GYROBEE

Ultralight Gyroplane

DOCUMENTATION

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DESIGN CONSIDERATIONS

General

Entry-level fixed-wing ultralights have a reputation for being uncomplicated aircraft that are relatively easy to fly. They tend to have definite limits with respect to wind, for example, but if flown within these limitations they handle very easily and provide a lot of pleasure to those who fly them. The goal of the ***Gyrobee*** project was to achieve something similar in the area of sport gyroplanes. This effort was highly successful, but if you are intent on duplicating the aircraft, **despite all my earlier warnings**, you must have a solid understanding of why the aircraft is configured the way it is. If you don't understand some of the critical design choices that were made, it is quite possible that you will make modifications that would ***result in an aircraft that is dangerous to fly***!

Many pilots take a very casual attitude toward the FAA requirements established in Part 103. They may have all sorts of justifications for flying an aircraft that is too heavy or too fast, but the only consequences they see is the remote possibility that they might run into an FAA official. Part 103 issues with respect to the ***Gyrobee*** have nothing directly to do with legality! Let's take the top speed issue, since it is the major one with respect to flight handling and stability. Since the goal was to have the ***Gyrobee*** be strictly legal, it was designed so that it would not exceed the **63 mph** (55 knot) **maximum level flying speed** mandated in the regulations. Because it could not be flown any faster in level flight, other decisions could be made with respect to making the aircraft more stable and easier to fly. These design features are not appropriate for an aircraft that can fly at 75-90 mph! If I had been designing an aircraft that would fly faster than 63 mph in level flight, I would have done it completely differently.

The ***Gyrobee*** feels extremely stable and handles nicely, but **if it were set up to fly faster, the pitch stability would degrade very rapidly** to the point where the aircraft would become dangerous to fly in all but the most expert hands! Set up properly, the ***Gyrobee*** is limited to a top level flying speed in the low 60's and handles well up to that maximum speed. In a steep descent, the aircraft might even reach 70-75 mph, but it still handles well because it is **descending**. In contrast, if you set the aircraft up so it will reach 75 mph in level flight, the result is increasingly marginal pitch stability and the feeling that the aircraft could bite you with the slightest mis-handling of the stick! There is no magic in the "set-up" area. If the aircraft is built and equipped like the prototype, it **cannot fly too fast** and you would be extremely pleased with its stability in flight. If an aircraft with Part 103-legal performance is too "tame" for you, **do not modify the *Gyrobee***! There are plenty of suitable gyros out there if you want to fly faster or heavier, but **this one isn't for you**! In the sections which follow, I will outline those areas that are most sensitive to modification.

Engines

Power is king in the area of sport gyroplanes and most experienced pilots find it difficult to believe that you can get decent performance out of the 40 hp. Rotax 447 used on the prototype. I weight 220 pounds and I certainly would not fly an aircraft with marginal climb performance! Since the aircraft is designed to fly well on comparatively low power, there are other advantages as well. The ***Gyrobee*** is a "floater" compared to almost all other gyros out there, which means you get optimum glide performance should the engine fail. This not only improves your chance of finding a suitable spot to land, it means that you can fly your approach at a significantly lower airspeed and that you can execute a no-roll landing much more easily, even without a stiff breeze to help. You don't have to use a Rotax as other manufacturers make perfectly suitable engines in the 40-45 hp range that would do just as well, assuming the use of a reduction drive that would let you swing an efficient 60 inch prop! Unless you are very heavy or routinely fly from high elevation fields, 40-45 hp should do just fine. If you have an altitude or weight problem, the design will accommodate a Rotax 503, but that is absolutely the biggest engine you should use!

Rotor Blades

Most gyro pilots assume that blades are basically inter-changeable and the only thing they impact is performance. While this may be true for most Experimental machines, blade selection is absolutely critical for the ***Gyrobee***. You may assume that the design requires the most efficient blades available, but this is not the case. Highly efficient blades are characterized by relatively low drag. **The *Gyrobee* requires a certain amount of blade drag to limit the maximum level flying speed!** Really efficient blades, such as Ernie Boyette's Dragon Wings, will let the aircraft reach 75-80 mph in level flight! These are superb blades for most gyros, but not the ***Gyrobee***! Given that the maximum level flying speed was to be no more than 63 mph (give or take a few mph), the rotor was placed on a tall mast with the pilot positioned low on the airframe. This maximizes pendulum stability and contributes to the mellow handling of the aircraft. At or below 63 mph, the aircraft drag profile is always rotor-dominated and the aircraft is quite stable. With high efficiency blades, rotor drag is lower at any airspeed and the aircraft will fly much faster. The high mast/low seat combination that works so well at low speeds is now a serious problem, due to a low vertical CG, relatively high engine thrust line, and relatively low rotor drag.

For the aircraft to fly as intended, **you must use blades with a higher drag profile**. Originally the prototype was flown on **Rotordyne** blades. These are bonded aluminum blades, which would suggest a low drag profile, but they have a relatively inefficient airfoil section, so they do the job very nicely. They are relatively heavy, so you will only have a few pounds of weight margin with respect to the 254 pound empty weight limit. Set at 0.75 degrees pitch, the blades are moderately easy to hand-start, but to require a solid pre-spin to get them moving. Unfortunately, as far as I can tell, Rotordyne blades are no longer being made, but you may be able to find a good used set.

Similarly, **Brock** blades have an efficient airfoil section but lots of rivets. As a consequence, they fly the aircraft very well but produce enough drag to slow the aircraft down and contribute a very high measure of stability. If you are buying new blades for this project, the Brock blades represent a good tradeoff between performance and drag. They are very light blades hand-start easily, which is a plus if you have no prerotator, or the prerotator is not working for some reason.

Rotor Hawk blades also work very well. Use a 24 foot rotor disc and set the pitch to 1.75 degrees. They are lighter than the Rotordyne blades, spin-up easily when hand-starting, and seem to retain energy very well.

The low-drag **Dragon Wings** blades are not recommended. This is strictly a function of the way the ***Gyrobee*** is designed, for these blades are probably the lightest and most efficient blades you can buy. They also hand-start with some difficulty, which is not optimum if you fly without a prerotator. These would be the blades of choice, based on performance, for an ultralight tractor design, such as the Lite Wing **Roto Pup**, or a machine with high-pilot seating and a lower engine thrust-line, much like the **Dominator** Experimental machines.

The **Sky Wheels** composite blades have an excellent reputation, but they are heavy enough that you would have a problem meeting the 254 pound empty-weight limit required by Part 103.

We have not had the opportunity to test fly the aircraft with other blades and, for reasons that should be obvious by now, I cannot recommend any blades that have not been test flown on the ***Gyrobee***.

Rotor Diameter

The major problem early in the flight-testing of the prototype was how to get a good climb rate when using blades of moderate performance and an engine of only 40 hp. Fixed-wing ultralights solve the problem by having a relatively high wing area for their weight, resulting in low wing loading. The solution with the ***Gyrobee*** was similar - increase the diameter of the rotor disc to improve the disc loading. The typical single-seat gyro flies at a disc loading of 1.2 to 1.4 pounds/square foot (psf) with engines in the 65-90 hp range. In the case of the original Rotordyne blades, we used with a 5 foot hub bar, producing a 25 foot rotor disc and a disc loading of about 1.0 psf. This produced excellent performance yet the aircraft could easily be flown in winds up to 30 mph, assuming a reasonable level of pilot experience. The ten-foot Brock blades were lighter and were flown with a 4 foot hub bar, producing essentially identical disc loading on a 24 foot rotor disc. The tall mast provides ample rotor clearance in either case. Although the aircraft will fly at a disc loading of 1.2 psf, I do not consider the climb performance margin acceptable.

Wide Main Gear

The main gear of the ***Gyrobee*** is quite wide, over seven feet, compared to most gyros. This wide stance makes it a bit harder to design a trailer for transporting the machine, but you should resist the temptation to narrow the stance by shortening the axle struts. This would have no impact on flight characteristics, but would degrade the ground **roll-over** angle. Most damage in typical gyro accidents occurs when a pilot touches down in a "crabbed" angle, often when executing an off-field landing with the engine out. All-too-commonly, the gyro will tip over, destroying the blades and severely damaging other parts of the airframe. The wide gear stance makes the ***Gyrobee*** highly immune to such roll-over accidents. It has been landed at the most bizarre angles and never shown the slightest tendency toward tipping over. I would suggest that you keep the main gear as documented on the drawings!

Fuel Tank

The fuel tank mounting looks a bit unusual to many and might appear to be insecure or cause major trim changes as fuel is burned off. In fact, the fuel tank stays solidly in place in the air or when the aircraft is jolted around on a rough field. There is no detectable trim change with fuel burn either. The major convenience of the approach taken in the prototype is that the entire tank can be removed and taken to the nearest gas pump if no fuel can is available!

Is it possible to use a seat tank on the ***Gyrobee***? The answer is yes, but some thought and work would have to go into the installation. The fiberglass bucket seat (far more comfortable than any seat tank), along with the aluminum back plates, functions as a shear web that reinforces the seat braces. Seat tanks are not structural members, and you would have to add a substantial shear web (3/32 to 1/8 inch thick aluminum sheet stock) to provide the needed reinforcement. This would have to be integrated with adequate attachment hardware for the lower seat **U tube** as well as hard points for the attachment of the upper seat back to the structure. It can be done but you will have some homework to do it right. If you plan to try, work with an experienced gyro builder if you have any doubts about the problems to be solved! If you do mount a seat tank, the fuel tank mounting shown in the drawings can be eliminated.

CRAFTSMANSHIP

If you watch experienced pilots examining home-built aircraft at a fly-in, you will notice that they tend to be very picky about craftsmanship. The reason is quite simple. Sloppy work doesn't just impair the appearance of an aircraft, it can render it unsafe. Building your own aircraft can be immensely satisfying, but you shouldn't even start such a project unless you are committed to doing the job right. This means the highest standards of craftsmanship using the proper tools for the job. Sloppy work can ruin up to $700 of quality aircraft materials. If you mess things up, you will not even be able to sell what's left, for no one who knows what they are doing would touch the material. If you've done

this sort of project before, you can skip what follows, otherwise stay with me for some detailed advice.

Just because there are no mandated inspection requirements for Part 103 aircraft, this does not mean that we are not dealing with life and death issues. Nature and gravity don't know about the regulations!

Materials

Only aircraft grade steel and aluminum alloys and hardware should be used to build an aircraft. Materials and hardware available from other sources such as hardware stores are not suitable. This is a gentle way of saying that **something will eventually fail and kill you!** Legitimate aircraft suppliers such as **Aircraft Spruce and Specialty Company**, **Wickes Aircraft Supply**, **Leading Edge Airfoils** (**LEAF**), **California Power Systems**, and other suppliers advertising in magazines such as ***Kitplanes*** and ***Rotorcraft*** stock the proper materials and should be your only source for materials and hardware unless you are really know what you are doing.

Cutting Tubing and Angle Stock

Although you can cut everything needed with a hacksaw, the job would not be fun and it would also take forever! A powered bandsaw is the ideal took for most of the work. Since it doesn't pay to buy such a tool for building one aircraft, see the later section on Getting Help if you don't have a bandsaw. Be sure to allow for the width of the cut when making all pieces - the **finished size** should match the prints! All cuts should be carefully-dressed with a fine file and steel wool since sharp edges can concentrate stress and lead to the formation of cracks.

Drilling

Drilling tubing, sheet, and angle stock is the most critical operation you will do on an aircraft construction project. Holes must be placed with **absolute precision** or the parts **will not fit** when assembled. You cannot do this job with a hand drill. A good drill press with an adjustable fence is ideal. Holes, particularly those drilled through tubing, must be absolutely true. This is particularly so with holes drilled near the edge of square tubing. These are positioned with only 1/32 clearance from the tubing wall. **If you score a side-wall when drilling, the entire piece must be discarded!** If you are not sure about the precision of the drill press, take the time to make some simple drilling jigs to assure proper placement of holes. Alternatively, you can center-punch the hole location on both sides of a tube (assuming you do the job very accurately), pilot drill from both sides with a 1/16 bit, and then finish-drill to size from both sides. If you don't have the proper equipment or are unsure about your skills, see the later section on **Getting Help**.

Quality drill bits and how you use then are important. Finished holes you will drill will be either 3/16 or 1/4 inch. Invest in half-a-dozen **carbide** drill bits of each size. Drill the holes gently so the bit **cuts the metal** instead of punching through. Use cutting oil to

make for an even cleaner job and the bits will last longer. Once holes are drilled, de-burr them, both to assure a snug fit for the attachment hardware and to avoid concentration of stresses that can lead to cracks.

Machining and Welding

The number of machined parts and the need for welding has been minimized, but you will still have to have some parts made up unless you have your own shop and know how to do the work. If builders interact on the Internet, it is possible that sources for these parts can be developed where the costs would be lower than doing the job locally.

Getting Help

Your best source of help on a project of this sort is your nearest PRA or EAA chapter. Members will often have the proper shop tools (or the Chapter may be so-equipped), they know how to use them, and they can give you advice at all stages of construction. If that sort of assistance is not available locally, consider checking in with the metal shop at your local high school, vocational center, or community college. You may be able to get training on and use of the equipment. It is also possible that the teachers may think that the project would be a good one for students, so you might end up with some help. You **must get an experienced PRA member or EAA designee to look over your project** prior to test flying. They may be able to spot problems you have overlooked! Even if it is not convenient, arranging for periodic inspections as the project proceeds can usually spot problems earlier, where they will take less time and money to fix!

COMMERCIAL COMPONENTS

Standard gyroplane and ultralight components were used whenever possible to speed up construction or to assure the required safety in the case of components that are too difficult for fabrication by the typical builder. All of these suppliers advertise in either ***Rotorcraft*** and/or ***Kitplanes*** magazine.

Ken Brock Manufacturing, Inc. (11852 Western Avenue, Stanton, CA 90680, Ph. 714-898-4366)

- KB-2 wheel set (**20300**)
- KB-2 Joystick (**20500**)
- KB-2 factory-built tail group (**20540**)

Leading Edge Airfoils, Inc. (LEAF)

- Rotax 447 engine and 2.58 B gearbox (**R 447 FC SC SM GB 2.5**)
- 2-blade 60-38 wood prop (**P6038L16R**)
- Fiberglass bucket seat (**J7155**) and cover (**J7156**)
- Eipper GT-style fuel tank (**30249**)
- Airframe brackets
- Some engine mount, airframe materials, and AN hardware

Aircraft Spruce and Specialty Company, Inc.

- Seat belt (**G6573-5**)
- Shoulder harness (**E-2884-1**)

Rotor Blades

Although it is possible for a builder to fabricate his/her own rotor blades and head, I do not recommend it! The blades you select for this aircraft have a critical impact on both the legality of the machine with respect to Part 103 *weight and speed limits*, and on the *stability* of the aircraft. Please read the earlier section on DESIGN CONSIDERATIONS carefully.

The prototype originally used 10 foot **Rotordyne** blades (**RC 1014 A**) on a 60 inch hub bar (**RC 1-16 C**). As far as I can tell, these are no longer being made. **The recommended alternative** is either a set of 10-foot blades from **Ken Brock Manufacturing** along with a matching four-foot hub bar or a set of 10-foot **Rotor Hawk** blades with a 4-foot bar.

Rotor Head

The prototype used a **Rotordyne** head (**RC 1019 A**), but I don't think these are still being manufactured. Any standard single-bearing head from Ken Brock, Rotor Flight Dynamics. Snow Bird, Air Command, Rotor Hawk, or most other vendors should be a satisfactory substitute.

KITS AND COMPONENTS

GyroTech Inc. (see their web page on the net at **http://www.gyrotech.iserv.net**) are now producing a kit for the ***HoneyBee***, the "next generation" aircraft in the ***Gyrobee*** line. Although I have no financial connection with the company, I did design the ***HoneyBee***, based on the basic characteristics of the ***Gyrobee*** but incorporating some new ideas which make it a very innovative little aircraft. This is a strictly-legal ultralight and the kit has been produced to the highest standards, including CNC machine work and powder-coating or anodizing of all metal components. If you order a complete kit, it can literally be assembled in one or two weekends. They have financing available for kit purchases and they also offer sub-kits and plans.

Materials Kits and Components

Complete component materials kits, sub-kits, and individual machined parts for the ***Gyrobee*** are available from **Aerotec Inc.** (49 Hayden Parkway, Burlington, VT 05403 Ph. 802-864-5496). Contact Doug Riley for details. Doug has bent over backwards to accomodate the needs of ***Gyrobee*** builders, all of whom will vouch for the quality of his components and materials.

NOTES

CONSTRUCTION SEQUENCING

The documentation is organized into discrete phases or stages, each involving one or more pages of supporting text and typically three to five drawings. These phases represent logical, defined steps in the overall construction sequence and should be followed in order.

If adequate funds were available to purchase all the required materials, hardware, and components at one time, I would use the following construction sequence:

- Farm out the machining work so the parts would be ready when needed.
- Cut all the required tubing and sheet-metal components and label each with masking tape to keep track of the pieces.
- Do all the required drilling work.
- Finish the pieces (see **FINISHING NOTES** below)
- Do the needed assembly, following the phases in the documentation.

If I had to work on a budget, I would treat each phase as a sub-kit, obtaining the materials, cutting and drilling, and performing the assembly steps for each phase in turn. In this way, the project could be paced to meet the available funds. Since the blades and engine are the most expensive items, I would budget set-aside funds as the project proceeded, to minimize the delay in obtaining these parts once the rest of the work was finished.

FINISHING NOTES

Bare aluminum will oxidize, become dirty, and show fingerprints from handling if not finished prior to parts assembly. In order of difficulty and cost, the finishing options are:

- **Clear Urethane**. Polish the parts with fine steel wool, degrease, and finish with one or more coats of clear urethane paint. This will provide a natural-metal finish, yet protect the metal surface. Since the finish is clear, this option has the least potential to show defects in application and is thus suited for hand application.
- **Anodizing**. The aluminum parts can be anodized to provide a color finish. The color options are limited and not vivid, but the effect is excellent, as is corrosion protection.
- **Painting**. The parts can be painted in any colors desired. Each piece will need to be polished, degreased, primed, and then color-painted. You may be able to arrange for painting at a local auto body shop. This eliminates a lot of work, there is a very wide range of possible color combinations, and auto paints are very durable.
- **Powder Coating**. This is probably the most expensive option but will probably provide the best results.

PHASE 1 - FRAME TRIANGULATION

Prints:

- **G1-1** Keel Tube
- **G1-2** Mast Pieces
- **G1-3** Mast/keel Cluster Plate
- **G1-4** Seat Braces
- **G1-5** Side View

Fabrication Notes

- **Keel Tube** (G1-1). The tube was carefully cut to length using a band-saw, with special attention to keep the ends square. All cut edges were de-burred and filed smooth to eliminate stress points. It was very critical that all holes were located with extreme care, drilled cleanly through, and de-burred. An accurate drill press with a fence is a great help. It was very important that the holes be drilled true and that the bit **not** score the inside tube walls when drilling holes near the edge of the tube. Clearance is a nominal 1/32 inch, so care was required. If the sidewalls are scored, we would have had to discard the piece. The holes on the top and bottom are based on the use of the Brock control stick.

- **Mast** (G1-2). See notes for the Keel (above) for general issues. Since the mast is made of two pieces of 2 x 1 extruded tube, the mast segments should be solidly clamped for all cutting, trimming, or drilling operations. When the mast pieces were complete, we temporarily secured the two pieces using 1/4 inch bolts (standard hardware store bolts are OK for **temporary** service) at the two 1/4 inch holes at the top of the mast and the last 1/4 inch hole toward the base (the one located at 28.5 inches on G1-2).

- **Cluster Plate** (G1-3). Since this part is thick (1.8 inch) stainless sheet, it was easier to have it fabricated at a machine shop.

- **Seat Braces** (G1-4).The drawings showed the right hand brace - the left is opposite.

Hardware

The basic airframe is a triangular truss made up the keel tube, the two mast segments, and the two seat braces. The following hardware was required to connect these pieces:

- **AN4-26A** bolts (2)
- **AN960-416** washers (4)
- **AN365-428** nylock nuts (2)
- **AN3-26A** bolts (7)
- **AN960-316** washers (14)
- **AN365-1032** nylock nuts (7)

Assembly

NOTE: *As a general rule, all bolts are installed so that a washer is located immediately under the head of the bolt with another under the nut.*

- The two mast/keel cluster plates (G1-3) were mounted on either side of the keel at the cluster of four 3/16 holes near the rear of the keel using four AN3-26A bolts, eight AN960-316 washers, and four AN365-1032 nylock nuts. The cluster plates were oriented so that the ends with the four 3/16 inch holes was above the keel while the end with the two 1/4 inch holes was below the keel (see G1-5). The nuts were torqued to the equivalent of hand-tight at this stage.

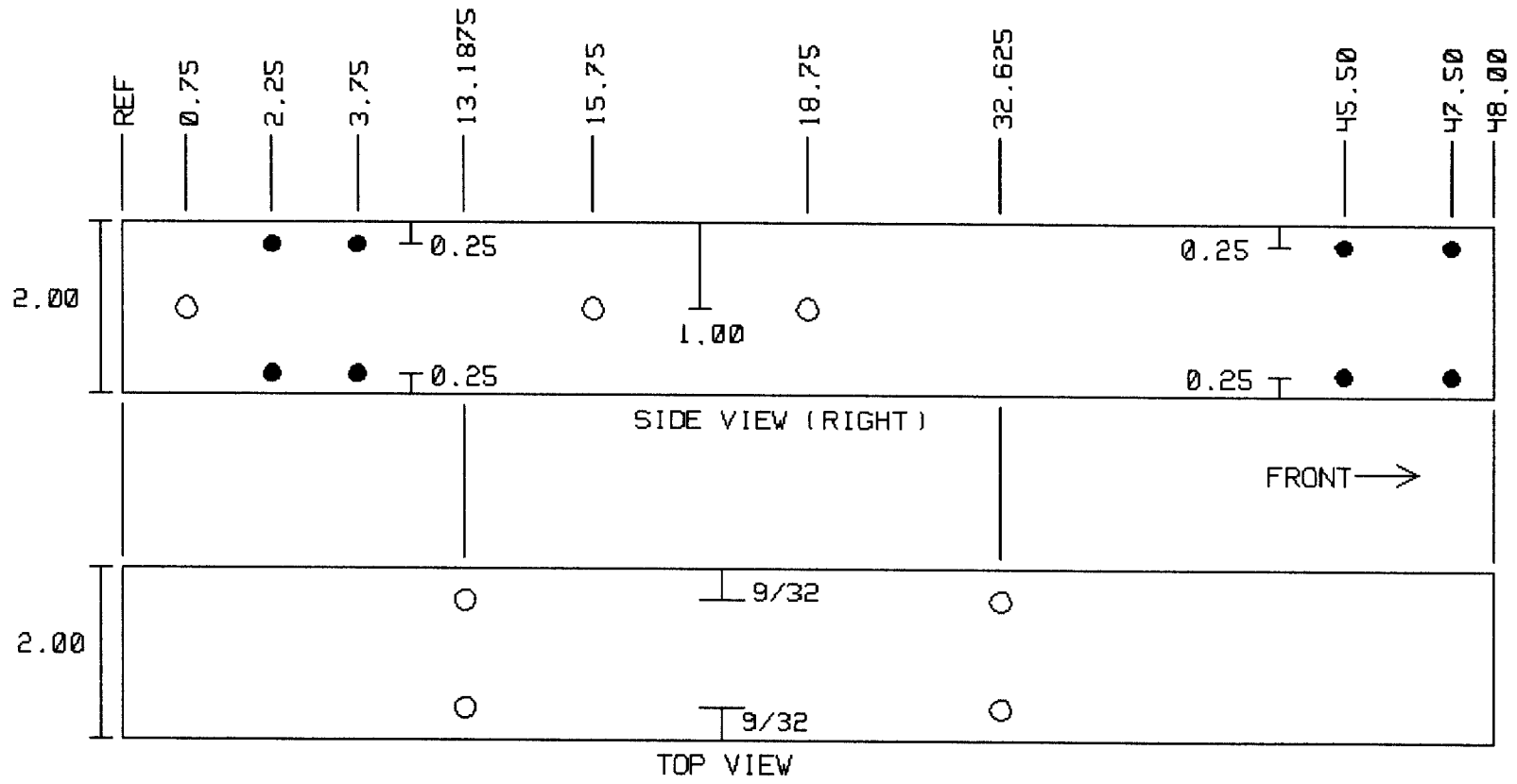
- The **bottom** end of the mast was positioned between the **upper** ends of the cluster plates and secured with remaining cluster hardware (see G1-5). Note that **upper rear** hole of the cluster plate was not bolted at this time. The nuts were torqued to the equivalent of hand-tight at this stage.

- The 1/4 inch hole at the **top** of the seat braces was secured to the 1/4 inch hole **37 inches** above the base of the mast using an AN4-26A bolt, two AN960-416 washers, and an AN365-428 nylock nut. At this point, the nut was tightened just enough to secure the parts but loose enough that the mast braces could be easily rotated.

- The **second** 1/4 inch hole from the **bottom** of the seat braces was secured to the 1/4 inch hole located **18.75 inches** from the **rear** of the keel using an AN4-26A bolt, two AN960-416 washers, and an AN365-428 nut.

- When all pieces were properly aligned, all nylock nuts were torqued for a tight fit.

Note that the lower ends of both the cluster plates and seat braces extended below the keel at this point. We blocked the frame upright at this stage so the ends of these pieces would not be damaged.

