion is permanently mounted so that the AN525-416R14 screws do not need to be accessed. The plywood was made long so that even with the extrusion in place, there will still be room to laminate 3 BID around the plugs up onto the previous 7 BID lamination with a minimum overlap. Finally, install the seatbelts themselves. The extrusion length for both inboard and outboard pieces is a nominal 1.3". When finished, this BL00 mount should be closed in, rounded, and have glass lapping onto the fuselage inside skin in the four directions.



SIDE VIEW

NOTE: HARDWARE OMITTED FOR CLARITY



INBOARD SEATBELT ATTACHMENT

(FRONT VIEW)

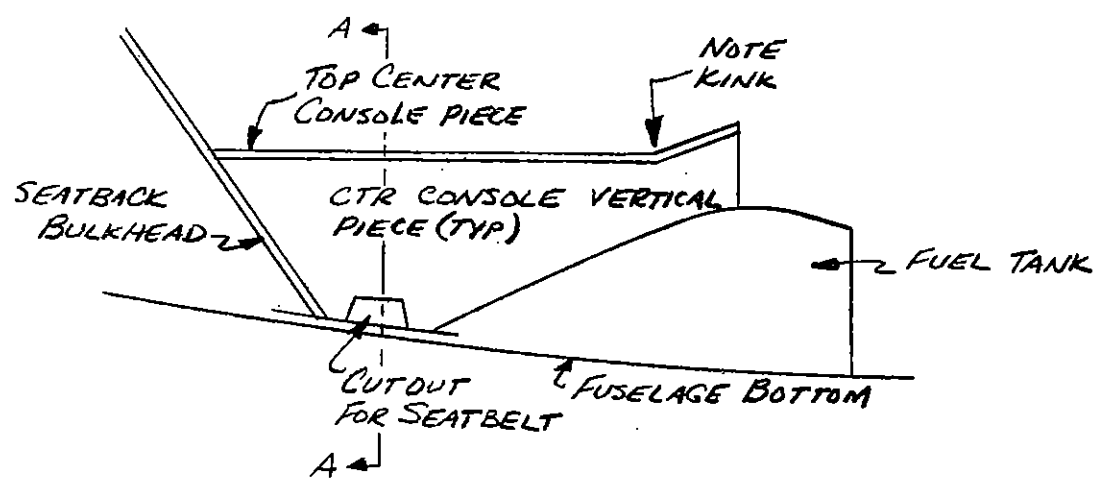
Now is a good time to install the shoulder harness assemblies permanently to their attachments. Since each occupant has a Y-harness arrangement from one bolt, there will need to be two slots per side placed in the seatback bulkhead to allow the actual harness to come through into the cockpit. Sit in the cockpit to determine best where these slots should be; they should be no larger than necessary, and should have a glass-to-glass bond lamination around the slots.

COCKPIT CONSOLE ASSEMBLY

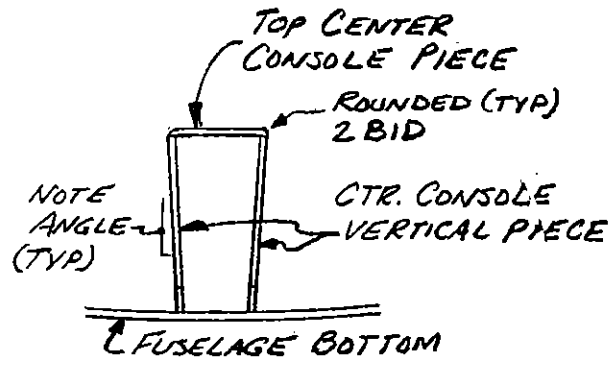
Now is a good time to install your center console and the two side consoles in your fuselage. The accompanying sketches show the locations.

Lets begin with the center console, the centerline of which should be on BL00. To gain more hip room the sides may be angled toward BL00 as they go down. The top center console piece is <u>not</u> installed until after all of the control stick mounting and rigging has been accomplished, but it can be used "dry" to help mount the center console vertical pieces. Remember that the glassed side of those pieces is the side not visible after assembly, i.e. the side nearest BL00. Two cut-outs will be necessary for the seatbelts to clear the pieces. Use flox along the bottom of each piece to attach them to the fuselage, and laminate 1 BID on the <u>inside</u> lapping onto the pieces and the fuselage a minimum of 1 inch. Do not glass the outside faces of the two center console vertical pieces until after the top center console piece has been permanently installed. The 'kink' is achieved with a saw cut into the foam (not glass) and beveling the foam so that the piece can angle upward.

CONTINUED ON NEXT PAGE



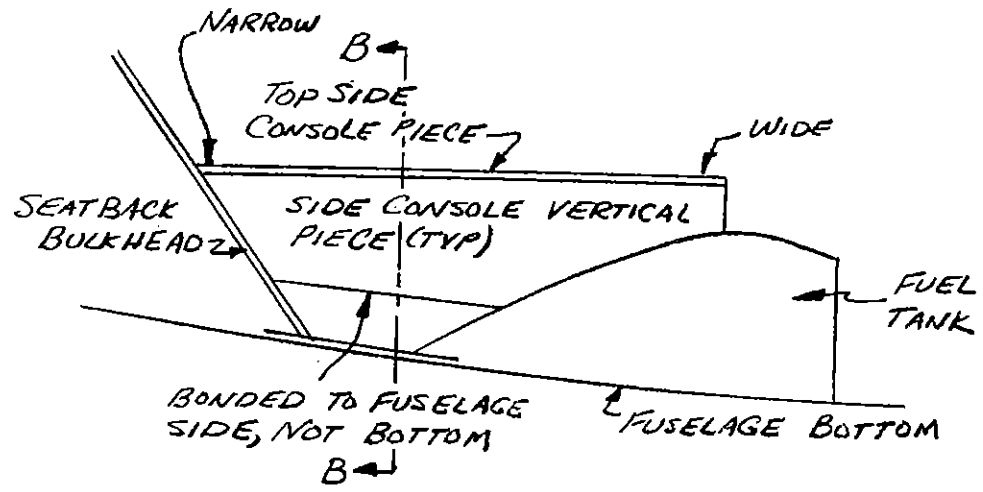
CENTER CONSOLE INSTALLATION



VIEW A-A

The side consoles can be completely assembled permanently at this time. Again, remember that the previously glassed faces go on the outboard and lower sides, so that they are not visible upon assembly. Laminate 1 BID tape at the joints wherever you can reach, and use flox at the joints also. Once each top and vertical piece has been joined, round the common corner and laminate 2 BID around the two faces, starting with a 1 inch minimum lapping onto the fuselage side, and finishing with a 1 inch minimum lapping onto the fuselage side, main fuel tank, or Seatback Bulkhead, depending on FS location. This will give each side console a 'one piece' look and reduce finishing weight later.

Both the side consoles and the center console should be assembled so that each top piece is level when in place. This will be useful later for leveling your aircraft for installation of the main wing and canard, as well as for weight and balance.



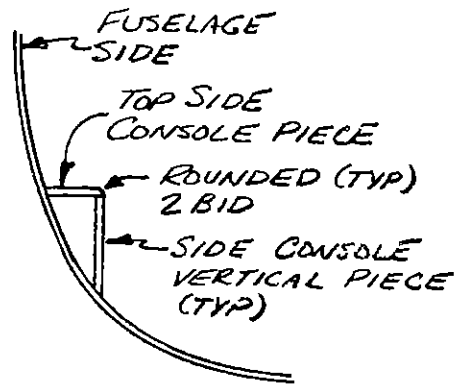
SIDE CONSOLE INSTALLATION

TOP CENTER CONSOLE ASSEMBLY

Once the control stick assembly is in place, and the CS13 push-pull rod to the elevators in place, you can permanently assemble the top center console piece. Some trimming will be necessary to clear the control stick and its associated hardware. The top piece is mounted with flox.

Round the top corners and laminate 2 BID at 45 degrees to BLOO around the top piece all the way down to the bottom fuselage, using 1" minimum lapping onto the fuselage bottom, Seatback Bulkhead, and main fuel tank.

To summarize, at this point in the construction, the center and side consoles are installed with 2 BID over the outside faces of each console, and 1" minimum lapping onto the rest of the fuselage structure. The consoles are now strong enough to put weight on.



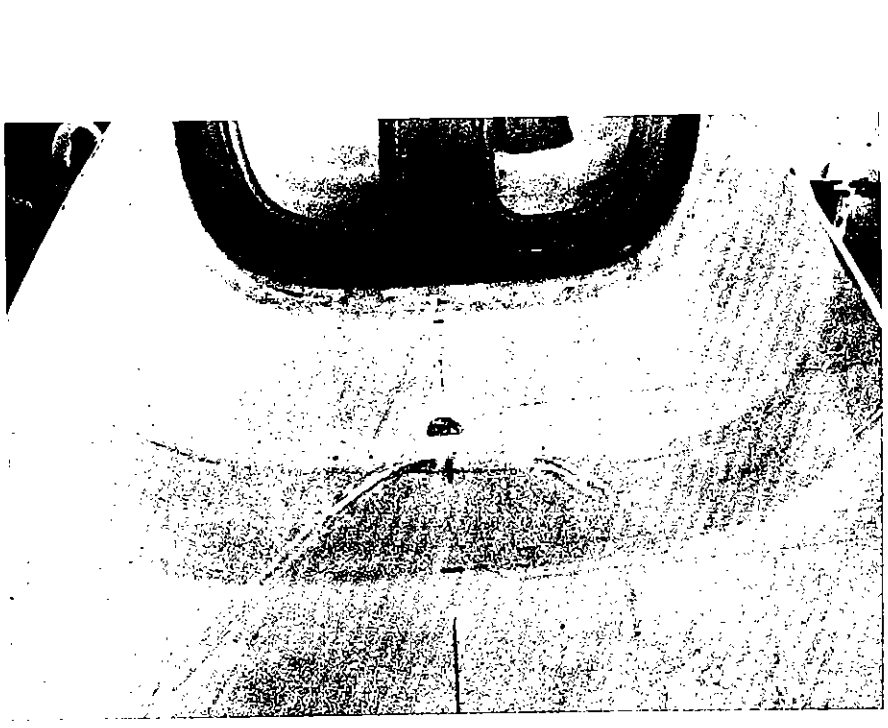
VIEW A-A

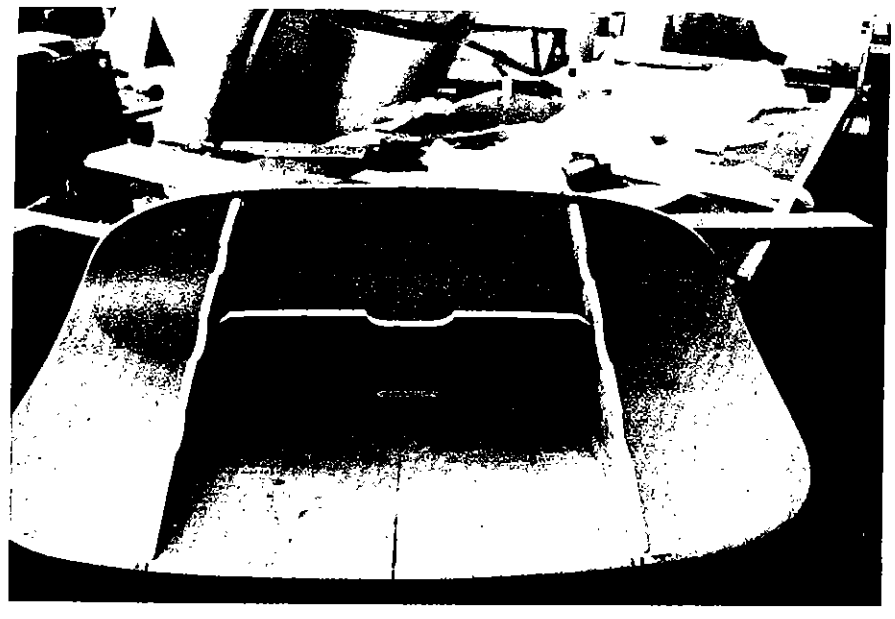
INSTRUMENT PANEL INSTALLATION

It is suggested that the Instrument Panel not be mounted in the fuselage permenently until all cutouts for instruments, radios, and equipment have been made.

However, at this time, you may elect to make the small sub-panels that extend from the bottom of the instrument panel to the top of each side console and the center console. The width should be the same as the width of the console. For material, you may use the 1/8" plywood, 0.063" aluminum, or even 1/4" thick white foam with 1 BID on each side.

These sub-panels are useful for switches, gauges, and as mounts for controls.





Top Left: Fuel Drain Valve installation
Top Right: Side view of baffle installation
Lower Right: Bottom view of baffle installation

CONTROL STICK INSTALLATION

Install the control stick only after the fuselage has been assembled and the fuel tank, center console, and side consoles have been installed.

The control stick is installed on the center console so that it may be actuated by either the pilot's right hand, or by the passenger's left hand.

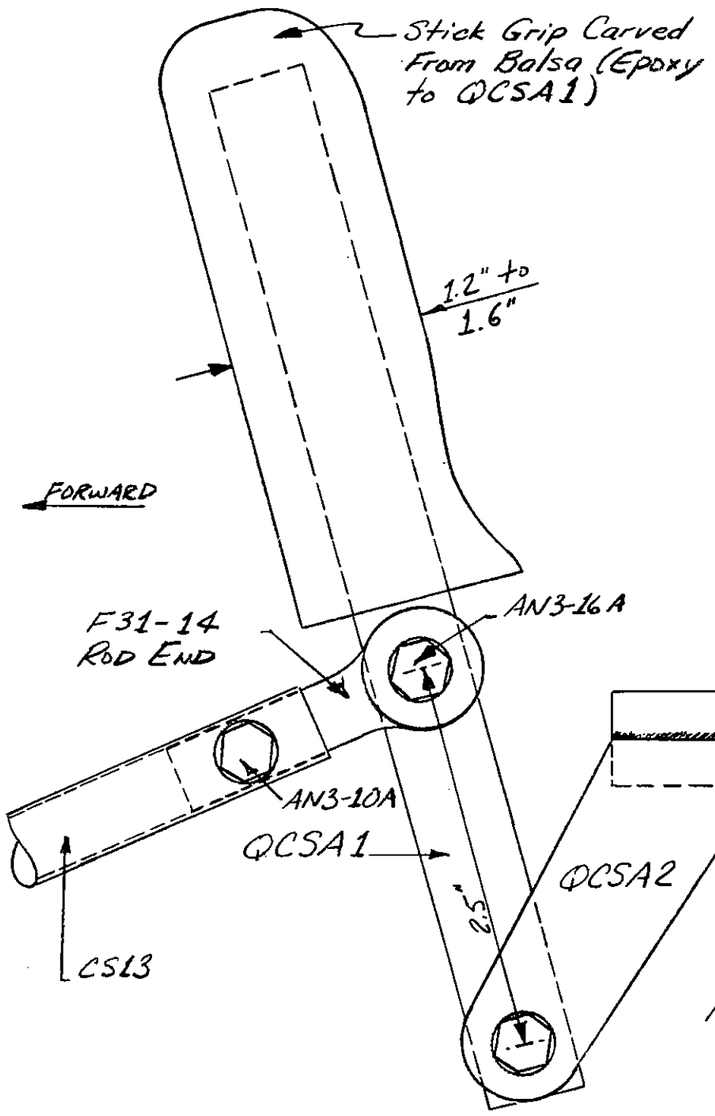
In order to make your Q2 have that "custom fitted" appearance, sit in the cockpit in a comfortable position that allows you to both see out of the cockpit and reach the rudder pedals. Rest your right hand on the center console and estimate where the control stick should be placed fore and aft to be most comfortable; mark that point somehow for future reference.

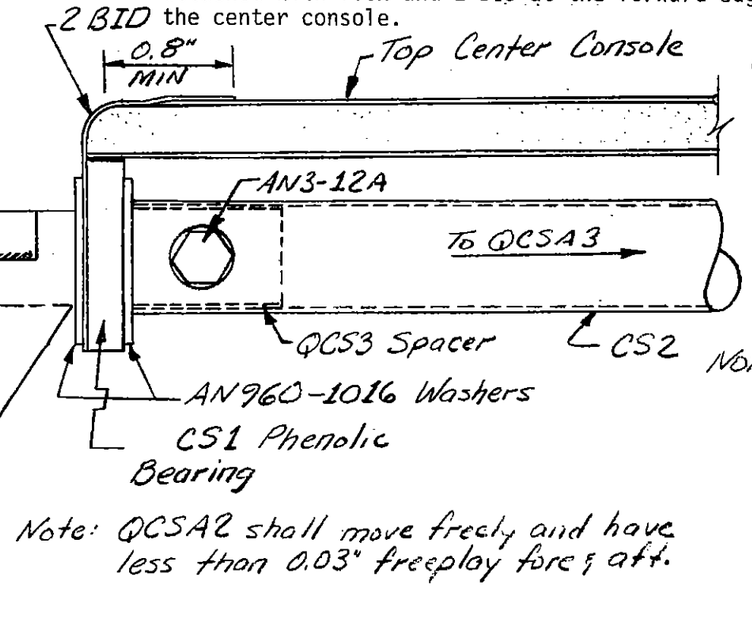
Next, assemble QCSA1 to QCSA2. It is important that the bolt tighten down on the spacer, not QCSA1, to allow the stick to pivot freely.

Find the QCS3 spacer material and cut it into two pieces. Also, find the three phenolic bearings CS1 and CS4 (2).

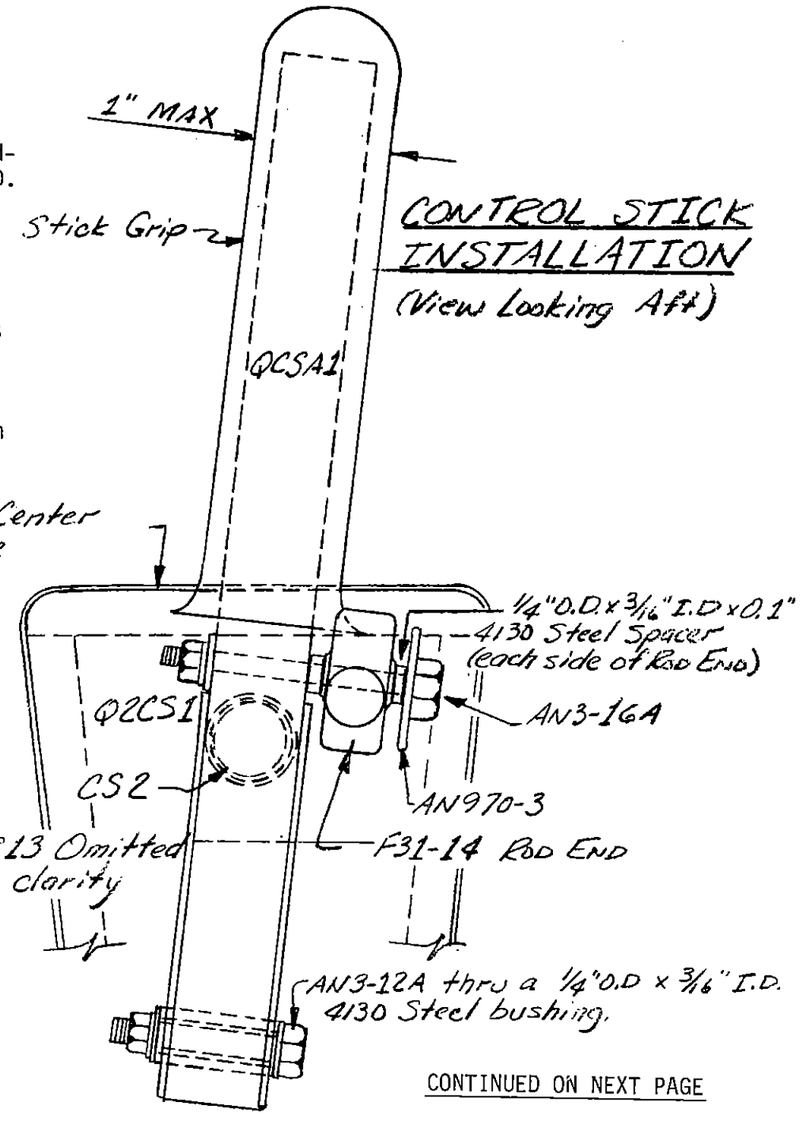
Study the sketches carefully. CS2 is the longitudinal aileron torque tube, which is made out of 3/4" O.D. by 0.035" wall 2024T3 Aluminum tubing. It needs to be approximately 44" long, but, as you can see, the exact length will be determined on installation, so make it long. CS2 translates the rotary motion of the control stick (for roll control) back to QCSA3, the aileron bellcrank, from whence the two vertical push pull tubes CS5 and CS12 actuate the two Q2CSA4's which move the ailerons.

From your previous determination of the proper control stick location, you can decide how much to trim back the center console so that the CS1 bearing can be attached with flox and 2 BID at the forward edge of the center console.





CONTROL STICK INSTALLATION
(Side View)



CONTINUED ON NEXT PAGE

Once that lamination has cured, trial fit the control stick, the QCS3 spacer, and the CS2 longitudinal aileron torque tube together so that you can locate the CS4 bearings back at the FS94 bulkhead. Be careful to avoid binding. The CS4 bearings should be located on BL00 at about WL14.5. Note that 2 BID and flox are used to attach each of the CS4 bearings to the bulkhead.

Once those laminations have cured, you can assemble the control system as shown. Remember, the stick must be smooth and free in the pitch and roll directions. Also, the fore and aft travel of QCSA2 must not exceed 0.03", as shown.

Work slowly and carefully, being sure not to elongate the holes you are drilling for the various AN3 bolts to connect everything together. Keep checking to make sure the control system remains free and smooth. There is little worse than a fine handling basic aircraft with a very stiff control system.

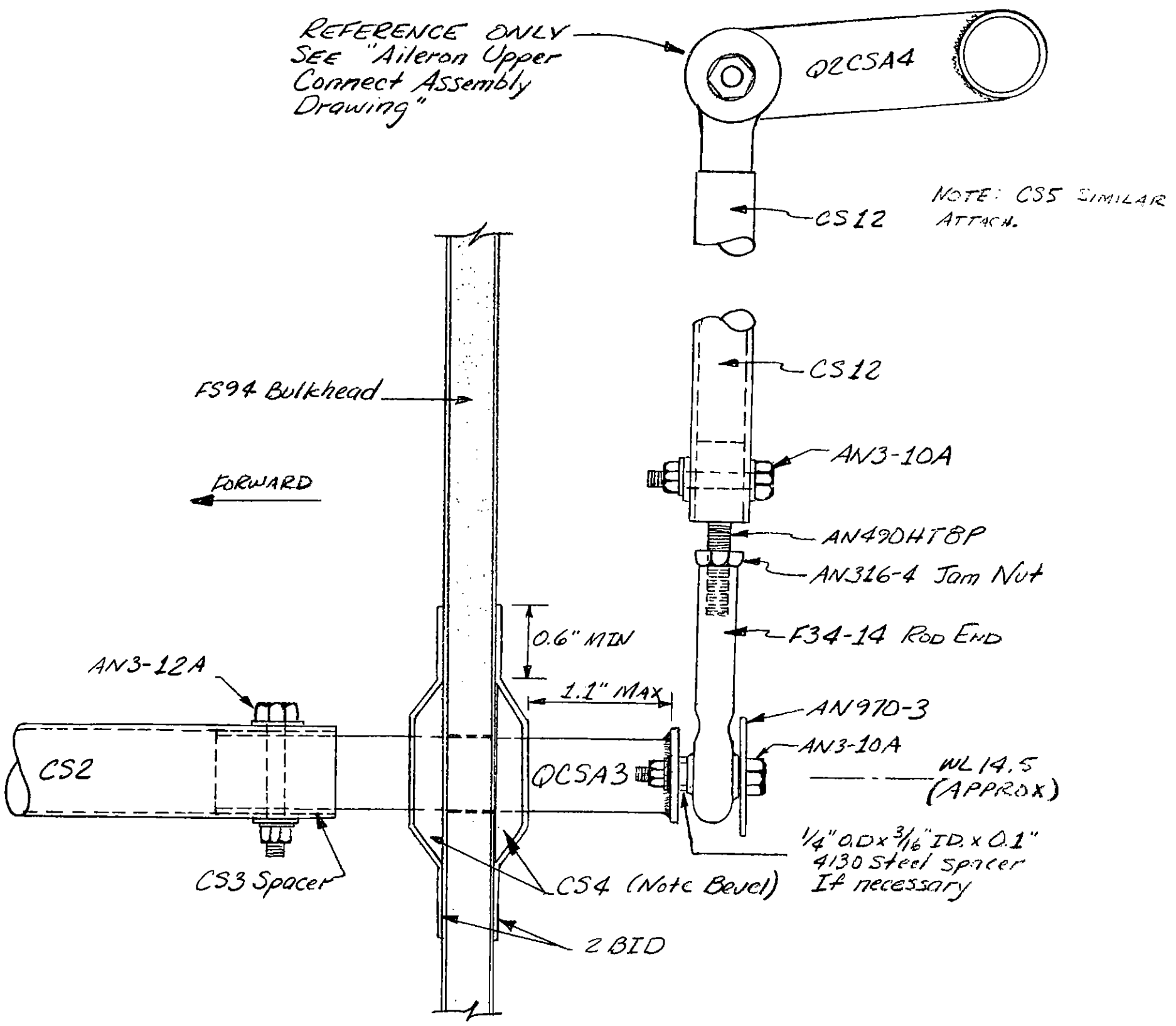
The AN3-12A bolt to connect CS2 to QCSA2 will require a hole drilled in the console. This hole can be left open for future access, or closed back up again. Please note that the control stick with neutral aileron is canted slightly toward the pilot for better stick/hand geometry.

CS5, CS12, and CS13 are made from 1/2" O.D. x 0.035" wall 2024T3 Aluminum tubing. The proper lengths will have to be determined upon installation. Don't forget the length taken up by the rod ends and AN490HT8 adjustable threaded rod ends. Each push-pull tube system has one of the adjustable rod ends to allow for small errors in properly sizing the push-pull tubes for length. You must have <u>at least</u> 2 threads of the adjustable threaded rod ends screwed into the rod ends to be safe. It is recommended that you set up your systems so that the adjustable rod ends are at mid-travel, to allow for future adjustment, particularly with the ailerons.

Use your aileron rigging template and your elevator rigging template to assure that you obtain the proper amount of travel in pitch and roll. Using wood bonded in place, make control limit stops both between QCSA3 and the fuselage bottom, between Q2CSA8 and the canard shear web, and between QCSA1 and QCSA2 to limit surface travel to the proper limits. <u>DO NOT HURRY THIS SECTION</u> it is too important an area to make mistakes in.

The stick grip is carved out of Balsa wood and attached to QCSA1 with epoxy.

Once your aileron and elevator control systems are functioning, climb into the cockpit and spend 5 minutes playing fighter pilot. Then get back to work, or you'll never finish your Q2.



AILERON LOWER CONNECT
(Side View)

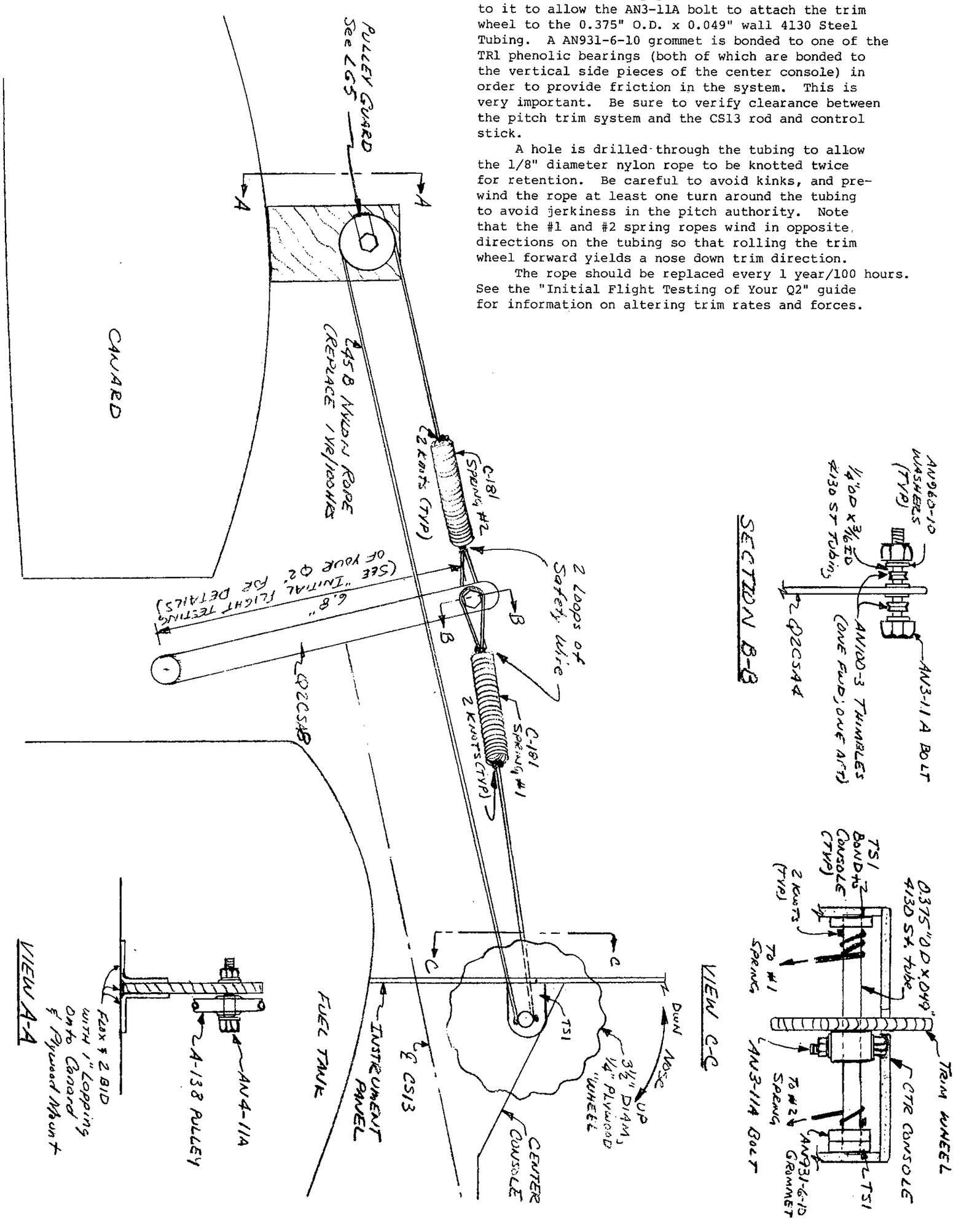
INSTALLING THE PITCH TRIM SYSTEM

The pitch trim system is a simple looking double spring system mounted in the center console forward of the control stick. It must be built exactly as per plans if you are to enjoy the same fine handling qualities as the prototype Q2. In addition to providing pitch trim capabilities, the system also serves to regulate the stick force per g of the control system in pitch.

The illustrations are straightforward. The trim wheel is carved from plywood, and a dowell is bonded to it to allow the AN3-11A bolt to attach the trim wheel to the 0.375" O.D. x 0.049" wall 4130 Steel Tubing. A AN931-6-10 grommet is bonded to one of the TR1 phenolic bearings (both of which are bonded to the vertical side pieces of the center console) in order to provide friction in the system. This is very important. Be sure to verify clearance between the pitch trim system and the CS13 rod and control stick.

A hole is drilled through the tubing to allow the 1/8" diameter nylon rope to be knotted twice for retention. Be careful to avoid kinks, and pre-wind the rope at least one turn around the tubing to avoid jerkiness in the pitch authority. Note that the #1 and #2 spring ropes wind in opposite directions on the tubing so that rolling the trim wheel forward yields a nose down trim direction.

The rope should be replaced every 1 year/100 hours. See the "Initial Flight Testing of Your Q2" guide for information on altering trim rates and forces.



MAKING YOUR Q2 TRAILERABLE

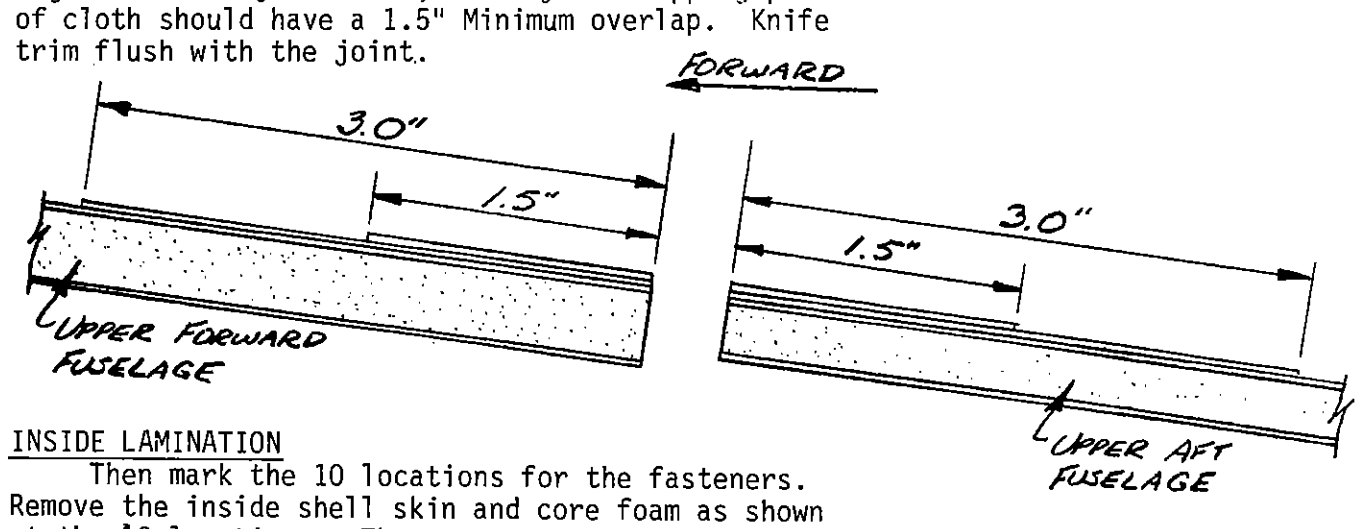
INTRODUCTION

In this chapter, you will make your Q2 trailerable and at the same time join the forward and aft fuselage shells together. As stated in Chapter 12, this task should be accomplished prior to mounting the vertical fin in Chapter 14. Also, Chapter 12 contains information on joining the forward and aft fuselage shells together permanently if you do not desire to make your Q2 trailerable.

EXTERIOR LAMINATION

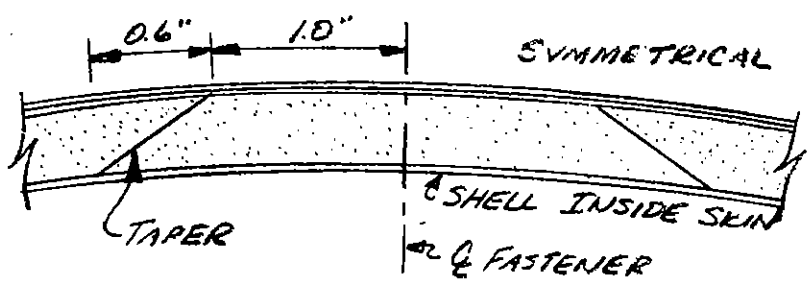
Begin by jigging the two shells together and checking for a good fit. Some sanding may be required for a flush fit.

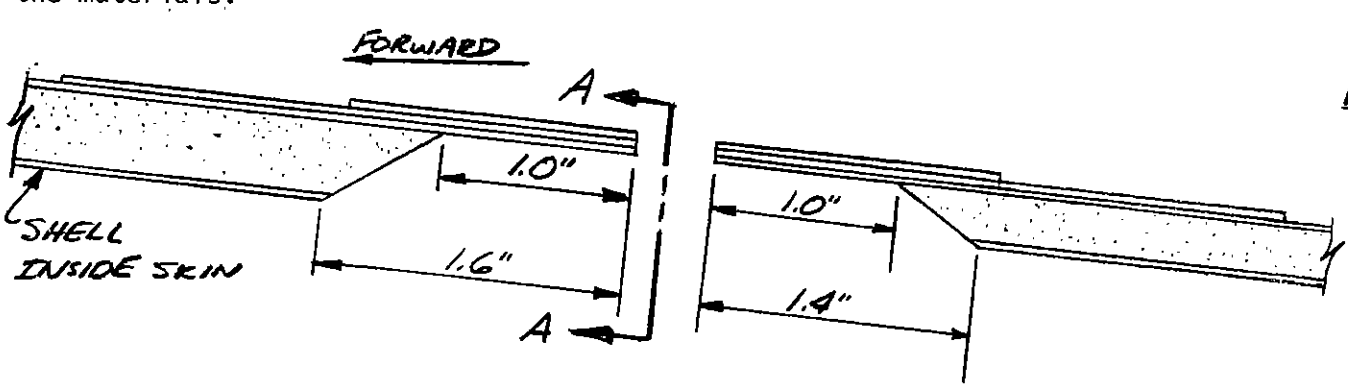
Next, sand the outside skin for 3" on either side of the joint in preparation for the lamination. Laminate 2 BID as shown around the area next to the joint. The first ply is 3" wide and the second ply is 1.5" in width. The lamination should be oriented 45 degrees to the joint line, and any overlapping pieces of cloth should have a 1.5" Minimum overlap. Knife trim flush with the joint.



INSIDE LAMINATION

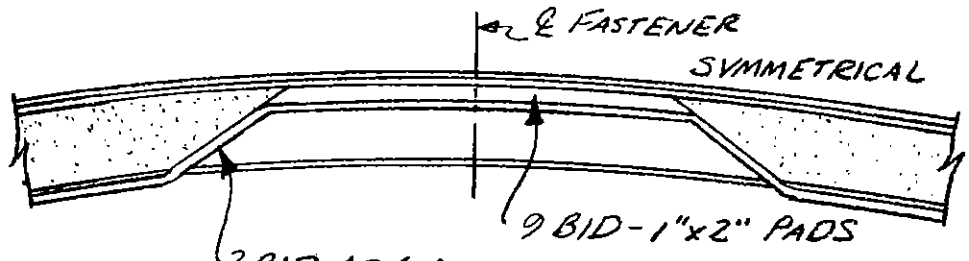
Then mark the 10 locations for the fasteners. Remove the inside shell skin and core foam as shown at the 10 locations. The taper shown is to allow the next laminations to flow smoothly around the corners. Each location will have an area 1" x 2" on each shell (a total of 2" x 2") sanded down to the outside shell skin, as shown. Note from the sketches that only the area around each fastener location is affected. If the FS94 bulkhead interferes with the lower 3 locations, slot the FS94 bulkhead as needed, and then replace the materials.



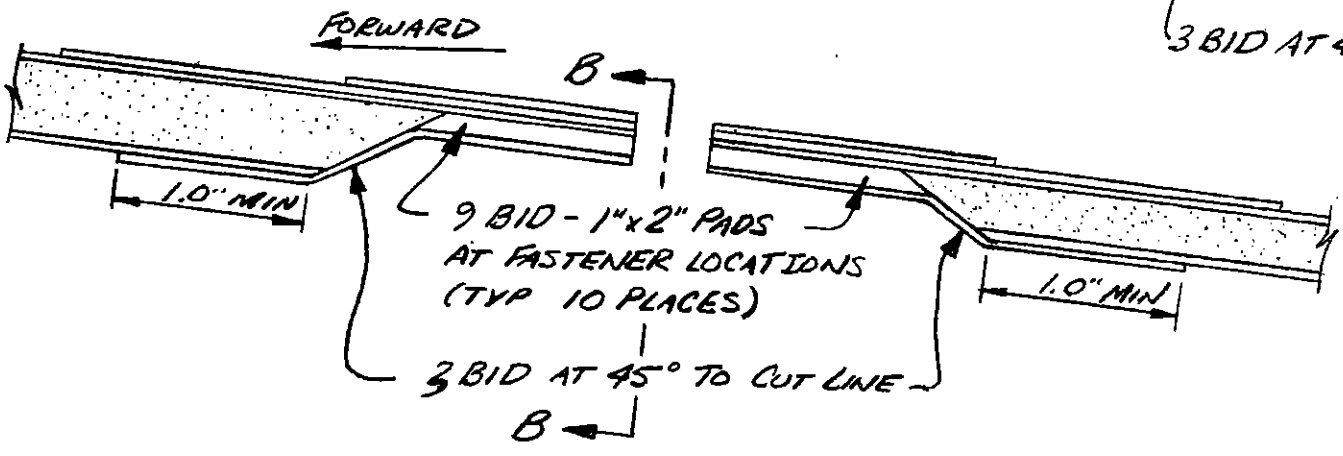


VIEW A-A

A pad of BID is laminated at each location and on each shell. A total of 9 BID approximately 1" x 2" are used. An additional 3 BID overlapping 1" minimum onto the inside shell skin are laminated to tie everything together. It is important to taper all laminations carefully to avoid joints, bumps, joggles, etc. Also, these laminations are oriented 45 degrees to the joint line.



VIEW B-B

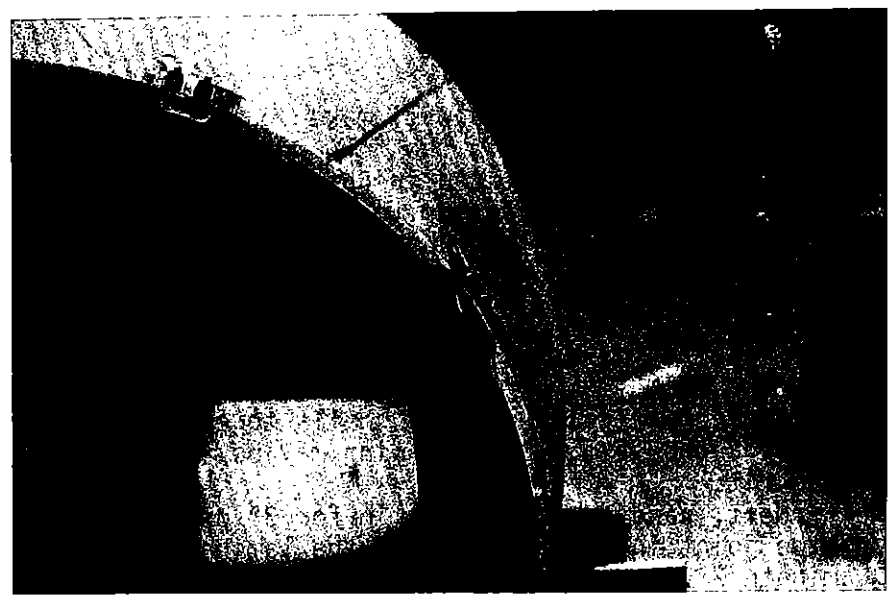


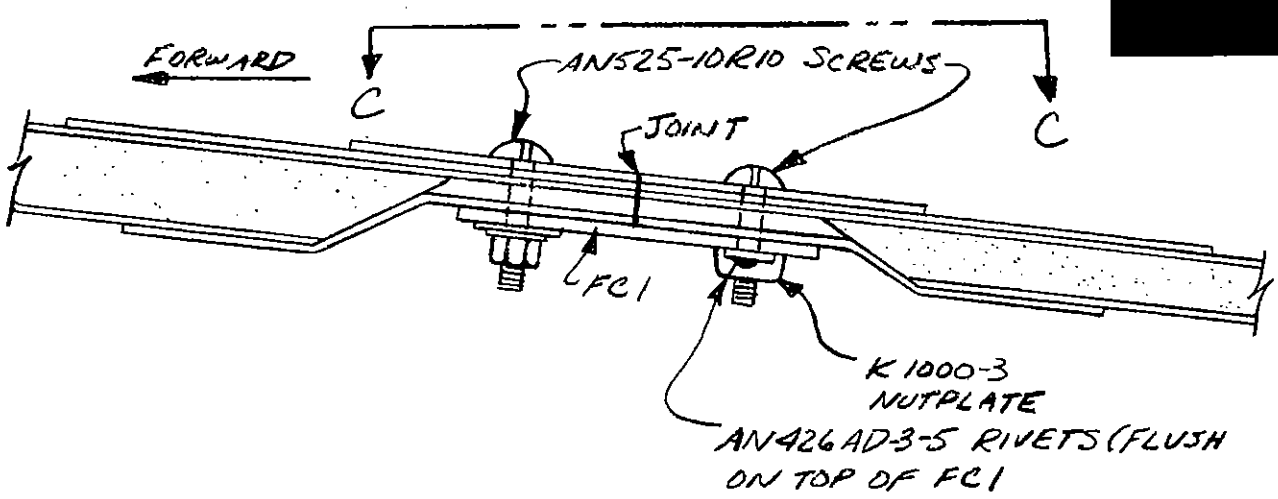
FASTENER INSTALLATION

Make 10 of FC1 and 2 of FC2 using the full size patterns provided. Attach the 10 FC1's to the forward fuselage at the 10 locations using AN525-10R10 screws. (2 per fasterner).

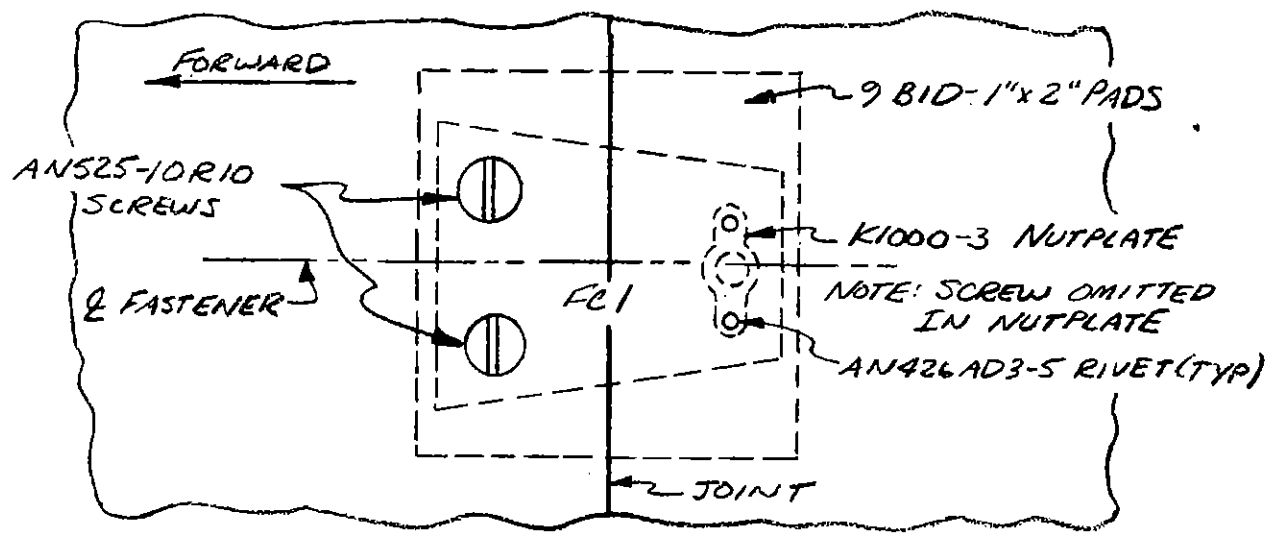
Jig the rear fuselage shell into position flush against the forward fuselage shell using a few dabs of Bondo. By shining a light inside the fuselage at each fastener location in order to see each FC1, drill in the #12 holes (10 locations) for the K1000-3 nutplates. Mount the nutplates to the FC1 fasteners with AN426AD-3-5 rivets, countersinking them flush from the side of FC1 next to the pads.

Install the AN525-10R10 screws (10 locations) to complete the assembly. That is all there is to it.





VIEW B-B



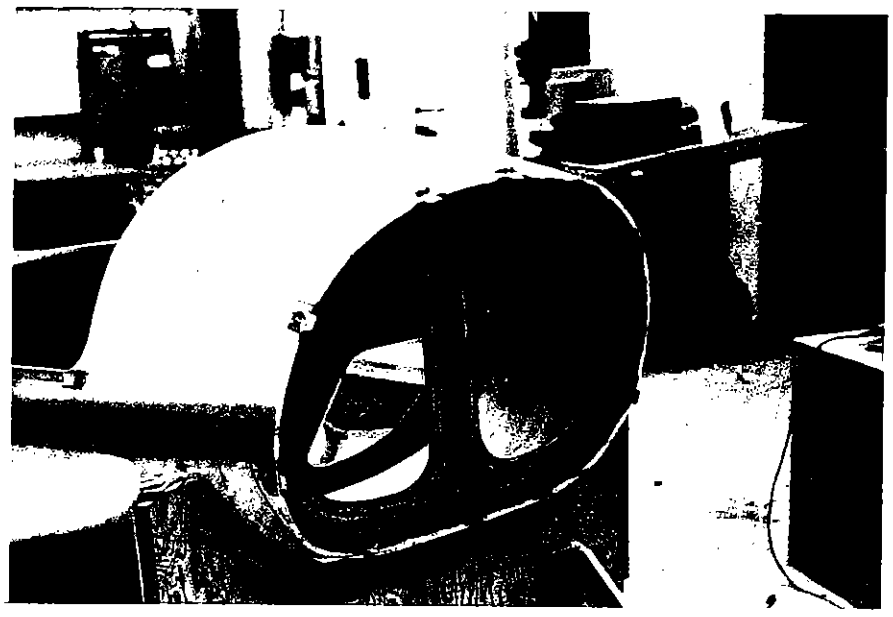
VIEW C-C

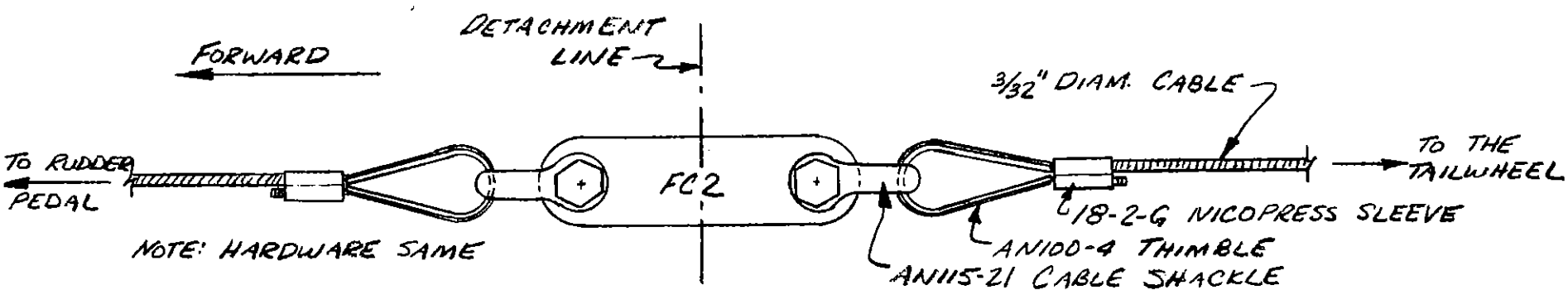
RUDDER CABLE DISCONNECTS

In order to complete making your Q2 trailerable, it is necessary to make quick disconnects for the two rudder cables running aft from the rudder pedals to the tailwheel. A simple method is shown here. To disconnect the cables, remove one of the AN3-5A bolts from each side.

In practice, to remove the rear fuselage, remove the 10 screws in the aft fuselage shell. Next, pull the forward and aft fuselage shells apart using the slack due to the rudder pedals so that you can remove the AN3-5A bolts indicated above.

As a final note, if your Q2 has any antennas located in the aft fuselage, they too will need to have quick disconnect fittings.





RUDDER CABLE QUICK DISCONNECT

END OF CHAPTER

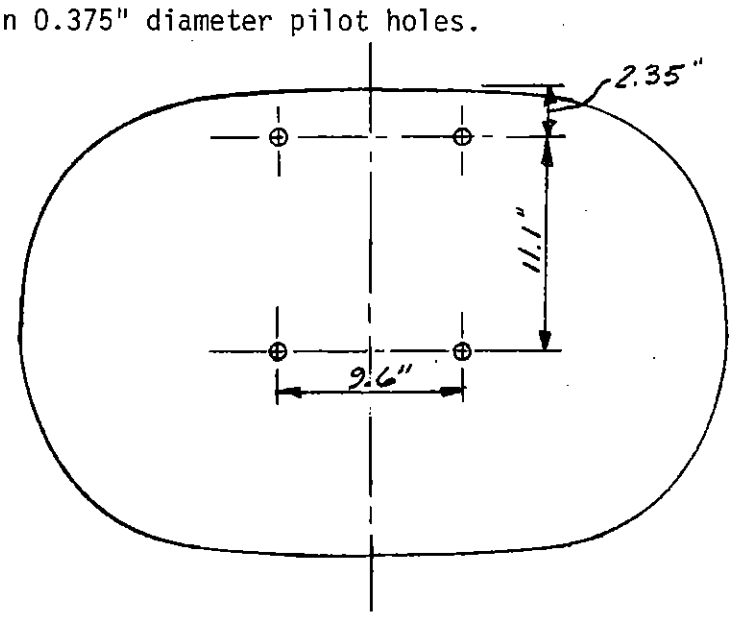
ENGINE INSTALLATION

ENGINE MOUNT INSTALLATION

Make 4 EM2 backup plates. A full size drawing is included.

Find the 4 Q2EM1 engine mount weldments. Use a AN6 bolt to stack each Q2EM1 to one EM2. Next, drill in 4 0.190" diameter holes in each Q2EM1/EM2 combination in the corners.

Using the sketch entitled 'Engine Mount Holes', locate the four hole locations on the firewall and drill in 0.375" diameter pilot holes.

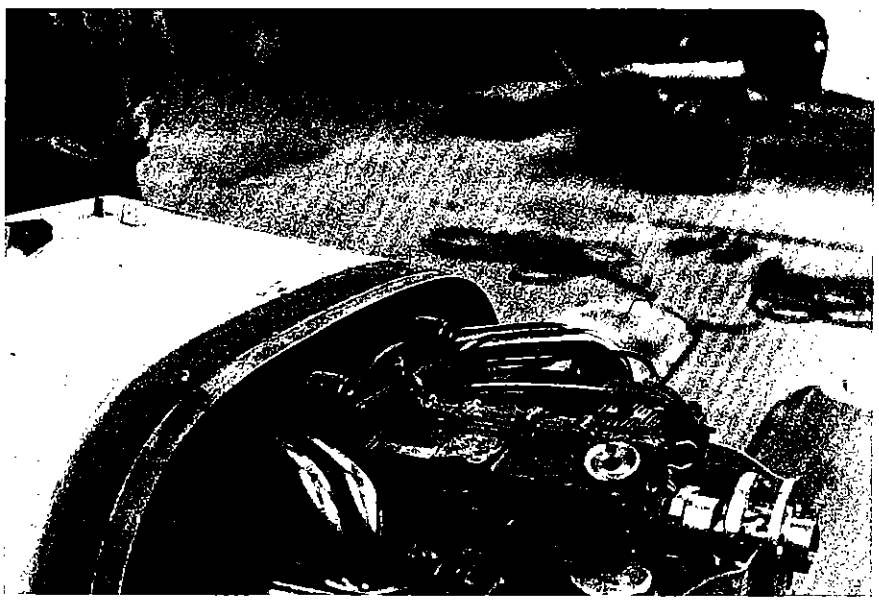


ENGINE MOUNT HOLES

Next, drill in the engine mounts on the firewall by taking each Q2EM1 and using an AN6 bolt to stack the Q2EM1 to the firewall, and then drilling the 4 0.190" diameter holes per Q2EM1 through the firewall. Temporairily mount the EM2 backup plate as shown using some AN3 bolts so that the engine may be temporarily mounted on the firewall.

PRELIMINARY ENGINE MOUNTING

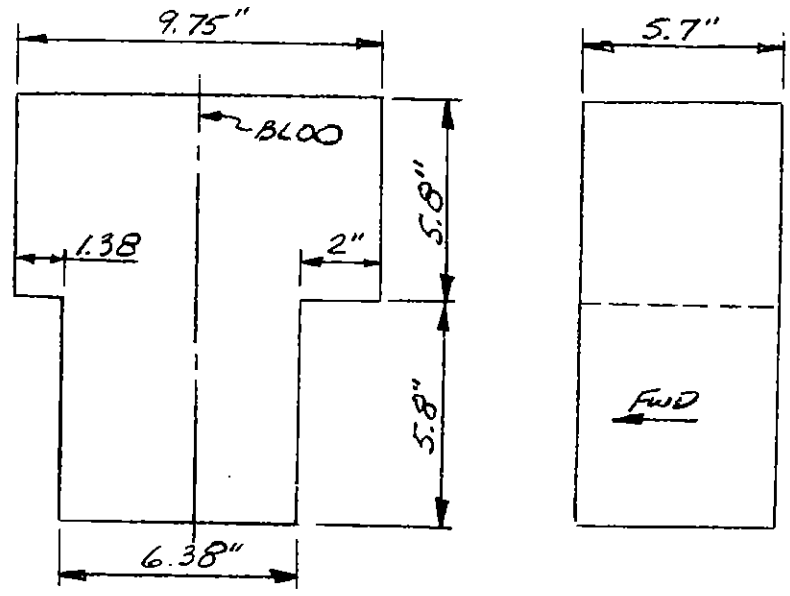
The purpose of this section is only to establish the size of the cutout in the firewall to clear the magneto and starter assemblies. Skip ahead to the section on "Magneto/Starter Box" to understand what the final shape and size must look like. Then, open up a hole in the firewall just large enough to clear everything. During the next section, you will make the final hole. Once the hole has been sized, remove the engine.



MAGNETO/STARTER BOX

On the Q2, the starter and magneto section of the engine projects aft of the firewall into a plywood box. This box is 9 sided and constructed from 1/8" thick plywood. It has the inside dimensions shown. These dimensions are rather critical, so follow them closely. Use a few dabs of 5-MIN to hold the 'jigsaw pieces' together and laminate 1 BID on both the inside and outside of the box.

Enlarge the previous cutout in the firewall until the box will just fit through it. Attach the box permanently using 2 BID tapes on both sides of the firewall. Verify that the magneto/starter accessories will fit within the envelope of the box.



MAGNETO/STARTER BOX

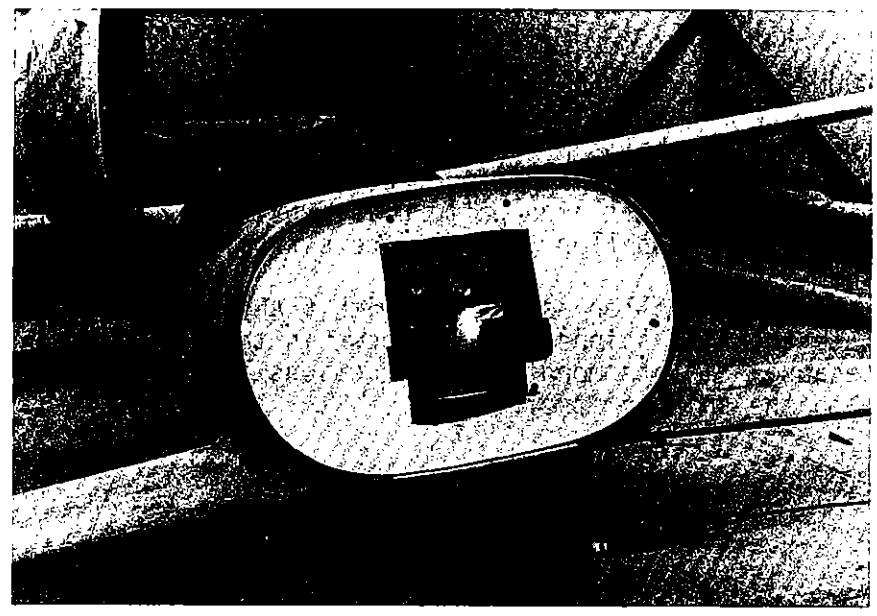
NOTE: All Dimensions are "inside" dimensions

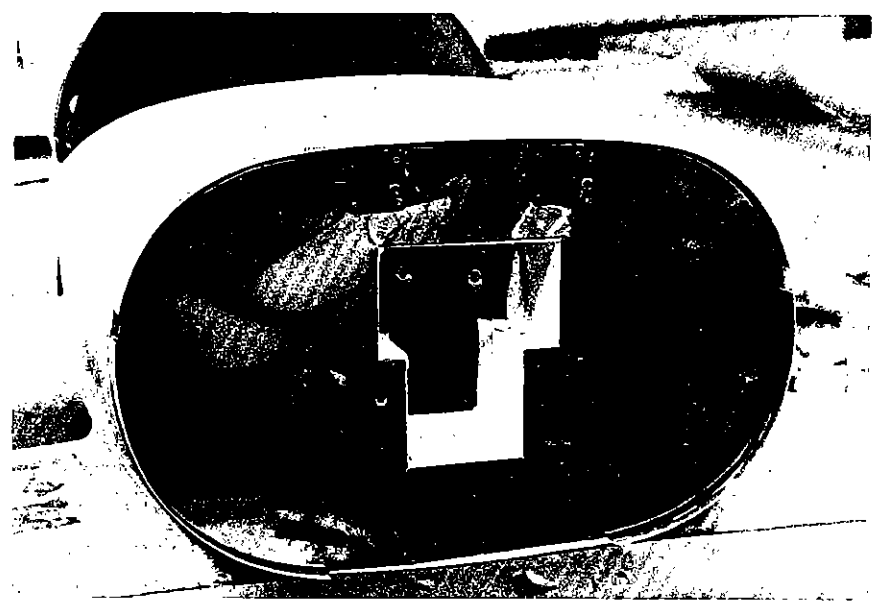
FIREWALL PROTECTION

Prior to mounting the engine permanently to the airframe, it is necessary to shield the firewall with fiberfrax and aluminum sheet.

One layer of fiberfrax must shield all exposed plywood, including the inside of the magneto/starter box. To protect the fiberfrax from abrasion due to normal wear and tear, a thin sheet of aluminum is fastened over the fiberfrax. However, the aluminum sheet does not need to be placed over the fiberfrax protecting the magneto/starter box; you may choose to use 2 layers of fiberfrax wherever a sheet of aluminum is not used.

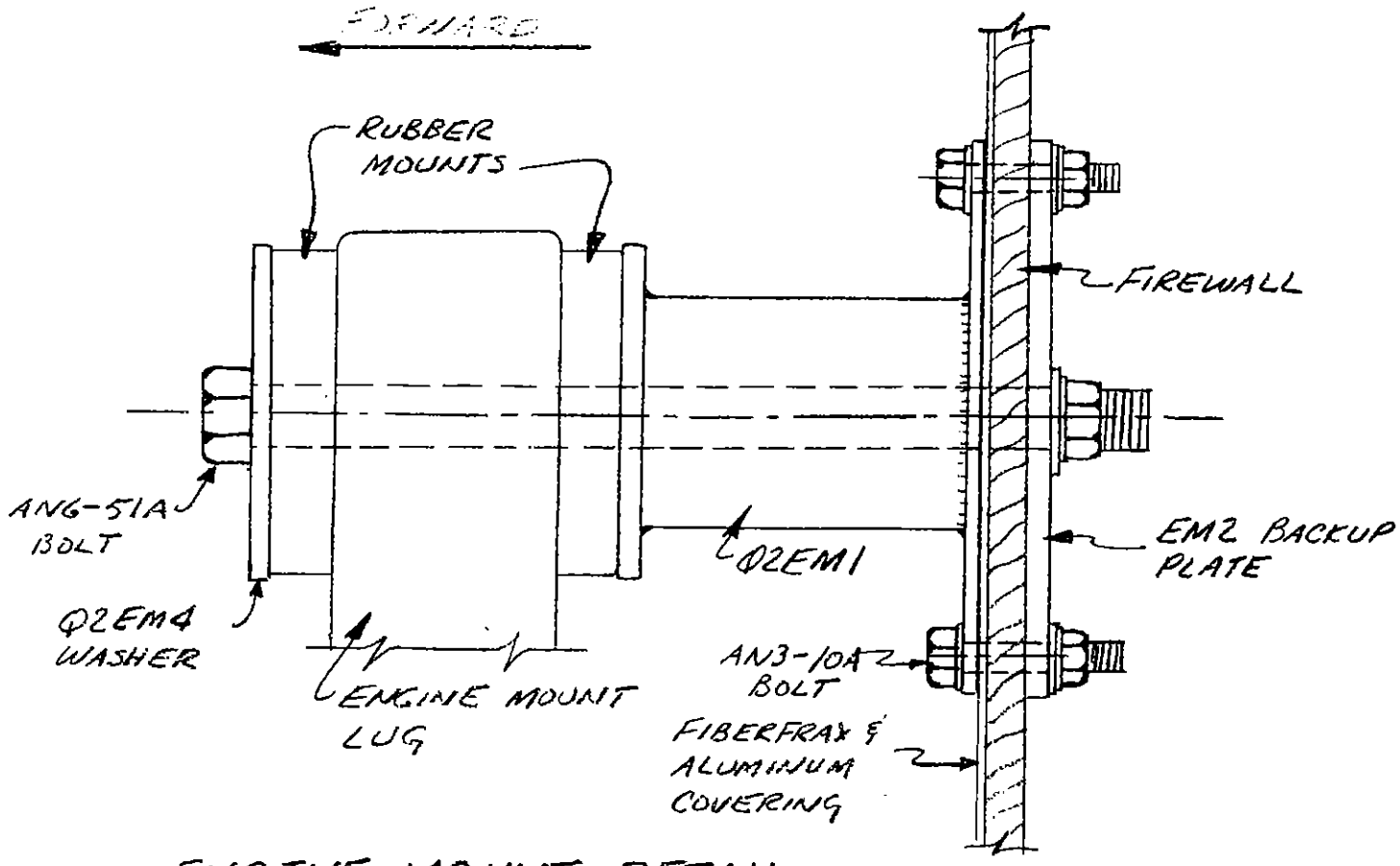
The fiberfrax may be held in position with epoxy. It is fragile, so be careful not to destroy it in handling. To attach the aluminum to the firewall, use a few BSP46 rivets located not closer than 2" to the outboard edge of the firewall. (The cowling flanges will be mounted there later.)





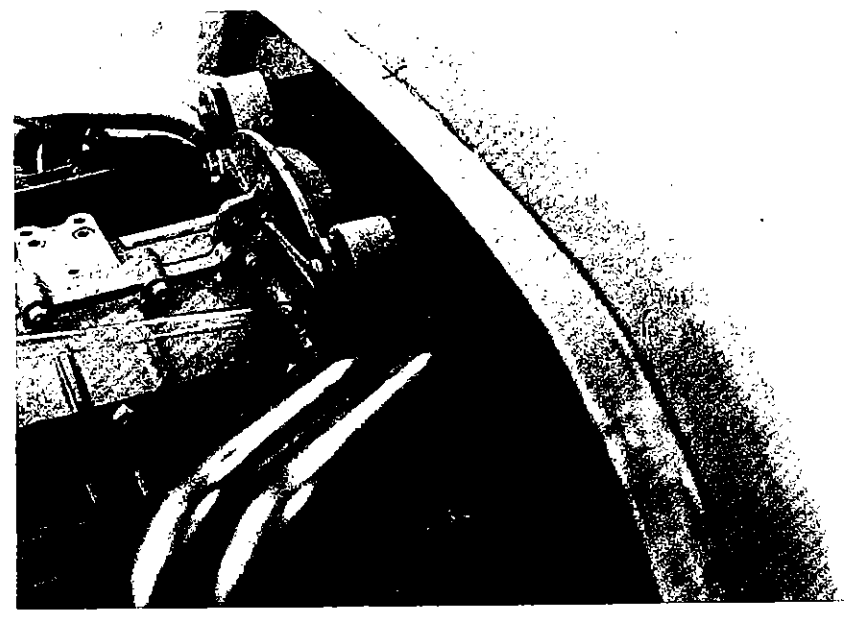
MOUNTING THE ENGINE

A typical engine mount assembly is shown in the sketches. Mount the engine permanently.



ENGINE MOUNT DETAIL

(TYP 4 PLACES)

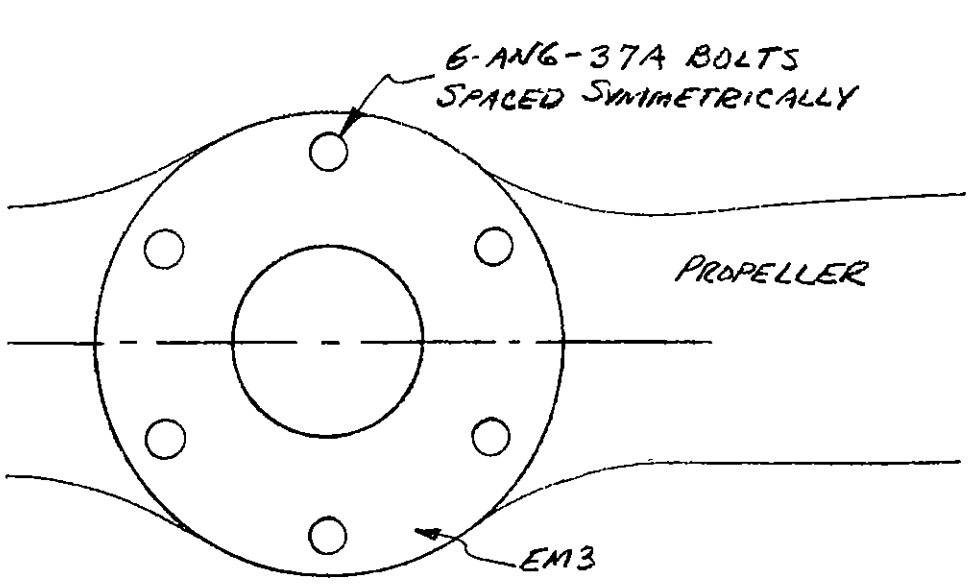


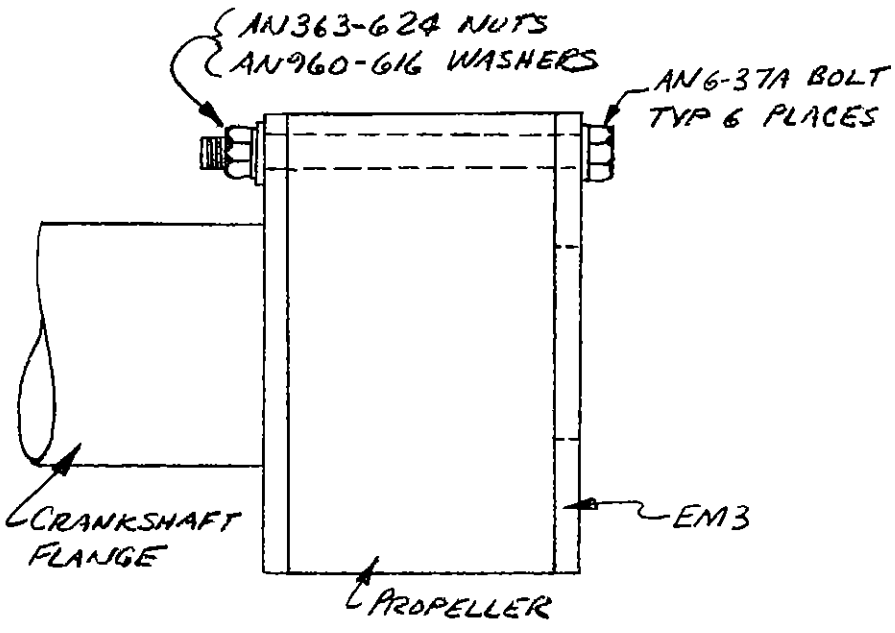
MOUNTING THE PROPELLER

The propeller is delivered to the builder with the mounting holes predrilled.

Make EM3 from a piece of 0.25" thick 6061T6 Aluminum. A full size pattern is provided. Use the predrilled propeller to drill the six bolt holes in the EM3.

The propeller is mounted with 6 AN6-37A bolts. Note that the spinner is not shown in the illustrations because complete mounting instructions are included with the spinner itself.





PROPELLER MOUNTING

NOTE: Spinner not shown but should be mounted at same time as prop.

COWLING FLANGE CONSTRUCTION

In this section, you will make the flange that attaches the cowling to the firewall. This flange will fit around the entire circumference of the firewall.

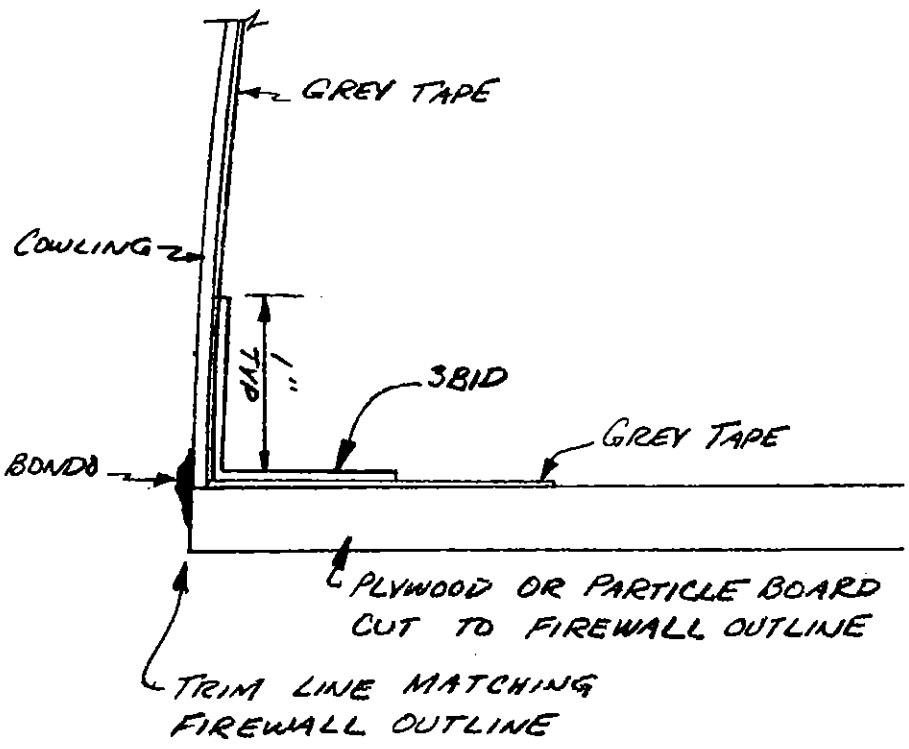
First, use masonite, scrap plywood, or particle board to make an accurate template of the firewall. This template will allow you to form an accurate flange that will produce an excellent fit on the cowling.

