Mustang Aeronautics Inc.
1990 Heide Dr. Troy, MI 48084 (248) 649-6818 fax (248) 688-9275
MustangAero.com

March 16, 2018

Midget Mustang Revisions & Updates

The following is a compendium of updates to the Midget Mustang drawing set and construction manual. These do not include minor updates and clarifications that are published in the newsletter or incorporated into the drawing set. For a complete update to the latest version of the drawings and manual, a new set should be purchased. A second set without a serial number can be purchased at a discount from Mustang Aeronautics.

Mustang Aeronautics has been providing Midget Mustang kits since 1992 with a revised aileron and elevator control system, one piece control surface skins, and main wing spars that are using the larger and stronger Mustang II capstrips. These are not mandatory changes for aircraft flown within the original 900 pound gross weight and utilizing engines no larger than the Lycoming O-290.

Several Midget Mustangs with Lycoming O-320 150hp and larger engines that also have the original torque tube control system have had issues with aileron flutter. The complex control system has many places where slop can be present in the system leading to aileron flutter. The main source has been the mounting of the torque tube from the aileron in the fuselage. The increased vibration from the larger engines aggravates this problem as well. To eliminate the aileron flutter issues with the larger engines we have changed to the Mustang II style pushrod system for the ailerons as well as the counterweight. A steel pushrod runs from the control stick to the aileron bellcrank located on the aft wing rib at sta 73.5. An aluminum pushrod connects the bellcrank to the aileron, passing through a hole in the wing rear spar. The aileron uses a piano hinge as opposed to the steel center line hinges mounted on the ends. This increases the aileron control stick forces at higher speeds but we feel this is a good feature. The aileron counterweight is now mounted off of the tip rib cantilevered ahead of the aileron spar. This reduces the counterweight lead required from 4-5 pounds to 2.5-3 pounds in each counterweight. The aileron itself and all of the other control surfaces have been changed to a one piece skin that is folded over at the trailing edge. This is mainly for manufacturing reasons. Care must be taken with this new set up that the trailing edge has the proper bend radius. If the radius is too large it will negatively affect the airflow over the surface.

Many changes that have been made in the kits are for manufacturing reasons. The airplane has also seen its empty and thus gross weights increased over the years by builders so we have made some changes to accommodate this as well. If you have any questions about these changes and how they apply to your Midget Mustang please contact Mustang Aeronautics and we will be happy to help.

Chris Tieman
Mustang Aeronautics Inc.

Mustang Aeronautics Inc.

1990 Heide Dr Troy, MI 48084

CONDITIONS OF SALE AND WARNING NOTICE

The Mustang series of amateur built aircraft have been in existence since the late 1940's. Since that time, builders have completed hundreds of aircraft and logged thousands of hours. The designs and construction techniques have been proven safe and effective over the years by builders like yourself. We here at Mustang Aeronautics are constantly trying to improve the safety and quality of our kits and the service to our customers. However, there are certain responsibilities that must fall upon the builder. Please read the following conditions carefully. If you find any of the items unacceptable, you should not do business with Mustang Aeronautics. Your name and signature at the end of this form constitutes your agreement to accept the Conditions of Sale spelled out below. Thank you for your confidence in Mustang Aeronautics and we look forward to serving you in the future.

All references hereafter to Company, Seller, or Mustang Aeronautics Inc. shall also include Chris K. Tieman

1. The Company will not be held responsible for any delays in deliveries due to delays of carriers and suppliers, strikes, Acts of God, or other causes for delay beyond its control.

2. Claims for defective materials or missing parts will be allowed only when made within thirty days of delivery. All returned materials must be shipped prepaid.

3. A cancellation fee may be assessed on all canceled orders.

4. All prices unless otherwise indicated are F.O.B. factory and are subject to change without notice. Delivery to the common Carrier shall constitute delivery to the buyer, and the responsibility for goods in transit shall be the Carrier's and the buyer's. A Way-Bill or Bill of Lading shall be sufficient evidence and proof of the date of shipment. Claims of damage in transit shall be made to the carrier and not to the Company. **WARNING:** If any container shows damage on arrival, it should be opened immediately and inspected before acceptance form the Carrier . A statement of damage should be made on your waybill at that time. The Company will not pay for goods damaged in transit, nor for shipping charges to and from the factory. All shipments are insured with the carrier.

5. Mustang Aeronautics Inc. is a corporation in the state of Michigan and accepts all orders only as sales contracts deemed entered into its Troy, Michigan office. No employee or agent of this company is authorized to alter conditions of these contracts as stated herein. Buyer agrees to resolve any and all grievances and legal claims in Troy, Michigan in accordance with the laws of the State of Michigan, U.S.A.

6. Homebuilt aircraft are licensed to fly by the U.S. Government in the "Experimental, Amateur-built" category. Such aircraft are legally treated by the FAA as "one-of-a-kind" in design and construction, manufactured by the individual home-builder. It must be expected to be unpredictable, hazardous, and even potentially lethal. Therefore, construction or operation of such Experimental Aircraft may be unsafe without acquiring, studying, and complying to the letter with all instructions, manufacturers manuals, and information pertaining thereto. It is required that all persons operating these aircraft be experienced and knowledgeable in all details related to operation and flight of powered aircraft.