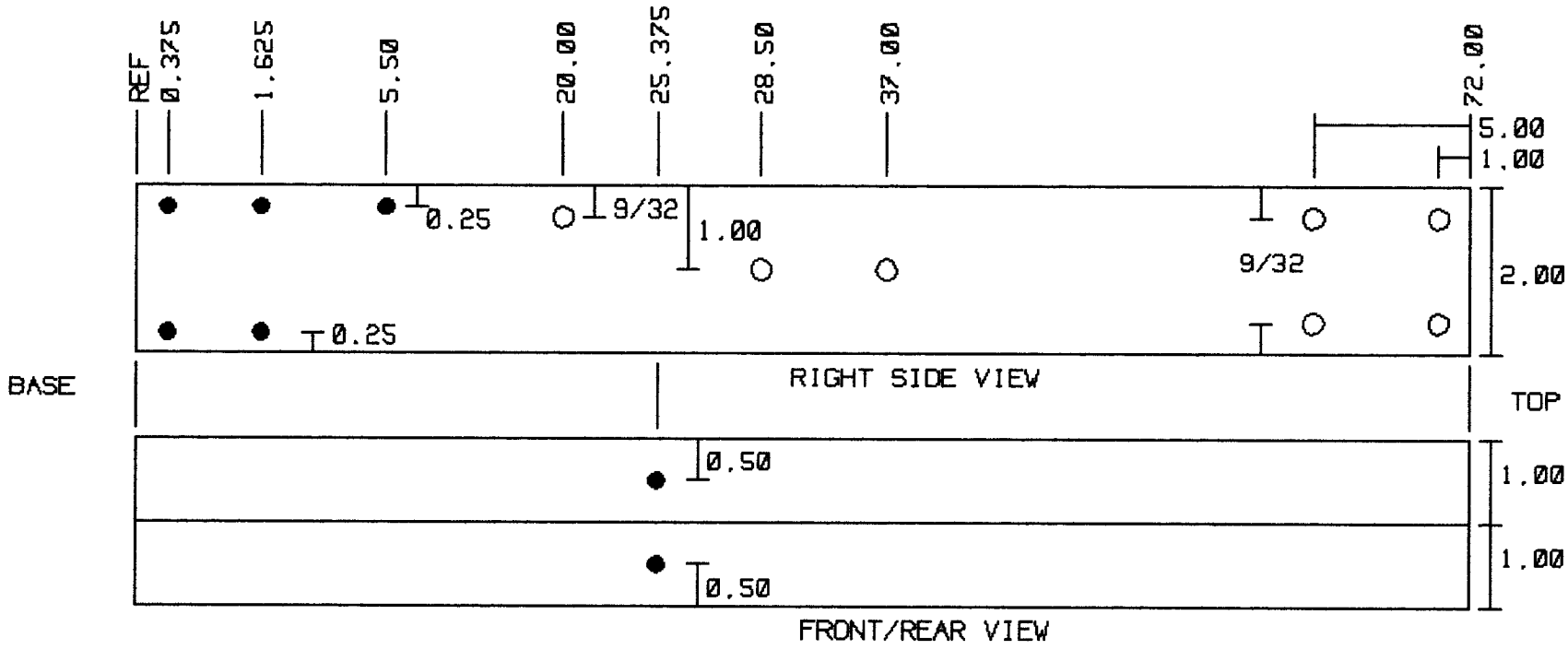


MATERIAL: 2 x 2 x 1/8 WALL 6061-T6 EXTRUDED TUBE STOCK

NOTE: ALL HOLES DRILLED THROUGH - SEE TEXT FOR CAUTIONARY NOTES

HOLE KEY
○ = 0.25
● = 3/16

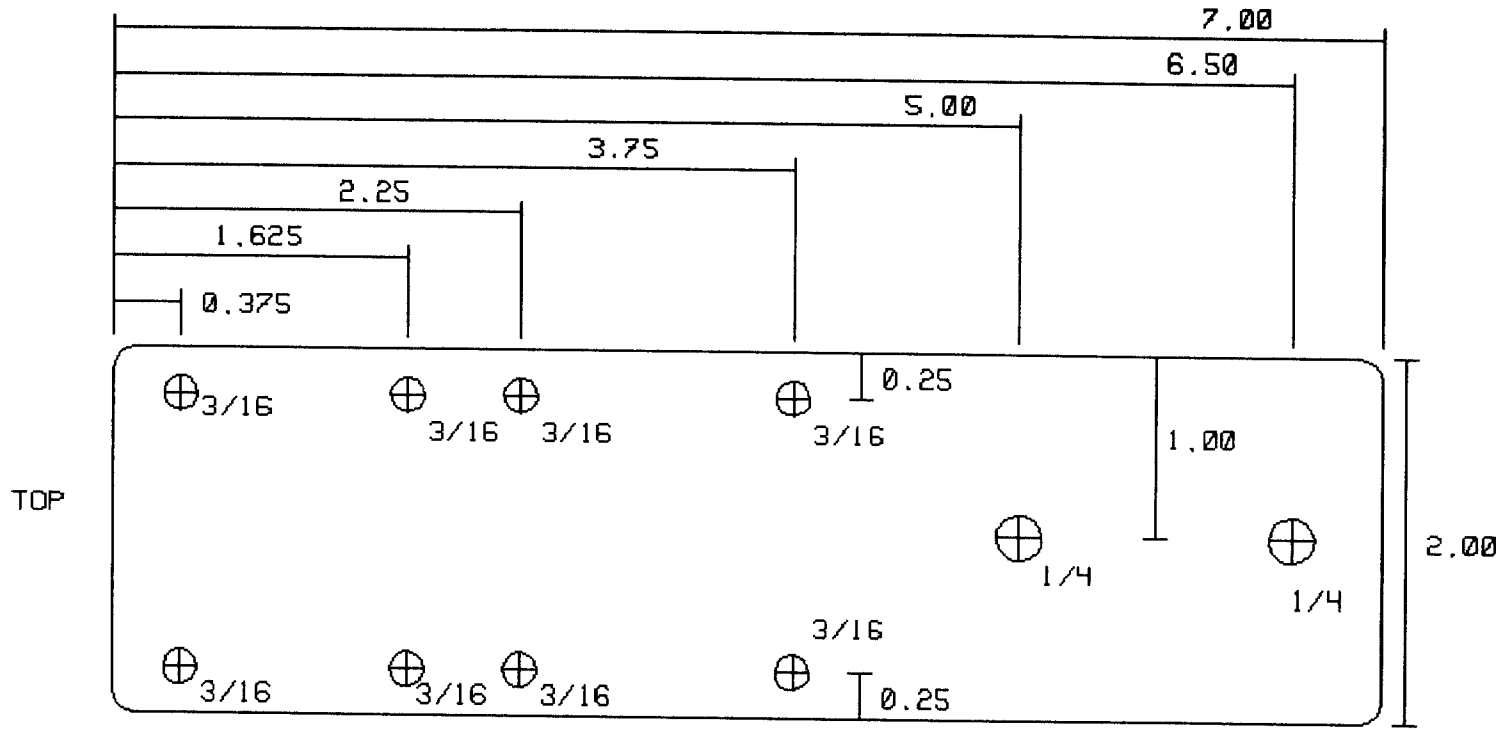
The GYROBEE	DATE: SEP 97 REV: 2.0
DRAWING: KEEL TUBE (1 ROD) G1-1	SCALE: PAGE OF



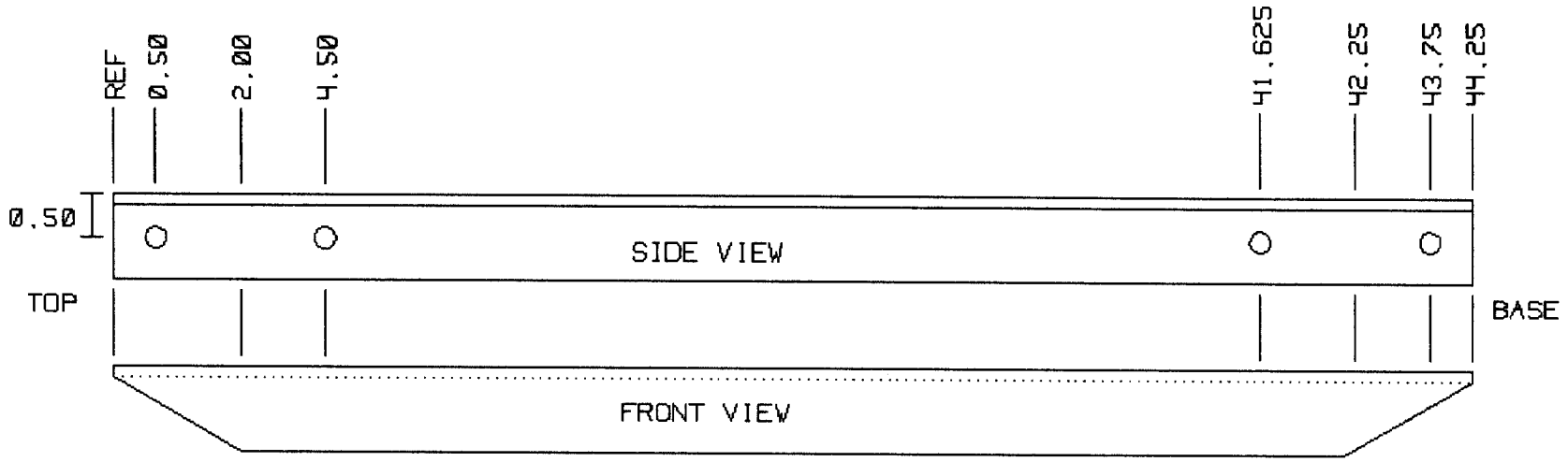
MATERIAL: 2 PIECES OF 2 x 1 x 1/8 WALL 6061-T6 EXTRUDED TUBE STOCK

HOLE KEY
○ = 0.25
● = 3/16

The GYROBEE	DATE: MAY 98 REV: 3.10
DRAWING: MAST PIECES (2 RQD) G1-2	SCALE: PAGE OF



The GYROBEE	DATE: SEP 97 REV: 2.0
DRAWING: CLUSTER PLATE (2 ROD) G1-3 1/8 INCH STAINLESS SHEET	SCALE: PAGE OF

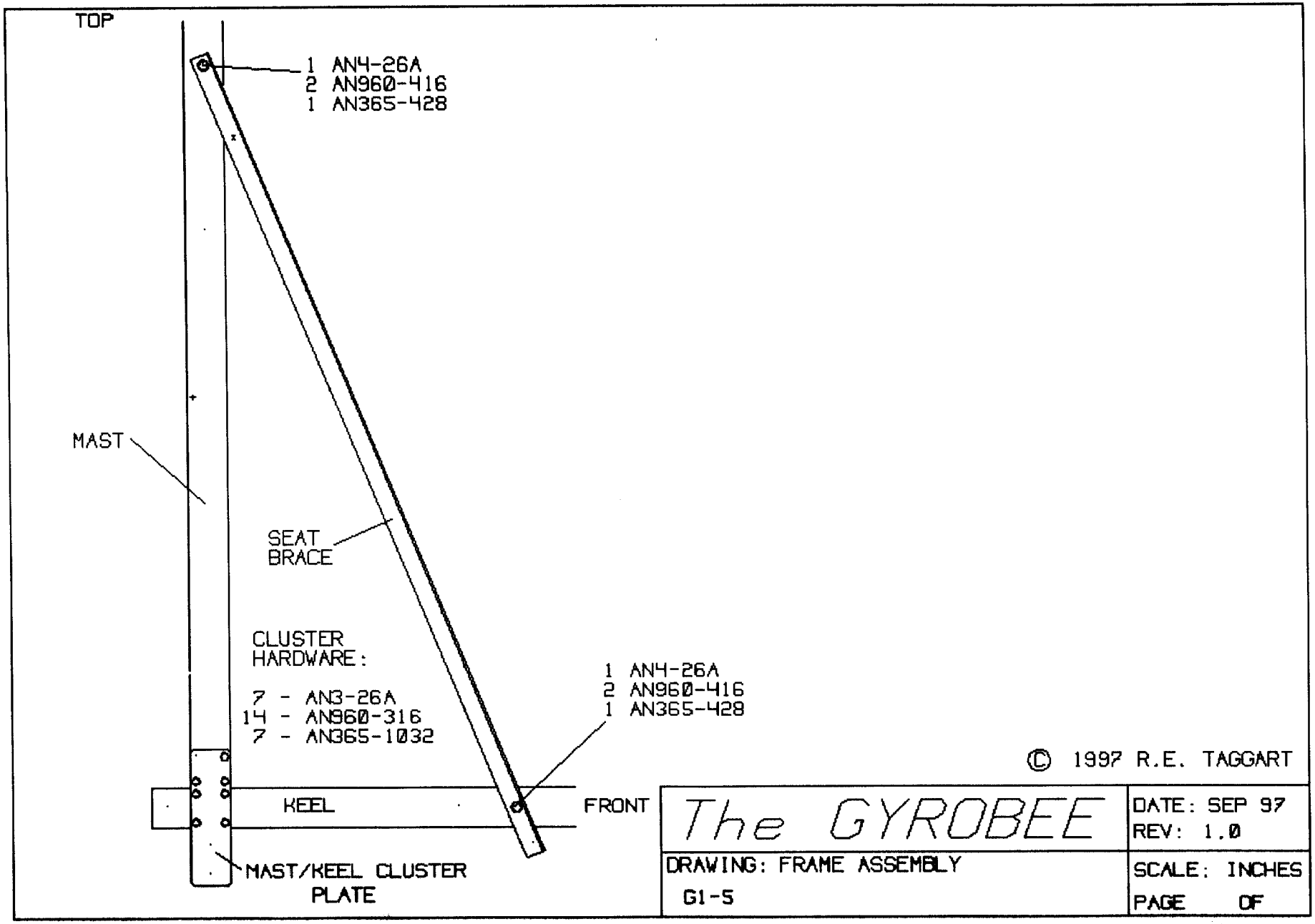


MATERIAL: 1 x 1 x 1/8 6061-T6 EXTRUDED ANGLE STOCK

RIGHT SIDE PIECE SHOWN - LEFT IS OPPOSITE

HOLE KEY
○ = 0.25
● = 3/16

The GYROBEE	DATE: SEP 97 REV: 2.0
DRAWING: SEAT BRACES (2 REQD) G1-4	SCALE: PAGE OF



The GYROBEE

DRAWING: FRAME ASSEMBLY
G1-5

DATE: SEP 97
REV: 1.0

SCALE: INCHES
PAGE OF

PHASE 2 - AXLE STRUT ASSEMBLY

Prints:

- **G2-1** Axle Strut
- **G2-2** Brackets
- **G2-3** Saddle Fittings
- **G2-4** Assembly

Fabrication Notes:

- **G2-1 Axle Strut**. The struts had to be bent as indicated to improve ground clearance with the KB-2 main wheels. This is a tough job given the 1/8 inch wall thickness of the axle strut tubing. We accomplished the bend by anchoring one end of the strut against a wall and used a truck wheel as a bending mandrel using a come-along to provide the bending force. It is important that both struts have the same final offset, even if the absolute value is a little off the 3.75 inches shown on the print.
- **G2-2 Brackets**. These can be fabricated from stainless sheet stock or the indicated brackets can be ordered from LEAF.
- **G2-3** Saddle Fittings. We farmed these parts out to a local machine shop.

Hardware:

- **AN4-21A** bolt (4)
- **AN960-416** washer (8)
- **AN365-428** nylock nut (4)

Assembly:

The following steps were used to assemble the **right** axle strut as shown in print G2-5, then repeat for the left strut:

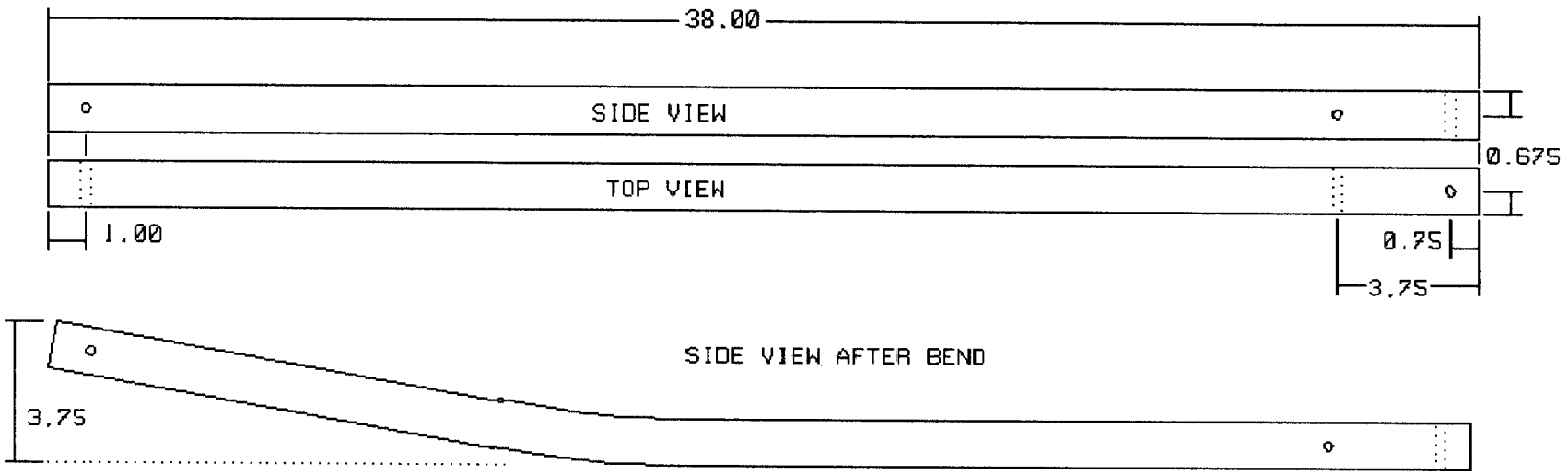
- At the outboard end of the strut (the end with two holes), insert a KB-2 axle (comes with the KB-2 wheel set) so that the shoulder extends 0.25 inch beyond the tube end.

- Secure the axle and strut and match-drill through the axle at the outboard 1/4 inch hole. This job should be done slowly and carefully with oil to assure a clean drill cut.

- Temporarily pin the axle in place with a 1/4 inch bolt, rotate the strut 90 degrees and match-drill the second 1/4 inch hole at the outboard end of the strut.

- Place saddle fittings on either side of the outboard axle hole and secure a small bracket with the indicated hardware. Note that the outboard bracket should face **up**!

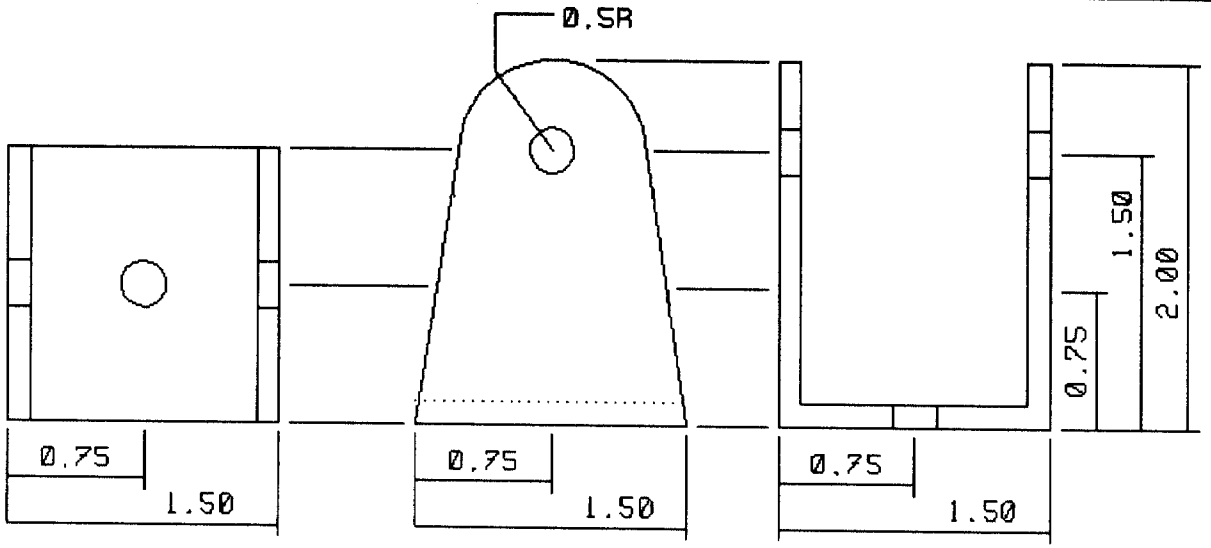
Repeat with the inboard saddle fittings and another small bracket, with the bracket facing **forward**.



MATERIAL: 1.25 INCH OD (0.120 WALL) 6061-T6 ALUM TUBE
ALL HOLES 1/4 INCH

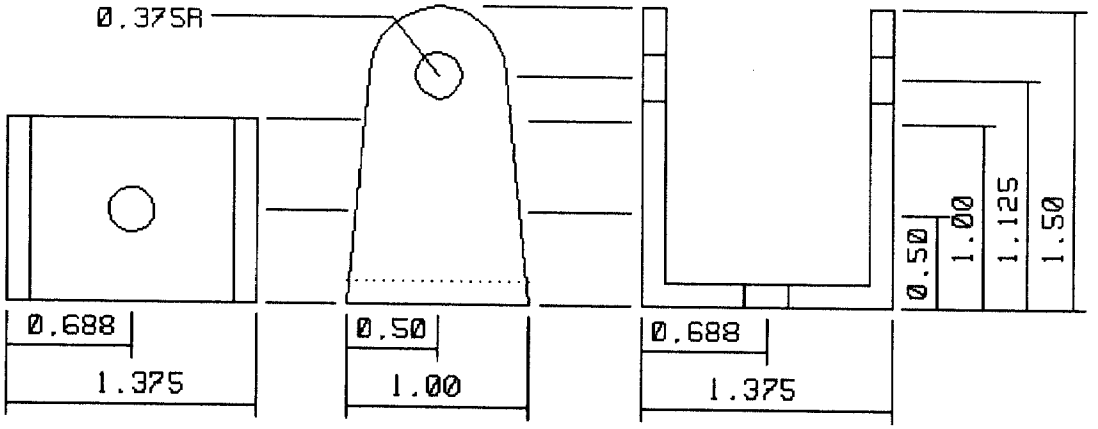
SEE TEXT FOR BENDING INSTRUCTIONS

The GYROBEE	DATE: JUNE 88 REV: 1.0
DRAWING: AXLE STRUT (2 ROD) G2-1	SCALE: INCHES PAGE OF



LARGE BRACKET

EQUIV. LEAF E1520



SMALL BRACKET

EQUIV. LEAF E1500

MATERIAL: BOTH BRACKETS 1/8 THK STAINLESS SHT.

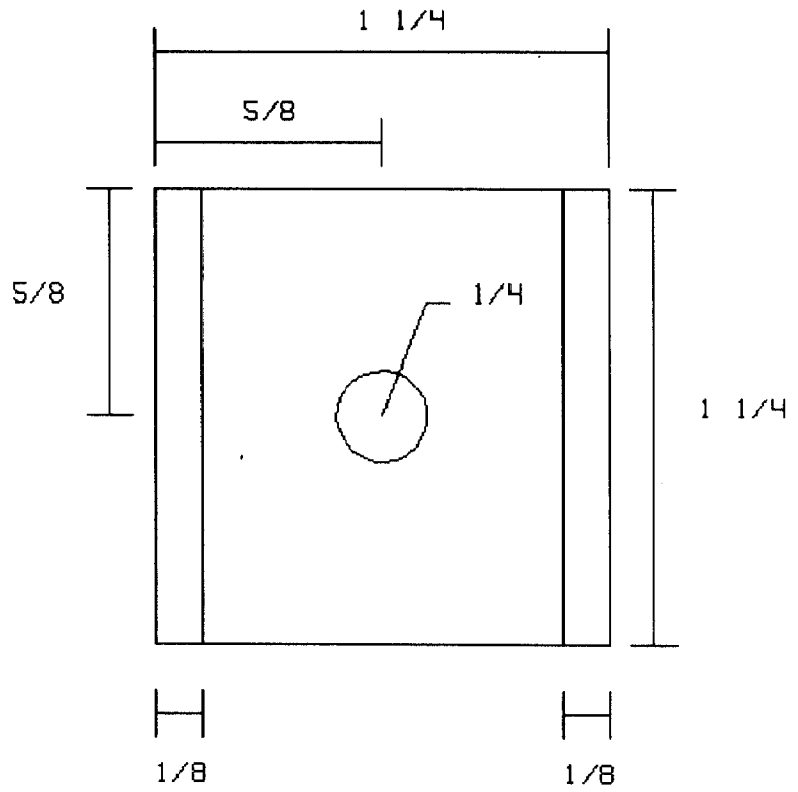
ALL HOLES 1/4 INCH

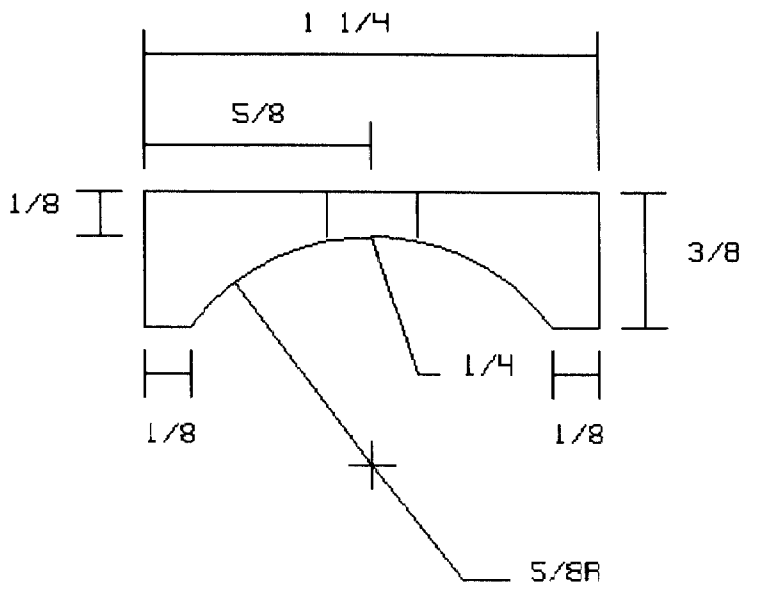
The GYROBEE

DRAWING: AIRFRAME BRACKETS
G2-2

DATE: SEP 94
REV: 1.1

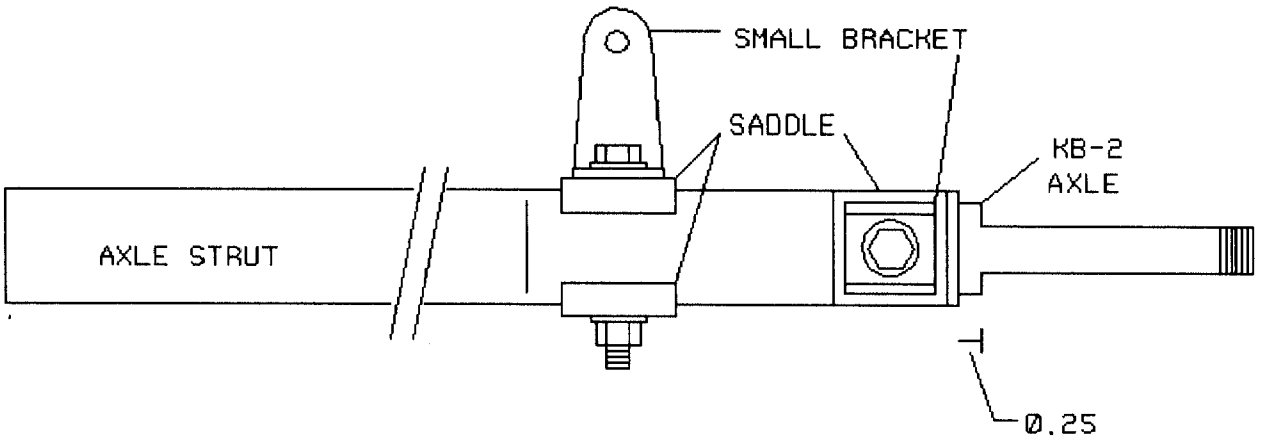
SCALE: INCHES
PAGE OF





MATERIAL: ALUMINUM (6061-T6) BAR STOCK

The GYROBEE	DATE: APRIL 88 REV: 2.0
DRAWING: AXLE SADDLE FITTINGS G2-3 10 ROD	SCALE: INCHES PAGE OF



BRACKET/SADDLE HARDWARE:

AN4-21A - 1
AN960-416 - 2
AN365-428 - 1

NOTE: OUTBOARD BRACKET SHOULD FACE UP
WHILE INBOARD BRACKET FACES FORWARD

RIGHT AXLE STRUT IS SHOWN - LEFT IS OPPOSITE

The GYROBEE	DATE: SEP 90 REV: 3.0
DRAWING: AXLE STRUT ASSEMBLY G2-4	SCALE: INCHES PAGE OF

PHASE 3 - MAIN GEAR MOUNTING

Prints:

- **G3-1 -** Axle Drag Struts
- **G3-2 -** Lap Belt End Fitting
- **G3-3 -** Main Gear Mounting

Fabrication Notes:

- **G3-1 - Axle Drag Struts.** Once the chromoly tubes have been cut to length and de-burred, insert the AN490HT8P fittings in both ends and center-drill the tube and fitting (3/16) at 0.5 inches in from each tube end. Secure the fittings in the tubes with the AN3 hardware indicated on the print. Thread the AN316-4 stop nuts onto each fitting and then screw on the HF-4 Heim fittings. Adjust the position of the Heim fittings so they are threaded approximately half way down the threaded shaft.
- **G3-2 - Lap Belt End Fitting**. This fitting will anchor the end of the lap belt to the keel. Since the fitting is made of 1/8 inch stainless sheet stock, you may wish to have it made at a local machine shop. Corner radius is not critical, but you do want to avoid sharp corners.

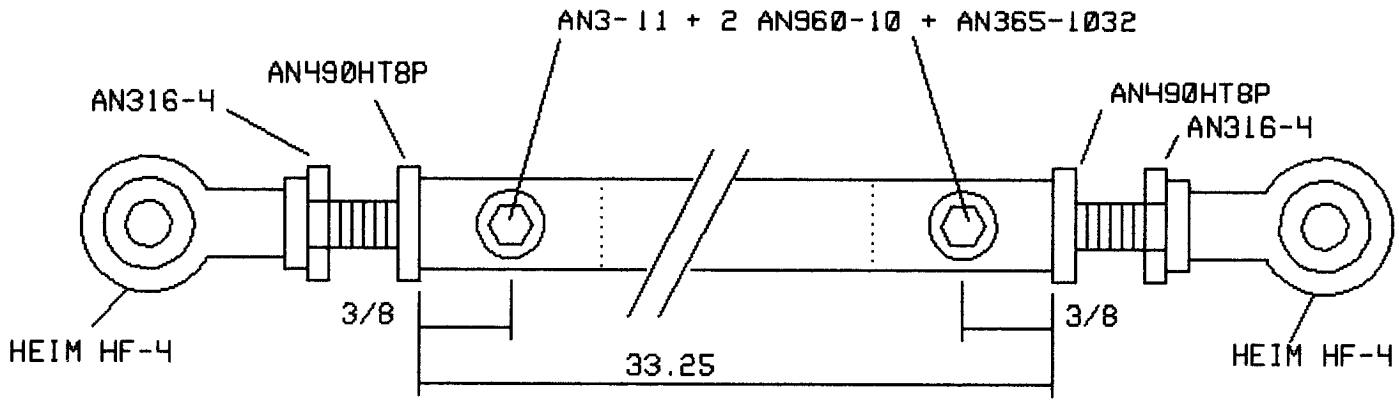
Hardware:

- **AN490HT8P** rod-end inserts (4)
- **Heim HF-4** female rod ends (4)
- **AN3-11A** bolt (4)
- **AN960-318** washers (8)
- **AN365-1032** nylock nuts (4)
- **AN4-17A** bolt (4)
- **AN4-20A** bolt (2)
- **AN4-26A** bolt (1)
- **AN4-31A** bolt (1)
- **AN960-416** washer (24)
- **AN970-4** washers (2)
- **AN365-428** nylock nut (8)

Assembly:

- Attach the two large brackets at the rear 1/4 inch hole on the keel as indicated in G3-3.
- Attach the remaining two small brackets at the 1/4 inch hole in the keel just behind the seat braces as indicated in G3-3. Note that there is an AN970 washer against the keel, followed by the lap belt end fittings (use the lower hole), and finally the bracket on each side.
- Wrap the axle threads with several layers of masking tape to prevent thread damage as you work with the airframe. Attach the right and left axle struts to the large brackets using the hardware indicated in G3-3. Use additional washers between the tube wall and the brackets, as needed, to minimize side play.