Bondo the cowling to the template at the outside edge, so that the cowling is draped like it will be when mounted on the firewall. It is necessary to do only one-half of the cowling at a time.

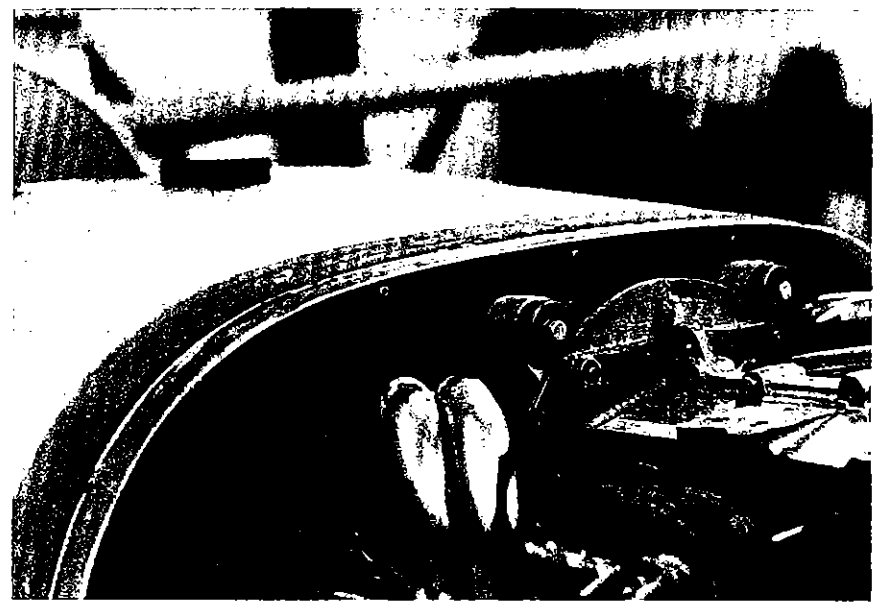
Next, using grey tape, protect two inches of the inside cowling skin and 2" of the template inside surface, as shown. Laminate a 3 BID flange around the inside joint, overlapping 1 inch onto the inside cowling skin and the inside template surface. Allow to cure thoroughly to prevent future warpage.

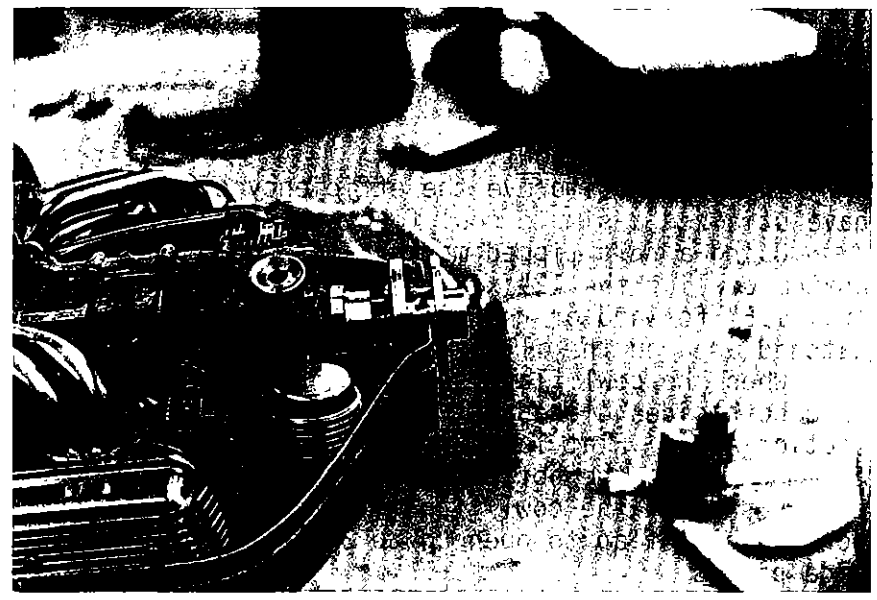
Repeat the process with the other half of the cowling.

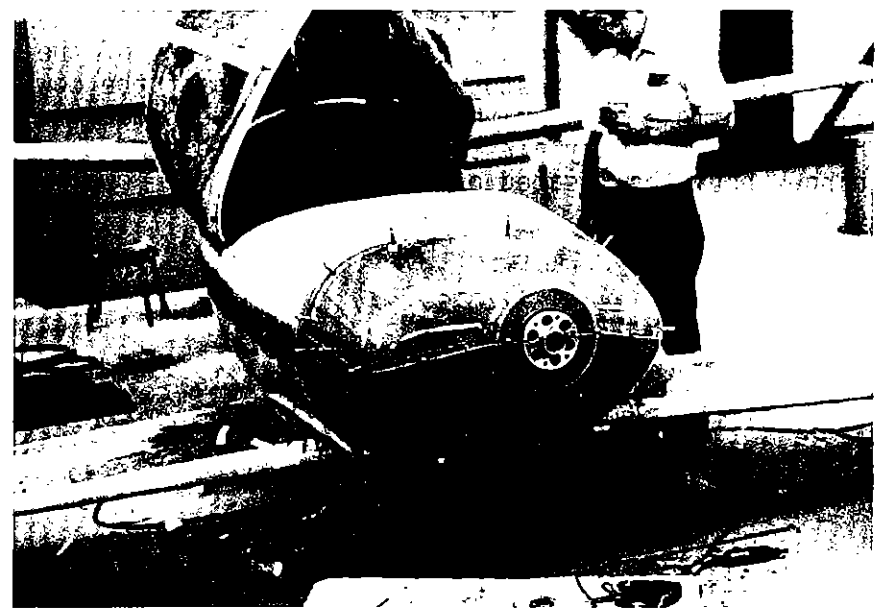
Remove the flanges from this simple "mold" and clean off the grey tape from the cowling.



COWLING FLANGE CONSTRUCTION







TRIMMING THE COWLING

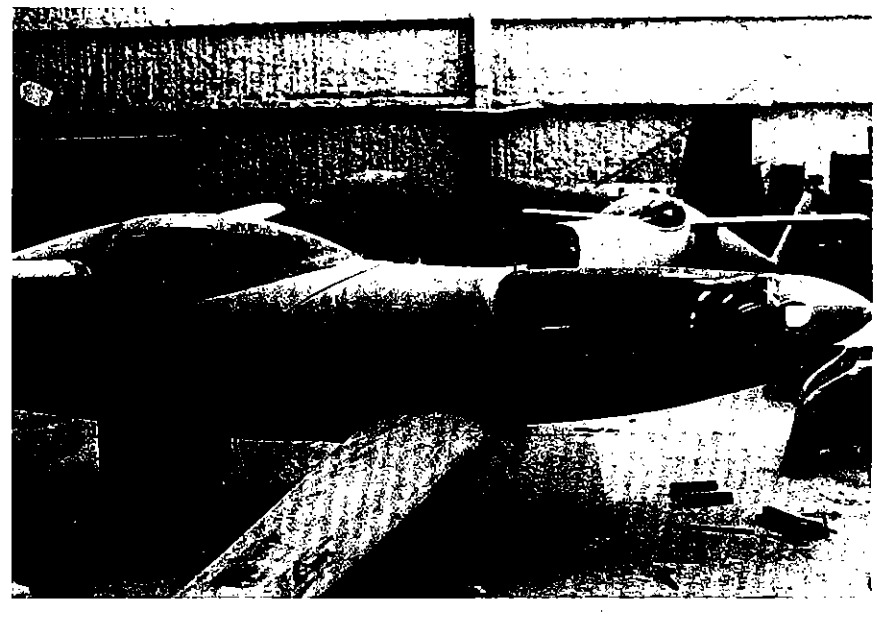
The cowling is shipped to you preformed and rough trimmed to size. Final trimming can only be accomplished with the engine mounted on the airframe and the propeller spinner available for fitting. Do not proceed further until that has been accomplished.

Previously, you fabricated two cowling mounting flanges, one for the top cowling half and one for the bottom cowling half. Locate these two flanges.

It will be necessary to cut a hole in the nose of the cowling for the crankshaft to pass through. The hole should clear the crankshaft by only 1/4" to minimize air leakage.

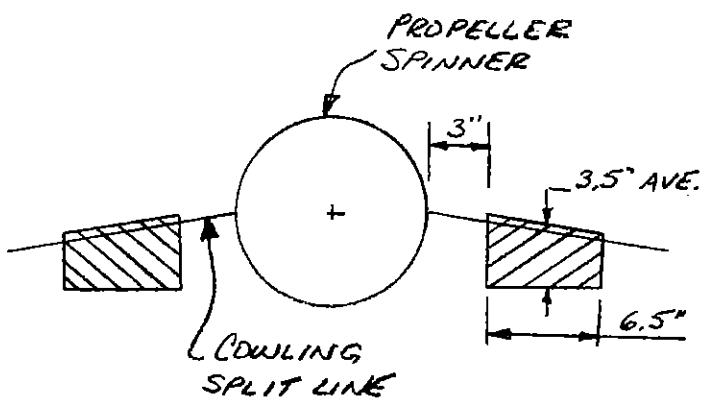
The fitting of the cowling is a trial and error operation. By fitting the spinner to the crankshaft flange, you can determine the necessary cowling length to allow only a 1/16" gap between cowling and spinner. Obviously, the cowling is trimmed as necessary on the aft face. Once the length has been arrived at, it is necessary to mount the cowling mounting flanges using BSP46 rivets on about a 3.5" spacing. The flanges are located so that the cowling will fit flush with the fuselage after mounting. The rivets holding the flanges also serve to mount the fiberfrax and aluminum sheet to the firewall.

Some trimming of the junction of the two cowling halves may be necessary to achieve a best fit.



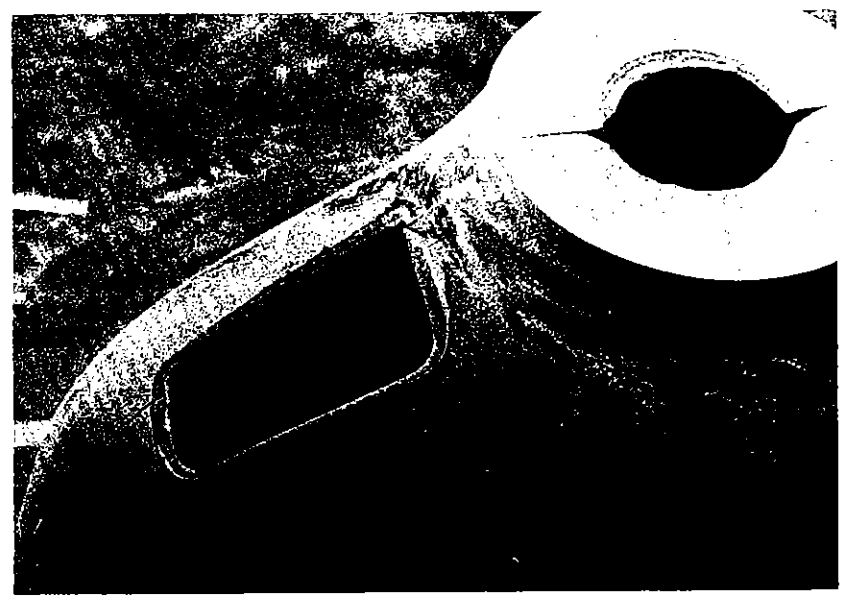
COWLING AIR INLETS

The cowling air inlets can now be cut into the cowling. They are nominally each 3.5" x 6.5" in size, with a 3/8" radius (using Bondo) around the lip. A sketch is included for reference.



COWLING AIR INLET
(FRONT VIEW)

NOTE: RADIUS LIPS 3/8" WITH BONDO



COWL FLAP CONSTRUCTION

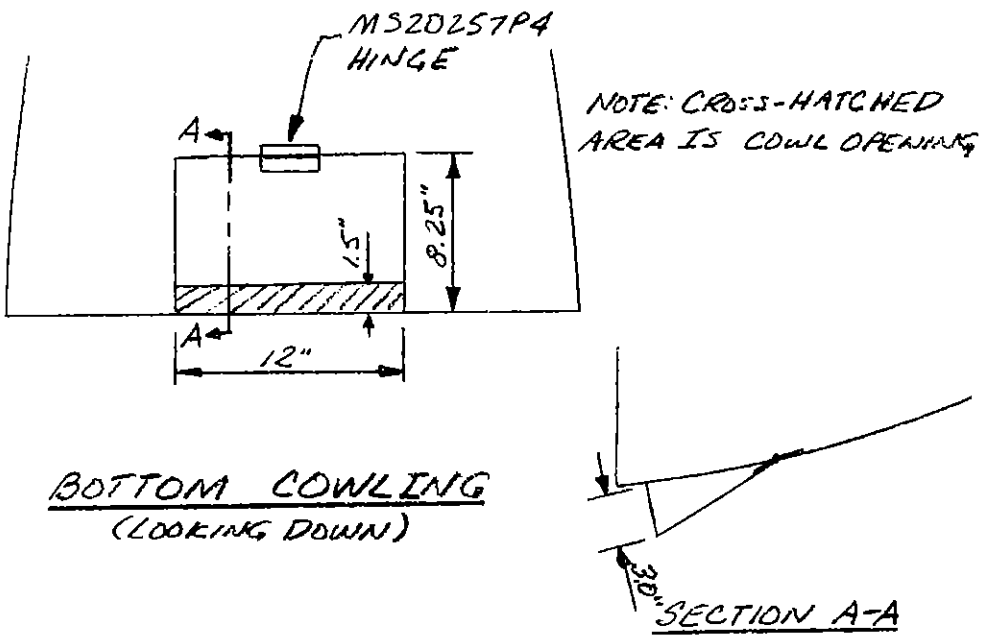
In order to improve the efficiency of your Q2, we have utilized a simple cowl flap.

Using a felt tipped marker, mark on the inside bottom cowling the 12" x 8.25" outline of the cowl flap. Trim 1.5" forward of the aft edge to remove the cross-hatched area on the illustration.

When the cowl flap is opened, it is necessary to have both sides closed off, like a dustpan. (See Section A-A). Flat laminated fiberglass (4 plies) is trimmed to fit the bottom cowl curvature and bonded to either side of the cowl flap with 2 BID. Allow room for the cowl flap to open up to 3.0" when making these side pieces.

Carefully cut out the cowl flap from the lower cowling. Smooth up all rough edges.

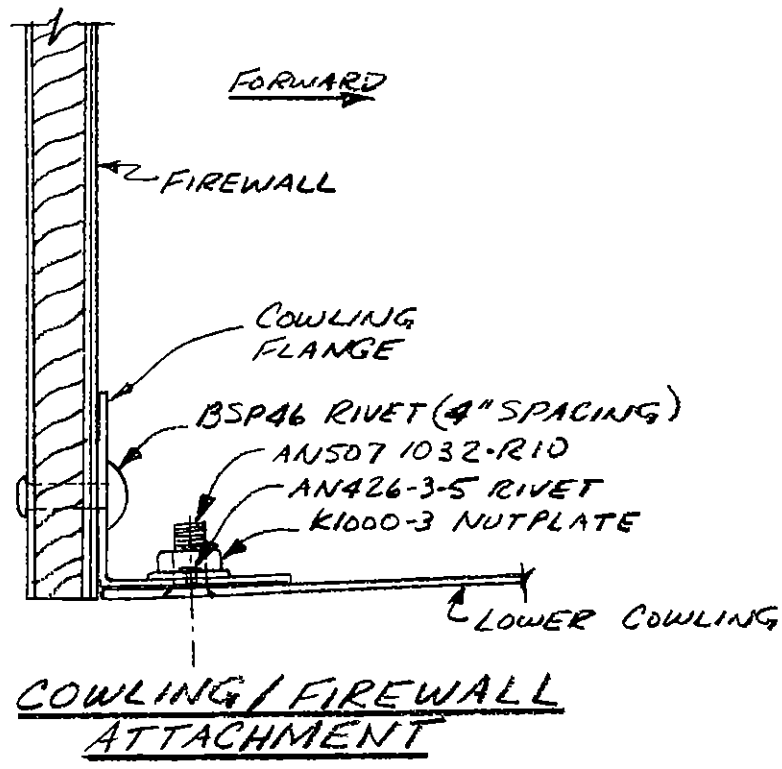
A short piece of the MS20257P4 hinge is used to hinge the cowl flap. It is located with 8 BSP42 rivets. To seal the remaining gap at the leading edge of the cowl flap, rivet asbestos along the width of the cowl flap with more BSP42 rivets, to form a secondary hinge and a primary air seal. The asbestos and the hinge should be located on the inside of the lower cowling.



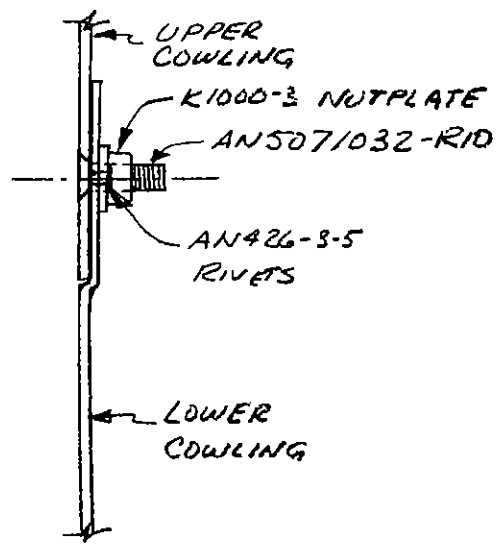
BOTTOM COWLING
(LOOKING DOWN)

MOUNTING THE COWLING

The cowling is mounted permanently using K-1000-3 nutplates and AN507 1032-R10 screws using an approximately 4" spacing. The nutplates are secured using AN426-3-5 rivets. Take time to accurately mount the cowling halves and you will be rewarded with an excellent fit.



COWLING / FIREWALL ATTACHMENT



UPPER/LOWER COWLING ATTACHMENT

CABLE GUIDES

Every push-pull cable except the carb heat control uses a cable guide to provide positive control of cable movement. Make up three cable guides as shown. The mounting bolt hole should be drilled upon assembly later.

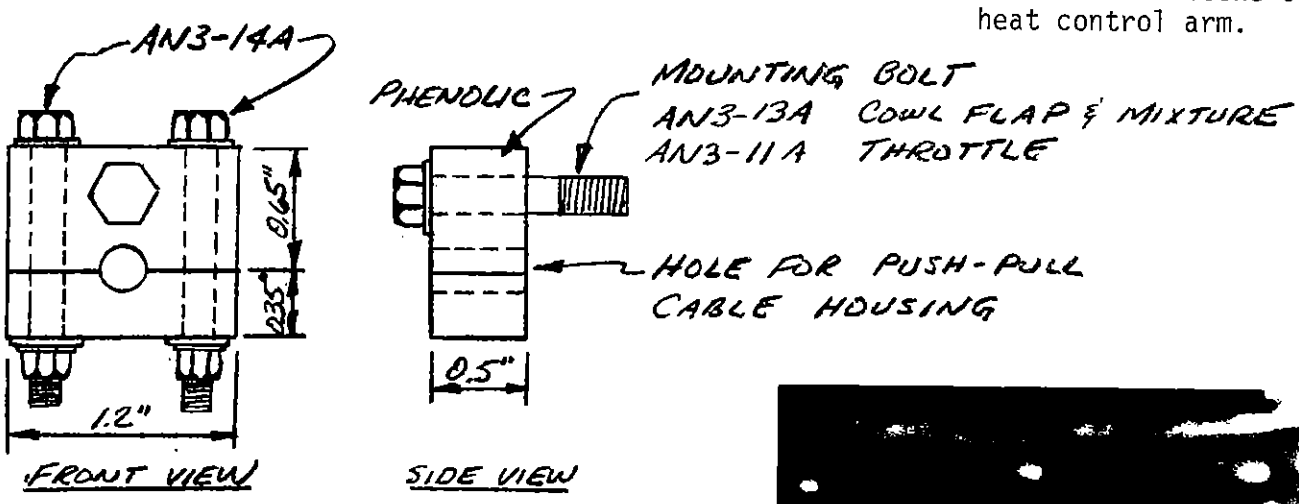
These cable guides function by sizing the hole that the cable housing passes through such that when the AN3-14A bolts are tightened, pressure will be exerted upon the cable housing, preventing slippage. Care must be exercised not to put excessive pressure on the housing, which might damage the cable.

Throttle cable: rivet a piece of the 3/4" x 3/4" x 1/16" aluminum angle to the oil cooler mount, as shown, using BSP42 rivets. Don't rivet through the oil cooler! Then, attach the cable guide and install the throttle cable. A sketch is included to assist you in hooking up the throttle cable to the throttle body arm.

Cowl Flap cable: bolt the cable guide to the firewall such that it can assist the cowl flap actuation. A sketch is included showing the arm on the cowl flap and attachment of the cable.

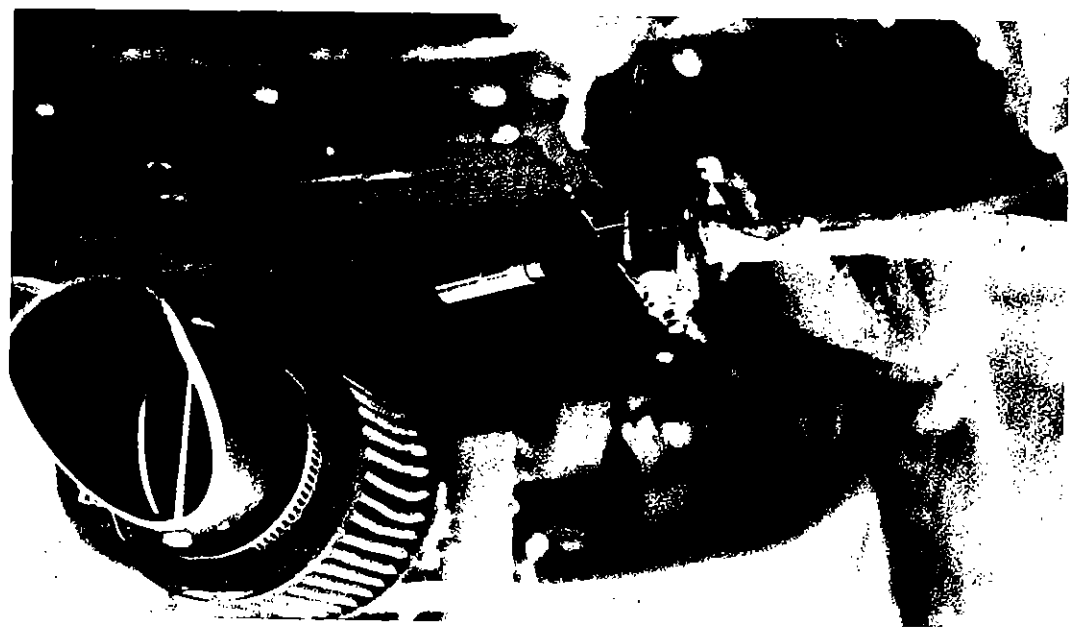
Mixture control cable: again bolt the cable guide to the firewall so that the mixture control can be actuated.

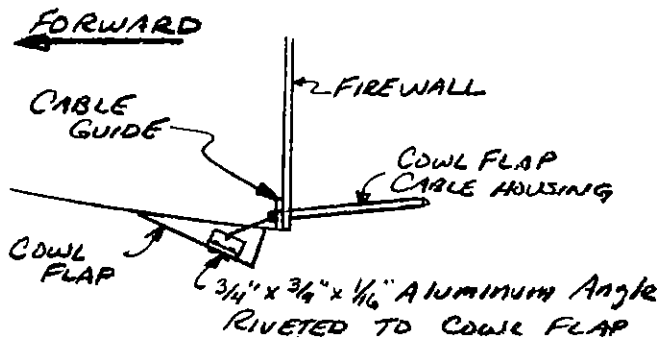
Carb heat: this control is potted into the firewall with silicone or 5-MIN and attached to the carb heat control arm.



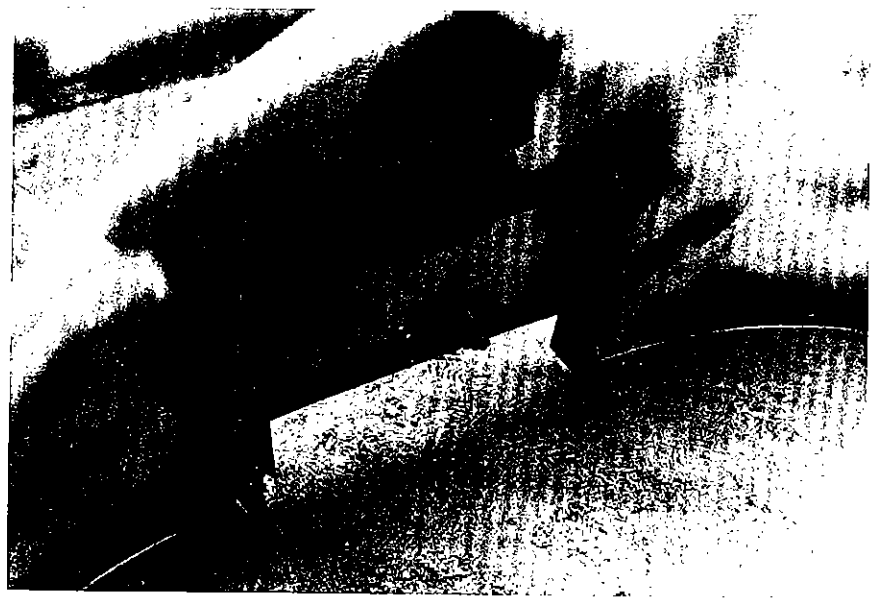
PUSH-PULL CABLE GUIDE

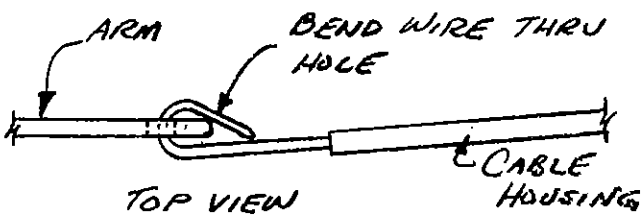
MAKE 3



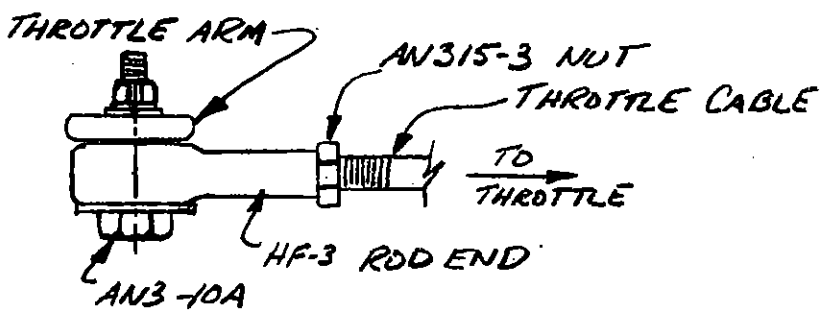


COWL FLAP ACTUATION





TYPICAL CABLE ATTACH
(EXCEPT THROTTLE)



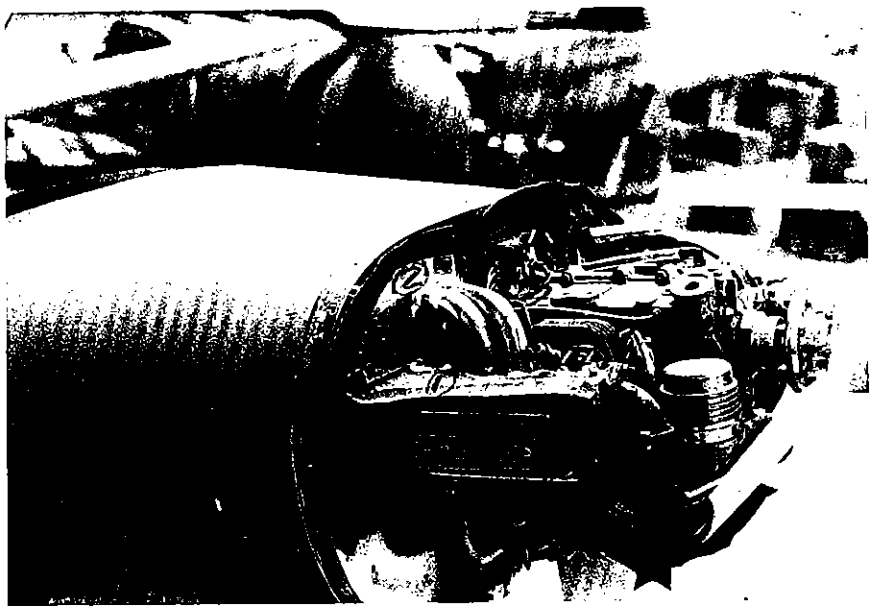
THROTTLE ATTACH

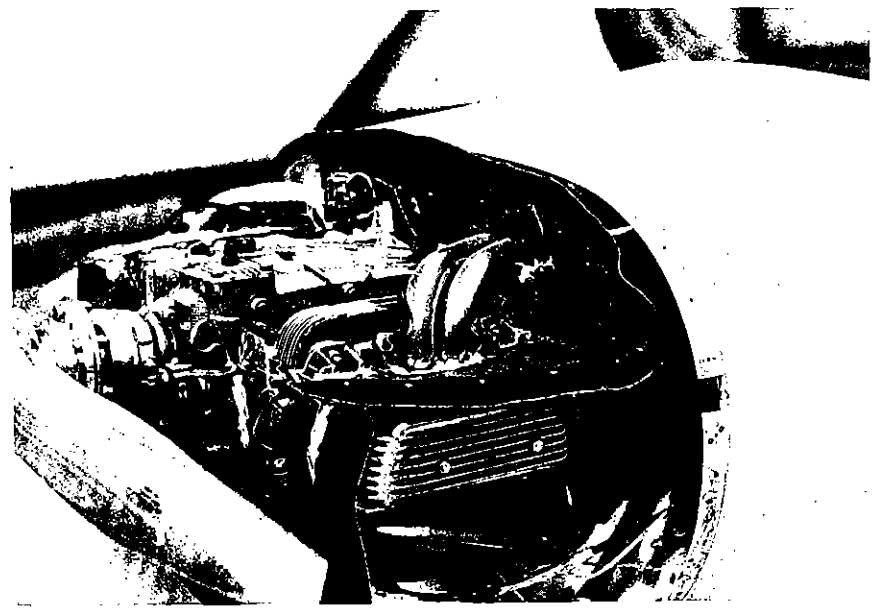
ENGINE BAFFLING

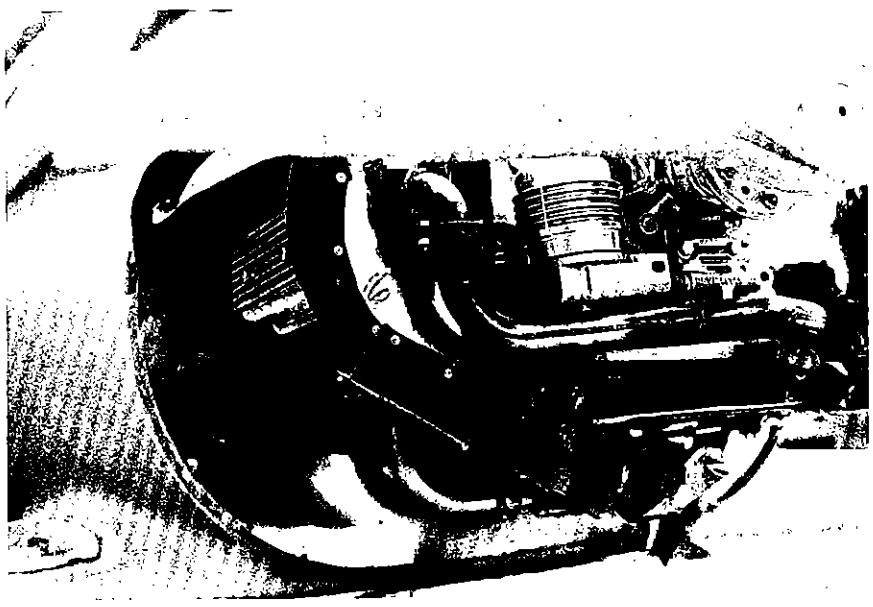
The purpose of the engine baffling is to provide adequate airflow for cooling to all critical areas of the engine and accessories. Air enters through the cowling air inlets located on either side of the spinner. A vertical baffle located in front of the forward engine cylinders forces the incoming air to travel upward across the cylinders and then down through the fins, exiting the bottom of the cowling through the variable opening cowl flap. Another vertical baffle located just aft of the rear cylinders assists in forcing the air down through the cylinder fins. Likewise, baffling between the cylinders and the sides of the cowling performs the same function. An opening in the forward vertical baffle allows airflow into the oil cooler. Once having passed through the oil cooler, this air mixes with the spent cylinder fin air to exit through the cowl flap.

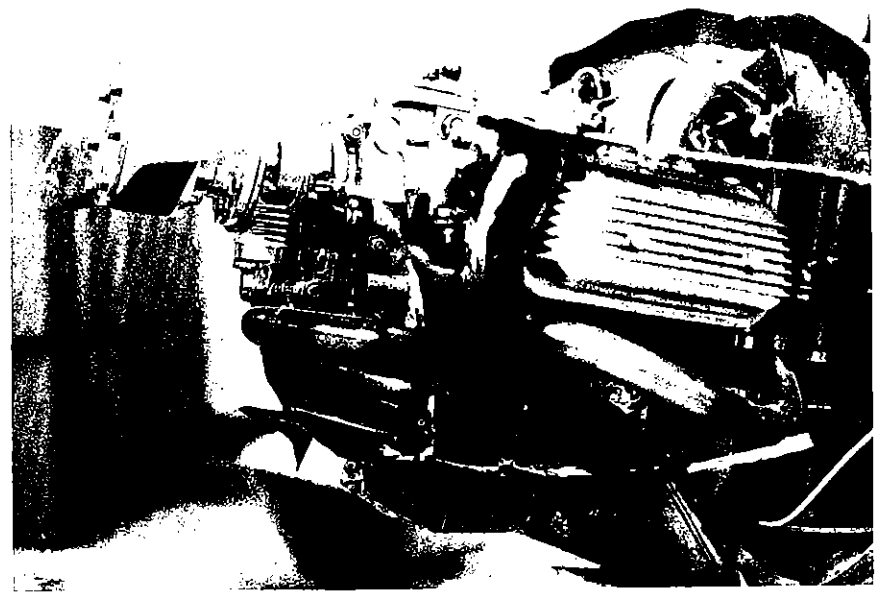
Aluminum with an 0.032" thickness is the primary baffle material. Approximate full size patterns are provided. However, there is no easy way to fit baffling around the complex shape of the engine. Areas of leakage must be closed off with aluminum in the case of large holes, and silicone in the case of small leaks. The black rubber asbestos is used between the aluminum and the cowling to provide a close fit when the cowling is installed. Pop rivets (BSP42) are used to join the pieces of baffling and asbestos together. Small angles can be bent up from the 0.032" thick aluminum to attach the baffles to bolts on the engine painted red. In this manner, the baffling will be removable.

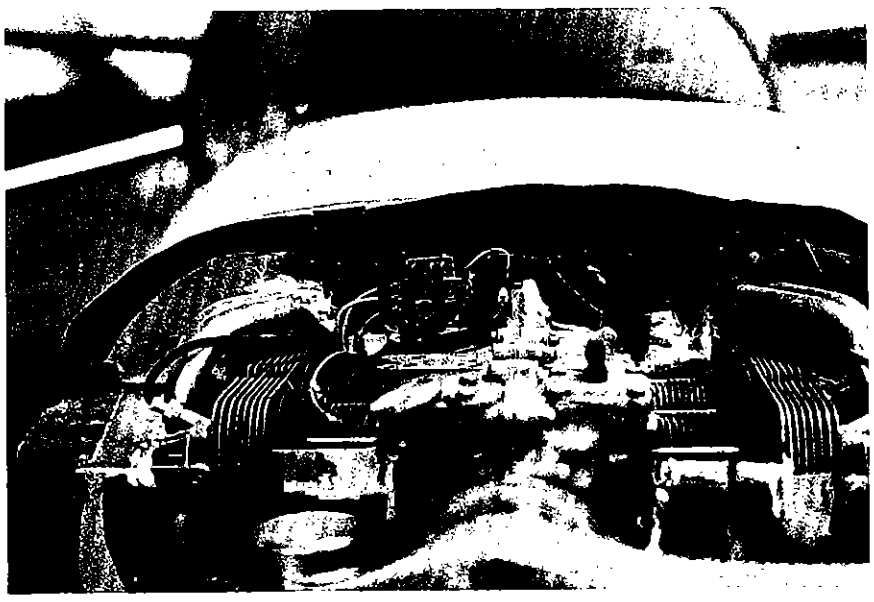
Baffling can easily consume 10 manhours of work, so don't hurry. Inadequate cooling is a major factor in many homebuilt aircraft engine problems.

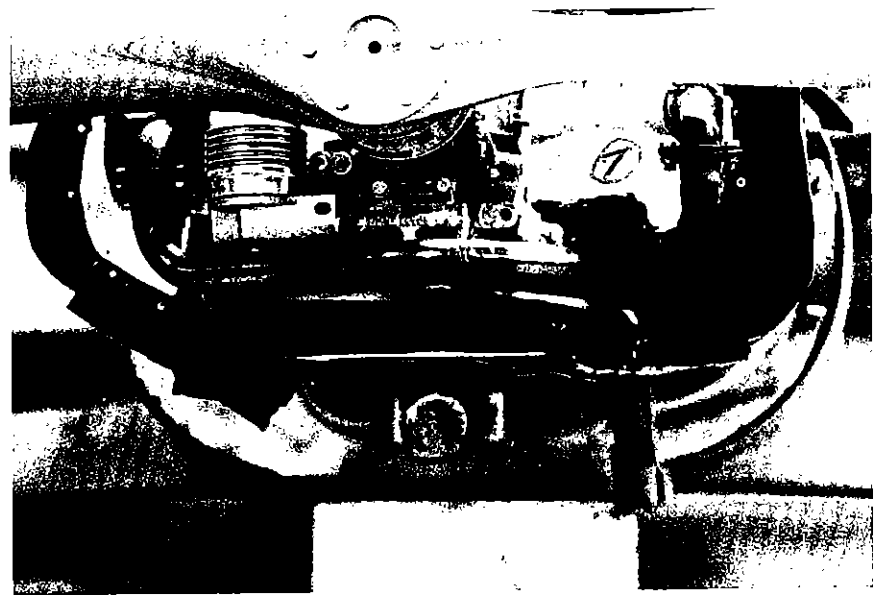












END OF CHAPTER

FUEL SYSTEM INSTALLATION

INTRODUCTION

The Q2 fuel system consists of a main fuel tank that forms part of the seat, and a fuel header tank positioned above the passengers' legs. The carburetor receives fuel by gravity feed from the header tank. The header tank is filled from the main fuel tank by an electric fuel pump, with a manual fuel pump as a backup. An overfill line in the header tank continually recirculates the excess fuel pumped by the fuel pump back to the main fuel tank. Each tank has a seperate fuel gauge. In the event of a complete fuel pump failure, a full header tank is sufficient for over 225 statute miles at economy cruise. The main fuel tank is filled from a fuel cap located on the right side of the fuselage just ahead of the instrument panel. The header tank can only be filled using the fuel pump.

FUEL FILLER SYSTEM

Provided with your Q2 kit is a small storage bottle. By cutting the neck from this bottle, the upper part can be used as the fuel cap. The storage bottle top is compatible with fiberglass/epoxy laminates. As an option, the builder might consider using a conventional aluminum fuel cap, but the mounting will be more difficult.

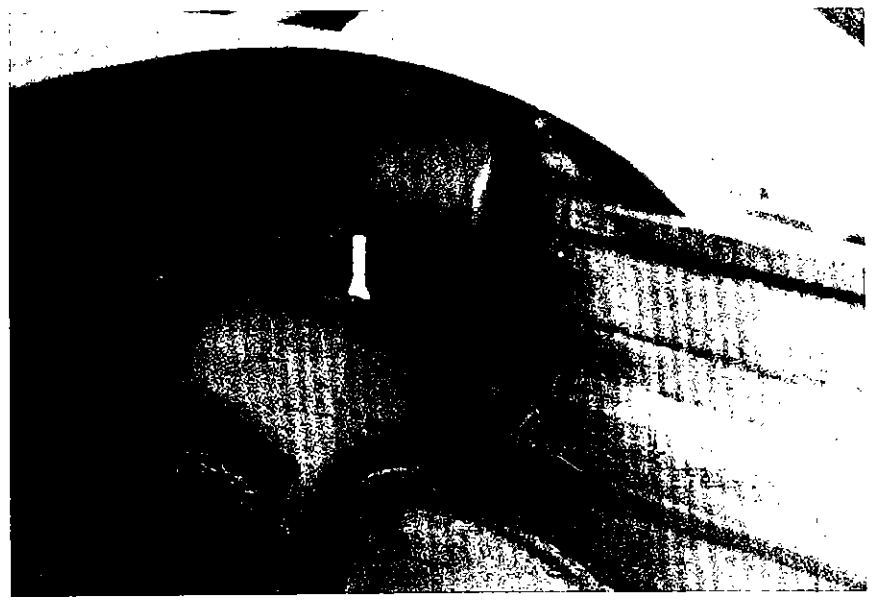
Once the top of the bottle has been cut off, trundle down to your nearest plumbing supply place and find a piece of PVC pipe of approximately the same diameter. Then, trundle back home and laminate the storage bottle neck to the PVC pipe with 2 BID. Be sure to sand both surfaces prior to the lamination.

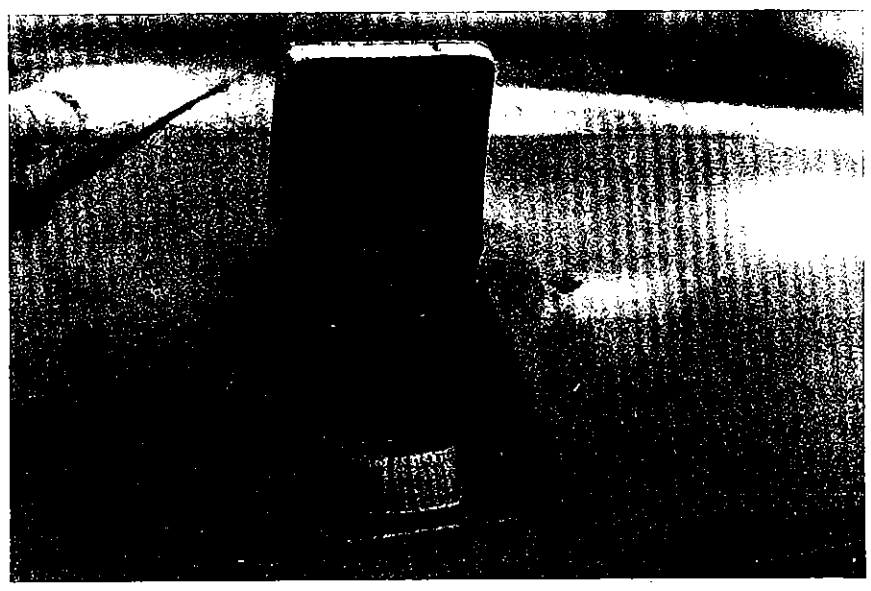
Take a magic marker and mark the location on the outside fuselage skin where the fuel filler door must go. Carefully, cut out a door and save it for later. Next, make a recess for the fuel cap from 1/4" white foam and fiberglass/epoxy.

As shown in the sketches and pictures, the PVC pipe is bonded into position with flox. The recess prevents spilled fuel from entering the cockpit.

To hinge the fuel cap door, you could use a small piece of hinge and bond it in place. However, because of the fuselage shape, this may not be satisfactory. An alternative is to make a small pin type hinge. Find a small diameter (about 1/16" diameter) steel rod. Grease it with vaseline to prevent adhesion by the epoxy, and lay it flat against the upper inside portion of the fuel cap door. Laminate 3 BID over it. When cured, the pin will still be able to rotate, but will be restrained by the cured laminate. Finally, fit the door carefully and bond the ends of the pin to the fuselage on either side of the fuel cap door cutout. Presto, a hinged fuel cap door.

Finally, drill a 1/16" diameter hole in the top of the fuel filler cap. This will serve as the main tank vent.





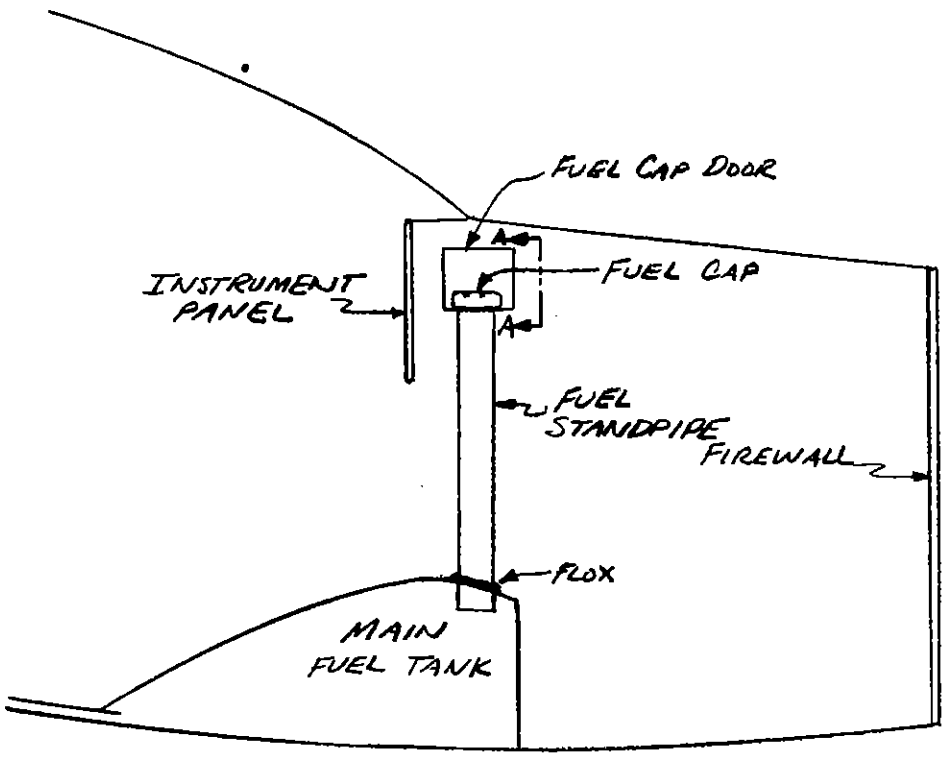
HEADER TANK CONSTRUCTION

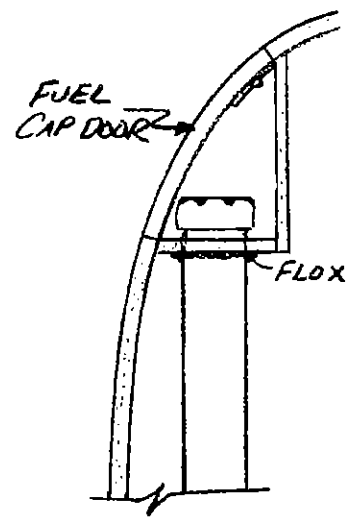
Previously, in Chapter 14, you have installed the main fuel tank permanently in the fuselage, along with the main fuel tank fuel gauge.

The important fuel header tank dimensions are shown in the accompanying drawings. This fuel header tank is installed against the upper fuselage inside skin approximately 5 inches aft of the firewall. Sufficient room must be left so that the pilot's and passenger's feet will clear the header tank.

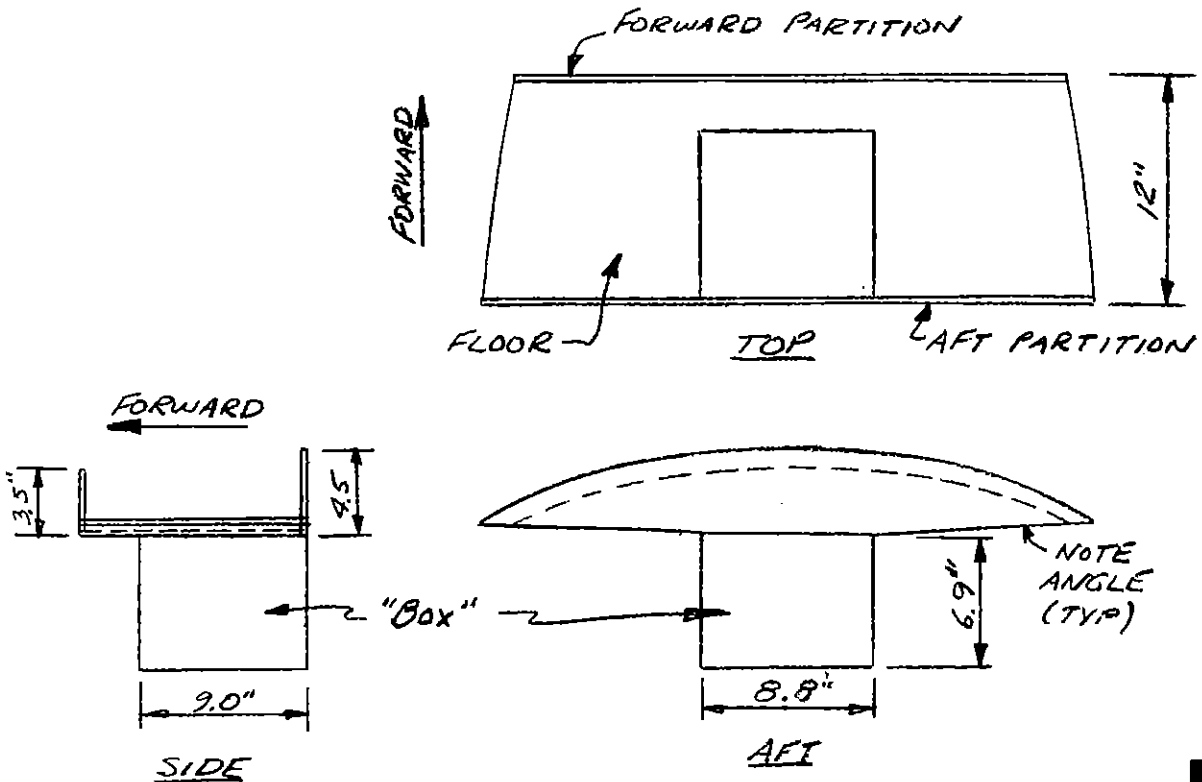
The large sump is a simple rectangular box. The upper portion of the header tank is curved to fit within the fuselage. This section must be custom fitted to each individual aircraft. Suggested heights for the front and rear pieces are provided as a guide. The length of 12 inches should provide sufficient clearance for the instrument panel radios and instruments. However, this header tank should be adapted to your particular aircraft, verifying that both the pilot and passenger can be comfortably seated.

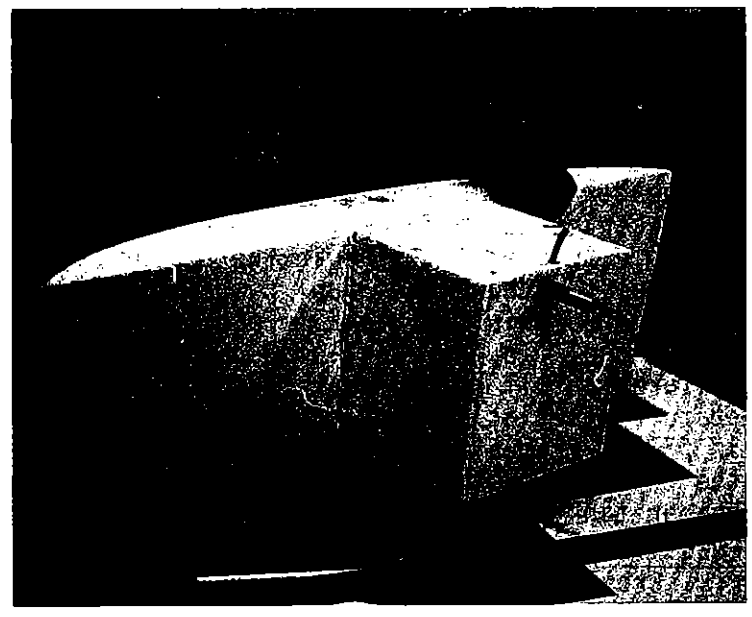
All pieces for the header tank should be cut from the 1/4" thick white foam. One BID on either side of the foam is used when assembling the header tank. The laminations that will 'see' gasoline, should be made slightly wet to minimize leakage.



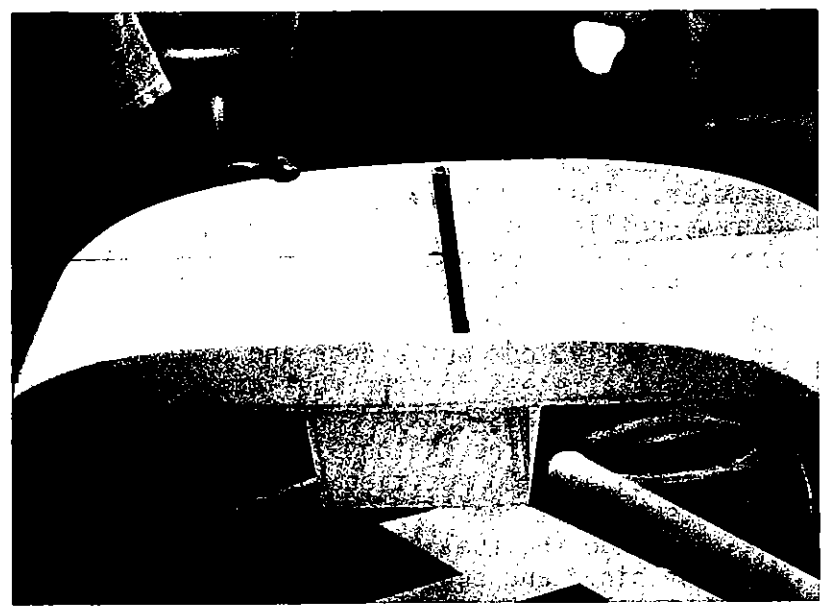


VIEW A-A





FUEL HEADER TANK LAYOUT

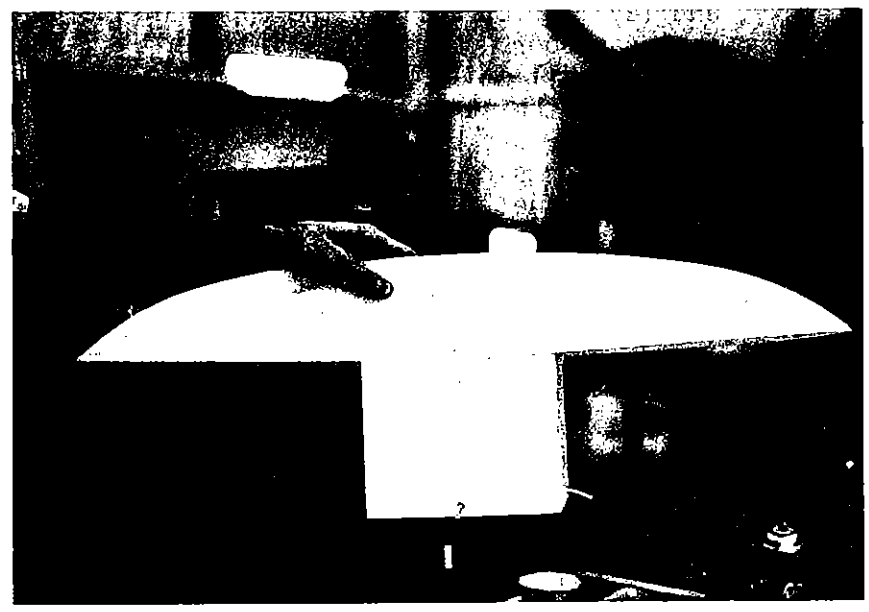


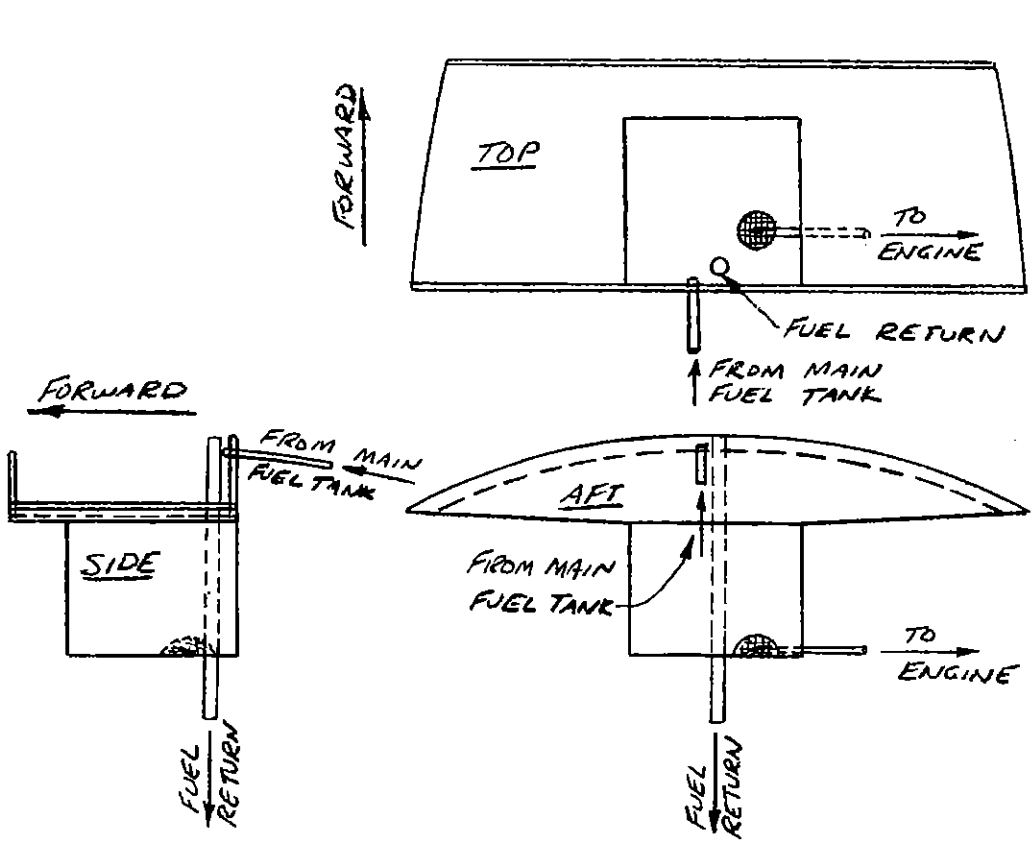
HEADER TANK PLUMBING

Prior to permanent installation inside the fuselage, the plumbing for the header tank should be installed. The accompanying drawing shows the location for all header tank plumbing. The fuel feed to the engine should be patterned after the main fuel tank feed shown on Page 14-3, including the screen and flox, but omitting the drain valve. Both the feed line from the main fuel tank and the feed line from the engine should be made from 1/4" O.D. Aluminum tubing. Allow the tubing to extend out from the header tank about 6 inches. Use liberal amounts of flox to seal the exit points.

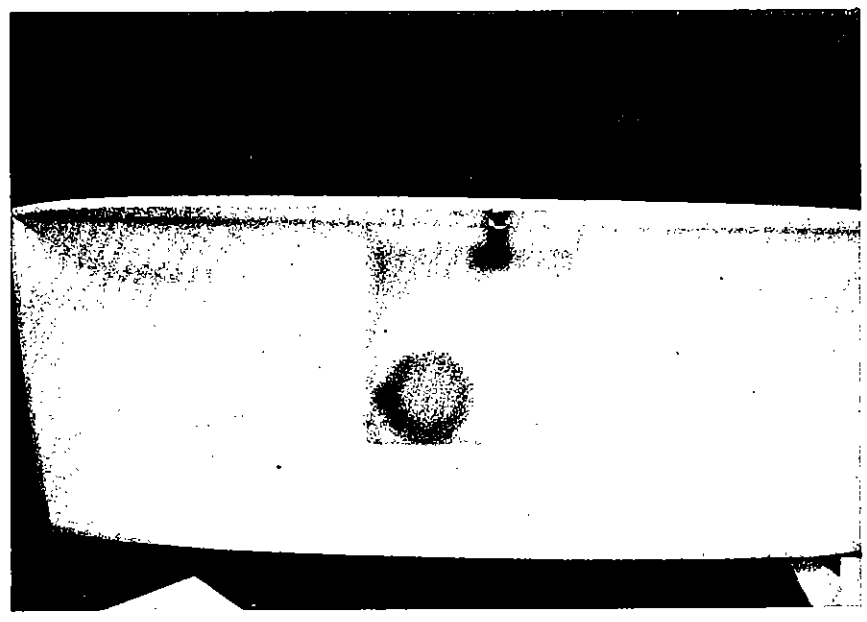
The fuel overflow return tube is made from 5/8" O.D. Aluminum tubing. It should extend to near the very top of the aft part of the header tank, in order to maximize the fuel capacity. Permit it to extend about 6 inches below the header tank, and seal the exit point with flox.

The routing shown for the plumbing is nominal, but will avoid interference.





HEADER TANK PLUMBING



HEADER TANK INSTALLATION

It is much easier to install the header tank prior to mounting the canard to the fuselage.

Install the header tank using 2 BID and flox where it meets the inside fuselage skin.

As a reminder, prior to permanently mounting the fuel header tank, make sure that it will not interfere with instruments, feet, rudder pedals, engine installation, etc. In order to maximize the fuel quantity, it has been made a tight fit in the forward fuselage.

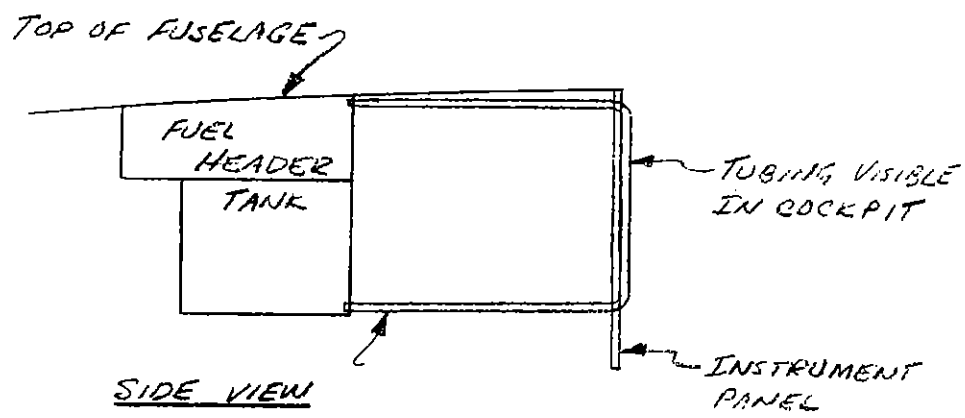
HEADER TANK FUEL GAUGE

It is necessary for the fuel header tank to have a fuel gauge to detect any failure of the fuel transfer system that would result in a reduced level of the header tank.

A very simple arrangement of clear plastic tubing is used to create a sight fuel gauge. It is floxed in place at the top and bottom of the fuel header tank, and then run aft through the instrument panel into the cockpit where it is turned vertically as shown.

Later, calibrate the gauge with the fuselage levelled with respect to WL15 by adding fuel in one gallon increments and marking the clear plastic tube. A similar calibration is performed on the main fuel tank guage.

It is important to note that the gauge will only be accurate while in straight and level flight.



HEADER TANK FUEL GAUGE

Particularly in the case of the fuel header tank guage, small changes in aircraft attitude will make large changes in the indication of fuel quantity. The fuel header tank gauge should be used only to verify that the fuel header tank is maintaining a full level in straight and level flight.

Also note that the fuel header tank gauge cannot be installed until after the instrument panel has been installed.

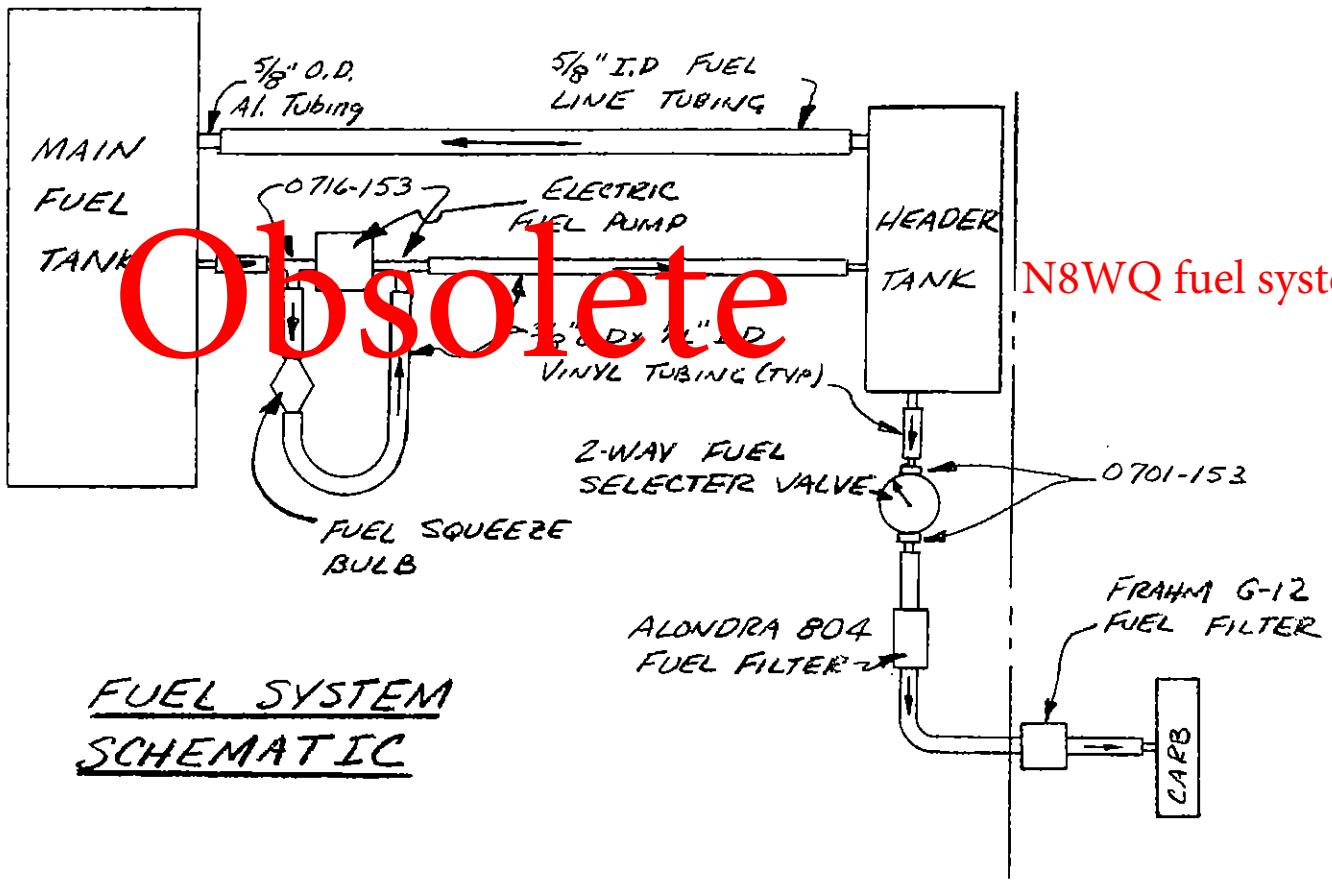
FUEL SYSTEM INSTALLATION

Included with this section is a schematic of the fuel system for your Q2. It is really quite simple.

Both the squeeze bulb (backup fuel pump) and the fuel shutoff valve must be capable of being actuated by the pilot while seated in the cockpit. However, it is important that the fuel line to the carburetor from the header tank travel a minimum distance. Therefore, it will probably be necessary to fabricate an extension on the fuel valve handle such that the fuel valve can be located near the firewall, in order to reduce the length of the fuel line to the carburetor.

The two filters shown are very important. They must be checked after every engine run for the first 20 hours. Regardless of how good of a job you expect to accomplish in keeping contaminents out of the two fuel tanks, particles will travel through the fuel lines and must be removed. This is a safety-of-flight issue. The vibration of taxiing will break loose particles for several hours. Do not ignore fuel contamination problems.

NOTE: USE GS-4 CLAMPS (12) & GS5 CLAMPS (2) FOR TUBING/TUBING CONNECTIONS



FUEL SYSTEM SCHEMATIC

N8WQ fuel system schematic (link)

END OF CHAPTER

INSTRUMENT AND PITOT-STATIC INSTALLATION

INSTRUMENT PANEL INSTALLATION

An infinite variety of instrument panel configurations are possible. Since this area of the aircraft is such a popular focus for that 'custom' look, we have refrained from presenting any specific configurations beyond the pictures of our panel and a few suggestions.

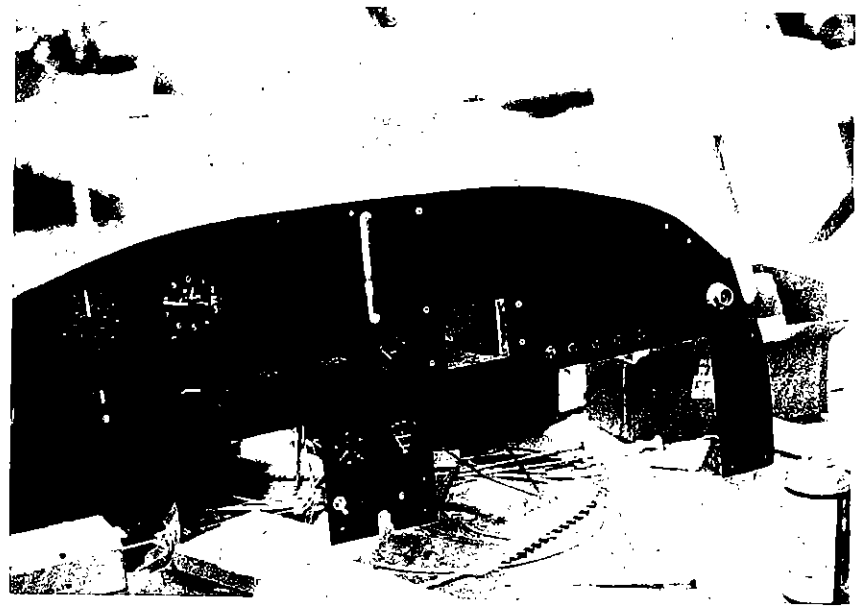
The basic outline of the instrument panel was cut-out in Chapter 4. It is suggested that all cutouts for instruments and equipment be completed prior to permanently mounting the instrument panel to the airframe. Nominally, the aft face of the panel is at FS41. This can vary depending on the particular pilot size and positioning to be used by the individual builder. The three sub panels that extend down below the instrument panel to meet the two side consoles and the center console are constructed from either scrap 1/8" thick plywood, or else 1/4" white foam with 1 BID on either side. One BID should be laminated on either side of the complete instrument panel to add rigidity and to seal the plywood.

If the builder wishes to make the instrument panel removable, small tabs can be fabricated. These tabs would be bonded to the fuselage, and the instrument panel bolted to them. Otherwise, permanently mount the instrument panel with BID tapes to the fuselage sides and the consoles. If the attachment is to be permanent, all work forward of the panel should be completed prior to this step, as access will become very difficult.

It is recommended that the following controls be on the center sub panel: cowl flap, carb heat, mixture control. It is further recommended that the throttle be located on the left sub panel. The electrical switches and fuses can be located either on the center sub panel, or else elsewhere accessable to the pilot. Conventionally, flight instruments go on the left side of the panel, engine instruments predominately in either the center of the panel or on the far right, and avionics are mounted in either the center or the right side of the panel.

Provision must also be made for a ground bolt, which is simply a AN3-7A bolt located somewhere on the panel that is used to connect the equipment needing grounding. (See the electrical system schematic).

The instruments included with the kit are those required by the FAA for day VFR flight. There is plenty of additional room available for optional instruments and avionics.

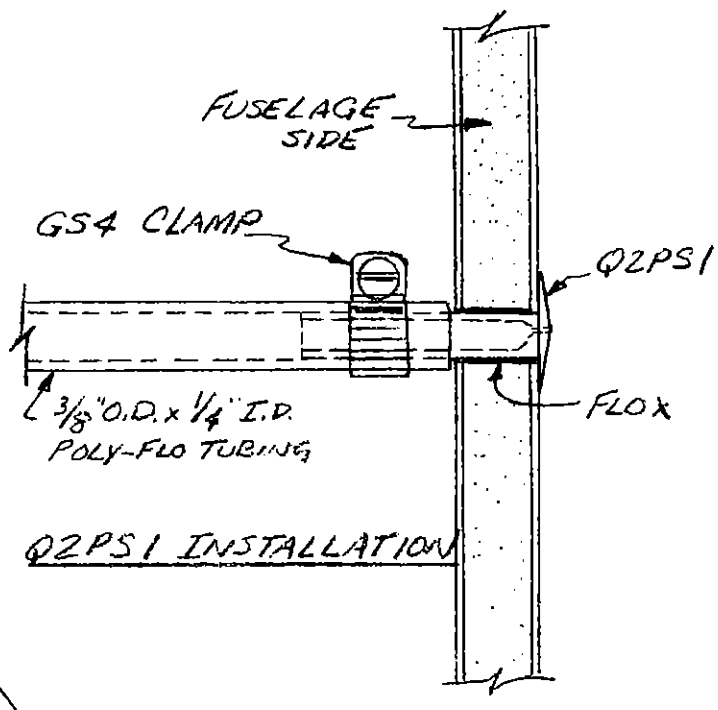


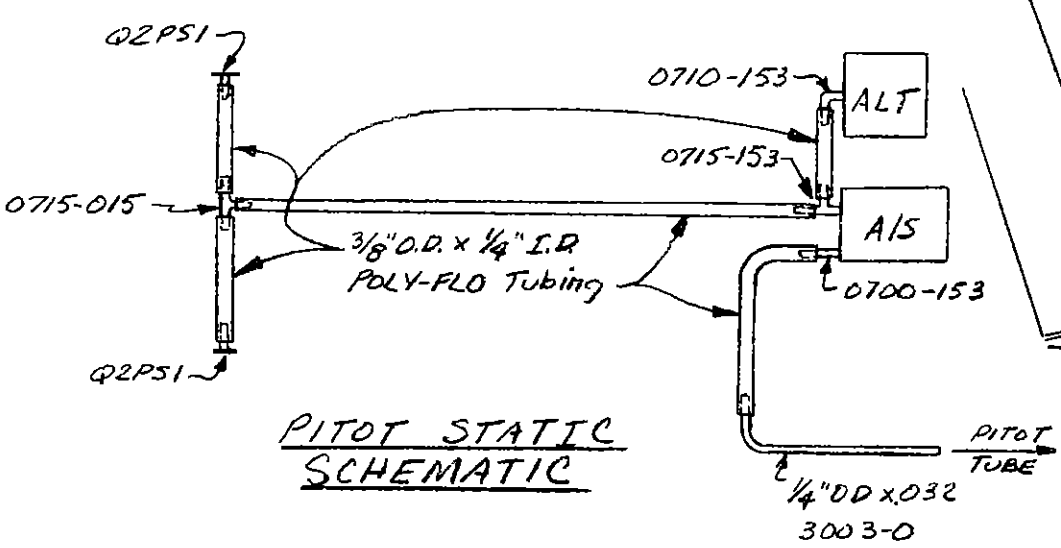
PITOT-STATIC SYSTEM INSTALLATION

Begin by mounting the two Q2PS1 static ports on either side of the fuselage as shown. Use flox, being careful not to clog up the static hole. Two static ports are used in order to assure accurate readings during sideslip maneuvers.