7. In recognition of the above, and because they cannot control nor assure the quality and accuracy of compliance with their instructions during and after construction of such Aircraft, the Seller (and their agents, servants, employees, contractors, successors, and assigns) hereby give notice to buyers and/or operators (and there heirs, administrators, and assigns) of this Aircraft, that they carry **NO LIABILITY INSURANCE.** There are also **NO WARRANTIES EXPRESSED OR IMPLIED, NOR GUARANTEE OF MERCHANTABILITY, NOR FITNESS FOR A PARTICULAR PURPOSE GIVEN REGARDING ITS CONSTRUCTION, ITS PLANS, ITS WORKMANSHIP, NOR SAFETY OF ITS DESIGN OR OF ANY OF ITS COMPONENTS BY THE SELLER, DESIGNER, OR CONTRACTORS.**

8. The buyer and/or operator, as defined above, acknowledges the receipt and understanding of this **WARNING NOTICE** and so agrees by their decision to go ahead with purchasing, accepting, and operating this aircraft or any of its parts to hold Seller, as defined above, **HARMLESS FROM ALL LIABILITY AND FROM ANY CLAIMS OF DAMAGES AND CAUSES OF ACTION WHICH MAY BE INCURRED BY THEM OR ANY THIRD PARTY** as a result of the purchase, use, construction, and operation of this aircraft, its plans parts, and components. **THE BUYER AND/OR OPERATOR HEREBY ASSUMES ALL RISK, LIABILITY, AND RESPONSIBILITY RELATIVE TO THE CONSTRUCTION AND OPERATION OF THE AIRCRAFT.**

Your Signature ____________________ Your Name (print) ____________________ Phone ____________________

Address ____________________ Serial No. ____________________

Return To Mustang Aeronautics, Inc.

rev. 7/22/13

Mustang Aeronautics Inc.

1990 Heide Dr Troy, MI 48084

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7. In recognition of the above, and because they cannot control nor assure the quality and accuracy of compliance with their instructions during and after construction of such Aircraft, the Seller (and their agents, servants, employees, contractors, successors, and assigns) hereby give notice to buyers and/or operators (and there heirs, administrators, and assigns) of this Aircraft, that they carry **NO LIABILITY INSURANCE.** There are also **NO WARRANTIES EXPRESSED OR IMPLIED, NOR GUARANTEE OF MERCHANTABILITY, NOR FITNESS FOR A PARTICULAR PURPOSE GIVEN REGARDING ITS CONSTRUCTION, ITS PLANS, ITS WORKMANSHIP, NOR SAFETY OF ITS DESIGN OR OF ANY OF ITS COMPONENTS BY THE SELLER, DESIGNER, OR CONTRACTORS.**

8. The buyer and/or operator, as defined above, acknowledges the receipt and understanding of this **WARNING NOTICE** and so agrees by their decision to go ahead with purchasing, accepting, and operating this aircraft or any of its parts to hold Seller, as defined above, **HARMLESS FROM ALL LIABILITY AND FROM ANY CLAIMS OF DAMAGES AND CAUSES OF ACTION WHICH MAY BE INCURRED BY THEM OR ANY THIRD PARTY** as a result of the purchase, use, construction, and operation of this aircraft, its plans parts, and components. **THE BUYER AND/OR OPERATOR HEREBY ASSUMES ALL RISK, LIABILITY, AND RESPONSIBILITY RELATIVE TO THE CONSTRUCTION AND OPERATION OF THE AIRCRAFT.**

Aircraft Sale Agreement

AIRCRAFT BUILT BY: ____________________

AIRCRAFT MODEL ____________ SERIAL NO. ____________ REGISTRATION NO. ____________

This is to certify that the Experimental Aircraft identified above is the sole property of the Seller whose signature appears below. It is further certified that the Seller agrees to sell the above identified aircraft to the Buyer whose signature appears below, and the Buyer agrees to purchase said aircraft, and further agrees, (for himself, his heirs, administrators, and assigns) to the following stipulations:

1. The Buyer is aware of risks and potential dangers involved when flying Experimental aircraft and knows that this type of "Amateur-Built" aircraft does not, nor is it required to, comply with Federal Aviation Administration's safety standards for commercially sold aircraft, nor with any other standards.

2. The Buyer agrees and understands that no warranties, neither explicit nor implied, neither verbal nor written are given by the Builder, nor the Seller, nor by their suppliers, as to the performance expectations and safety of this Experimental equipment. The Buyer acknowledges that he has read and agrees to comply to the letter with all instructions of the Seller as well as those contained in the Manuals of Vendors' parts and components.

3. The Buyer states without reservation that he possesses the skills and knowledge necessary to operate said Aircraft, and that he is currently in compliance with all requirements of the FAA and will operate said Aircraft pursuant to all applicable instructions and flight rules governing flight of said aircraft.

4. THE BUYER AGREES TO ASSUME THE RISK AND TO HOLD (FOR HIMSELF, HIS HEIRS, ADMINISTRATORS AND ASSIGNS) THE SELLER, BUILDER, DESIGNER, MATERIALS OR PLAN SUPPLIERS, AND ANY OTHER THIRD PARTIES ASSOCIATED IN ANY WAY WITH THE CONSTRUCTION, DESIGN, APPROVAL, LICENSING AND/OR OPERATION OF SAID AIRCRAFT, ITS PLANS OR ANY PART THEREOF, HARMLESS FROM AND INDEMNIFY THEM AGAINST ANY AND ALL LIABILITIES, DEMANDS, CLAIMS, SUITS, LOSSES, DAMAGES, CAUSES OF ACTION, FINES OR JUDGMENTS, INCLUDING ALL COSTS OF LITIGATION, AND EXPENSES INCIDENT THERETO, CAUSED OR OCCASIONED BY OR ARISING FROM THEIR ACTS, NEGLIGENCE AND/OR OMISSION, OR FROM ANY OTHER CAUSE IN ANY INCIDENT RELATED CONSEQUENTIALLY TO HIS USING OR BEING EXPOSED TO THIS AIRCRAFT.

5. No one is authorized to modify or waive these conditions, and the Seller admits no liability by accepting this release.

Additional Seller's instructions: ____________________

____

____

____

____

BUYER (SIGNATURE)	DATE	SELLER	
ADDRESS	CITY	STATE	ZIP

GUEST RECORD AND AGREEMENT

Aircraft Built by: ______________________ Model: ______________ Registration No.: ____________

This is to certify that the Experimental Aircraft identified above is sole property of the Owner whose signature appears below. It is further certified that the Owner hereby grants permission to the Guest signed below, and the Guest agrees, (for himself, his heirs, administrators and assigns) to operate this Aircraft in accordance with the following stipulations:

1. The Guest is aware of risks and potential dangers involved when flying Experimental aircraft and knows that this type of "amateur-built" aircraft does not, nor is it required to, comply with Federal Aviation Administration's safety standards for commercially sold aircraft, nor with any other standards.