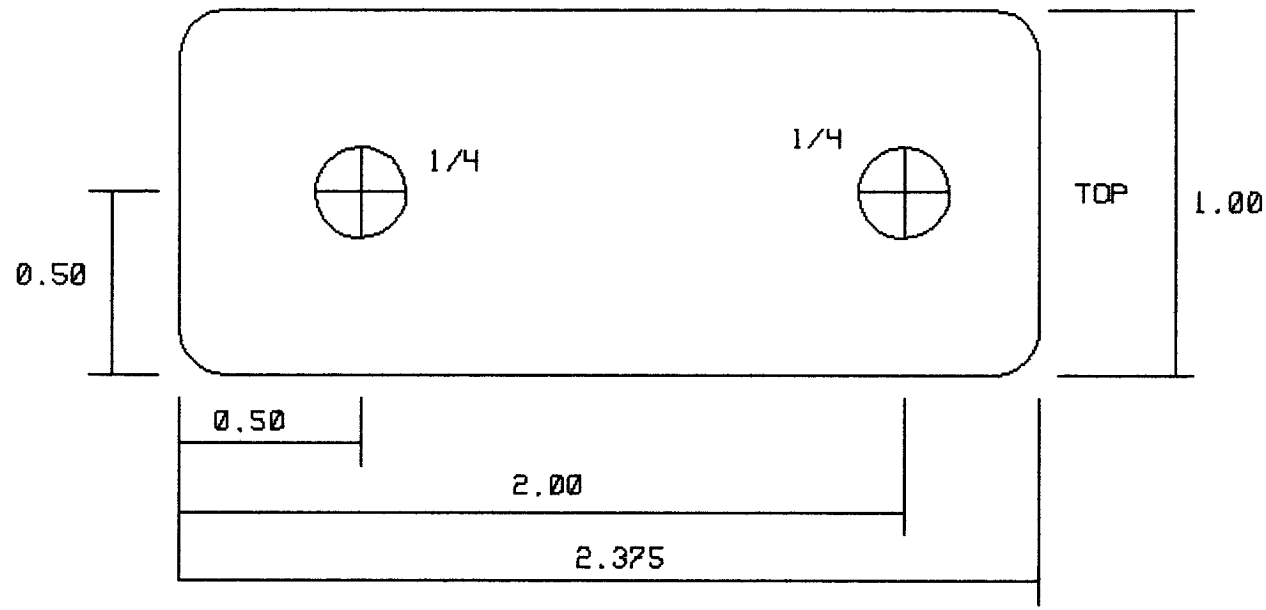
- Follow the printed instructions on G3-3 to attach the drag struts, on each side of the aircraft, between the small bracket on the keel and the forward-facing bracket on the axle strut. Adjust the length of the struts using the threaded Heim fittings at both ends of each strut so the gear legs are essentially at right angles to the keel with the struts in place. We will fine-tune this later when the vertical struts and nose wheel have been installed.
- Grease the two main axles and install the KB-2 main gear wheels with the hardware provided. **Be sure to install the cotter pins in each axle to secure the castle nuts.**



MATERIAL: 9/16 DIA. .065 WALL 4130 CHROMOLY TUBE STOCK

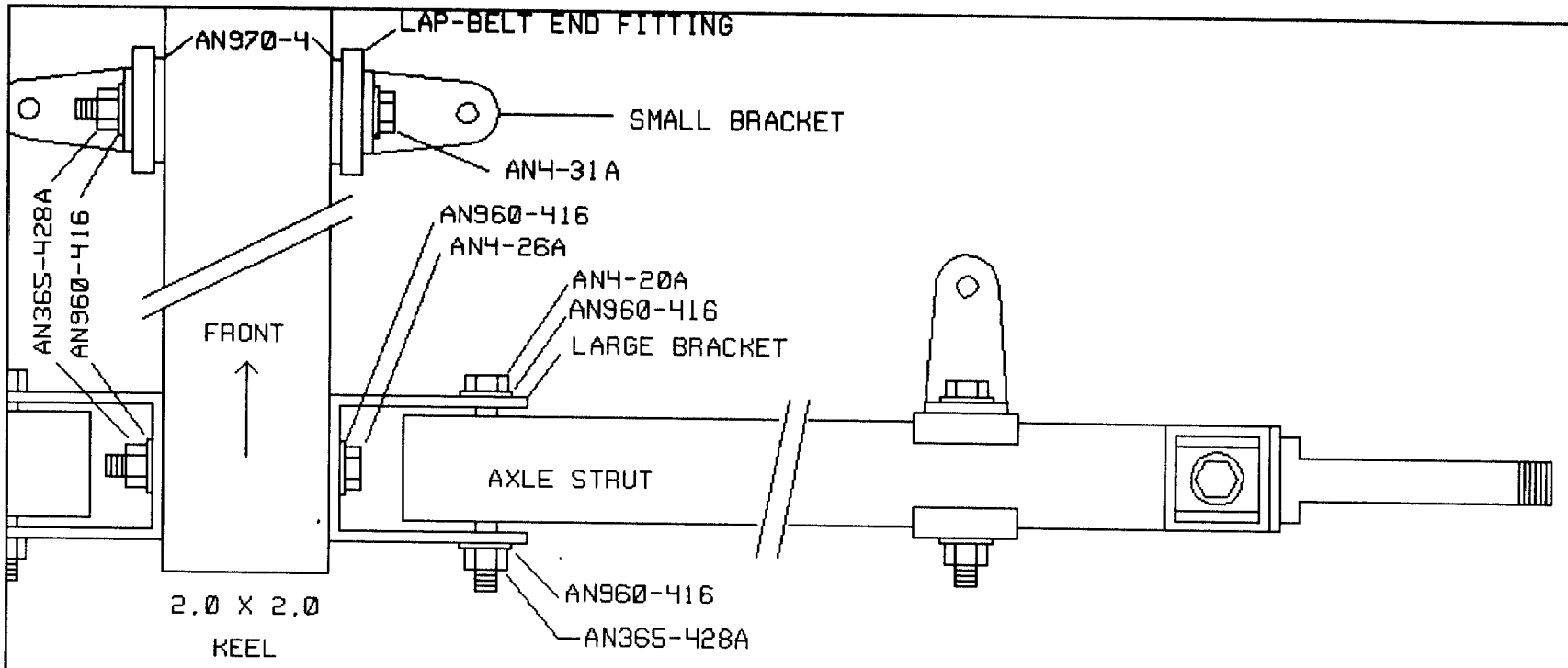
PRIOR TO DRILLING THE HOLES TO SECURE THE TUBE END FITTINGS, IT IS SUGGESTED THAT YOU CHECK THE STRUTS FOR OPTIMUM LENGTH. SET ONE OF THE GEAR AXLE STRUTS AS CLOSE TO 90 DEGREES TO THE KEEL AT POSSIBLE. TEMPORARILY SCREW THE HEIM ENDS TO THE END FITTINGS AT ABOUT THE HALF-WAY POINT AND SLIDE THE FITTINGS INTO THE ENDS OF THE STRUT. AT THIS POINT, CHECK THE TOTAL LENGTH AGAINST THE DISTANCE BETWEEN THE DRAG STRUT ATTACHMENT BRACKETS (SEE G3-3). SHORTEN THE LENGTH OF THE DRAG STRUT, IF REQUIRED, FOR A GOOD FIT. TRIM BOTH STRUTS TO THE SAME LENGTH AND THEN DRILL THE HOLES FOR THE ROD END FITTINGS AND INSTALL.

The GYROBEE	DATE: MAY 98 REV: 2.10
DRAWING: AXLE DRAG STRUTS (2 RQD) G3-1	SCALE: INCHES PAGE OF



MATERIAL: 1/8 THK STAINLESS SHEET STOCK

The GYROBEE	DATE: SEP 97 REV: 1.00
DRAWING: LAP BELT END FITTING G3-2 (2 REQUIRED)	SCALE: PAGE OF



HORIZONTAL STRUT ATTACHMENTS NOT SHOWN.
EACH STRUT IS SECURED TO THE SMALL BRACKETS ON THE AXLE AND KEEL WITH AN AN4-17 BOLT, 2 AN960-416 WASHERS, AND AN AN365-428A NUT. ADDITIONAL AN960-416 WASHERS SHOULD BE USED INTERNAL TO THE BRACKETS AS SPACERS TO PROVIDE A SNUG FIT.

RIGHT SIDE SHOWN - LEFT IS OPPOSITE

The GYROBEE	DATE: REV:
DRAWING: MAIN GEAR MOUNTING G3-3	SCALE: INCHES PAGE OF

PHASE 4 - MAIN GEAR SHOCK STRUTS

Prints:

- **G4-1** - Temporary Shock Plate
- **G4-2** - Shock Plate
- **G4-3** - Upper strut Fittings
- **G4-4** - Main Gear Vertical Struts

Fabrication Notes:

- **G4-1 - Temporary Shock Plate**. This part can be made from any alloy as it is only used as a temporary anchor for the struts during construction.
- **G4-2 - Shock Plate.** Since this piece is fabricated from 1/8 inch stainless sheet stock, you may wish to have it made by a machine shop**.** Put this part aside for later use.
- **G4-3 - Upper Strut Fittings.** These are machined parts.
- **G4-4 - Main Gear Vertical Struts**

Hardware:

- **AN3-14A** bolt (2)
- **AN960-316** washer (4)
- **AN365-1032** nylock nuts (2)
- **AN4-17A** bolt (2)
- **AN960-416** washers (12)
- **AN365-428** nylock nuts (2)

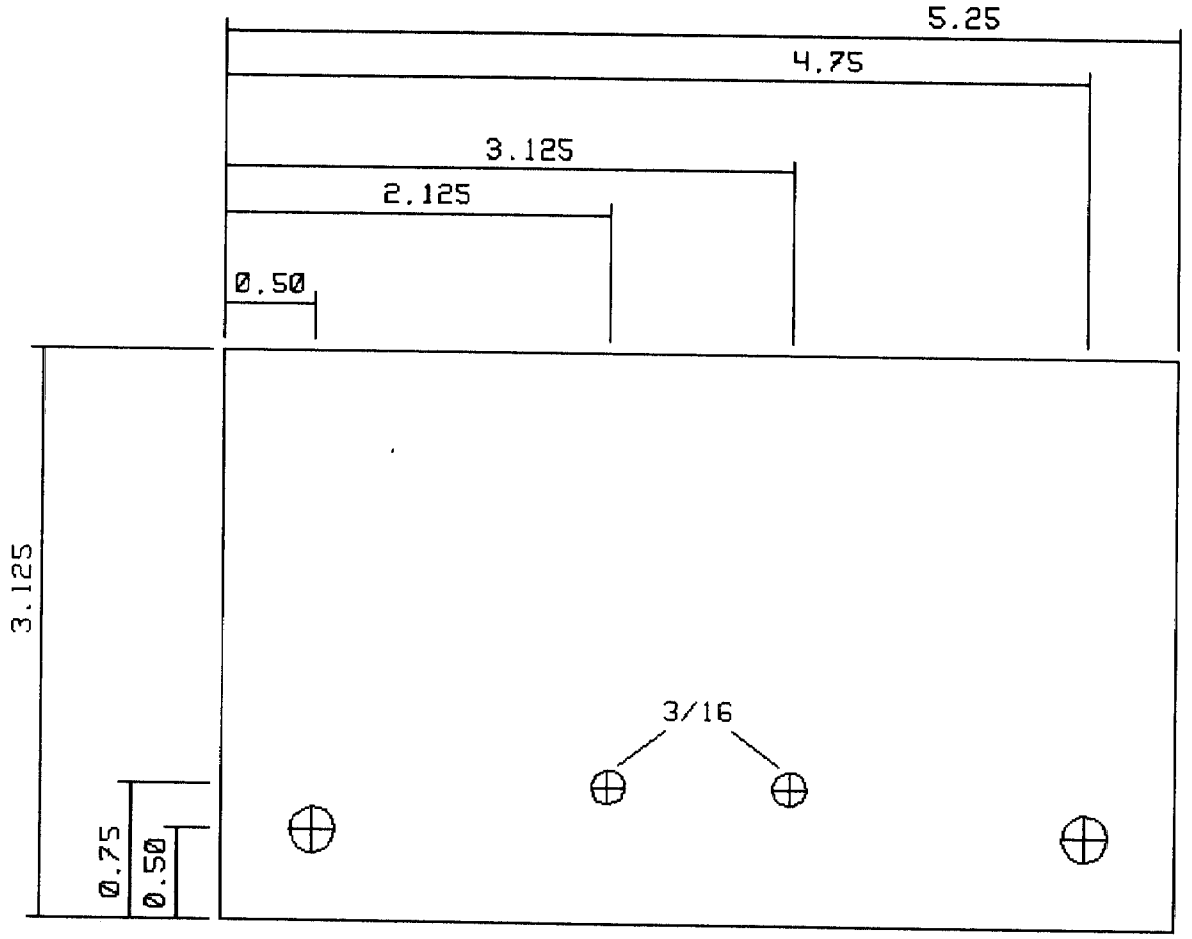
Assembly:

- Attach the temporary shock plate to the rear of the mast at the 3/16 inch holes. The edge of the plate without the holes should be oriented upward. Secure with hardware-store quality 3/16 bolts. The plate and hardware will be replaced later in assembly.

- Slide an upper strut fitting into the end of each vertical strut (the end with the 3/16 hole). Rotate the fitting to align the holes and secure with the AN3 hardware indicated in G4-4.

- Secure the other end of each vertical strut to the small vertical bracket at the far end of each axle strut. Use an AN4-17A bolts, two AN960-416 washers, and an AN365-428 nut at each point. Use additional washers, as needed, between the tube wall and the bracket to minimize side play.

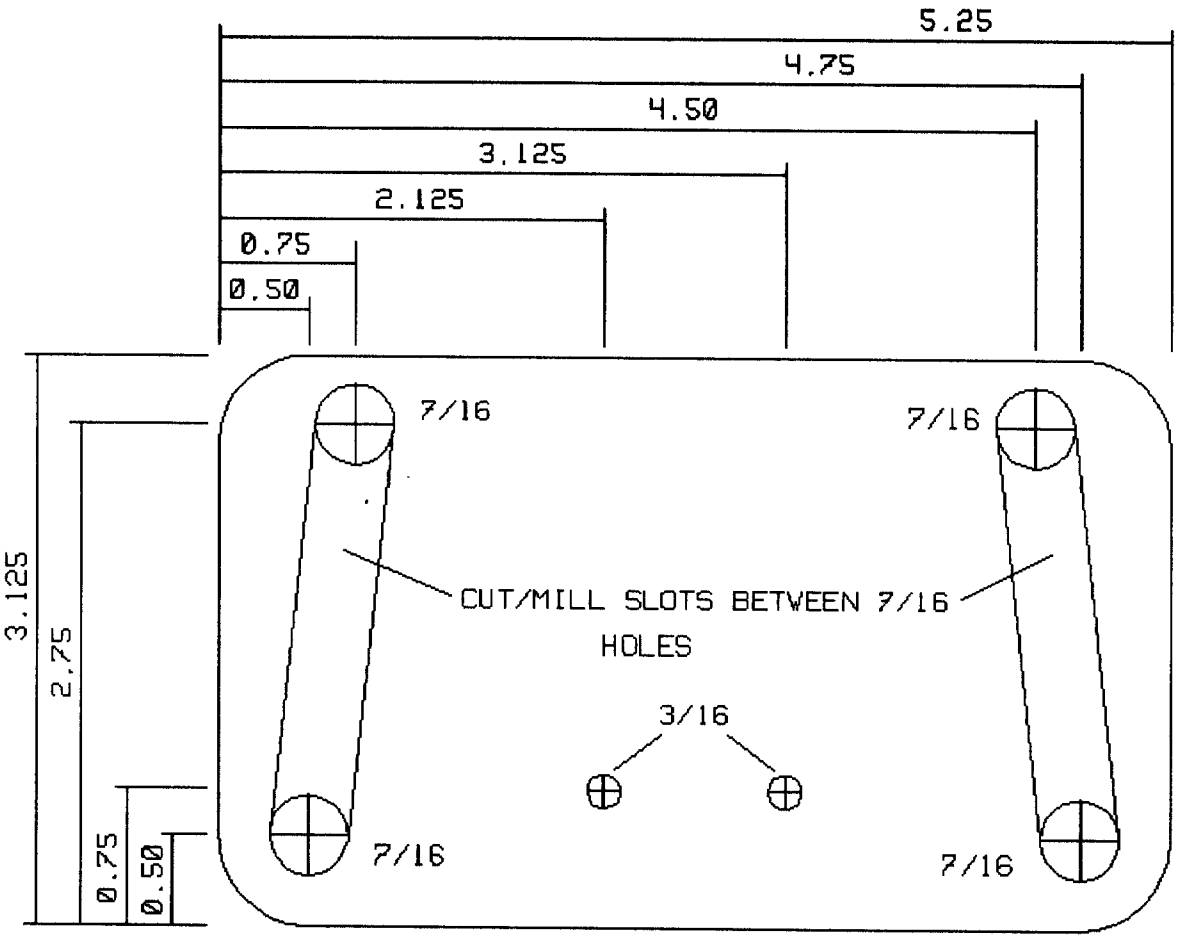
For each vertical strut, slide the slotted end of the upper strut fitting over the edge of the temporary shock plate and pin to the plate with a hardware-store quality 1/4 inch bolt. This hardware will be replaced later in assembly. The frame can now be allowed to rest on the main gear.



MATERIAL: 1/8 INCH ALUM SHEET STOCK

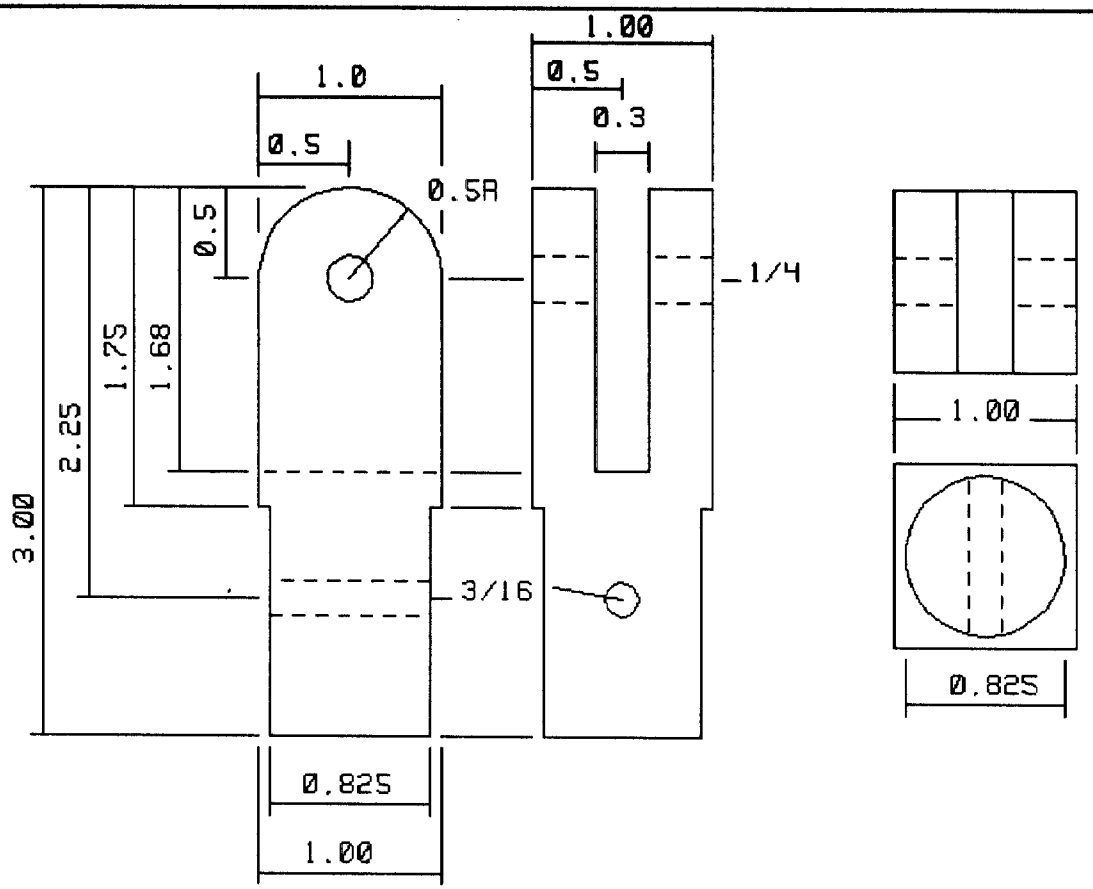
ANY GRADE OF ALUMINUM SHEET STOCK CAN BE USED AS THIS IS NOT A FLIGHT-READY COMPONENT

The GYROBEE	DATE: SEP 91 REV: 2.0
DRAWING: TEMPORARY SHOCK PLATE GH-1	SCALE: INCHES PAGE OF



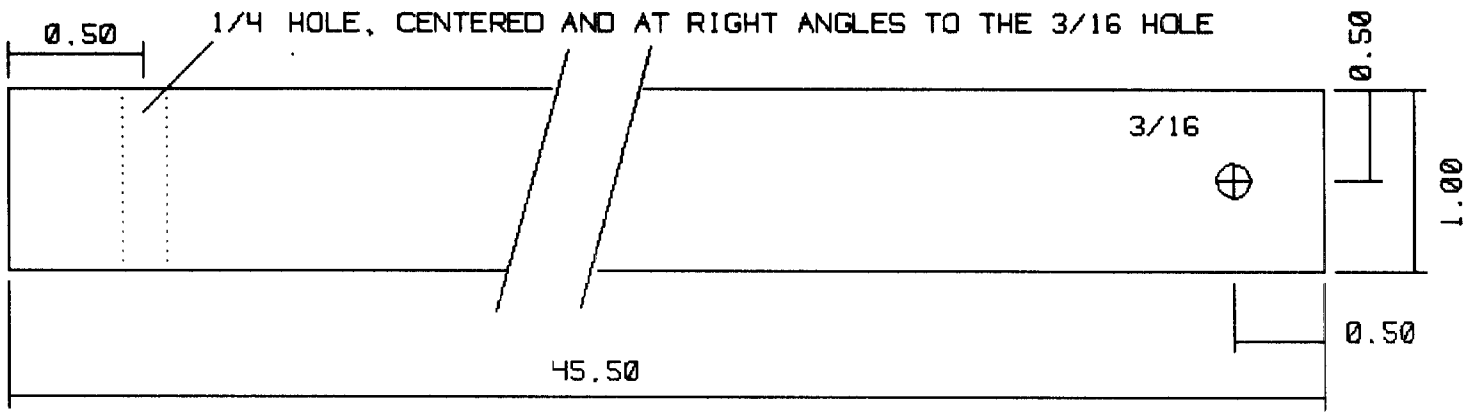
MATERIAL: 1/8 INCH STAINLESS SHEET
CORNERS ROUNDED ON 1/2 INCH RADIUS

The GYROBEE	DATE: SEP 91 REV: 2.0
DRAWING: SHOCK PLATE (1 ROD) G4-2	SCALE: INCHES PAGE OF

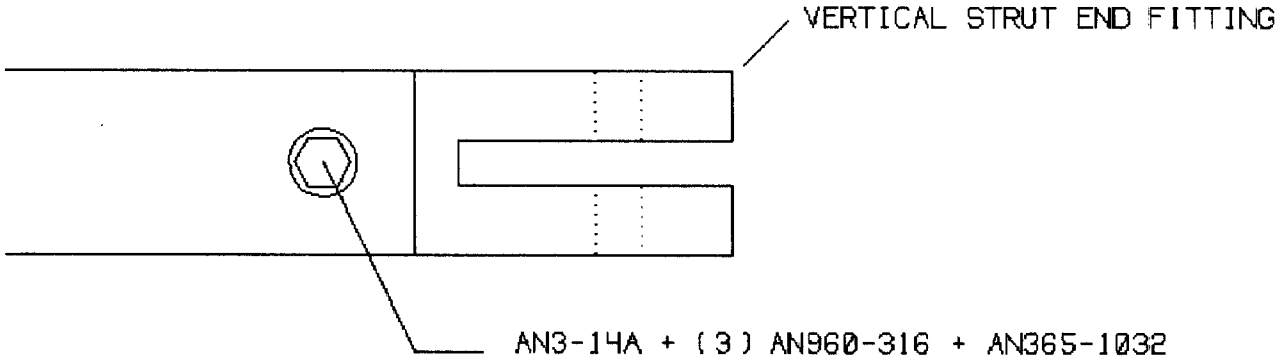


MATERIAL: ALUMINUM (6061-T6) BAR STOCK

The GYROBEE	DATE: APRIL 88 REV: 1.0
DRAWING: MACHINED PARTS G4-3 UPPER STRUT FITTING (2 RQD)	SCALE: INCHES PAGE OF



MATERIAL: 1 INCH O.D. 0.063 WALL 6061-T6 ALUM. TUBE STOCK



END FITTING MOUNTING DETAIL

The GYROBEE	DATE: MAY 88 REV: 1.0
DRAWING: MAIN GEAR VERTICAL STRUT G4-4 (2 RQD)	SCALE: INCHES PAGE OF

PHASE 5 - NOSE BLOCK INSTALLATION

Prints:

- **G5-1** - Nose Block
- **G5-2** - Nose Block Cheek Plates
- **G5-3** - Nose Block Installation

Fabrication Notes:

- **G5-1 - Nose Block**. This is a machined component. This part could be made of 6061-T6 aluminum, but the steel is stronger and provides needed nose weight.