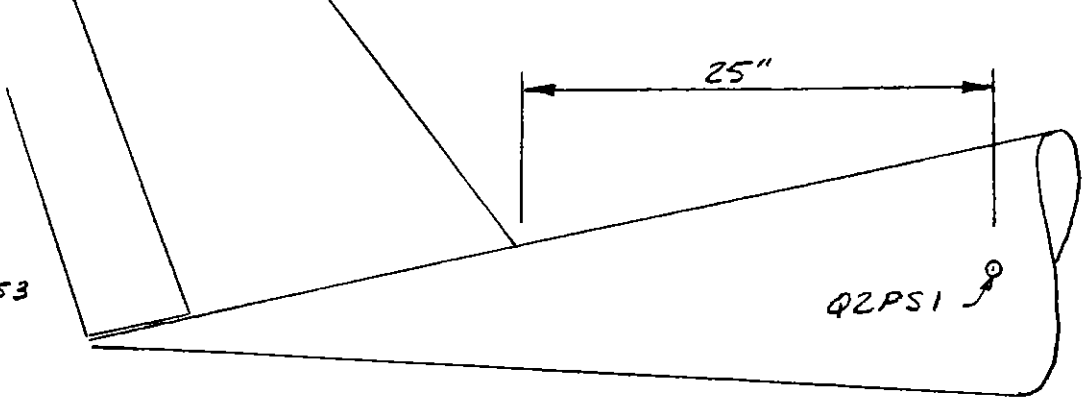
The schematic indicates the required connections for the Airspeed and Altimeter. Run the tubing so that it does not interfere with baggage or passengers. It is recommended that it travel down the center console before reaching the instruments.

The pitot system must be leak checked. Have one individual watch the airspeed indicator, while the other person blows into the pitot tube and uses his tongue to hold in the presssure. The airspeed indicator should register a speed, which remains constant for a few seconds. If the speed diminishes while the second individual is holding the pressure in the system, then there is a leak somewhere, probably at one of the connections.



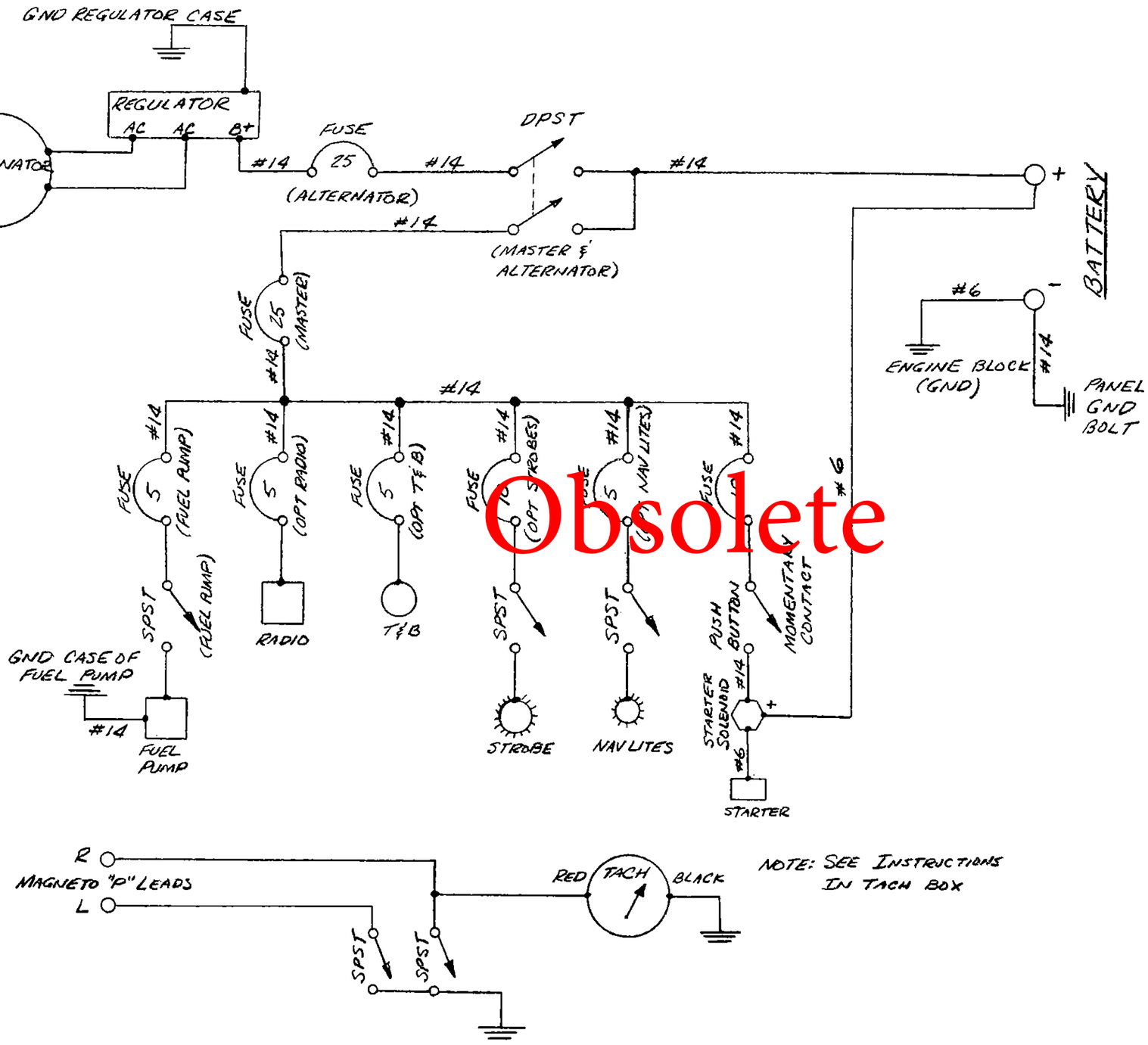


PITOT STATIC SCHEMATIC



Q2PS1 LOCATION

END OF CHAPTER



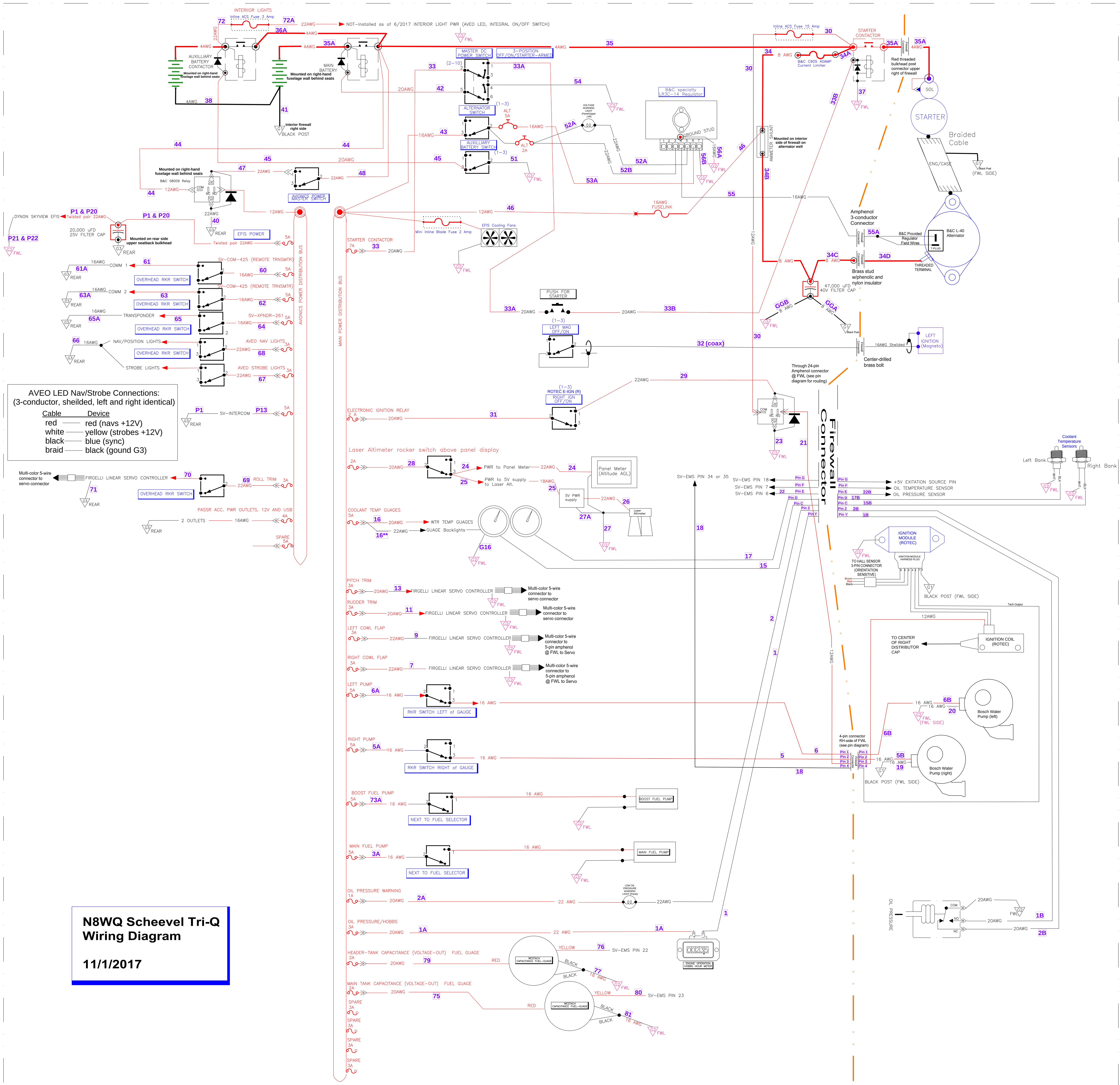
INTRODUCTION

The schematic accompanying this chapter details the necessary wiring for the standard Q2 kit. Additional information is provided for wiring the more popular optional equipment items. A separate schematic details hooking up the magneto switches and tachometer.

The panel ground bolt is simply a AN3-7A bolt located on the instrument panel that is used to connect all items that must be grounded.

The fuses, fuse holders, wire (#14 and #6), connectors, and switches for the standard Q2 kit are included. Optional equipment will require additional components. The battery recommended with an electric starter is a 12 v, 18 AH battery.

It is advisable to wait until a weight and balance has been performed (see the Q2 Pilot's Manual) prior to locating the battery, in order to use it as ballast to achieve the desired center of gravity range. In lieu of that, it should be located in the baggage compartment at about FS80.



N8WQ Scheevel Tri-Q
Wiring Diagram
11/1/2017
INTERIOR LIGHTS
NOT-installed as of 6/2017 INTERIOR LIGHT PWR (AVEO LED, INTEGRAL ON/OFF SWITCH)
AUXILIARY BATTERY CONTACTOR
MAIN BATTERY
Mounted on right-hand fuselage wall behind seats
interior firewall right side
BLACK POST
MASTER DC POWER SWITCH
3-POSITION OFF/ON/STARTER-ARMED
ALTERNATOR SWITCH
AUXILIARY BATTERY SWITCH
B&C specialty LR3C-14 Regulator
GROUND STUD
STARTER CONTACTOR
STARTER
Braided Cable
ENG/CASE
Amphenol 3-conductor Connector
B&C Provided Regulator Field Wires
B&C L-40 Alternator
THREADED TERMINAL
Brass stud w/phenolic and nylon insulator
47,000 uFD 40V FILTER CAP
PUSH FOR STARTER
LEFT MAG OFF/ON
32 (coax)
LEFT IGNITION (Magneto)
Center-drilled brass bolt
Through 24-pin Amphenol connector @ FWL (see pin diagram for routing)
ROTEC E-IGN (R) RIGHT IGN OFF/ON
ELECTRONIC IGNITION RELAY
Firewall Connector
DYNON SKYVIEW EFIS
P1 & P20
P21 & P22
20,000 uFD 25V FILTER CAP
Mounted on rear side upper seatback bulkhead
EFIS POWER
EFIS Cooling Fans
AVIONICS POWER DISTRIBUTION BUS
MAIN POWER DISTRIBUTION BUS
OVERHEAD RKR SWITCH
COMM 1
COMM 2
TRANSPONDER
NAV/POSITION LIGHTS
STROBE LIGHTS
AVEO LED Nav/Strobe Connections:
(3-conductor, sheilded, left and right identical)
Cable — Device
red — red (navs +12V)
white — yellow (strobes +12V)
black — blue (sync)
braid — black (gound G3)
SV-INTERCOM
FIRGELLI LINEAR SERVO CONTROLLER
Multi-color 5-wire connector to servo connector
ROLL TRIM
PASSR ACC. PWR OUTLETS, 12V AND USB
2 OUTLETS
Laser Altimeter rocker switch above panel display
PWR to Panel Meter
PWR to 5V supply to Laser Alt.
Panel Meter (Altitude AGL)
5V PWR supply
COOLANT TEMP GUAGES
WTR TEMP GUAGES
GUAGE Backlights
PITCH TRIM
RUDDER TRIM
LEFT COWL FLAP
RIGHT COWL FLAP
Multi-color 5-wire connector to 5-pin amphenol @ FWL to Servo
LEFT PUMP
RKR SWITCH LEFT of GAUGE
RIGHT PUMP
RKR SWITCH RIGHT of GAUGE
BOOST FUEL PUMP
NEXT TO FUEL SELECTOR
MAIN FUEL PUMP
OIL PRESSURE WARNING
OIL PRESSURE/HOBBS
ENGINE OPERATION HOBBS HOUR METER
HEADER-TANK CAPACITANCE (VOLTAGE-OUT) FUEL GUAGE
MAIN TANK CAPACITANCE (VOLTAGE-OUT) FUEL GUAGE
SPARE
Coolant Temperature Sensors
Left Bank
Right Bank
+5V EXITATION SOURCE PIN
OIL TEMPERATURE SENSOR
OIL PRESSURE SENSOR
IGNITION MODULE (ROTEC)
BLACK POST (FWL SIDE)
IGNITION COIL (ROTEC)
TO CENTER OF RIGHT DISTRIBUTOR CAP
Bosch Water Pump (left)
Bosch Water Pump (right)
4-pin connector RH-side of FWL (see pin diagram)
OIL PRESSURE

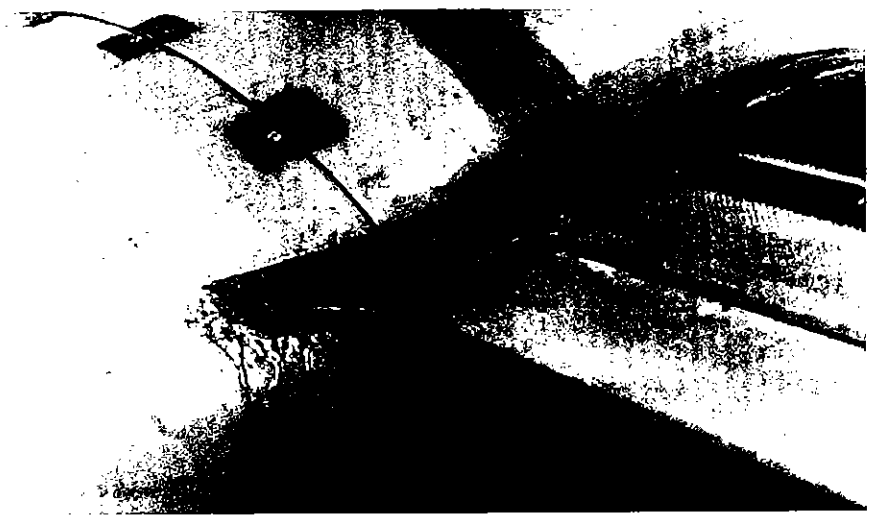
COMPLETING YOUR Q2

STREAMLINING YOUR Q2

A significant improvement in your Q2's aerodynamic cleanliness can be achieved by fabricating fillets and fairings for the major component intersections. A bit of artistic ability is necessary to develop a pleasing and efficient shape, but at this stage of the construction, you'll be up to it.

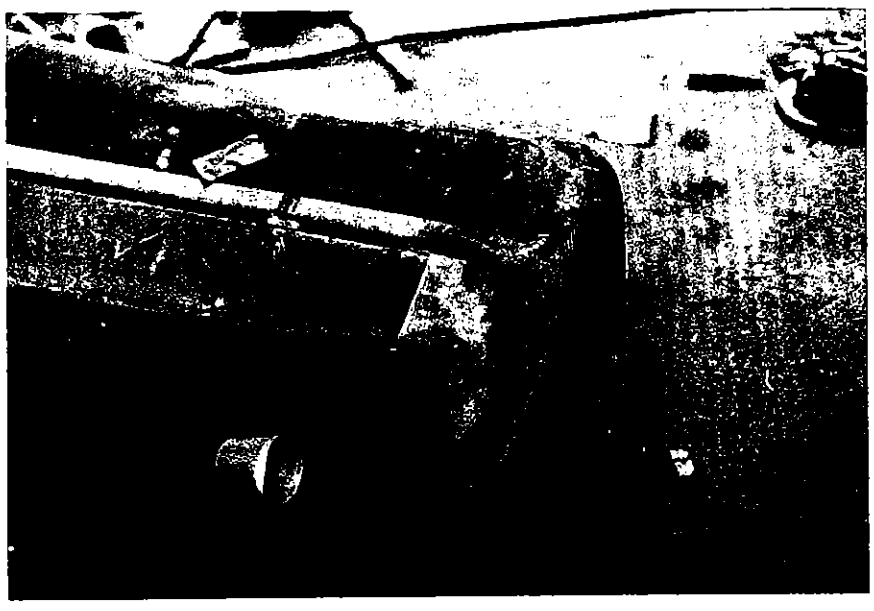
AILERON FILLETS

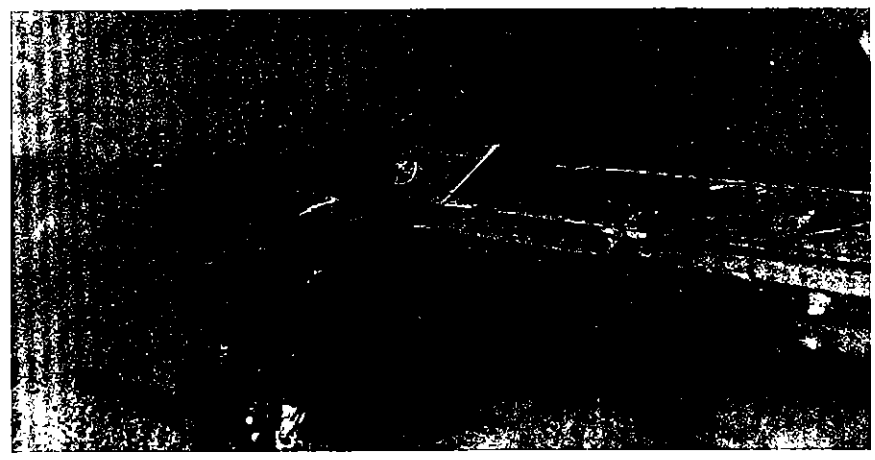
The aileron/fuselage junction should be filleted using scrap foam and 1 BID. Each fillet will need to be 2 piece, as shown, if your aft fuselage is removable. Careful work should allow most of the gap to be filled on the top surface, while leaving a gap on the bottom side to allow removal of the aileron.



ELEVATOR OUTBOARD FILLETS

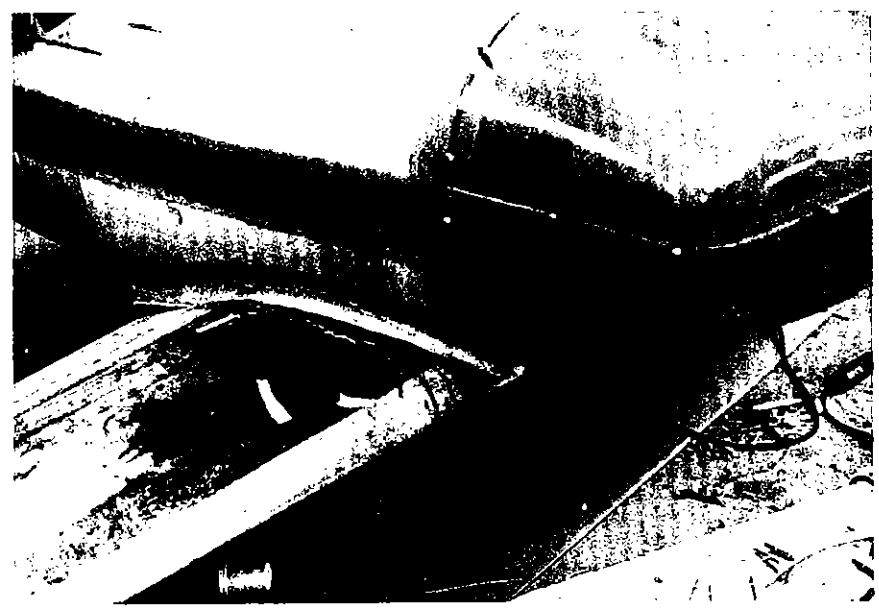
A fillet is also necessary between the inboard face of the wheel pant and the outboard end of the elevator. Set the elevator with the trailing edge approximately 4 degrees up. Use scrap foam and 1 BID to create a fillet similar to the one shown in the picture.

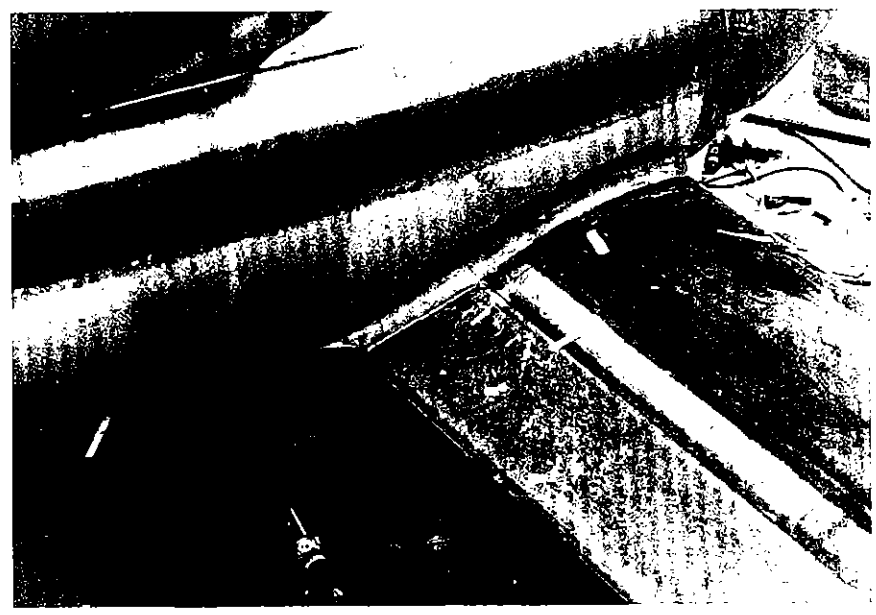




ELEVATOR INBOARD FILLETS

At the elevator/fuselage junction, a more complicated fillet will improve performance. Since the junction angle is more than 90 degrees, you will want to sweep in a radius as shown using scrap foam and 1 BID again. Visualize how the fillet will sweep into the cowling.





CANARD/FUSELAGE FAIRING

At this point, their should be a noticeable and ugly gap under the fuselage where the canard and fuselage meet. A fairing should be made out of scrap foam and 1 BID similar to the picture.

MAIN WING TIPS

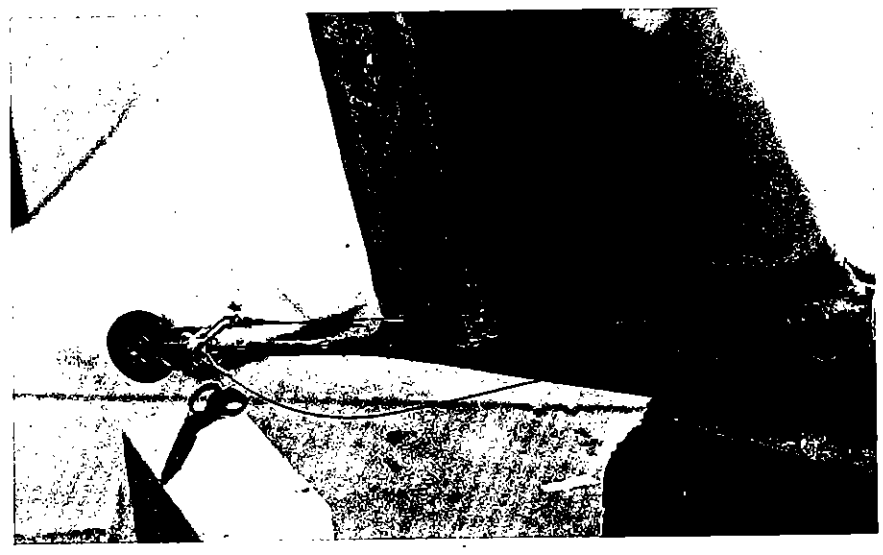
Now would also be a good time to carve wing tips on the main wing. If you wish, you may add up to 3 inches of foam to the wing span to facilitate a smooth looking wingtip. Keep it simple, however.

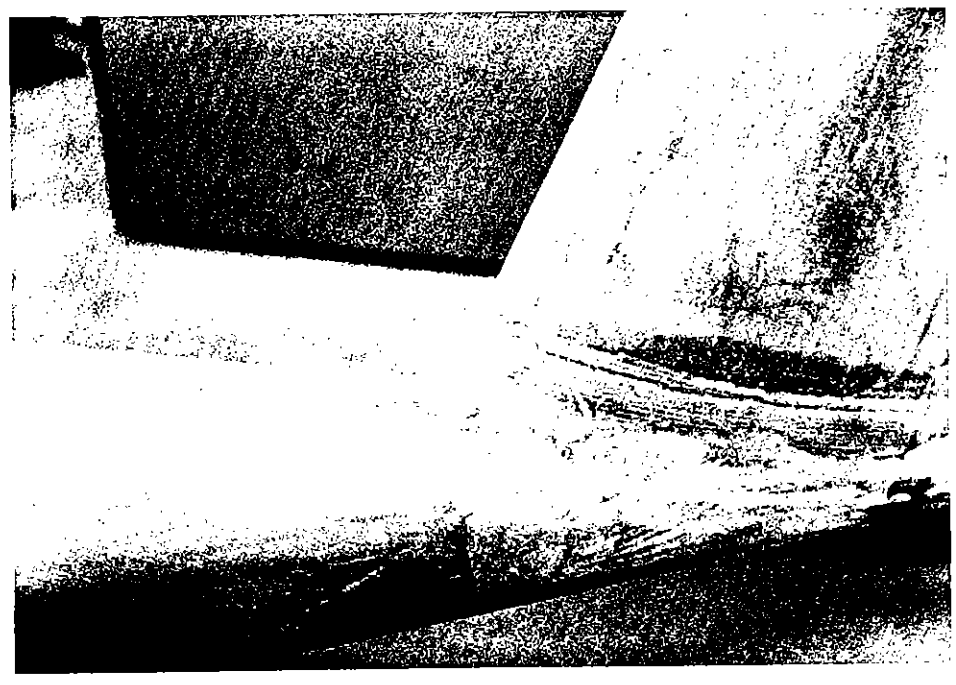
VERTICAL FIN TIP

Ditto for the tip of the vertical fin.

VERTICAL FIN ATTACHMENT

Previously, you mounted the vertical fin to the bottom of the fuselage. Now is the time to permanently attach it to the fuselage and create a pleasing fillet shape at the same time. Using pieces of foam, fill the gap between the vertical fin and the aft fuselage. Carve the foam down to a pleasing shape, as shown, and laminate 2 BID overlapping onto the aft fuselage skin a minimum of 2 inches.





CARBURETOR AIR INLET

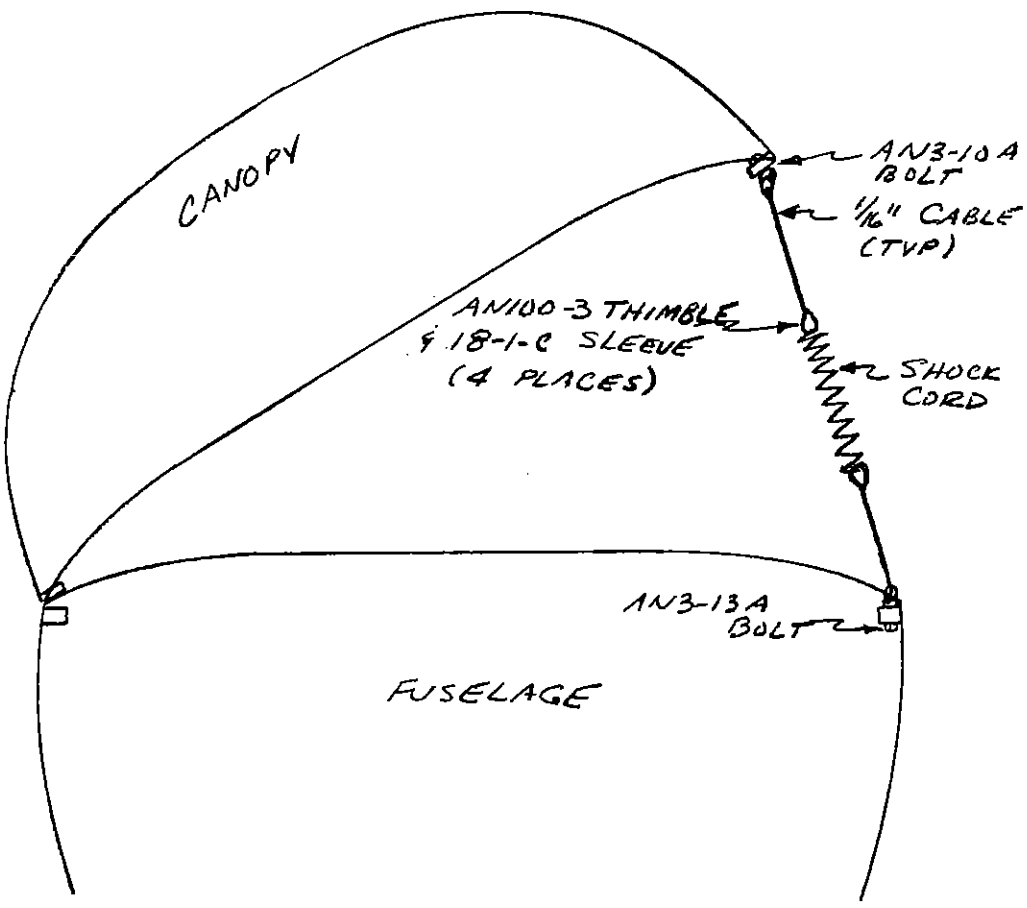
Cut a round hole in the lower cowling for the carburetor air inlet. Fabricate a round tube by laminating 4 BID around a bottle such that the tube will slip over the end of the alternate air source. (Don't forget to use vaseline on the bottle so the lamination can be removed). Bond the tube to the lower cowling carburetor air inlet hole. The result will be a direct ram air flow into the carburetor.

CANOPY RETENTION

It is advisable to have some form of restraint for an open canopy besides permitting it to rest on the main wing. Otherwise,in case of a strong wind, the canopy may be blown off of the aircraft.

The illustration shows a simple shock cord arrangement. The cable is sized so that the canopy will remain open with tension against the shock cord. This will require the canopy to be open approximately 90 degrees.

A more clever solution is to purchase a small gas spring assembly (such as those on automobile hatchbacks) and install it on the aft canopy bulkhead and the seat-back bulkhead. This is the ultimate in sex appeal!

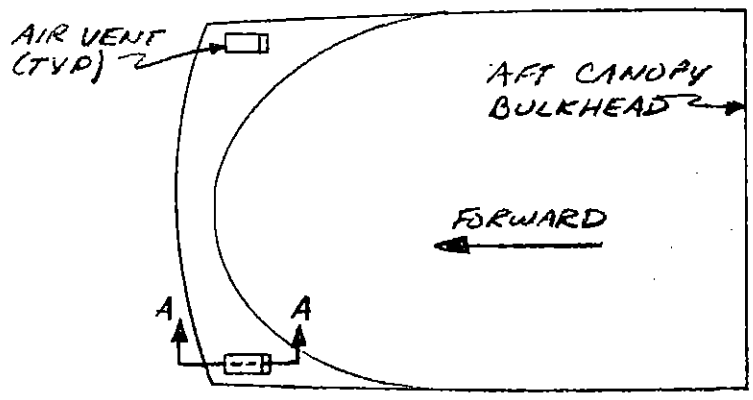


CANOPY RETENTION CABLE
(FRONT VIEW

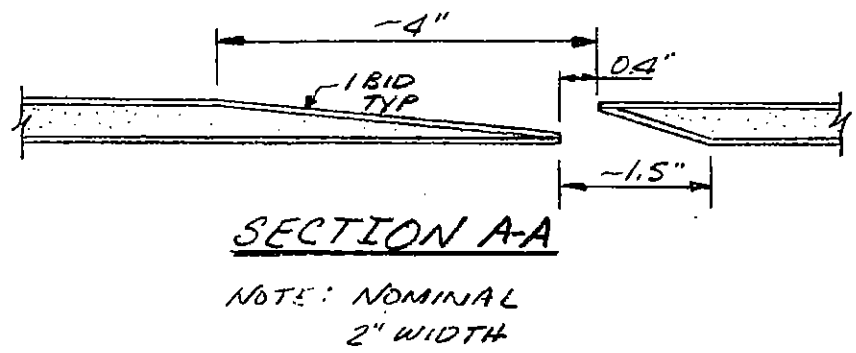
COCKPIT AIR VENTS

A cockpit air vent on either side of the fuselage must be installed prior to first flight. A simple shape, and recommended location, is shown in the sketches.

To exhaust the cockpit air, a hole could be cut in the tailcone, or else an exhaust vent could be cut in the aft top fuselage.



CANOPY VENT SYSTEM
TOP VIEW



SECTION A-A

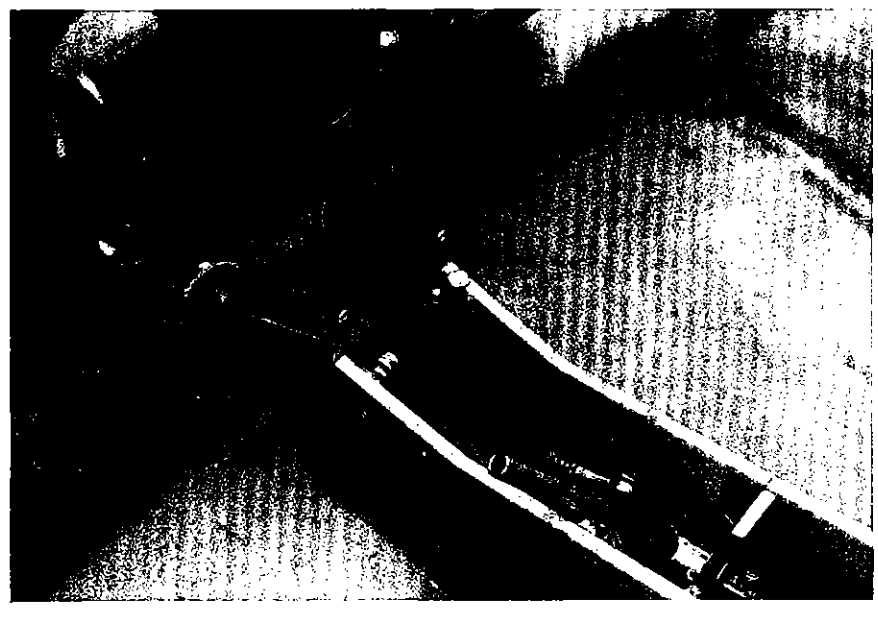
NOTE: NOMINAL 2" WIDTH

PITCH TRIM SYSTEM TENSION

While writing Section II of these plans, and building N81QA, we built a simple system to vary the tension, or drag, on the pitch trim wheel.

Make a third TS-1 bearing from phenolic. Drill a 3/8" diameter hole as shown. Next, saw-cut the bearing through the hole, but do not go all the way through and make two pieces. The lower half of TS-1 is bonded with resin to the end TS-1 bearing already mounted. Do not bond the top half or the system will not function.

Study the sketch. By turning the screw, the size of the 3/8" hole can be varied slightly, changing the tension on the pitch trim drum. A knob bonded to the screw would make tension adjustable in flight.



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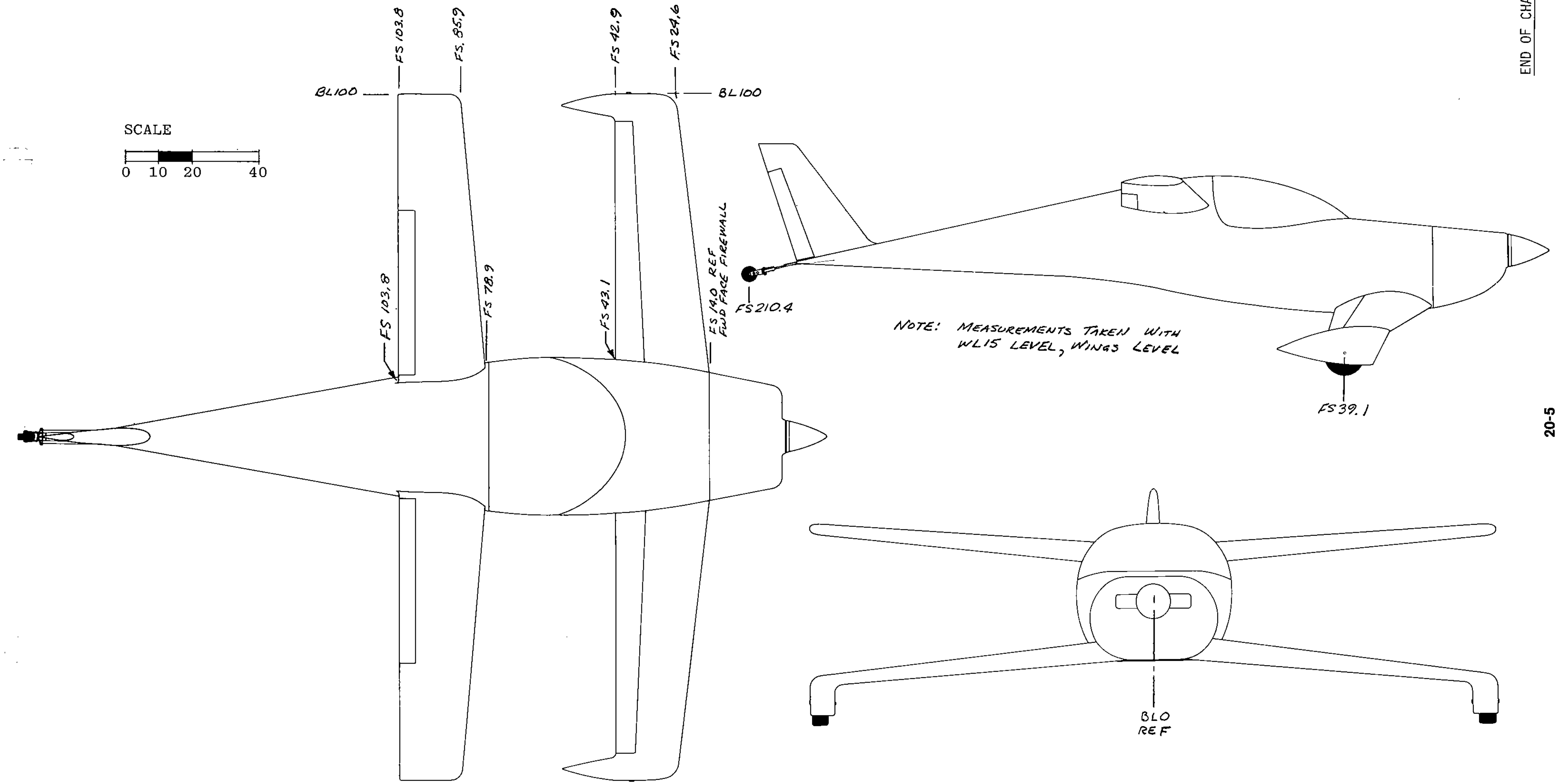
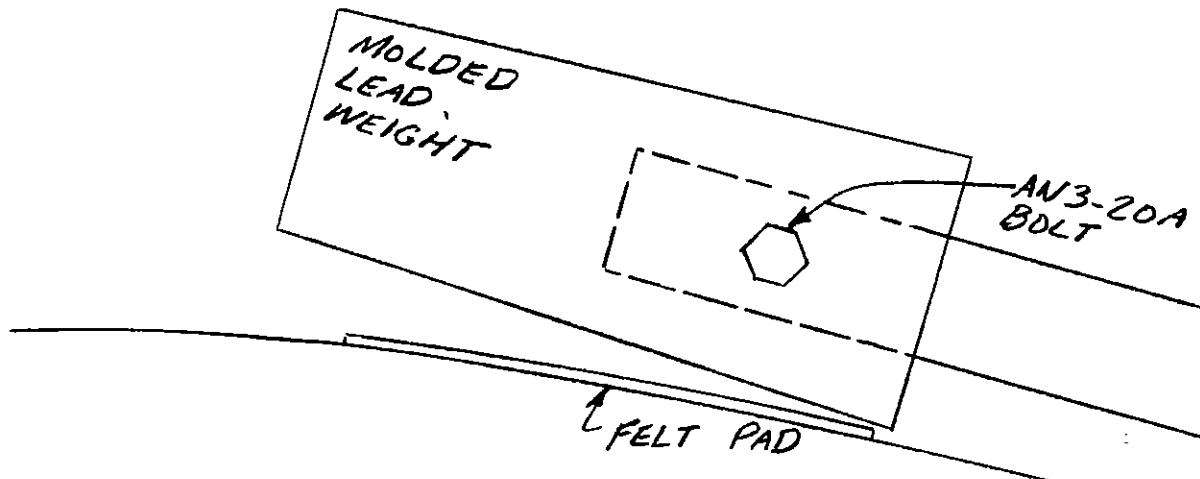


END OF CHAPTER

NUMBER	DATE	DESCRIPTION
Q2PC11	21 August, 1981	MASS BALANCING ELEVATORS. In preparation for testing on turbocharged Revmasters and possible A-65 thru C-85 installations, we have further explored the very high speed area of the Q2 operating envelope. We have found that mass balancing the elevators improves the ride qualities at high speed. Therefore, we are supplying to all builders the drawings and hardware to mass balance all Q2 elevators, and recommend this before first flight. See pages for details.



ELEVATOR MASS BALANCING

Locate the two Q2CSA11 arms and the molded lead weights.

These elevator mass balance arms can be retrofitted to the elevator control system even after the canard has been mounted to the fuselage. This will allow a closer clearance with the fuselage sides and maximize the available legroom. If the mass balance arms are installed prior to mounting the canard, careful measurements must be made to assure clearance with the fuselage sides.

Begin by attaching a molded lead weight to each Q2CSA11 as shown.

Next, remove the two bolts holding CS20 in position, and slide it outboard through the CS14 phenolic bearing until a Q2CSA11 arm can be slid onto the tube with the lead weight projecting forward. Reinstall the bolts holding CS20 in position.

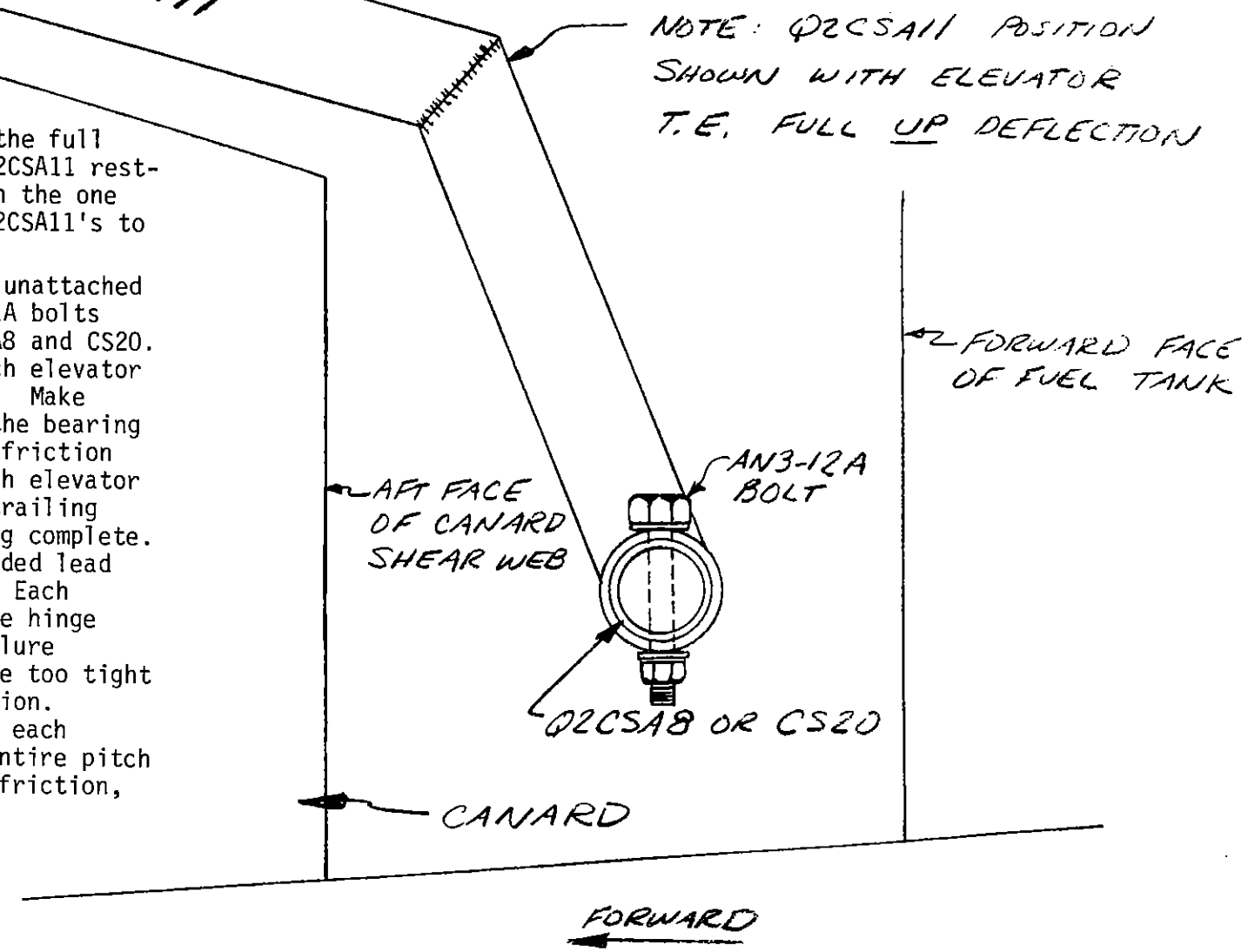
Then remove the three bolts securing Q2CSA8 and slip it inboard until the second Q2CSA11 arm can be slid on the outboard end inward with the lead weight projecting forward. Reinstall the bolts holding Q2CSA8 in place.

Locate the Elevator Rigging template and jig the elevator in the full trailing edge up position. With the elevator in this position, each Q2CSA11 should be almost resting on the canard upper surface just inboard of the fuselage. Note the piece of felt called out as a bumper stop. The Q2CSA11's are located as far outboard as practical so as not to interfere with pilot or passenger legroom. Verify that when the elevator is rotated to full trailing edge down position, that the arc of each Q2CSA11 clears the fuselage and all other components.

Finally, return the elevator to the full trailing edge up position with each Q2CSA11 resting almost on the canard, and drill in the one AN3-12A bolt per side to attach the Q2CSA11's to Q2CSA8 and CS20.

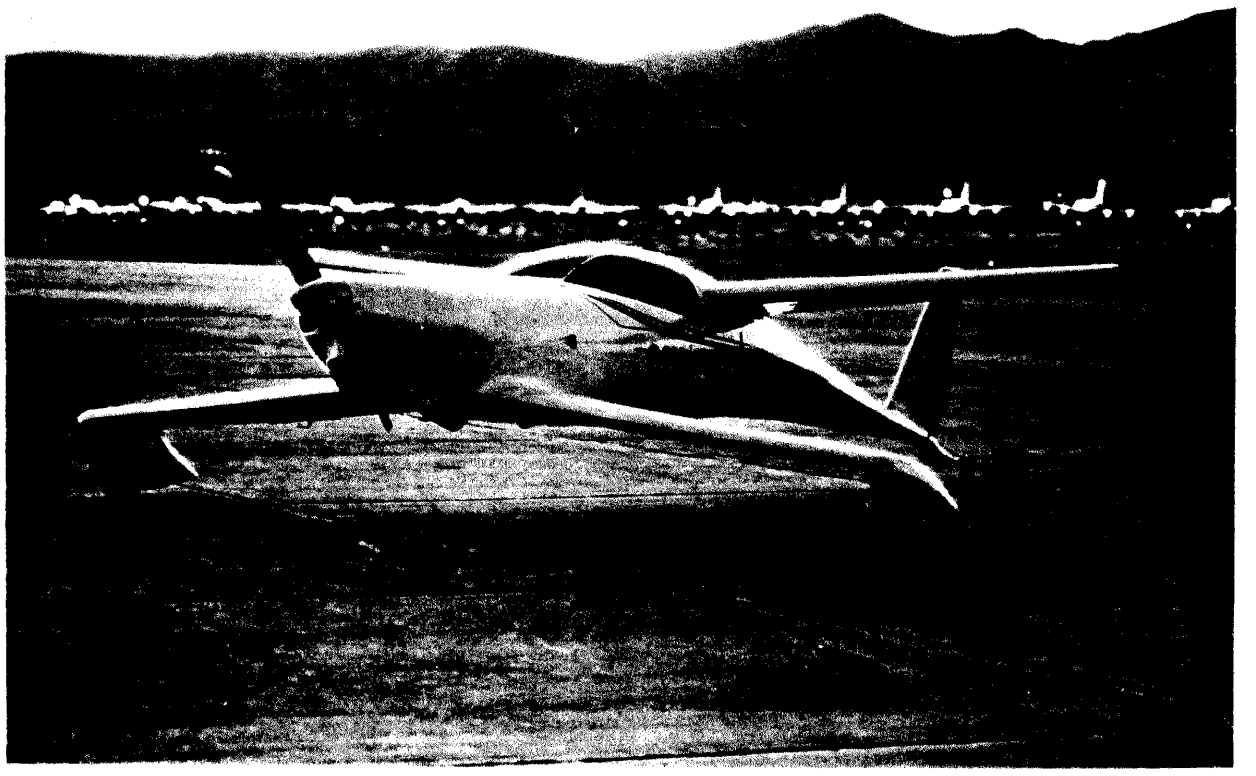
Leave the CS13 pitch control arm unattached from Q2CSA8, and remove the two AN4-11A bolts attaching the universal joint to Q2CSA8 and CS20. Remove the universal joint so that each elevator can rotate independently of the other. Make sure that you have lubricated all of the bearing and hinge points to reduce the system friction to a minimum. It is desirable for each elevator to balance at 0 degrees to 2 degrees trailing edge up with all painting and finishing complete. Remove lead, as necessary from the molded lead weight until that postion is reached. Each elevator should rotate freely about the hinge points when given a slight nudge. Failure of this check means that the pivots are too tight and must be adjusted for minimum friction.

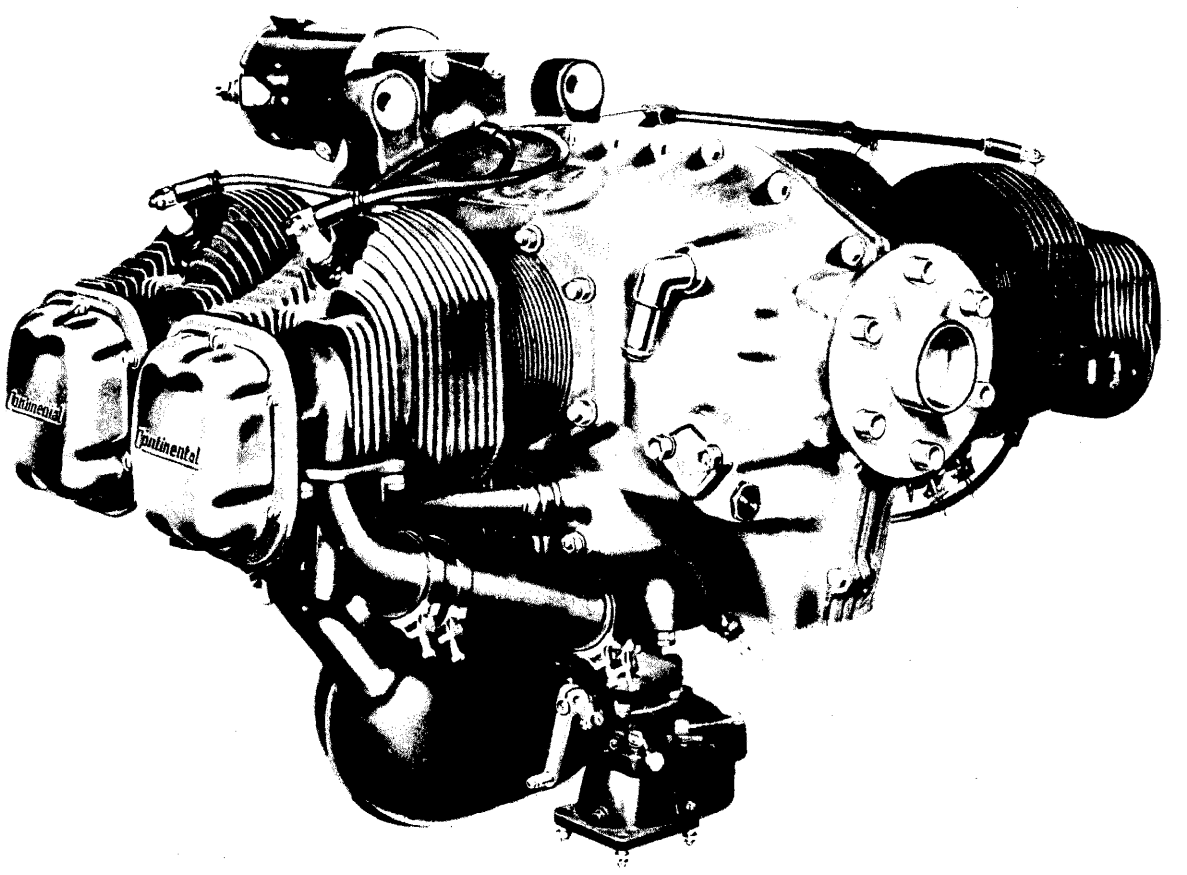
Once the amount of lead weight on each elevator has been adjusted, bolt the entire pitch control system together and check for friction, excess play, and interferences.



Q·200 CONSTRUCTION PLANS
SECTION II

Addendum to Q2/Q·200 Construction Plans
Continental O·200 Engine Installation





STEP CHART

Step I. Construct magneto box.

A. Use Appendix Sheet #2 as an assembly guide.
B. Glue pieces together with 5 min.
C. Cover box inside and outside with 1 Bid.

Step II. Build up the header tank and set aside to cure.

Step III. Cut out hole in firewall.

A. Use template in Appendix Sheet #3 to find position and shape of cut out.
B. Save template: You will use it to locate engine mounts locations.

Step IV. Mount magneto box in firewall.

A. Box should be taped in with 2 Bid tape and flox.
B. Install firewall stiffeners on inside of firewall with 2 Bid.
C. Lay-up a 4 Bid local lay-up over the 4 engine mount areas, both inside and outside of firewall.
D. You people who have changed your mind on engine types and have already installed a header tank have a big problem. You will find it very hard to install the magneto box and impossible to install the engine mount bolts with the bolt heads on the inside of the firewall. Since the header tank on the Q-200 is smaller anyway, we would suggest you remove the large header tank before you try to install the magneto box and engine mounts.

Step V. Using firewall template, locate and drill 3/8" engine mount bolt holes and install Q2EM1-C stand-offs with AN3-10A bolts.

Step VI. Install header tank.

Step VII. Install prop extension on engine prop flange, use anti-seize around all lugs and bolt threads.

Step VIII. Install engine on aircraft.

A. Weight tail down and chock airframe.
B. Engine is to be off set slightly to the right to off set engine torque. Washers are supplied to be placed between the EM1-C and the Continental #530741 washer on the left engine mounts as needed (see plans for proper engine off set).

Step IIIX. Install propeller spinner flange.

Step IIX. Install cowl.

A. Trim aft edge at firewall using spinner flange to locate forward end.
B. Space cowl .1 aft of the spinner flange.
C. Make cowl mounting flange (see Q-2 construction plans 16-3).
D. Rivet cowl flange to firewall.
E. Drill small positioning holes to hold cowl in place; celcos work well for this.
F. Install nutplates provided.
G. Remove cowl for Step IX.

STEP CHART CONTINUED

Step IX.

A. Position controls.
   1. Throttle.
   2. Mixture.
   3. Carb heat - Alt. air.

B. Install exhaust.

C. Install carb. heat/alt. air muffs.

D. Install prefab fiberglass air duct elbow to bottom of carb.

E. Install heat transfer valve.

F. Install short section of 2.5" scat hose to front of elbow & heat transfer valve.

G. Install short section of scat hose connecting front (cold side) of heat valve to prefab air inlet duct.

H. Wiring & instrumentations.
   1. Alternator leads.
   2. "P" leads.
   3. Starter cable & Solenoid.
   4. Engine ground
   5. Oil temperature line or wire.
   6. Oil pressure line or wire.
   7. EGT lead.
   8. CHT lead.
   9. Tach cable (if mechanical tach. is used).
   10. Manifold pressure line (if used).

I. Fuel.
   1. Mount gas-co-lator on forward side of the firewall.
   2. Run gas line to gas-co-lator.
   3. Run primer lines if carburetor doesn't have primer circuit.

Step X. Remove engine.

A. Seal firewall openings around wire and control holes.
B. Fire proof firewall.
C. Bolt voltage regulator to the firewall.

Step XI. Install aileron balance assembly.

Step XII. Bolt engine to airframe for final installation.

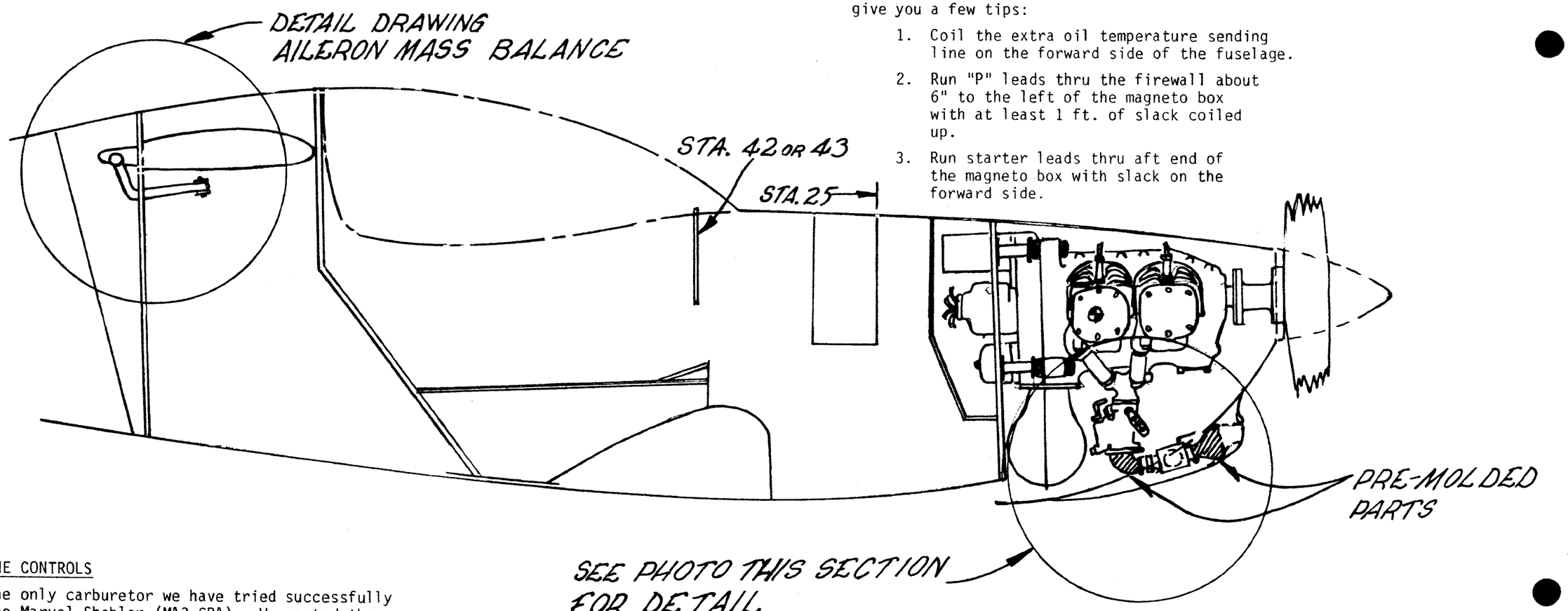
A. Shim for engine torque, 1° right and 1° down.
B. Tighten engine mount bolts to 180 to 190 in. lbs.
C. Install cotter pins.
D. Install all engine controls and hook-ups.
E. Check for proper rigging and make sure there is no interference.

Step XIII. Install cooling and induction system.

A. Cut cooling inlet in lower cowl.
B. Install cooling ramp and radius inlet.
C. Cut induction air inlet using prefab scoop as a guide.
D. When position is correct, perform final trim, flox, and cleco in place. After cure, fair edges and tape 1 ply Bid. in & out allowing 1 in. overlap,
E. Install exhaust system.

Step XIIIV. Engine run.

A. Install prop, check for track.
B. Check for oil leaks.
C. Use Continental guide for break-in run.



The exact rigging & adjustment is covered later on. At this time select firewall locations for running starter leads and wires, oil temp line, oil pressure line, EGT & CHT leads, carburator alternate air cable, "P" leads to the magnetos. Engine grounds are located on studs on bottom engine mount bosses. Either left or right ground stud can be used. I did not give exact locations for wire and cable routing, because each of you will undoubtedly arrange your panel to suit your own needs and likes, but I will give you a few tips:

1. Coil the extra oil temperature sending line on the forward side of the fuselage.
2. Run "P" leads thru the firewall about 6" to the left of the magneto box with at least 1 ft. of slack coiled up.
3. Run starter leads thru aft end of the magneto box with slack on the forward side.

ENGINE CONTROLS

The only carburetor we have tried successfully is the Marvel Shebler (MA3-SPA). We routed the throttle cable behind and around the top of the oil tank, securing the cable to a plate affixed to 2 bolts on the oil tank and a stud at the lower engine mount also used to dampen the oil filler neck from vibration. The mixture cable routes in front of the tanks.

All this is to allow you to pull engine forward far enough to disconnect the hard to reach areas, such as mag. wires, etc.

HEADER TANK CONSTRUCTION

The header tank used in this conversion is smaller than the tank used for the standard Revmaster engine. The main size difference allows more room from the forward face of the tank to the firewall. The construction and mounting is basically the same as the larger tank, page 17-2, Q-2 Plans. Use the perspective drawing to help guide you with the plumbing.

Note the Following:

1. The fuel pump mounted on the aft tank face.

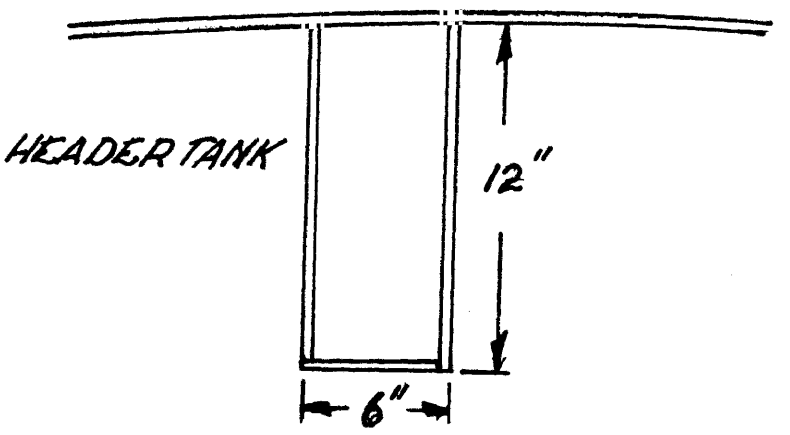
2. The fuel return tube stops 1" below the top of the tank.

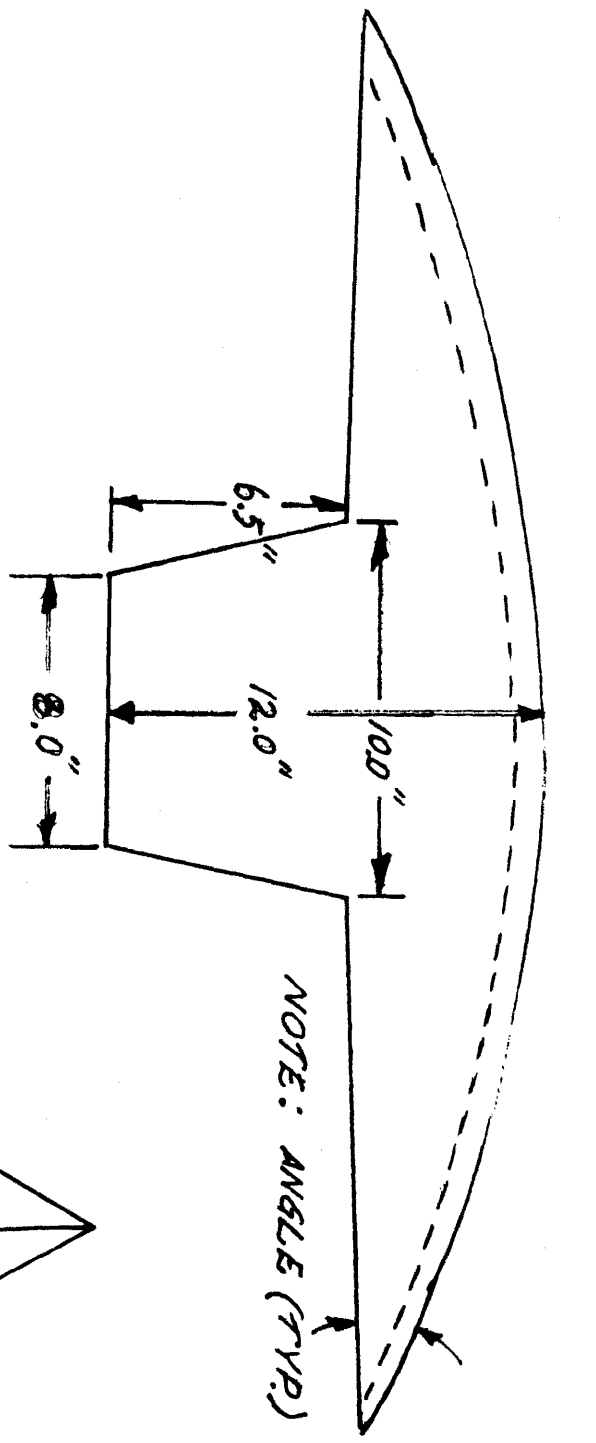
3. A fuel vent line is stuck into the center of the return tube about a half an inch and exits thru the bottom of the tank, where it is connected to a hose which runs to a tube on the aft of the canard shear web, bent forward into the airstream.

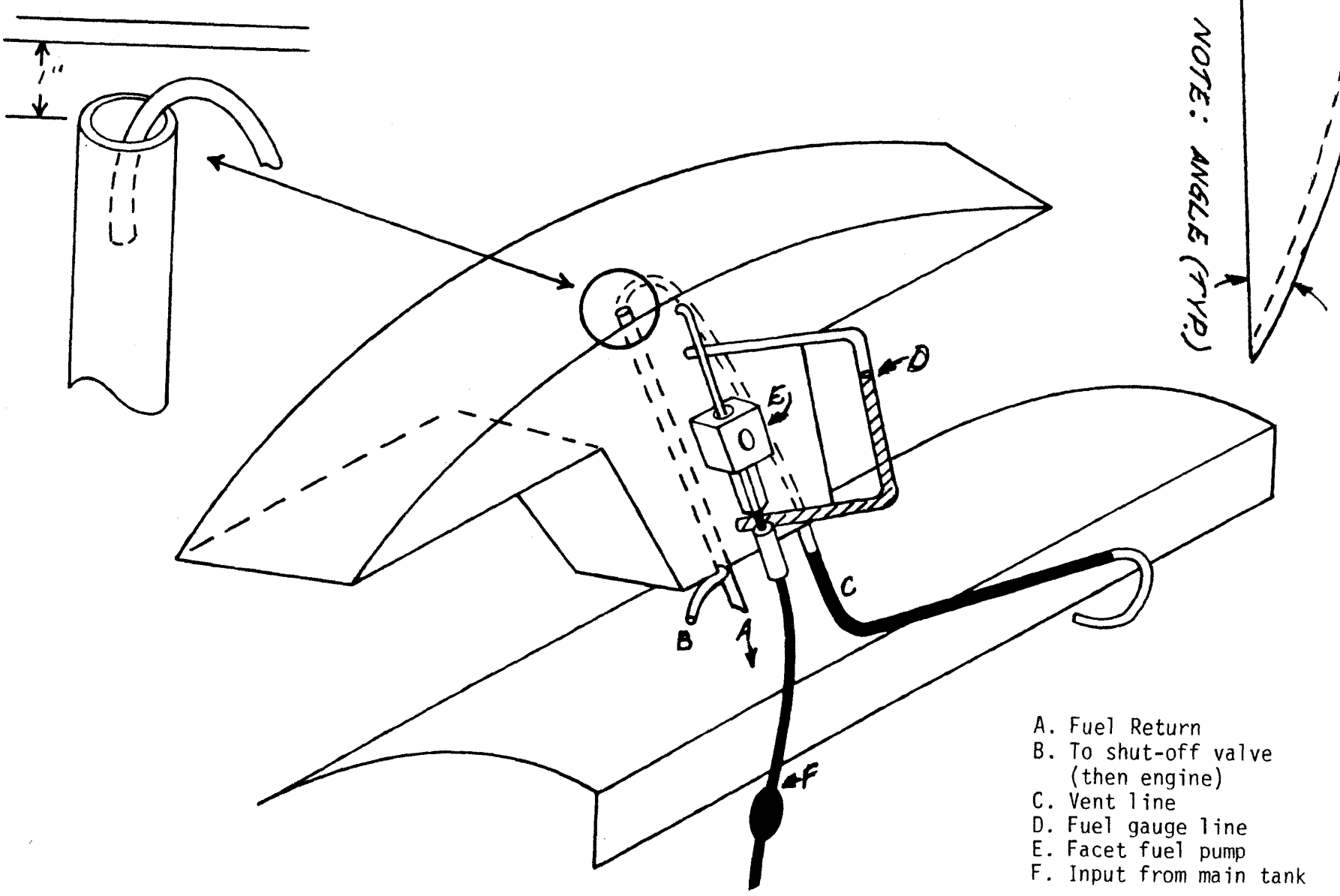
4. The fuel that exits the fuel pump from the main tank enters the header tank 1" from the top, so fuel will not back drain thru the pump when it is off.

5. You can make a fuel indicator by using some white foam and sanding it into a small ball. Paint it red and dip it into epoxy and allow to cure. Place it in the fuel level tube making sure it is small enough not to get stuck.

The installation of the header tank will require you to crawl into your aircraft and lay on your back to do the attaching. You will have lots of space to work and laminate. Those of you who still wish to install the larger tank will not have it as easy.







A. Fuel Return
B. To shut-off valve (then engine)
C. Vent line
D. Fuel gauge line
E. Facet fuel pump
F. Input from main tank

MAGNETO BOX ASSEMBLY & ENGINE MOUNTING

The magneto box assembly serves three functions:

1. Isolate and protect the aft accessory case.
2. To extend the firewall around the aft of the engine for fire, fume and noise protection.
3. To add additional strength to the firewall.

The box itself is made of 1/8" aircraft plywood, glued together with flox and resin and covered with 1 BID cloth on each side. In addition to the box itself, two vertical stiffeners run across the inside face of the firewall. Full size templates for all pieces are given in the appendixes. The pieces are to be cut out and assembled on the firewall template. Five minute epoxy mixed with a little micro can be dabbed on the pieces in small areas to help hold the pieces in place while the flox cures. By covering the template with waxed paper you can avoid soiling the template. In aircraft where the instrument panel and, or header tank have already been installed, you will have to install the vertical stiffners after the box is in place on the firewall. Sand a radius on the outside corners of the plywood. Cover inside and outside with 1 BID. The vertical siffeners Q2-MB 8, 9, 10, & 11, are to be laminated with 2 BID to the firewall on each side later on.

The next step is to cut-out the hole in the firewall using the full size template.

This can be done at the time the firewall is cut-out before it is installed in the airframe or after it has been attached to the airframe. Again, try to save the template, for you can use it to locate engine mounting holes after magneto box is installed and the 4 BID local beef-up is cured. If you have already installed a header tank for the Revmaster and now wish to install the Continental, I have some bad news. We recommend you remove the tank from the airframe for the following reasons.