2. The Guest agrees and understands that the builder of said Aircraft has the sole responsibility for its manufacture, design and workmanship. He also understands and agrees that no warranties, neither explicit nor implied, neither verbal nor written are given by the Builder, nor the Owner, nor by their suppliers, as to the performance expectations and safety of this Experimental equipment. The Guest acknowledges that he has read and agrees to comply to the letter with all instructions of the Owner as well as of those contained in the Manuals of Vendors' parts and components. The Guest states without reservation that he/she possesses the skills and knowledge necessary to operate said Aircraft, and that he/she is currently in compliance with all requirements of the FAA and will operate said Aircraft pursuant to all applicable instructions and flight rules governing said flight.

3. **FOR THE PRIVILEGES AND COURTESIES EXTENDED TO THE GUEST WHILE OPERATING, OR RIDING IN, OR BEING EXPOSED TO THE SUBJECT EXPERIMENTAL AIRCRAFT, THE GUEST AGREES TO ASSUME THE RISK AND TO HOLD (FOR HIMSELF, HIS HEIRS, ADMINISTRATORS AND ASSIGNS), THE OWNER, BUILDER, DESIGNER, MATERIALS OR PLAN SUPPLIERS, AND ANY OTHER THIRD PARTIES ASSOCIATED IN ANY WAY WITH THE CONSTRUCTION, DESIGN, APPROVAL, LICENSING AND/OR OPERATION OF SAID AIRCRAFT, ITS PLANS OR ANY PART THEREOF, HARMLESS FROM AND IDEMNIFY THEM AGAINST ANY AND ALL LIABILITIES, DEMANDS, CLAIMS, SUITS, LOSSES, DAMAGES, CAUSES OF ACTION, FINES OR JUDGMENTS, INCLUDING ALL COSTS OF LITIGATION, AND EXPENSES INCIDENT THERETO, CAUSED OR OCCASIONED BY OR ARISING FROM THEIR ACTS, NEGLIGENCE AND/OR OMISSION, OR FROM ANY OTHER CAUSE IN ANY INCIDENT RELATED CONSEQUENTIALLY OR INCONSEQUENTIALLY TO HIS USING OR BEING EXPOSED TO THIS AIRCRAFT.**

4. The Guest also agrees to replace, repair or adequately compensate the Owner and/or third parties for any equipment or materials which he may consume, wear out, lose, damage or destroy in the course of his using, acting upon and/or operating said Aircraft. He also agrees to use all reasonable care and precautions to prevent accidents, and to obey safety rules, regulations and instructions of the FAA, local officials and of local Airport management.

5. No one is authorized to modify or waive these conditions, and the Owner admits no liability by accepting this Release. The Guest shall carry one executed copy of this Release with him while operating the Aircraft, and the Owner shall file the second copy in his records.

6. The Owner further certifies that he grants this permission, and the Guest receives it, of their free will and accord, and no compensation in any form for it has been exchanged or promised between them. This permit is valid only for the date(s) shown below.

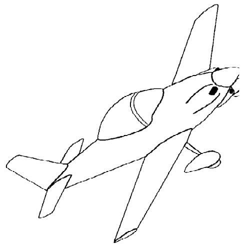
Additional Owner's Instructions: ____

____

______________________	______________	______________________
Guest	Date	Owner

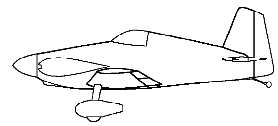
______________________________	______________________________
Guardian, if under legal age	Guardian, if under legal age

Mustang Aeronautics, Inc.
1990 Heide Dr
Troy, MI 48084



Phone: (248) 649-6818
Fax: (248) 688-9275
MustangMail@MustangAero.com

Aircraft Registration



Mustang Serial No. ____________

Name: ___________________________________

Address: ______________________________
____
____
____

Telephone: ______________________________

E-Mail: ______________________________

Midget Mustang: ☐ Mustang II: ☐

Plans Built: ☐ Kit Built: ☐

Folding Wing: ☐ Tri-Gear: ☐

Original Plans Owner? yes ☐ no ☐

[If you are not the original owner, please supply any available info on previous owner(s) in the comments section]

Date Started: __________________________

First Flight: __________________________

Aircraft N#: __________________________

Engine Used: __________________________

Empty/Gross Weight: __________________________

Can we give your contact info to other builders?

yes ☐ no ☐

Building and Flight Comments: *(optional)*

____
____
____
____
____
____
____

(Submit Registration to Mustang Aeronautics upon project completion)

Areas to inspect closely for cracks would be:

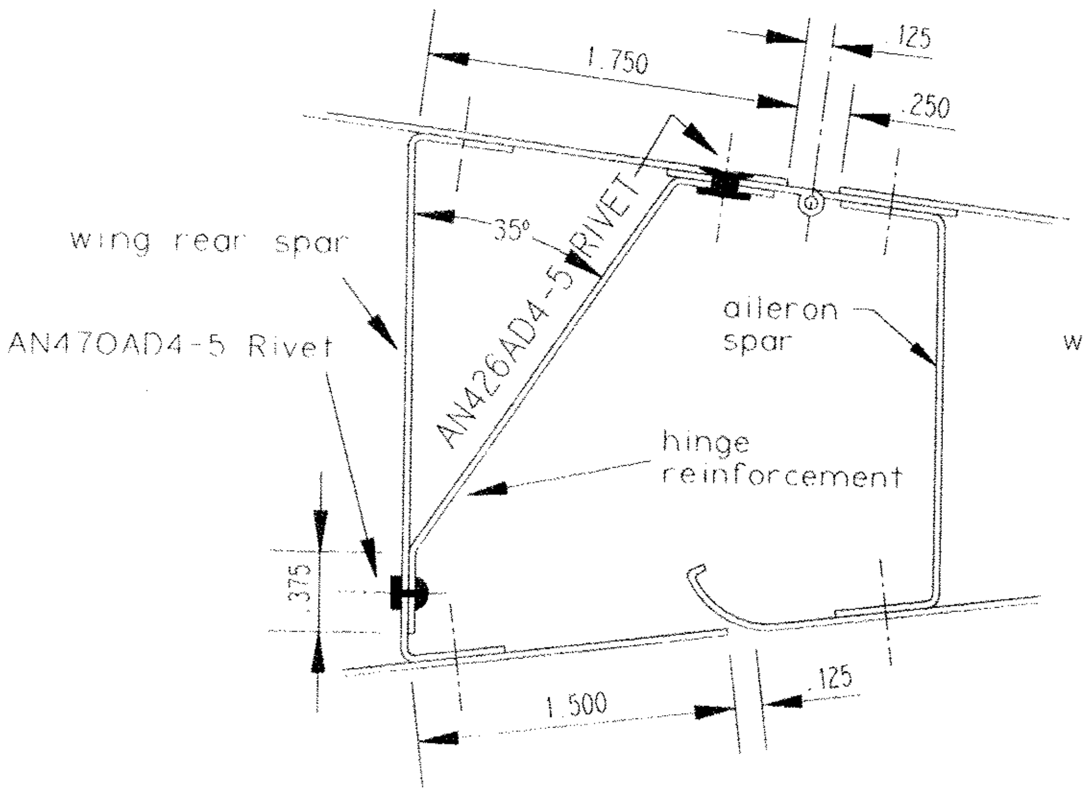
-the landing gear mount tubes between the gear leg and the main/front spar. Looking for cracks near welds at main spar bracket or bent tube.

-the small square horizontal bulkhead under the elevator control horn at the aft end of the tailcone. This has cracked on some airplanes leading to a failure in the major fin attach point here, it has never been catastrophic but every preflight should include checking for movement here by pulling the tip of the fin rear spar towards the tip of the horiz stab rear spar, one hand on each.

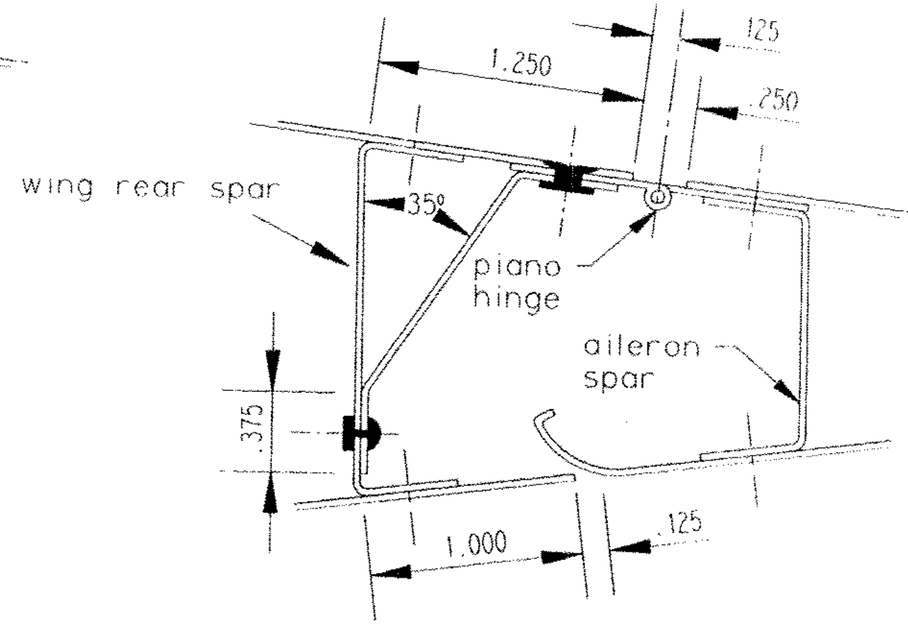
-the horiz stab and vert fin spar around the outboard hinge brackets for the rudder and elevators. Airplanes with some bad hinge alignment developed cracks here.

-the elevator control arms between the elevators and the control horn. Looking for cracks around the welds.

figure O



Aileron Attachment
[sta. 63.0]



Aileron Attachment
[sta. 106.5]