Hardware:

- **AN3-26A** bolts (8)
- **AN960-316** washers (16)
- **AN365-1032** nylock nuts (8)

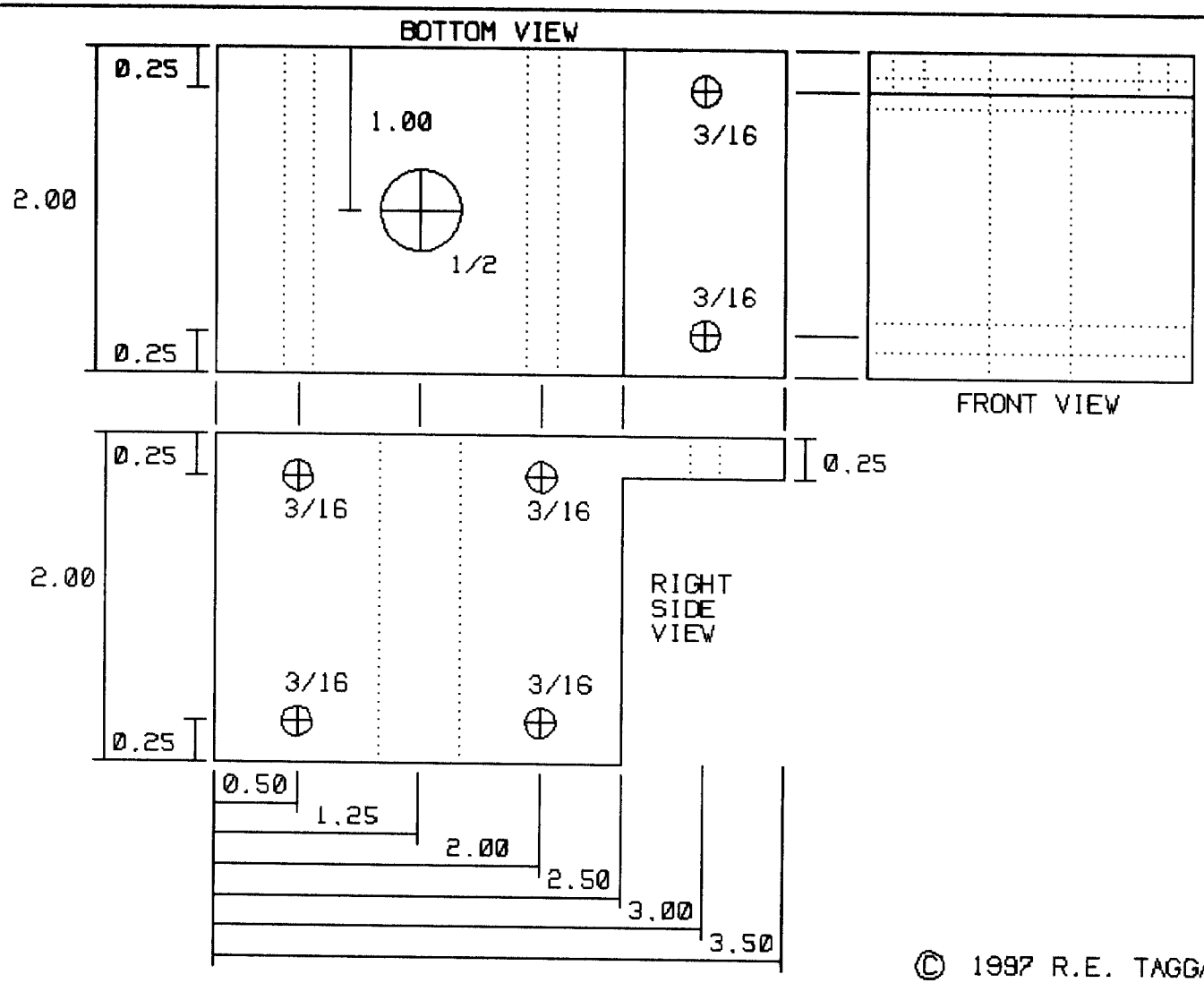
Assembly:

- Loosely bolt the cheek plates on either side of the nose block.

- Place the rear of the nose block flush with the front of the keel tube and insert the remaining four AN3 bolts.

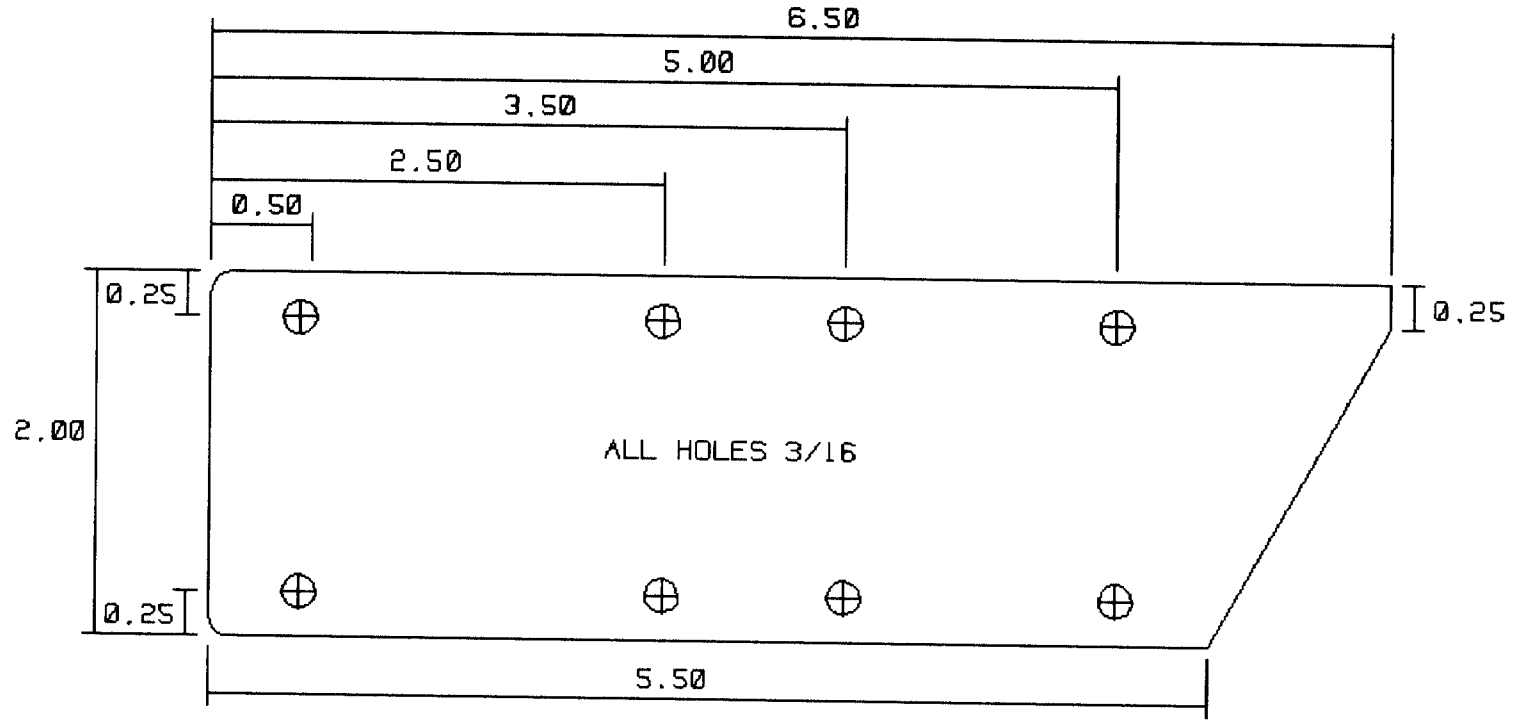
- Making sure to maintain alignment, tighten all nuts.

- At this point, the nose wheel assembly can be temporarily attached to the nose block using a hardware-store-grade 1/2 inch bolt. This makes it easier to move the airframe around. The nosewheel will be permanently mounted later.



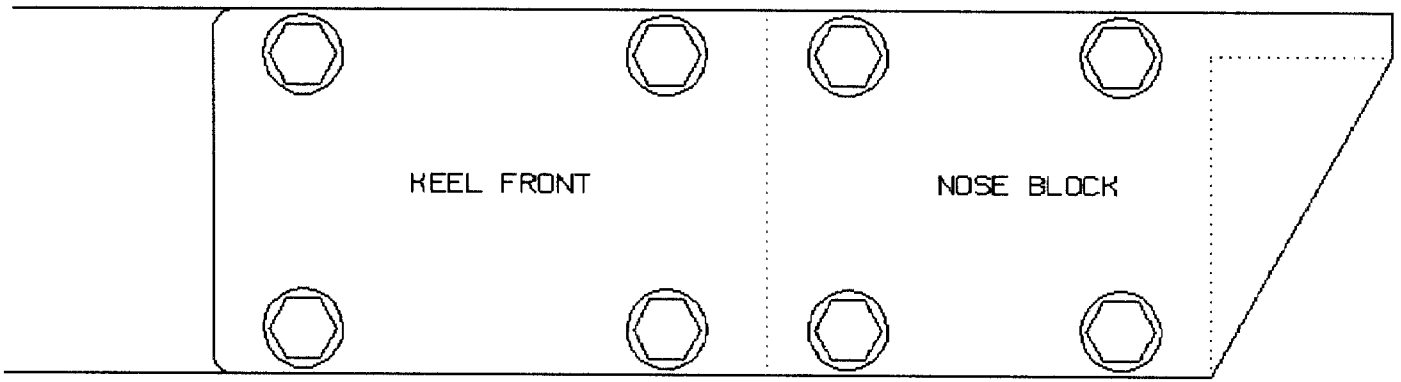
VIRTUALLY ANY GRADE OF STEEL CAN BE USED FOR THIS COMPONENT. PRIME AND PAINT PRIOR TO ASSEMBLY TO INHIBIT RUST.

The GYROBEE	DATE: SEP 97 REV: 3.0
DRAWING: NOSE BLOCK (1 ROD) G5-1 MATERIAL: STEEL	SCALE: PAGE OF



NOSE BLOCK CHEEK PLATES (2 REQD) - 1/8 INCH 6061-T6 SHEET.

The GYROBEE	DATE: SEP 97 REV: 2.0
DRAWING: NOSE WHEEL CHEEK PLATES G5-2	SCALE: PAGE OF



MOUNTING HARDWARE:

8 - AN3-26A BOLTS

16 - AN960-316 WASHERS

8 - AN365-1032 NUTS

The GYROBEE	DATE: SEP 97 REV: 2.0
DRAWING: NOSE BLOCK ASSEMBLY GS-3	SCALE: PAGE OF

PHASE 6 - ENGINE MOUNT

Prints:

- **G6-1** - Horizontal Engine Strut
- **G6-2** - Diagonal Engine Strut
- **G6-3** - Engine Mount Assembly

Fabrication Notes:

- In addition to the four struts shown on G6-1 and G6-2, you will have to make two one inch spacers from 3/8 O.D. (1/4 I.D.) 6061-T6 aluminum tube stock. Both ends of each spacer should be square with respect to the tube wall.

Hardware:

- **AN3-6A** bolt (2)
- **AN960-316** washers (6)
- **AN4-6A** bolt (2)
- **AN4-30A** bolts (1)
- **AN4-52A** bolt (1)
- **AN960-416** washers (6)
- **AN970-4** washers (14)
- **AN365-428** nylock nuts (6)

Assembly:

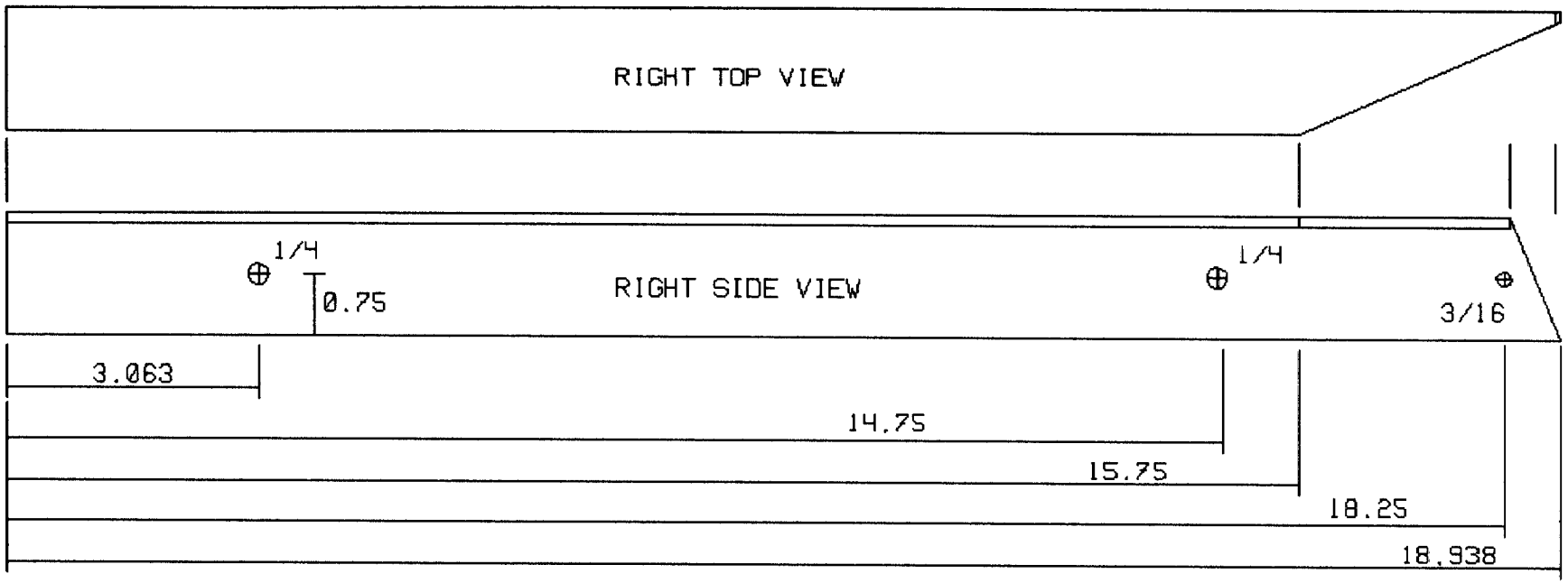
- Using Detail B of G6-3 as a guide, mount the two horizontal engine bearers, including the use of two AN970-4 washers between each bearer and the mast. Although not labe;ed in the detail, the usual AN960 washers are used under the head and nut. Tighten the nut enough to hold the bearers but loose enough that they can be rotated slightly. The top of the temporary shock plate should just reach the bottom edge of the two bearer struts.

- Using Detail A of G6-3 as a guide, secure the bottom end of each diagonal strut. Note that four AN970-4 washers are used as spacers on each side and that AN970-4 washers replace the normal AN960 washers at the outboard enf of each spacer. Tighten the nut but allow for movement of the strut at this point.

- Attach the upper end of each diagonal strut to the outside of the horizontal strut using the hardware indicated.

- With the ends of the horizontal strut overlapping the outside of the two seat braces, match drill 3/16 holes in the seat braces, securing with the AN-3 hardware indicated. Note that the AN960 washer is mistakenly labeled as AN960-10 - it should be AN960-316.

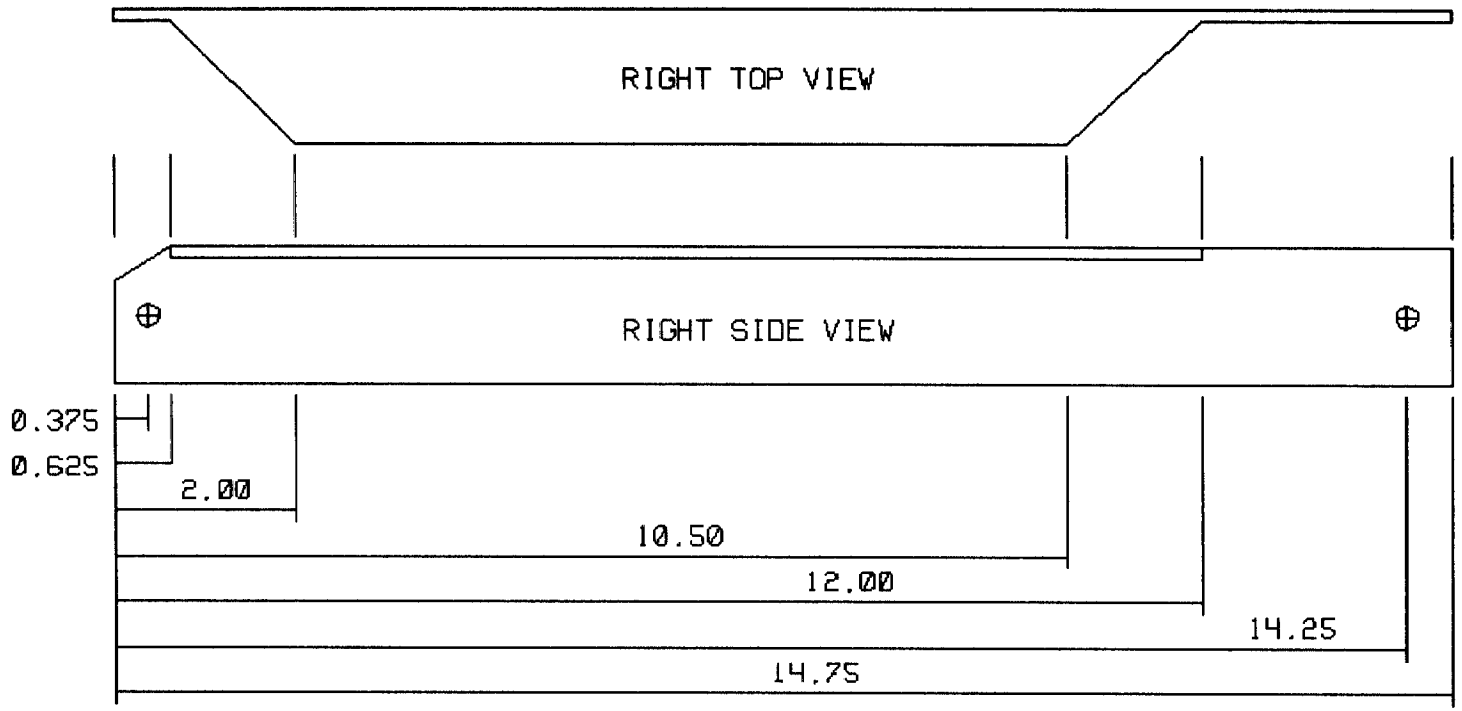
- Tighten all remaining nutes.



RIGHT STRUT SHOWN - LEFT IS OPPOSITE

MATERIAL: 1.5 x 1.5 x 1/8 6061-T6 EXTRUDED ANGLE

The GYROBEE	DATE: SEP 97 REV: 2.0
DRAWING: HORIZONTAL ENGINE STRUT G6-1 2 REQUIRED	SCALE: PAGE OF

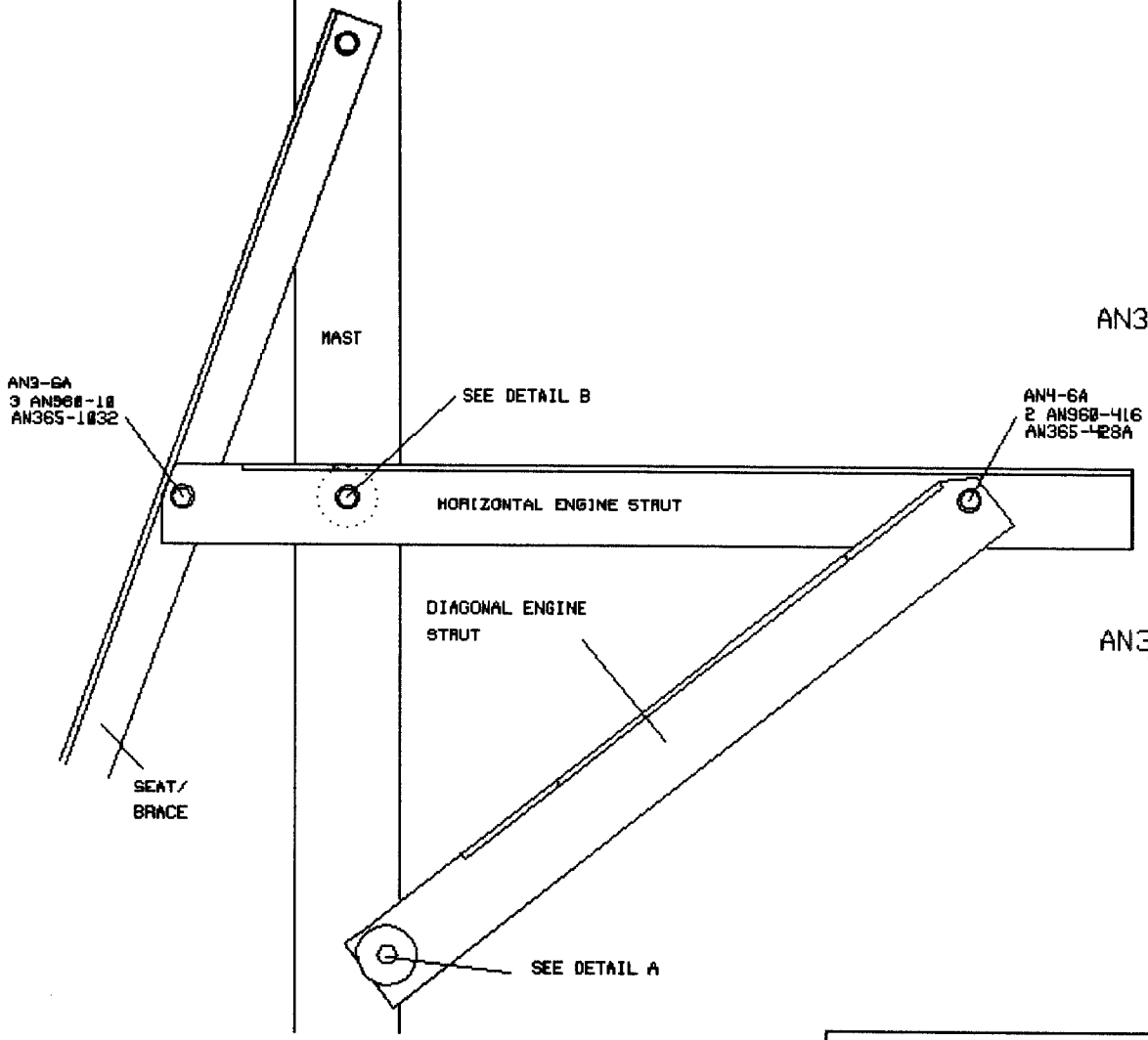


ALL HOLES 1/4 INCH

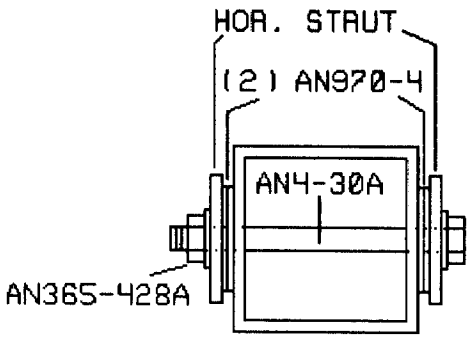
RIGHT SIDE SHOWN - LEFT IS OPPOSITE

MATERIAL: 1.5 X 1.5 X 1/8 6061-T6 EXTRUDED ANGLE

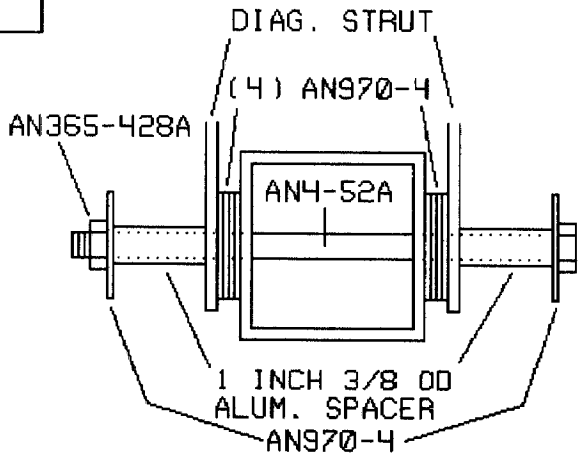
The GYROBEE	DATE: SEP 97 REV: 2.0
DRAWING: DIAGONAL ENGINE STRUT G6-2 (2 REQUIRED)	SCALE: PAGE OF



LEFT SIDE VIEW



DETAIL B



DETAIL A

The GYROBEE	DATE: SEP 97 REV: 3.0
DRAWING: ENGINE MOUNT ASSEMBLY G6-3	SCALE: NA PAGE OF

PHASE 7 - FUEL TANK MOUNT

Prints:

- **G7-1** - Horizontal Strut/Beam
- **G7-2** - Diagonal Strut
- **G7-3** - Cross and Side Pieces
- **G7-4** - Top View
- **G7-5** - Side View

Fabrication Notes:

- There are no particular difficulties here - just remember to trim the cross-pieces as indicated (G7-3) after drilling.

Hardware:

- **AN3-6A** bolts (6)
- **AN3-30A** bolt (1)
- **AN960-316** washers (14)
- **AN365-1032** nylock nuts (6)
- **3/16 pop-rivets** - aluminum

Assembly:

- Take a 6 inch length of 2 X 2 x 1/8 wall square tube and drill a 3/16 hole displaced 0.25 inch from one wall. Temporarily bolt the horizontal beams/struts to this piece as if it were the mast in G7-5. Hardware-store 3/16 bolt, nut, and washers will do as they will be removed later.

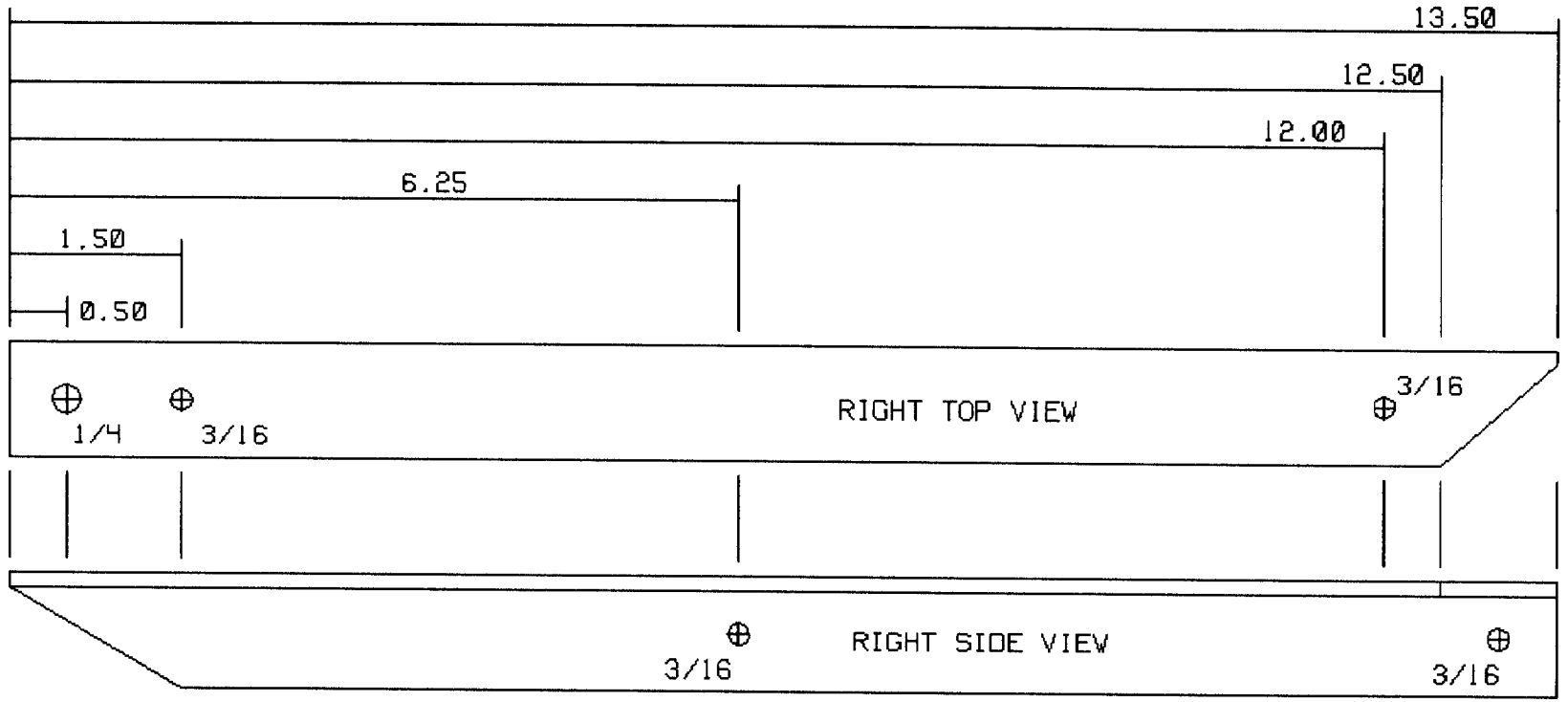
- Bolt on the cross-pieces with the indicated AN3 hardware per G7-4.

- Pop-rivet the side beams into place per G7-4.

- Take the assembly to a welding shop and have the horizontal, cross, and side pieces heliarc welded. **Do not weld the horizontal beams to the dummy mast piece**!

- Remove the dummy mast section and bolt the assembly to the mast using the AN3 hardware indicated in G7-5. Tighten the nut just enough to permit some movement of the assembly.