1. Removing the header tank makes the installation the header tank a heck of a lot easier.

2. The recommended header tank size is reduced to allow for more room behind the firewall, move it's cg aft and reduce cg shift as fuel is consumed.

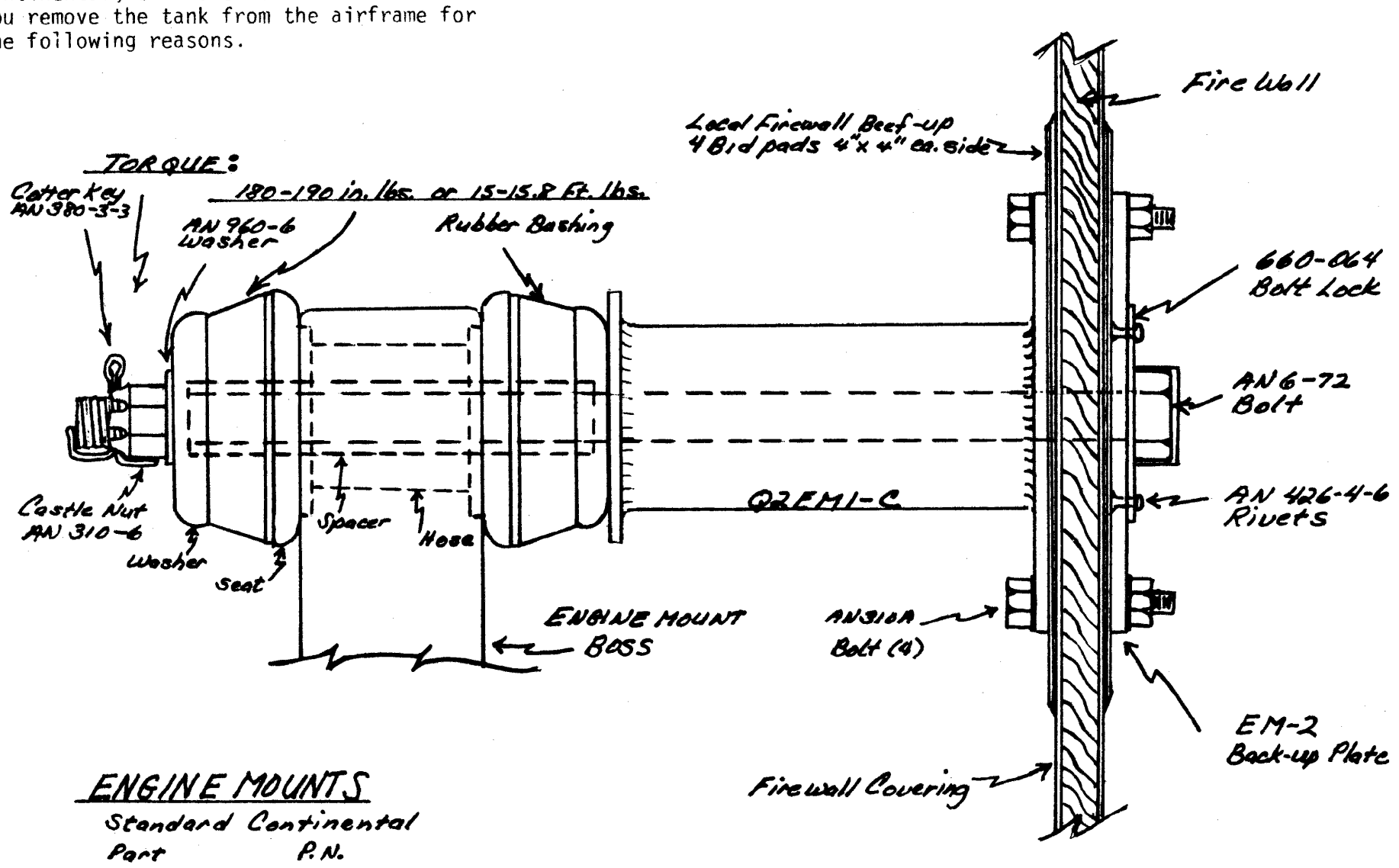
The loss of fuel capacity is to be made-up in a slight increase in main tank size and, or an aft auxillary tank in the baggage compartment area. The smaller header tank is recommended but you may wish to re-install the larger header tank after the magneto box and engine mounts are installed; the choice is yours.

Mount the magneto box in the firewall with flox and a 2 BID. Put 2" tape on each side. Also, lay-up the 4 BID pads inside and outside of the firewall in the engine mount areas. Next install the stiffeners Q2-BM 8, 9, 10, & 11 on the inside of the firewall. You will have to trim the outboard ends of the stiffeners to fit the contour of the inside of the fuselage.

After all this is cured, drill the 3/8" holes in firewall for the mount bolts, make the EM-2 spacers and install the Q2 EM1-C mount standoffs. We have found that installing the 3/8" mount bolts with the bolt heads facing aft will allow for easy engine installation and removal. With the bolt head locked down one man can unwrench the engine, slthough two are needed to lift it on and off.

Now it is time to trail fit the engine to the airframe. Chalk the tires to secure the aircraft. Lay-out a butt line extending forward 3' past the firewall. When you install the inner engine mount rubbers, install a thick washer (Q2-EM4) on each of the left mount stand-offs as a starting place.

Now install engine and remaining mount systems and tighten to 180-190 in-lbs. Install propellor extension, using snti seize on prop flange and bolts. Torque to 200-220 in-lbs. and safety wire bolts one to one.

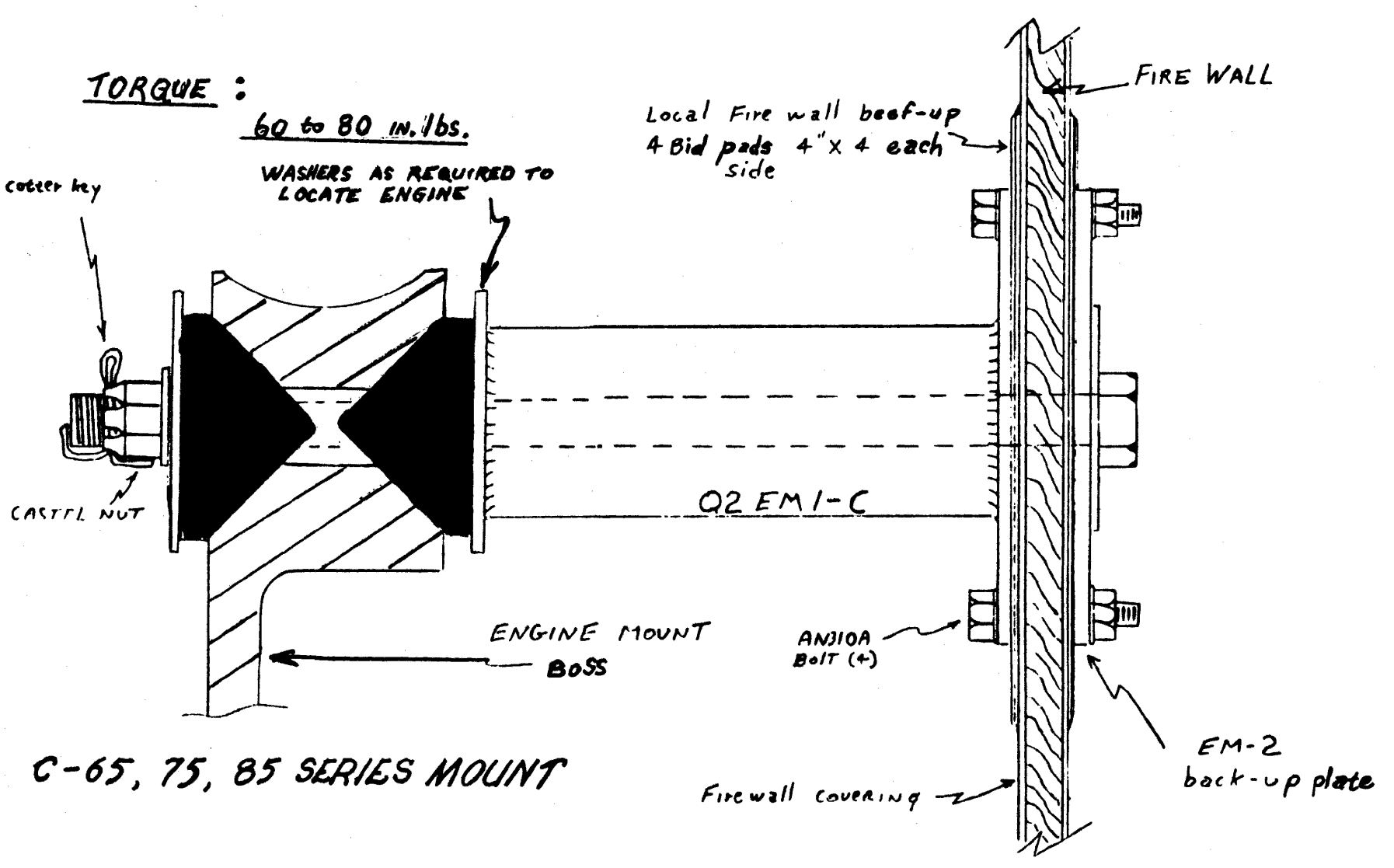


ENGINE MOUNTS

Standard Continental

Part	P.N.
Hose	638S5-16
Spacer	530627
Seat	530626
Bushing	530740
Washer	530741

Level aircraft to wl 15 and drop a plumb bob from the center of the end of the prop extension to the butt line on the ground. The bob should end up .2 to .3" to the right of the butt line. Now place a level on top of the engine case to make sure it is level. Engine position can be controlled by different thickness washers between engine mounts and standoffs. The engine off-set is to allow for engine torque, and you can correct for a slightly warped firewall by using washers to obtain correct left-right and horizontal engine alignment. Check clearances between magneto box and starter, magnetos, alternator, etc. You should try to maintain at least .2" at the closest points. Remember, the engine will rock slightly at idle.

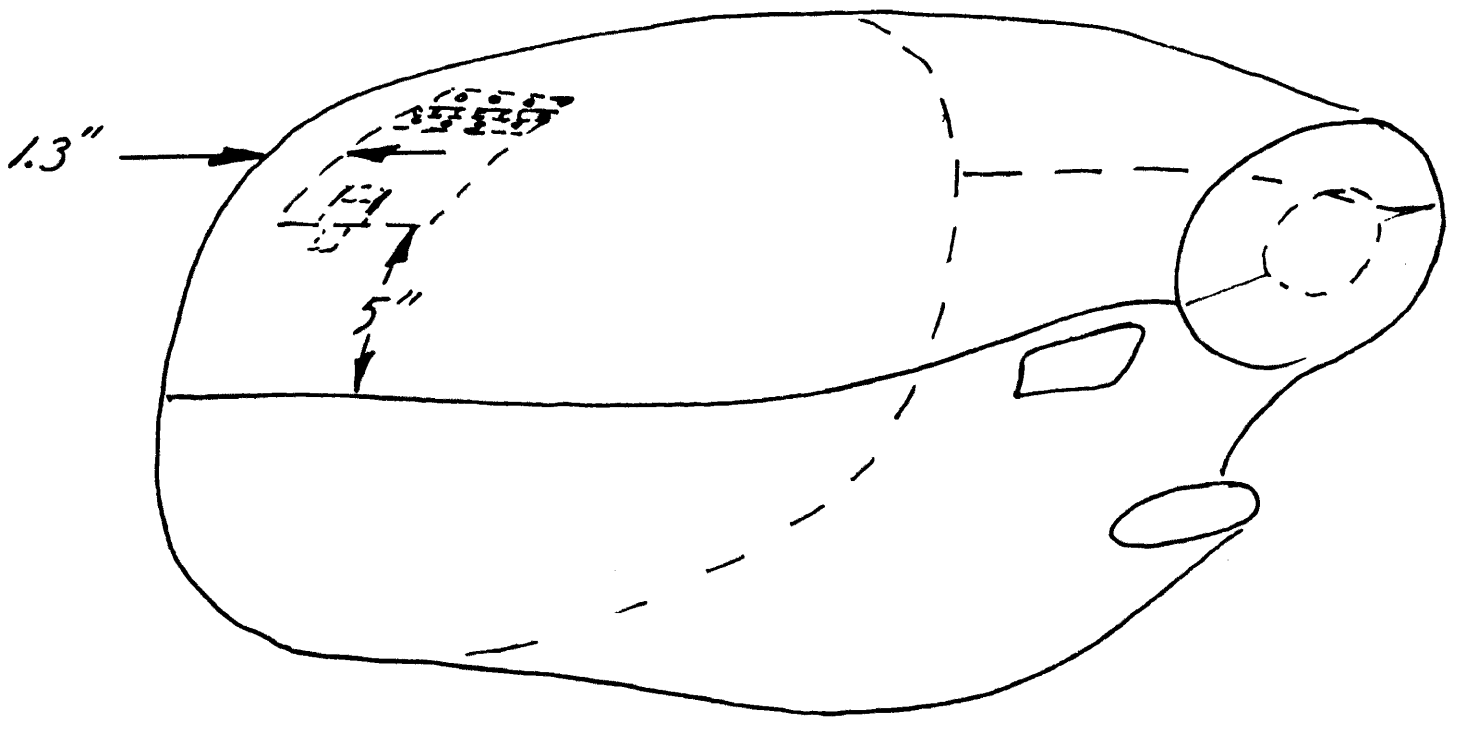


C-65, 75, 85 SERIES MOUNT

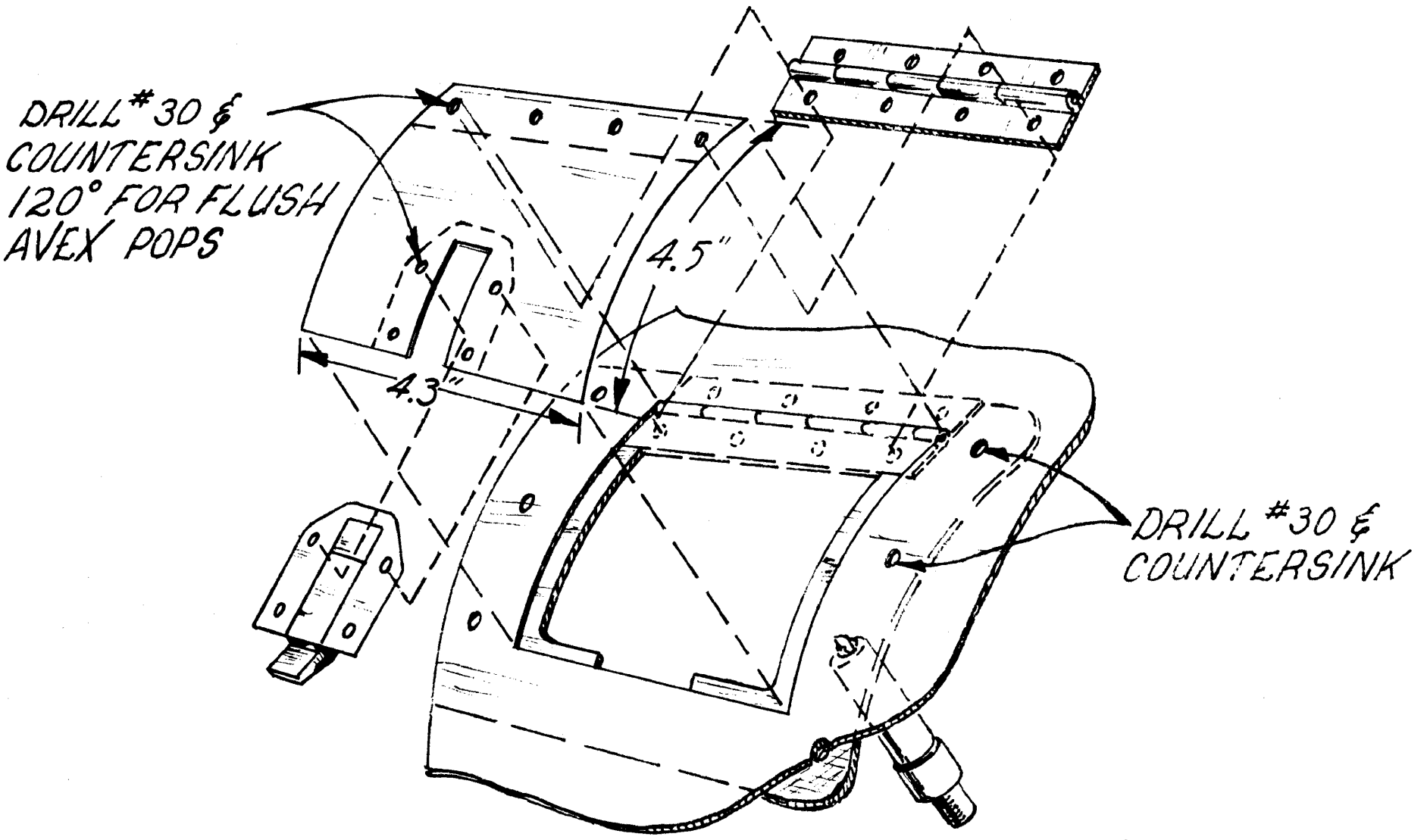
The alternator used with this installation is the B & C specialty 12 amp alternator. Available from:

Bill Bainbridge
518 Sunnyside Court
Newton, Kansas 67114
316-283-8662

It is a well proven, light and compact unit and will put out enough power for instruments, radios etc. We are working on a light weight, small alternator conversion of 35 amps, which will supply enough power for most all accessories, color radar, 3 axis auto pilot, color TV and wet bar etc. Although it is not recommended, larger alternators can be used by modifying the size and shape of the magneto box to suit. The penalty will be a reduction in foot room.



OIL CHECK DOOR



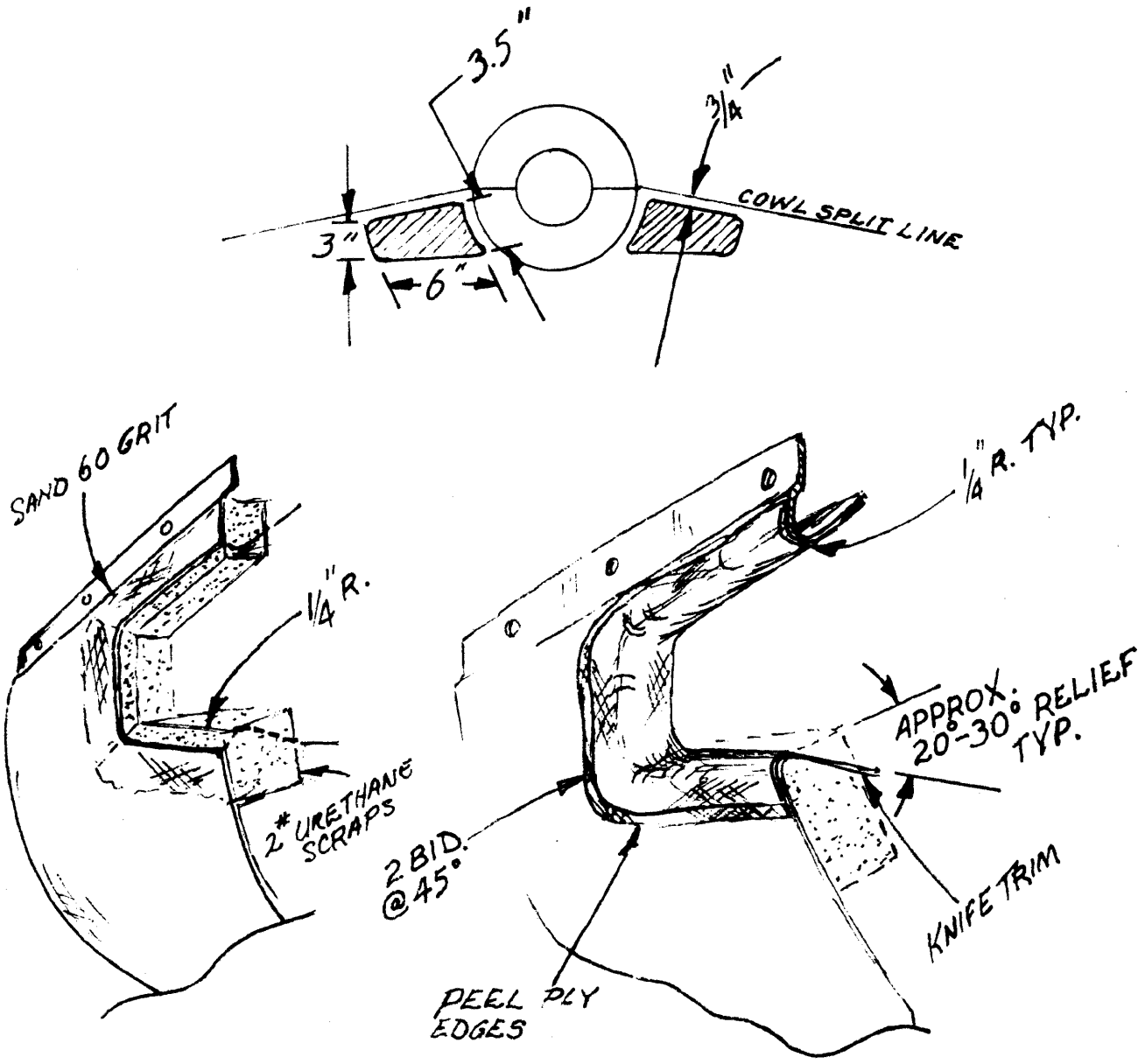
NOTE: DRAWING NOT TO SCALE

OIL CHECK DOOR
LOCATION:

Ours is about 5" up from top half split line and 1.3" from AFT edge and measures 4.3" wide x 4.5". You can configure yours however you like.

Construction Steps:

1. Make a full size cardboard pattern of the oil-check door, placing it on the outside of the top cowling. Draw a fine line around the pattern.
2. Grey tape the inside for a release, then lay-up 4 or 5 ply Bid allowing at least 1" to the perimeter dimension and let cure.
3. Remove inside lip lay-up, grey tape, and dremel saw the fine line you established in step 1.
4. Trim door top so formed aluminum hinge can be flushed in place, floxed (being careful not to get epoxy/flox in hinge area) and flush riveted in place using Avex (1604-0412) pop rivets. Of course you roughed the hinge and attach area for a good bond.
5. Trim inside cured lip allowing .2 inside stop and .5 to .75 outside trim for flox bond.
6. Sand both inside surfaces, flox and celco in place. Wipe off excess, Squeeze out, and install Hartwell flush latch with #1604-0412 Avex rivets.
7. Fill recesses with micro in finish mode.



COOLING AIR INLET:

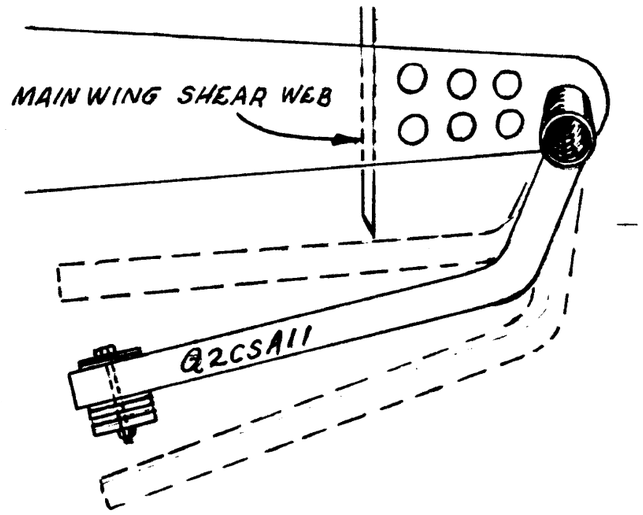
Layout trim lines for sketch & cut-out. Sand 60 grit 3/4" around cut-out in preporation for 2 ply bid. 45° Lay-up front side. Install 1" styro. or urethane foam to form inside lip with small dabs of 5 min. epoxy allowing ¼" foam to protrude inside trim line. Radius foam ¼" & away from opening about 20° or 30°. Glass 2 or 3 ply bid, let cure, knife trim, and finally, remove foam form.

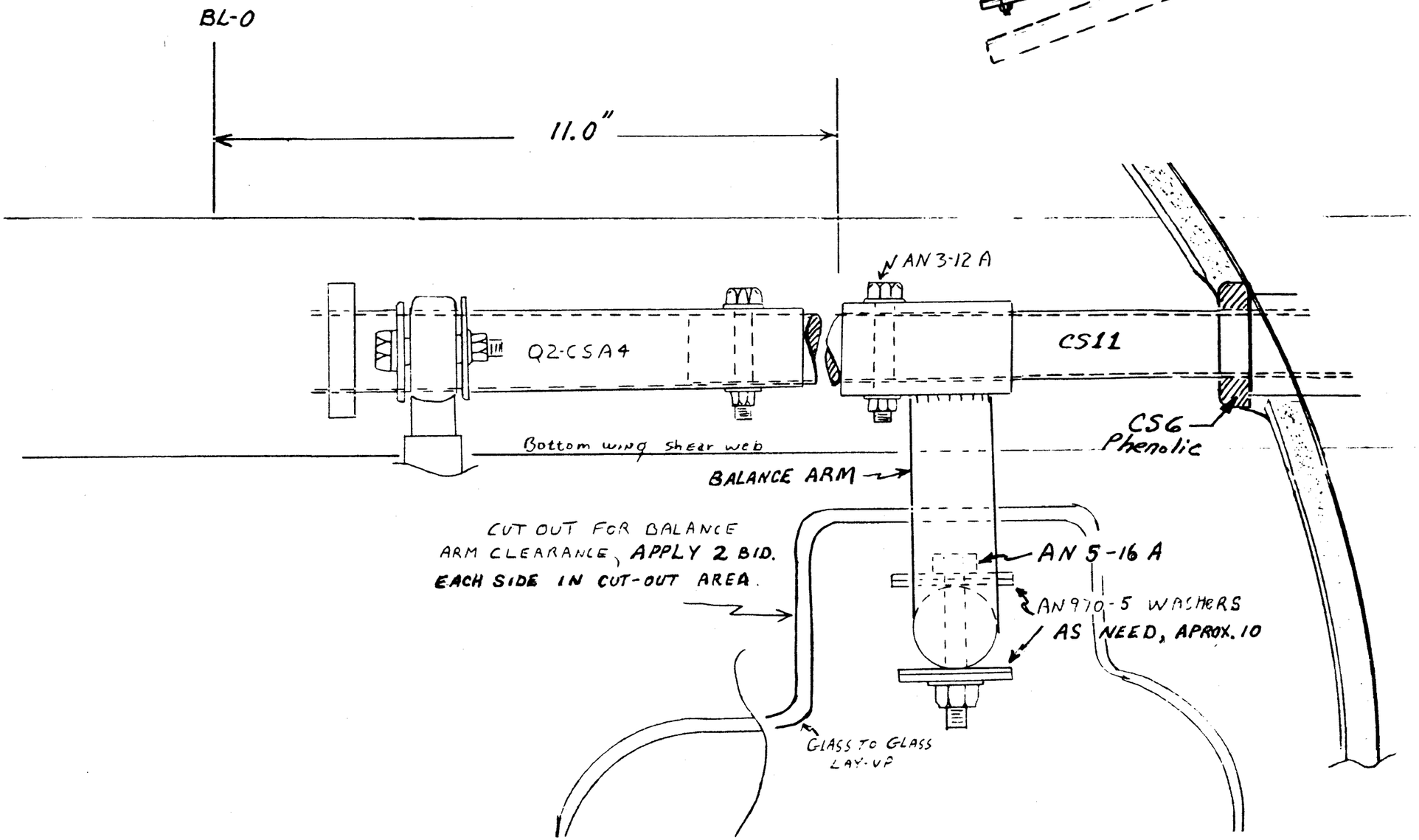
COWLING INSTALLATION

The cowling is a little long, to allow for individual building differences. Temporarily fasten spinner bulkhead to the end of the propellor extension. By attaching little spacers to the aft edge of the spinner bulkhead (about .10") you can trim the cowling to the fuselage and maintain a .10" gap between the spinner and the cowling. The details for the cowling installation are found in Q-2 Plans, page 16-3. The location and shape of the air inlets are different for the O-200 and are given in these plans. Also, the cowl flap has been eliminated. After the cowling has been cut to size and the cowling flanges have been attached to the firewall and the attach holes have been drilled between the upper and lower cowling halves. Remove cowling to install all nut plates, install air inlet radius and air inlet for the carburetor, cut oil door etc. If you have celcos (temporary sheet metal fastners), they make positioning the cowling easier during fitting and triming. Also, duct tape will help hold cowling in place during fitting. At this point, remove engine (do not lose track of mount spacers) and install firewall and seal all firewall openings around wires and cowling. You may bolt the voltage regulator and gascolator on the firewall at this time. Run primer lines from gascolator to primer, and primer to intake spider and fuel line from shut-off valve to gascolator to carburetor.

AILERON MASS BALANCING

The ailerons are balanced for obvious reasons of higher speed, and can be accomplished fairly fast. Assuming, of course, your aircraft can be disassembled behind the rear wing. As with the elevators, the ailerons should be as friction free as possible. The washers are bolted on the end of the internal balance arm to bring each aileron to full or slightly leading edge heavy balance. Make sure there is no interference with the arm for full aileron travel. Remember to disconnect ailerons from each other when balancing.



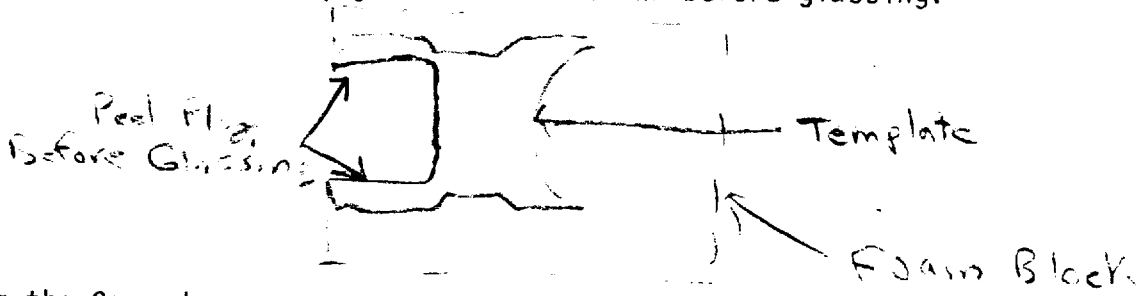


Dear Builder:

The enclosed drawings are for use in constructing the new LS(1) 0417 Mod wing. The four large appendix sheets are the final drawings. The few instructions included here are not. Those of you who have not started building your kits may wish to wait for the final chapter. The rest of you, we believe, should be able to proceed as you have gained enough experience that you do not need detailed instructions.

From BL15 to BL100, the hotwire block sizes are exactly the same as called out in the Q2 Construction Plans. From BL0 to BL15, we use 2 pieces instead of 1. The blocks for these should be sized to 15.70" long. These sections are jigged after the spars and other hotwired sections have been located. A bevel will need to be sanded to allow for the canard's anhedral.

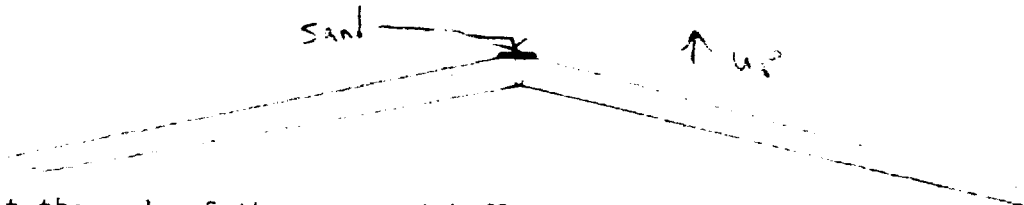
Place the trailing edges of the slot core templates at the edge of the foam blocks and hotwire only the elevator slot areas. Next, glass these with 2 BID. Note: Put down some peel ply in the area shown before glassing.



Jigging the Canard:

Locate the BL15, 48.8, 100 jigging templates to your jig table using the string holes and level lines for alignment. The spars must meet together at BL00. If they do not, recheck your alignment and adjust the templates. Sand the spars completely for bonding. There is an extra ply of fiberglass on the surface of the spars for this purpose.

Next, sand the crown off the top of the spars where they join. You may sand down until you just touch the foam. Wear a dust mask when sanding the black carbonfiber.



Coat the ends of the spars with flox then bond to the jigs with 5-min micro dabs. Remember the spars must join together perfectly with no joggles. Wipe the excess flox off and if there are no gaps, you may proceed with glassing the spars together. Otherwise, wait until the flox has cured and sand.

Use lumber as shown in the Q2 Plans before turning the canard over. Not as much will be required due to the stiffness of the spars.

After the canard has been covered, attach the slot cores with micro. Some sanding may be required to allow for the skin overlap on the spars. Both the slot cores and the elevators are exactly the same size and in the same position as in the Q2 Plans. After the micro has cured, sand the tabs on the cores down to the canard surface and glass with 2 BID.

Next, build the elevators. Hotwire cores are the same as is shown in the Q2 Plans. Note that there is only 1 slot for cutting the hole for the torque tube. When bonding the torque tubes in the elevator cores, use a brush and wet micro down this slot.

Use the templates provided for jigging the elevators for glassing. It is probably best to jig them after the torque tubes are installed but before the micro has cured. Glass with 2 UNI at 45°. When you sand down the tabs for glassing the top surfaces, note that the elevator has a blunt trailing edge. Refer to the hotwire templates. After glassing, sand the elevator trailing edges to length. Then remove some foam and fill with dry micro to prevent the skins from peeling.

Refer to the Q2 Plans for installation of the elevators, QCSM2's, CS17, CS14, CS15, etc.

Build the wheel pants using the templates provided. Refer to the Q2 Plans for detailed instructions. Note that these pants are designed to fit the standard tires only. We will design pants for the 500 x 5 tires later. You may modify the design yourself by referring to the Q2 Plans.

Install the wheel pants in the same manner as is detailed in the Q2 Plans. We recommend establishing about 1/2 - 3/4° toe out. This is accomplished by placing a mark on the inside face of each pant that is 2" forward of the axle hole centers, then sighting on the marks for alignment. This seems to improve ground handling.

Laminate the spars together first with 3 Ply BID at 45° extending about 6" either side of the joint. Stagger the plies about 1/2" to 1". Next, the caps are laminated using UNI. These caps are a minimum of 3½" wide and may be laminated on a clean plastic surface prior to transferring to the spars. Since these tapes are narrow and short, you may find it easier to use the selvage edge for one side of each ply. This will reduce the fraying.

We suggest that the bottom cap be laminated at this time and that you wait until the bottom surface of the canard has been covered to do the top.

The lamination schedule for the caps is:

Bottom: 5 ply - 18" x 3.5"
5 ply - 16" x 3.5"
5 ply - 14" x 3.5"
5 ply - 12" x 3.5"
5 ply - 10" x 3.5"

Top: 5 ply - 20" x 3.5"
5 ply - 18" x 3.5"
5 ply - 16" x 3.5"
5 ply - 14" x 3.5"
5 ply - 12" x 3.5"
5 ply - 10" x 3.5"

After the caps are cured, sand for bonding the skins.

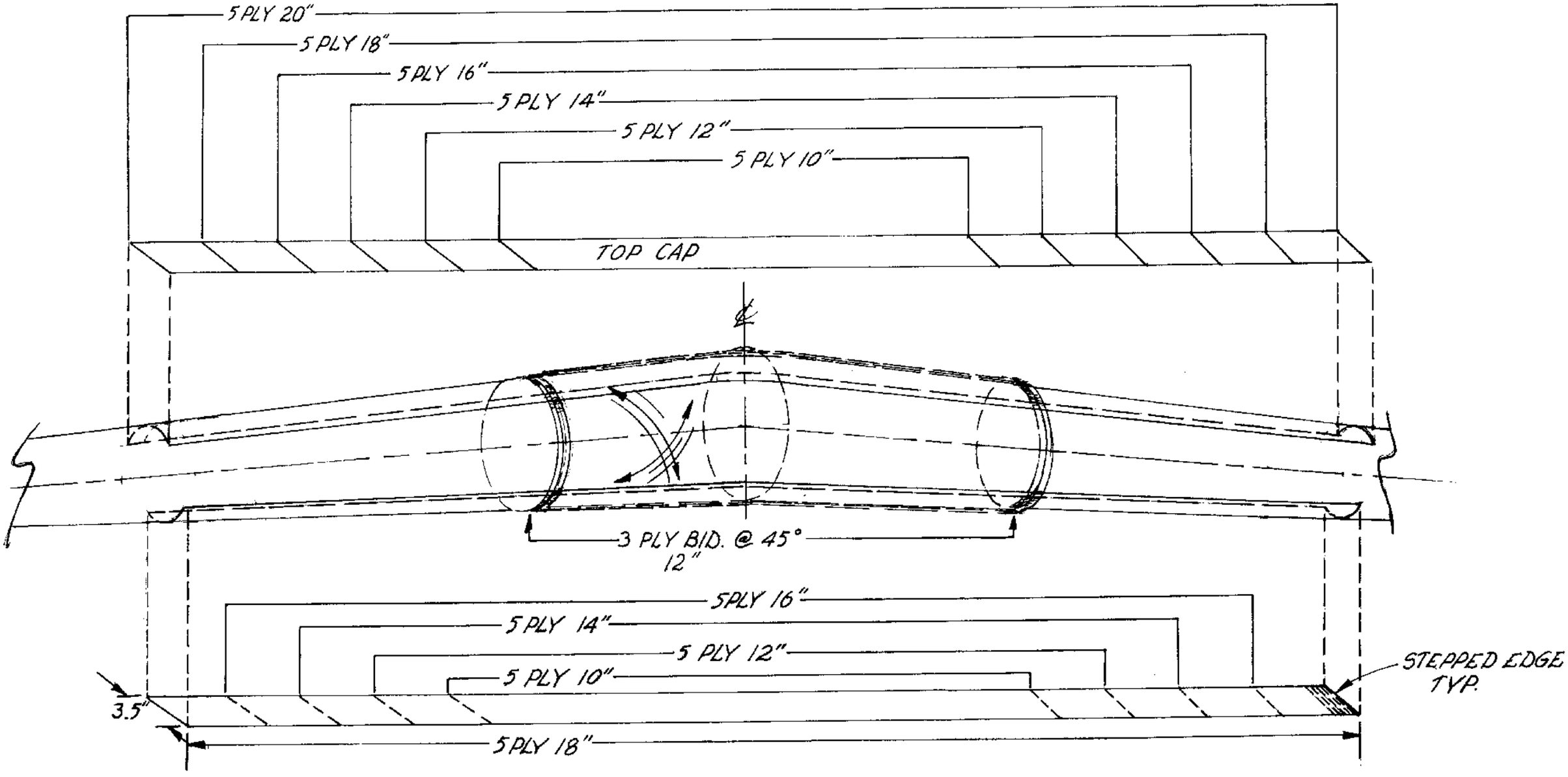
The center section cores will need to be modified to allow for these caps.

The canard cores may now be jigged and bonded together. Refer to the Q2 Plans. Laminate ribs of 2 BID at 45° at the BL15 joints. Jig the BL15 to BL00 cores after the ribs are semi-cured (still tacky). Sand the tabs on the cores tangent to the spars. Fair the surface of the core to the caps with very dry micro. Do not get any micro on the caps.

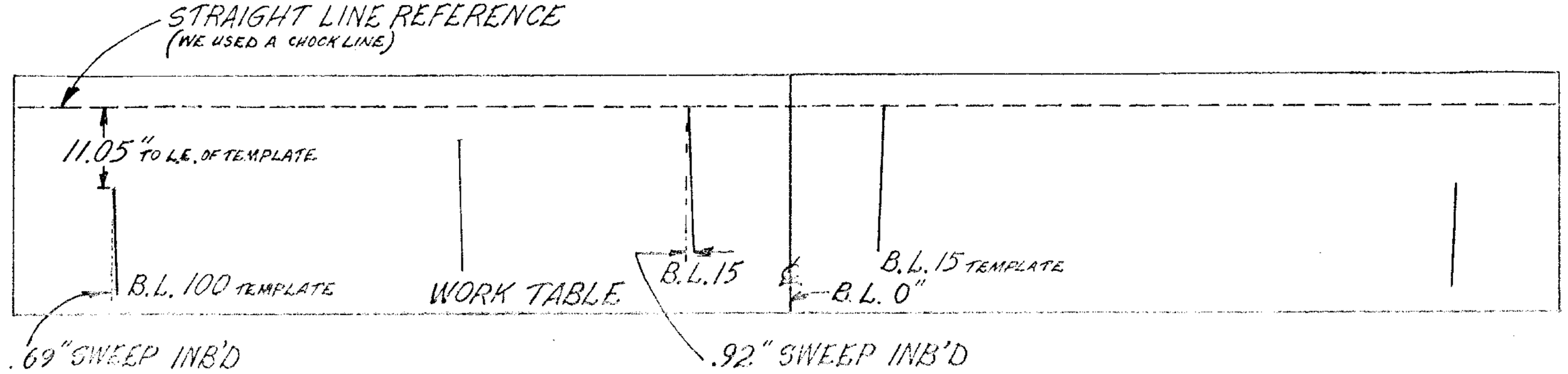
Canard Skin Lamination Schedule:

Bottom - 2 Ply at 45° to the spars (90° to each other)
1 Ply spanwise
Overlap the spars with all 3 plies outboard of the caps and overlap the caps. Knife trim the skins at the leading edge. After curing, sand to taper the skins between 0 and 1 on the hotwire templates.

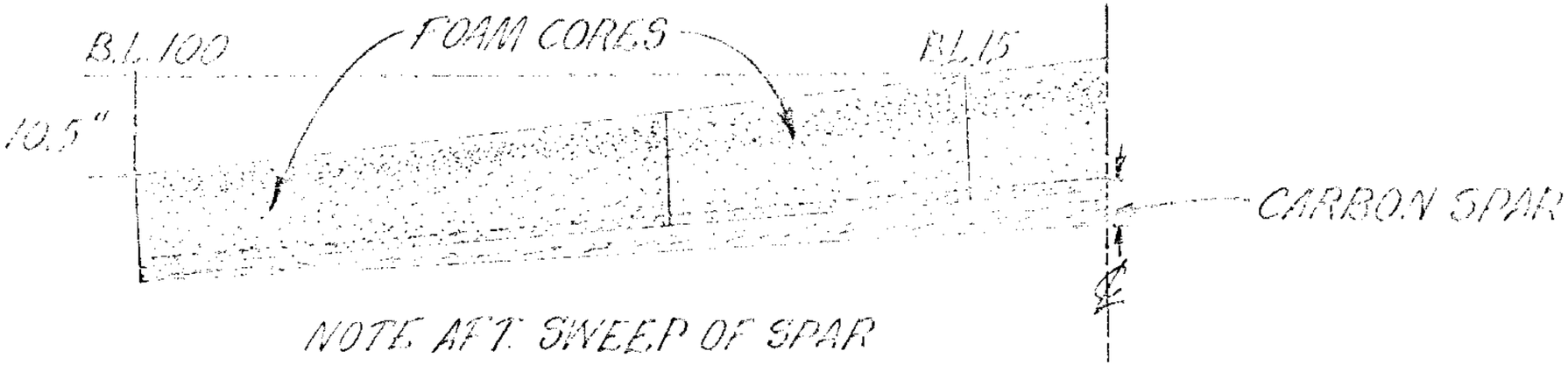
Top - 2 Ply at 45° to the spars (90° to each other)
1 Ply spanwise
1 Ply spanwise to BL15 each side for extra "heel" protection.
Overlap the spars and the bottom skins on the spar by about 1½".
Overlap the caps. Overlap the leading edge of the bottom to about 1½ on the hotwire templates.

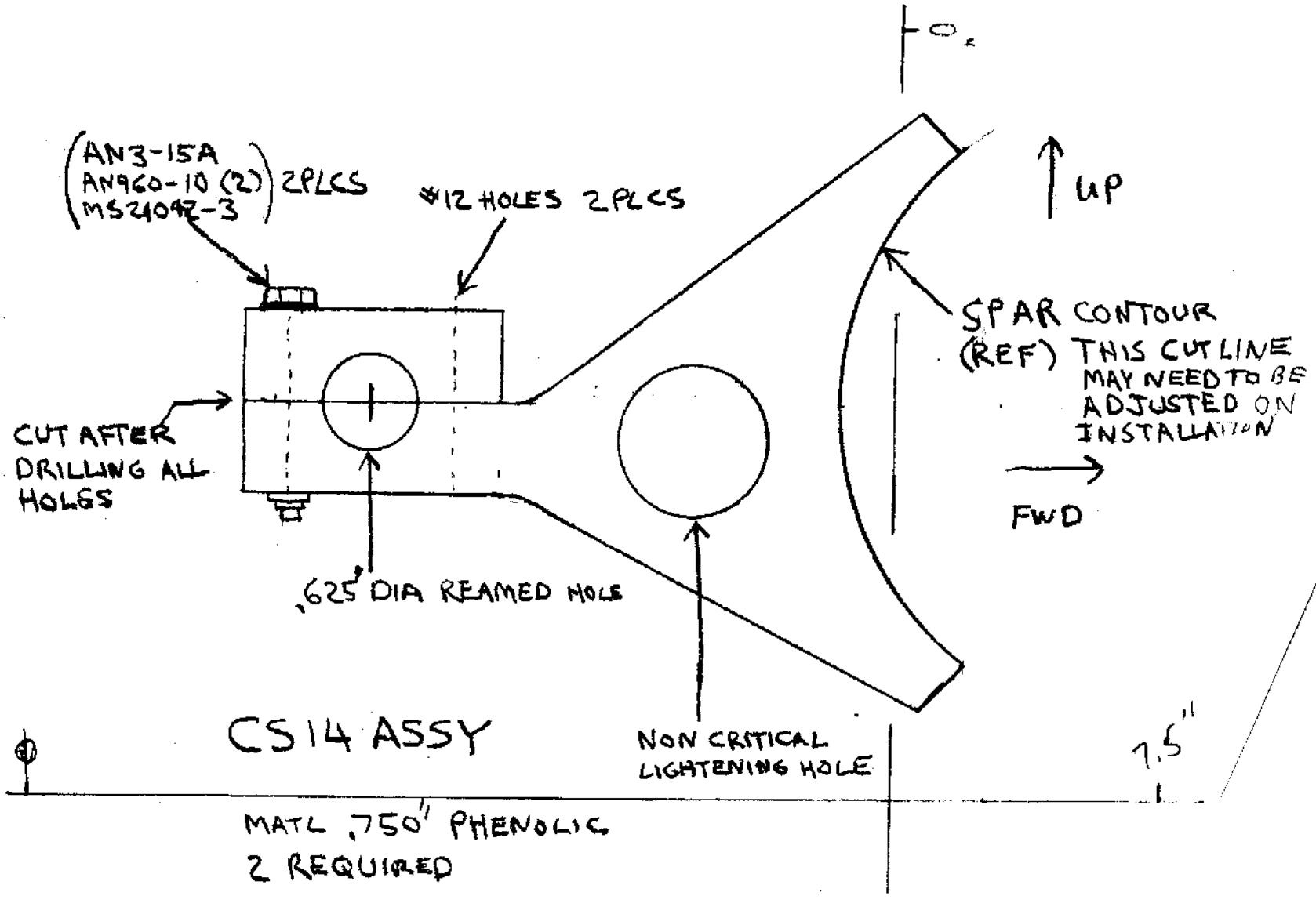


7/14/83
DRAWING NOT TO SCALE
LARRY LOMBARD
Q.A.C.



CANARD FIXTURE
PLACEMENT ADDENDUM
TO APPENDIX SHEET W-1
8/26/83
DRAWN BY:





MATL .750" PHENOLIC
2 REQUIRED

LOCATE EACH CS14 ABOUT 2.5" FROM BL00
AFTER ELEVATORS & HINGES HAVE BEEN LOCATED

INSTALL WITH FOX & 2 BID/EACH SIDE

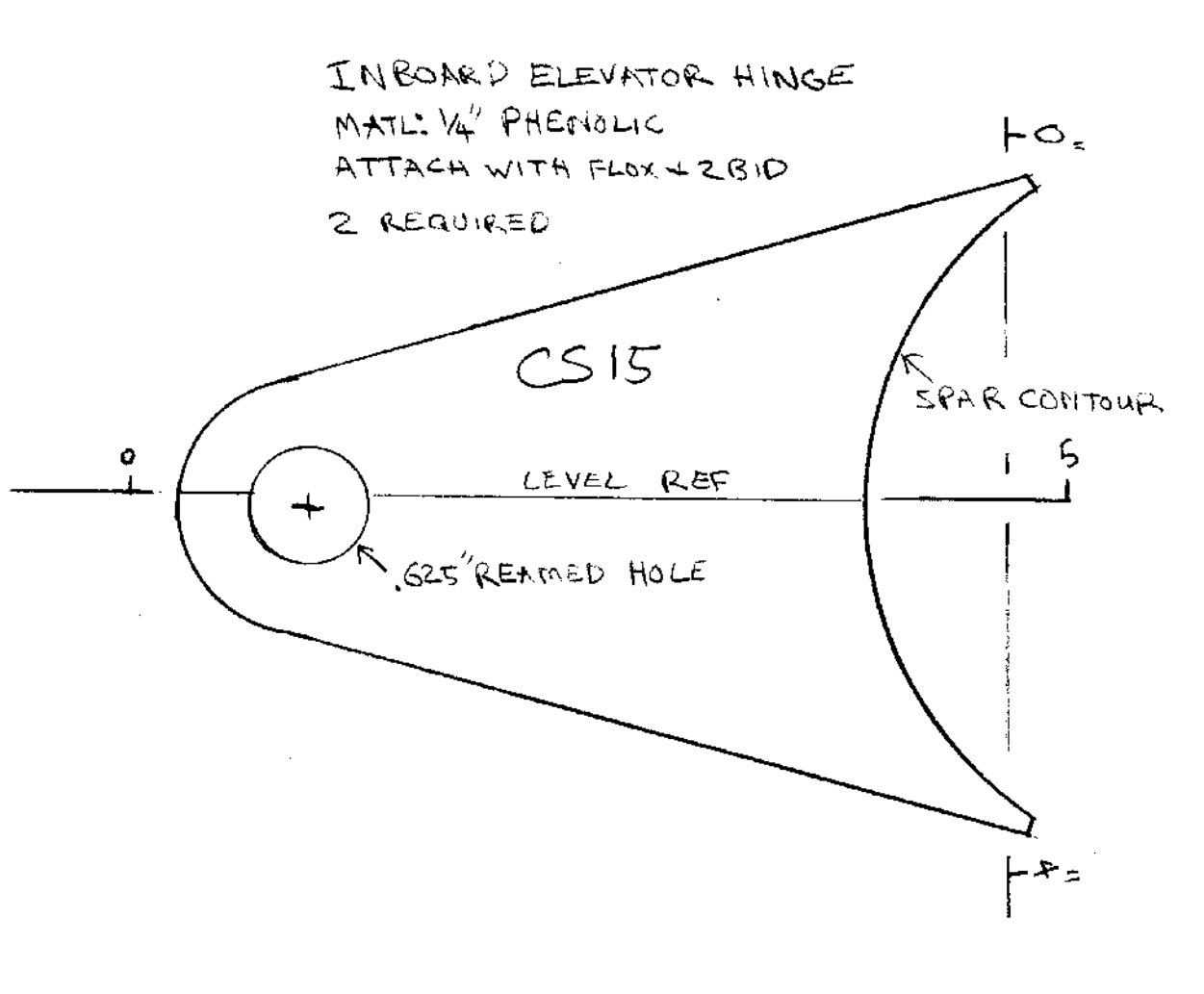
CS14 ASSY

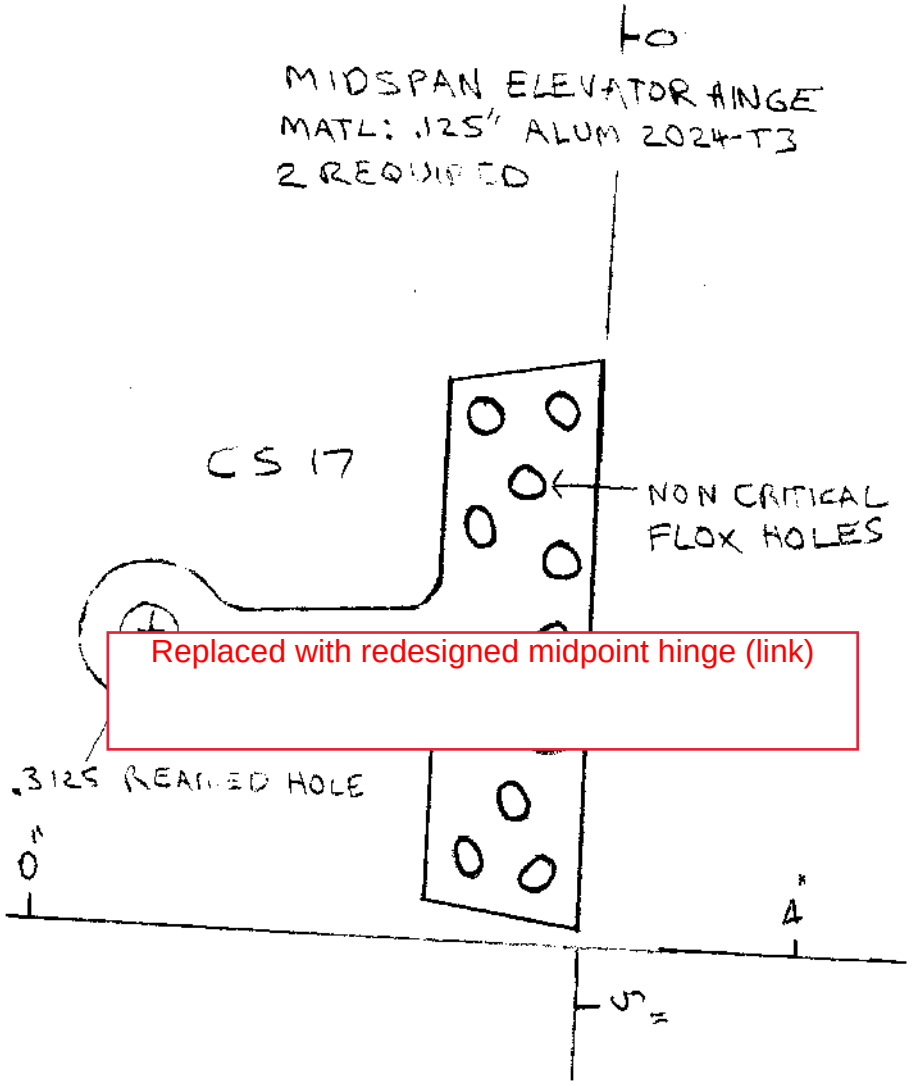
NON CRITICAL
LIGHTENING HOLE

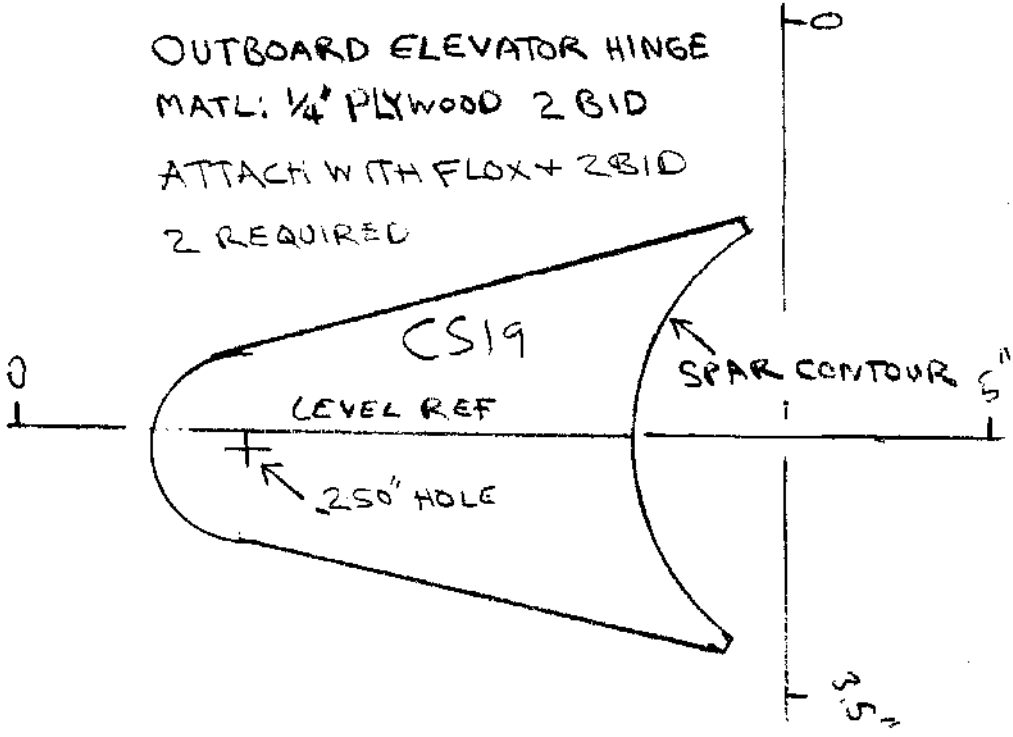
MATL .750" PHENOLIC
2 REQUIRED

LOCATE EACH CS14 ABOUT 2.5" FROM BL00
AFTER ELEVATORS & HINGES HAVE BEEN LOCATED

INSTALL WITH FOX & 2 BID/EACH SIDE

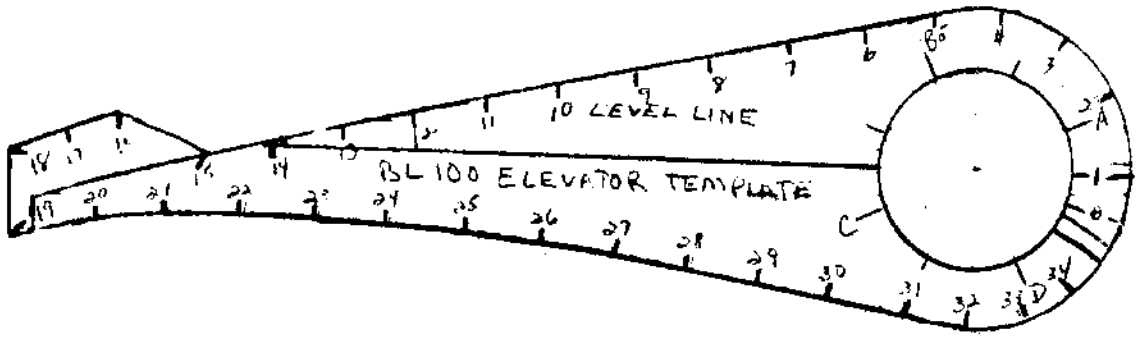

INBOARD ELEVATOR HINGE
MATL: 1/4" PHENOLIC
ATTACH WITH FLOX + 2BID
2 REQUIRED
CS15
SPAR CONTOUR
LEVEL REF
.625" REAMED HOLE
0
5

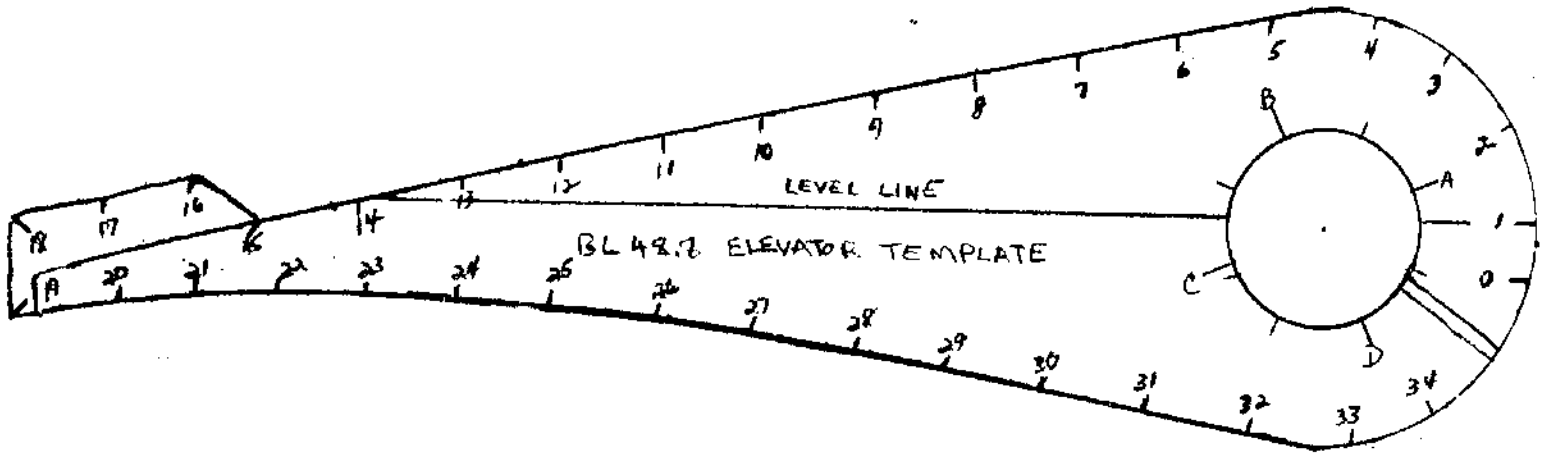

MIDSPAN ELEVATOR HINGE
MATL: .125" ALUM 2024-T3
2 REQUIRED
CS 17
NON CRITICAL
FLOX HOLES
Replaced with redesigned midpoint hinge (link)
.3125 REAMED HOLE
0"
4"

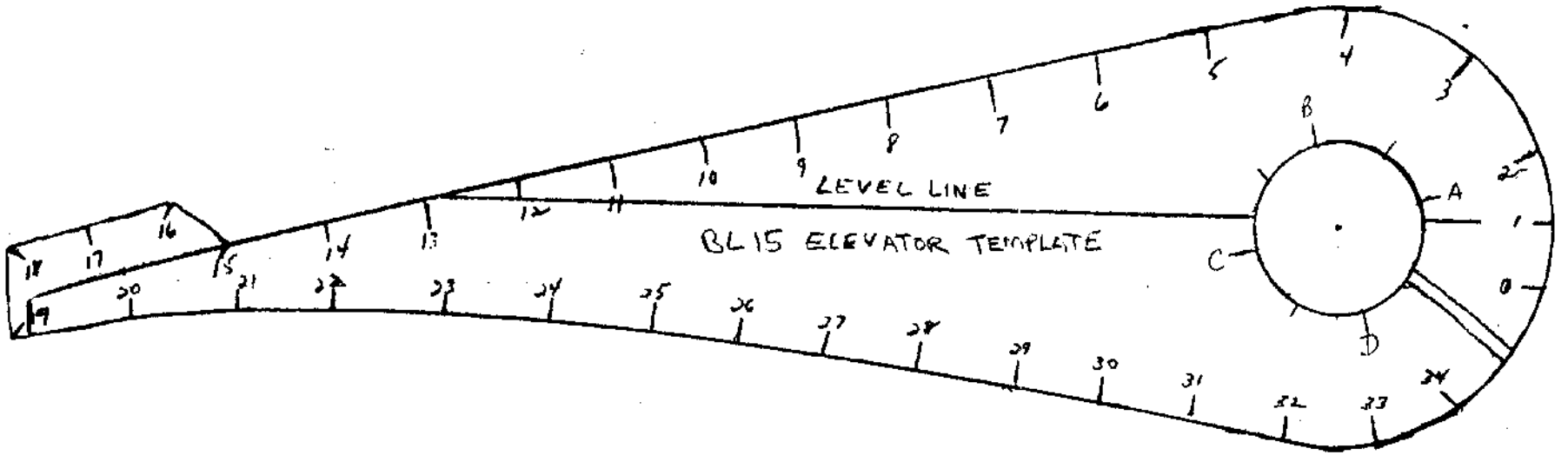

OUTBOARD ELEVATOR HINGE
MATL: 1/4" PLYWOOD 2 BID
ATTACH WITH FLOX + 2BID
2 REQUIRED
CS19
0
LEVEL REF
SPAR CONTOUR
5"
.250" HOLE
3.5"

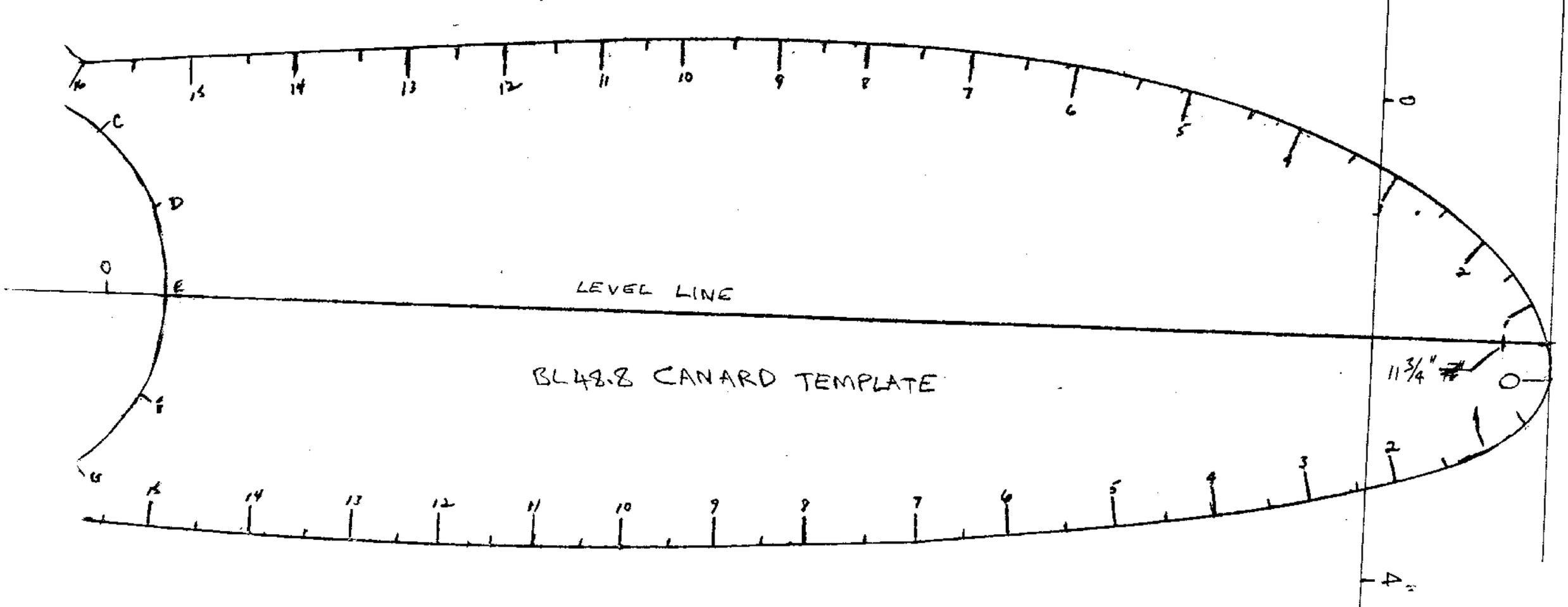
Dear Builder,

The original templates sent to you were incorrectly numbered. Please substitute the old templates received earlier with this new copy. If you have already cut with the old ones, simply renumber them.





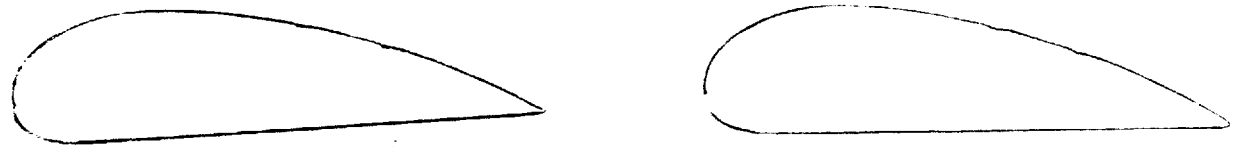



LEVEL LINE
BL48.8 CANARD TEMPLATE
11 3/4"

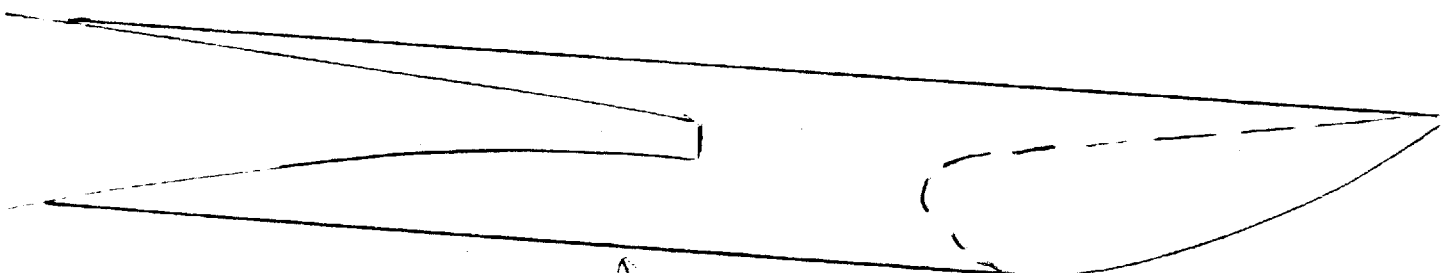
"Sparrow Strainers" These are trim devices required due to the pressure distribution of the LS(1) 0417 Mod airfoil. At the current time, QAC is experimenting with smaller versions and different placements. We hope to reduce drag with these tests. If we are successful, we will send out a change to all who have ordered the new wing. The system shown has been tested and works very well. Do not fly without them.

The inboard attach point should be 24.75" from the inboard edge of each elevator.

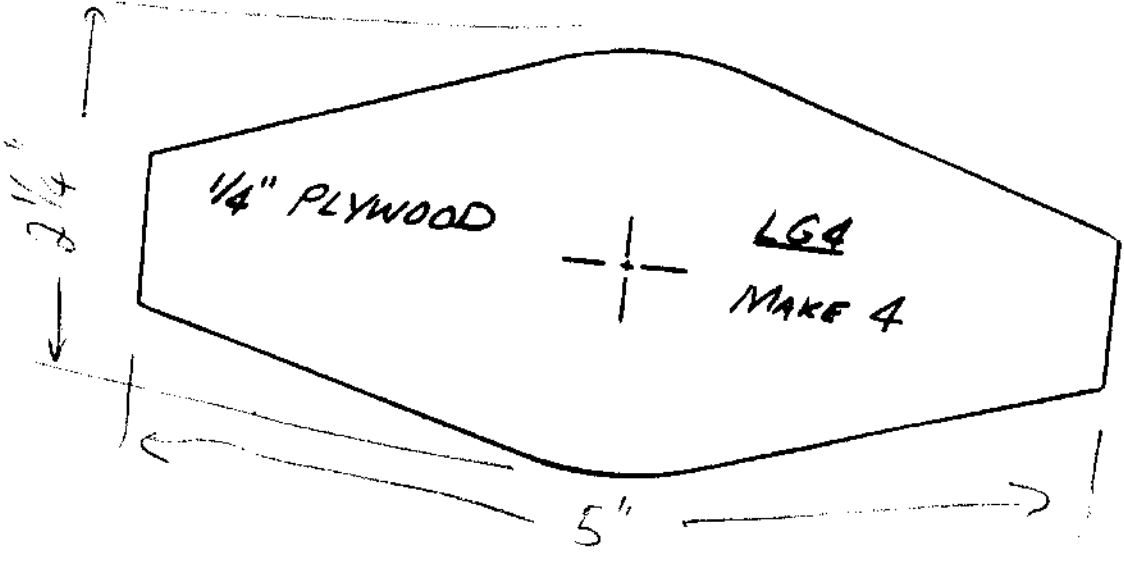
Make the small airfoil sections from balsa, carve to shape. Assemble on the elevators with flox and 1 BID, peel plied.