Midget MustangAileron Controls

Figure 1

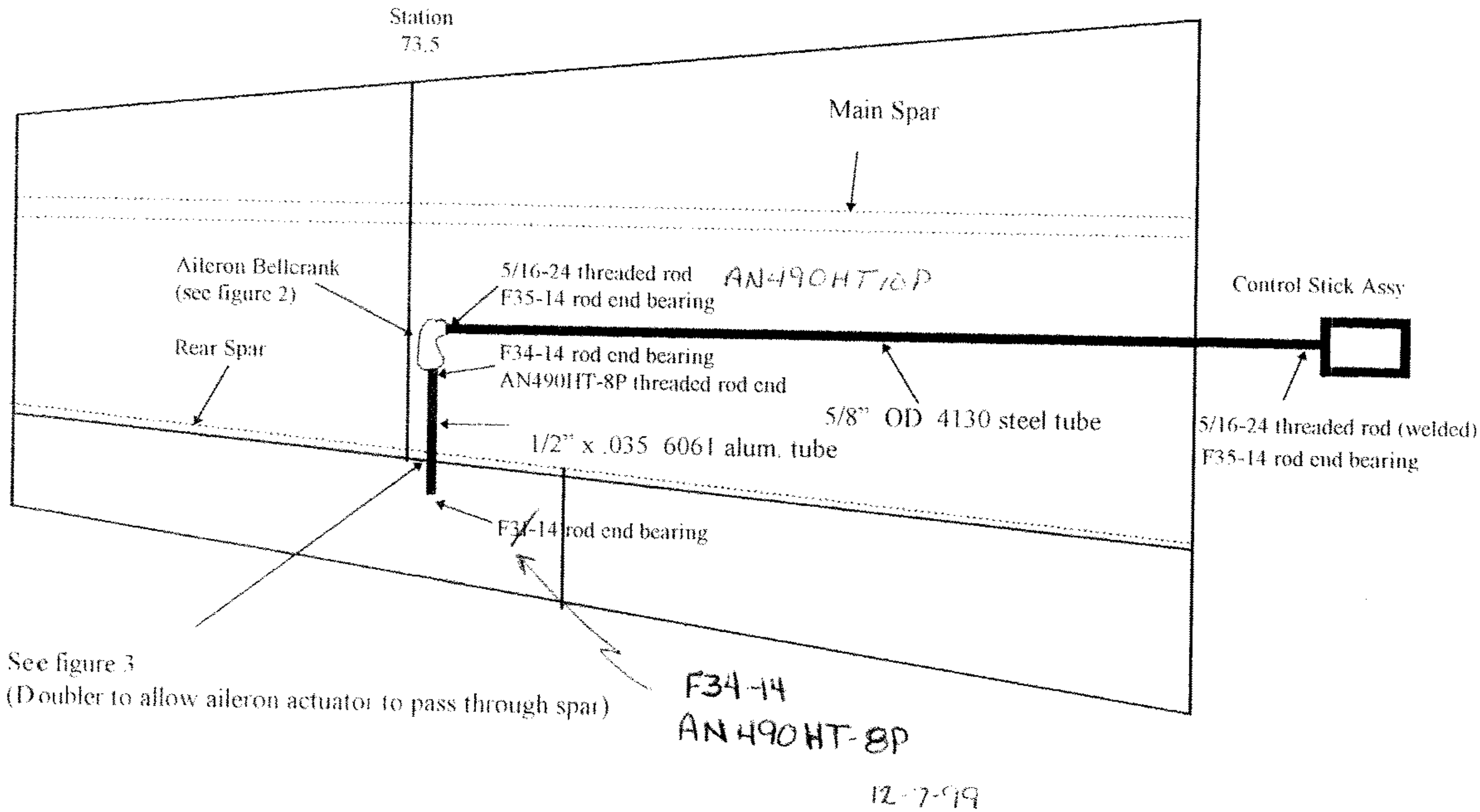