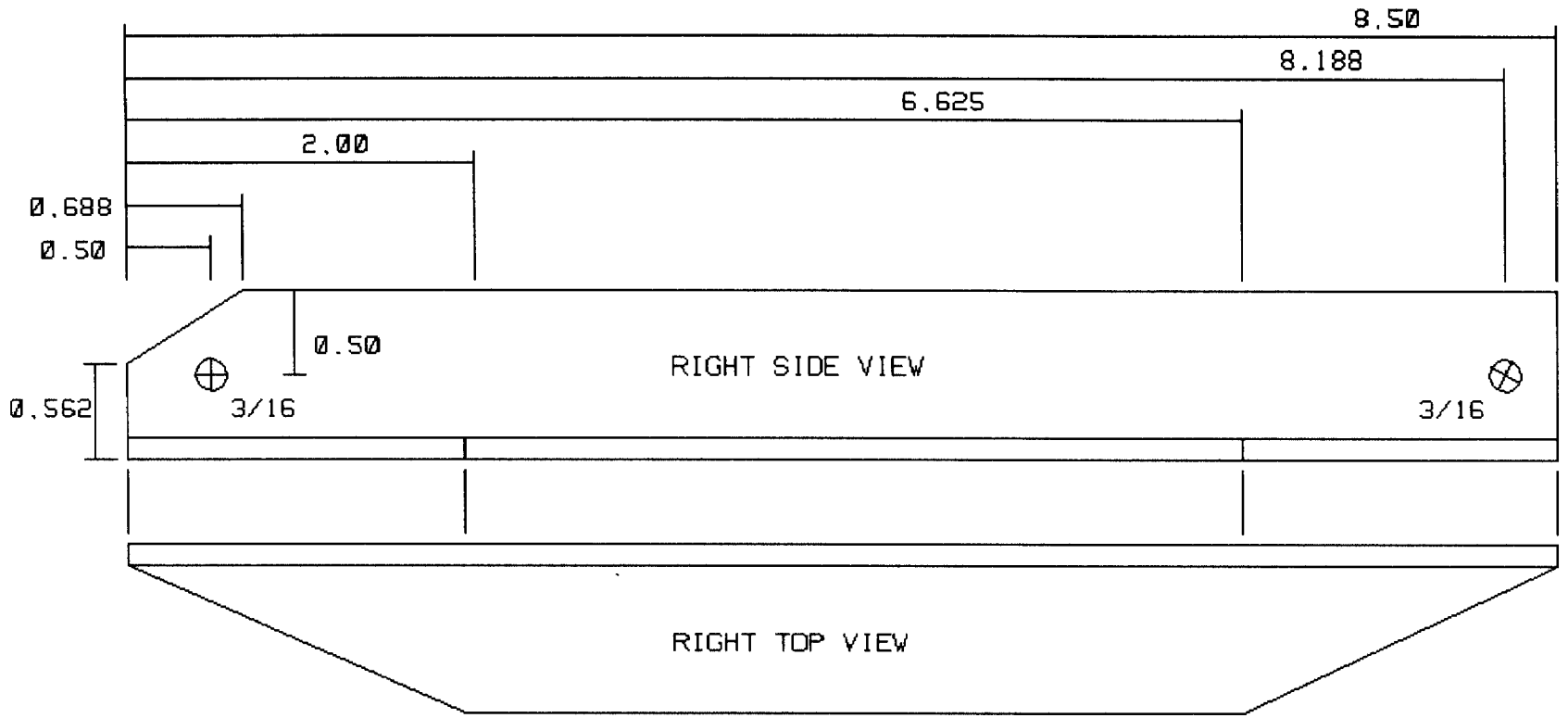
Install the diagonal struts per G7-5 and tighten all nuts.



MATERIAL: 1 x 1 x 1/8 6061-T6 EXTRUDED ANGLE STOCK

RIGHT MOUNT SHOWN - LEFT IS OPPOSITE

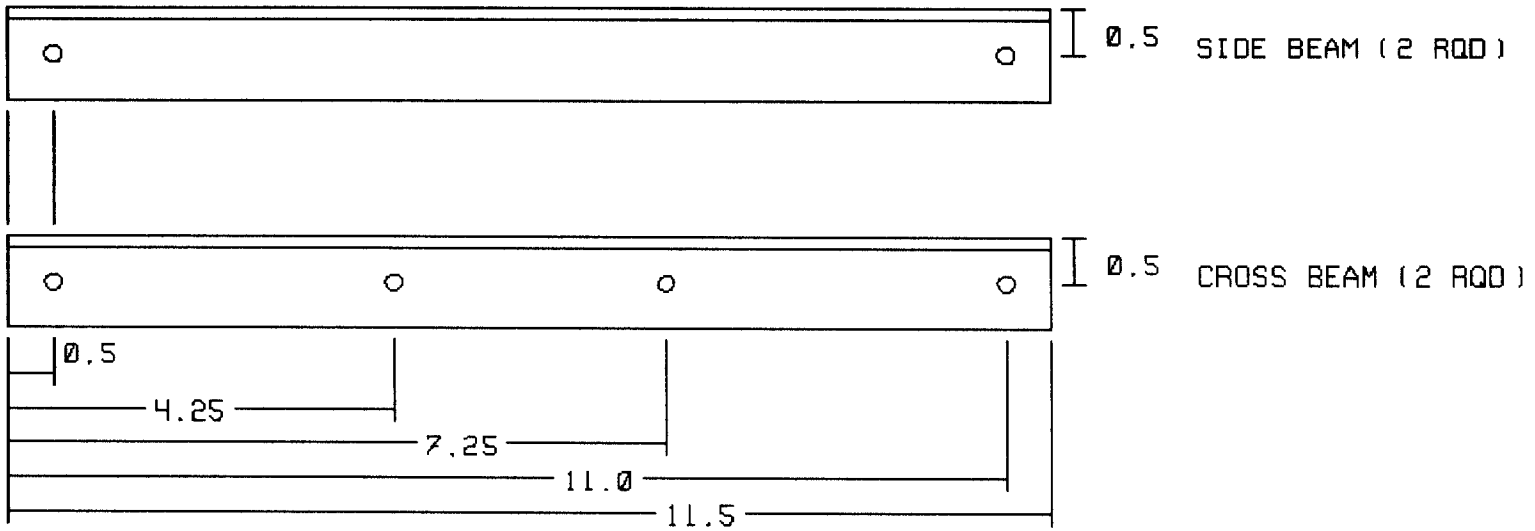
The GYROBEE	DATE: SEP 97 REV: 2.0
DRAWING: FUEL TANK MOUNT (EIPPER) G7-1 HORIZONTAL BEAM (2 RQD)	SCALE: PAGE OF



MATERIAL: 1 x 1 x 1/8 6061-T6 EXTRUDED ANGLE

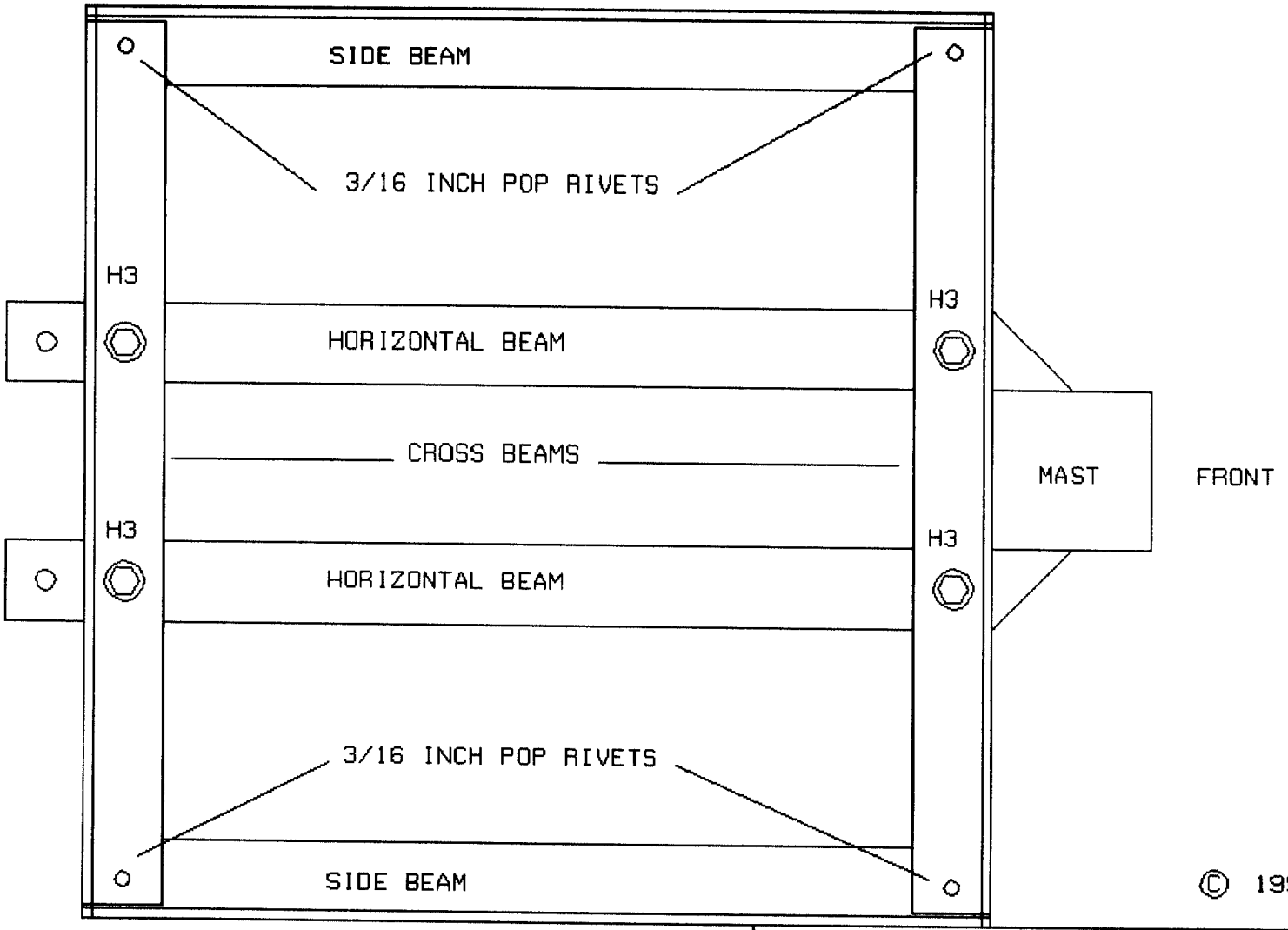
RIGHT PIECE SHOWN - LEFT IS OPPOSITE

The GYROBEE	DATE: SEP 97 REV: 2.0
DRAWING: FUEL TANK MOUNT DIAGONAL STRUT (2 ROD) G7-2	SCALE: PAGE OF



MATERIAL: 1 X 1 X 1/8 6061-T6 EXTRUDED ANGLE
ALL HOLES 3/16
CUT 3/16 OFF EACH END OF EACH CROSS BEAM AFTER DRILLING PIECE

The GYROBEE	DATE: MAY 88 REV: 1.0
DRAWING: FUEL TANK MOUNT CROSS AND SIDE PIECES G7-3	SCALE: INCHES PAGE 2 OF 5



H3: AN3-6A BOLT, 3 AN960-10 WASHERS, AN365-1032 NUT (4 SETS RQD). SEE ASSEMBLY NOTES FOR ALTERNATE SIZING AND FRAME WELDING OPTIONS

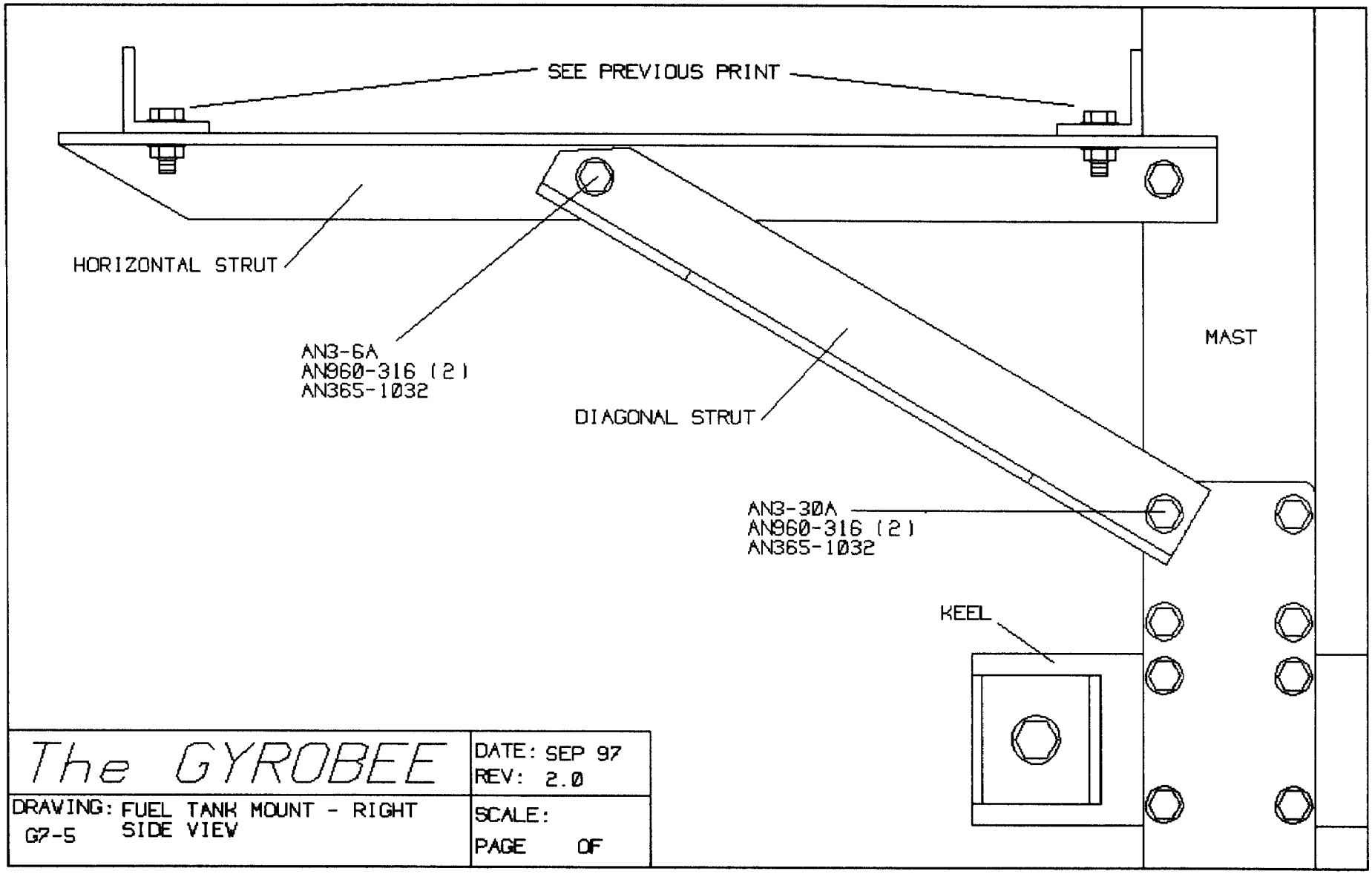
The GYROBEE

DRAWING: FUEL TANK MOUNT (EIPPER GT)
G7-4 TOP VIEW

DATE: MAY 88
REV: 1.0

SCALE: NONE

PAGE OF



The GYROBEE	DATE: SEP 97 REV: 2.0
DRAVING: FUEL TANK MOUNT - RIGHT SIDE VIEW G7-5	SCALE: PAGE OF

PHASE 8 - RUDDER PEDALS AND LINKAGES

Prints:

- **G8-1** - Rudder Pedal Bracket
- **G8-2** - Rudder Pivot Brackets
- **G8-3** - Rudder Pedals
- **G8-4** - Rudder Control Horn
- **G8-5** - Rudder Control Horn Brace
- **G8-6** - Spring and Heim Rod Attach Points
- **G8-7** - Assembly Top View
- **G8-8** - Assembly Side View
- **G8-9** - Rudder Pedal-Control Horn Connections

Fabrication:

The prints contain all the essential fabrication details.

Hardware:

- **AN3-6A** bolt (6)
- **AN3-7A** bolt (6)
- **AN960-316** washer (24)
- **AN365-1032** nylock nuts (12)
- **AN4-7A** bolt (4)
- AN4-11A bolt (2)
- **AN4-22A** bolt (2)
- **AN960-416** washer (38)
- **AN8-27** bolt (1)
- **AN960-816** washer (2)
- **AN310-8** castle nut and matching cotter pin (1)
- **AN115-21** shackle (2)
- **AN316-4** check nut (2)
- **HM4** Heim rod end (2)
- **HF4** Heim rod end (2)

Assembly:

- Fabricate both the rudder pedal bracket (**G8-1**) and rudder pivot brackets (**G8-2**) and attach the pivot brackets to the pedal bracket using the hardware indicated in **G8-1**.

- Attach the rudder pedal bracket to the nose block (see **G8-7**) using the hardware indicated in **G8-1.**

- Fabricate the rudder pedals per **G8-3**.

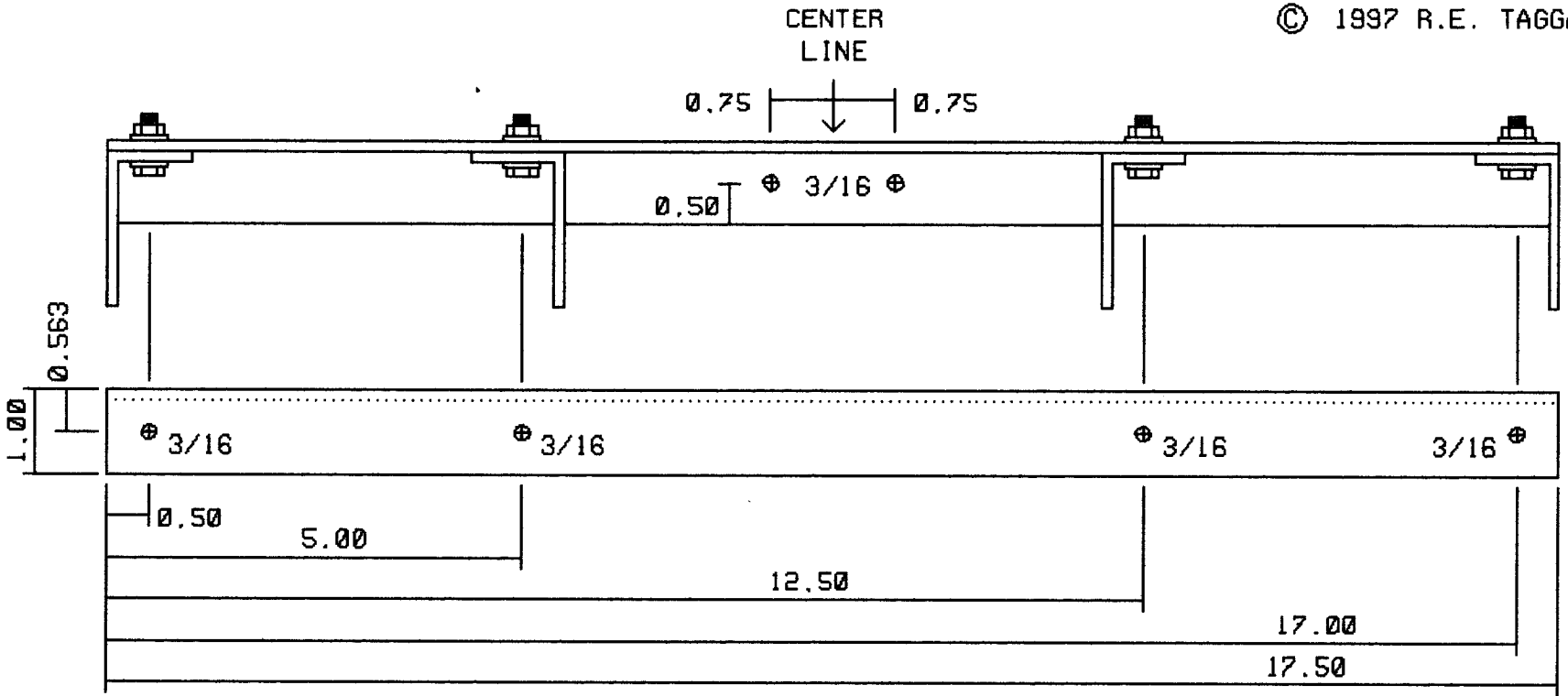
- Fabricate both the rudder control horn (**G8-4**) and brace (**G8-5**).

- Following the detail view on the **left** side of **G8-6**, attach the bracket to the lower side of the front of the control horn at the two end-holes. As you assemble these pieces on the AN4-22A bolt, install an HM4 Heim rod end in the space indicated.

- Following the detail view on the **right** side of **G8-6**, install the wheel-spring attach points in the holes on either side of the nose-wheel fork.

- Using **G8-9** as a guide, thread a check nut on each HM4 threaded extension followed by an HF4 fitting.

- The HF4 fittings connect to the lower extension of the rudder pedals using an AN4-11A bolt as indicated. Adjust the position of each HF4 fitting so that, when they are attached to the pedals, the control horn is centered and both pedals show equal deflection. Once this is achieved, tighten the check nuts. Install the nut on the AN4-11 bolts only hand-tight at this point, since they will have to be removed for final rudder cable installation.



MATERIAL: 1 X 1 X 1/8 INCH EXTRUDED 6061-T6 ALUM. ANGLE STOCK

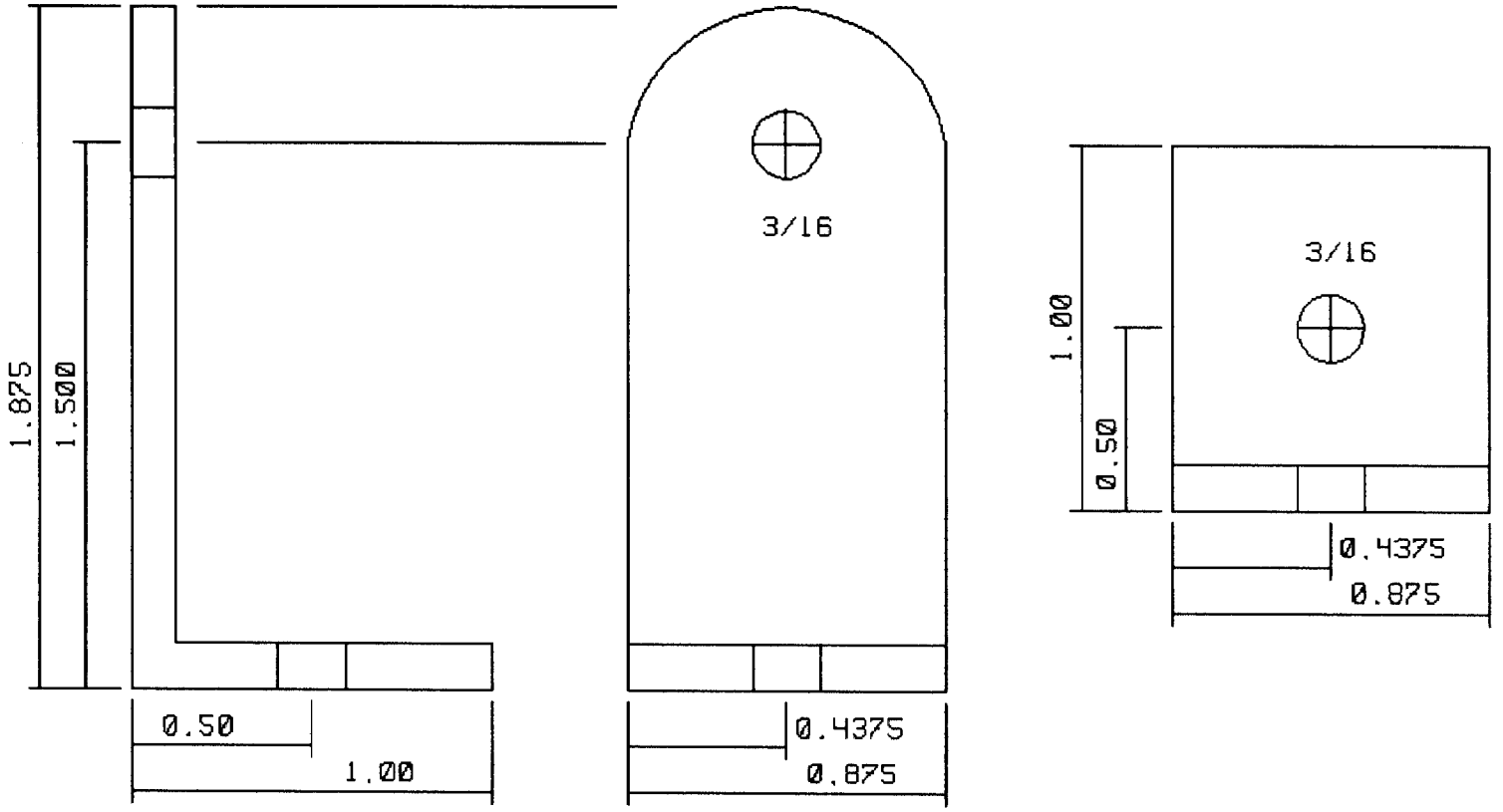
RUDDER PEDAL PIVOT BRACKETS SHOWN MOUNTED - SEE GB-31 FOR BRACKET

PEDAL BRACKET IS ATTACHED TO THE NOSE BLOCK WITH AN AN3-7A BOLT, TWO AN960-316 WASHERS AND AN AN365-1032 NUT AT EACH OF THE TWO 3/16 HOLES ADJACENT THE CENTER LINE.

INDIVIDUAL HINGE BRACKETS (4 TOTAL) ATTACH TO THIS BRACKET USING AN AN3-6A BOLT, 3 AN960-10 WASHERS, AND AN AN365-1032 NUT.

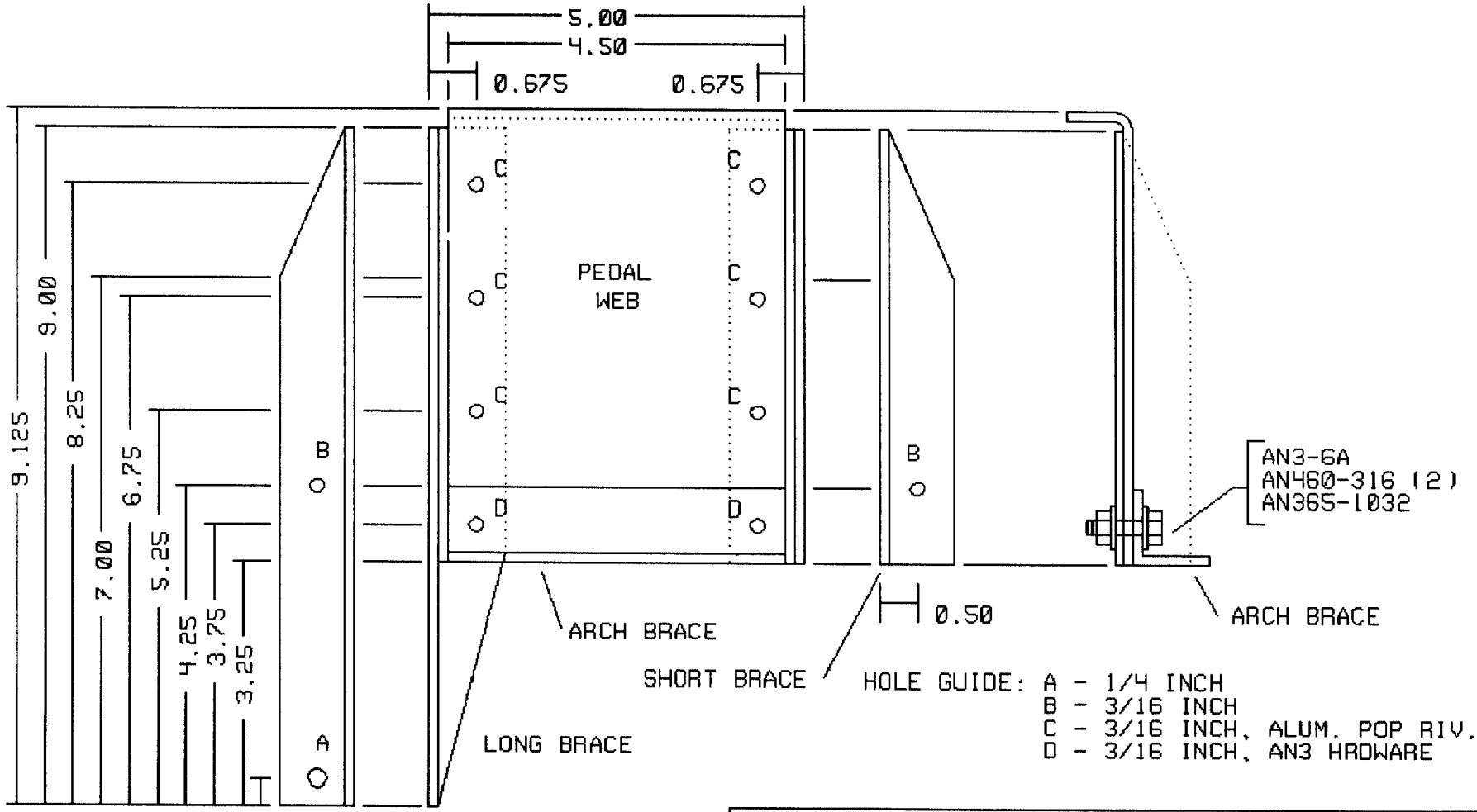
PEDALS ATTACH TO THE BRACKETS WITH AN AN3-7A BOLT, 3 AN960-10 WASHERS, AND AN AN365-1032 NUT AT EACH PIVOT HOLE. AN ADDITIONAL WASHER IS USED BETWEEN EACH PEDAL SIDE AND BRACKET TO REDUCE SIDE PLAY.