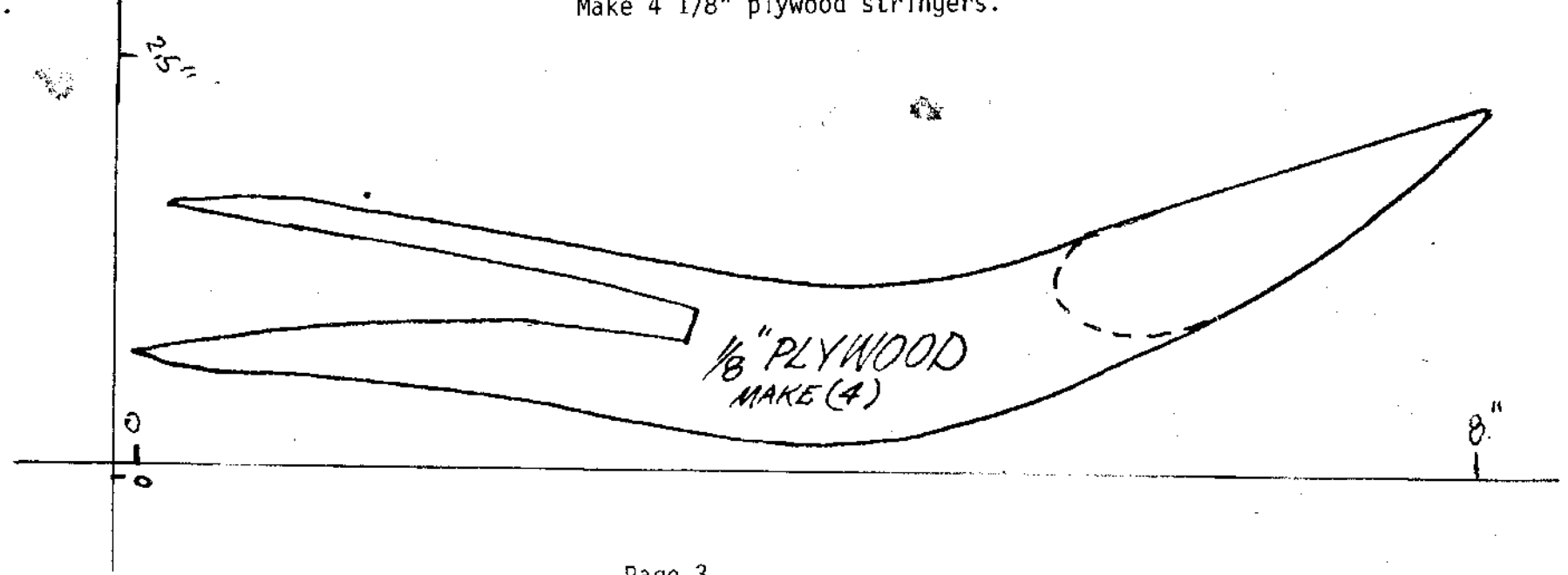
Balsa 2 Required

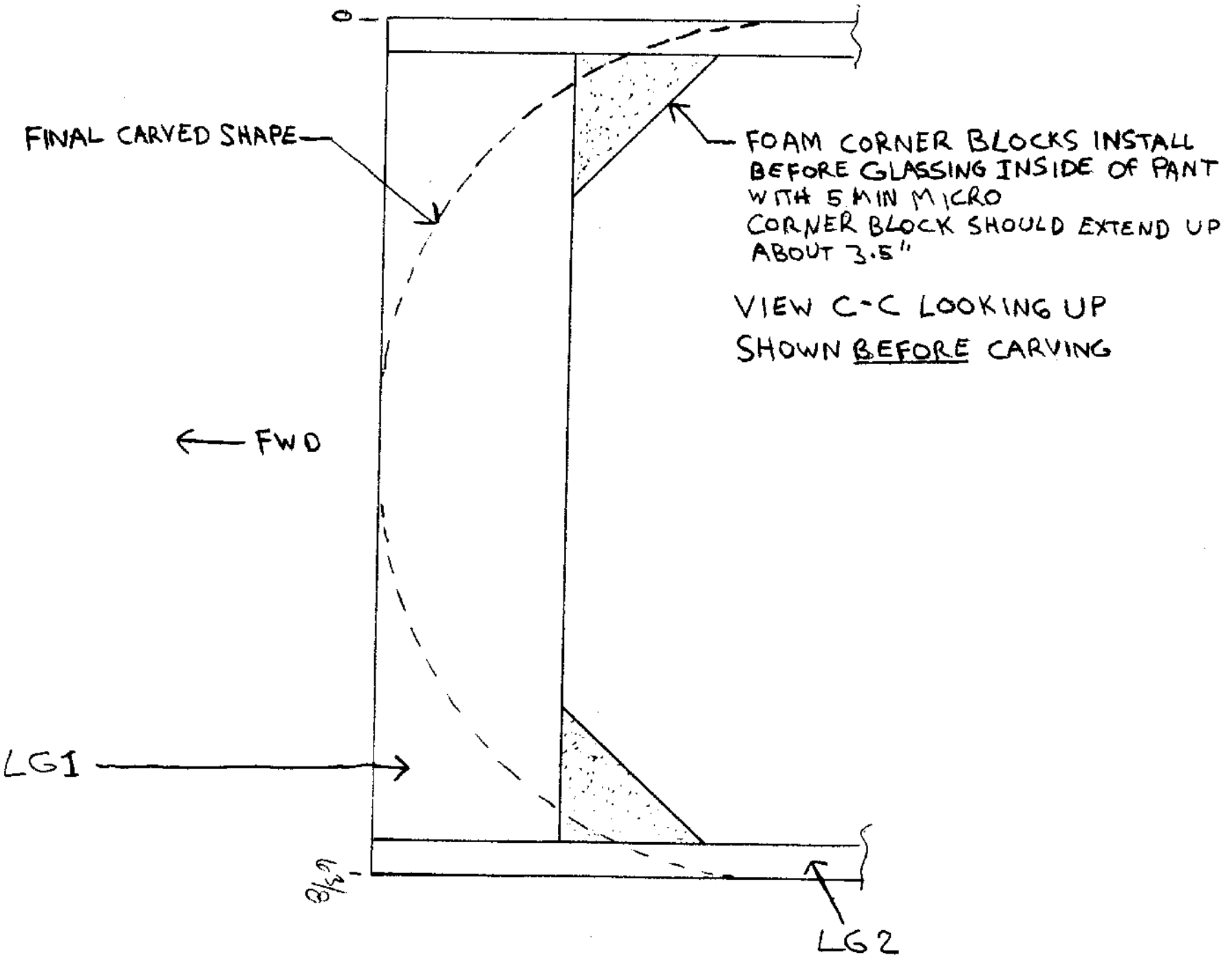


1/8 Plywood 4 required


1/4" PLYWOOD
LG4
MAKE 4
2 1/4"
5"

Make 4 1/8" plywood stringers.

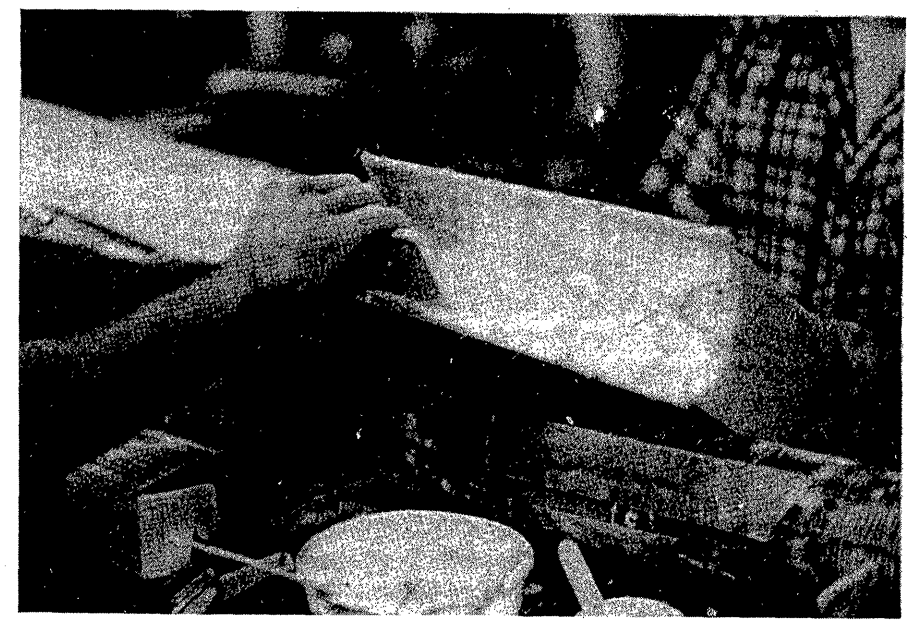



FINAL CARVED SHAPE
FOAM CORNER BLOCKS INSTALL BEFORE GLASSING INSIDE OF PANT WITH 5 MIN MICRO CORNER BLOCK SHOULD EXTEND UP ABOUT 3.5"
VIEW C-C LOOKING UP
SHOWN BEFORE CARVING
FWD
LG1
LG2

CONSTRUCTION OF LS(1) 0417 MOD CANARD.

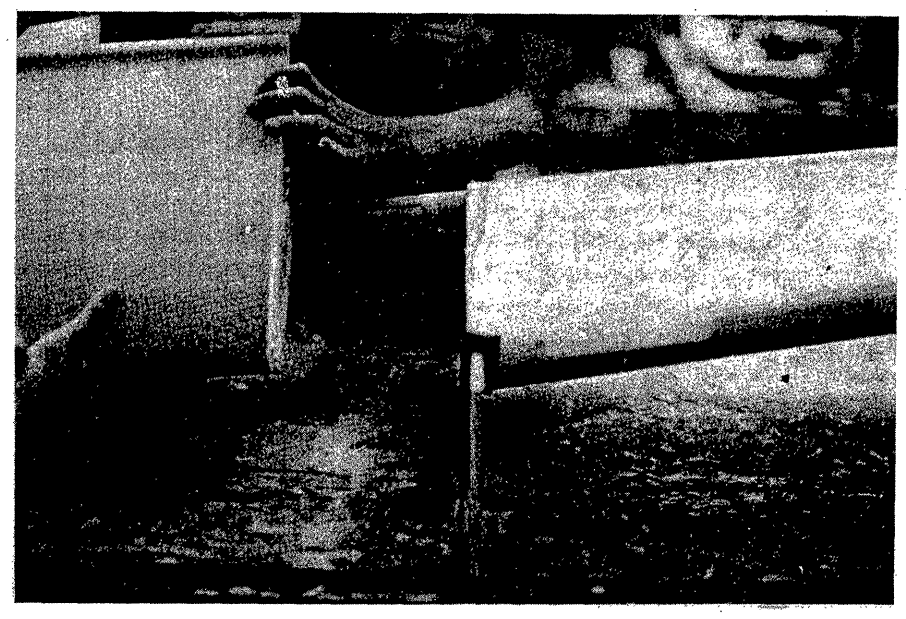
JIGGING THE CANARD:

Establish a B.L.15 reference line on the topside of your canard jigging table. This can be done with a long straight edge or chalk line. Locate and mark on your table B.L.'0-0', 15, 48.8, and 100, both sides. Place jig blocks B.L.15, 48.8, and 100 in their respective places (they are glued to ¼" or thinner plywood, fiberboard, etc.). 5 minute or bondo to table shimming for level, proper anhederal, and sweep (see addendum to appendix sheet W-4-8/26/83). (*Also, disregard string hole alignment methods aft end of jig blocks). Note: B.L. 100 blocks will extend slightly outboard of B.L.100 foam cores since foam core measurement was flat, not at anhedral angle. You can move the B.L.100 jig blocks inboard to match the cores when trial fitting to spars.



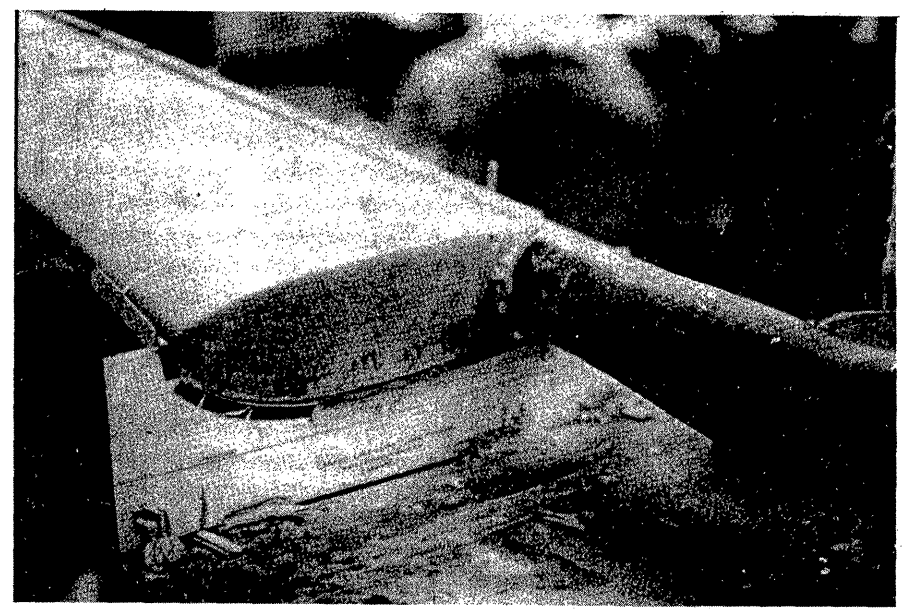
Trial fit both spars at trailing edges (we held ours in place with large rubber bands). Some custom fitting will likely be needed @ B.L.'0-0'. Note, 3.5° + sweep aft of spars at outboard tips.

Sand spars completely for bonding. There is an extra ply of fiberglass on the surface for this purpose. Grind center portion of spars (B.L.'0-0'°) at apex to minimize bump. Wear a dust mask when sanding the black carbon fiber. *See 1st sketch page 2.



From B.L.15 to B.L.100, the hotwire block sizes are exactly the same as called out in the Q2 Construction Plans. From B.L.0 to B.L.15, we use 2 pieces instead of 1. The blocks for these should be sized to 15.70" long. These sections are jigged after the spars and other hotwired sections have been located. A bevel will need to be sanded to allow for the canard's anhedral. Trial fit cores in place, check transition alignment, and sweep aft. From B.L.15 to B.L.100, you should measure about 10.5" at L.E. foam cores.

Coat the ends of the spars with flox, then bond to the jigs with 5-min micro dabs. Remember the spars must join together perfectly with no joggles. Wipe the excess flox off and if there are no gaps, you may proceed with glassing the spars together. Otherwise, wait until the flox has cured and sand.



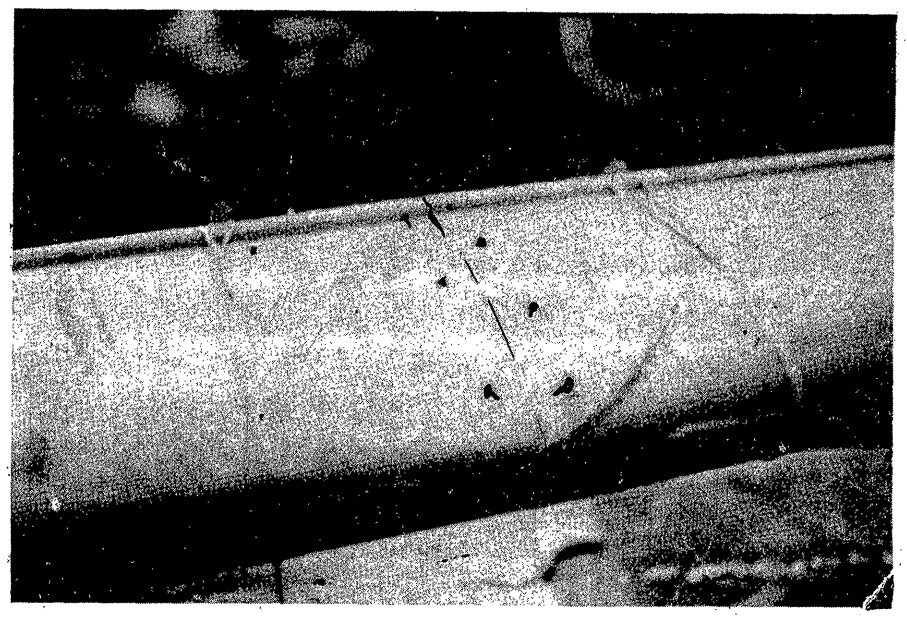
Laminate the spars together first with 3 ply BID at 45° extending about 6" either side of the joint. Stagger the plies about ½" to 1". Next, the caps are laminated using UNI. These caps are a minimum of 3½" wide and may be laminated on a clean plastic surface prior to transferring to the spars. since these tapes are narrow and short, you may find it easier to use the selvage edge for one side of each ply. This will reduce the fraying.

We suggest that the bottom cap be laminated at this time and that you wait until the bottom surface of the canard has been covered to do the top.

The lamination schedule for the caps is:

Bottom: 5 ply - 18"x3.5"
5 ply - 16"x3.5"
5 ply - 14"x3.5"
5 ply - 12"x3.5"
5 ply - 10"x3.5"

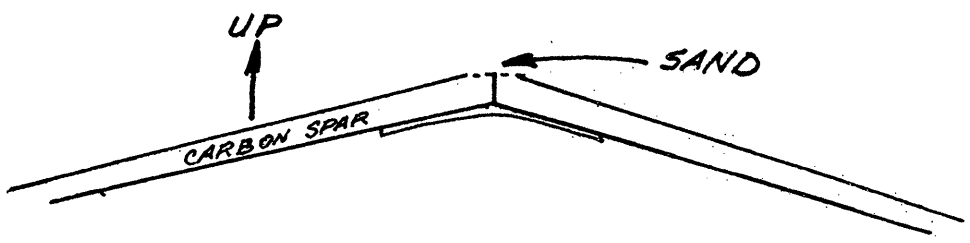
Top: 5 ply - 20"x3.5"
5 ply - 18"x3.5"
5 ply - 16"x3.5"
5 ply - 14"x3.5"
5 ply - 12"x3.5"
5 ply - 10"x3.5"



After the caps are cured, sand for bonding the skins.

The center section cores will need to be modified to all for these caps.

The canard cores may now be jigged and bonded together. Refer to the Q2 Plans. Laminate ribs of 2 BID at 45° at the B.L.15 joints. Jig the B.L.15 to B.L.'0-0' cores after the ribs are semi-cured (still tacky). Sand the tabs on the cores tangent to the spars. Fair the surface of the core to the caps with very dry micro. Do not get any micro on the caps.



We didn't attempt to shape B.L.'0-0' cores for a micro joint, but instead, left a gap to be filled with pour-in-place #2 density (x-40 available from Aircraft Spruce). Build a dam with cardboard and duct tape bottom gap. Sand fair after cure (usually about 30 minutes).

Note: Center blocks (B.L.15-'0-0') are shown with straight leading edge (B.L.100-B.L.'0-0') B.L.15-B.L.'0-0' blocks should be parallel to firewall at leading edges, thus eliminating approximately .9" sweep B.L.'0-0' - B.L.15. You can hand shape the inboard blocks since surface contour is not a critical flying surface.

Do a final check top and bottom of cores for transition errors, warpage, etc. Place additional support members (blocks 31.9 & 74.4) in appropriate positions to assist core support for glassing. We made random felt pen - - - marks on cored ±45° to assist unidirectional cloth alignment.

Micro foam cores and allow an hour or 2 set up time before glassing.

THE LAYUP:

Better conservation of cloth can be employed by fitting scrap triangle with selvage edge inboard for first pull. (e.g.)

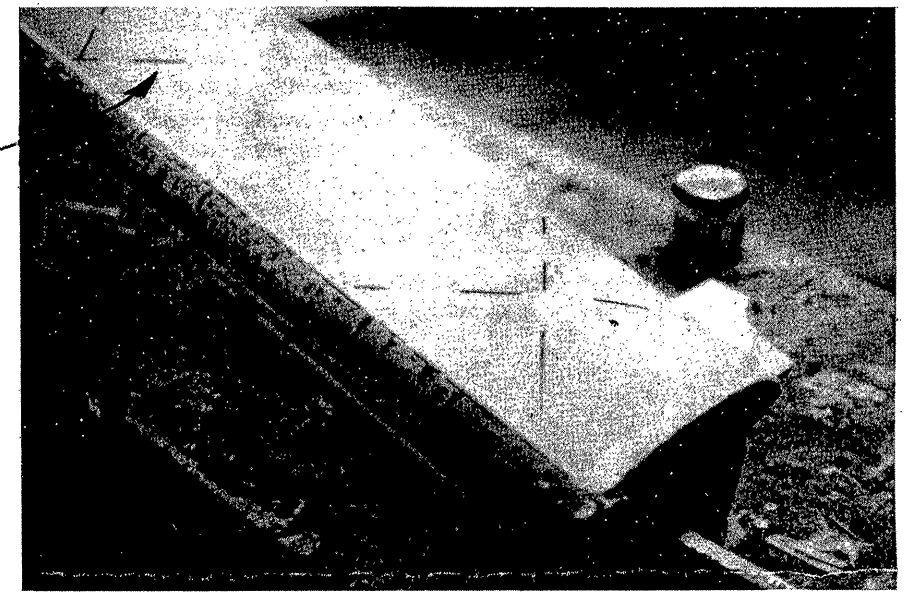
Allow UND. to wrap spar at T.E. and let cloth drape tangent at L.E.

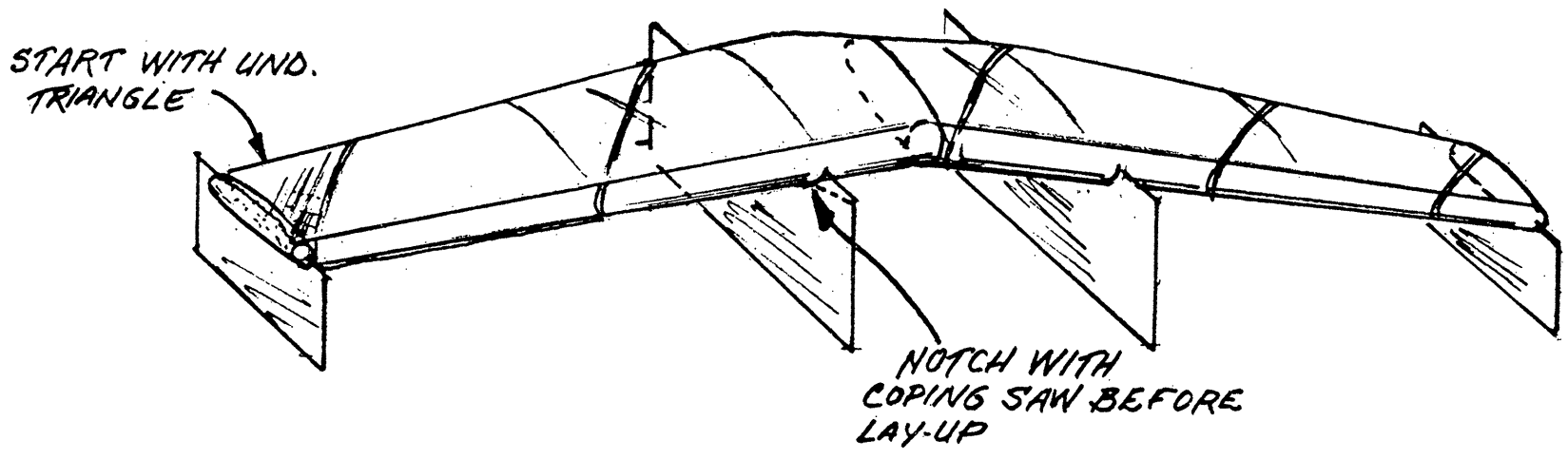
Canard skin lamination schedule:

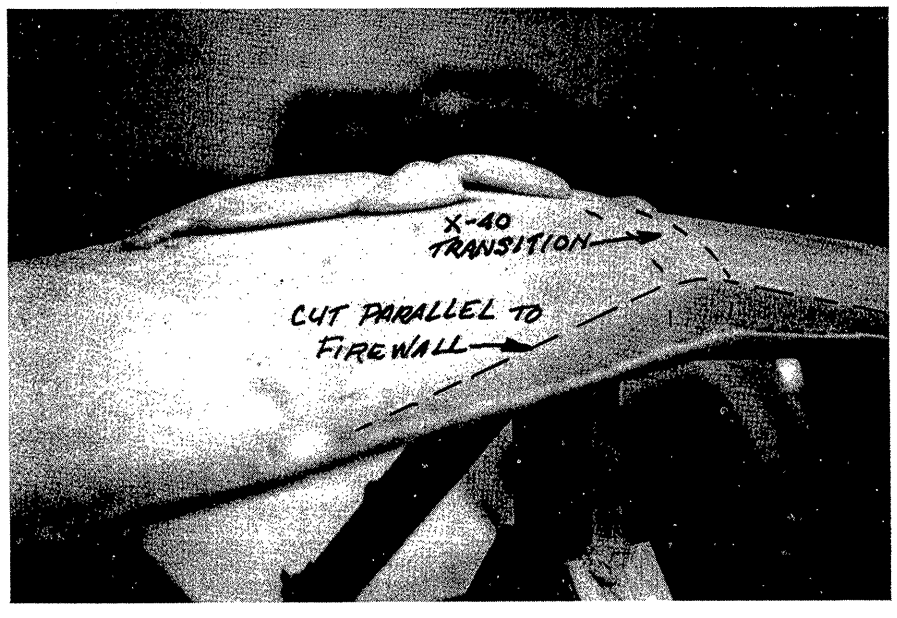
Bottom - 2 ply at 45° to the spars (90° to each other)
1 ply spanwise
Overlap the spars with all 3 plies outboard of the caps and overlap the caps.
Knife trim the skins at the leading edge. After curing, sand to taper the skins between 0 and 1 on the hotwire templates.

Top - 2 ply at 45° to the spars (90° to each other)
1 ply spanwise. We let selvage edge parallel L.E.
1 ply spanwise to B.L.15 each side for extra "heel" protection. Overlap the spars and the bottom skins on the spar by about 1½". Overlap the caps. Overlap the leading edge of the bottom to about 1½ on the hotwire templates.

Knife trim leading edge, let cure 24 hrs.

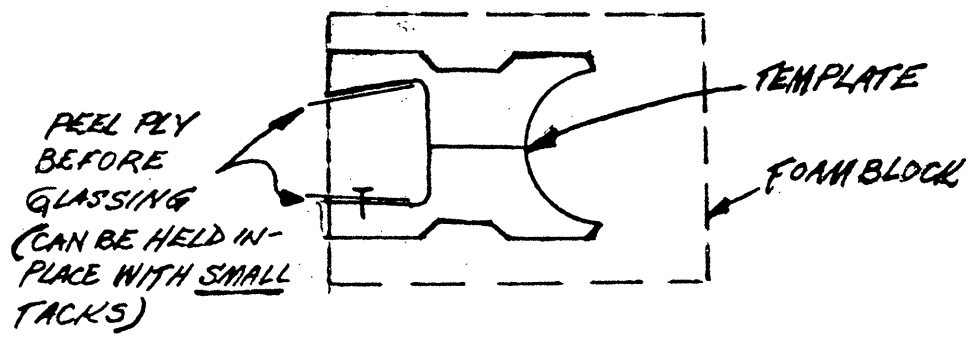






SLOT CORES:

Place the trailing edges of the slot core templates at the edge of the foam blocks and hotwire only the elevator slot areas. Next, glass these with 2 BID. Note: Put down some peel ply in the area shown before glassing. Let cure.



Use lumber as shown in the Q2 Plans before turning the canard over. Not as much will be required due to the stiffness of the spars.

After the canard has been covered, attach the slot cores with micro. Some sanding may be required to allow for the skin overlap on the spars. Both the slot cores and the elevators are exactly the same size and in the same position as in the Q2 Plans. After the micro has cured, sand the tabs on the cores down to the canard surface and glass with 2 BID.

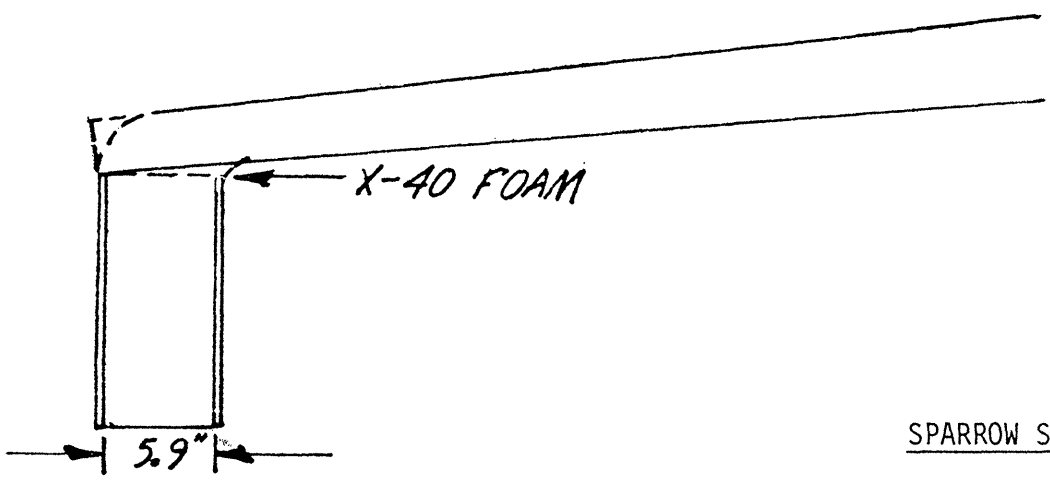
> Note: It may be easier for you to build the elevators before installing the slot cores & trial fit the attach structure. The slot cores can be treated as fairing, sectioned, & installed around CS 15, 17, & 19 with one ply BID. Be sure to micro high density white foam blocks in place as hard parts detailed in Q2 Plans.

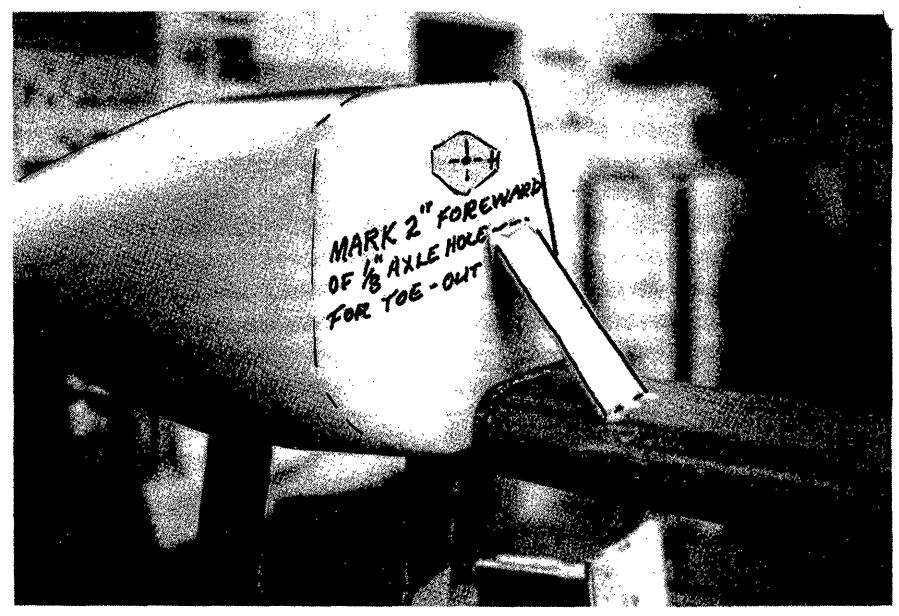
Next, build the elevators. Hotwire cores are the same as is shown in the Q2 Plans. Note that there is only 1 slot for cutting the hole for the torque tube. When bonding the torque tubes in the elevator cores, use a brush and micro down this slot.

Use the templates provided for jigging the elevators for glassing. It is probably best to jig them after the torque tubes are installed, but before the micro has cured. Apply peel ply to bare foam trailing edge 1/4" to 3/8" before glassing for a stippled close-out. Glass with 2 UNI at ±45°. When you sand down the tabs for glassing the top surfaces, note that the elevator has a blunt trailing edge. Refer to the hotwire templates. After glassing, sand the elevator trailing edges to length. Then remove some foam (¼") and fill with dry micro to prevent the skins from peeling. Coat w/pure epoxy first.
Refer to the Q2 Plans for installation of the elevators, QCSM2's, CS17, CS14, CS15, etc.

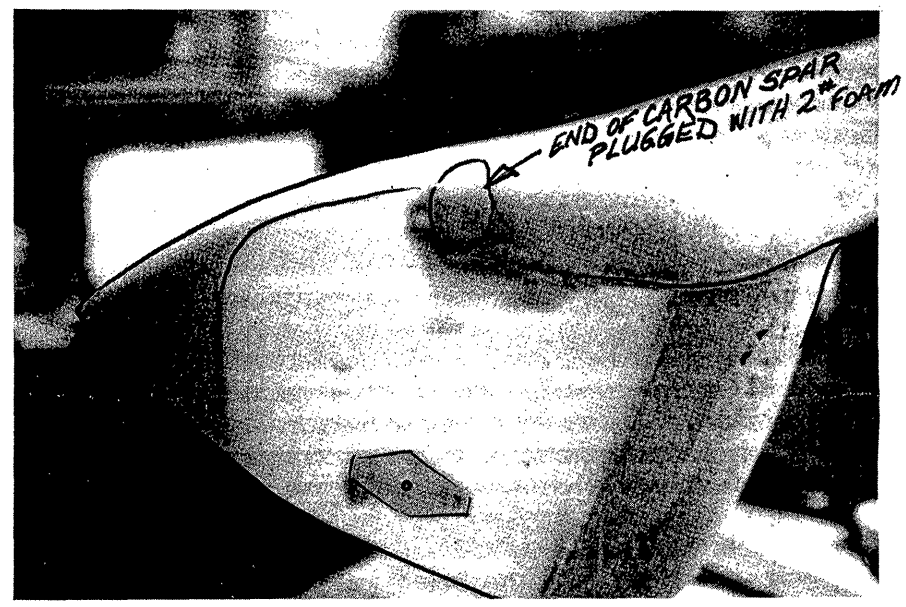
Build the wheel pants using the templates provided. Refer to the Q2 Plans for detailed instructions. Note that these pants are designed to fit the standard tires only. We will design pants for the 500x5 tires later. You may modify the design yourself by referring to the Q2 Plans.

To fit pants to wing, you may want to fill taper with X-40 foam.





Install the wheel pants in the same manner as is detailed in the Q2 Plans. Note extra UND plys. We recommend establishing about 1/2 to 3/4° toe out. This is accomplished by placing a mark on the inside face of each pant that is 2" forward of the axle hole centers, then sighting on the marks for alignment. This seems to improve ground handling.



SPARROW STRAINERS:

These are trim devices required due to the pressure distribution of the LS(1) 0417 Mod Airfoil. Thru testing, we have found the most effective position to be inboard (both sides of course).

Construct as follows:

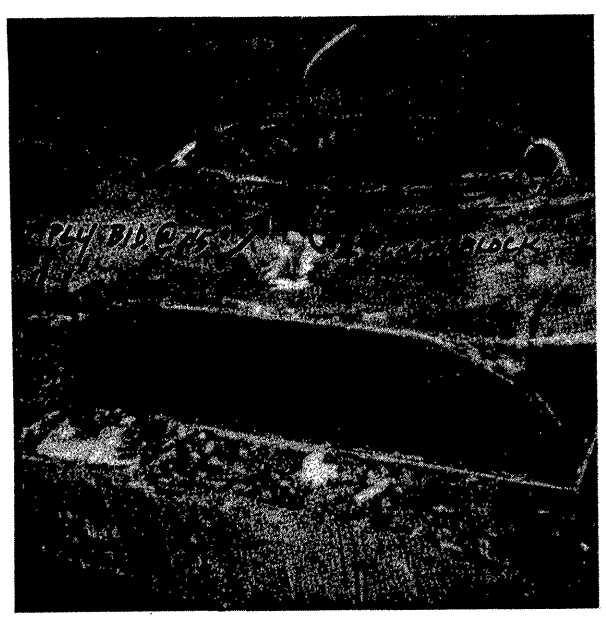
Make 4 1/8" plywood stringers.

Also, 2 11.5" balsa wing sections.

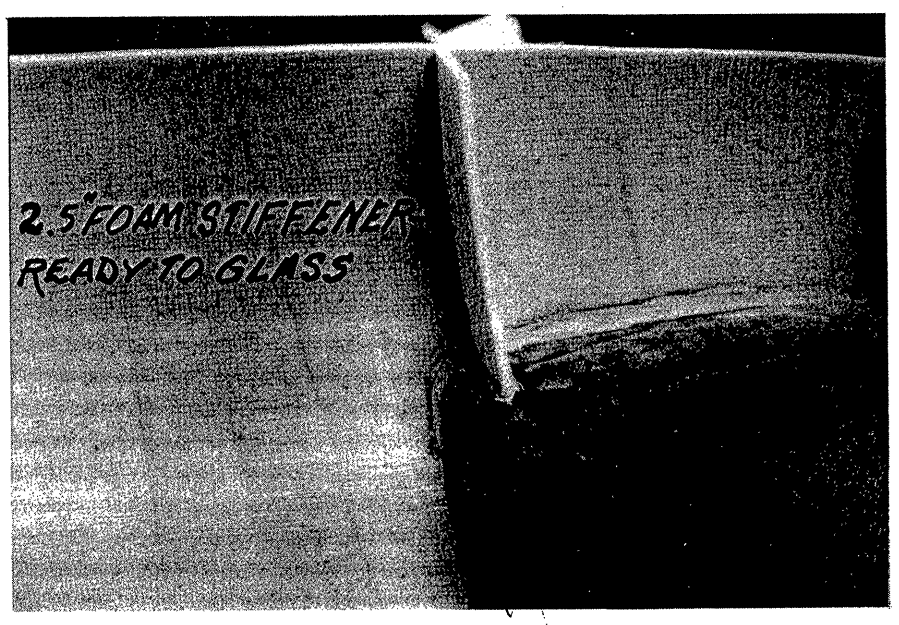
11.5" BALSA
MAKE 2

5 minute epoxy 2 plywood stringers and airfoil section on elevator about 1" outboard from inboard but line. (duct tape and large rubber bands are helpful here). Make small micro radius at stringer attach to elevator. Cover everywhere with 1 ply BID. (we used a lighter weight tooling cloth available at most hobby houses - about 4 oz.). This cloth is also a good choice for antenna close-outs.

Installing the new canard to the fuselage will tax your imagination. Not unlike Chapter 12-2 of the Construction Plans, it may take several hours to trim and jig the canard to the fuselage and in reference to the wing. You should exercise extreme caution in leveling the fuselage in all quadrants and jigging the canard. (You did bond reference levels to canard while it was jigged for glassing, didn't you?) Please note: your LS-1 mod. canard mounts at zero incidence as opposed to the G.U. Also, without a straight center section as on the G.U., there is no bottom reference to the fuselage. Therefore, it would be best to have the magneto box cut-out completed as a reference to the apex of the LS-1 for final canard-to-fuselage assembly.



After canard is installed with liberal dry micro radius and 2 ply BID, micro transition blocks from fuselage bottom to canard (4#x3/8 white urethane) and 2 ply BID inside and outside lapping at least 1" everywhere. (see drawings and photo).



Then, with 2# urethane block or, better still, X-40 pour-in-place, fair bottom of fuselage cut-out to firewall and closeout with 1 ply BID @ 45°. Next, install additional 2.5" stiffeners left and right sides of fuselage centered over spars as per drawing.

LS(1) 0417 MOD CANARD INSTRUCTIONS

Category: Q-2/Q-200 Plans
Published: Tuesday, 30 December 2014 07:44
Written by Sam Hoskins and Dan Yager
Hits: 10055

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[**EDITOR'S NOTE**: *The text below is an attempt to improve the instructions for building an LS1 Mod Airfoil Canard for the Q-200 aircraft. The text and photos below are a combination of the original text and photos from LS(1) 0417 MOD CANARD construction documents provided by Quickie Aircraft Corporation. I have also included text and drawings from the Q2 and Quickie Plans when referenced, as well as construction notes provided by a builder as he reconstructed his canard after an accident. The text and images are provided for informational purposes only. Please read and understand the LEGAL DISCLAIMER above before attempting to use this information in your own design*.]

CONSTRUCTION OF LS(1) 0417 MOD CANARD

The canard construction consists of seven basic parts.

- Hotwire all foam cores.
- Build the elevators.
- Join the two carbon fiber spars.
- Attach foam cores to the spars.
- Glass the upper and lower surfaces of the canard.
- Attach and glass the elevator slot cores.
- Install the elevator attach brackets.
- Build and attach the wheel pants and brakes.

BUILDER'S TIP:

Use BLUE Dow Styrofoam or equivalent. The older style orange foam seems to have internal stresses, which can result in warped parts, particularly thinner components such as ailerons and elevators. Also, much of the original kit foam is now 30+ years old.

BUILDER'S TIP :

At the time of this revision, precut cores are availablevia EUREKA CNC – Steve James has a vendor account here on the Quickie Builders Association website and you can buy his foam cores directly. Seriously consider using this high quality source since it will save you many hours of sourcing foam , dealing with templates, alignment, making mistakes, etc.

CNC Foam Cores from Eureka CNC

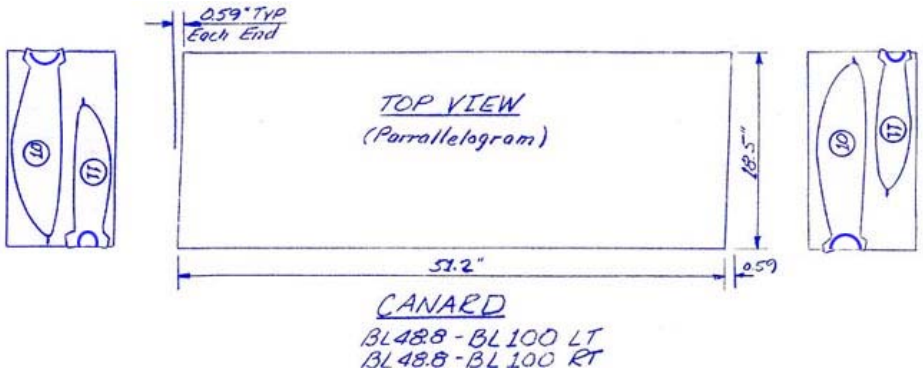
From BL15 to BL100, the hotwire block sizes are exactly the same as called out in the Q2 Construction Plans. . .

Q-2 Plans: Page 5-2

CANARD CORES

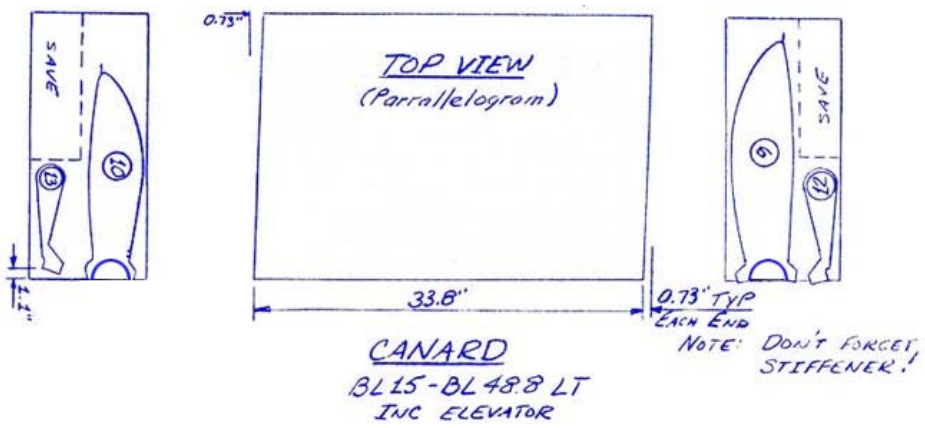
The outboard and inboard canard cores are cut from skewed, parallelogram style blocks, with the exception of the canard center section. The reason for this is to obtain the proper sweep of the canard when the cores are jigged together later.

Begin by squaring up the 10" x 20" X 96" nominal dimension block of polystyrene foam to obtain a length of 51.2", with the skew as indicated. Next, using the sketch provided, hot-wire the outboard canard foam cores. Note that the bottom set of templates are upside down, so as to obtain the proper geometry upon jigging.



Next, find the extra pieces from the 10" x 24" blocks (2) and face them up to the dimensions shown. These two blocks are used for the inboard

elevator cores and inboard canard cores. The portions not used will be used later for the outboard elevator cores.

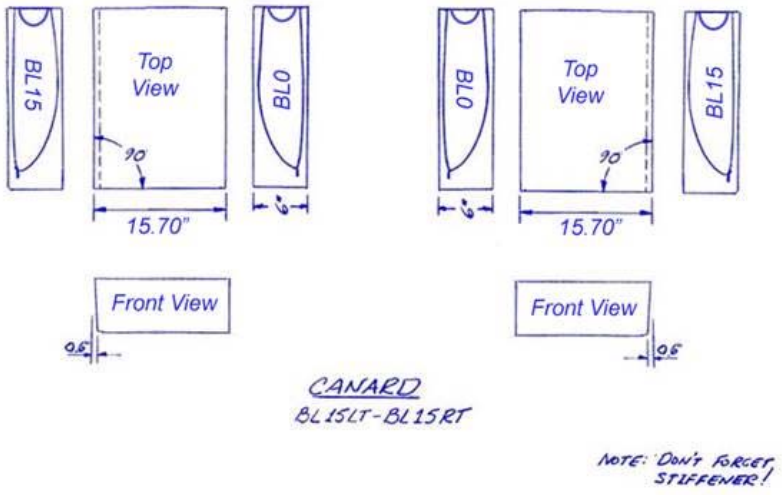


Q-2 Plans: Page 5-3

Locate the remaining part of the 10" x 20" block and size it as shown, in order to make the canard center section. Keep the unused portion for cutting the vertical fin, so don't make the height over 6.0". Note the 0.6" taper dimension is to allow for the proper anhedral angle upon assembly in the canard female jigging templates.

. . . From BL0 to BL15, we use two pieces instead of the one used in the old GU canard. 1. The blocks for these should be sized to 15.70" long. These sections are jigged after the spars and other hotwired sections have been located. A bevel will need to be sanded to allow for the canard's anhedral. Trial fit cores in place, check transition alignment, and sweep aft. From BL15 to BL100, you should measure about 10.5" at L.E. foam cores.

IMAGE FROM PLANS REPLACED WITH SKETCH BELOW



NOTE: Cut one LEFT and one RIGHT center core using the BL0 and BL15 templates.

BUILDERS TIP:

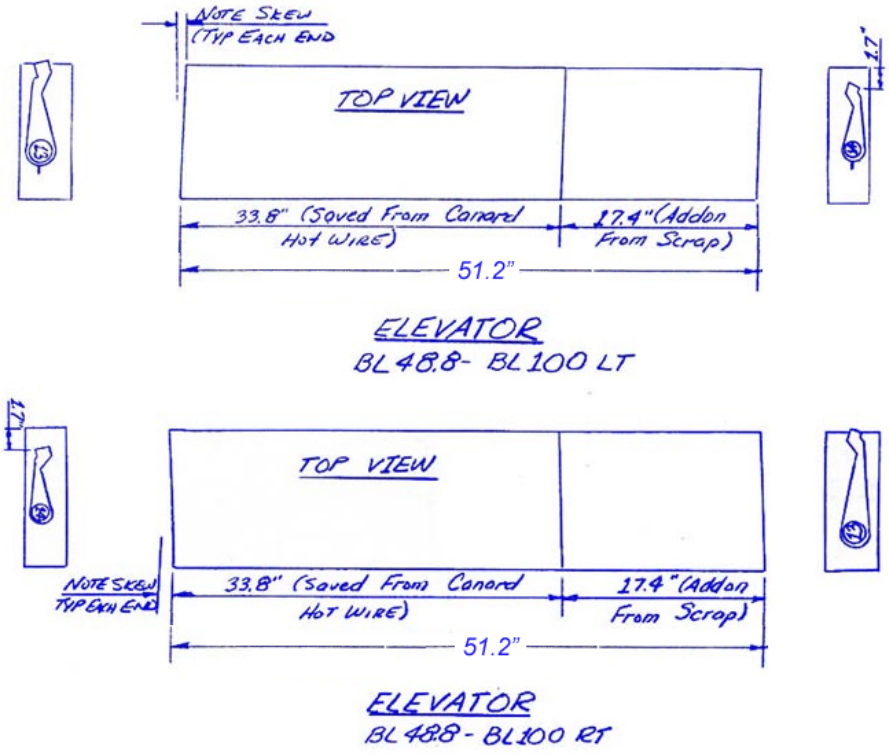
The following sentence appeared at this point in the original LS1 Construction instructions:

You may want to skip ahead and build the elevators now. At any rate, they must be built before you attach the elevator slot cores.

Since it is advisable to construct the elevators first, we have re-arranged the original instructions to include elevator construction prior to the construction of the canard.

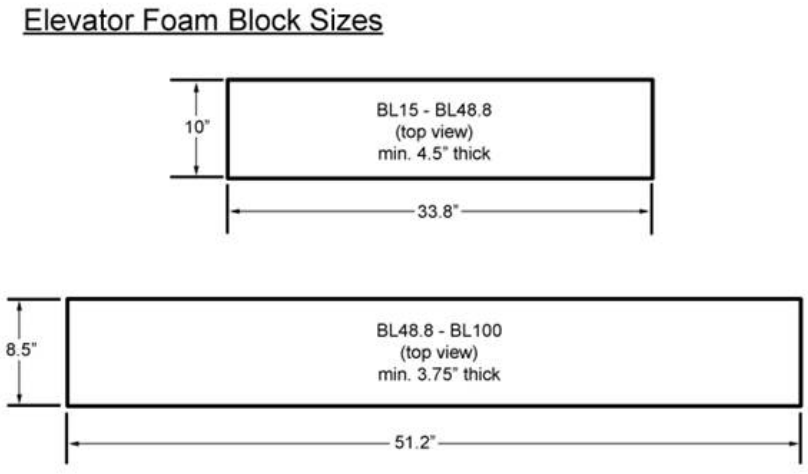
OUTBOARD ELEVATOR CORES

Hot wire for the elevator torque tubes like you did on the inboard elevator cores.



BUILDER'S TIP:

In order to avoid the hassle of putting scrap pieces of foam together, you may want to purchase additional foam, so you can cut everything out and have just two pieces . (As shown below.)

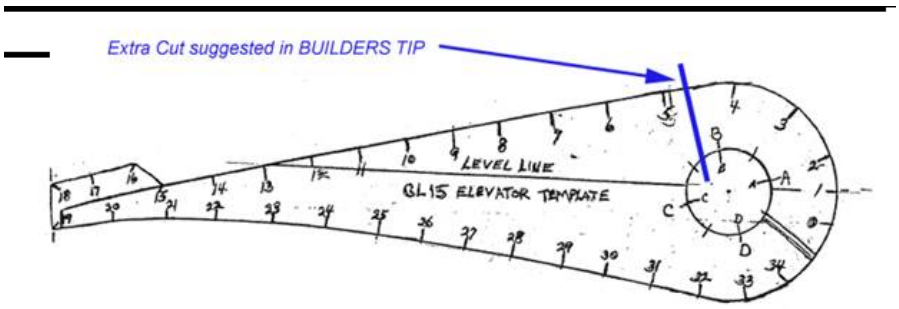


Shown above are the foam blocks after cutting out the elevators.
Note that you cut LEFT and RIGHT elevators out of the same block
by flipping the templates over and placing them on the opposite ends.

Note that the templates only show 1 slot for cutting the hole for the torque tube.

BUILDERS TIP:

The Q-200 elevator templates only show one cut for the torque tube. It is suggested you make two cuts as shown below. Otherwise , it is all but impossible to adequately bond the cores to CS16 without voids .

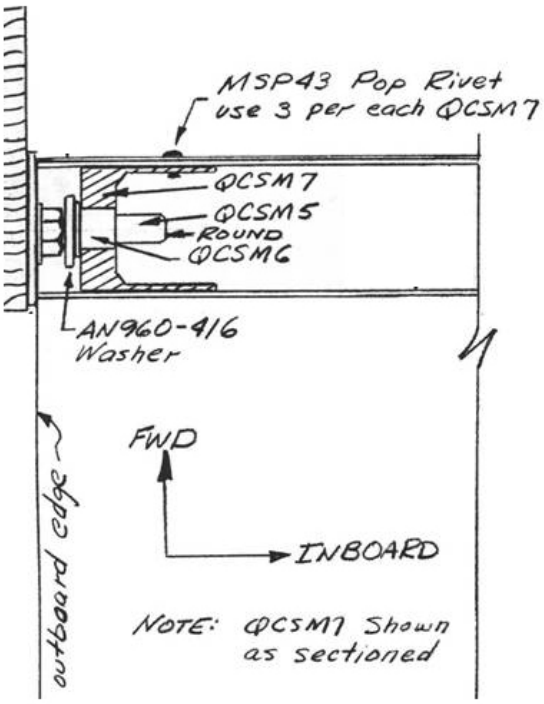


NOTE: Above drawing not to scale.

Suggested extra cut marked with a felt tipped marker.

BEFORE BUILDING THE ELEVATORS:

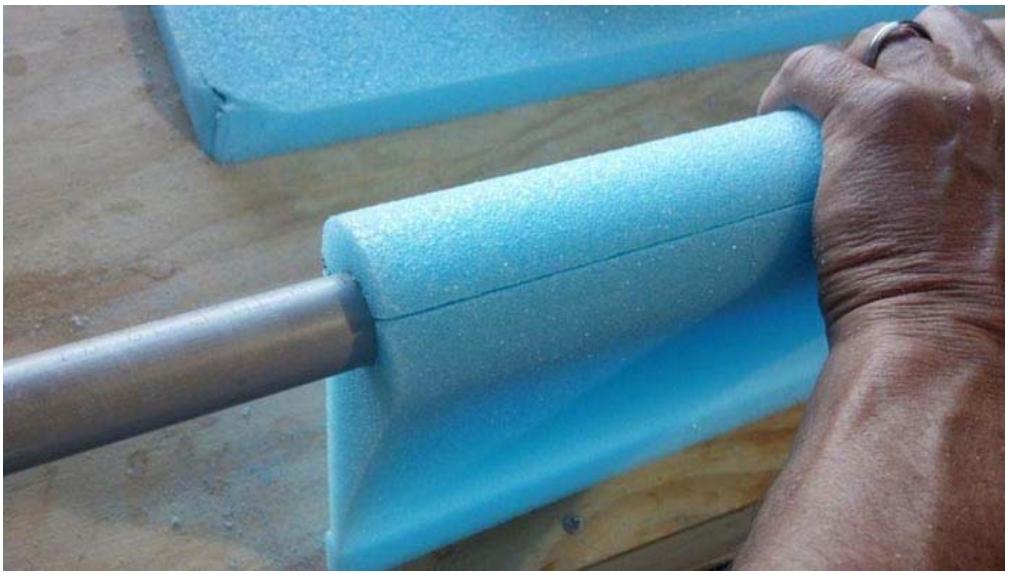
Find CS16 (72” Aluminum Tube), QCSM7 pivot and QCSM6 bushing. Push QCSM6 into QCSM7 until seated. Push QCSM7 into CS16. Use 3 MSP-43 cherry rivets spaced radially at least 0.4" apart, to secure in place. This will become the outboard pivot for the elevator. Note: the original plans had you do this after building the elevator, doing it now will prevent the need to drill the rivet holes through the complete elevator.



Detail of Drawing from QAC Q-2 Plans p 9-6

Use some ingenuity and fashion tools to enlarge the hole for the torque tube to fit a little better, and making a little room for the micro. You can fashion tools out of the spare foam or use a wooden dowel. Do not get too aggressive sanding in this area.

Then “Check Fit” until you are happy with the result. In the photo below, more sanding of the center hole is required to close that gap.

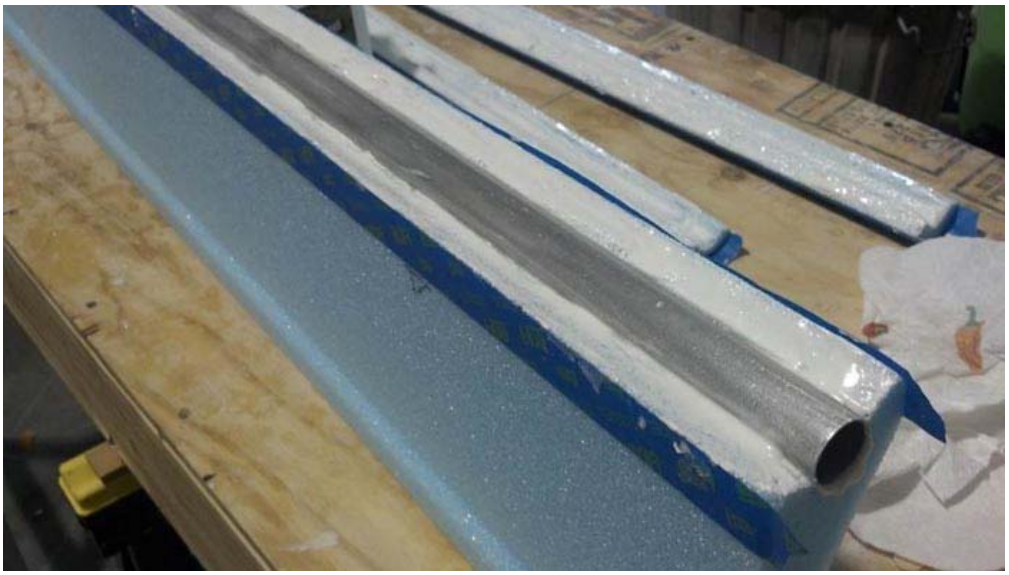


Join the cores together with expandable foam and temporarily maintain alignment using your torque tubes.

This photo shows the use of saran wrap to keep the expanding foam from attaching to the torque tube while jigging the cores. Naturally you will remove this plastic wr a p prior to glassing the cores.

You will now have an elevator core that is too long and the outboard section must be trimmed. Measure 72” from the inboard end of the elevator foam core. T rim the outboard portion so the core is now 72” long. Now it ’s time to permenantly install the torque tubes into the cores , but f irst, p repare your elevator jig templates and hot glue them in place on your work table.

The liberal use of painter ’ s tape helps applied to the torque tube will keep the micro from spreading and prevent you from having to dress it up after the micro has cured. We also apply painters tape to the foam, as shown below, to help keep things clean and tidy. Once you have the torque tubes embedded in the cores, you may remove the tape so it doesn’t become a permanent fixture of your elevator. Like the canard, wrap with rubber bands. Set the assembly into the jigs for curing. Double-check to ensure the cores are perfectly straight and not sagging. You can wedge scrap foam under the elevator to help hold the alignment.



Apply peel ply to bare foam trailing edge 1/4" to 3/8" before glassing for a stippled close-out.

Use the templates provided in the plans to construct the elevator jigs, and ensure proper alignment of all parts before continuing.

Glass your elevators with 2 UNI at ±45° to the trailing edge, just like the aileron. Measure the elevator foam cores and then cut the UNI cloth to the proper size. More than one piece of UNI will be required to cover the entire 72" elevator span. Where the UNI pieces join, no overlap is needed, (i.e. butt joint is OK) but stagger the joints on Ply #2 so that the foam along the butt joint line is covered. Lay up these plies exactly like you did on the ailerons. Don't forget the foam scraps in the end of CSI6. Do not trim the trailing edge until after the elevators are mounted on the canard.

After the layup has thoroughly cured, you may break it loose from the jig and flip it over. You will not use a jig for the top side of the elevator.

When you sand down the tabs for glassing the top surfaces, note that the elevator has a blunt trailing

edge . That is normal . Refer to the hotwire templates. After glassing the top side, sand the elevator trailing edges to length. Then remove some foam (1/4") and fill with dry micro to prevent the skins from peeling. Coat with pure epoxy first.

BUILDER'S TIP :

After you glass the second side, find an extremely flat table and lightly clamp and/or weight the elevator to ensure that it cures flat.

CANARD CONSTRUCTION

JIGGING THE CANARD

Next, you will need to jig the canard cores on the jig table. It would probably be a good idea to clean off the jig table of any bondo chips, wood, epoxy, etc., so that you start with a clean surface.

Find the canard core female jigging templates (6)

Now study the sketches. The canard cores are jigged upside down on the jigging table using the canard core female jigging templates. If your table is not at least 200 inches long, you will have to extend it like you did on jigging the main wing.

Begin by drawing a straight line along your jigging table and marking the locations (BL's) of the canard core female jigging templates. Next, temporarily set the canard core female jigging templates on the jigging table so that their **leading** edges are the distances from the straight line, called out in the accompanying illustrations.

Now begin to trial fit the **four outboard** canard cores into position. Be careful in handling the foam cores to prevent damage to the foam. All cores may have to be sanded in order to make them fit together within the maximum tolerance of 1/16".

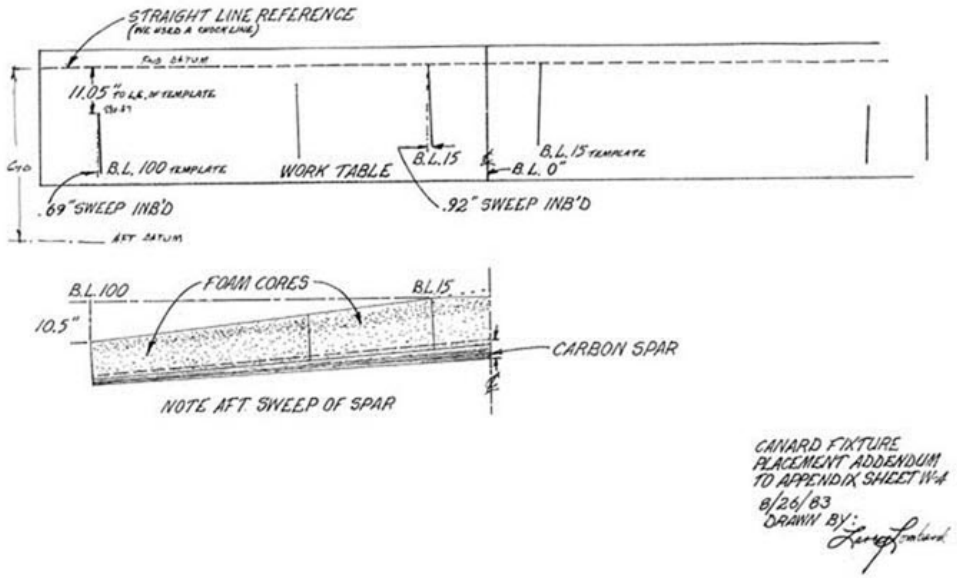
Establish a BL15 reference line on the topside of your canard jigging table. This can be done with a long straight edge or chalk line. Locate and mark on your table BL0-0, 15, 48.8, and 100, both sides. Place the leading edge of the jig blocks BL15, 48.8, and 100 in their respective places (they are glued

to 1/4" or thinner plywood, fiberboard, etc.).

BUILDER'S TIP:

Use a Hot Glue Gun for temporary fastening of spars. You can also use the Hot Glue Gun to fasten template jigs to the work surface, or any place else in these instructions that call for 5-minute epoxy or bondo to temporarily tack anything in place. Make sure you remove all traces of hot glue when making structural parts.

5 minute or bondo to table shimming for level, proper anhedral, and sweep (see addendum to appendix sheet W-4 8/26/83). (*Also, disregard string hole alignment methods aft end of jig blocks).



Addendum to Appendix Sheet W-4 8/26/83

Note: The sweep is established by the placement of the BL15 and BL100 Template Jigs on the work table. Once they are fastened to the table, trial fit the spars. The BL48.8 Template Jig should not be used until AFTER the spars have been permanently joined.

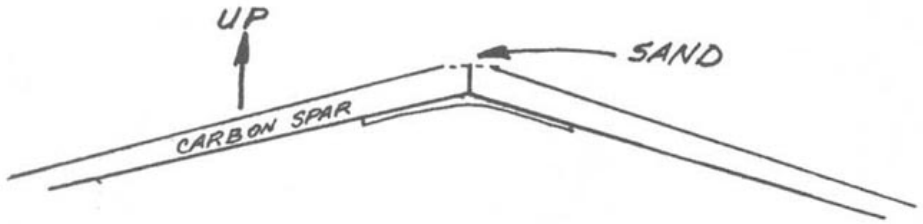
Once your jigs are in in place, go ahead and dry-fit everything just to see how it all looks.

NOTE: BL100 blocks will extend slightly outboard of BL100 foam cores since foam core measurement was flat, not at anhedral angle. You can move the BL100 jig blocks inboard to match the cores when trial fitting to spars.

JOINING THE SPARS

Trial fit both spars at trailing edges (we held ours in place with large rubber bands). Some custom fitting will likely be needed @ BL0-0. Note: 3.5°+ sweep aft of spars at outboard tips.

Sand spars completely for bonding. There is an extra ply of fiberglass on the surface for this purpose. You may want to use a powered sander, just be careful. Grind center portion of spars (BL 0-0) at apex to minimize bump. Wear a dust mask when sanding the black carbon fiber. *See 1st sketch page 2.



1st Sketch From Page 2

Jigging the Spars

Set the spars in the jigs and verify their fit. Remember the spars must join together perfectly in the center with no joggles. Tack one spar to the jig templates using the hot glue gun. The jigs at BL15 & BL100 establish the position and sweep of the spar, therefore at this time the jig at BL48.8 is unneeded.

Then, coat the inboard ends of the spars with liberal amounts of flox. Join the spars at the center, ensuring good flox squeeze out. Wipe the excess flox off and, again, ensure there are no gaps. When everything is perfect, use bungees to hold in place and tack the second spar in place with the hot glue gun. Wait until the flox has cured and sand smooth. Do not break the spars out of the jigs yet. Be careful when handling, at this point the joint is still relatively fragile.

Center Spar Laminations

Next, the caps are laminated using UNI cloth. These caps are a minimum of 3-1/2" wide and may be laminated, **five at a time,** on a clean plastic surface **(Such as Saran Wrap)** prior to transferring to the spars. Since these tapes are narrow and short, you may find it easier to use the selvage edge for one side of each ply. This will reduce the fraying. Heads up! If you forget to remove the saran wrap the joint will be useless.

You will first, laminate the spars together with 3 ply BID wrapped all around at 45° extending about 6" either side of the **center** joint. Stagger the plies about 1/2" to 1".

The lamination schedule for the caps is:

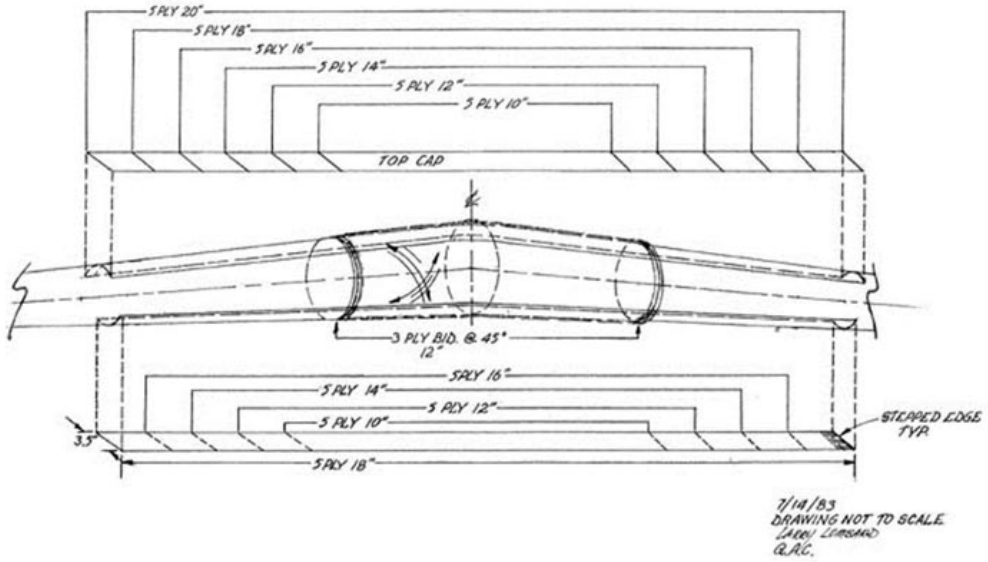
Bottom:

- 5 ply - 18" x 3.5"
- 5 ply - 16" x 3.5"
- 5 ply - 14" x 3.5"

§ 5 ply - 12" x 3.5"
§ 5 ply - 10" x 3.5"

Top:

§ 5 ply - 20" x 3.5"
§ 5 ply - 18" x 3.5"
§ 5 ply - 16" x 3.5"
§ 5 ply - 14" x 3.5"
§ 5 ply - 12" x 3.5"
§ 5 ply - 10" x 3.5"



LS1 Spar Cap Lamination Schedule

BUILDERS TIP:

Cut all spar caps prior to laminating, and get organized.

Cut out all of the spar caps before you begin.

Get organized! This is going to take a couple of hours even if you have help!

Since so many pieces of glass are used, this layup can take a couple of hours. It would be advisable to have someone mix epoxy for you. You may choose to do the top and bottom caps in one session, using the Saran Wrap method described above.

This photo shows all of the spar caps in place TOP and BOTTOM.

Once the laminations are complete, carefully wrap the entire lamination with PEEL PLY. Be careful not to disturb the alignment of the caps. You will probably need to cut several pieces of peel ply to accommodate the taper.

Wrap everything in PEEL PLY when all of the spar caps are in place.

Let everything cure for at least 48 hours before removing from the jig. When you return in two days, do NOT forget to remove the PEEL PLY!

Keep everything warm for a couple of days. Make sure the temperature does not exceed 100 deg. F.

After the caps are cured, sand as necessary for bonding the skins, though if you used peel ply, the sanding will be minimal. The center section foam cores will need to be opened up a bit to allow for these caps.

The level lines on all cores must remain perfectly level at all times. This is important, so take your time.

Stand back and sight span wise along the canard to verify that the canard is straight, and is not bowed or kinked. Verify that the leading edges are straight, and that the trailing edges are straight also.

Don't be concerned if the canard core female jigging templates need to be moved inboard or outboard to remove any bows or kinks. Also, a long straight edge will help you looking for kinks and joggles, or dips.

When everything is perfect, mix up some bondo **(or use the hot glue gun)**

and carefully attach the canard core female jigging templates to the table top in the necessary location. Next, rest the canard cores on the canard core female jigging templates.

Outboard Canard Foam cores placed in the jig, as a trial fit, and checked for level.

Note: it's time to remove the peel ply from the center of the spar!

Check the alignment and individual level lines again; then again and again until everything is Perfect, with a capital P. The next step is to join the foam cores together with micro slurry after verifying that the core fit is within 1/16".

CAUTION

The canard foam cores must fit within 1/16" or exothermic damage may result.

Core preparation is the single most important factor in obtaining an accurate, strong, and lightweight canard, so don't hurry through this section unless you don't mind regretting it for years to come.

Place light tack masking tape along the spar to prevent micro and epoxy from migrating. You should remove the tape once the cores are in place, and before the epoxy has cured.

Paint the spar with pure epoxy and coat the inside cavity of the foam core with micro. Start with the BL0- BL15 cores. Use firm pressure to seat the core onto the spar and squeeze out excess micro

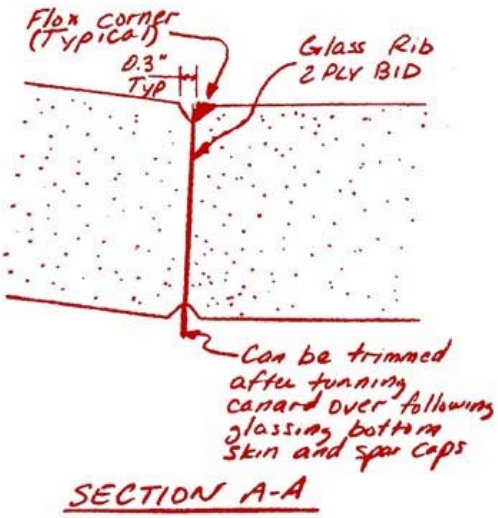
.

Check, recheck, and re-recheck each core level line and alignment as the cores are joined. **Recheck your level lines, and then tack the cores to the jig blocks using the hot glue gun.**

Insert the BL48.8-100 core in the same manner, joining the two cores with micro slurry. Use large rubber bands, or filament packing tape, to apply continuous pressure. We want to make sure there are no voids. You should observe micro slurry squeeze out. Repeat for the other side of the canard and let cure for 24 hours.

You will need to open the spar cavity a bit to accommodate the LS1 spar cap laminations. You may also need to trim the BL0 joint where the cores join.

Note that the canard center section foam core gets a glass rib of 2 BID and flox corners at each end of the canard center section foam core. Laminate the ribs of 2 BID at 45° at the BL15 joints. Jig the BL15 to BL00 cores after the ribs are semi-cured (still tacky). The flox corner should be added after the entire series of canard cores have been joined and cured.



2 BID at 45° glass ribs being added to the BL15 end of the center foam core.

2 BID at 45° glass rib on BL15 end of the center foam core. (Opposite angle.)

BUILDER'S TIP :

In these photos we used filament tape to hold the cores in place. We found i t would be better to use rubber bands or bungee cords, since they will apply a constant force. Filament tape won 't do that.

X-30 expanding foam is used to fill the gap between the foam cores after set-up .

BUILDER'S TIP :

Instead of using micro to join the two most outboard cores, use two-part expandable foam cores, use a good quality two-part expandable foam.

Canard on the jig table ready for cleanup sanding and prep.

Q-2 Plans: Page 10-2

PREPARING THE CANARD CORES FOR GLASSING

At this point, the canard cores should be jigged on your jigging table upside down, 5-minuted or hot glued/bondoed in place, and able to take a direct hit from a 88 mm howitzer without budging from its location.

Use a sanding block to clean up all joggles, excess micro, and any bumps on the canard cores. At either end of the canard center section core, round the joint so that the glass will flow smoothly across the joint.

This is your last chance to do it right, so spend at least another hour making these cores as perfect as you know how. While you're at it, check,

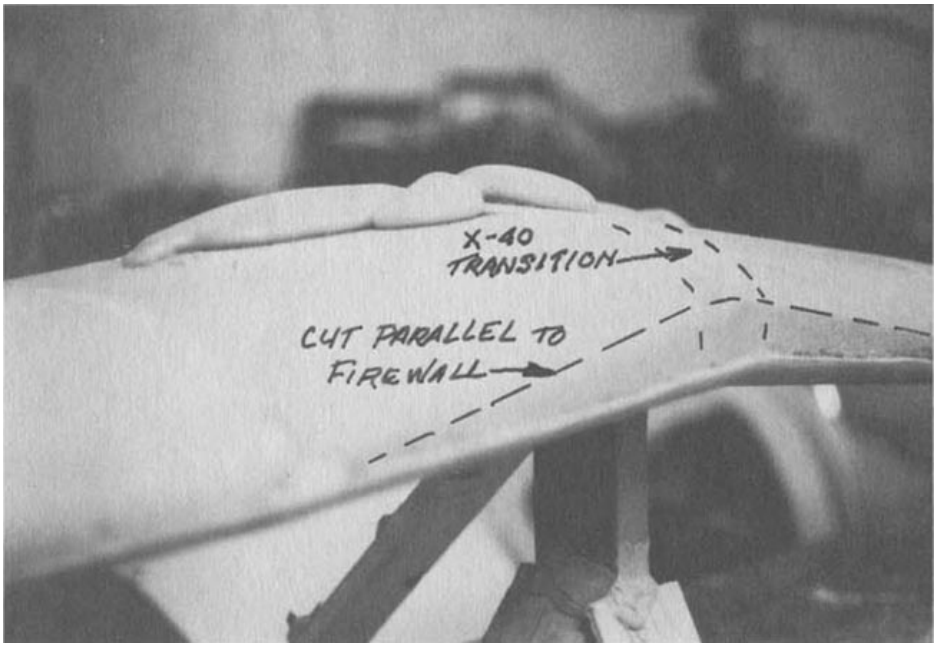
recheck, and re-recheck all the canard level lines that you can see until you can do it in your sleep. If you are not proud of everything sitting on that jig table, don't go on to the next step until you are.

Sand off the tabs on the cores tangent to the spars. Fair the surface of the core to the caps with very dry micro. Do not get any micro on the caps.

When the center cores have cured, you will notice a joggle where the foam transitions to the LS1 spar caps. The photo and description in the original LS1 construction addendum shows this joggle being filled with X-30 expanding foam. Experience has shown this to be a BAD practice as delamination can occur , so instead use very dry micro to eliminate the joggle.

Center joggle and foam core trailing edge tangent to the spar are filled with dry micro and sanded smooth.