Figure 2

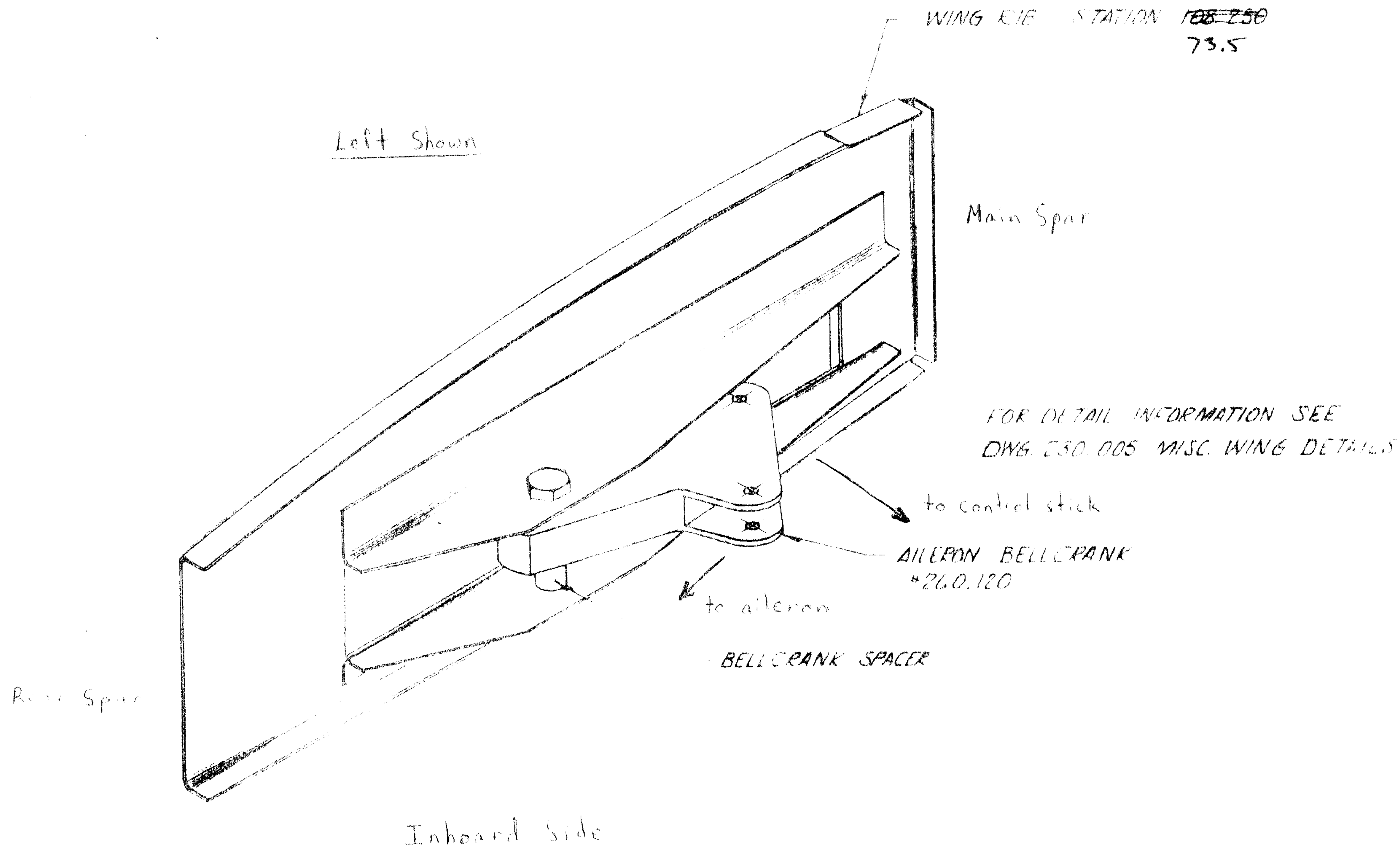
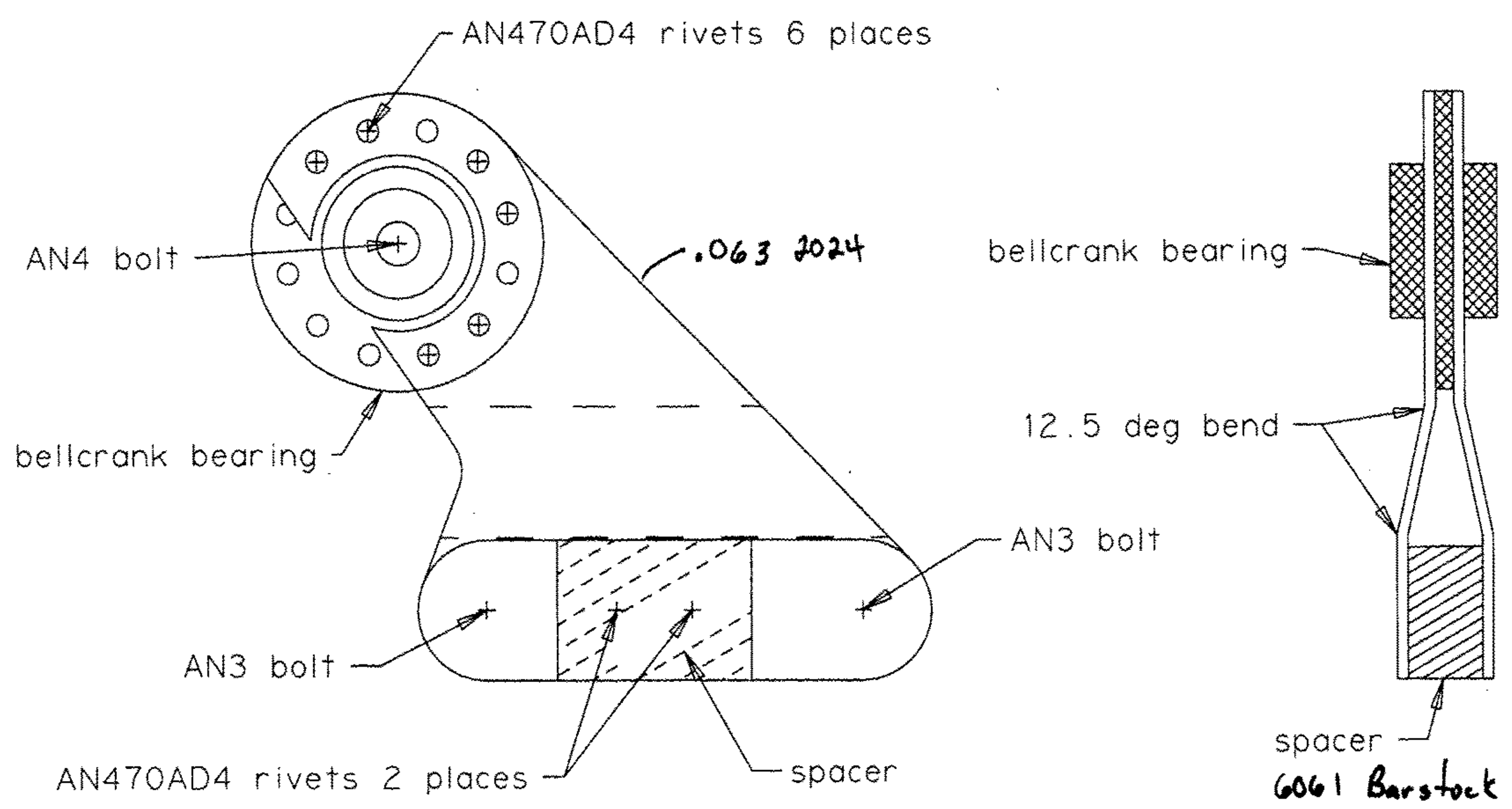