The GYROBEE	DATE: MAY 98 REV: 3.10
DRAWING: RUDDER PEDAL BRACKET GB-1	SCALE: INCHES PAGE OF



FABRICATE BRACKETS FROM PIECES CUT FROM 2 X 2 X 1/8 INCH SQUARE EXTRUDED ALUM. TUBE STOCK
SEE TEXT FOR HARDWARE REQUIREMENTS

The GYROBEE	DATE: SEP 91 REV: 2.0
DRAWING: RUDDER PIVOT BRACKETS G8-2 (4 REQD)	SCALE: INCHES PAGE OF



HOLE GUIDE: A - 1/4 INCH
B - 3/16 INCH
C - 3/16 INCH, ALUM. POP RIV.
D - 3/16 INCH, AN3 HRDWARE

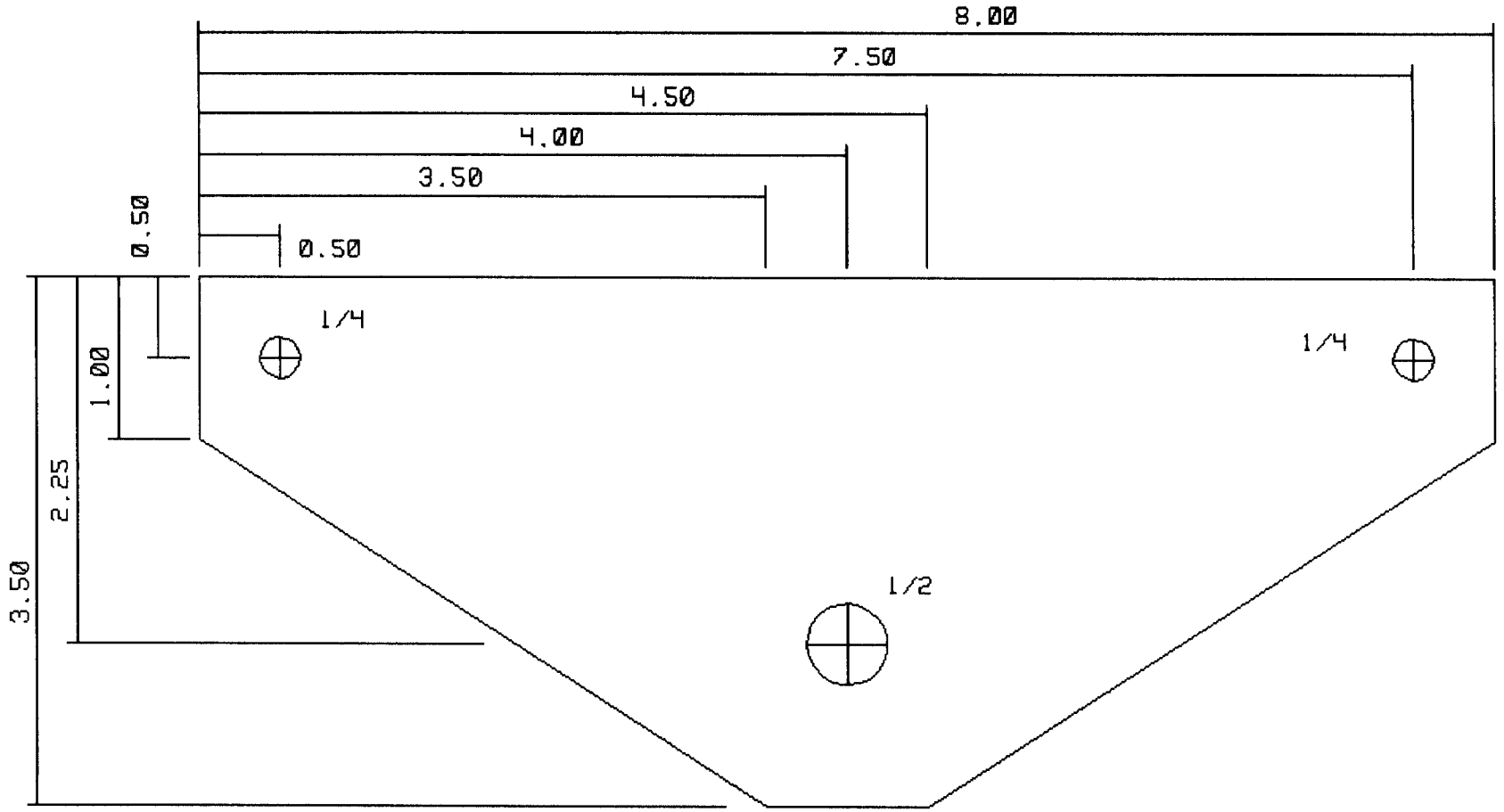
MATERIAL: PEDAL WEB - 0.0625 6061-T6 SHT
BRACES - 1 X 1 X 1/8 6061-T6 EXTRUDED ANGLE

The GYROBEE

DATE: JUNE 88
REV: 2.0

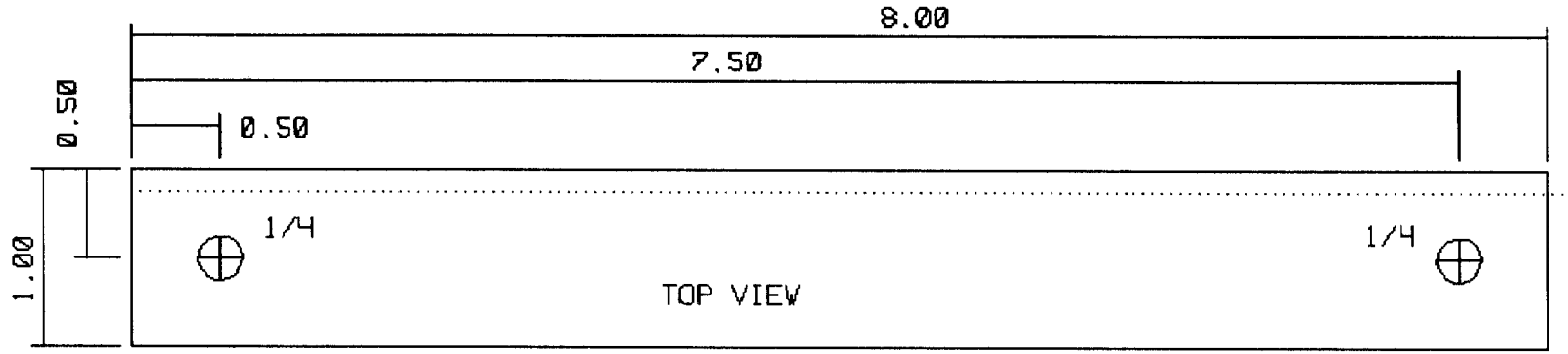
DRAWING: RUDDER PEDALS (2 RQD)
G8-3 RIGHT SHOWN, LEFT IS OPP.

SCALE: INCHES

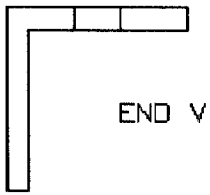


MATERIAL: 1/8 THK 6061-T6 ALUM. SHT STOCK

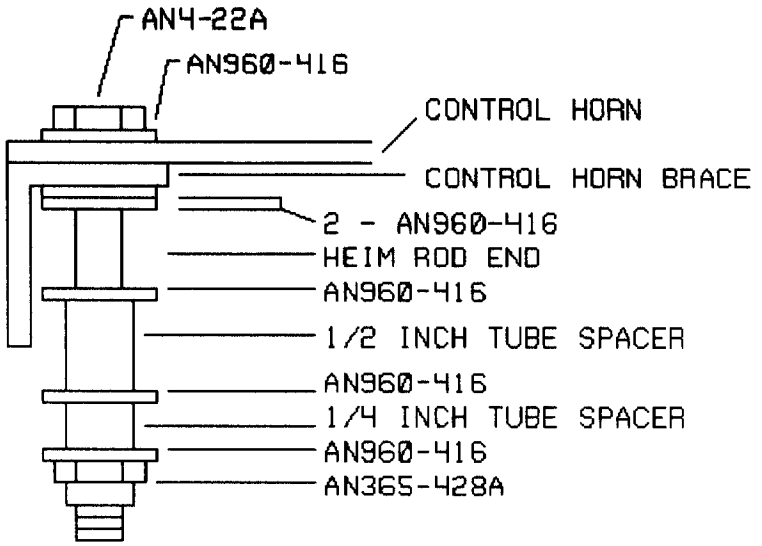
The GYROBEE	DATE: APR 90 REV: 1.0
DRAWING: RUDDER CONTROL HORN GB-4	SCALE: INCHES



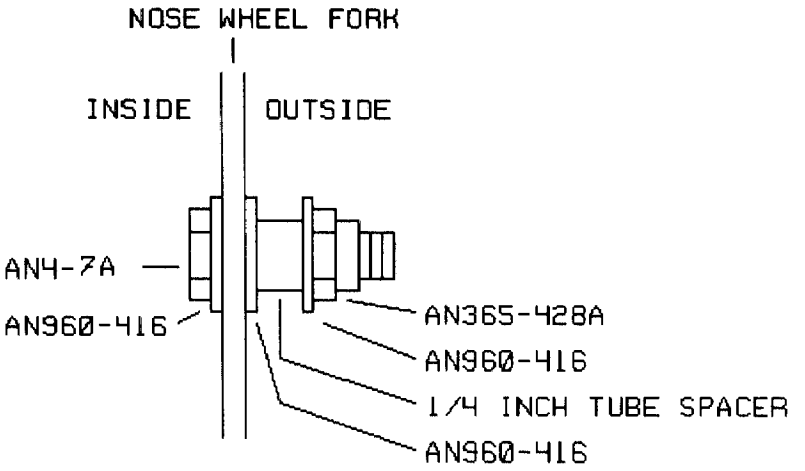
MATERIAL: 1 X 1 X 1/8 EXTRUDED 6061-T6 ALUM. ANGLE STOCK



The GYROBEE	DATE: SEP 91 REV: 2.0
DRAWING: RUDDER CONTROL HORN BRACE G8-S	SCALE: INCHES PAGE OF



CONTROL HORN HEIM AND SPRING ATTACH POINTS (2 ROD)



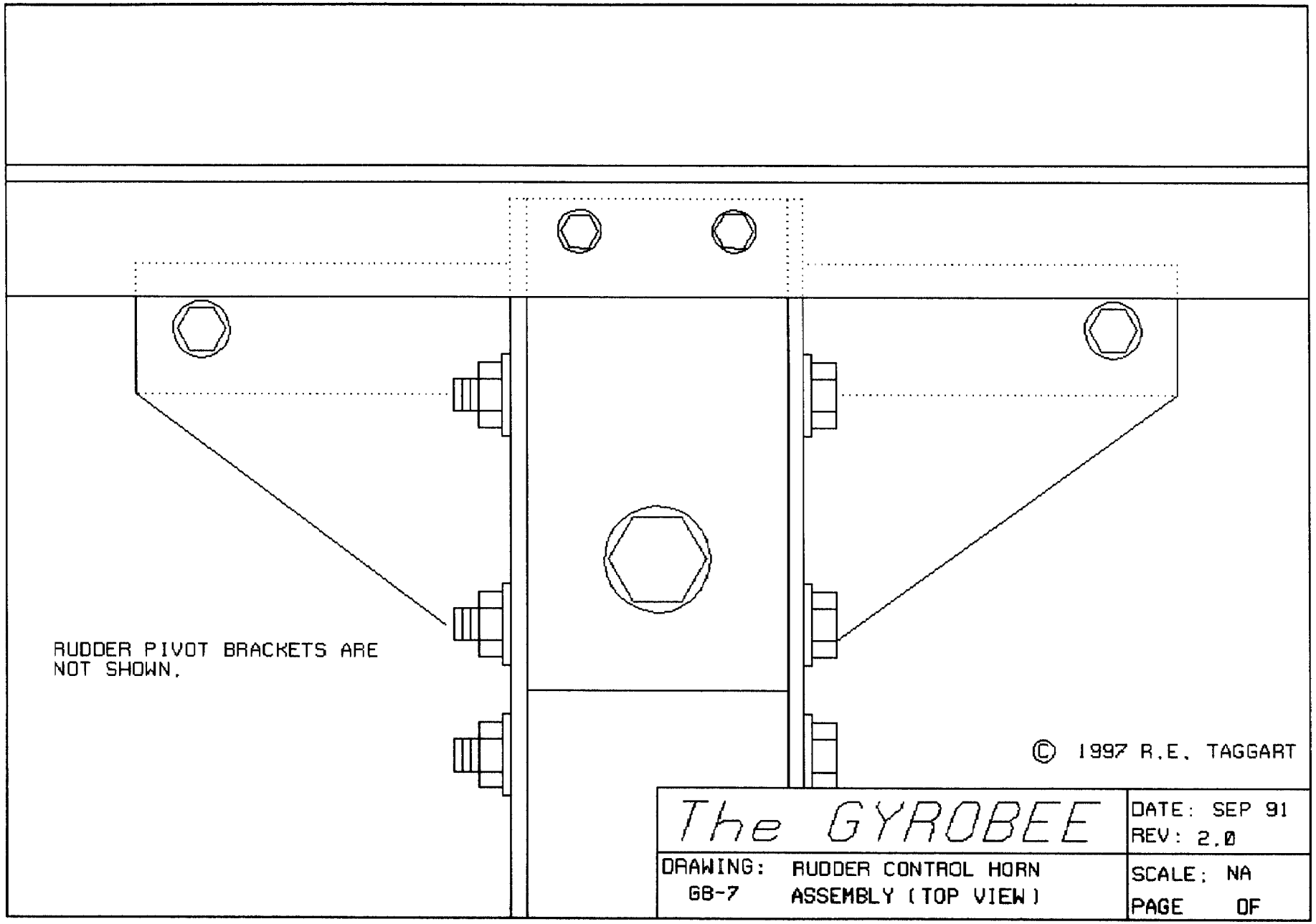
WHEEL FORK SPRING ATTACH POINT (2 ROD)

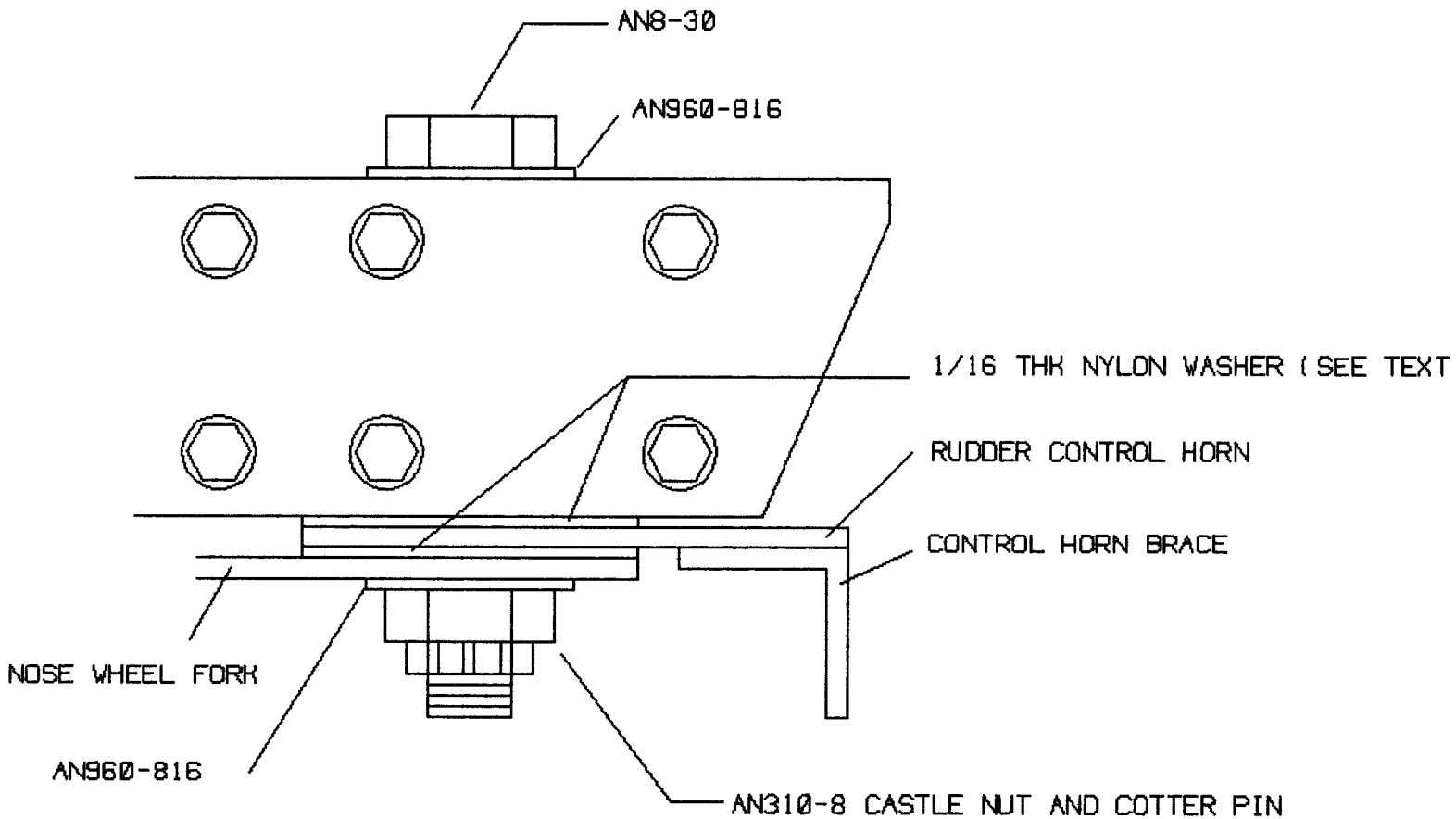
(1) SEE PHOTOGRAPHS FOR DETAILS OF SPRING AND HEIM ROD LINKAGES

(2) SEE PARTS LIST FOR SPRING OPTIONS

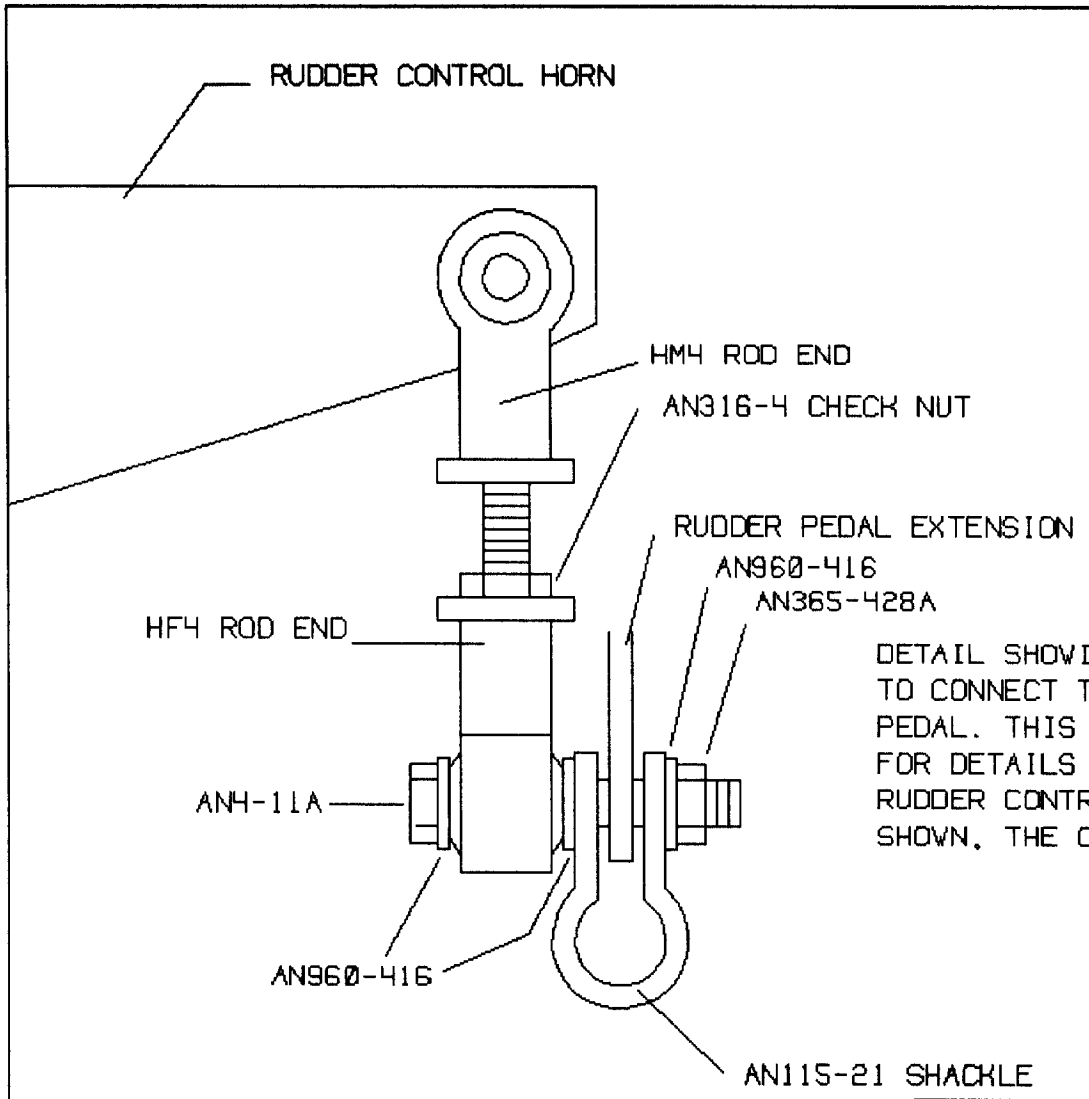
(3) ALL TUBE SPACERS FABRICATED FROM 3/8 INCH O.D. (1/4 INCH I.D.) 6061T-6 ALUM. TUBE STOCK

The GYROBEE	DATE: MAY 90 REV: 2
DRAWING: G8-6 SPRING AND HEIM ROD ATTACH POINTS	SCALE: PAGE OF


RUDDER PIVOT BRACKETS ARE
NOT SHOWN.
© 1997 R.E. TAGGART
The GYROBEE
DATE: SEP 91
REV: 2.0
DRAWING: GB-7
RUDDER CONTROL HORN
ASSEMBLY (TOP VIEW)
SCALE: NA
PAGE OF



The GYROBEE	DATE: MAY 98 REV: 1.10
DRAWING: RUDDER CONTROL HORN ASSY. G8-8 SIDE VIEW	SCALE: NA PAGE OF



DETAIL SHOWING THE USE OF HEIM ROD END FITTINGS TO CONNECT THE RUDDER CONTROL HORM AND RUDDER PEDAL. THIS VIEW IS DIAGRAMATIC. SEE ALSO G8-6 FOR DETAILS OF THE ROD END ATTACHMENT TO THE HORN. RUDDER CONTROL CABLE ATTACHES TO SHACKLE. ONE SIDE SHOWN. THE OTHER IS OPPOSITE.

The GYROBEE	DATE: APR 90 REV: 1.5
DRAWING: G8-9 RUDDER PEDAL/CONTROL HORN CONNECTION	SCALE: NA PAGE OF

PHASE 9 - MOUNTING THE SEAT

Prints:

- **G9-1** - Rear Seat Plates
- **G9-2** - Bottom Seat Plates
- **G9-3** - Seat Bottom Angles
- **G9-4** - Seat Support Struts

Fabrication:

G9-1, **2**, **3** describe the fabrication of the rear and bottom seat plates and the seat bottom angles. You will have to delay making the seat support struts (**G9-4**) until the seat is in place, since the precise seat position determines the length of these parts.

Hardware:

- **AN3-7A** bolt (20)
- **AN960-316** washer (40)
- **AN365-1032** nylock nut (20)
- **AN4-6A** bolt (2)
- **AN4-26A** bolt (1)
- **AN960-416** washer (6)
- **AN365-428** nylock nut (3)
- **3/16 pop-rivets** - aluminum

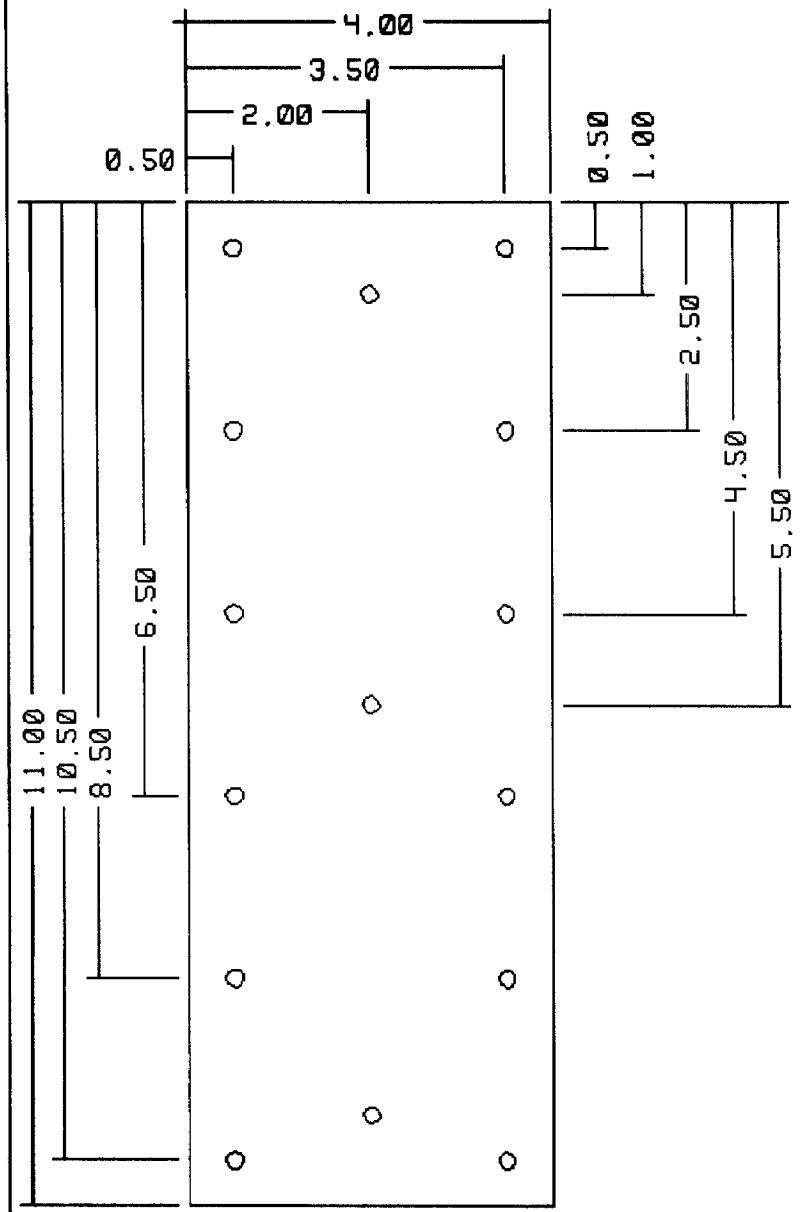
Assembly:

- Draw a reference center line down the back of the seat and along the bottom.
- Position the back rear seat against the rear of the seat so the center-line is centered in the three 3/16 holes down the middle of the plate. Maintaining the centered orientation, slide the plate up and down the seat back to locate the flattest portion of the seat back. When located, use a 3/16 bit to drill the three holes through the seat back using the plate as a drilling guide.
- Align the front rear plate (1/16 inch) with the three centered holes and pop-rivet the two plates together, through the seat back, from the inside of the seat.
- Repeat the previous two steps with the lower (1/8) and upper (1/16) seat bottom plates.
- Using the 1/8 seat plates as drilling guides, drill the 12 - 3/16 holes through the seat back and the 8 - 3/16 holes through the seat bottom.
- Align each seat bottom angle with the four 3/16 holes along each edge. The edge of the angle should align with the edge of the plate with the down-ward directed side facing toward the center of the seat bottom (see top of **G9-4**). The single 1/4 inch hole of each brace should face the **front** of the seat. Secure each bottom angle brace at four points using the AN3 hardware indicated in **GB9-2**.
- Lay a strip of masking tape down the forward flange of the two seat braces and mark the center-line with a pencil.
- Position the rear of the seat against the seat braces so the lines you have drawn are visible in the center of the 6 holes along each edge of the rear seat plates. Slide the

seat up or down, keeping it centered, until the bottom of the seat is positioned 9 inches above the top of the keel and clamp or firmly hold the seat in place against the seat braces.