-

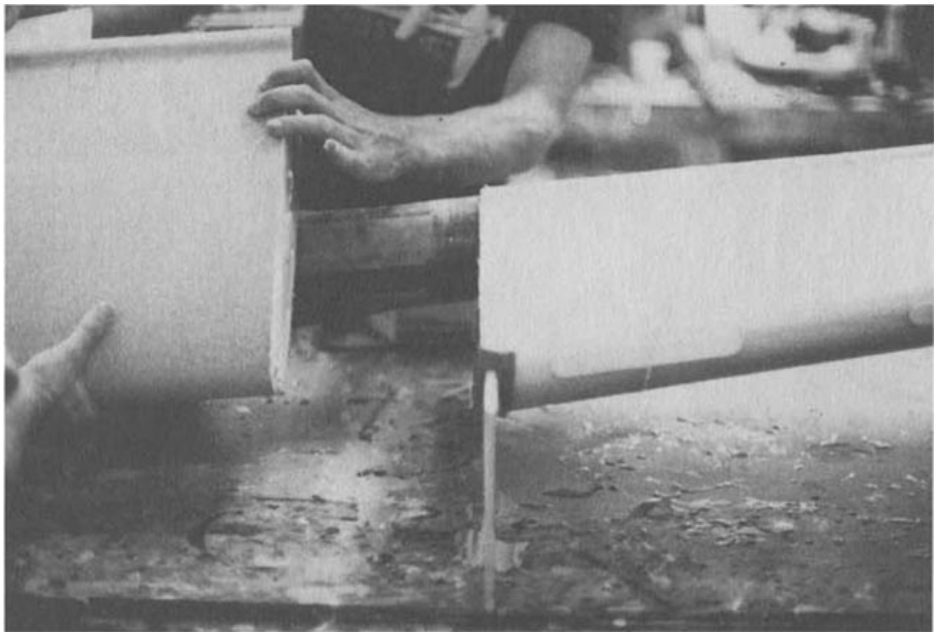


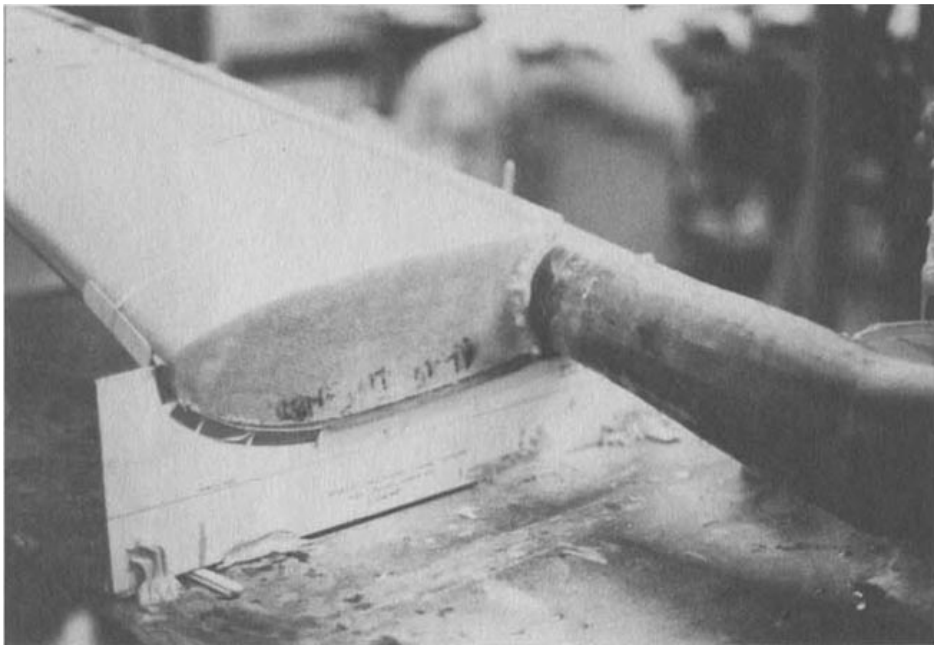
Fill Gap with X-40 - Sand L.E. Flush with Firewall. DO NOT fill the joggle with X40 as shown in this original plans photo.

However, you should sand the LE flush with the firewall as shown.

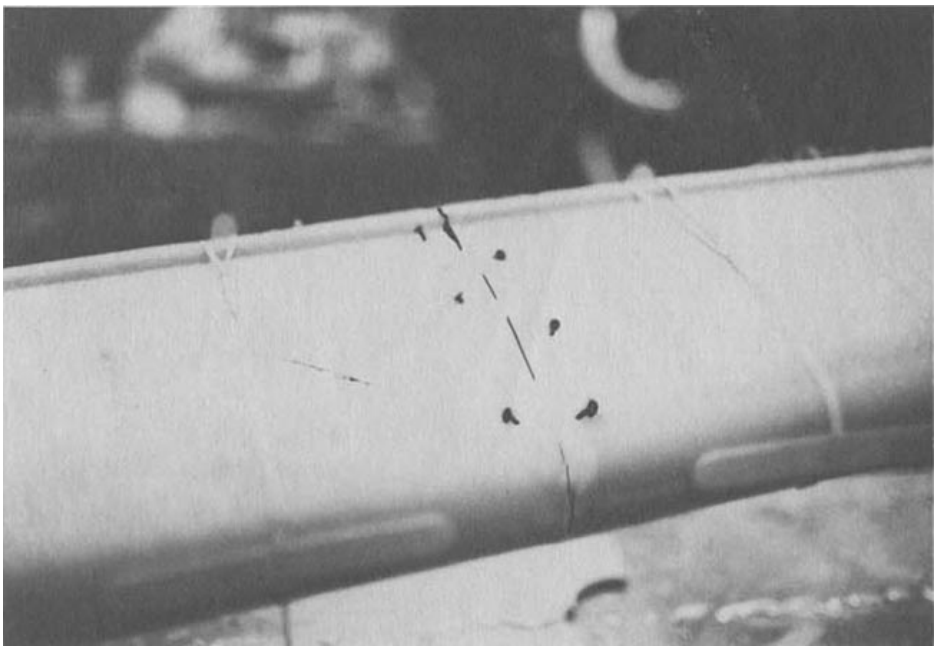
Note: Center blocks (BL15-'0-0') are shown with straight leading edge. BL15-BL0-' blocks should be parallel to firewall at leading edges, thus eliminating the sweep in that area. You can hand shape the inboard blocks since surface contour is not a critical flying surface. You should verify that you have removed enough of the LE. Find your CS14 pivots and tape them roughly in place. See QAC Chapter 10 (A) Elevator Control Addendum.

Go to the fuselage and measure the distance from the front of the fuel tank to the firewall. Now, measure from the aft end of CS14 to the LE of the canard and compare the two to make sure you will have enough clearance between CS14 and the fuel tank, once everything is glassed and the canard is mounted.





Do a final check top and bottom of cores for transition errors, warpage, etc. Place additional support members (blocks 31.9 & 74.4) in appropriate positions to assist core support for glassing. . .



Hold Everything together with T-pins and Rubber Bands...

. . . We made random felt pen marks on cores ±45° to assist unidirectional cloth alignment.

Felt pen marks on cores ±45° to assist UNI alignment

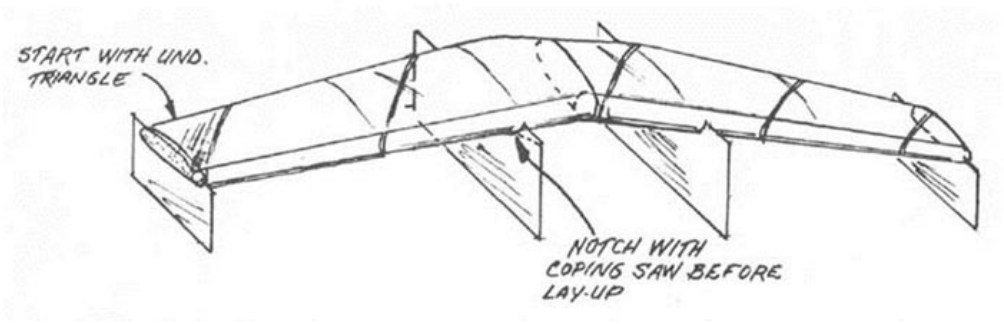
Canard ready for micro with ±45° lines drawn to assist UNI alignment. Additional jig templates have been added to help support the foam blocks during glassing and the cure cycle. You will also need to trim the leading and trailing edges of the jigs so you have room to drape the glass tangent to the LE & TE.

A note about organization for the layups. At this point, you should have your cores perfectly jigged in place and your spar caps cut, marked, and set aside in a clean location. (I like to use a magic marker to draw a center line on the spar caps). I recommend having at least four people helping for the layup. One person strictly for mixing epoxy and micro. Apply Micro to the entire canard foam cores .

Canard after micro application.

THE LAYUP:

Better conservation of cloth can be employed by fitting scrap triangle with selvage edge inboard for first pull. (e.g.)



Scrap Triangle of UNI to Start

Allow UNI to wrap spar at T.E. and let cloth drape tangent at L.E.

Canard skin lamination schedule:

Bottom -

- § 2 ply at 45° to the spars (90° to each other)
- § 1 ply span wise
- § Overlap the spars with all 3 plies outboard of the caps and overlap the caps.
- § Knife trim the skins at the leading edge. After curing, sand to taper the skins between 0 and 1 on the hotwire templates.

Top -

- § 2 ply at 45° to the spars (90° to each other)
- § 1 ply span wise. We let selvage edge parallel L.E.
- § 1 ply span wise to BL15 each side for extra "heel" protection. Overlap the spars and the bottom skins on the spar by about 1 1/2". Overlap the caps. Overlap the leading edge of the bottom to about 1 1/2 on the hotwire templates.
- § Knife trim leading edge, let cure 24 hrs.

BUILDERS TIP:

You may either pre-cut the 45° UNI Laminations or you may cut as you go:

A. PRE-CUT: Make construction paper templates of the laminations, and then transfer to the UNI. Carefully mark these for placement on the canard and set aside.

B. CUT AS YOU GO: Requires 3 people but is simpler. After you have applied micro to the entire canard foam cores and, have 1 person hold the roll of UNI cloth over the canard. The other two people hold opposite edges of the cloth and align the selvage edges with the 45° lines on the foam. Trim in place as you go. (See photo below)

These three fine individuals are demonstrating the "CUT AS YOU GO" method of applying UNI cloth to the upper surface of the canard.

Applying the span-wise UNI spar cap.

Wetting out the span wise UNI.

BUILDERS TIP:

Experience has shown that additional UNI spar caps may be required, on the top side of the canard, to prevent dimples from appearing in the upper surface of the canard. See the addendum at the end of this section.

BUILDERS TIP:

After the laminations are complete, be sure to peel ply the spar, where the trailing edge cores will be attached.

BUILDERS TIP:

Some builders have had success by applying peel ply to the entire surface of the canard, after the final glass layers are applied. This is easily accomplished by using DACRON wing covering fabric. It may be useful to cut several pieces in 12” x 24” or larger sections. Make sure you have some overlap of each piece to facilitate peel ply removal.

Celebrate the layup and let it cure at least 48 hours at room temperature before you disturb it.

Bottom Glass layup completed, with PEEL PLY covering the entire surface.

FLIPPING THE CANARD OVER:

Use lumber as shown in the Q2 Plans before turning the canard over. Not as much will be required due to the stiffness of the spars.

Q-2 Plans: Page 10-4

Build a framework out of scrap lumber and bondo to hold the canard jigged in place while you turn it over. As shown in the pictures in the MAIN WING chapter in the "Laminating The Top Skin And Top Spar Caps" section, we suggest that the lumber run from tip to tip with a few cross pieces. Don't get fancy; just tie everything together so that the main wing won't move.

Check the canard tip level lines. Jig, and shim, and bondo until the canard tip level lines are absolutely perfect; almost, or maybe, doesn't count. Then use bondo to secure all of the jigging so that a jackhammer will be required to remove the canard from the jigging table.

Temporary lumber framework attached to bottom of canard with bondo to facilitate flipping it over and glassing the top surfaces.

Next, (when you are sure of your framework) break the canard core female jigging templates loose with a hammer and chisel(they won't be needed again), and turn the canard over so that the unglassed cores are upward. Set the canard on the jigging table once again.

This photo shows the canard flipped over in preparation for work on the top surfaces.

NOTE: The temporary lumber framework is still attached

Prep and glass the TOP surfaces of the canard foam cores just as you did with the bottom. Cover everything with PEEL PLY (as you did on the bottom) after your final layer of glass, allowing overlap s to facilitate PEEL PLY removal later.

Again the TOP Canard skin lamination schedule (for your convenience):

Top -

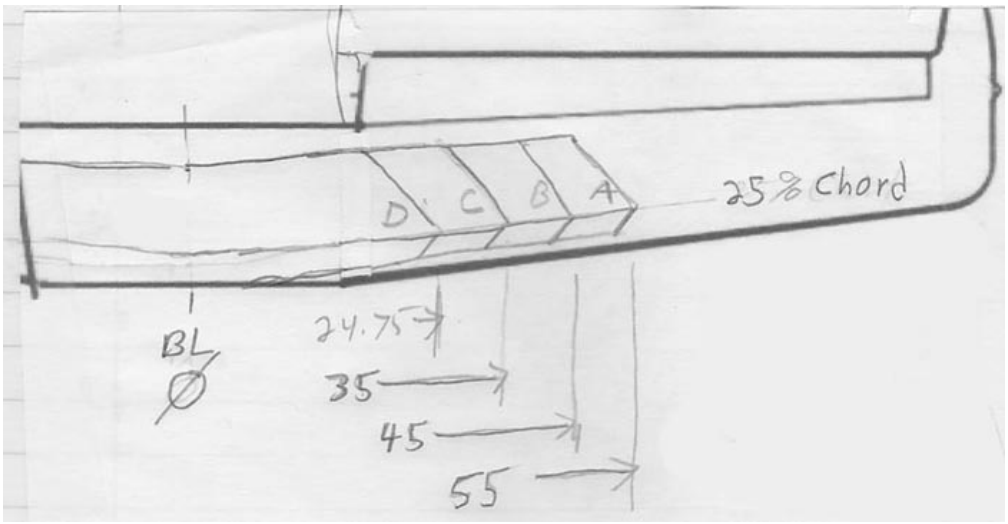
- 2 ply at 45° to the spars (90° to each other)
- 1 ply span wise. We let selvage edge parallel L.E.

- 1 ply span wise to BL15 each side for extra "heel" protection. Overlap the spars and the bottom skins on the spar by about 1 1/2". Overlap the caps. Overlap the leading edge of the bottom to about 1-1/2" on the hotwire templates.
- Knife trim leading edge after a couple of hours. Let the whole thing cure for at least 48 hours before you break it loose.

BUILDER'S TIP:
Experience has shown that several Q-200 aircraft have experienced some dimpling of the upper surface of the canard. While not fully understood, it is not believed that minor dimpling creates an unsafe condition. Some builders have elected to strengthen the upper surface of the canard, which seems to help.

Optional Builder's Tip - Stiffen Upper Surface of the Canard

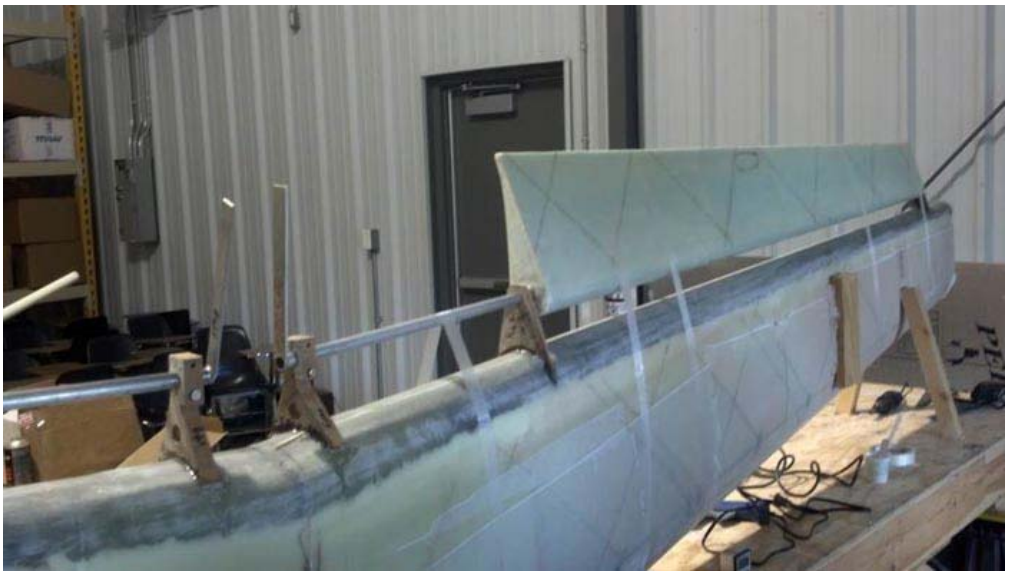
This builder made his UNI caps about 13" wide and stepped each about 3/8" aft. The "point" of each caps forms a 90 deg. angle. The point is at the 25% chord line.



BUILDER'S TIP:
You will need the elevators to continue to the next steps. You should build the elevators before the canard.

INSTALLING THE ELEVATOR MOUNTING ATTACHMENTS

Now we will install the elevator mounting brackets, before we install the slot cores.



OUTBOARD ELEVATOR PIVOT ASSEMBLY

..... These instructions cover only the assembly of the left outboard elevator pivot, but the right outboard elevator pivot is a mirror image, and may be accomplished at the same time.

.....First, review the MAIN WING chapter section on "Outboard aileron Pivot Assembly". Except for the part number changes, you will be doing exactly the same operations. It is suggested that you install the CS14, CS15 & CS19 elevator mounting pivots before you install the slot cores. After the slot cores are installed you will install the CS17, mid-span pivot.

If you haven't already done so, locate a QCSM7 pivot about 0.25" inboard of the outboard end of the elevator using 3 MSP43 cherry rivets spaced radially at least 0.4" apart. It will be necessary to "tunnel" through the elevator skin and elevator foam core in order to reach the CS16 elevator torque tube for riveting. The holes made by the tunneling operation should be filled after riveting with dry micro.

.....Find CS19, and insert a QCSM5 stud with the 2 AN970-4 washers, 1 AN960-4 washer, and 2 AN363-428 nuts, just as you did on the aileron outboard 'pivot assembly. Remember, there must be a minimum of 0.6" from the AN960-4 washer inboard to the end of the QCSM5 stud so that the elevator must be moved inboard at least 1/4" before it "falls off" the QCSM5 stud for disassembly. Finally, round the end of the QCSM5 stud slightly to assist in mounting the elevator.

.....When the elevator is mounted, CS19 will fit against the canard spar.

.....Do you understand? Good, read the above explanation again two times until it is indelibly etched in your memory.

.....Now you are ready to do the same thing for the right elevator. Remember that the QCSM2 pivot assembly, complete with QCSM3 stud, must be pushed into the CS16 elevator torque tube with the stud pointing OUTBOARD. (A mirror image of what you have already done). Be very careful in setting up the right mid-span elevator pivot assembly, and verify that it, too, will function as described in the paragraph above.

INSTALLATION OF THE ELEVATORS

The elevators are installed and rigged prior to the installation of the slot cores and the canard being mated to the fuselage. As a result, after mating only CS13 needs to be hooked up for a functioning pitch control system.

The procedures detailed here are similar in scope to what you have already accomplished in mounting the ailerons on the main wing, except that the elevators have a center pivot on each side.

Begin by jigging the canard perfectly vertical, with the leading edge at the table and securing with bondo.

Take a piece of QCSM1 and make two 1.8" 1ength pieces to slide inside the elevator as reducers. A saw cut and perhaps some light sanding will be necessary to make them fit snugly and flush with the inboard ends of the two elevators. Verify that Q2CSA8 will slide into the reducers and through CS15 with a minimum of clearance and play.

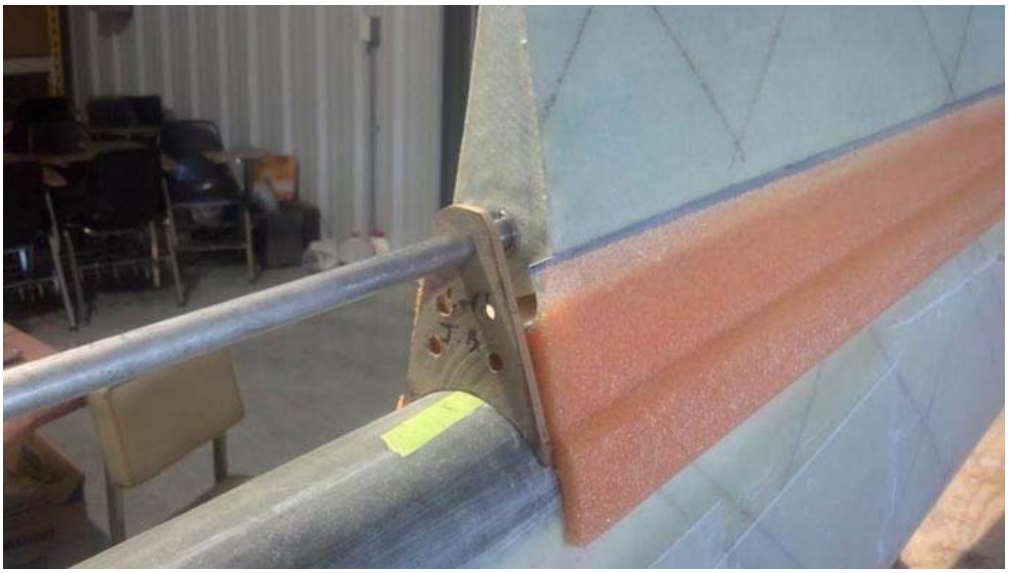
Find the phenolic bearings CS15 (2) and CS14 (2). Dull the phenolic completely with sandpaper except inside the reamed 5/8" diameter holes. Be sure that the other 1/2" diameter holes have been drilled out. These are non-critical on diameter, but must be there to assist bonding of the phenolic to the structure. They are NOT lightening holes.

A little about the order of construction is in order. You will first position the CS15 & CS19 pivots in place and secure with flox (permanent glassing will come a little later). Next, CS14 will be installed, followed by the installation of the elevator slot cores, and finally, the mid-span pivot.

The right and left elevators are mirror images of one another. Each elevator has an outboard hinge CS19, a mid-span hinge CS17, and an inboard hinge CS15. Q2CSA8 slips into the elevator reducer at the elevator end. These procedures were developed to help you get the elevators mounted without binding, with the proper clearances, and with the ability to get them off again.

First, we will locate CS15 on the canard. To trial fit, make a mark on the canard at BL18.5 on each side of the canard. The inboard face of CS15 will be placed at this mark. Now, go to the fuselage and verify that you will have clearance between the elevator and the fuselage. This is a preliminary fit just to get you started. You may want to tack CS15 in place with a bit of hot glue or even tape, until you know everything is positioned correctly. Measure from the outboard face of CS15, outboard 73" and make a mark. This will serve as the inside face of the outboard pivot, CS19. Ensure that the level lines on CS 15 & CS19 are correct.

When you are satisfied that CS15 & CS19 are in the proper BL position, install the elevator use the LS1 elevator jigging templates to adjust the pivots radially about the spar. It may help to tack CS14 into place. This will take a while and you will need more than just your two hands. This step is critical to making sure the airflow over the canard flows properly into the elevator. Use both the templates and the level lines on the pivots. Note: slot cores are shown for reference only. Do not install the slot cores until the pivots have been completely mounted. Make and trial fit elevator spacers, which have a nominal length of 1.0" each. The actual length should be sized to allow the elevator to have a lateral free play (i.e. inboard to outboard) of about 0.05". Assemble each elevator, and again check for binding, misalignment, or excessive free play.

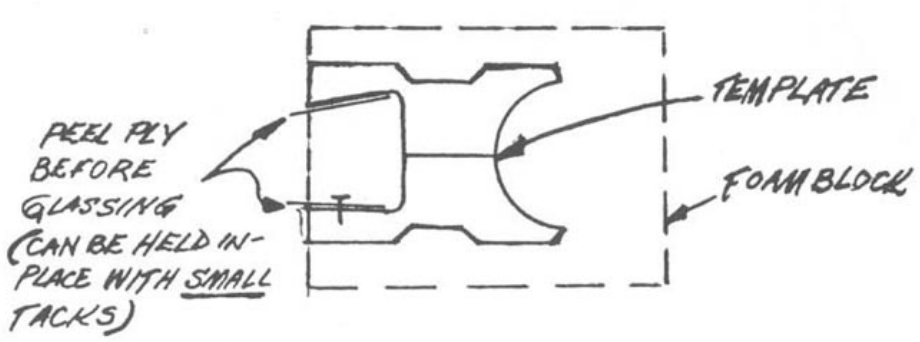


As you are doing all of this, you want to maintain perfect alignment of the Q2CSA8 with the rest of the elevator. We used a digital reference level to ensure that Q2CSA8 was exactly parallel with the spar. You will need to raise or lower CS14 to achieve the alignment.

Once everything is perfect, flox the pivots into place and let cure overnight. Now would be a good time to once again verify that the inboard end of the elevators will have clearance to the fuselage. Ensure that alignment remains perfect and that the elevator rotates freely. Carefully lay up the BID cloth that permanently holds CS19, CS15, and CS14 in place. These parts must be solidly mounted so that they cannot break off while in service. Use the "Aileron Installation" section of the MAIN WING chapter as a guide to the laminations. After you verify that the pivots didn't move overnight and are still perfect, permanently attach the pivots to the spar with two ply of BID on each face.

ELEVATOR SLOT CORES:

To start out with, the elevator slot foam cores that you hot-wired way back when were purposely made longer than necessary. Place the trailing edges of the slot core templates at the edge of the foam blocks and hotwire only the elevator slot areas. Next, glass the inside flat area with 2 BID. NOTE: Put down some peel ply in the area shown before glassing. Let cure. Do not glass the side where the spar goes.



Once the inner slot has cured, complete the slot core hot wiring. Dry fit your slot cores into the space between your elevator pivots. It will be necessary to trim the outboard of the outboard slot core to fit.

Now, you are going to repeatedly install and remove the elevator to as you trim the TE of the slot core. Work slowly as you trim. Keep trimming until you have about 1/16" clearance between the inner slot and the elevator.

The important point to remember is that the top and bottom of the elevator slot foam cores should flow smoothly into the top and bottom surfaces of the canard, respectively. If the elevator slot foam cores want to stick up a little bit, this is OK since that can be sanded later. Any dip, however, will have to be filled with micro.

Now it's time to permanently attach the slot cores. You will paint the spar with pure epoxy and use a thick layer of micro on the slot core. We found it helpful to stuff shop towels or other soft material in elevator slot to enable the nose of the elevator to push the slot core down during the cure cycle. This will help eliminate any voids. Insert stirring sticks along the length, on top and bottom, to help maintain alignment and the 1/16" clearance.

MIDSPAN ELEVATOR PIVOT ASSEMBLY

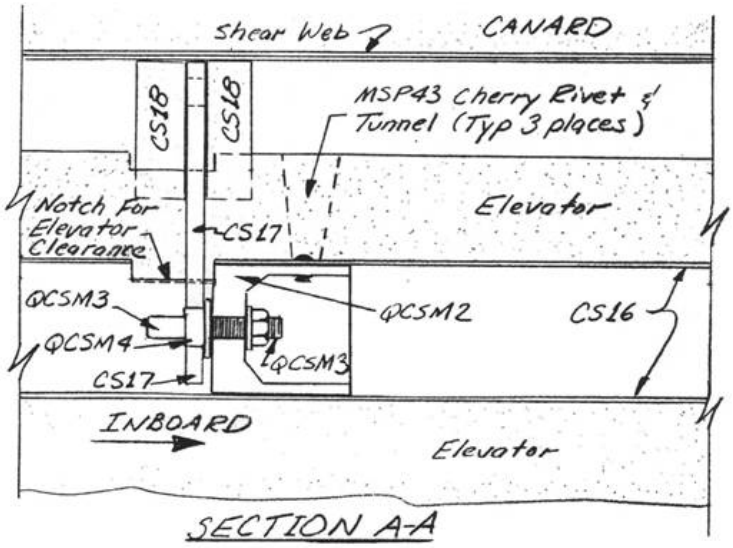
..... Read this section carefully before doing anything, and take the time to visualize what the words are saying. Otherwise, you may find it difficult to install or remove your elevators!

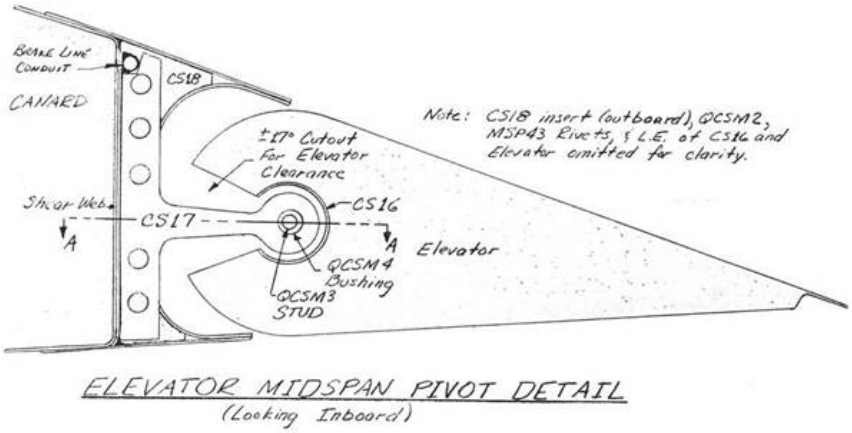
.....These instructions will cover the left mid-span elevator pivot assembly, but the right mid-span elevator pivot assembly is a mirror image.

.....Find a QCSM3 stud and a QCSM2 pivot. Screw the QCSM3 stud into the QCSM2 pivot, retaining it with AN363-1032 locknut, making sure that the assembly is tight. Next, round the end of the QCSM3 stud slightly, as shown, to facilitate installation and removal of the elevator later.

.....Measure 30" outboard on the elevator from the inboard end and place a mark. Using a router bit, route out a slot 1/8" wide for about plus or minus 17 degree of elevator travel. (See sketch – note, sketch is for the old GU canard, but the idea is the same.

Caution: Only open the elevator the bare minimum required. There has been a documented fatality where the builder took too much out of the elevator torque tube resulting in an in-flight failure.





.....Next, insert the QCSM2 pivot assembly, complete with QCSM3 stud, into CS16, the elevator torque tube, with the stud pointing outboard. (See sketch) QCSM2 pivot assembly through the CS16 elevator torque tube with a small diameter stick until it just reaches flush with the slot that you routed out. Rivet the QCSM2 pivot assembly to CS16 using 3 MSP43 cherry rivets spaced radially at least 0.4" apart. Again, it will be necessary to "tunnel" through the elevator skin and the elevator foam core to reach the tube. Again, you will fill the holes with dry micro.

.....The routed slot must be expanded so that the CS17 hinge can slide off of the QCSM3 stud and out of the CS16 elevator torque tube while remaining perpendicular to CS16. This is to allow assembly and disassembly of the elevator. Probably, you will have to open the routed slot up to about 0.6" wide. Keep this opening to the minimum! At the same time, verify that the CS17 hinge can rotate at least 17 degrees up and down to allow proper elevator movement. If not, make the routed slot bigger, as necessary. It is important, however, not to remove any more "meat" from the CS16 elevator torque tube than necessary, so work carefully. .

.....Now we come to the 2 CS18 inserts. Make sure they have been made from the High Density foam, not the bulkhead type foam. These inserts are positioned against the canard spar on either side of the CS17 hinge, and provide a local beef-up to take the hinge loads. To determine exactly which BL the CS18 inserts must go at, you will need to trial fit the elevator in position in the elevator slot foam core, making sure that the inboard end of the elevator coincides with the inboard end of the elevator slot foam core that you have previously trimmed to fit the fuselage.

..... With the CS17 hinge mounted on the elevator up against the end of the QCSM2 pivot, and with the elevator in position in the elevator slot foam core, you can mark on the elevator slot foam core where the 2 CS18 inserts must go. Next, route out the foam in the elevator slot foam core in preparation for later bonding of the CS18 inserts in place. Any excess foam removed can be filled in later with flox during assembly.

.....Now, let's carefully review how the elevator is removed from the mid-span elevator pivot. The elevator is moved inboard, resting on the QCSM3 stud, at least 1" until it falls off the QCSM3 stud. During this movement, the CS17 hinge remains where it was, since it was permanently attached to the canard (between a sandwich of CS518 inserts) during assembly.

Once the laminations indicated in step 6 have cured, you will want to install the CS17's permanently. Install the elevators on the inboard and outboard pivots; remember to leave at least a gap of 0.5" inboard for the elevator spacers. (If you haven't lost any inches anywhere up to this point. those spacers will be 1.0" in length). Install CS17 on QCSM3 against the face of QCSM2. Make CS17 the meat of a sandwich with a pair of CS18's as the bread, and trial fit the sandwich against the canard shear web dry through the slot made previously. When satisfied with the fit, and sure that the elevator clearance is a minimum of 1/16" top and bottom, permanently mount CS17 and the CS18's with wet flox. It is very important to really pack the flox into the holes so that you get very good squeeze out, and not trapped air. If the flox doesn't ooze out when CS17 and CS18's are pushed into place, then you haven't got enough flox pushed into the holes. Use tape and stirring sticks to maintain the 1/16" elevator clearance top and bottom while the setup is allowed to cure for at least 24 hours. Obviously, be careful that the excess flox does not interfere with the elevator movement, or bond the elevator to the shear web. If you previously removed the top and bottom canard skin where the slot was ground out, be sure to laminate 2 BID top and bottom once the laminations have cured. . The above procedures are used with both elevators.

It is recommended that you wait until the canard is installed on the airframe before you drill the holes that connects the elevator to Q2CSA8. When the time is right, find your elevator rigging template & reassemble everything, and set the elevators at 0 degrees. Also, verify that each elevator is pushed outboard against CS19. Verify that both Q2CSA8 overlaps into the elevator reducers a minimum of 1.8". Now drill in very carefully the two bolts that fasten Q2CSA8 and CS16 elevator reducer together. BE CAREFUL! Don't let the holes elongate; use a small drill and work up in size. Also, be absolutely sure that each elevator is at the same angle (i.e. no asymmetry) and that full elevator deflection is available without any interference anywhere in the system.

The elevator slot foam cores are unique in that both the brake line conduit and the pitot tube must run through the lower, forward edge as shown on the sketch.

The pitot tube runs out the right canard, exits at about BL40. Be sure you use enough tubing, at each end, to reach their ultimate connection.

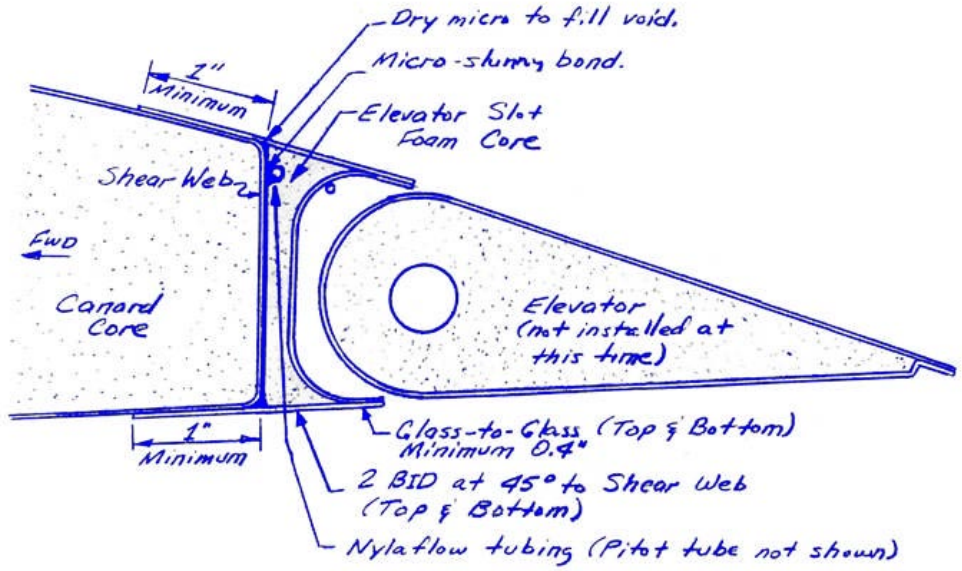
In the right canard, the brake line conduit enters the inboard end of the elevator slot foam core within 1/2" of the top edge, and continues all the way outboard to the end of the outboard elevator slot foam core on the right side of the aircraft. Let the Nylaflow tubing extend at least 24" beyond the end of the slot foam core. On the left canard, do the same routing. You should use a router bit or your Dremel to route out the foam. Any extra "room" in the foam is filled with dry micro or two-part foam. Both the brake line conduit and pitot tube are installed with 5-MIN dabs to hold them in place, and then surrounded with dry micro, as shown. You also may want to try making wire staples out of 0.042" safety wire. Keep both lines as straight as practical.

This photo shows a second tube, which is for the Angle of Attach indicator. This feature is only available with certain EFIS avionics.

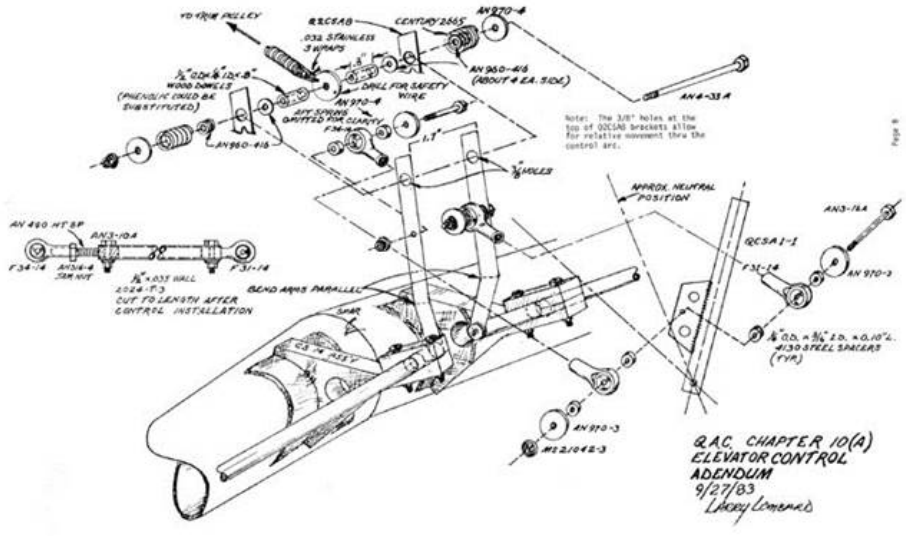
Next, sand down the slot core "tails" so that you can achieve a minimum of 0.4" of glass-to-glass bond with the inside lamination., while at the same time fairing everything nicely into the canard contour forward of the spar. At the glass-to-glass bond area, you must sand away all micro and epoxy and get down to the glass. Spend some time looking at the surfaces getting the best alignment that you can. When everything is ready, laminate 1 ply BID at

45 degrees to the canard shear web on the elevator slot foam cores, being sure to achieve at least 0.4" of glass-to glass bond, and lapping up onto the canard at 1 east 1". Note that the sketch ca11s out dry-micro fill if required at the top and bottom of the spar joint.

GU canard shown below for reference.



INSTALLING THE ELEVATOR SLOT FOAM CORES ONTO THE CANARD CORES



POST-CURING THE CANARD STRUCTURE

..... In order to minimize creep in the canard, the canard should be post-cured prior to installing it on the aircraft.

.....Creep is the tendency for the epoxy to deform due to heat and load. In the case of your aircraft, the heat could be obtained on a hot day with the aircraft setting in the sun, and the load is always there when the aircraft is resting on its 'landing gear'. The loading through this means is both bending and torsional in nature.

.....Creep can be minimized by heating the structure to a higher temperature than it will see while in

service. If you own a multi-million dollar corporation, you should use a very large oven with accurate temperature control throughout; if you are like the rest of us, you can obtain equal results by painting the canard black with primer and setting it in the bright sun to effect the post-cure.

.....If you desire, you may want to finish the canard up to the primer stage before post-curing it. (Note the surface waviness criteria in the finishing section of the Composite Materials Education chapter). However, if you desire to do all of the messy finishing work at one time, you can elect to just shoot some black primer on the canard, and clean it off later. It is important to remember that when you attach the canard to the fuselage later, wherever the BID tapes that secure the canard to the fuselage attach to the canard, the canard must be free of any paint, micro, feather fill, etc.; i.e. just the pristine structure.

.....The reason you will want to use black is that it makes the job easier by absorbing more heat, thus raising the temperature of the structure quicker. . The technique you will use is quite simple. Expose the top and bottom surfaces of the canard to the sun, changing the angle of the canard periodically to heat the entire surface. Check the temperature frequently by placing the palm of your hand on several locations. If you can hold your hand on the surface for about 5 seconds without screaming out in pain, the temperature is perfect. Permit the canard to set at that temperature for about 10 minutes. DO NOT PERMIT THE CANARD TO GET TOO HOT.

.....It is not necessary to post-cure any other structure on your aircraft.

You may also choose to build an oven to post cure your canard. This is relatively done using ½" foil backed foam board available from home building centers, such as Home Depot. It's okay for the structure to be flimsy, don't over engineer it. It only has to last about eight hours. We used drywall screws to attach it to the jig table, and duct tape to hold everything together. You should get at least three heat sources and plenty of fans to keep the air moving within the oven. Air movement is very important to avoid hot spots which may damage the foam. We also highly recommend using a thermostatic control to prevent overheating. You want 145F for eight hours. No hotter, no longer.

Get a thermometer and insert it through the foam in several places over the course of the cure. Monitor that you dont get any hot spots.

NOTE: There is a full write-up about how one builders created a post cure oven in Q-Talk #161:

http://www.quickheads.com/index.php?option=com_content&view=article&id=2362&catid=48&Itemid=101

SPARROW STRAINERS:

These are trim devices required due to the pressure distribution of the LS(1) 0417 Mod Airfoil. Through testing, we have found the most effective position to be inboard (both sides of course).

Construct as follows:

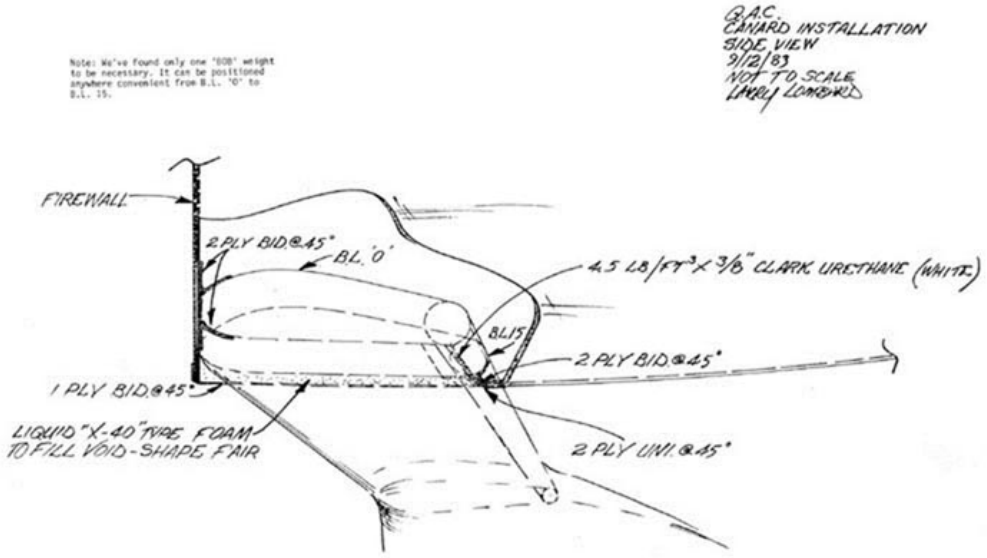
Make 4: 1/8" plywood stringers.

Also Make 2: 11.5" balsa wing sections.

5 minute epoxy 2 plywood stringers and airfoil section on elevator about 1" outboard from inboard but line. (duct tape and large rubber bands are helpful here). Make small micro radius at stringer attach to elevator. Cover everywhere with 1 ply BID. (We used a lighter weight tooling cloth available at most hobby houses - about 4 oz.) This cloth is also a good choice for antenna close-outs.

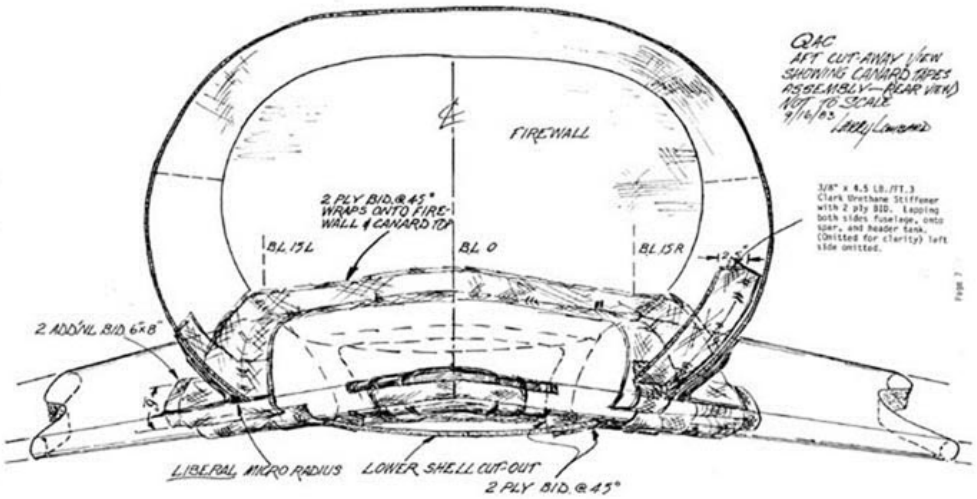
INSTALLING THE NEW CANARD

Installing the new canard to the fuselage will tax your imagination. Not unlike Chapter 12-2 of the Construction Plans, it may take several hours to trim and jig the canard to the fuselage and in reference to the wing. You should exercise extreme caution in leveling the fuselage in all quadrants and jigging the canard . (You did bond reference levels to canard while it was jigged for glassing, didn't you?)

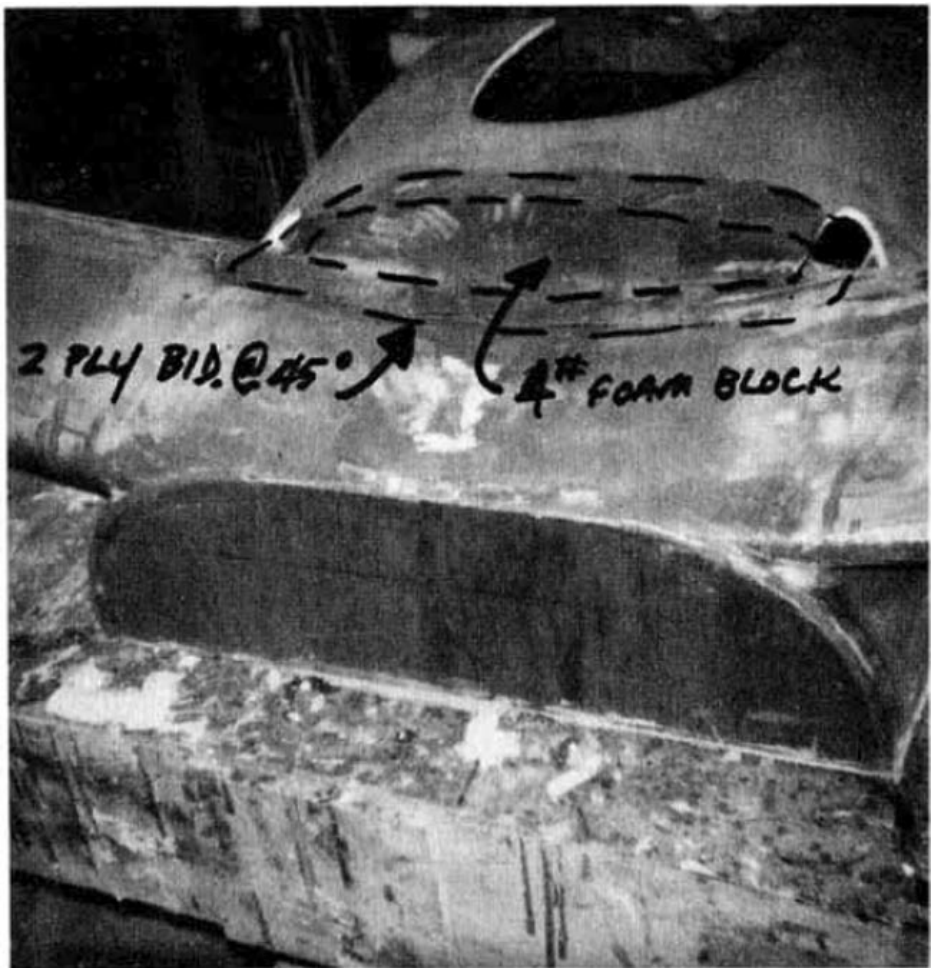


Please note: Your LS-1 mod canard mounts at zero incidence as opposed to the G.U. Also, without a straight center section as on the G.U., there is no bottom reference to the fuselage. Therefore, it would be best to have the magneto box cut-out completed as a reference to the apex of the LS-1 for final canard- to-fuselage assembly.

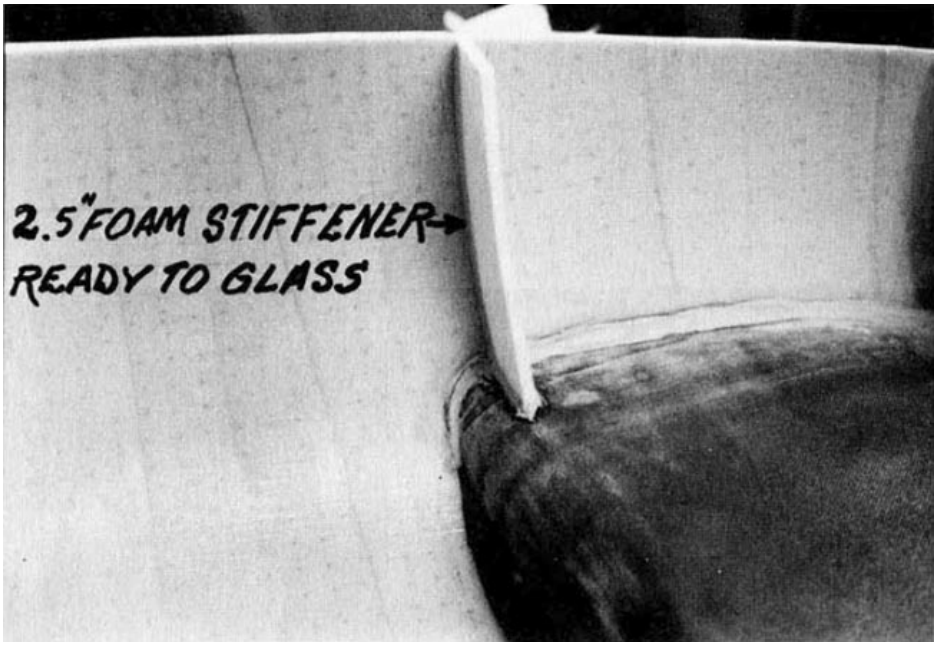
After canard is installed with liberal dry micro radius and 2 ply BID, micro transition blocks from fuselage bottom to canard (4# x 3/8" white urethane) and 2 ply BID inside and outside lapping at least 1" everywhere. (See drawings and photo.)



Then, with 2# urethane block or, better still, X-40 pour-in-place, fair bottom of fuselage cut-out to firewall and closeout with 1 ply BID @ 45°. You may also use the previously discarded piece of fuselage shell that you removed to install the canard. Attach with 2 BID.

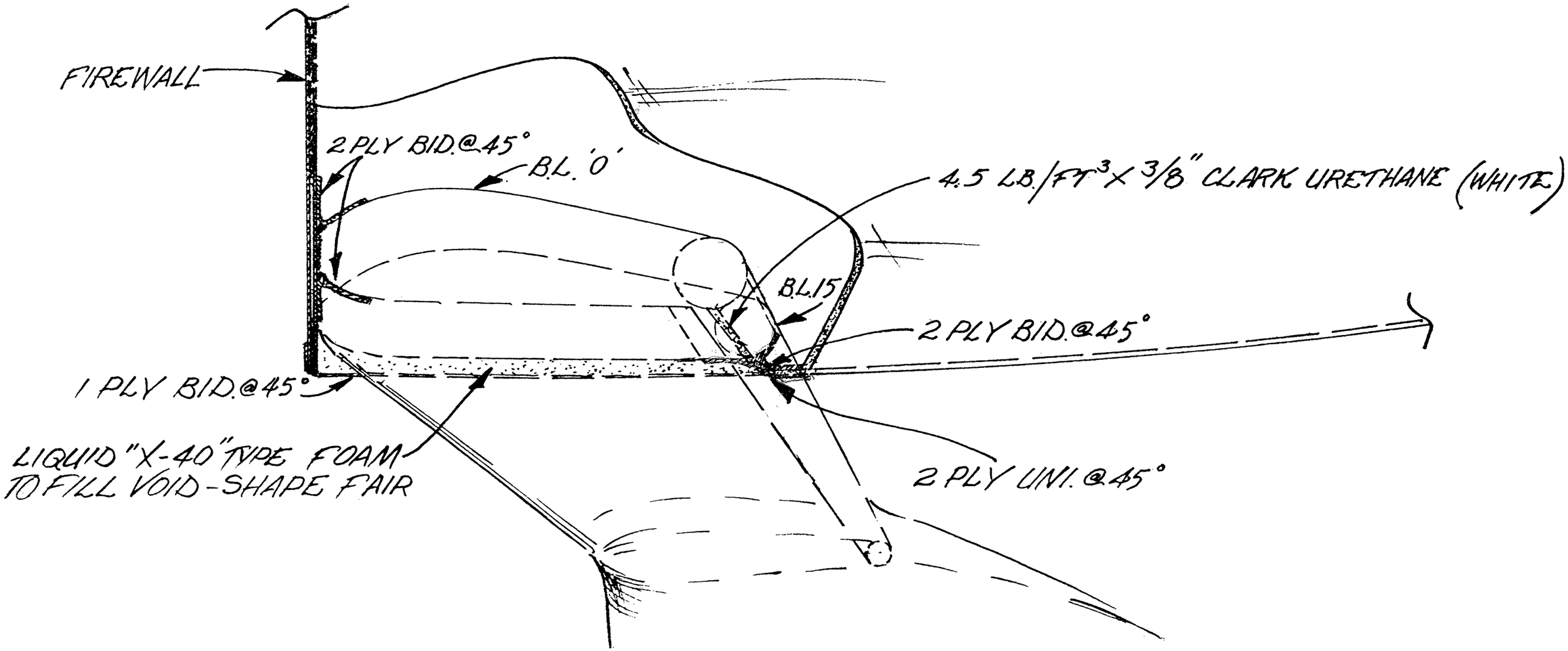


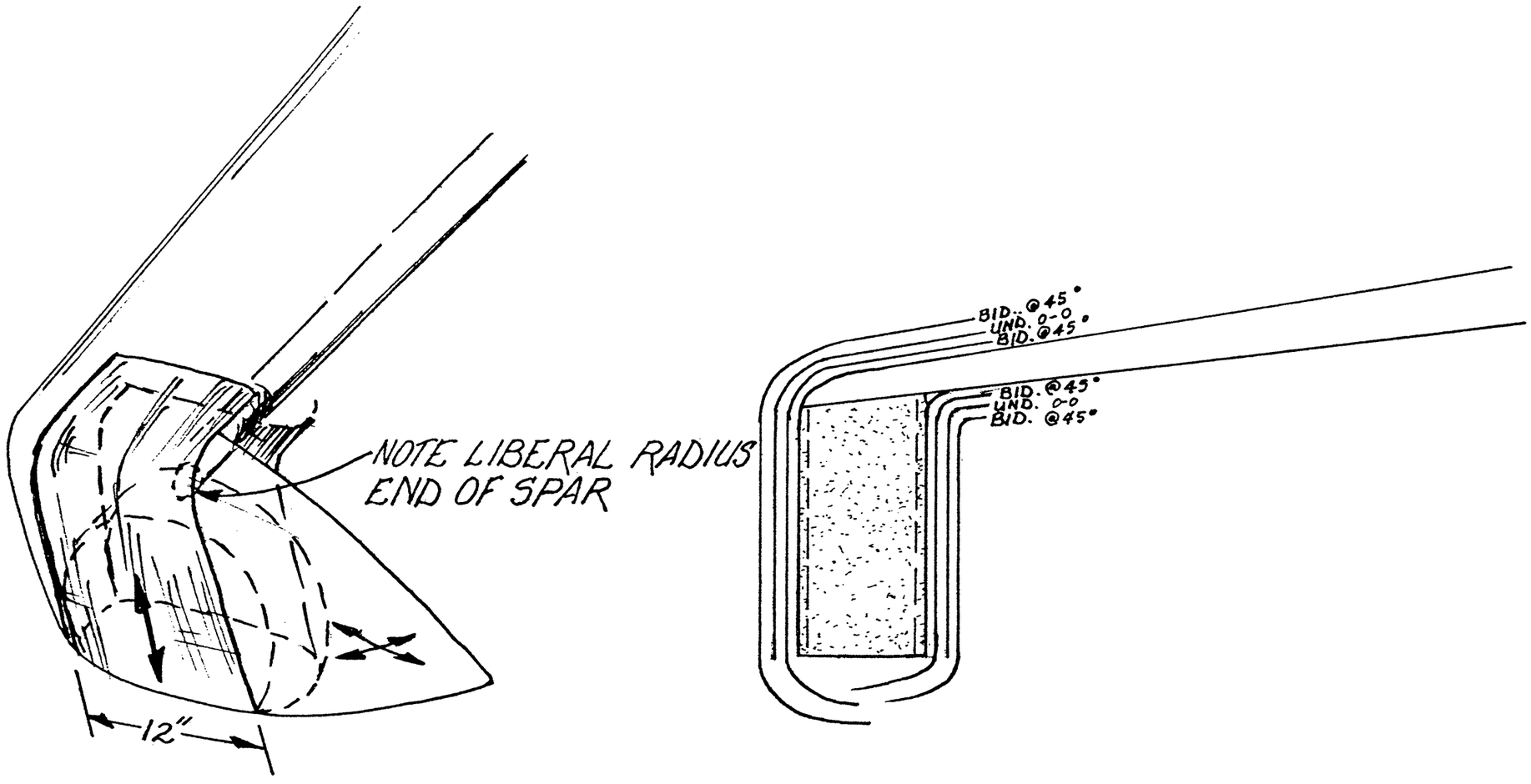
Next, install additional 2.5" stiffeners left and right sides of fuselage centered over spars as per drawing.



Note: We've found only one 'BOB' weight to be necessary. It can be positioned anywhere convenient from B.L. '0' to B.L. 15.

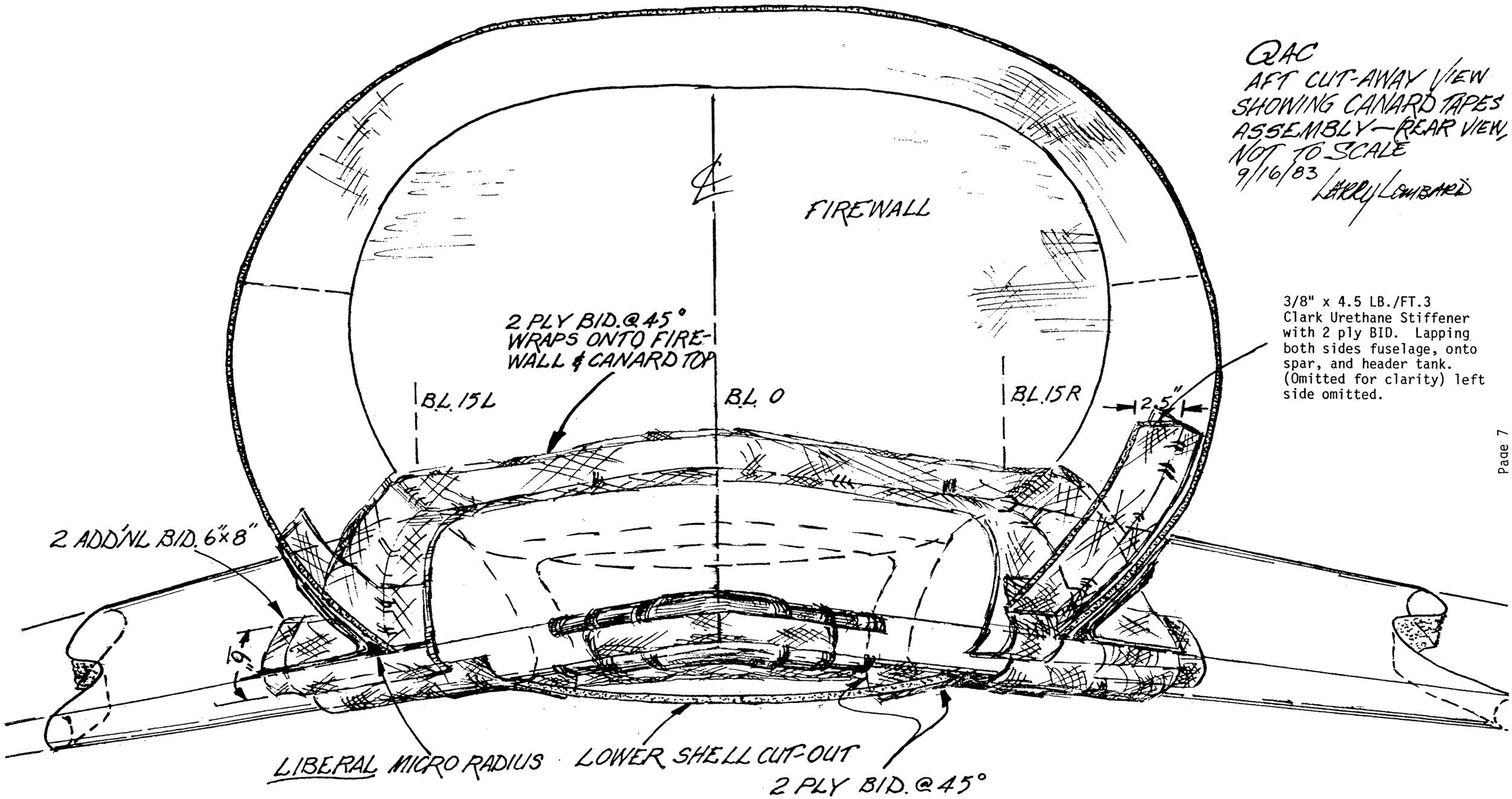
Q.A.C.
CANARD INSTALLATION
SIDE VIEW
9/12/83
NOT TO SCALE
LARRY LOMBARD



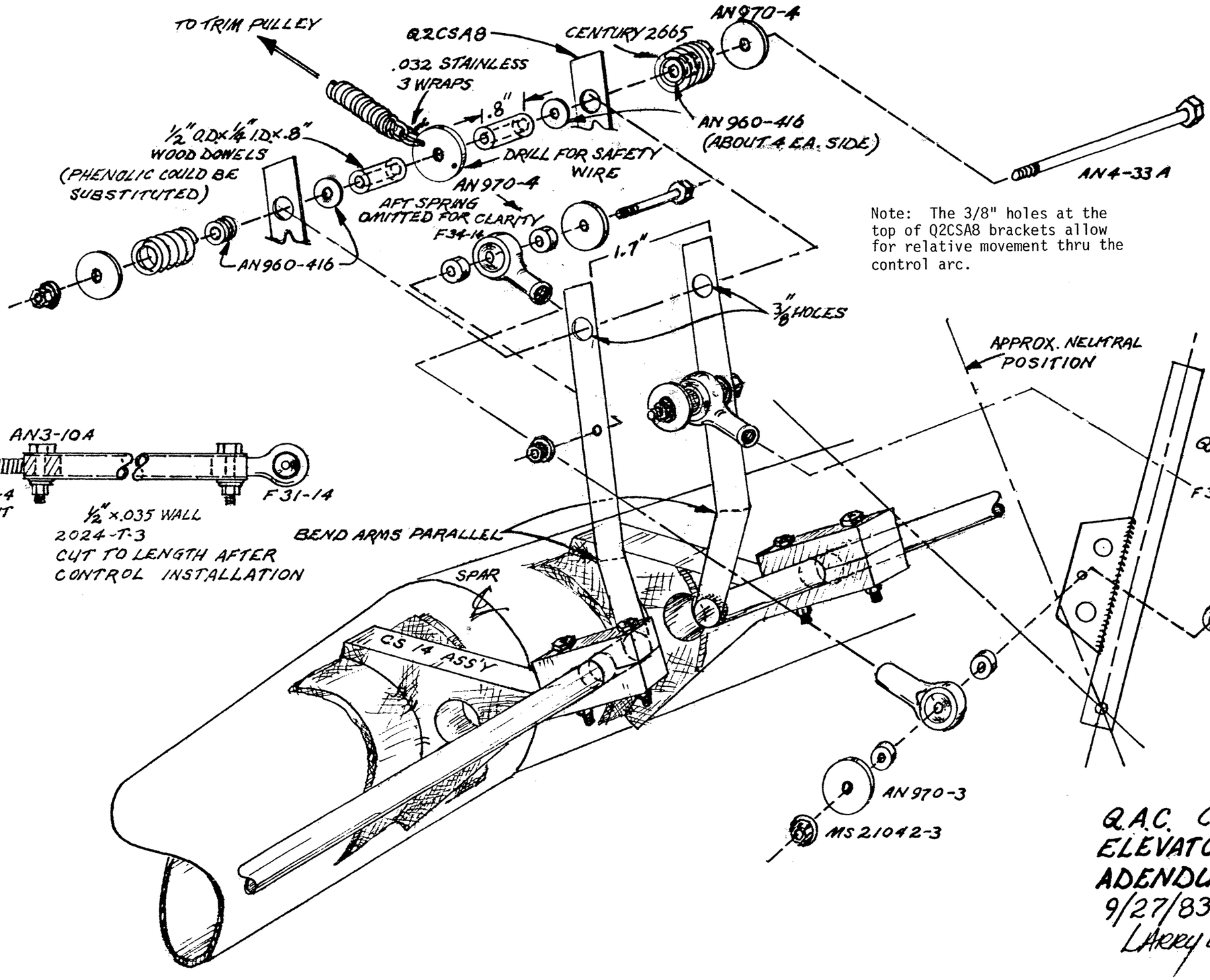


QAC
ADD'NL UND. PLY @
WHEEL PANT
9/19/83
LARRY LOMBARDS

QAC
AFT CUT-AWAY VIEW SHOWING CANARD TAPES ASSEMBLY—REAR VIEW, NOT TO SCALE
9/16/83
LARRY LOMBARD



3/8" x 4.5 LB./FT.3 Clark Urethane Stiffener with 2 ply BID. Lapping both sides fuselage, onto spar, and header tank. (Omitted for clarity) left side omitted.

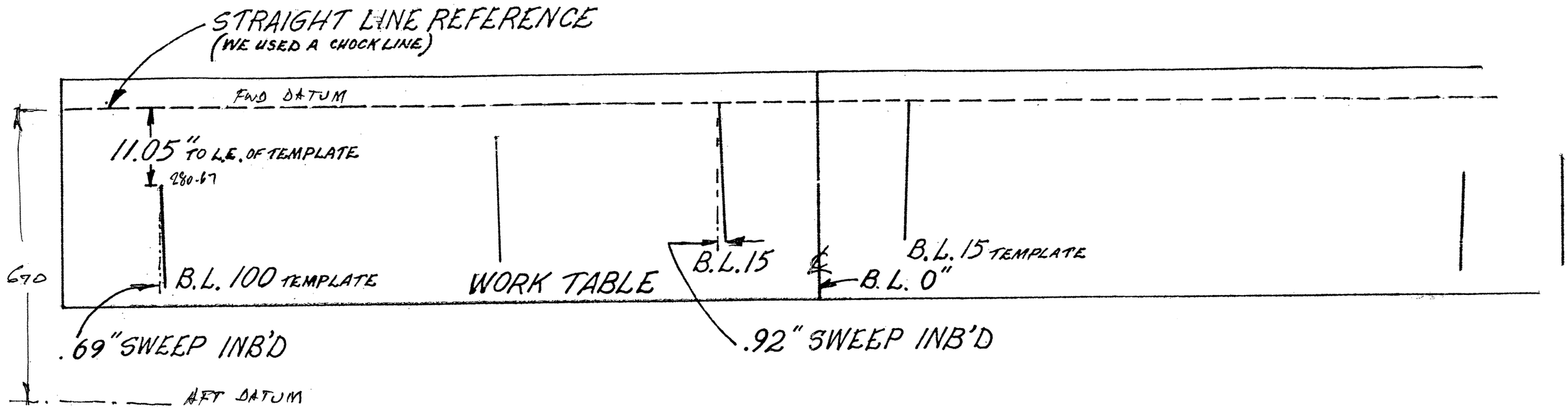


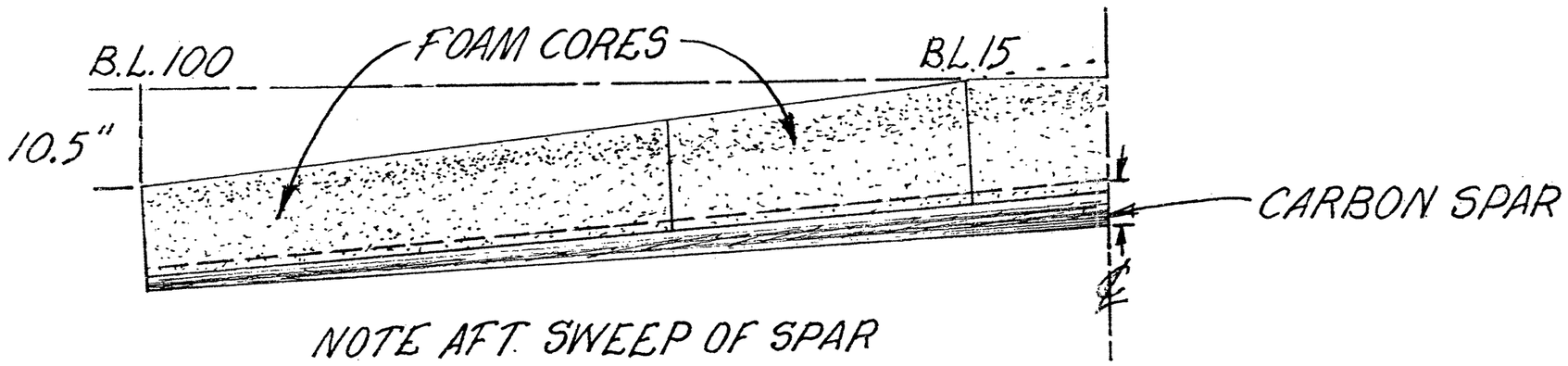
Note: The 3/8" holes at the top of Q2CSA8 brackets allow for relative movement thru the control arc.

Q.A.C. CHAPTER 10(A) ELEVATOR CONTROL ADENDUM

9/27/83

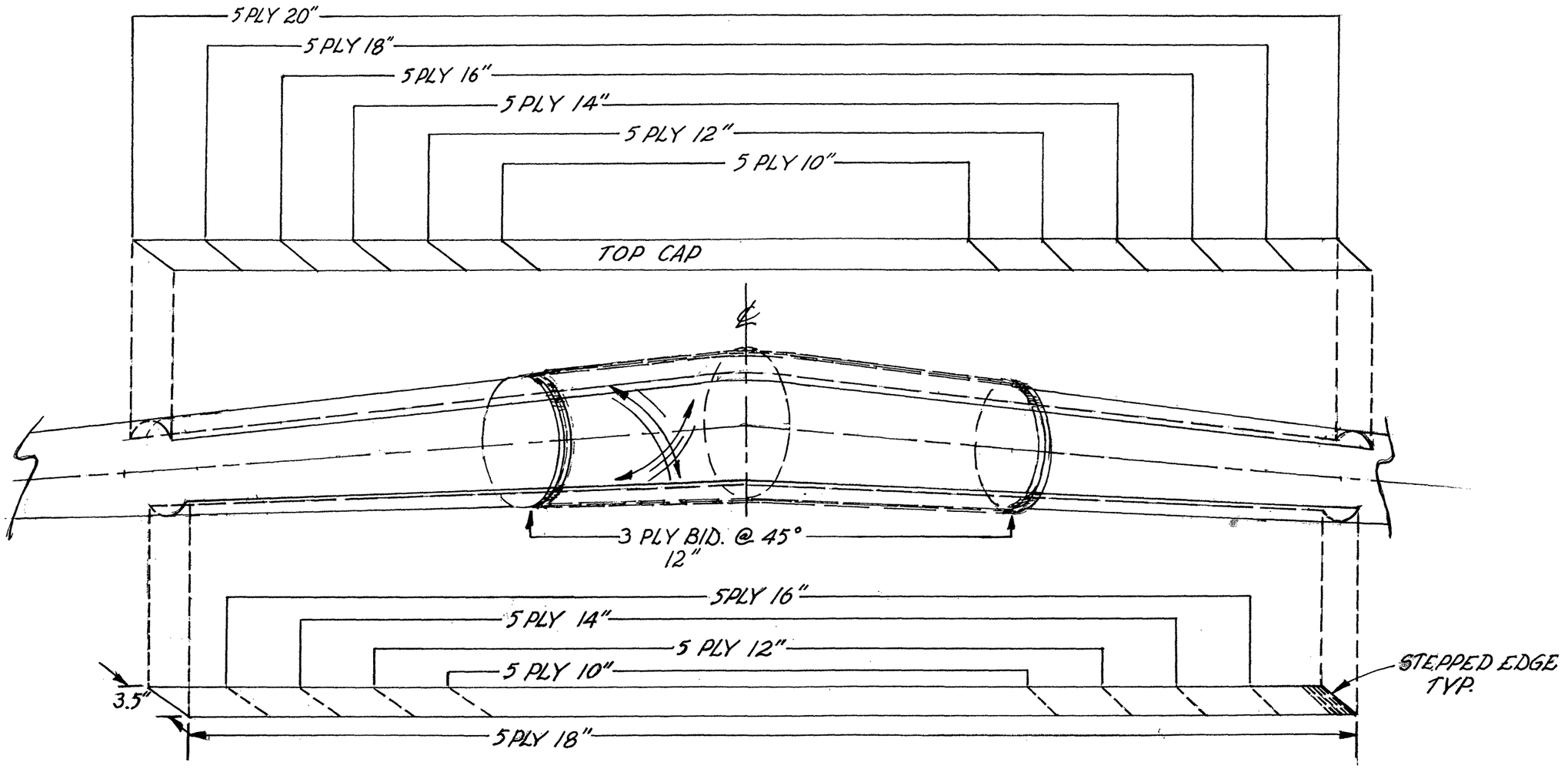
LARRY LOMBARD





NOTE AFT SWEEP OF SPAR

CANARD FIXTURE
PLACEMENT ADDENDUM
TO APPENDIX SHEET W-4
8/26/83
DRAWN BY: Larry Lombard



7/14/83
DRAWING NOT TO SCALE
LARRY LOMBARD
Q.A.C.