Left Shown
WING RIB STATION ~~108.250~~ 73.5
Main Spar
FOR DETAIL INFORMATION SEE
DWG. 230.005 MISC. WING DETAILS
to control stick
AILERON BELLCRANK
#260.120
to aileron
BELLCRANK SPACER
Rear Spar
Inboard Side

Figure 2a



Assembly 260.120
aileron bellcrank

Bushing: .468 X 3/8 OD X .058 wall

full size

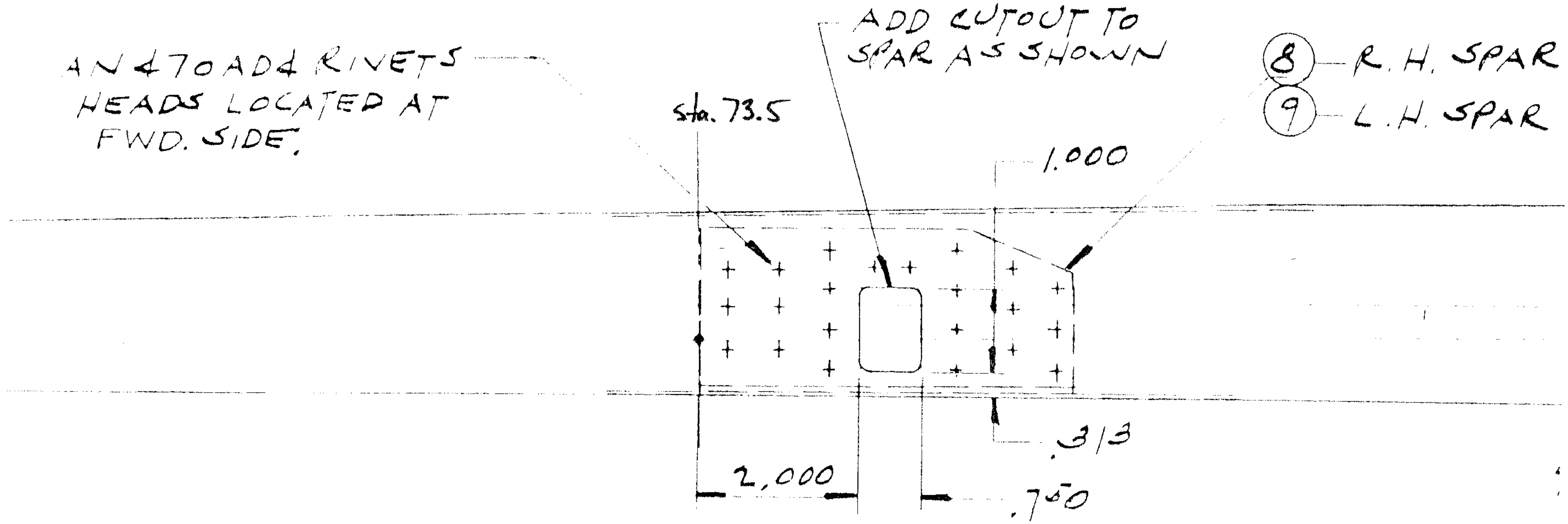
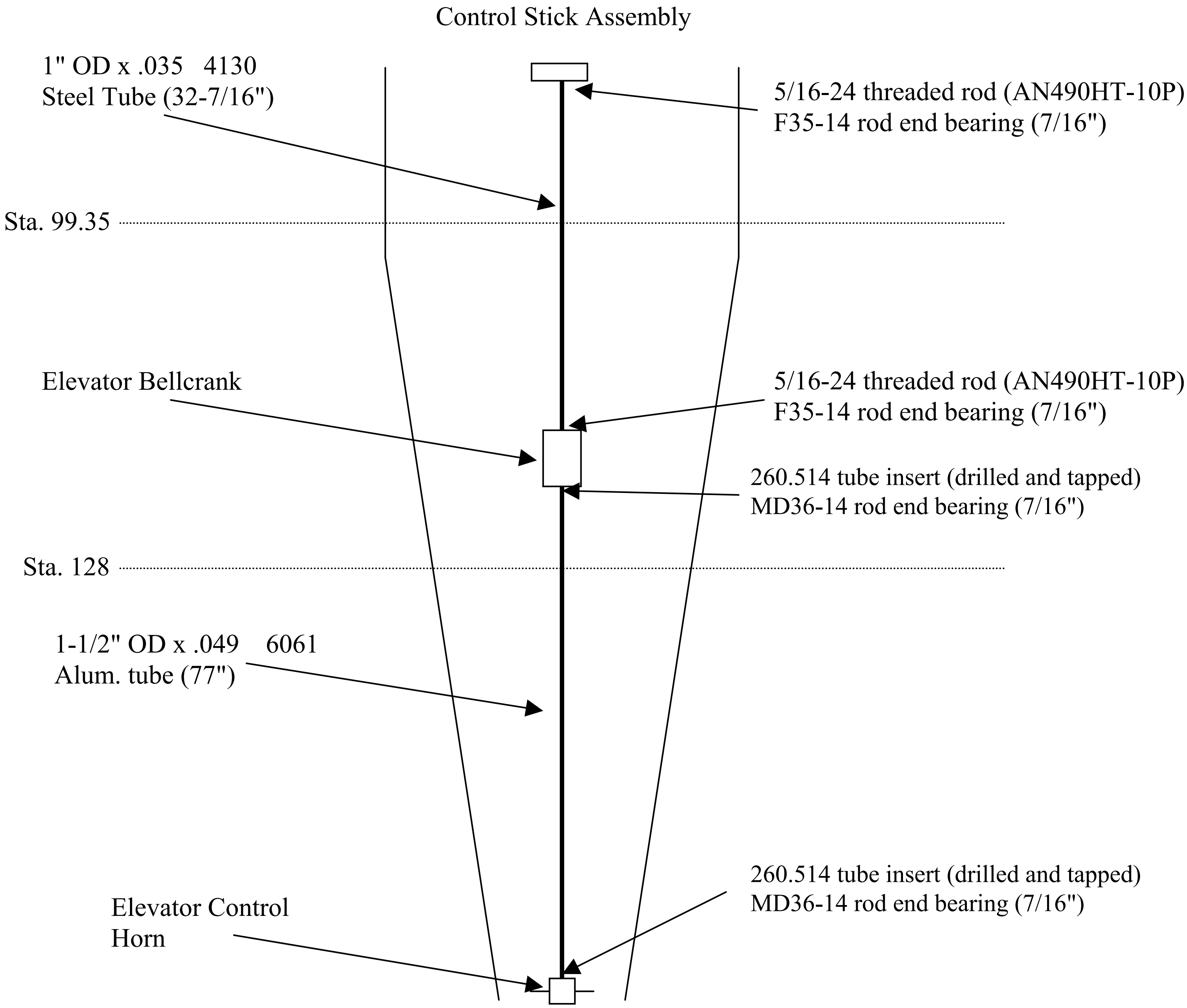
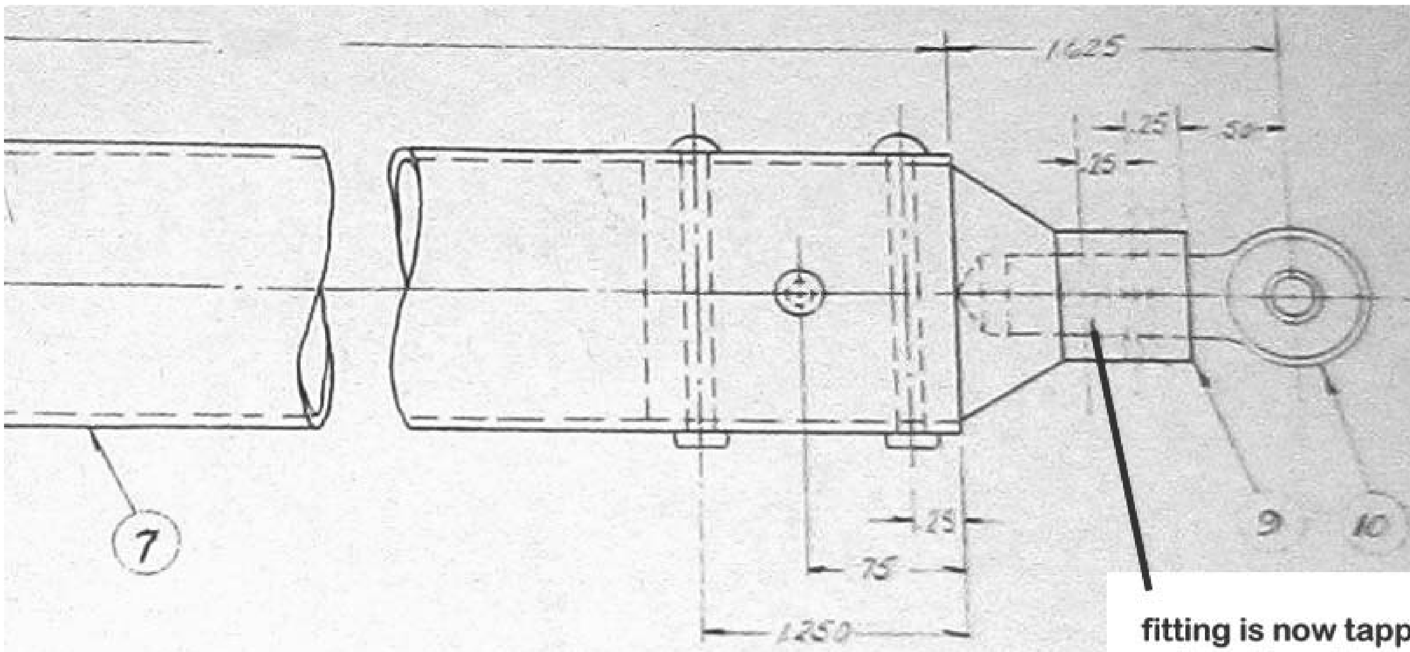