- Using the rear seat plate as a drilling guide, drill through the seat braces at the upper and lower holes on the plate using a 3/16 bit. Temporarily secure the seat to the mast braces at these four holes using 3/16 hardware.
- Now drill the remaining holes through the braces using the rear seat plates as a drilling guide.
- Remove the seat from the braces, strip the masking tape from the seat braces, and de-burr the holes you have drilled.
- Attach the rear of the seat to the seat braces at all 12 holes using the AN3 hardware noted in GB-1.
- With the seat in place, measure the distance from the 1/4 inch holes in the lower seat braces straight down to the center of the keel side-wall. Add 1 inch to this measurement. This is distance **A** in **G9-4**. Fabricate the two seat support struts at this time.
- Loosely attach the upper end of each support strut to the lower seat brace using the hardware and orientation shown in **G9-4**.
- Using a wooden block against the forward flanges of the seat support struts, to assure they stay parallel, align them straight up and down and clamp them to the sides of the keel.
- The lower 1/4 inch holes in each seat support strut should be located at the center of each keel side-wall.. Use the holes as a drill guide to match-drill 1/4 inch holes in the keel side-walls. Move the struts out of the way, de-burr the two new holes, and attach the struts to the keel with the AN4 hardware indicated in **G9-4**. Tighten all the AN4 hardware at this time.

The seat should now be firmly anchored in place. Put the inner foam pad in place and secure the vinyl seat cover. You are now free to sit in the seat and make engine sounds whenever you need encouragement!

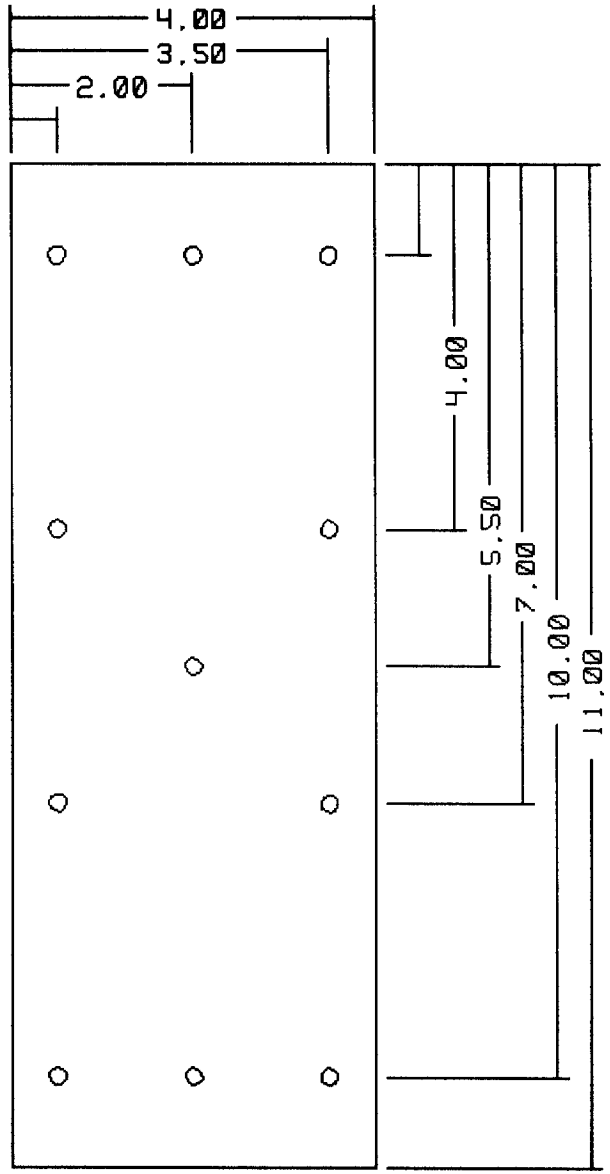


ALL HOLES 3/16 INCH. BACK SEAT PLATE IS 1/8 THK 6061-T6 ALUM. SHEET, FRONT PLATE IS 1/16 THK. 6061-T6 ALUM. SHEET. PREPARE BACK PLATE AS SHOWN AND THEN USE AS A TEMPLATE TO MATCH DRILL THE FRONT PLATE

ON ASSEMBLY, USE BACK PLATE TO MATCH DRILL THE THREE CENTER LINE HOLES ON THE SEAT BACK. USE 3/16 INCH POP RIVETS, INSERTED FROM THE FRONT, TO SECURE FRONT AND BACK PLATES TO THE REAR OF THE SEAT. ONCE SECURE, MATCH DRILL ALL HOLES THROUGH THE FIBERGLASS SEAT BACK.

THE SEAT MOUNTS TO THE MAST/SEAT BRACE RAILS AS DESCRIBED IN THE TEXT. AT EACH OF THE 12 MOUNTING HOLES, AN AN3-7A BOLT, 2 AN960-10 WASHERS, AND AN AN365-1032 NUT ARE USED.

The GYROBEE	DATE: JUNE 1988 REV: 1.0
DRAWING: REAR SEAT PLATES (2 ROD) G9-1	SCALE: INCHES PAGE OF

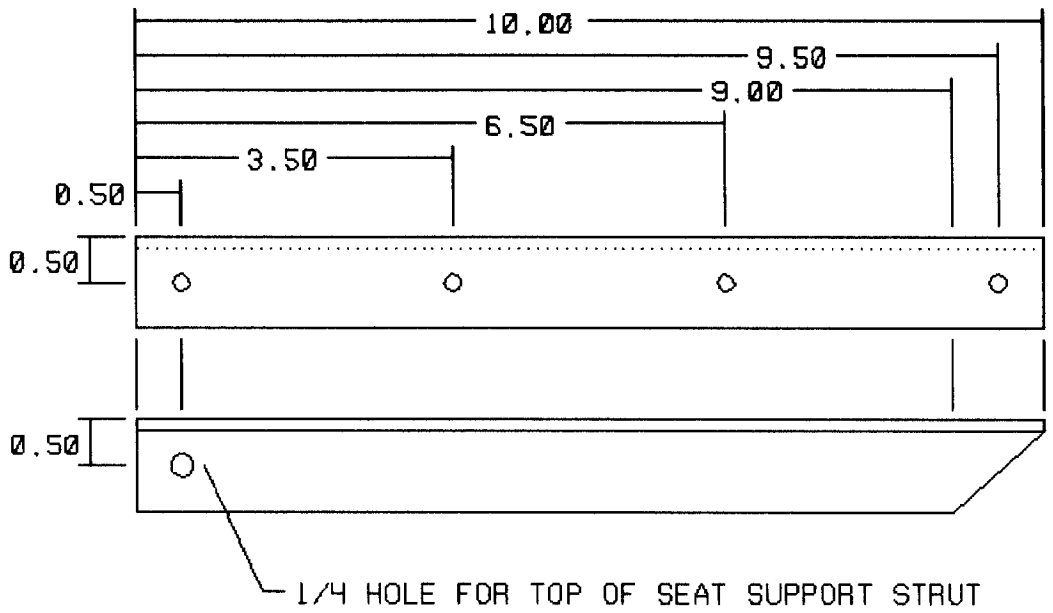


BOTTOM PLATE IS 1/8 INCH 6061-T6 ALUM. SHT. TOP PLATE IS 1/16 INCH 6061-T6 ALUM. SHT. PREPARE BOTTOM PLATE AS SHOWN AND USE AS A TEMPLATE TO MATCH DRILL THE TOP PLATE. ALL HOLES ARE 3/16 INCH.

ON ASSEMBLY, USE BOTTOM PLATE AS A TEMPLATE TO MATCH DRILL THE THREE CENTER-LINE HOLES ON THE SEAT BOTTOM. USE 3/16 POP RIVETS TO SECURE TOP AND BOTTOM PLATES TO THE SEAT BOTTOM AND THEN MATCH DRILL THE REMAINING HOLES THROUGH THE FIBERGLASS.

AT EACH OF THE 8 HOLES THE SEAT IS SECURED TO THE LOWER SEAT BRACES USING AN AN3-7A BOLT, 2 AN960-10 WASHERS, AND AN AN365-1032 NUT.

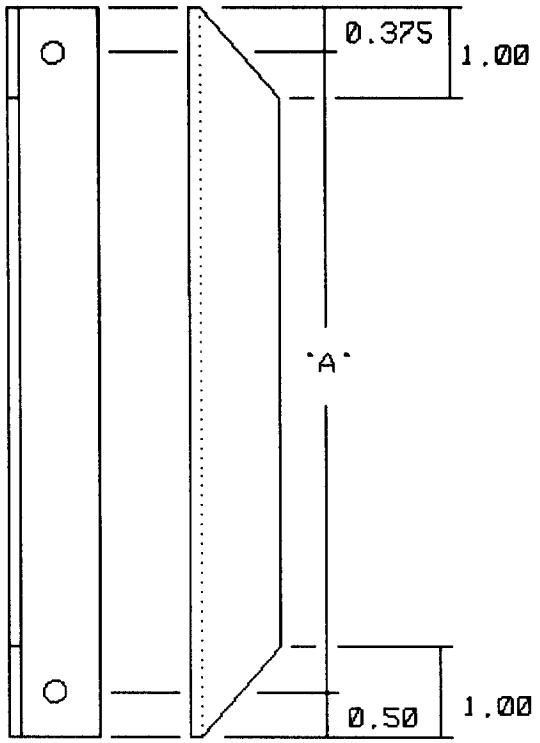
The GYROBEE	DATE: JUNE 88 REV: 1.0
DRAWING: BOTTOM SEAT PLATES (2 RQD) G9-2	SCALE: INCHES PAGE OF



MATERIAL: 1 X 1 X 1/8 EXTRUDED 6061-T6 ALUM. ANGLE

ONE PIECE SHOWN, SECOND IS OPPOSITE

The GYROBEE	DATE: JUNE 88 REV: 1.0
DRAWING: SEAT BOTTOM ANGLES (2 RQD) G9-3	SCALE: INCHES PAGE OF



MATERIAL: 1 X 1 X 1/8 6061-T6 ALUM. EXTRUSION

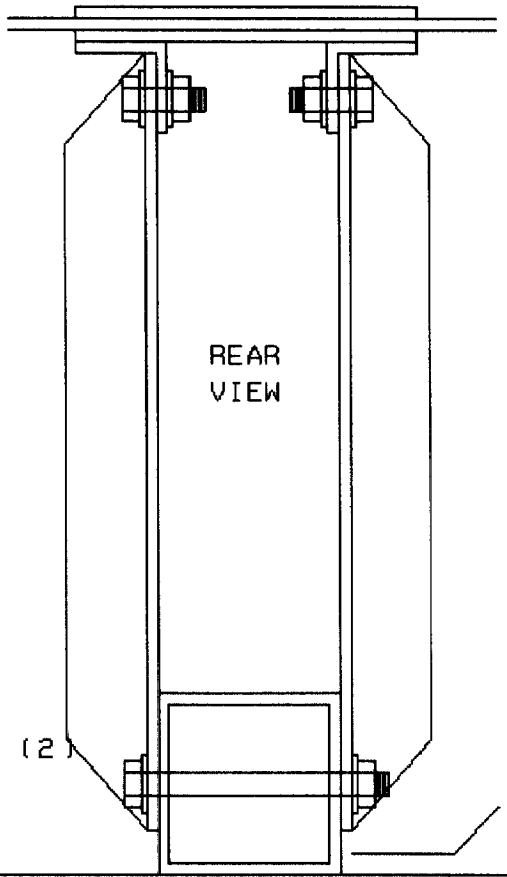
LEFT STRUT SHOWN. RIGHT IS OPPOSITE

SEE TEXT FOR DETERMINATION OF DIMENSION "A"

SEAT BOTTOM HARDWARE

BOTH SIDES:

AN4-6A
AN960-416 (2)
AN355-428



The GYROBEE	DATE: JUNE 88 REV: 1.0
DRAWING: SEAT SUPPORT STRUTS (2 RQD) G9-4	SCALE: INCHES PAGE OF

PHASE 10 - CONTROL STICK, TAIL BOOM, AND TAIL GROUP

Prints:

- **G10-1** - Tail boom
- **G10-2** - Tail wheel plates
- **G10-3** - Tail wheel mounting

Fabrication:

- **G10-1** (Tail boom). Drill the single 1/4 inch hole indicated. The slot on the top of the boom must be milled or cut - be sure to finish all cut edges. This slot is designed to clear the rear mounting hardware for the control stick. If you are not using the KB-2 control stick, the slot will have to be relocated to center on the location of the rear stick attachment bolts.
- The plates in **G10-2** have some odd dimensions. You should probably make a full-sized layout on paper and then transfer to the sheet stock.

Hardware:

- **AN3-26A** bolt (4)
- **AN4-26A** bolt (2)
- **AN4-27A** bolt (4)
- **AN960-316** washers (8)
- **AN960-416** washer (12)
- **AN970-5** washer (10)
- **AN365-1032** nylock nuts (4)
- **AN365-428** nylock nut (6)
- **KB2** tail group hardware

Assembly:

- Slide the front of the tail boom between the mast/keel cluster plates and temporarily pin in place with an **AN4** bolt using the upper of the two holes on the cluster plate.

- Clamp the forward section of the tail boom up against the lower side of the keel so the front of the boom is located between the two seat brace extensions. Match-drill 1/4 inch holes from either side, using the holes in the seat brace as a drilling guide. Remove the tail boom.

- Using heavy paper as a pattern, transfer the bolt pattern from the KB-2 rudder assembly to the top of the rear of the tail boom. The pattern template should be carefully centered side to side and the location of the rudder/fin hinge line should correspond to the rear end of the tail boom. Drill these 1/4 inch holes through the tail boom from top to bottom.

- Repeat this process with the bolt pattern from the horizontal stabilizer. When aligning this pattern on the top of the tail boom, measure to assure that the stab will be located

just forward of the vertical fin. If you are not sure, loosely bolt the fin/rudder at three points to verify the positioning of the stabilizer template.

- Mount the control stick supports to the upper keel using four **AN4-27A** bolts and matching hardware. The stick assembly can then be mounted. The position of the threaded pivot inserts in the mounting blocks should firmly secure the stick but still permit free movement of the stick assembly. lightly grease the pivot points.

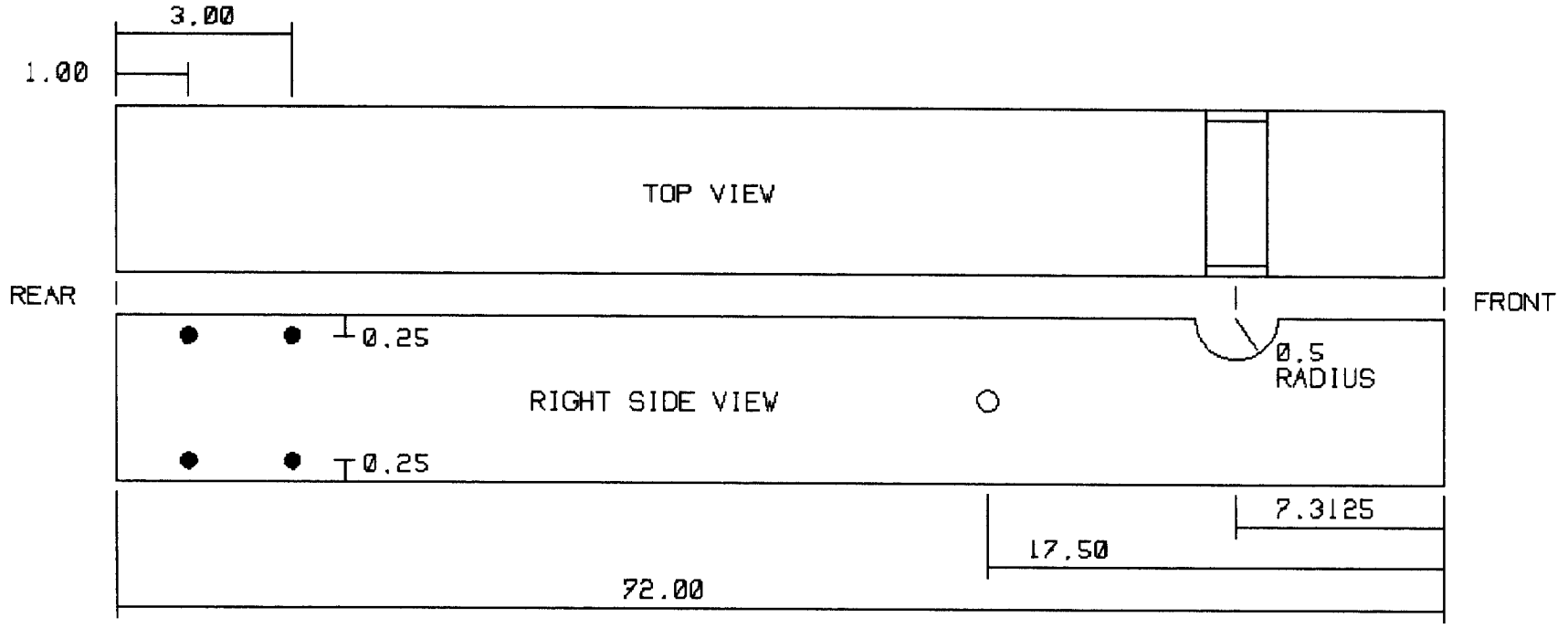
- Slide the tail boom back into place between the cluster plates and seat brace extensions and secure with the **AN4-26A** hardware.

- Use the hardware supplied to mount the vertical fin/rudder at the back of the tail boom. The bolts insert from the bottom of the boom (make sure there is a washer under each bolt head) and capture the threaded holes at the base of the fin/rudder above the tail boom.

- Cut a piece of thick rubber from a tire/truck inner-tube and use it as a gasket between the top of the tail boom and the bottom of the horizontal stabilizer, punching or cutting holes as required to pass the 3/16 mounting bolts. The gasket should be two inches wide and its length should match the center chord of the stabilizer.

- Secure the horizontal stab to the top of the tail boom using the **AN3** hardware supplied with the KB-2 tail group components.

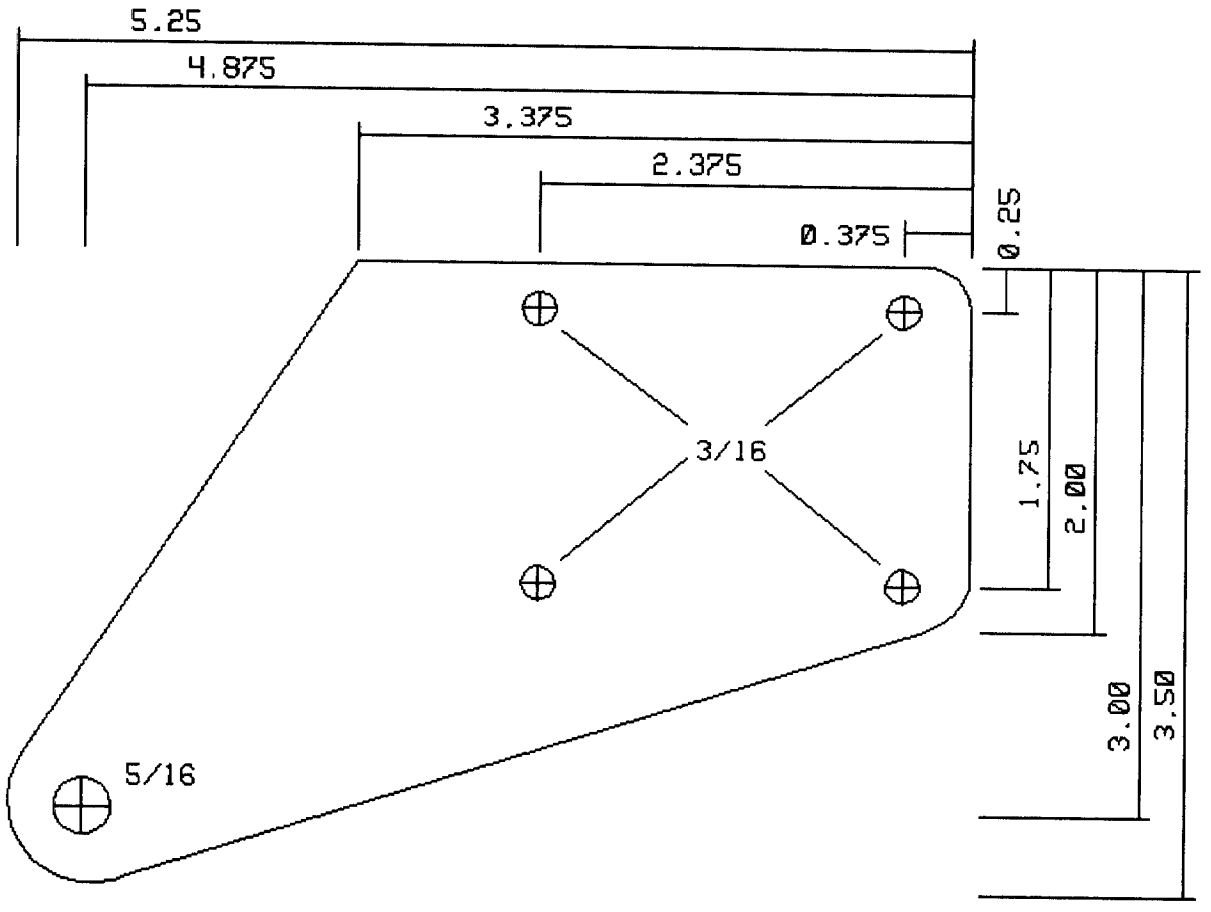
Mount the tail wheel plates on either side of the rear end of the tail boom using the hardware indicated in **G10-3**. Mount the tail wheel to the plates. Use AN970-5 washers between the inside of the plates and the wheel as needed to eliminate excess side-play.



MATERIAL: 2 x 2 x 1/8 WALL 6061-T6 EXTRUDED
TUBE STOCK

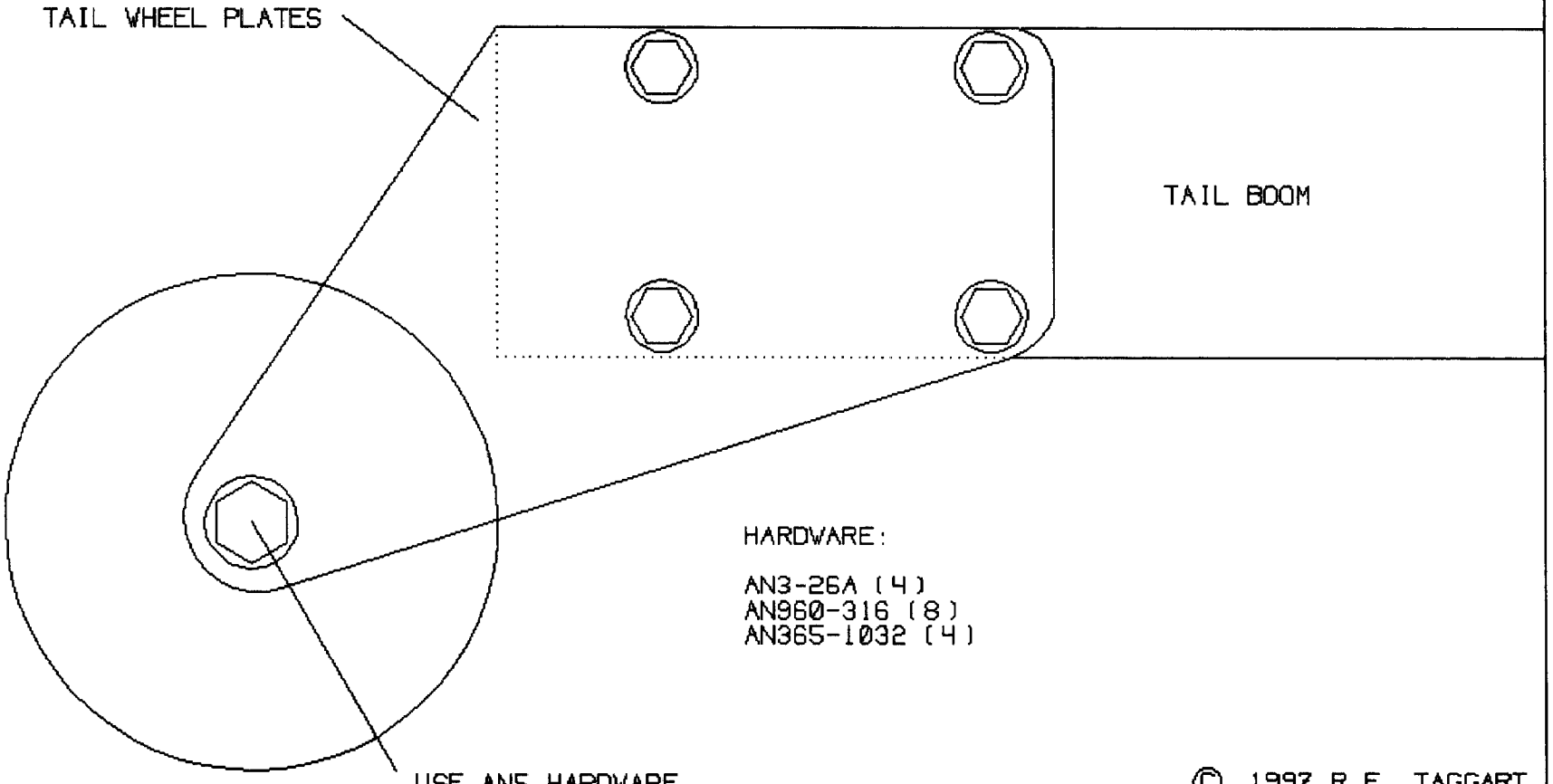
HOLE KEY
○ = 0.25
● = 3/16

The GYROBEE	DATE: SEP 97 REV: 1.0
DRAWING: TAIL BOOM G10-1	SCALE: PAGE OF



MATERIAL: 1/8 THK 6061-T6 SHEET STOCK

The GYROBEE	DATE: SEP 97 REV: 3.0
DRAWING: TAIL WHEEL PLATES (2 RQD) G10-2	SCALE: PAGE OF



The GYROBEE	DATE: SEP 97 REV: 3.0
DRAWING: TAIL WHEEL MOUNTING G10-3	SCALE: PAGE OF

PHASE 11 - ROTOR HEAD CHEEK PLATES

Prints:

- **G11-1** - Head cheek plate layout

Fabrication:

There is no way to provide a single universal layout for the rotor head cheek plates since the various rotor heads differ slightly in layout. **G11-1** provides some guidelines for laying out the cheek plates based on your particular head unit. The hole pattern on the **right** side (bottom) is based on the holes at the top of the mast and the layout can be transferred to a paper template using print **G1-2**. The layout diagram, drawn full-size, should include the outline of the upper part of the mast so you can be sure of adequate clearance between the top of the mast and the bottom of the head assembly.

The hole pattern at the left represents the hole pattern for the rotor head base and can usually be taken from the cheek plates that are typically supplied with the head. If no cheek plates were supplied, measure the vertical and horizontal distance between the mounting holes and make a full-sized paper template for the head pattern. Draw a line parallel to the lower two holes that represents the dimension of the downward extension of the two head end blocks below the lower holes. This line will indicate the downward extension of the blocks for determining clearance. Use intersecting lines from the holes, as shown in **G11-1**, to determine the center of the hole pattern.

To determine the relationship of the upper (head) and lower (mast) holes:

- Rotate the upper hole pattern (head) **10 degrees (see note at end of this section) backward** with reference to the mast and

- Position the center of the head pattern (the intersection point for the diagonal lines) directly above the forward edge of the mast, and

- Position the head pattern vertically so the lower line you drew (marking the lower extension of the head end blocks) **clears the rear of the mast by 1/4 inch**.

When all three conditions are met, mark the location of all holes. Now plot an outline around all the holes to mark the extent of the cheek plates.

Cut and finish the pair of plates and use a center-punch to transfer your hole pattern to one of the plates. Clamp the two plates together and match-drill the required holes. The mast holes are 1/4 inch, but the head mounting hole size is determined by the head you are using and you should use the head as a guide for the required size.