Contents

Tri-Q Plans Introduction

The Tri Q conversion was developed for the average pilot who learned in a conventional nose wheel airplane.

The plans were developed after the installation was proven in actual flight testing by us. We tried to make the plans as easy to understand as possible but as always, parts of them may be difficult to comprehend for some people. We suggest that you go over the PLANS, DIAGRAMS, and PICTURES, a few times before jumping into it. The main thing is to try and understand basically what you will be doing before you do it so everything will fall into place.

While you are building, constantly refer to the diagrams and pictures to help clarify the words. If you are still having trouble with some part of the conversion, please call me and I will be glad to help you in any way I can.

TRI Q CONVERSION OUTLINE

I. CANARD REMOVAL

1. Carefully cut out canard
2. Support on jig table
3. Grind down left over fuselage left on the canard
4. Remove the wheel pants
5. Cut notch or notches and remove the anhedral (bottom flat)
6. Micro and re-glass the cut or cuts
7. Jig rudder pedals, toe brake assemblies, and master cylinder stand-offs, and bond in place.
8. Glass all blocks in place (2 BID)
9. Check movement and fit of brakes and pedals
10. Re-install canard (2BID) (if without wing extension option proceed to section III)

II. WING AND CANARD EXTENSIONS (OPTIONAL)

1. Hot wire foam extensions
2. Sand outer 3" of the wings down to glass
3. 5 miniute epoxy in place
4. Sand to fit (depends on application circumstances) Tip splice
5. Glass extensions with appropriate layers
6. Feather glass lay-ups, fill weave, prime, and paint
7. Install canard (2BID)

III. FUSELAGE MODIFICATION

1. Draw centerline on floor and line up plane.
2. Remove the tail cone
3. Cut out all parts required out of materials supplied
4. Cut out triangular holes in the seatback bulkhead for front gear attach fittings.
5. Flox inserts in place
6. Sand smooth rounded corners
7. Glass inserts with appropriate lay-ups
8. Cut 6" rectangular hole behind the front attach fitting
9. Put plywood inserts in rear foam attach bulkhead
10. Micro bulkhead and sand smooth
11. Bond bulkhead in place at edge of hole
12. Radius hole and remove finish 1. 5" from cut out
13. Glass around the 6" wide hole onto fuselage and up onto front and rear attach fittings (2 BID)
14. Glass inside front attach support (9 BID)
15. Glass rear attach bulkhead (5 BID)
16. Glass rear attach bulkhead (6, 7, 8, 9, 10, & 11)

17. Locate holes for gear attachment and drill out to 3/8"
18. Install 1/8" aluminum bearing plates
19. Bond triangular support in place and glass .(2 BID) after gear has been fitted and removed

IV. MAIN GEAR FINISH AND MOUNTING

1. Sand gear till all dull
2. Apply torsional lay-ups (8 UNI)
3. Trim gear leg for brake assembly and install axles (preliminary)
4. Re-align fuselage and jig it in the appropriate position
5. Jig gear in place and mark attach location then sand it
6. Make the bushed aluminum tubes
7. Bond the plywood tabs on the gear
8. Lay-up your glass tabs and drill holes
9. Trial fit the gear then remove and install the aluminum tubes
10. Now install the triangular supports
11. Install axles, wheels and brakes after adjusting camber and toe in
12. Route brake lines on rear of gear and glass (1 BID)
13. Fit rectangular cut fuselage piece back in place and glass (2 BID) unless using it for belly board option
14. Get fairings and wheel pants ready for installation
15. Install fairings and wheel pants

V. BELLY BOARD INSTALLATION (OPTIONAL)

1. Fit the rectangular cut fuselage piece back in place
2. Prepare the board for use
3. Install hinge and connector on board
4. Build release mechanism and install
5. Fit the 1/4" plywood tab, route the cable and nylaflow tubing
6. Install the board and check for fit
7. Hook up the cable and adjust
8. Seal hole with cover piece between board and gear

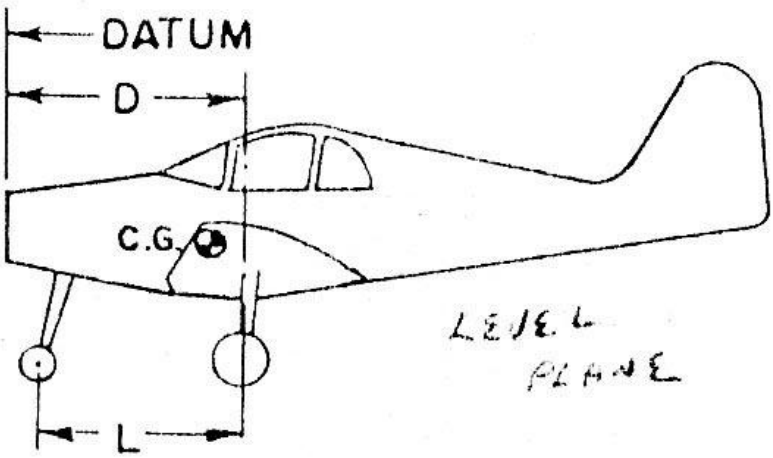
Tri-Q Weight and Balance

With the Tri Q installation, empty weight CG will shift to the rear. It is therefore important for builders to establish a new empty, weight and balance, for their aircraft. On the prototype Tri Q, we re-located the battery from mid tail cone area, to the baggage area (approx 36" forward) to obtain the correct weight and balance.

It should also be noted that the seat station is incorrectly positioned on the weight and balance section of the flight manual. We found that the actual CG of the pilot and co-pilot seats were at least 4" aft of the indicated location. Net result is that the actual CG of a loaded Q2/Q200 is about one inch aft of calculated CG. This could, and in some cases does, place a loaded Q2/Q200 aft of the CG limit. If possible, you should weigh your Q2/Q200 both empty and with pilot/co-pilot in position to correctly identify your CG.

The following will aid you in calculation of your CG.

NOTE: The Datum line in a Q2 is 14 inches in front of the firewall.



NOSE WHEEL TYPE AIRCRAFT

DATUM LOCATED FORWARD OF THE MAIN WHEELS

$$C.G. = D - \left(\frac{F \times L}{W}\right)$$

CG = Distance from datum to center of gravity of the aircraft.
W = The weight of the aircraft at the time of weighing.
D = The horizontal distance measured from the datum to the main wheel weighing point.
L = The horizontal distance measured from the main wheel weighing point to the nose or tail weighing point.
F = The weight at the nose weighing point.

Tri-Q FAA Requirements

If your aircraft has not flown off the restrictions prior to a change to a tri gear, you must complete all required paper work and flight tests as before.

If your aircraft has completed the flight tests and received the unrestricted experimental certificate, you will need to notify your local FAA GADO or Engineering and Manufacturing office.

They may require further flight testing in a restricted area until satisfied all is O.K. We were allowed to conduct the ground and flight tests without restrictions as our local Officials determined flight safety was not jeopardized by the tri gear conversion.

Proper airframe log book entry is important and should follow this format:

Aircraft converted to a tri gear (Tri Q) by installing a tri gear conversion kit as supplied by Tri Q Development. Modifications to the airframe, including glass layup schedules, reinforcing bulkheads, gear installation, etc. was accomplished using materials as supplied in the kit and Tri Q plans. A new "empty weight and balance" has been computed and a sample fore and aft loading program completed.

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New Empty Weight	_____
New Empty Wt. CG	_____
Date	_____
Total Time (If Any)	_____
Signature	_____

Tri-Q Warnings

The tri gear conversion was not designed to make good pilots out of bad ones, nor good airplanes out of bad ones. It was designed to provide the average pilot a reasonable chance to taxi, take off and land the 02 without the directional problems associated with the tail wheel airplane. It is assumed you will be current in a nose gear airplane before flying your Tri Q.

A few tips and recommendations will aid you in your ground work, take off and landings in the Tri Q.

If the airplane has never flown as a tailwheel A/C, determine accurately the weight and balance and try to make your initial flights at the mid CG location. Set the aileron at about 1/4" trailing edge up until it is determined that the elevators are at the proper trailing edge position (in line with the wing tip fairings) when at cruise speed. Reflexing the ailerons will change the position of the elevators in flight. The more you reflex the ailerons up the more the elevators move up.

Spend some time in the airplane at a mid taxi speed (20 to 30MPH) and get a feel for the ground handling. You will notice that the brakes seem very sensitive. Don't try to make direction changes with the brakes until the rudder has been deflected full stop. 95% of all direction control can be made with rudder alone. It is very important that you keep your feet off the brakes for take off and landing. A slight brake may be needed if x Winds are high but you should venture into x winds only after several hours have been flown without serious x winds.

Once you are sure all is in order its time to go fly. Let me take you through a typical take-off and landing sequence. After the check list has been completed, set the elevator trim so that the trailing edge of the elevators are approx. 3/4" below the tip fillet. Mixture rich and the cowl flap open. Line up with runway centerline, and apply full power smoothly. You should take about 4 seconds from idle to full power. At about 70 MPH the nose should be rotated to the climb attitude and almost immediately you will be flying. Directional control should be maintained totally with rudder input. Don't try to jab a brake now and then, it just isn't necessary. Establish a climb speed of 100 MPH for best engine cooling and visibility and reduce engine speed if necessary to maintain temperatures.

I found it easiest to determine your best approach speeds before you make your 1st landing. Therefore, climb to 4 or 5 thousand feet and ease the power back to idle. Pull the nose up and slowly dissipate speed until you run out of elevator or you get a pitch buck. This should happen at about 65 to 70 MPH depending on your airspeed indicator accuracy and static system location. Now you know the magic number to avoid on short final. You may also want to get about 30 minutes flight time making turns etc. to get use to the handling. Lets go back into the pattern for a landing.

Establish about a 120 MPH downwind leg and reduce power to start your descent to final. I will set up a 100 MPH base and final to keep visibility high. On about a 1/4 mile final, reduce power to show 85 to 90 over the fence and then power off. Maintain a nose high attitude, but not necessarily a full aft stick, and let the airplane settle onto the runway. It is best to fly it on rather than try to make a full stall landing. Remember, if the airplane starts a pitch buck while still three feet high, the nose will come down hard.

As soon as the main gear touches, the nose will almost always pitch down enough to kill all the

lift on the canard. You can then lower the nose the rest of the way to the runway and let the airplane rollout. Do not attempt any wild short field landings until you have plenty of time in the airplane and are very familiar with those sensitive brakes.

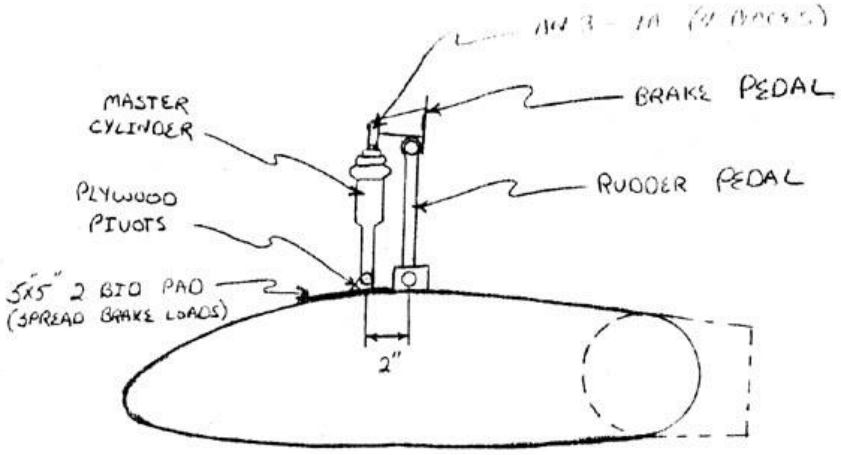
An alternative landing would be using a little power all the way to touch down. This reduces the "pitch down" to a minimum and gives the pilot more time to feel for the runway. Again, don't make your first landing a full stall. I have landed at 100 MPH indicated with plenty of distance between the nose wheel and runway. After a few landings are "under your belt" go ahead and try slower and full stall landing. Stick to the one that feels best after several hours of flying.

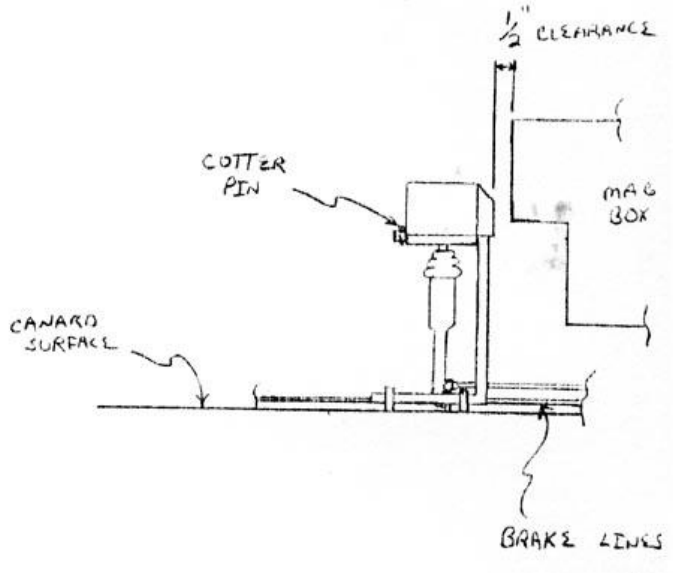
If your plane is typical of our prototype, you should have many fun hours flying your Tri Q.

Good luck and may all your landings equal all your take-offs.

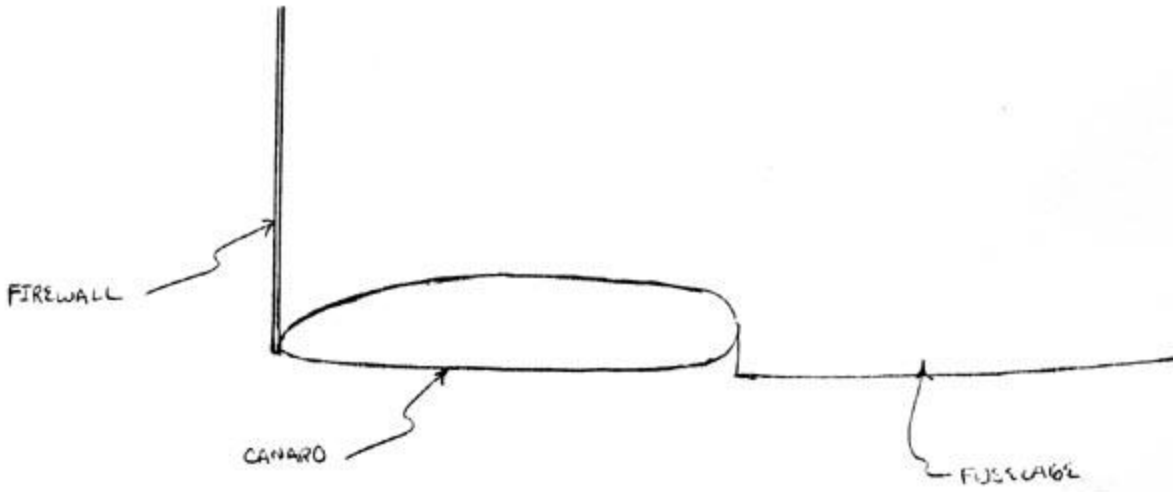
Tri-Q Brake Assembly Installation

After the canard has been made flat you can jig your rudder pedals and brake assemblies in place. This is done according to the plans except for the addition of the brake pedals, master cylinders, and plywood bottom pivots. When jigging your rudder pedals, keep in mind the extra room taken up by the brake pedals over by the mag box. The brake pedals simply slide over the rudder pedals and holes are drilled in the rudder pedals to allow cotter pins to hold the brake pedals in place. The master cylinders are bolted in place on the brake pedals, then swung down to the canard so you can mark the spot for the bottom plywood pivots inboard of the master cylinders. These pivots are 2" in front of (toward firewall) the center line of the rudder pedal pivots. Sand the area where the pivots will go. Flox the pivots in place and glass 2 BID onto the canard like the rudder pedal pivots were done. Trim the hole and bolt the master cylinder in place. Adjust the brake pedals so you can actuate the rudder pedals without applying brakes but close enough to allow easy application.





Sand about a 4 inch wide strip on the canard where you will be mating it to the fuselage. Install the canard as per original instructions.



Tri-Q Elevator Hook Up Modification (If Needed)

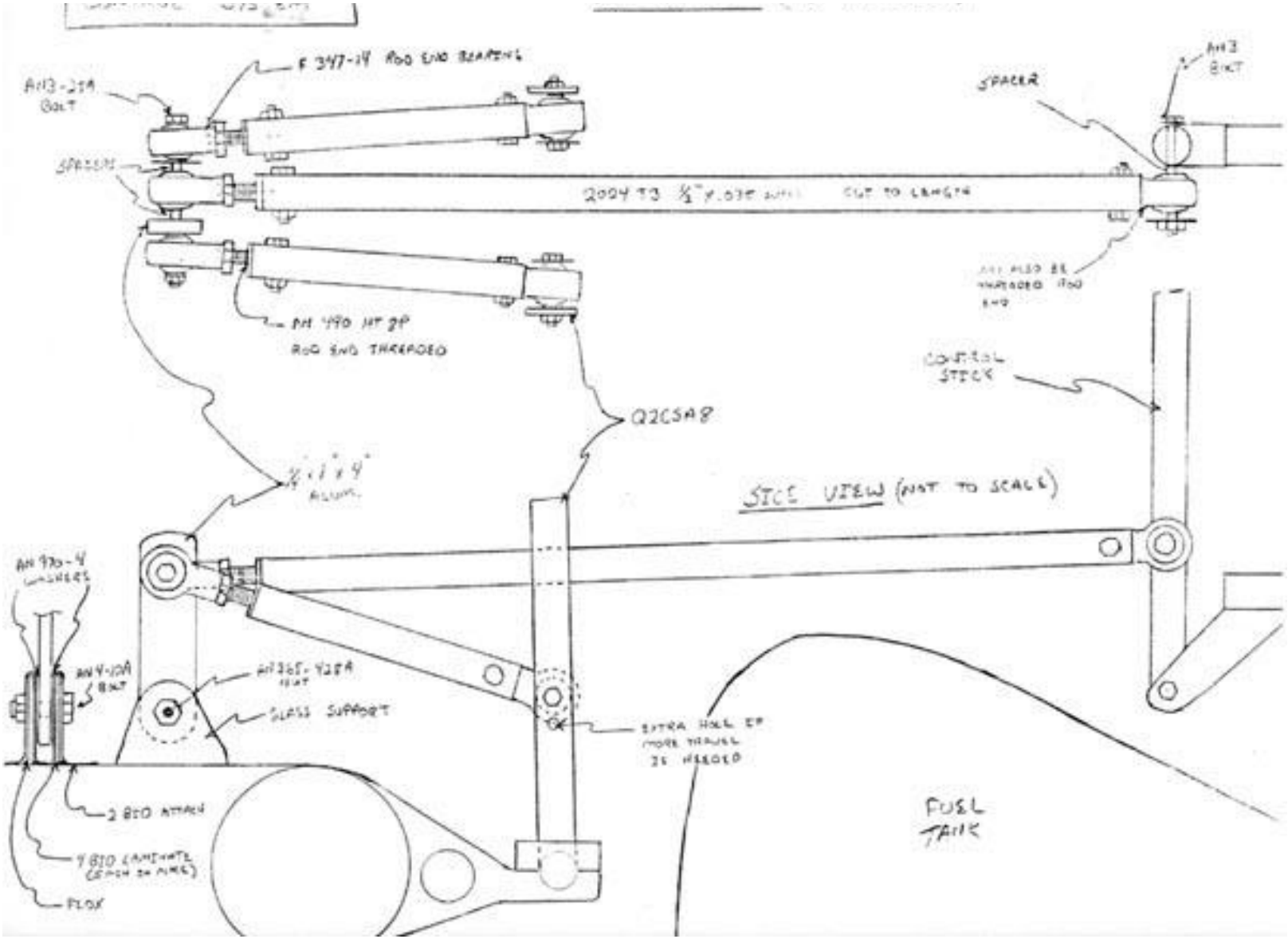
When you removed the anhedral from your canard, the center elevator pivot was moved down which then made the hook up of the Q2CSA8 more difficult. We found that with the old system (single control old canard) the control rod could be bent enough to allow attachment and full movement. We were not so lucky with the new canard or new dual rod system.

If your main fuel tank has not been installed or if it has but you do not have the center arm rest installed, you could modify it with a tunnel to allow the two push rods to fit and move freely. If your tank is in and it would be to difficult to do this modification there is another way of hooking the system up but it requires a few extra parts and a few more dollars. You may order the parts yourself through Aircraft Spruce or you can let us know and we will send you them for the cost of the materials plus shipping and handling.

EXTRA MATERIALS NEEDED

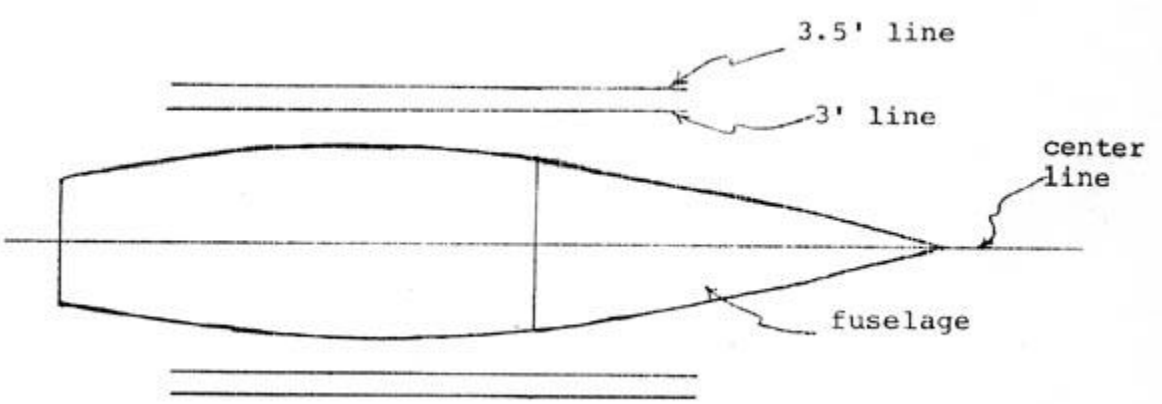
2 '	1/2" x .035	Aluminum Tubing
1	1/4" x 1" x 4"	Aluminum Bar Stock
2	F347-14	Rod End Bearings
2	AN 490 HT8P	Rod End Threaded
2	AN 970-4	Washers
2	AN 970-3	Washers
1	AN 4-10A	Bolt
1	AN 365-428A	Nut
1	AN 3-25A	Bolt
3	AN 365-1032A	Nut
2	AN 3-7A	Bolts
4	AN 960-10	Washers

NOTE: You may already have some of the hardware such as nuts, bolts, and washers left over from the kit.


F 347-14 ROD END BEARING
AN3-20A BOLT
SPACER
AN3 BOLT
2024 T3 ½" x .035 WALL CUT TO LENGTH
MAY ALSO BE THREADED ROD END
AN 490 HT 8P ROD END THREADED
Q2CSA8
CONTROL STICK
½ x 1 x 4" ALUM.
STICK VIEW (NOT TO SCALE)
AN 960-4 WASHERS
AN4-10A BOLT
AN365-428A NUT
GLASS SUPPORT
EXTRA HOLE FOR MORE TRAVEL IF NEEDED
2 BID ATTACH
7 BID LAMINATE (EACH SIDE OF WEB)
FLOX
FUEL TANK

Tri-Q Fuselage Modification

Draw a long line on the floor of your shop or garage with a marker. This line will be your centerline for lining the airplane up when installing the gear. You will also need two (2) lines parallel to that one at 3' & 3.5' on each side. Later you will mark FS 14 through 60 as well.



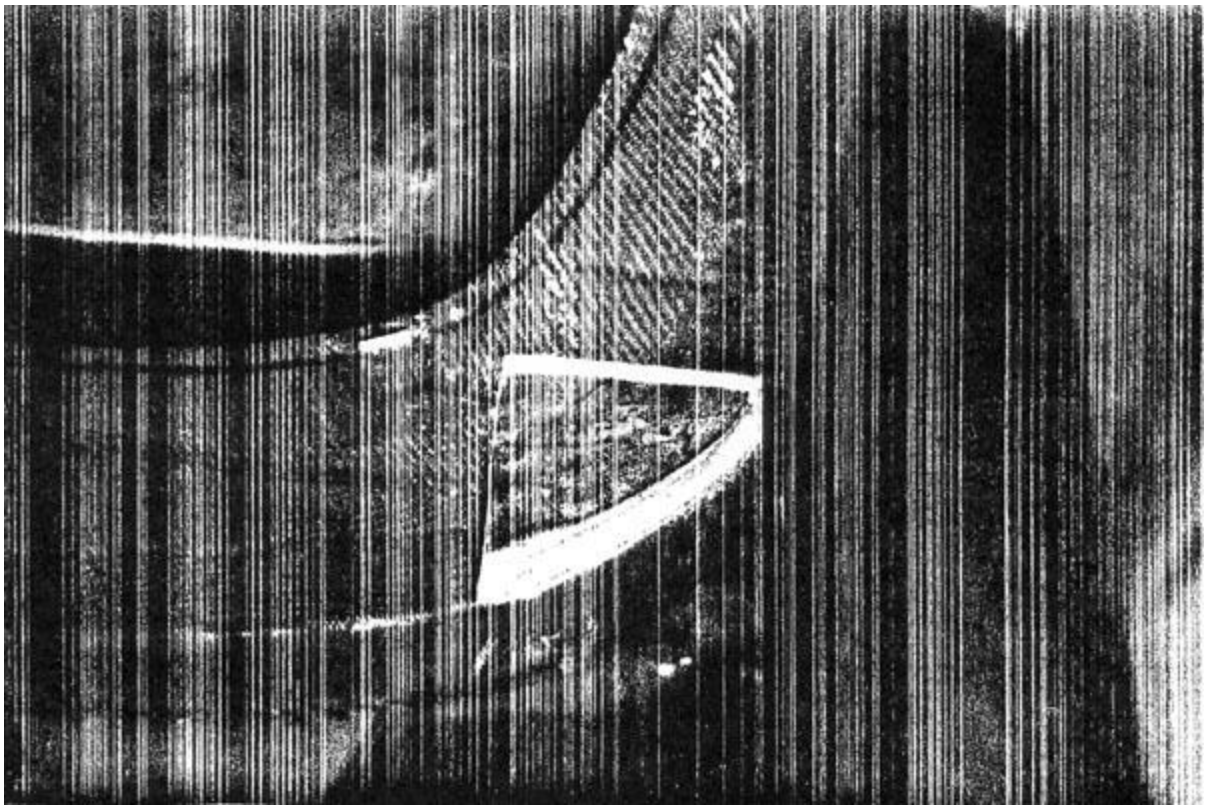
You can take the fuselage apart now and remove your interior where it will interfere with the modification.

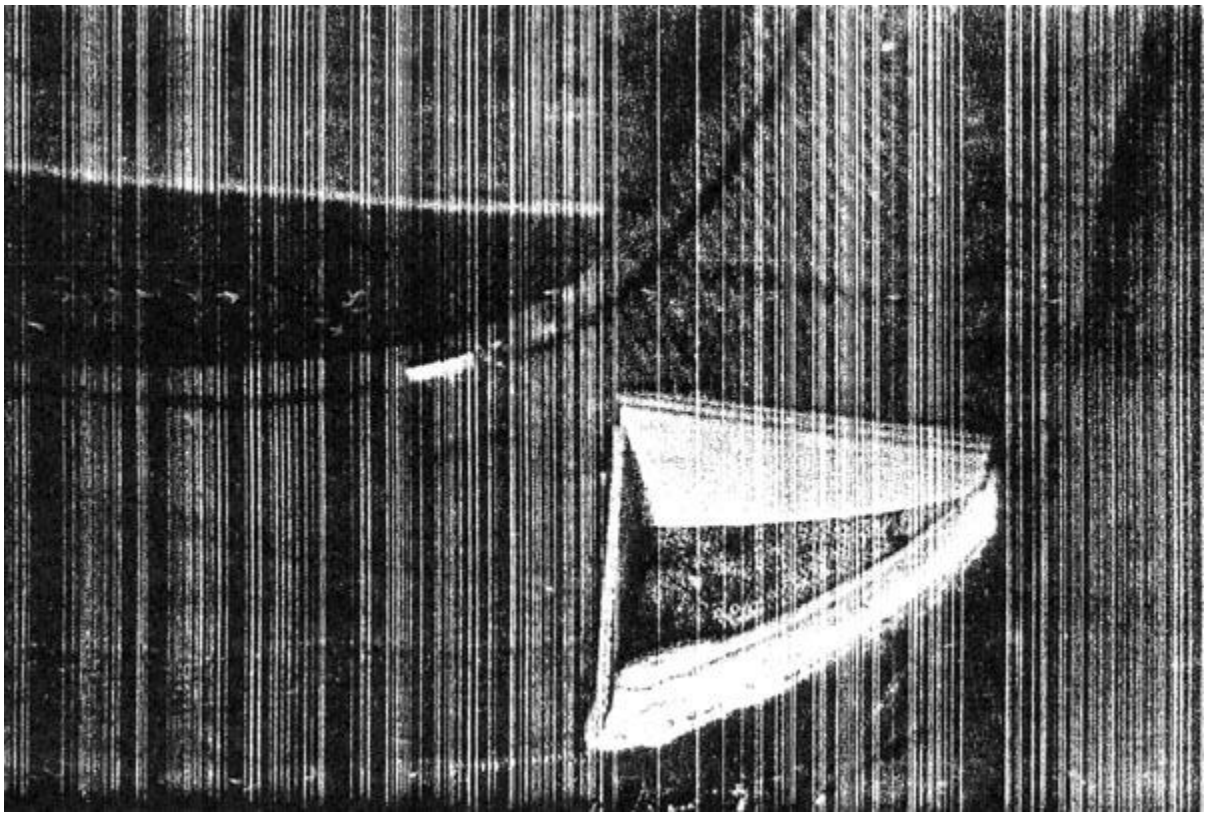
Start on sanding the inside of the fuselage where you sit, up 1" onto the fuel tank, side arm rest, and center armrest. Sand the seatback bulkhead from the center console over and up the sides to the vertical seatback bulkhead. You should do this with 40-60 grit sandpaper. Always remember to sand over all areas that are to be glassed. From the template and drawings provided, cut out your two triangular shaped holes in the seatback bulkhead for your front attach inserts. The easiest way I found to do this is to drill a series of holes long enough to allow you to use a hacksaw blade for most of the cutting.

You will need to clean the hole up with a file or dremel tool to allow your plywood inserts to fit properly.

When you insert the 1/4" plywood mounting plate, it must be perpendicular to the fuselage bottom and perpendicular to the centerline of the airplane. (Get it as close as you can.) When satisfied with the fit, flox in place both the 1/8" and 1/4" pieces.

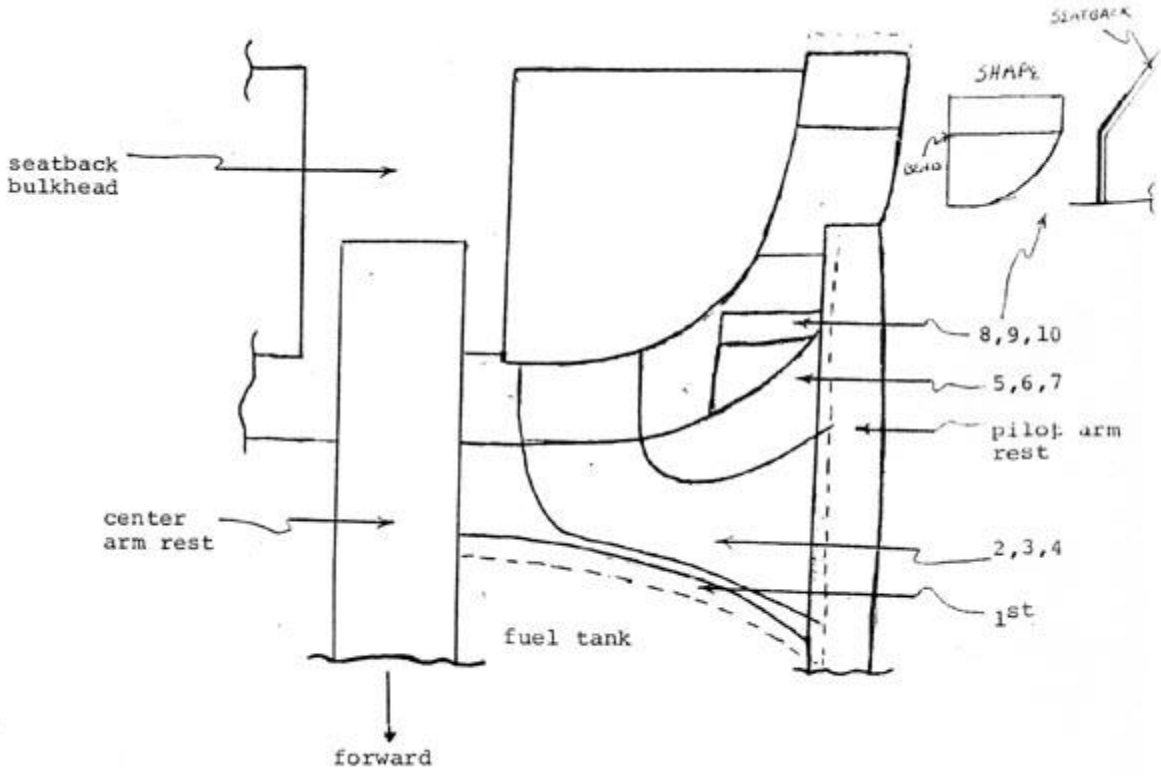
Once cured, round all corners at least 3/16" to !:i" to allow for the glass to lay into and over the hole without air bubbles being present.



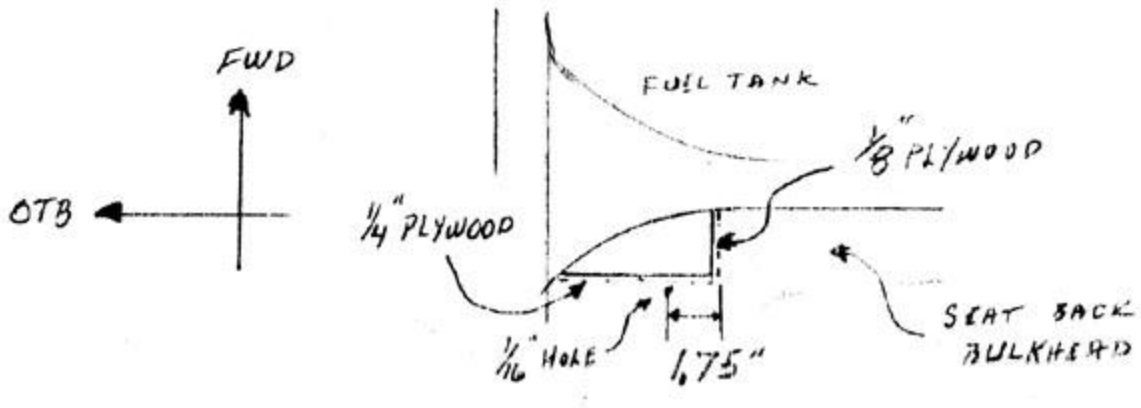


Dry micro the inside corners to 1/8" radius and begin your fibre glass lay-ups as shown in the diagrams. Start with a 15" wide 45° bid and fit all of the large pieces in before actually epoxying them. Cut more as you need it. These are awkard layups and you are bound to waste some material. Save all large scraps for future use.

NOTE: Typical bulkhead gear attach lay-up schedule: Involves 1st layer(s) covering the largest area, next layers covering a slightly smaller area but accumulating, and so on.



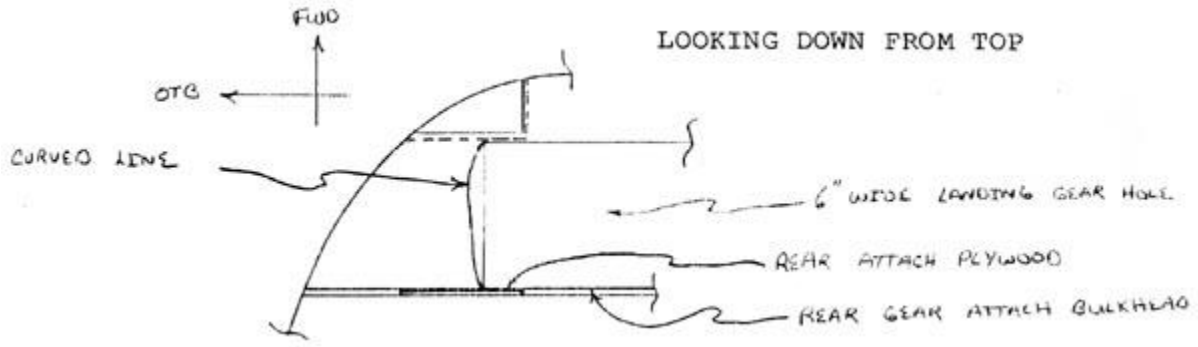
After these lay-ups have cured) you will cut the rectangular hole in the fuselage. Using a small drill bit, drill two holes (one on each side) through the fuselage laterally 1.75" from the inboard end of the vertical plywood inserts and against the back side of the plywood.



LOOKING DOWN FROM TOP

Now, get under the fuselage and, using a bendable straight edge and a fine line marker, connect the dots (holes). Measure back 6" from that line and draw a line parallel to the first one. Then,

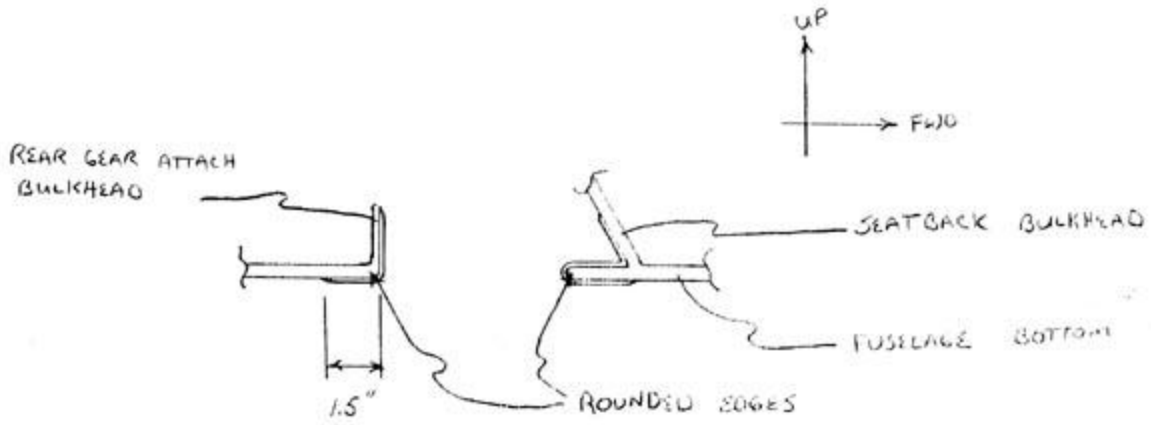
using a square, draw a line back from the holes to make a rectangle. Using the template provided, draw the curved line on the outsides of the rectangle where the gear will exit the fuselage. Now drill a few holes along the line so you can insert a saber saw and cut out your hole.



Now sand a strip from the cut out back 3" to 4" behind it on up to the seatback bulkhead, and forward to the front attach. Remember, wherever you are glassing, it needs to be sanded. Prepare the rear bulkheads by sanding them to fit better right along the edge of the hole and perpendicular to the fuselage. Before installing the plywood inserts, check their positioning so they match up with the front plywood inserts. Install them with micro. After that has cured round the top of the bulkhead, mix up some micro, and cover both sides of the bulkhead. This is done so you don I t have to do the microing after the bulkhead is in place a s this would be more difficult. After they have cured, sand them smooth. Now, put the bulkhead in place and use the square to line it up vertically and mark along the bulkhead on the fuselage so you can line it up again when you install it. Mix up some bondo and apply it to the bottom of the bulkhead and on the top where it will bond to the seatback bulkhead. Put it in place and hold onto it until it is cured. Apply the other side in the same fashion.

Now you will prepare the rectangular hole for glassing. Round the edges of the hole so the glass has a gentle radius to go around.

You will also need to sand the bottom of the fuselage 1.5" around the hole cut out. If this is a retrofit installation to a plane that has been flyinq, you will need to remove all of the finish in this area.



NOTE: When you are doing the lay-ups on the bulkheads, it is easier to cut glass as you need it as there is less waste. The pieces are odd shapes which need to be cut out separately.

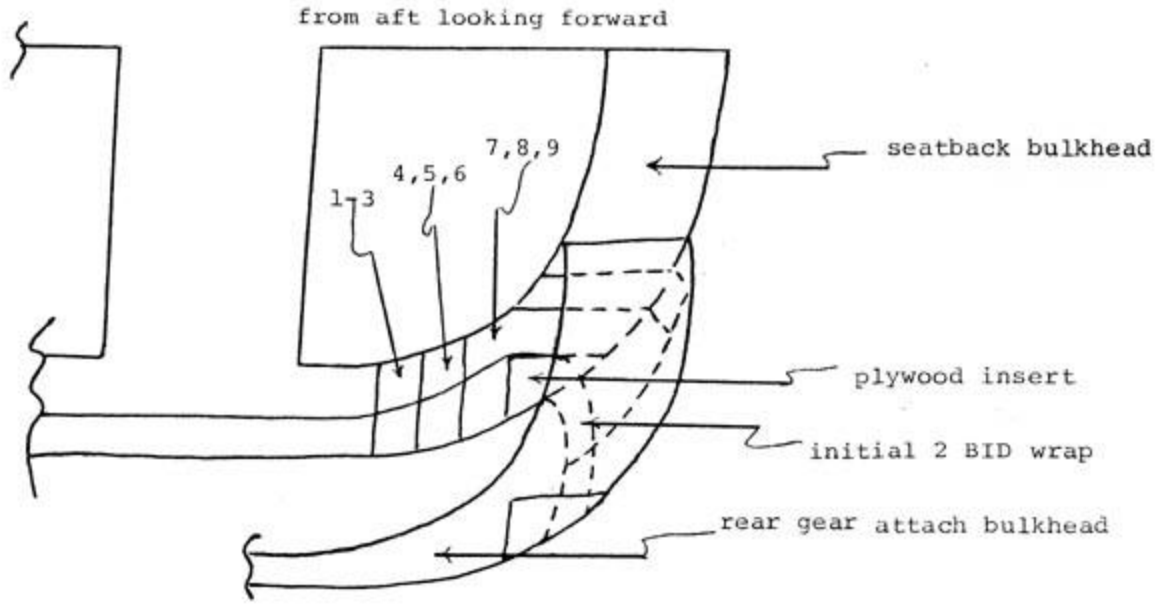
It should take about three (3) of the long bid 45° strips 4" wide to do the full radius of the hole. It is easier to do this step with four (4) pieces of bid so you don't have to work with real long strips. This is a two (2) bid lay-up and simply overlap the lay-ups in the center of the fuselage about two (2) inches. Around the four (4) corners you may have to , make cuts to allow them to lay down. Cut some small patches to fill these areas and overlap 1/4" or so. The lay-up schedule diagrams for the two (2) bulkheads show this two (2) bid lay-up. After this has cured, be sure to sand this lay-up to prepare it for the next lay-up.

From now on, all lay-ups on the inside of the two bulkheads will come down but will not wrap around onto the bottom of the fuselage.

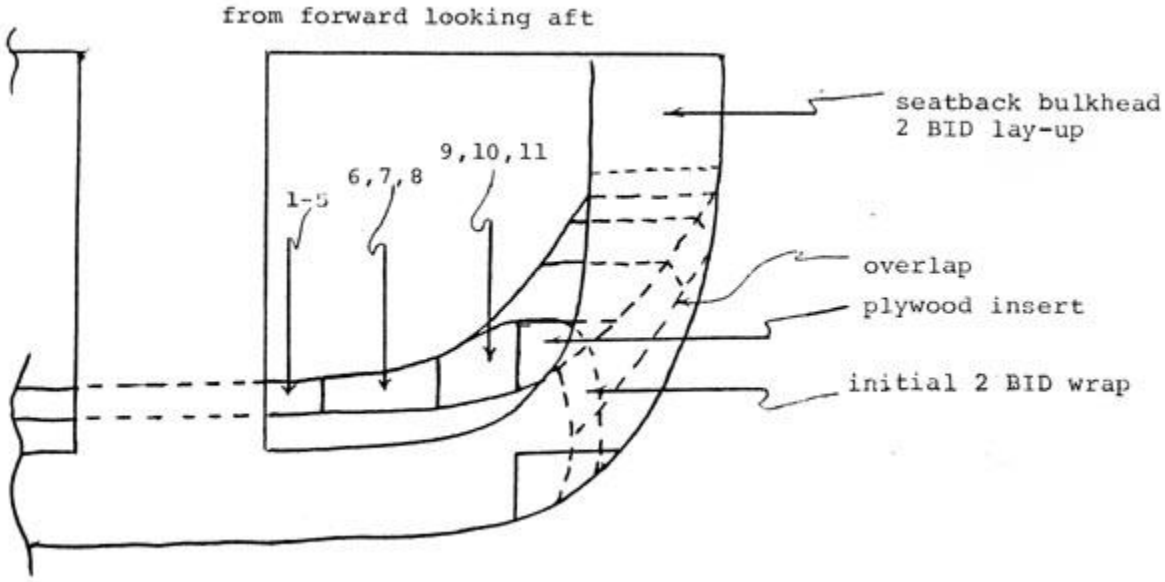
NOTE: When you proceed with the next lay-ups you may split up the job by glassing only half of the required layers then sanding and finishing the rest later. I found this to work well since it is somewhat tiring.

Your next lay-up will be the inside of your front gear attach bulkhead. This is the seatback bulkhead. Cut a few strips of bid at 45° about 6" wide. But remember, you can cut them as you need them. The diagram shows how these lay-ups are applied. Those first three (3) layers must extend up from the plywood on past the V shape created by the two bulkheads corning together and onto the rear gear attach bulkhead about 1". These layers also spread onto the fuselage above the hole where the gear will exit the fuselage and eventually tie into the lay-ups from the other bulkhead. These lay-ups also extend across toward the center of the bulkhead behind the armrest and terminate there. There is no need for them to tie across to the other side. Also, the last three (3); 7, 8, & 9, must extend at least three (3) inches to each side of the plywood inserts.

NOTE: Be sure to study all of the drawings and full size diagrams in order to put the appropriate number of layers on the bulkheads.



Before glassing the rear gear attach bulkhead, you must sand some of the past lay-ups on the inside of the front gear attach where the neW layers will overlap, as well as, sanding the original 2 bid lay-up around the hole. Cut a couple of 10" wide bid at 45°, more will be needed later. You will stretch the bid through the center of the bulkhead where the width is not needed and widen it as you go up the sides to the seatback bUlkhead and onto that. It's important to note that the first five layers extend up onto the seatback bulkhead on both sides of the rear gear attach bulkhead about 1", but two of those five layers go on up onto the back side of the seatback bulkhead to the vertical seatback bulkhead. As before, the last three (3) layers must extend beyond the attach plywood inserts three (3) inches on either side.



It's easiest to do a right then left, right then left, etc., lay-up schedule for the first five layers/with overlaps in the center of an inch or so. This schedule can be continued on the rest of the lay-ups also.

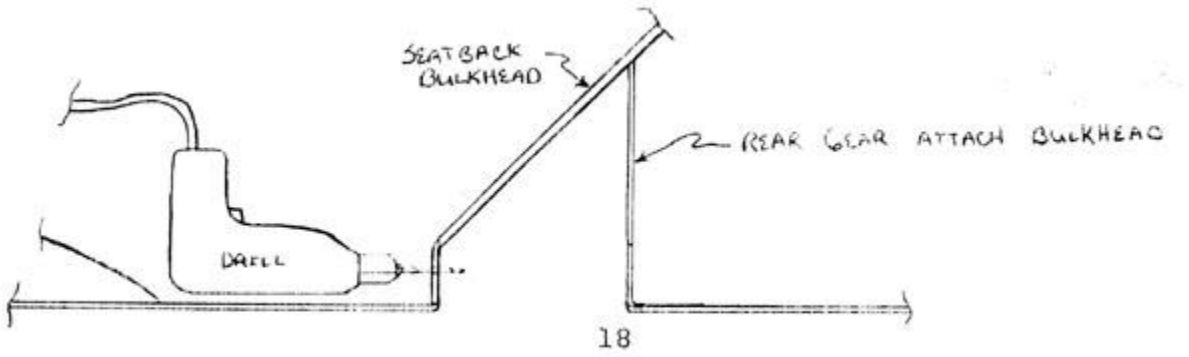
NOTE: Don't be too concerned if you feel the lay-ups are ending up sloppy on each side of the fuselage between the two bulkheads, especially up in the corner. These lay-ups are tough to get perfect and I have allowed for this. Do the best you can with a brush to wet it out as good as possible.

You have just completed the toughest part of the whole conversion. It's all downhill from here.

Use some sandpaper and remove all the splinters so you do not hurt yourself, otherwise you will be putting holes in your hands.

Tri-Q Mounting Holes

Using the paper template that you made the plywood insert from, and also referring to the full size drawings, mark your hole in the front attach area. Since this hole must be perpendicular to the fitting, you may find that your electric drill is too big to lie down enough to give you that type of hole. If that is the case, borrow or rent an air drill. These are very narrow and work very well. Start with an l/8" hole. If you have access to a 3/8" snake bit (long bit), that would be the best to use for your final drilling through both holes at once.



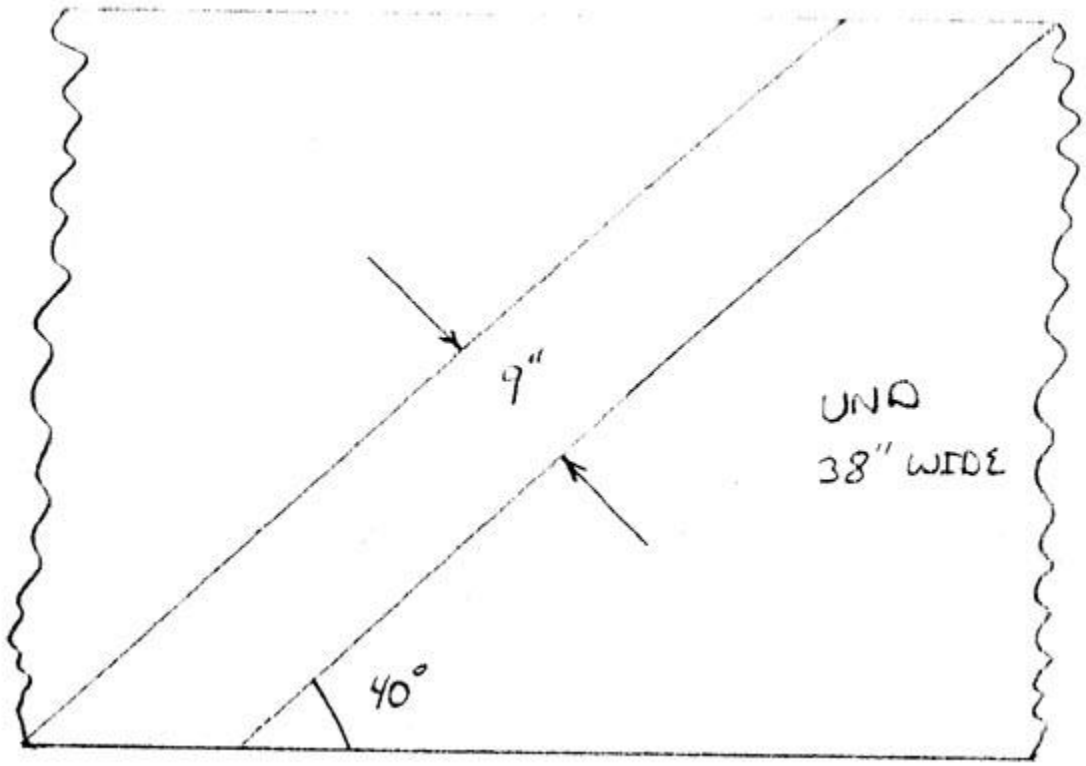
Get those four (4) 1/8" aluminum pieces that you made at the beginning for the additional bearing and surface load. Fit them into their positions and make sure ,that/with the holes lined up, they fit up flat against the plywood and glass attach fittings. When satisfied with the fit, get your AN6-74A bolts, slide the front attach plates on the bolts and insert them into and through their holes. Slide the rear plates on and line them up. Now drill out the three (3) 3/16" holes in each of the four (4) plates through the plywood and glass attach fitting. Get eight (8) of the 12 AN3-7A bolts and appropriate washers and, nuts and bolt through the top holes of all four (4) plates from the inside. The drawings should help here. The bottom four (4) bolts must be put in after the gear is in place and from the outside in. You will have to be creative in sliding the nuts in place here but take your time, they will fit. Leave those bolts out for now though.

Tri-Q Landing Gear

In this section you will ultimately join the main gear to the fuselage and to the wheels/brakes/axles.

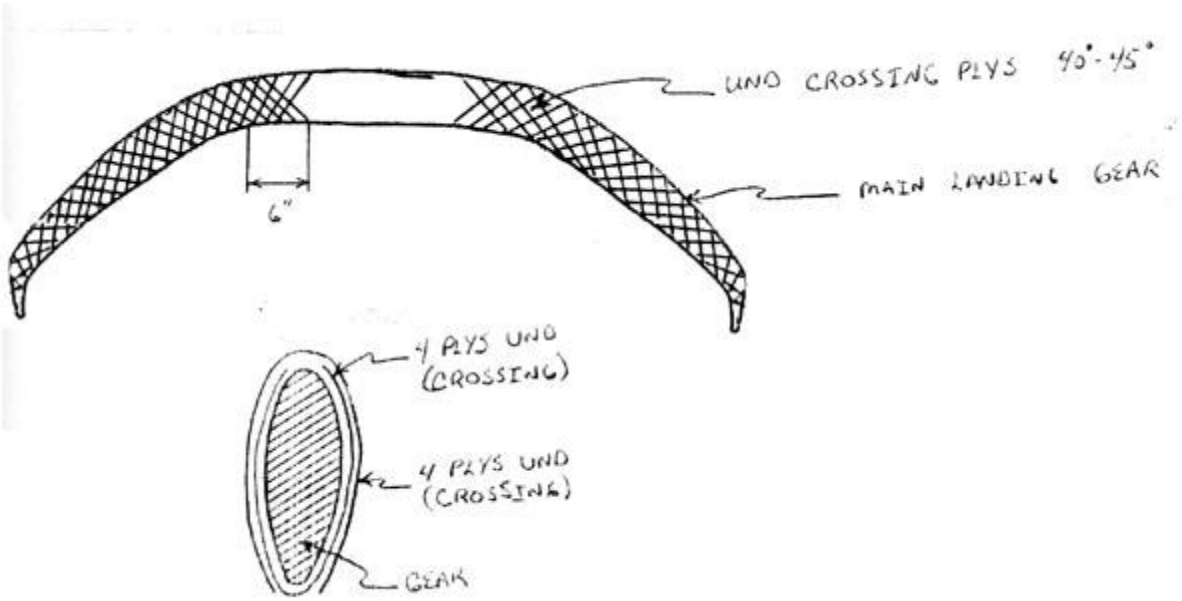
TORTIONAL STIFFNESS LAY-UP

Completely sand the S-glass molded gear with 36 to 40 grit sand paper until it is all dull except for the center (fuselage) area,6" inboard of elbows. Jig the gear leading edge down with tips on the work table and the center section on a tall chair or similar support. Even the gear on the supports so it is all fairly flat. Now put small dabs of 5 min. or bondo down where the gear touches the table and chair. After the glue has cured, you will make a lay-up using UND strips, 9" wide at approx. 40° to the salvage edge. You'll need around 16 strips but this will vary, depending on how much you splice.



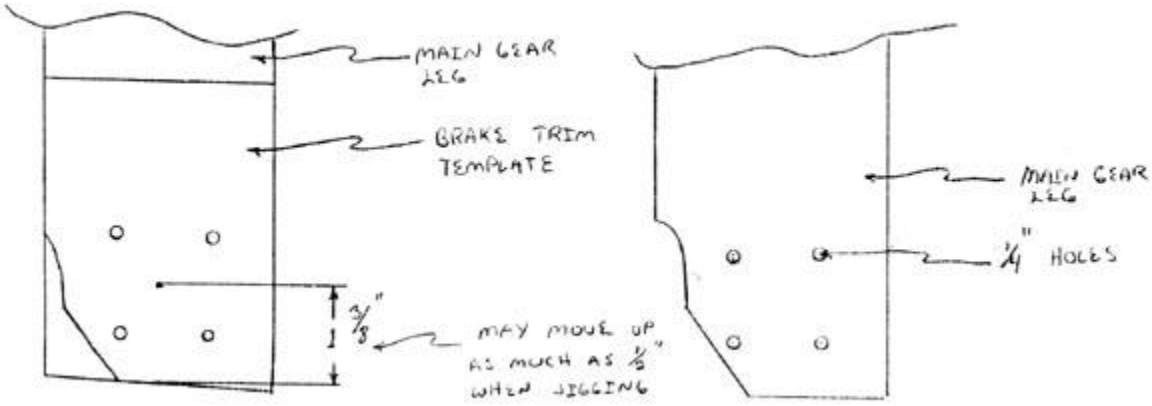
Paint some epoxy all over the gear legs where the lay-ups will go. Lay-up the first ply so that it extends 6" inboard of the turn, down to the tip with the fibers running approx. 40°-45° to the leading and trailing edge across the face of the gear. If you need to, splice pieces together, do not overlap them. Just butt them together. You are allowed up to 1/4" between butts. The second ply is layed up similarly but with the major fibers crossing the first ply at the opposite angle. Make sure your lay-ups are straight, with no wrinkles. Your third and fourth plys of UND are done in

the same manner. Make sure you have an equal number of plys going each way (crossing).



After this lay-up has cured, break it loose from the table and chair, turn it over, re-jig it, and bond it back on in a similar fashion. You will need to trim and taper the previous lay-up so your following lay-up will flow smoothly around the leading edge.NOW, lay-up the last four (4) plys exactly like the first four and sand smooth without getting into your earlier lay-up.

In order to facilitate the completion of the next step, it is best to install the axles, wheels, and tires. First, you will trim the bottom and trailing edges of the gear legs to fit the brake calipers. In order to locate the axle position you will simply measure up from the bottom of the gear3/8" in the center of the gear and mark the spot. NOW, position the brake trim template so that the centering hole fits over the mark that you just put on the gear. Line up the sides and mark the 4-1/4" holes and the outline of the template. Make a preliminary cut with a saber saw along the line you just drew. Later you will modify it to get the appropriate clearance.

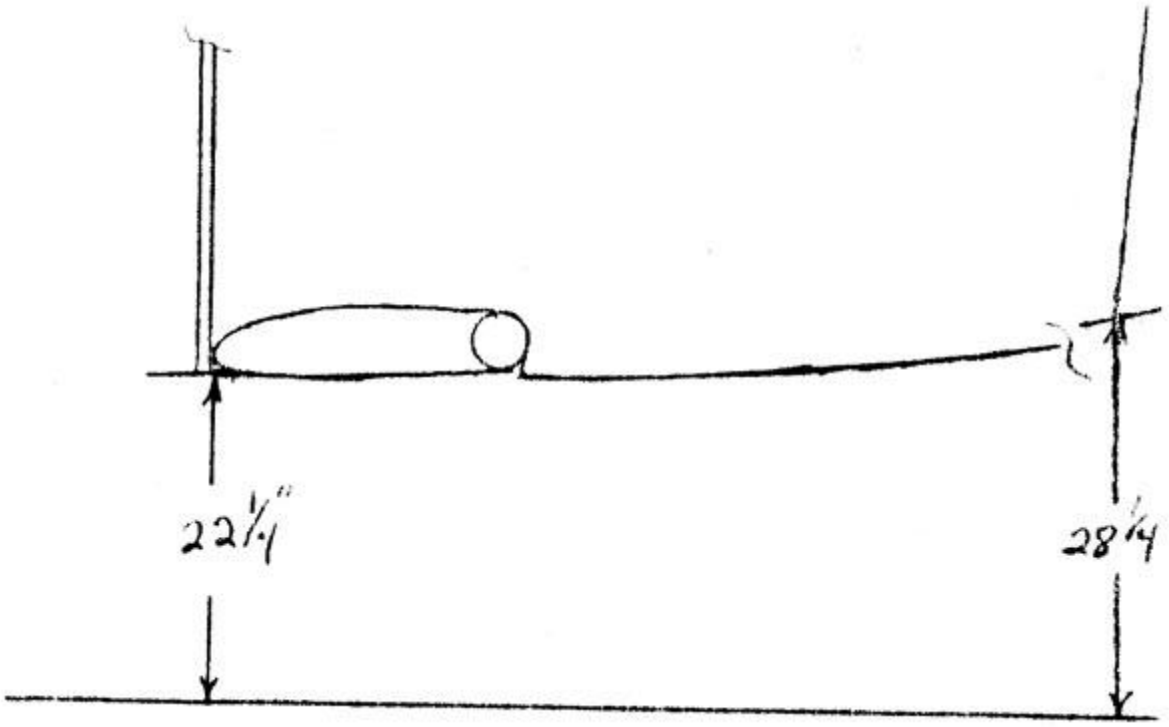


Clamp the axle over the original axle position mark and line it up with the four (4) hole marks you already made. Use two (2) "c" clamps for this. Being careful not to ream the axle, drill through the axle and on through the S-glass gear with a 1/4" bit. Now bolt the axles on with two

(2) 1/4" bolts diagonally across the axle. Use any 1/4" bolts that will fit since this is being done just to jig the gear in the fuselage.

Tri-Q Positioning the Gear in the Fuselage

Go back to your fuselage and jig it so that the rear of the fuselage at the split line is 28-1/4" from the ground and the bottom of the canard at the firewall is 22-1/4" from the ground. You must also line it up and level it laterally, using the ball level in the plane or by leveling a string stretched across the main wing tips.

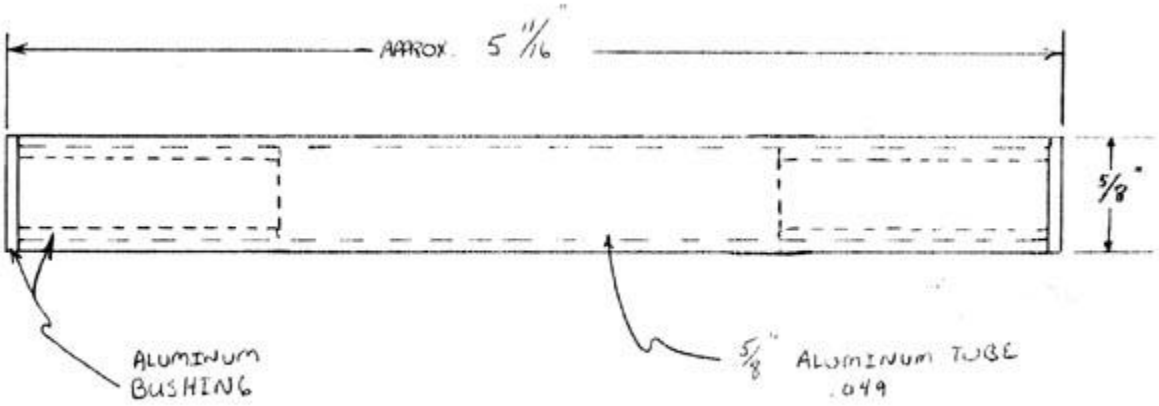


Check your floor to see how level it is around your airplane. Make adjustments by stretching a string across the floor and leveling it at the tires. You will mark on the floor the amount of correction required to keep the gear level. Do the same, fore and aft. The measurements given at the beginning of this section were taken from a relatively level floor. With the airplane in its jigged position, drop a plum bob down from the canard at the firewall and mark FS 14 on the floor on your existing line. Now go back from there to FS 50 and mark 50-60. Using a square, go out to your outer lines and mark FS 50-60. These marks are basically for lining your gear up so that both sides are at the same FS number, 56 to 57. It is not critical that you be exactly at a certain point, but just that you have both sides the same.

Now, slide the gear in place and roll it up to get a preliminary fit. Mark the approximate position of the mounting tabs on the gear. Pull it back out and sand about a 3" wide stripe around the gear with #40 or #50 sandpaper.

Now you will have to make your bushed aluminum tubes used in the gear attach assembly. Measure distance between the two attach points, it should be similar to the drawings at 5-11/16". This measurement would include the bushed ends in your tube assembly. You can afford to make it Slightly oversized and file the ends to fit. When you have the tubes sized smaller than your initial measurement, press fit the bushings into the ends of the tubes. If they seem too snug, you may have to sand or file them slightly. If they seem to slip in with no effort, you should rough

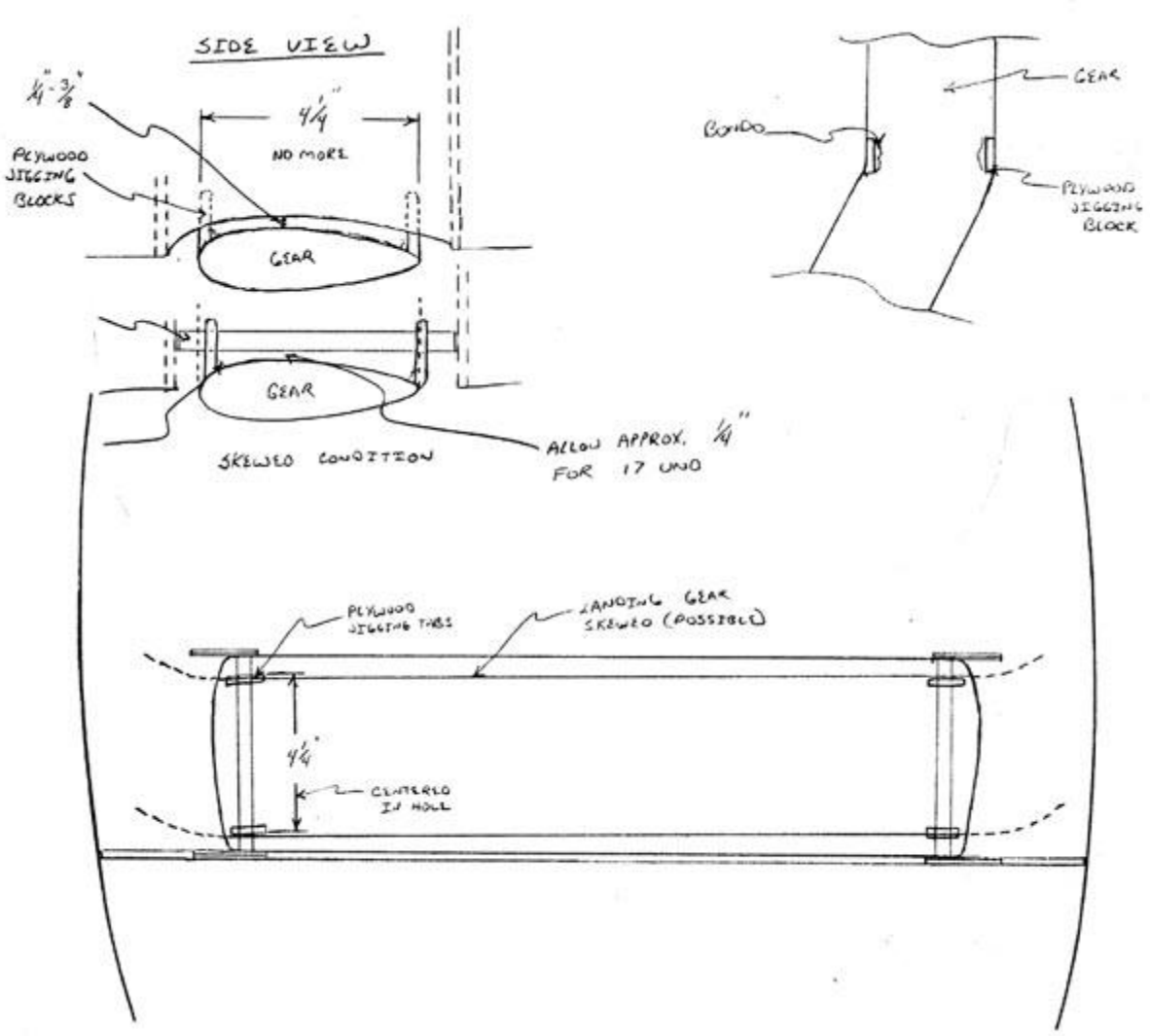
the outer surface of the bushing and inner surface of the tube, and with some epoxy, glue them in. Since we cannot control the inner diameter of the tube, it may be slightly off in either direction. If there is any slop in them contact us and we will send you new tubing.



Now slide the 1/4" plywood gear jigging blocks over the 5/8" tubing and bushing. Slide the gear back up in place; check the side to side positioning as well as the fore aft positioning. Both gear legs (axles) should be close to FS 56.5. Of course, the tires should be evenly lined up on the 3.5' parallel lines, seven foot spread. The gear legs themselves should be centered between the 3' lines or 6' spread. In some cases you will find that in order to get your axles to line up at the same FS#, your gear looks skewed slightly in the hole. The seatback bulkhead, which was used for the front attach fitting, might have been put in slightly skewed which then makes the hole skewed. If this is the case, up to 3/16", you should keep your plywood tabs 4 1/4" apart but move them so they end up centered in the hole that should be approx. 5 3/4" wide after the lay-ups.

NOTE: If you have more skew than 3/16" let me know. This just moves the tabs in and out on the gear to allow for the glass lay-ups and clearance for the 3/16" nuts that fit between the tabs and the attach points. Don't be too concerned about getting everything exactly right since this can't be done or if it could it would take you 3 days. The camber and toe-in will be adjusted later which will take care of any differences you might have in axle location. What I am saying is get it as close as you can get it and as close as your plane will allow you to get.

Once you have the gear where you want it, secure it so it won't move and secure the fuselage so it doesn't move either. Now slide the 5/8" bushed tubing assembly in place and slide the AN6 74A bolt through. You should have one plywood block in front of the gear and the other behind it. These plywood blocks will need to fit up against the edge on top of the gear. You will be removing and assembling this part quite a bit until the fit is right. There will probably be a slight angle to the plywood blocks. This is normal. Remember, outside to outside of the blocks should be 4 1/4".



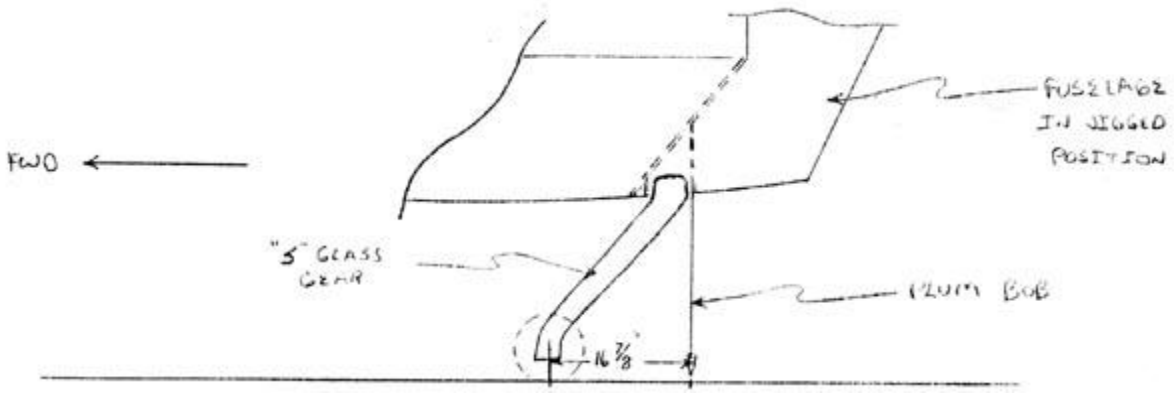
When satisfied with the fit, bondo the blocks onto the gear. After it has cured, gently remove the bolts, remove the gear, and remove the 5/8" tubing. Take the gear to your work bench and jig the gear upside down with the tabs hanging down toward the floor. Smooth the transition from the tab onto the gear with a sanding block, file, etc. Apply gray tape or packaging tape to the outsides of the tabs for a good release.

ADDENDUM TO JIGGING GEAR IN FUSELAGE

Since all Q2's are slightly different, jigging the gear in the fuselage can be difficult. It is also the most difficult to explain.

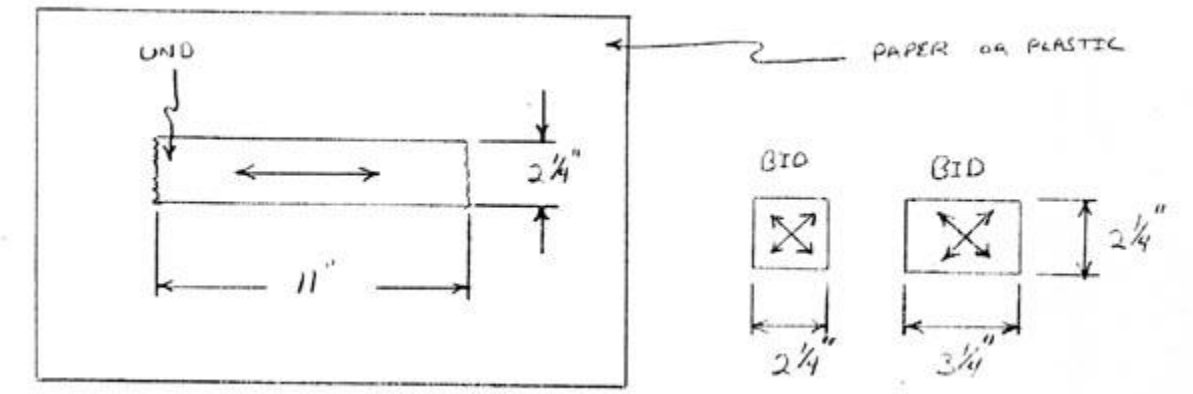
After you have your plane jigged in the appropriate position, drop a plum bob down from the leading edge of the rear attach bulkhead down to the ground and mark it. Now, draw a line perpendicular to the center line 16-7/8" in front of the mark you just made. When you slide your gear up in place and center the gear in the fuselage, the axles should line up with that line. The axles were mounted in the lowest position possible for the preliminary fit so that if you had to, you could move them up: 1/2" or less. If the landing gear won't go up or back far enough to get the axles to line up, you need to make some adjustments. Measure the distance from the axle to the ground. Now let air out of both tires until the gear will fit up in place. The 1/4" plywood tabs can also be trimmed up to 1/4" to allow the gear to get closer to the bushings. Remember to allow room for the 17 layers of uni. Once you have the gear jigged into position, measure the distance from your axles to the floor again. The difference will give you the change in axle position.

DO NOT move these axles, especially if you have the LS canard, until you have checked the nose gear positioning. You may find that the nose is higher, therefore allowing you to leave the axles at the original positiOn. I realize this is not easily understood so if you have a question, just call me .



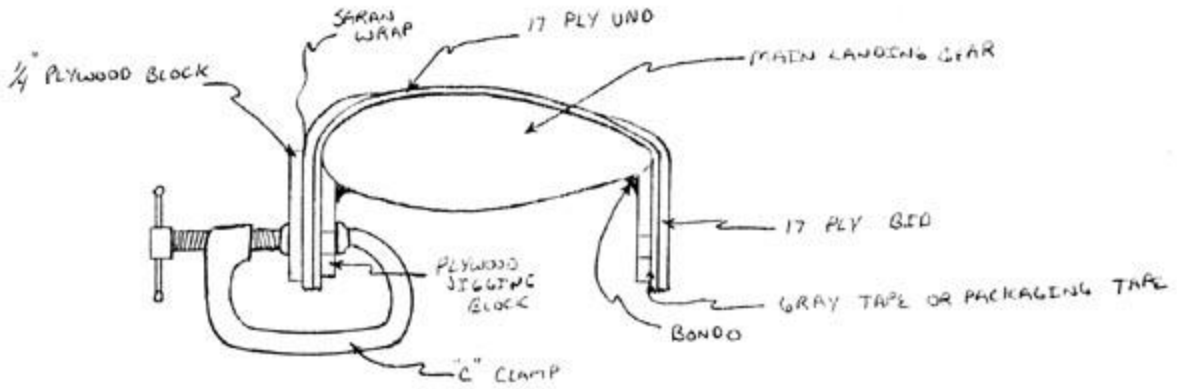
Tri-Q Gear Attach Fitting Lay-Up

Cut 68 pieces of UND 2-1/4" x 11". Cut 68 pieces of bid 2-1/4" x 3-1/4". Cut 68 pieces of bid 2-1/4" x 2-1/4". Wet out 17 plies of UND 2-1/4" x 11" on a piece of paper or plastic, not wax paper. Usually you can wet out two to three layers at a time. Squeegee out excess epoxy but make sure not to make it dry.



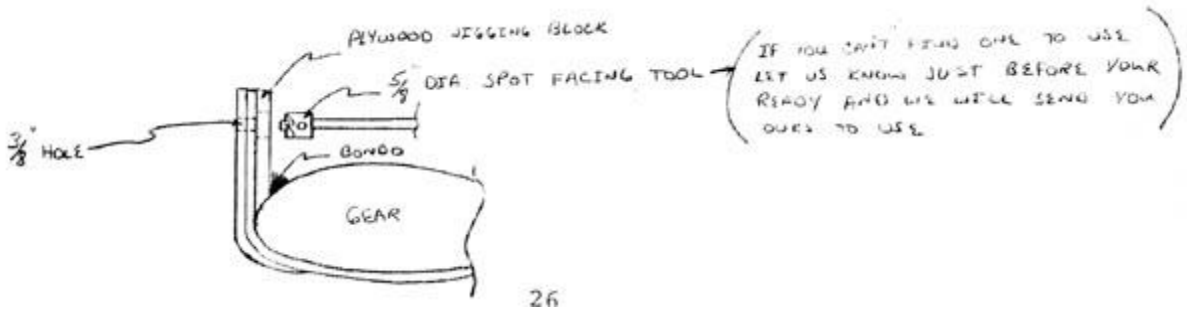
Paint a coat of epoxy over the attach section of the gear for and aft over the plywood blocks. Peel the 17 plies of UND off the paper and lay it across the gear and down the taped face of the plywood blocks. This should more than cover the surfaces. Now lay-up 17 plys of bid 2-1/4" x 3-1/4" on a piece of paper, squeegee excess epoxy, peel off the paper, and apply on top of the UND, and lapped up over the leading edge of the tab. Now lay-up another 17 p1ys of bid 2-1/4" x 3-1/4" and apply to the trailing edge of the gear on the tab. Your outside lay-up is now done.

Wrap saran wrap over your lay-up and smooth it out. This should be enough to hold everything in place for cure. If it starts to creep more than a little, you should get a small piece of 1/4" plywood and a small "c" clamp and clamp with just enough pressure to hold everything in place. Large "C" clamps will not work because they are too heavy.



After this lay-up has fully cured you should trim or saw the glass tabs down to the plywood blocks. Now, using a 3/8" bit in a drill, drill a hole as close to the center of the 5/8" hole in the jigging block as possible. Now chuck the 1/4" dia. x 10" long steel rod into your drill, insert it

from the rear through your 3/8" hole, then screw the 5/8" dia. spot fac-e tool onto the end of the 1/4" rod. Locate the spot face in the 5/8" hole in the plywood jigging block on the forward tab. Drill through slowly so you don't build up a lot of heat and melt it. Drill through all 34 layers of glass. Now, take the tool apart and repeat the procedure on the other tab.

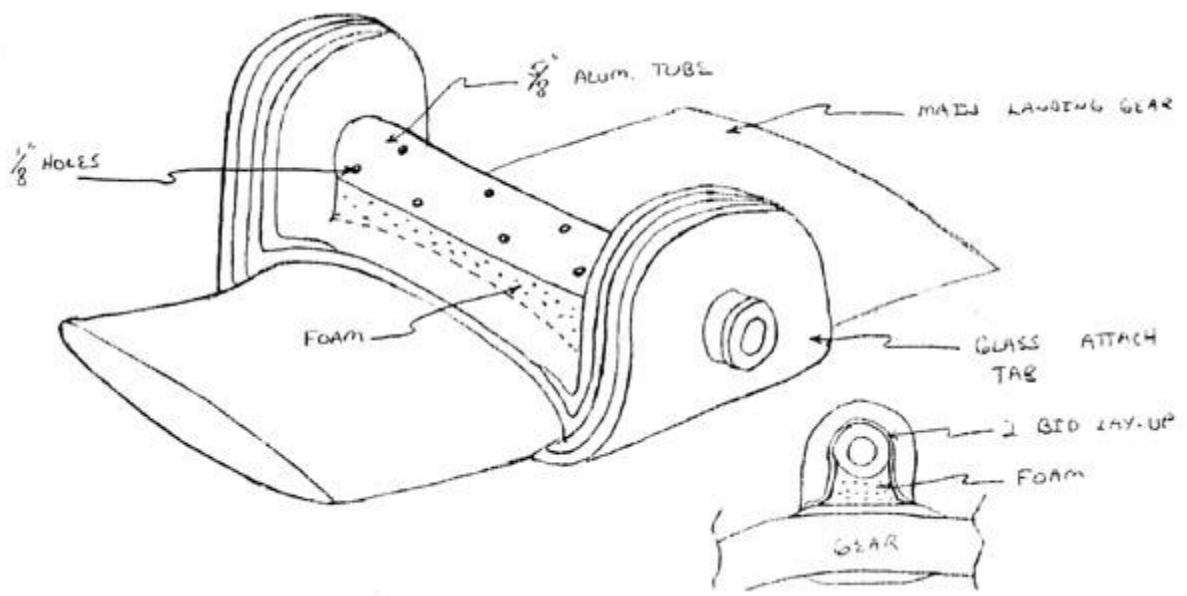


Now chisel the plywood blocks out as well as the bondo that might be left on the gear. Sand the tabs on the insides, and any area where you are going to glass that might need smoothed out. Mix up some flox (small amount) and, using your finger, put some in the corner between the glass tab and the gear. Make a nice radius with your finger so the glass will flow nicely.

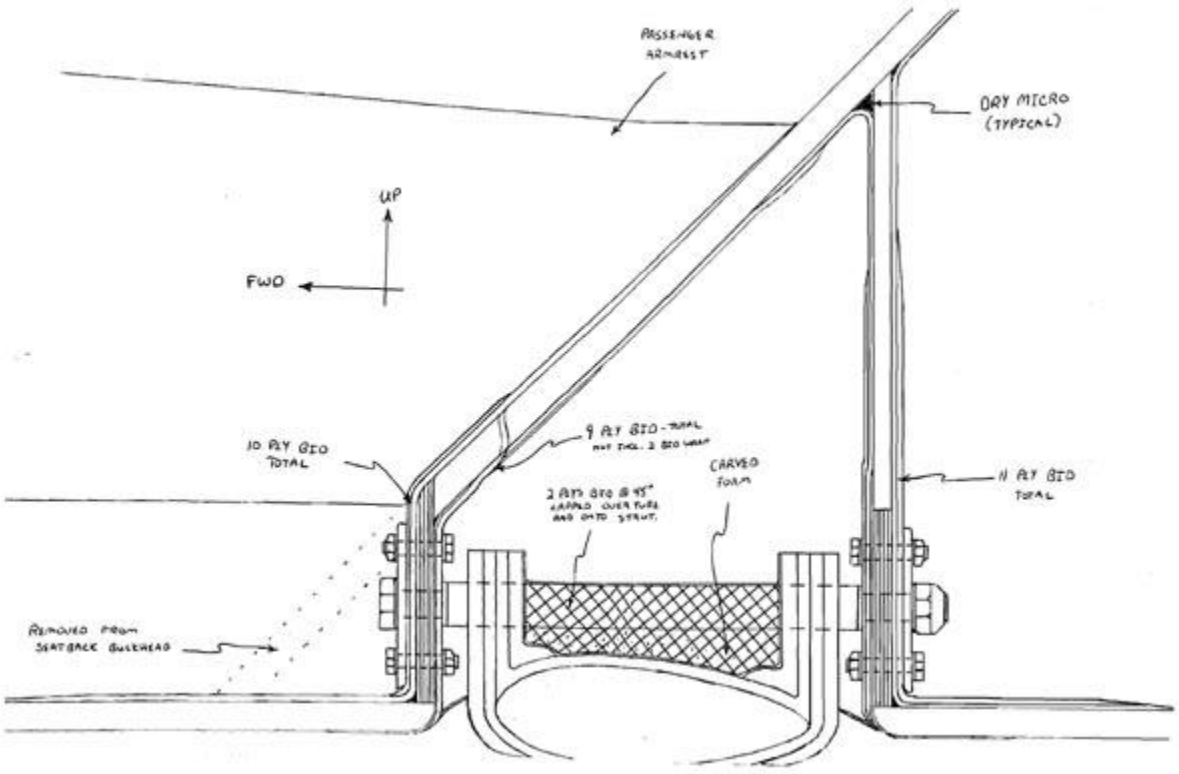
Assuming you now have the gear jigged upright, coat the inside faces of the tabs and the gear between them with epoxy. Using the same method as before, lay-up 17 UND 2-1/4" x 10" and apply from tab to tab. Stipple the UND down in the corners against the flox. Next, same as before, wet out 17 layers of bid 2-1/4" x 2-1/4" and lay them on the glass tabs down onto the gear on top of the UND. This is done for both front and rear tabs. These layups should stay just fine.

Now, using the 10" extension and the spot face tool, drill out the holes from both sides, then all the way through from one side to another.

Drill eight (8) to ten (10) 1/8" holes in those aluminum tubes on the top half of them where they will see glass.



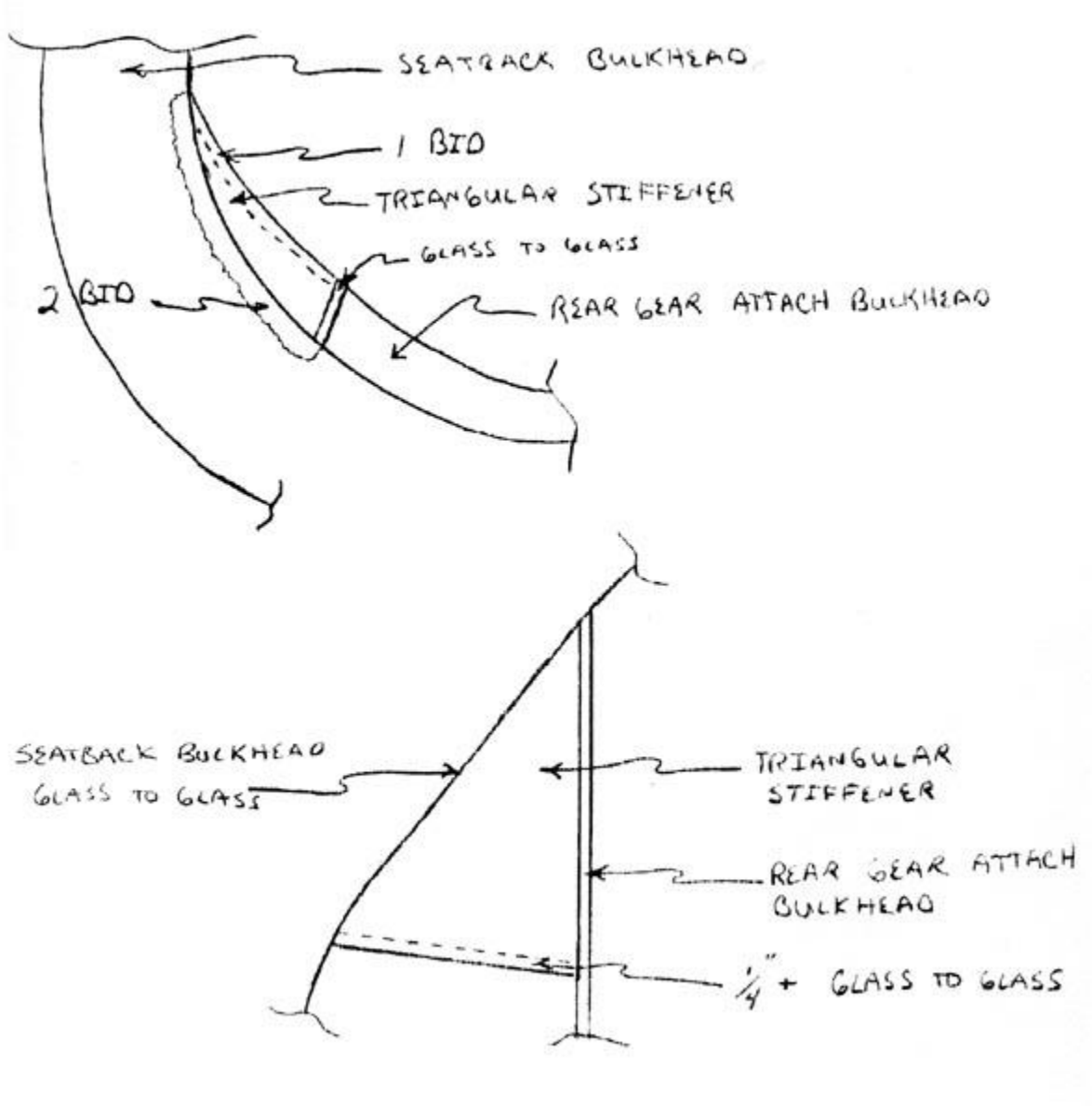
Sand the tube so it is dull and rough. Now, insert the tube assemblies with their bushings in place and slide the gear back in place up in the fuselage. Put the AN6-74A bolts through to lock it in place. Now, check to make sure everything lines up and the gear pretty much splits the hole down the center. Scribe some marks on the aluminum tubes on each side of the glass tabs. These will be used to line the tubes up for floxing and glassing. If you are installing the belly board, you might want to work on that for a while to get the board fitted. After you are finished with that, remove the gear and jig it upright so you can permanently attach those aluminum tubes. Remove the tubes, sand the insides of all tabs as well as a two (2) inch stripe between them, and reinsert them using wet flox where the tubes go through the tabs. Get some scrap urethane foam and fill the area under the tube to the gear. There shouldn't be much room under there. You may also use pour in place foam then sand to a smooth transition. Cut four (4) BID big enough to fit over the tubes, up onto the tabs, and onto where you sanded earlier. Use two (2) BID for each side, micro the foam, and glass. After this lay-up cures, trim and sand the transition smooth.



Tri-Q Triangle Stiffener Installation

Get those triangle shaped 1/4" foam stiffeners that you cutout earlier. These fit in between the rear gear attach bulkhead and the seat back bulkhead, right above the attach fittings. Trim them so they fit down flush with the tops of the bulkheads. Now put them on a flat surface, micro the bottom (underside) of the stiffener and lay-up two (2) BID at a 45° to the base of the triangle. Let that lay-up cure.

Now sand the insides of the two bulkheads about 1 inch down from where the triangle stiffeners fit. Re-fit the stiffeners in place and bend them so they tend to stay bent. This will make them easier to install. Sand the outer 1" of the stiffeners on the side that has been glassed. Now, bondo the 2 long edges of the stiffeners, put them in place, and hold them there until the bondo cures. Clean up any excess bondo on the inside of the stiffeners and bulkheads. Micro the slots created by the intersection of the stiffener and bulkheads on each side (underneath) and apply 1 BID overlapping onto the bulkheads and stiffener approx. 1". At the base of the triangle stiffener, taper the foam down to the glass and leave at least 1/4" of glass exposed for a glass to glass close out. Round the top surface sides slightly so the glass will flow across the bulkheads easily.. Micro the stiffener top surface and lay-up 2 BID overlapping onto the outsides of the bulkheads about 1".

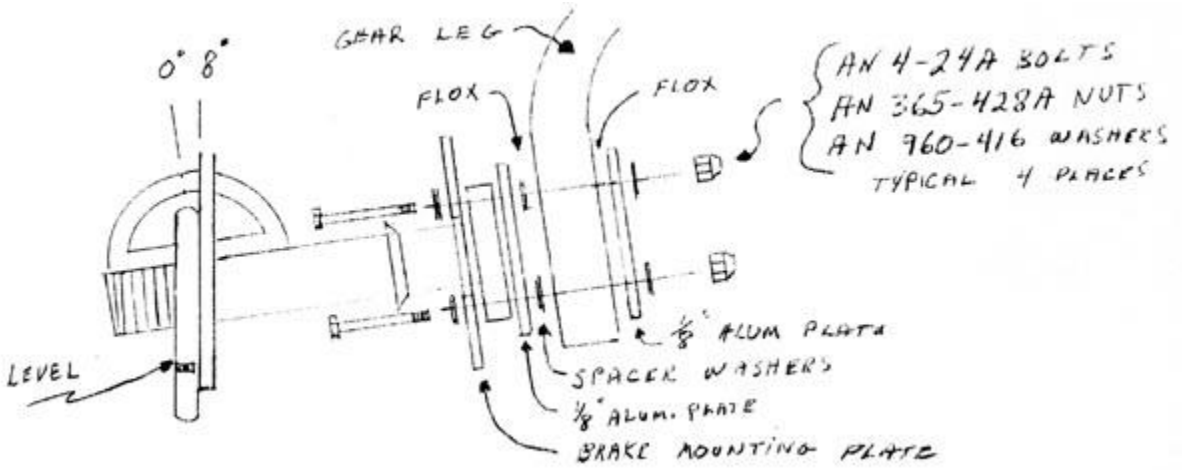


If you are putting the belly board option on, you will need to do that at this time.

Tri-Q Axle/Wheel/Brake Assembly

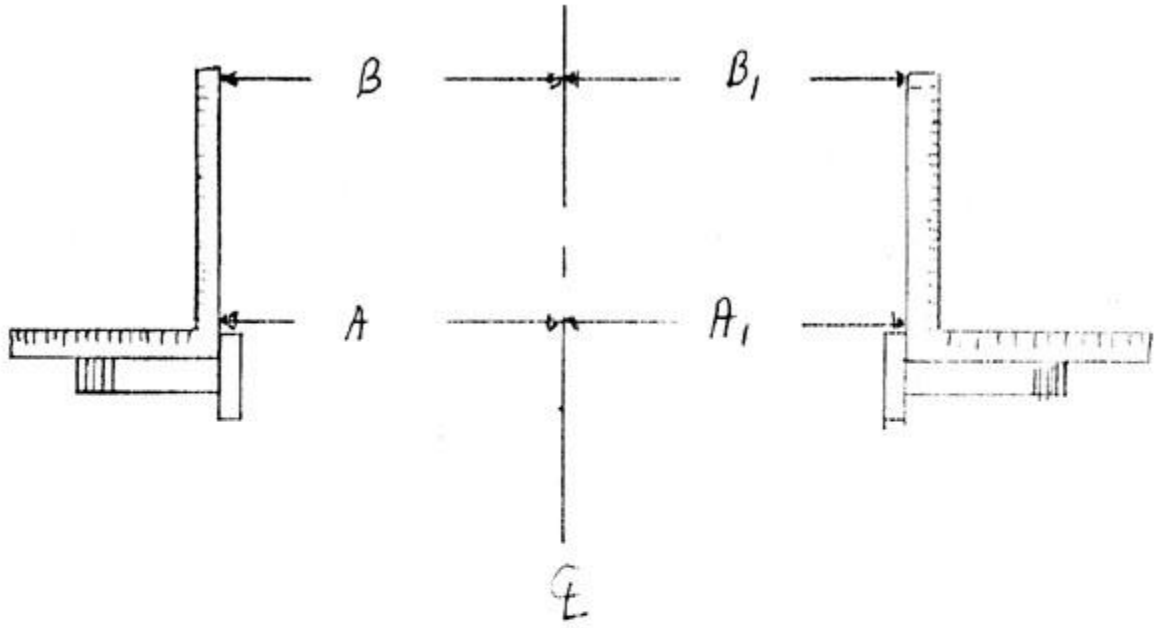
It is important to install the aluminum axles with the proper toe in and camber to insure adequate ground handling.

Re-install axles using the 1/8" aluminum plates on both sides of the landing gear legs. With fuselage level and on center line, place washers (various thicknesses) between outer aluminum plate and gear to achieve an 8° camber and a 1/2° toe in. The 8° camber can be determined by using a protractor, placed on the top surface of the axle, with a straight edge and level.



Any other means is also acceptable.

Toe in can be achieved using two 2' carpenter squares. By placing the short end of the square on each axle, the distance between the widest portion and narrowest .portion can be measured. This distance should be .25 in. (1/4") max. to .125 (l/8") min. from the center line of the airplane. From one gear to the other would measure .50 (1/2") max. to .250 (1/4") min.



$A - B = .125$ to $.250$

$A_1 - B_1 = .125$ to $.250$

OR

$(A + A_1) - (B + B_1) = .250$ to $.500$

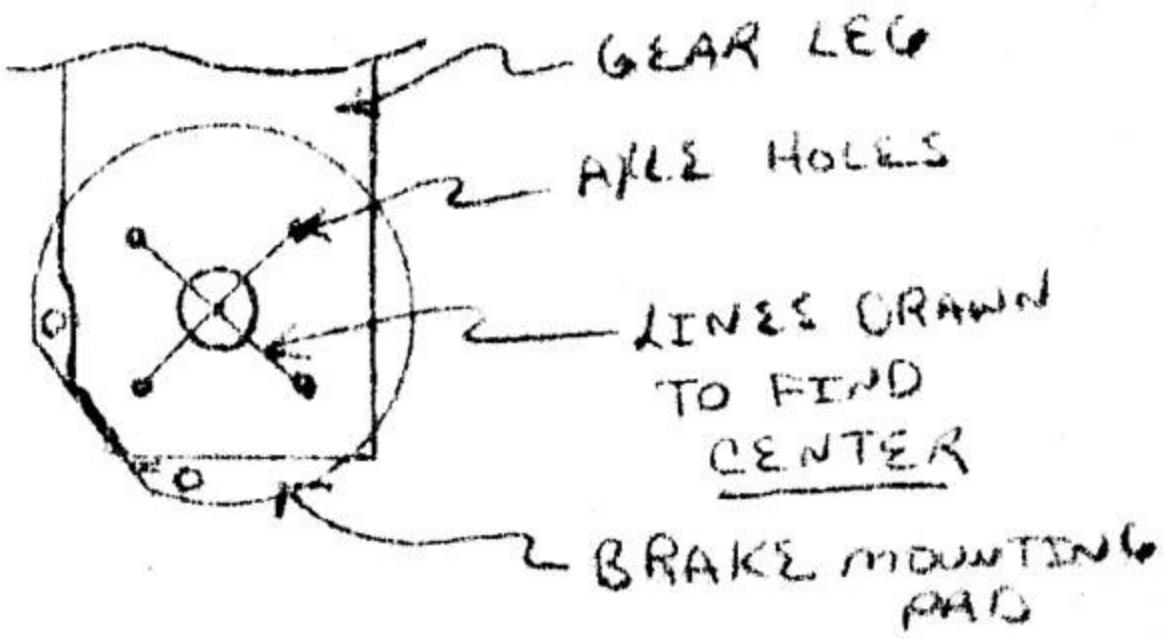
A single carpenter's square can be used if measurements are made only to the centerline of fuselage.

Once the proper amount of washers are determined for each bolt, it's time to flox the whole mess in place. Rough sand the aluminum plates for good bond. Some sanding of the gear leg can be done in lieu of washers, if preferred.

Loosen all bolts enough to force a medium wet flox mixture between both aluminum plates and the gear leg. A good squeeze out is needed to ensure a solid flat mounting surface. The washers will be floxed between the outboard plate and gear leg. Coat the bolts with vaseline to prevent permanent installation.

Re-check camber and toe in and let set overnight to cure.

The brakes are made up of three essential components; brake mounting plate, brake disc, and wheel halves. The brake disc is attached to the inner wheel half with three allen head bolts. The next step will be to mount the brake mounting plate to the axle.

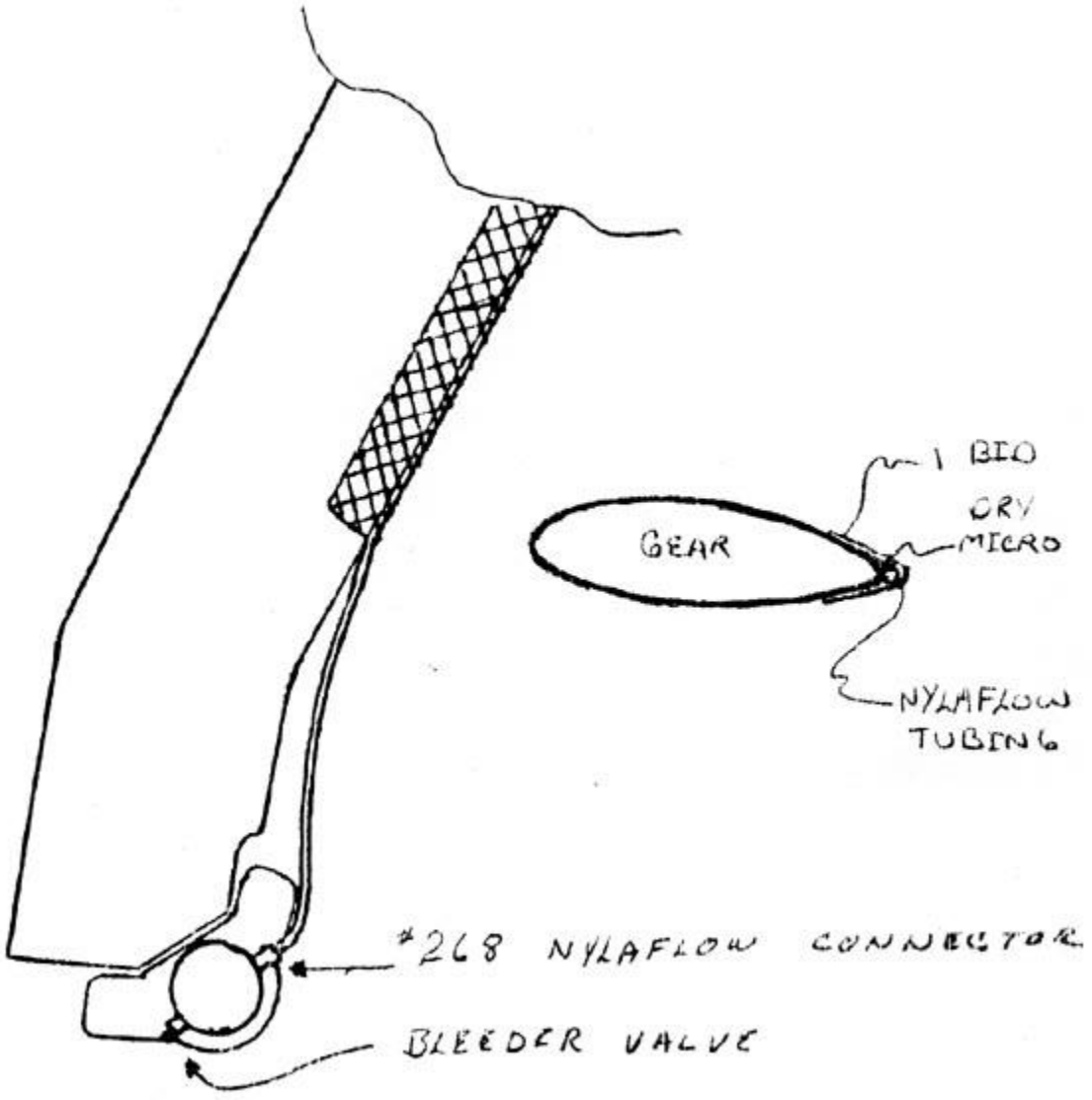


Remove axles from gear and center the brake mounting pad on the gear leg over the previously, drilled axle mounting holes. Make sure you mark each mounting pad right and left as hole location may be slightly different. "c" clamp in position and using gear legs as a hole locator, drill the four holes through the mounting pad. The brake pucks (attached to the mounting pad) should be positioned at the lower rear of the gear leg.

Remove and re-install. using axle, mounting plate, spacers, etc. as shown on previous exploded view. Check to ensure clearance between brake puck and gear leg. File or grind gear leg until puck moves freely.

The wheel is assembled by first removing the brake disc and sliding it into the brake pucks. Then a spacer, followed by the wheel. then another spacer, and finally. the wheel nut. Proper spacers are important to ensure brake mounting pad and brake disc are in alignment.

Brake lines can now be routed and connected to the brakes using the provided #268P Nylaflow connectors. Five min. the nylaflow to the gear trailing edge in a few spots, dry micro the gap, then cover with 1 (one) bid overlapping onto the gear leg at least 1/2".

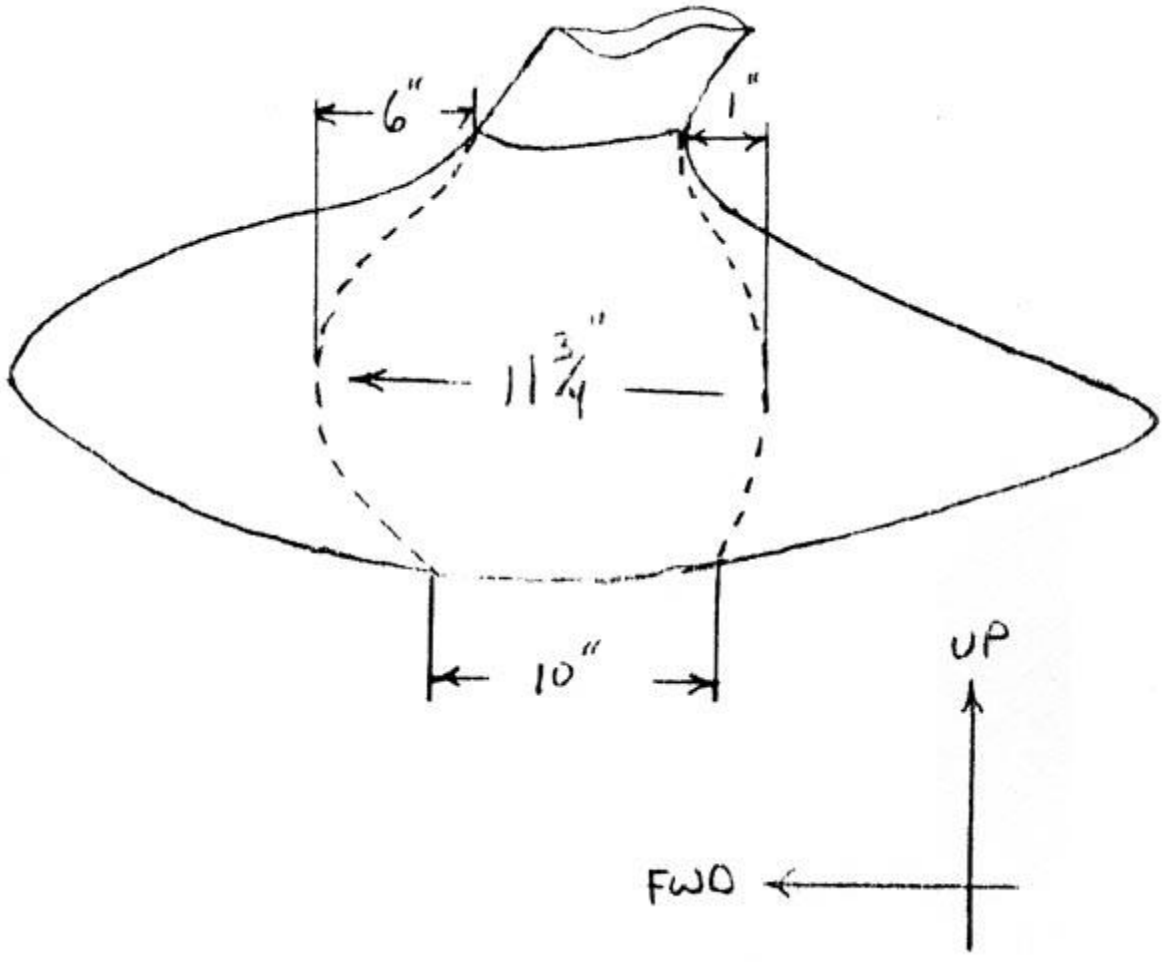


Install the brake bleeder valves on the bottom of the brake assemblies and bleed by pumping aircraft type brake fluid from the bleeder valve up to the master cylinder until full. The slotted screw under the rubber boot on the master cylinder will have to be loosened until fluid appears at screw. When full, tighten bleeder valve shut off) then slotted screw and check for firm brake.

Tri-Q Wheel Pant Construction

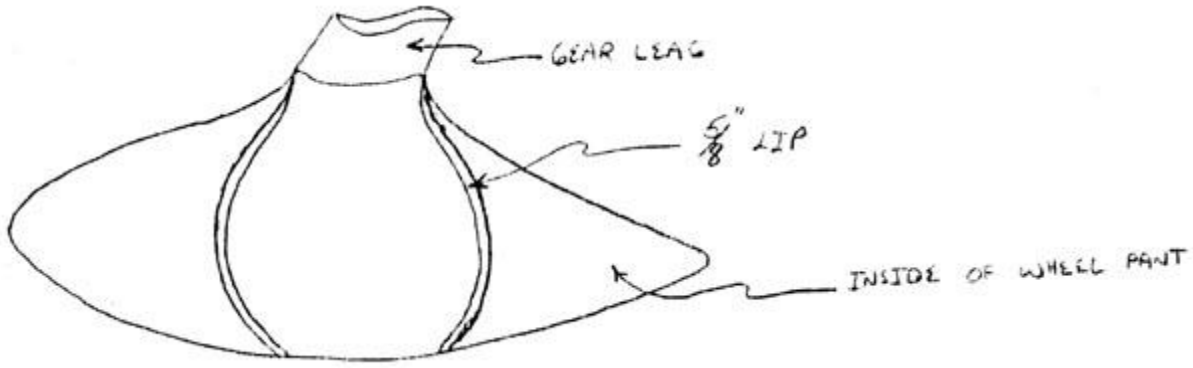
Now you have your main and nose landing gears on with their wheels, tires, and brakes (mains). You are ready to construct the wheel pants.

The main wheel pants come to you pre-molded in two halves. Basically, you must trim them to the lines, and put them around the tire at least over the tire. If you put a block on top of the tire, it will help you line everything up. Trim the neck that goes around the gear so that everything fits pretty good. When you are satisfied that both sides fit, take them to your work bench and five minute epoxy them together in spots as they would be on the airplane. Rough up the inside of the pant 1" each side of the seam. Now tape the seam closed on the outside of the pant with grey tape. Dry micro the slot on the inside and glass it with 2 BID strips 2" to 2 1/2" wide at a 45°. After this has cured you may remove the gray tape. You will now cut the wheel pant to allow it to install on the gear leg. Make a cut similar to the drawing. This cut is not critical it just must be big enough to slide over the gear leg and tire.

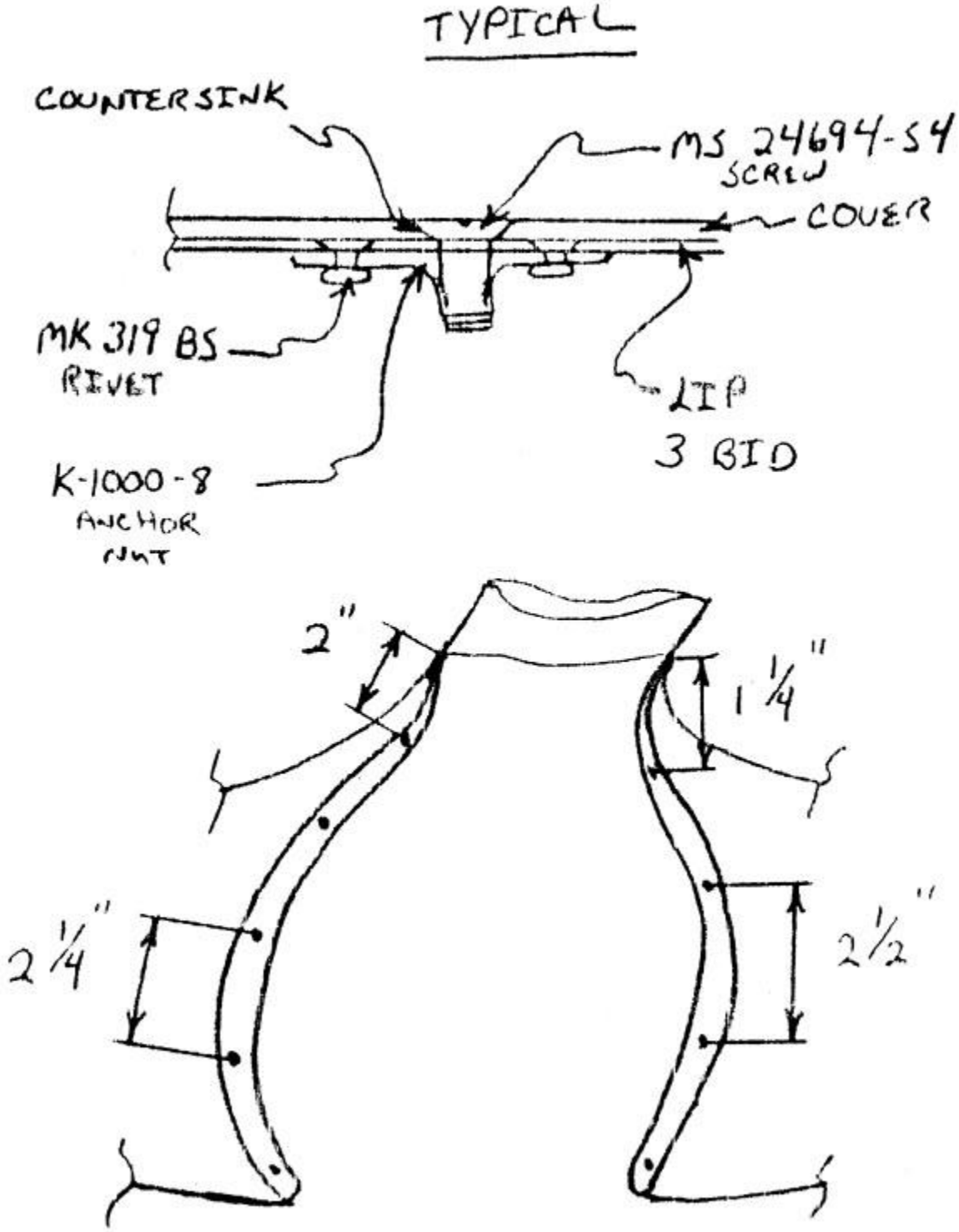


After this has been cut out, fit the pant back on the gear and check to make sure everything still fits right. Take your pant back over to the bench. Sand the wheel pant on the inside, just inside of the cut out you just made about. 1". Now take that piece you just cut out and tape the inside around the perimeter a couple of inches. Use a razor blade to trim the tape even with the edge. Fit the piece back in the pant and tape it on over the outside of the pant. Using 3 BID strips 2"

wide at a 45°, glass the split on the pant from the inside. This lip you are making is what you will eventually put anchor nuts on. At the tpp around the neck, only use two layers, as this build up will effect it's attach to the gear leg. When cured remove the outer tape and pu~1 the cover off. Remove the tape from the inside of the cover. Trim the lip that has been left to about 5/8" from the cut. Taper the lip to nothing in the last inch or so from the neck of it.

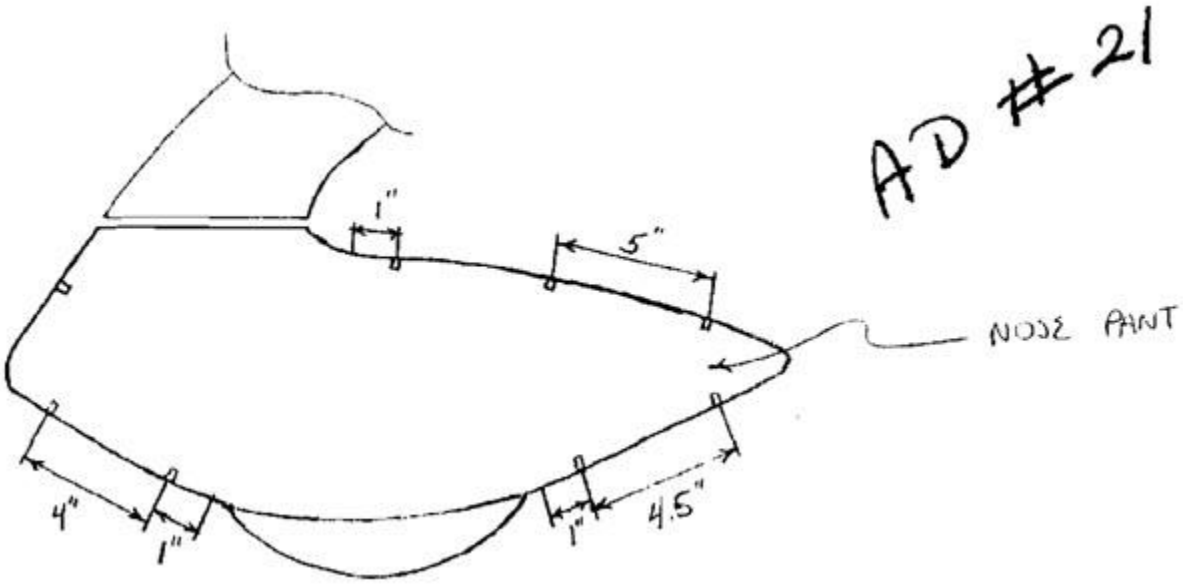


Now fit the piece back on and mark the 5 holes on the front part of the cover and the 4 holes on the back part. Try to center the holes in the lip. Drill the holes out to 1/8". Install the 9 K-1000-8 8-32 Anchor nuts with the MK 319 BS flat head pop rivets. Using a counter sink tool or large drill bit, counter sink the 9 holes so the MS 24694-S4 screws fit flush with the cover. This wheel pant is now ready to be installed.



The nose pant also comes in two pre-molded halves but with the lip already as part of the pants. Trim the pant half with the lip so you have approx. 1/2"-5/8" of the lip remaining and trim the other one so that you leave approx. 1/4"-5/16" of glass past the centerline mark that you see on that pant. At the nose and tail ends, narrow the lip portion of the pant to about 3/4". This allows the ends to fit together better. Now, snap the pants together and mark where you need to trim to allow the right and left side to fit together the way it's supposed to.

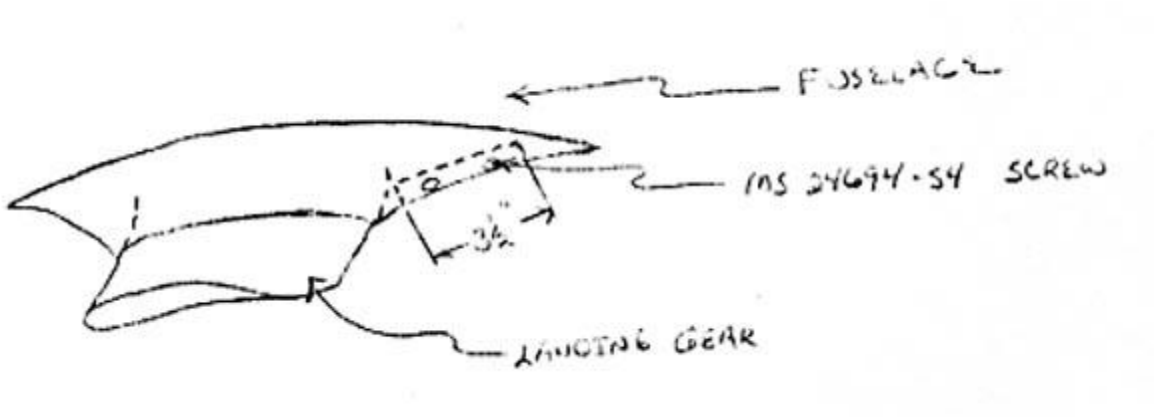
After you are satisfied with the fit, drill your holes in the pant in the approx. position shown in the diagram and install the K1000-06 6-32 anchor nuts with the MK 319 BS flat head pop rivets on the lip portion of the pant. Again you will counter sink the holes so that the MS 24693-S28 screws fit flush with the surface of the pant. The nose wheel pant is now ready to install.



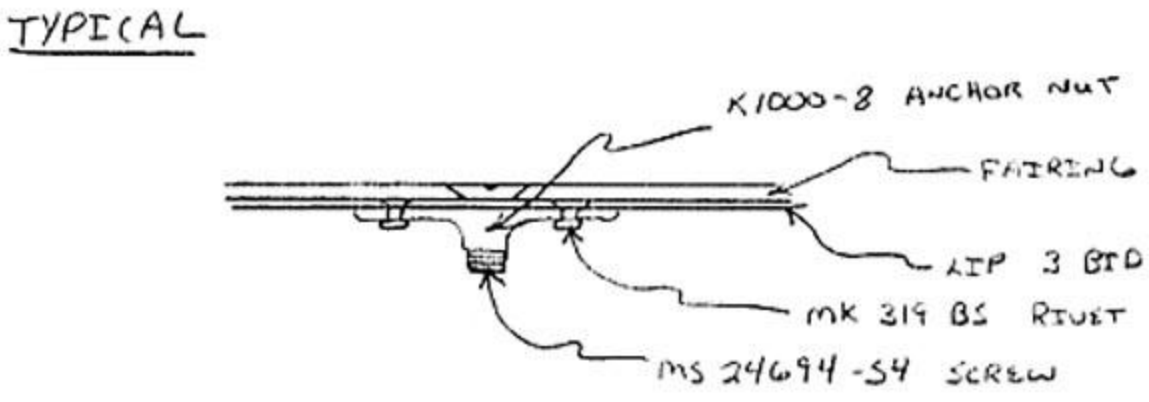
Tri-Q Fairing Construction

There are basically 4 fairings, 3 of which are pre-molded. One of these you will fabricate yourself. First we will work on the two fuselage to gear fairings.

Trim the fairings to the lines. You will be making a lip just as you did before on the main wheel pants. Rough up the inside surface just above the split. Gray tape the inside surface on the bottom side of the split. Knife trim the edge, put it together, and gray tape the outside of the split. Now, using 3 BID strips, 2" to 21/2" wide, glass the inside across the split only about 3 1/2" in the middle so you don't have any glass going to the ends. This is done because of the interference caused at the fuselage and gear when the whole thing is glassed.

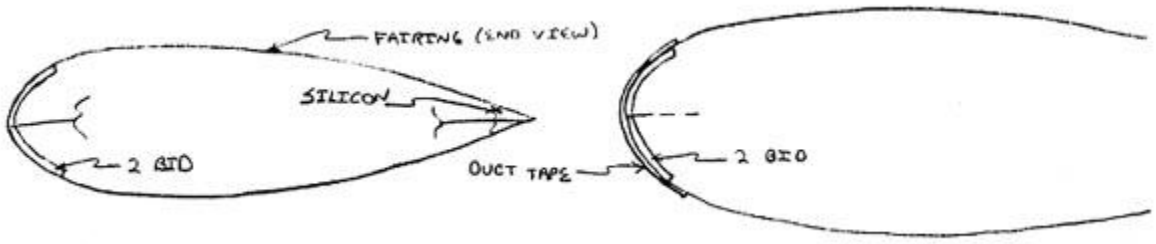


After cured, remove the tape and break it loose. Don't get carried away or you will break your fairing. Remove the inside tape and trim the lip to 5/8" as before. Let the fairings come back together and mark the two holes 2-1/4" apart in the center of the split. Drill the 1/8" holes and install the K1000-8 8-32 anchor nuts with the MK 319 BS flat head pop rivets. Again countersink the holes to allow the MS 24694-S4 Screws to fit flush with the surface of the fairings. These fairings are now ready to install.



The nose gear fairing comes in two pre-molded sides with an indentation in the leading edge for glassing the sides together. Trim the fairings to the trim lines and fit them together to check for fit. Sand the indented portion then tape the trailing edge together. Five minute epoxy the leading edge of the fairing just enough to hold it in place. Glass the two together with 2 BID. After

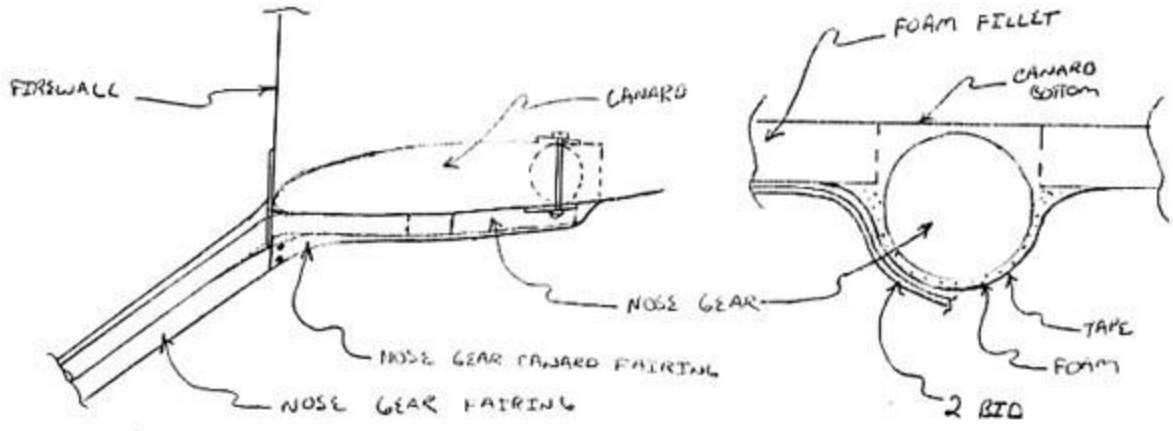
cured, you will remove the tape and finish the transition of the BID lay-up. This fairing will then stretch and slide over the gear leg when installed.



The last fairing extends from the firewall back to the rear attach fitting of the nose gear. The reason this fairing is not supplied is because of the differing bottom contours of the airplanes.

Put the nose gear fairing in place with tape to hold it where you want it. Using strips of foam (blue or orange), cut a groove down the center just deep and wide enough to fit over the gear. It's easier to do this in small pieces. When all the pieces are fit, gray tape the gear and 5 minute epoxy, in place, the foam chunks. After cured, sand and shape the foam chunks to a pleasing shape. Then gray 'tape over the foam and onto the bottom of the canard or cover piece under it. Try not to overlap the tape. Wax the tape with anything. Glass over the tape with 2 BID @ 45° onto the canard about 1" on each side. When cured, pull it off, trim it, and finish the surface. Remove all of the foam and tape. This cover is now ready to install.

NOTE: It is best to paint all wheel pants and fairings off the airplane after they have been installed and checked for fit.

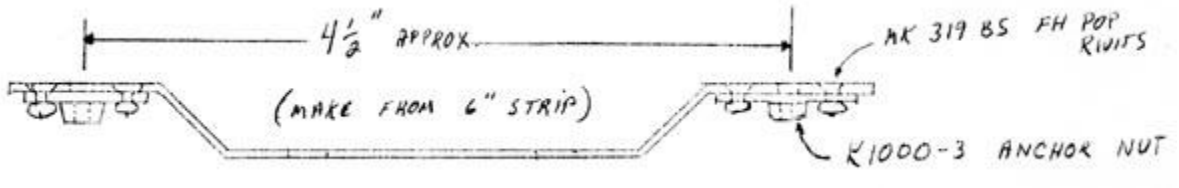


Tri-Q Wheel Covers / Fairings Installation

Wheel covers and gear to fuselage fairings should be installed prior to finishing of main gear. This is to minimize scratching and to provide a "dam" for some bondo work.

The main gear fairing is installed by sliding the fairing tightly into place and drilling two attach holes through the fairing and into the fuselage on the bottom of the aircraft. These holes should be small enough for the AN 631 phillips flat head screws. Enlarge the fairing holes enough for clearance and use the A3135-017-24A countersunk washers.

The wheel fairings are attached in a 3 point fashion. Fabricate two strips of the 1" wide 4130 flat steel as illustrated. Zinc chromate when finished.



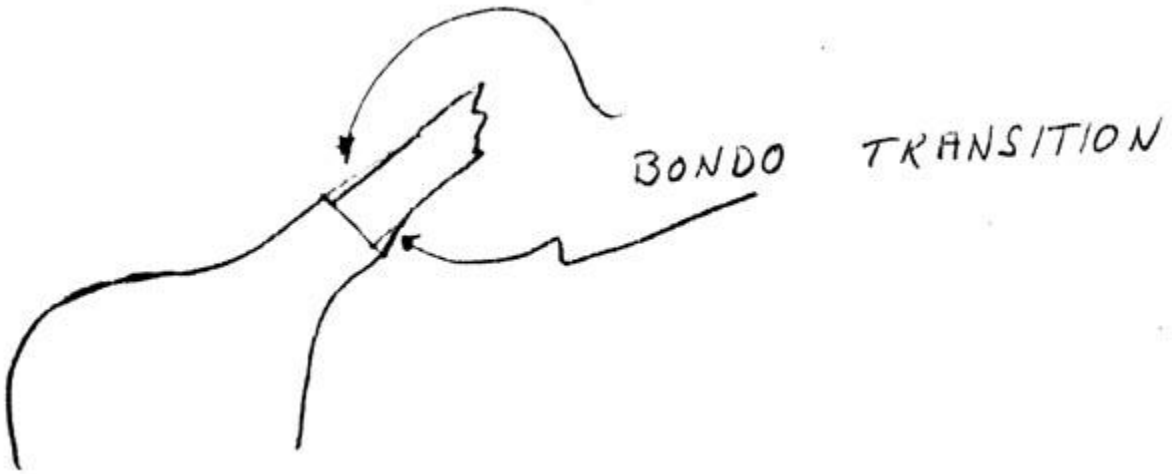
position and attach to the lower two axle bolts. Final shaping will be necessary to insure proper fit. This is best done with the fairings assembled and positioned over the tires. Allow at least 3/4"clearence between tires and covers by setting a spacer block on top of the tire during fitting. Make sure covers are aligned fore and aft with the wheels and with the proper camber.

When the brackets are properly aligned, position a pen light behind the anchor nuts and mark and drill the holes. Lock in place using the MS24694-549 10-32 countersunk machine screws and the A3235-02B-935 countersunk washers.

The outboard attach is made by inserting the 5/8" x 3" aluminum plug into the axle with the threaded portion the outside. Apply a small amount of bondo to the plug where it enters the axle and slide the plug out until it is firmly against the wheel cover. Using a pen light, carefully mark the position of the 1/4" hole. Remove the wheel covers being careful not to break the bondo holding the 5/8" rod to the axle.

Scribe a mark on the 5/8" rod through the hole used for the cotter key in the axle nut. Once this is done the 5/8" rod can be removed and the cotter key hole drilled through the 5/8" rod. You can also drill the 1/4" hole in the wheel cover and attach a 3/8"washer to the inside of the cover directly over the 1/4" hole. A one bid patch will hold the washer in place. After cure, countersink the hole for the 1/4 x 20 x 3/4" FU machine screw and A3475-020-24Acountersink washer.

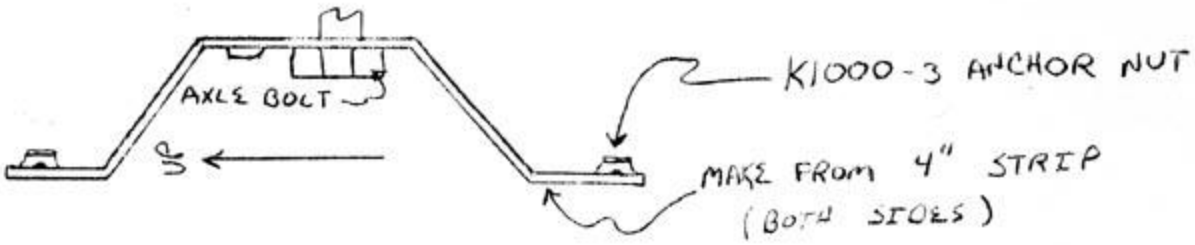
The wheel covers can now be installed and a bondo transition between the covers and gear legs can be made.

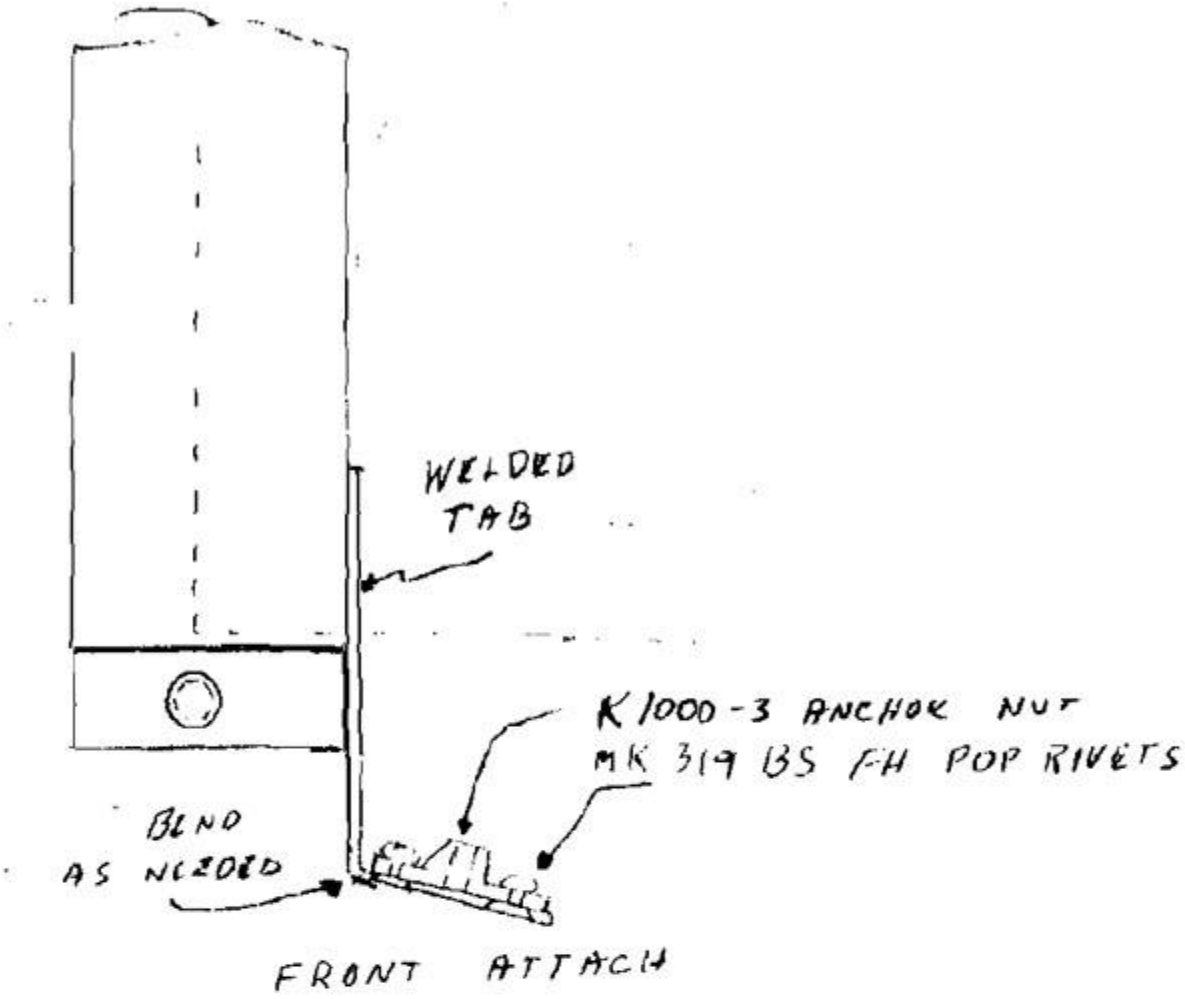


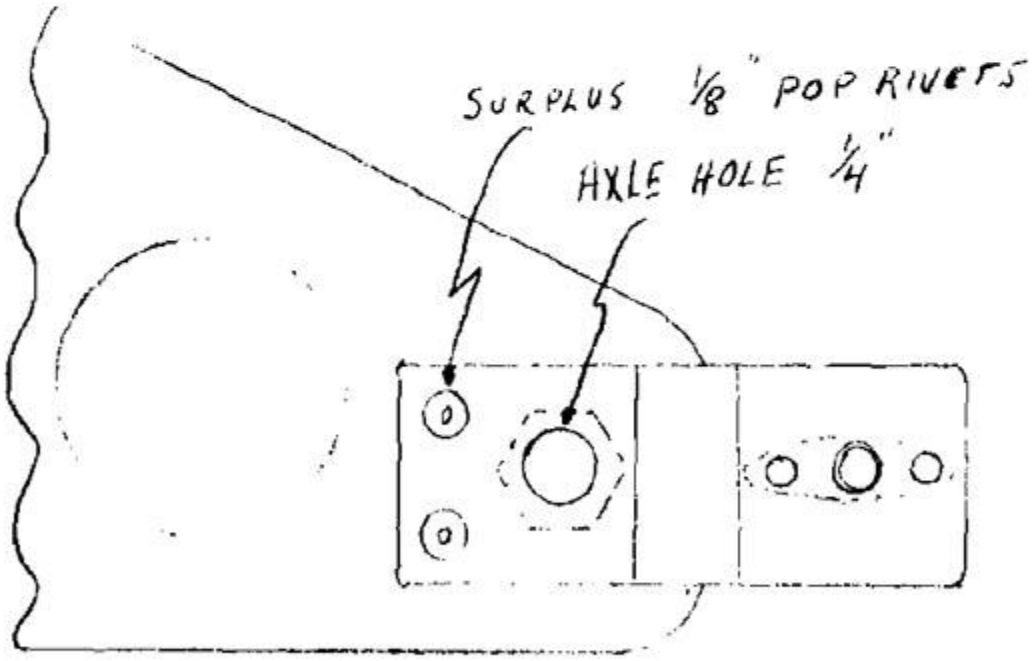
The gear legs are now ready for final finish work.

The nose gear fairings consist of the two wheel half covers and the strut fairing.

Fabricate the attach brackets from the one inch 4130 steel as illustrated.




WELDED TAB
K1000-3 ANCHOR NUT
MK 319 BS FH POP RIVETS
BLND AS NEEDED
FRONT ATTACH

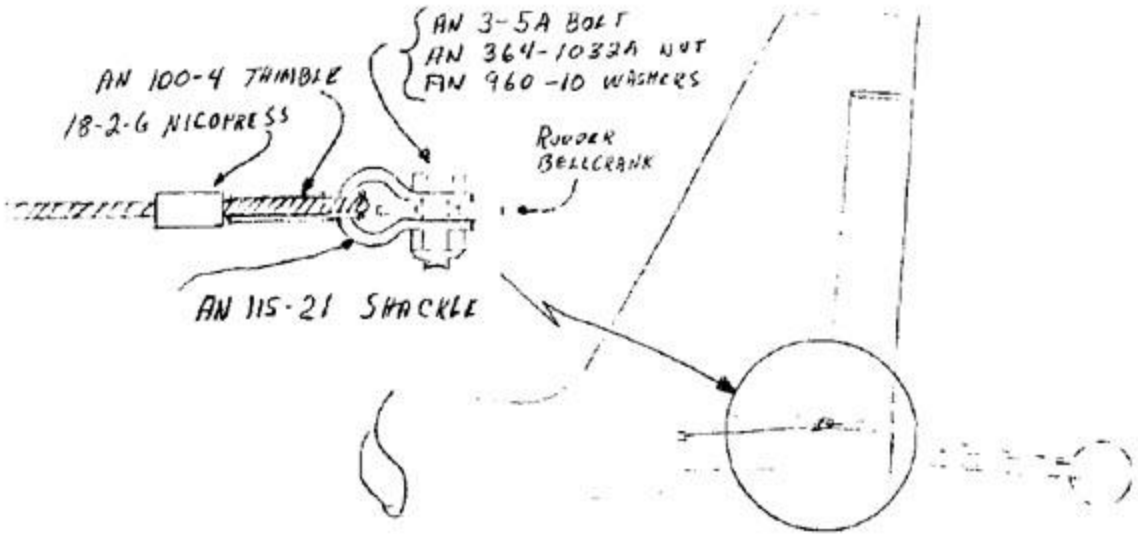

SURPLUS 1/8" POP RIVETS
AXLE HOLE 1/4"

Tri-Q Tail Modification

At some point in the conversion process it will be necessary to modify the tail assembly. If your airplane has been completed as a tail dragger, you will need to cut off the tail spring in line with the trailing edge of the rudder. Some grinding and bondo work may be needed for cosmetic clean up.

Pull the old rudder cables forward enough no allow a fuselage clean-up where the cables exited the sides. Align and drill with a 1/4" snake drill bit (12" long) new rudder cable holes in line with the rudder bellcrank horn. Insert and flox in place a piece of 3/16" nylaflow tubing long enough to clear the rear most bulkhead.

Re-route the rudder cables through the nylaflow and check for proper alignment. Do not connect cables until everything else is completed. You then can adjust rudder peddle position by shortening or lengthening the cables. Once this is finished, attach the cables using the AN-115-21 cable shackles, AN-100-4 cable thimbles, the 18-2-G nicropress sleeves. Check for full rudder travel.



Tri-Q Nose Gear Installation

The nose gear assembly consists of the fork unit, main steel spring unit and the rear attach slip unit. Due to builder variations and differences between the GU and LS canard, we use the rear attach slip piece to allow for these variations.

Prepare the aircraft for nose gear installation by removing any foam that might be present in an area 1" wide and centered on the bottom of the canard. This will allow the gear to nest directly against the canard bottom. A larger foam removal area must be made directly below the shear web (on the GU canard) or below the spar on the LS canard. This will allow the rear attach slip unit to bolt directly in front of the shear web on the GU or directly to the spar on the LS canard. On the GU canard, this cut out area should be enlarged to 3"x3" and, after sanding, a three bid lay-up applied. The LS canard does not require any additional preparation as there are already numerous glass lay-ups in this area.

Now trial fit the gear into position with the slip unit in place. With the nose tire installed and the fuselage position at22-1/4" firewall to floor and 28-1/4" split line to floor, the tire should just touch the floor. An aluminum spacer can be fabricated and placed between the rear attach slip unit and the wing if more tire clearance is needed or the front firewall bracket can be dropped a maximum of 1/4" if less clearance is needed. If you drop the front, an aluminum spacer block must be fabricated and placed between the gear and the wing so landing loads are spread to the wing and not on the four firewall attach bolts only. If the tire is within 1/4" either way, no further adjustments are necessary.

With the gear still in position mark the two rear attach hole positions. This should be within 1/4" and in front of the shear web on the GU canard and centered on the spar of the LS canard. Drill through the wing using an 8" or longer 1/4" drill. Keep the drill bit as vertical as possible so the exit holes on the top side will look semi professional. Now fabricate a 1/8" aluminum "washer" about 1-1/2"x3" and place over the top through holes, mark and drill the 1/4" holes.

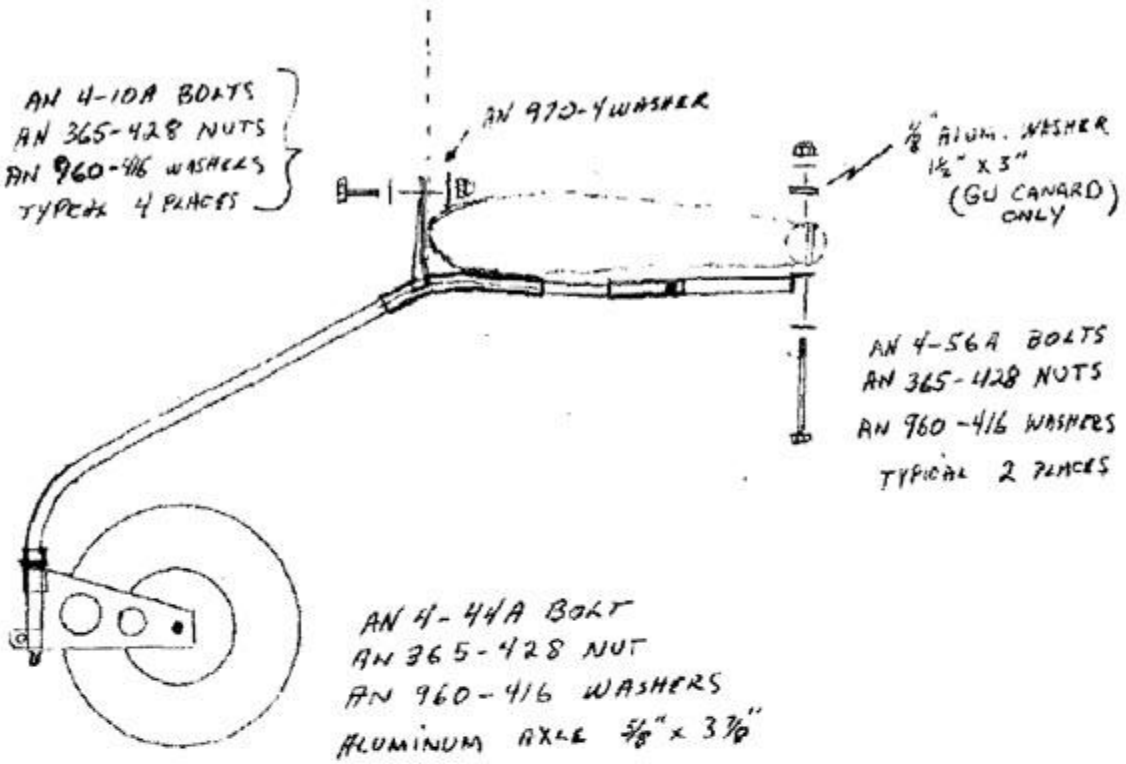
Bolt the rear slip unit into place and position the nose gear into its approximate position. Level the fork using a good carpenter's level and place enough weight on the nose tire to firmly implant the gear against the firewall and bottom of the wing. Drill the 1/4" firewall attach holes one at a time and insert a 1/4" bolt to hold while drilling the remaining holes. Tighten two of the bolts and re-check everything.

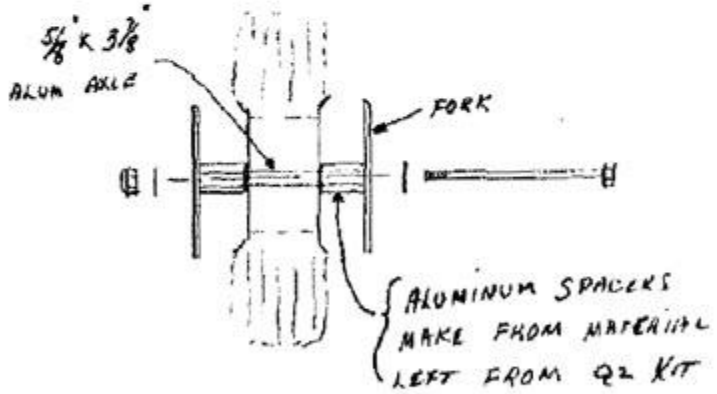
Now mark the position of the rear attach slip unit on the steel gear. This is to establish a common reference for drilling the 1/4"holes through the slip unit. It isn't easy to achieve a good alignment so take your time and make sure everything is in good position before drilling the 1/4" holes.

Bolt the slip unit into place and then bolt the entire nose gear into position. Check for alignment and make sure there is no interference between firewall bolts and any other parts of the engine. Adjust the fork fricti9n lock so there is about a 6 lb. force needed to move the tire when a horizontal force is applied to the tire at the rearmost point. The friction will need to be checked for the first ten hours or so to insure proper dampening.

You can now proceed with the fairing installation as previously outlined.

NOTE: We have not had the opportunity to install the gear in theQ200. Therefore, a careful check of the clearance between the gear and oil sump is needed. In the event the drain should interfere, the entire nose gear can be offset enough to clear this drain. If a problem exists, call for assistance.





NOTE: MAKE SURE YOU ARE CLAMPING DOWN ON THE ALUM. AXLE AND NOT THE ALUM. SPACERS. THESE SPACERS SHOULD BE SLIGHTLY UNDERSIZED.

Tri-Q Construction Photos