Hardware:

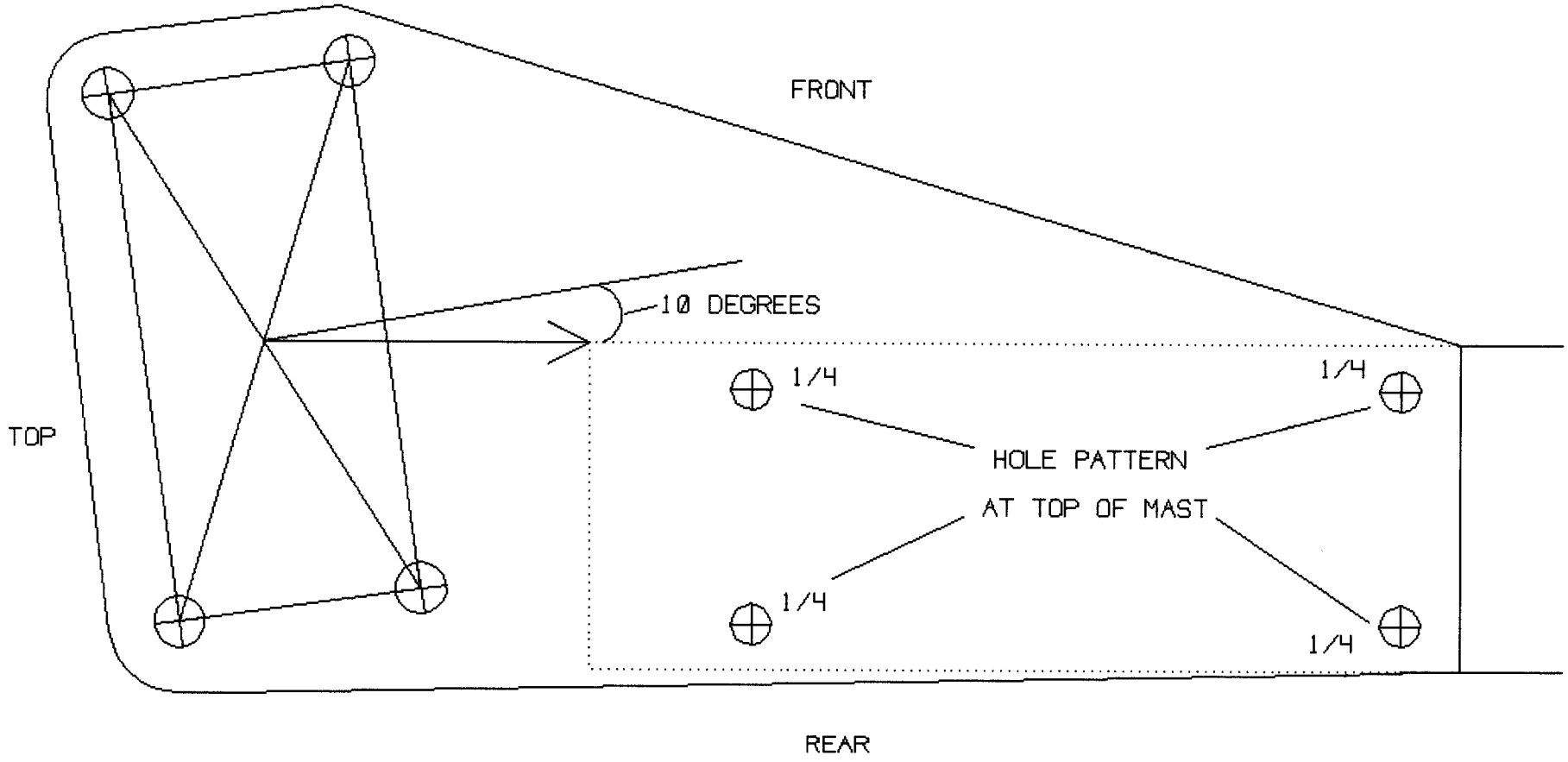
- **AN4-26A** bolt (4)
- **AN960-416** washer (8)
- **AN365-428** nylock nut (4)
- Head mounting hardware

Assembly:

Mount the plates at the top of the mast using the AN4 hardware and then mount the head between the upper end of the plates using the hardware supplied with your rotor head.

Note:

The 10 degree mounting angle shown in print **G11-1** is appropriate for the Rotordyne head used on the prototype. Other heads may require a slightly different angle, depending on the range of travel of the head in the pitch axis. See **Appendix 1** for information on the proper head angle and rotor system set-up.



MATERIAL: 1/8 THK 6061-T6 SHEET STOCK

The GYROBEE	DATE: APR 99 REV: 3.1
DRAWING: HEAD CHEEK PLATE LAYOUT G11-1 SEE TEXT FOR DETAILS	SCALE: INCHES PAGE OF

PHASE 12 - RUDDER CABLE INSTALLATION

Print:

- **G12-1** - Fairlead block

Fabrication:

The rudder cables are routed through a fairlead block consisting of an outer casing fabricated by cutting away one side of a 2 inch long piece of 2 x 2 square tube stock. Inside of the block is a solid or laminated block of hardwood, finished to provide a smooth slide-fit into the casing and sanded flush with the casing on the top side and the front and back faces. Two offset 1/8 inch wide/deep slots are cut in the block to pass the 3/32 rudder cables. When the block is complete, center the block in the space between the keel/mast cluster plate, flush against the lower tail boom, and match-drill 1/4 inch holes in the casing, using the cluster plate holes as a drill guide. Remove the fairlead assembly and finish drilling through the hardwood block, using the holes in the casing as a drill guide.

Hardware:

- **AN115-21** shackles (2)
- **AN100-4** stainless thimbles (4)
- **AN393-11** clevis pins (2)
- **3/32 oval nicopress sleeves** (8) (LEAF M1031)
- **3/4 inch cowling pins** (2) (LEAF F5110)
- **AN4-26A** bolt (1)
- **AN960-416** washer (2)
- **AN365-428** nylock nut (1)
- **3/32 inch (7x7)** stainless control cable (25 feet)

Assembly:

Assembling the rudder cables will require a tool for cleanly cutting the cable as well as a swaging tool for the nicopress sleeves. All of these are available in the LEAF catalog, but it makes little sense to buy these tools for just this project (although they are a good investment for a club). Many EAA chapters or individual members will have the necessary tools or, failing that, visit the maintenance hangar at the local airport.

- Install an **AN115** shackle at each of the two rudder control horns using an **AN393** clevis pin and a cowling pin for retention.

- Slip an **AN100-4** stainless thimble into each of the rudder shackles.

- Cut the length of rudder control cable in half and double-swage a stainless thimble at one end of each length. If you are not sure how to do this step, get some help!

- Remove the shackles from the lower extensions of the rudder pedals, slip the thimble-end of the cables over each shackle, and re-install, tightening the nylock nuts at this time.

- Run the two cables parallel to the keep back past the mast/keel cluster plate. Slide each cable into the slot in the hardwood fairlead block and slide the casing over the block to retain the cables. Install the block under the tail boom at the mast/keel cluster plate using the **AN4-26A** hardware.

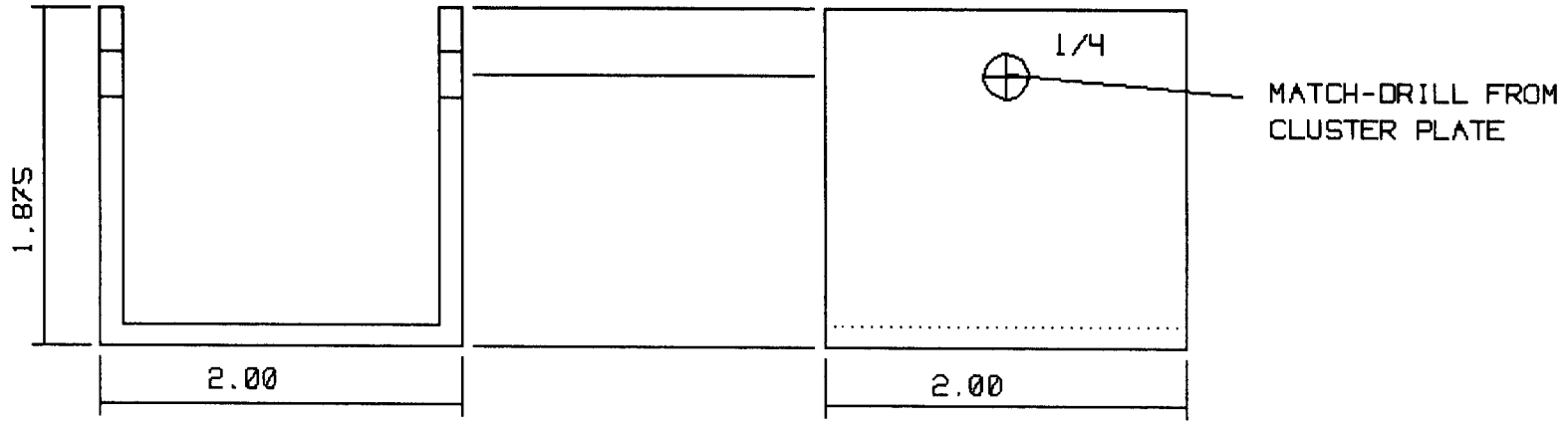
- Cross the cables under the tail boom and hold them taught at the rudder control horns. The cables should not rub where they cross-over. Center the rudder, blocking it if required. Place a wood block across the rudder pedals so both have the same angle and they are at about the half-way point in their range of movement.

- Run each cable around the thimble in the two shackles at the rudder control horns. The cables should have no slack, but they shouldn't be particularly tight either. Double swage the cable at each thimble and cut off the excess.

- Remove the rudder and pedal blocks. The rudder should be centered with equal pedal deflection. If the right pedal is deflected forward, the rudder should deflect to the right and vice versa with the left pedal. Total rudder deflection in either direction should be essentially equal.

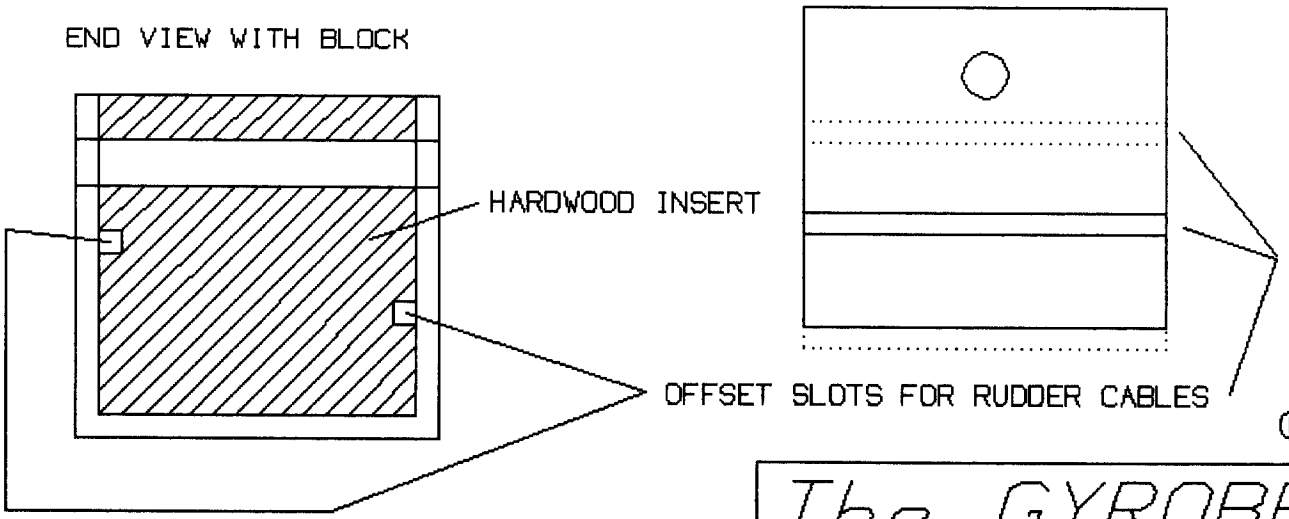
END VIEW

SIDE VIEW



SIDE VIEW WITH BLOCK

END VIEW WITH BLOCK



The GYROBEE	DATE: APR 90 REV: 1.5
DRAWING: FAIRLEAD BLOCK G12-1	SCALE: NA PAGE OF

PHASE 13 - SEAT BELT AND SHOCK PLATE INSTALLATION

Prints:

- **G13-1** - Shock plate and harness plate mounting
- **G13-2** - Vertical strut/shock plate attachment

Fabrication:

- The harness plate in **Detail A** of **G13-1** should be made up from 1/8 inch 6061-T6 sheet stock.
- Prepare a 7/8 inch long spacer from 3/8 OD 6061-T6 tube
- Fabricate the 3/8 inch OD spacers detailed in **G13-2** (two sets)

Hardware:

- **AN3-32A** bolt (2)
- **AN960-316** washer (22)
- **AN365-1032** nylock nut (2)
- **AN4-6A** bolt (3)
- **AN4-26A** bolt (1)
- **AN4-34A** bolt (2)
- **AN960-416** washer (8)
- **AN365-428** nylock nut (6)
- **AN970-4** washer (4)
- **AN870-6** washer (4)

Assembly:

- Secure the mast so the airframe cannot tip over and remove the bolts holding the vertical strut fittings to the temporary shock plate. Remove the temporary shock plate from the mast.

- Mount the shock plate (G4-2) to the rear of the mast with a pair of AN3-32A bolts. Where the bolts emerge from the front of the mast, add 9 AN960-316 washers to each bolt and then slide on the harness plate and secure each bolt with another AN960-316 washer and an AB365-1032 nylock nut.

- Using Detail B of G13-1 as a guide, use an AN4-26A bolt to mount a 7/8 inch long 3/8 OD spacer between the seat braces at the hole above the attach point for the engine bearers. Use a total of four AN960-416 washers, one each for the bolt head and nut and one at each end of the spacer where it hears against the inside of the seat braces.

- Thread the common strap from the shoulder harness between the seat braces and over the spacer from the previous step. Secure the strap end-fitting to the 1/4 inch hole in the harness plate using an AN4-6A bolt and associated hardware.

- Secure each lap bent fitting to the belt plates on the keel using an AN4-6A bolt and associated hardware.

- Using G13-2 as a guide, attach each vertical strut fitting to the shock plate. The internal spacer (B) should be greased when slid into the bolt and grease should be applied to the internal area of the slot once the fittings are in place.

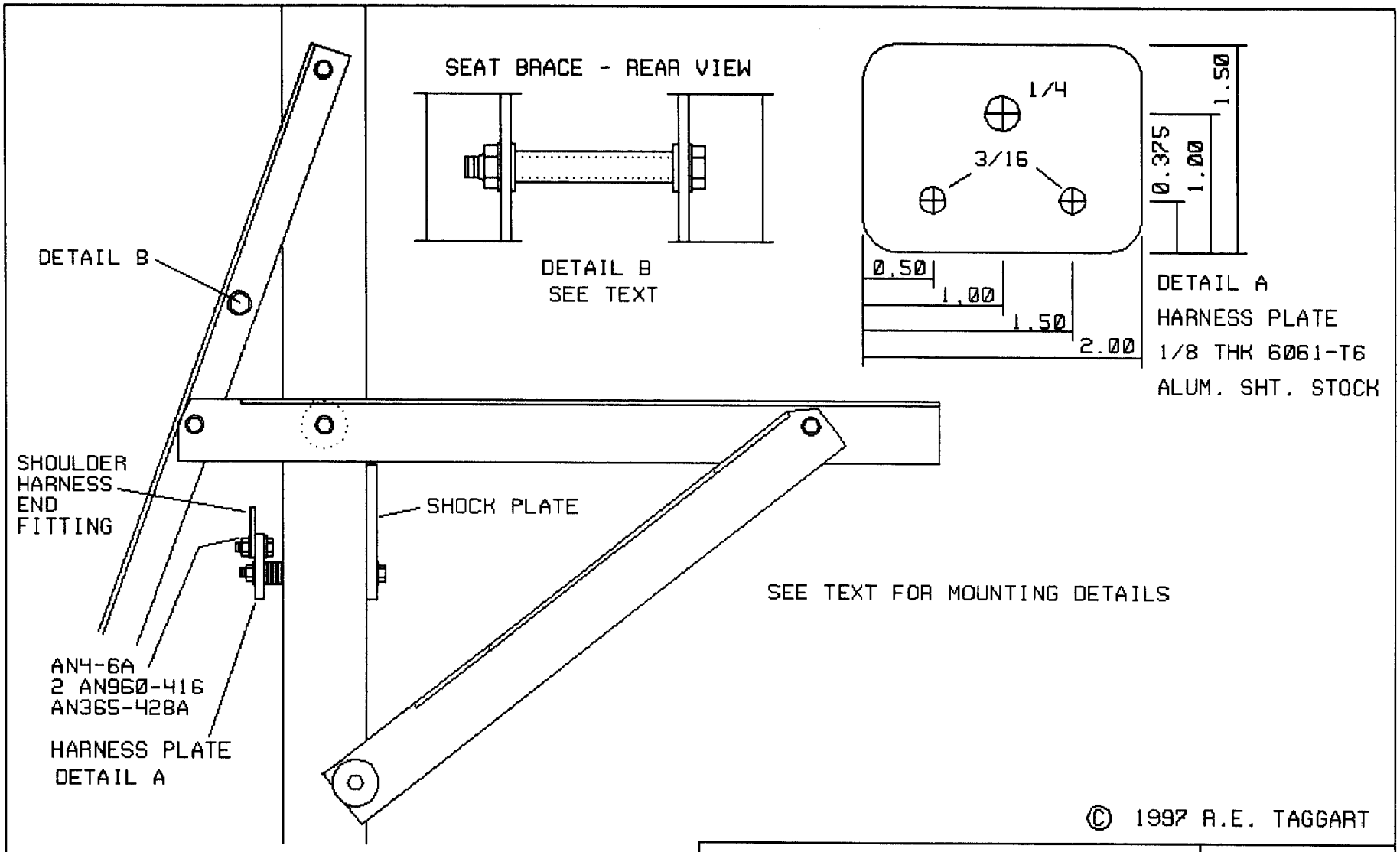
- Tie off, with double knots, two 6 inch loops of standard braided bungee chord.

- At each strut fitting, loop the bungee over one of the outer strut fitting spacers, stretch it down around the spacer where the diagonal engine bearer attaches to the mast, and back up to the spacer on the other side of the strut fitting. It should take a LOT OF EFFORT to stretch the bungees into place. If it is too easy, make each loop a bit shorter. If you can't do it, make the loops a bit longer.

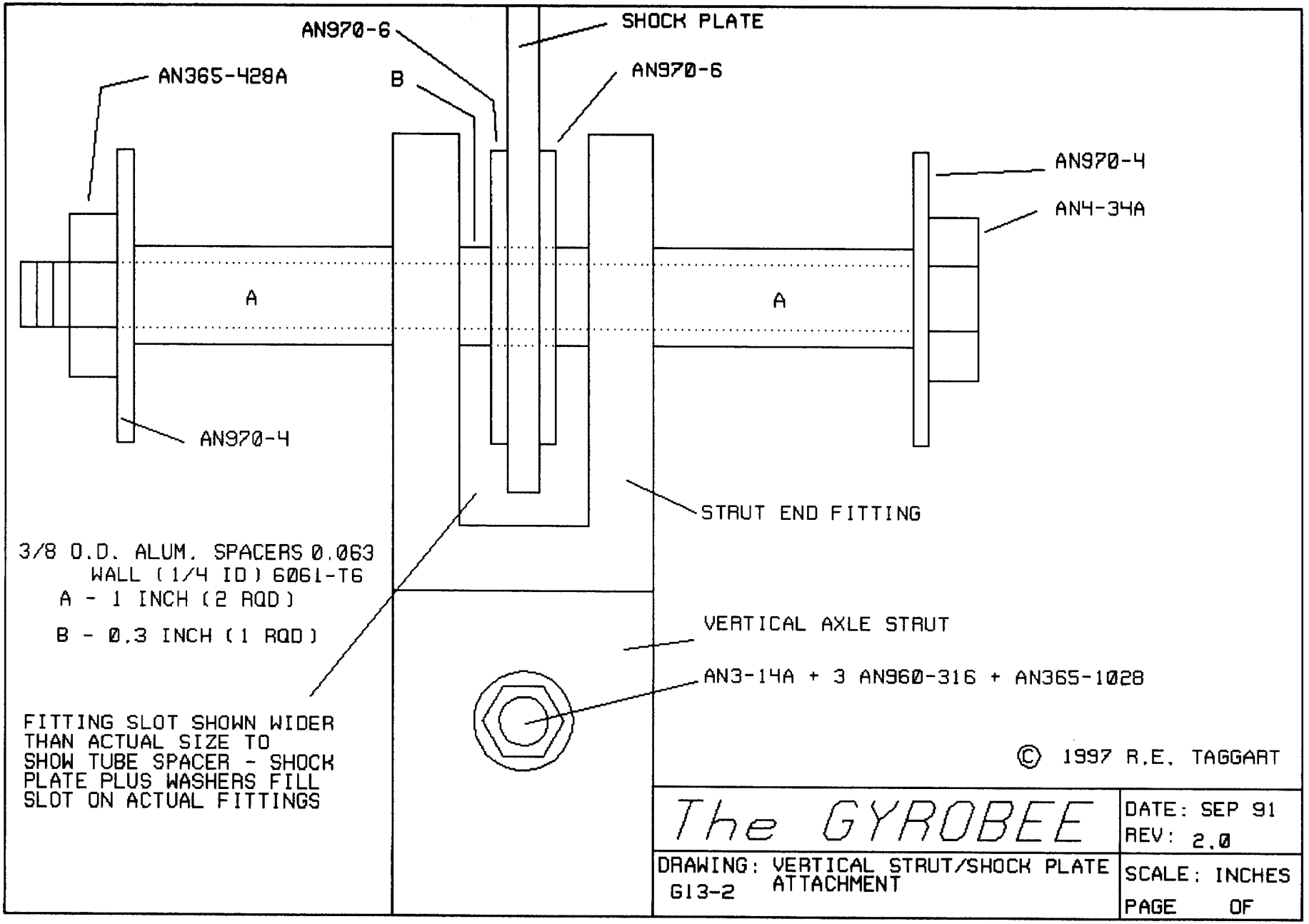
CRITICAL MAINTENANCE NOTE!

AT LEAST ONCE EACH FLYING SEASON, CRITICALLY INSPECT THE INNER SPACERS ON THE STRUT FITTINGS FOR EXCESSIVE WEAR AND REPLACE AS REQUIRED. IF THE SPACER HAS WORN THROUGH, YOU SHOULD REPLACE THE BOLT AS WELL.

FAILURE TO PERFORM THIS INSPECTION CAN ULTIMATELY LEAD TO ATTACHMENT FAILURE OF ONE OR BOTH VERTICAL GEAR STRUTS, RESULTING IN EXTENSIVE AIRFRAME DAMAGE AND POSSIBLE INJURY!!



The GYROBEE	DATE: SEP 91 REV: 2.0
DRAWING: SHOCK PLATE AND HARNESS PLATE MOUNTING G13-1	SCALE: NA PAGE OF


AN970-6
SHOCK PLATE
AN365-428A
B
AN970-6
AN970-4
AN4-34A
A
A
AN970-4
STRUT END FITTING
3/8 O.D. ALUM. SPACERS 0.063
WALL (1/4 ID) 6061-T6
A - 1 INCH (2 RQD)
B - 0.3 INCH (1 RQD)
VERTICAL AXLE STRUT
AN3-14A + 3 AN960-316 + AN365-1028
FITTING SLOT SHOWN WIDER
THAN ACTUAL SIZE TO
SHOW TUBE SPACER - SHOCK
PLATE PLUS WASHERS FILL
SLOT ON ACTUAL FITTINGS
© 1997 R.E. TAGGART
The GYROBEE
DATE: SEP 91
REV: 2.0
DRAWING: VERTICAL STRUT/SHOCK PLATE ATTACHMENT
G13-2
SCALE: INCHES
PAGE OF

PHASE 14
ENGINE MOUNTING AND FUEL TANK INSTALLATION

Prints:

- **G14-1** - Eipper engine mount
- **G14-2** - Fuel tank
- **G14-3** - Muffler mounting plate

Hardware:

- See **G14-1**
- **AN848-40** fuel fitting
- **AN316-7** stop nut

Other Components:

- Small stainless hose clamps
- Fuel primer bulb
- Vinyl fuel line
- Nylon cable ties

Engine

Detailed notes are not practical here as you will need to apply some ingenuity. On the prototype we were able to use a custom dynafocal engine mount for the 447 that was available from LEAF. This mount is no longer available so an alternative is needed. Print **G14-1** shows a detail view from the LEAF catalog for the engine-mounting components used on the Eipper Sprint and Sport fixed-wing ultralights. Although this is an inverted mounting system, there is no reason why the same mount cannot be used to mount the engine upright on the engine mount rails. To provide maximum clearance, the cross-piece at the PTO/gearbox end of the engine should be flush with the end of the horizontal engine mounting beam.

Muffler Mount

To conserve space, we utilized the side-mount muffler option. A steel plate (G14-3) anchors to the two engine mount bolts on the muffler side of the engine (the size and spacing of these holes is dependent on the details of your engine mounting hardware. The muffler secures to the plate with two heavy-duty stainless hose clamps visible in several of the pictures in the Gyrobee Photo Gallery on the Rotorbyte Website. The plate should be well-finished to prevent corrosion. The muffler springs should be safety-wired and it is good practice to apply high-temperature silicone adhesive to the coils to inhibit vibration.

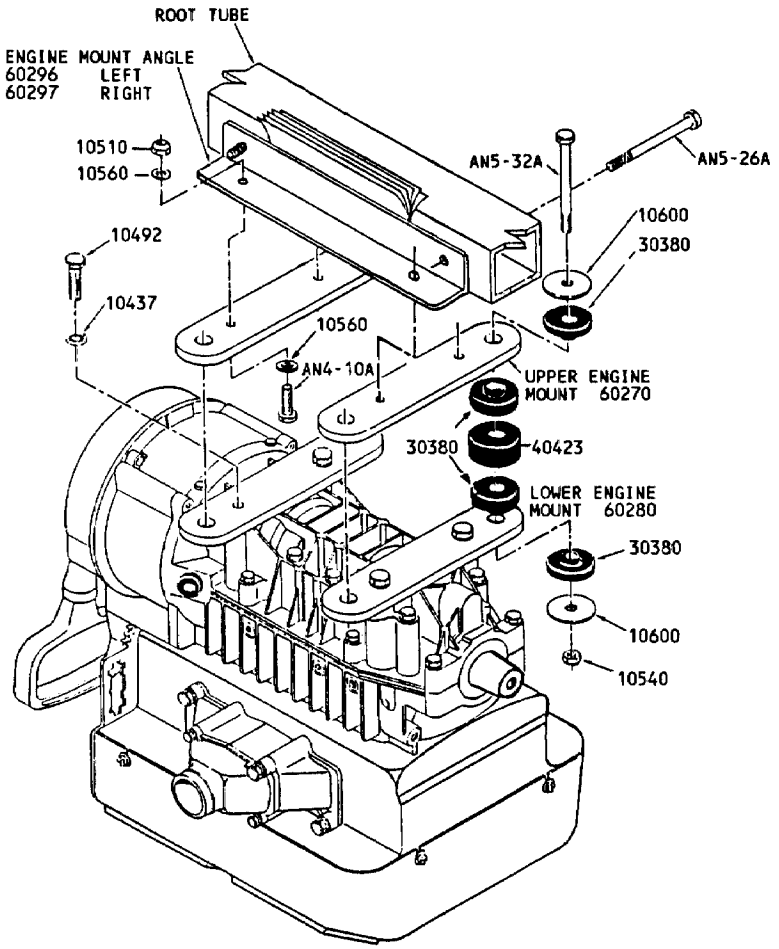
This plate should be inspected prior to each flying session. After a year or two, it will eventually fail due to the initiation of one or two small cracks originating at the ends of the slots for the stainless clamps. When this occurs, the plate should be replaced (we keep an extra on hand to encourage prompt replacement). The part does not fail in a

catastrophic fashion and should not present a safety hazard in you are diligent about your preflight inspections.

Fuel Tank

G14-2 contains all the information needed to plumb the fuel tank. Many of the photographs in the **Gyrobee Photo Gallery** on the **Rotorbyte Website** contain details on the placement of the fuel system components. Note that the fuel pick-up tube should be flush with the tank bottom and directed toward the rear, since the aircraft flies in a nose-up attitude.

ENGINE MOUNT - SPRINT, SPORT
ROTAX 447



The GYROBEE	DATE: SEP 97 REV: 2.0
DRAWING: EIPPER ENGINE MOUNT G14-1	SCALE: NA PAGE OF