AN470AD4 RIVETS
HEADS LOCATED AT
FWD. SIDE.
sta. 73.5
ADD CUTOUT TO
SPAR AS SHOWN
8 R.H. SPAR
9 L.H. SPAR
1.000
.313
2.000
.750

Figure 3

Midget Mustang Elevator Controls

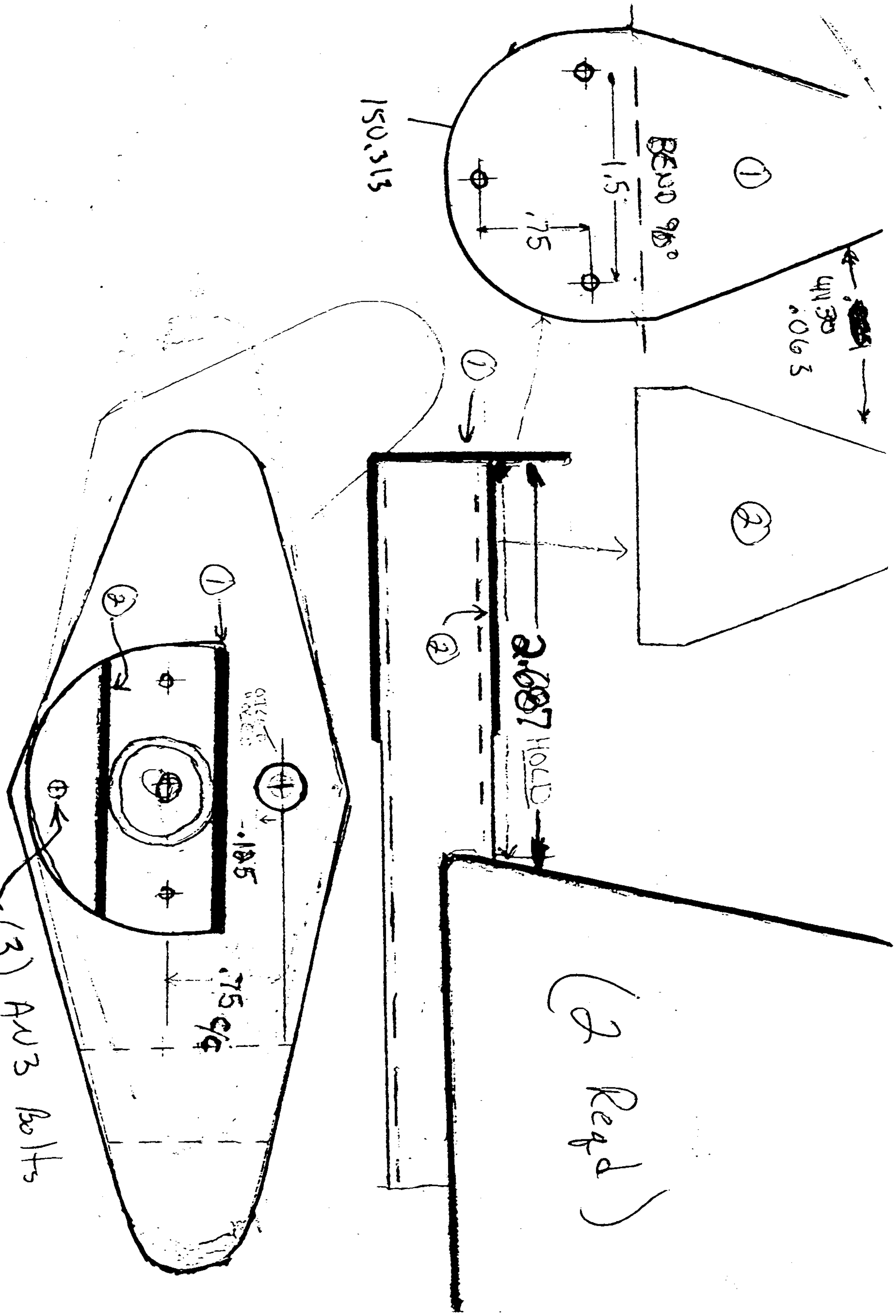




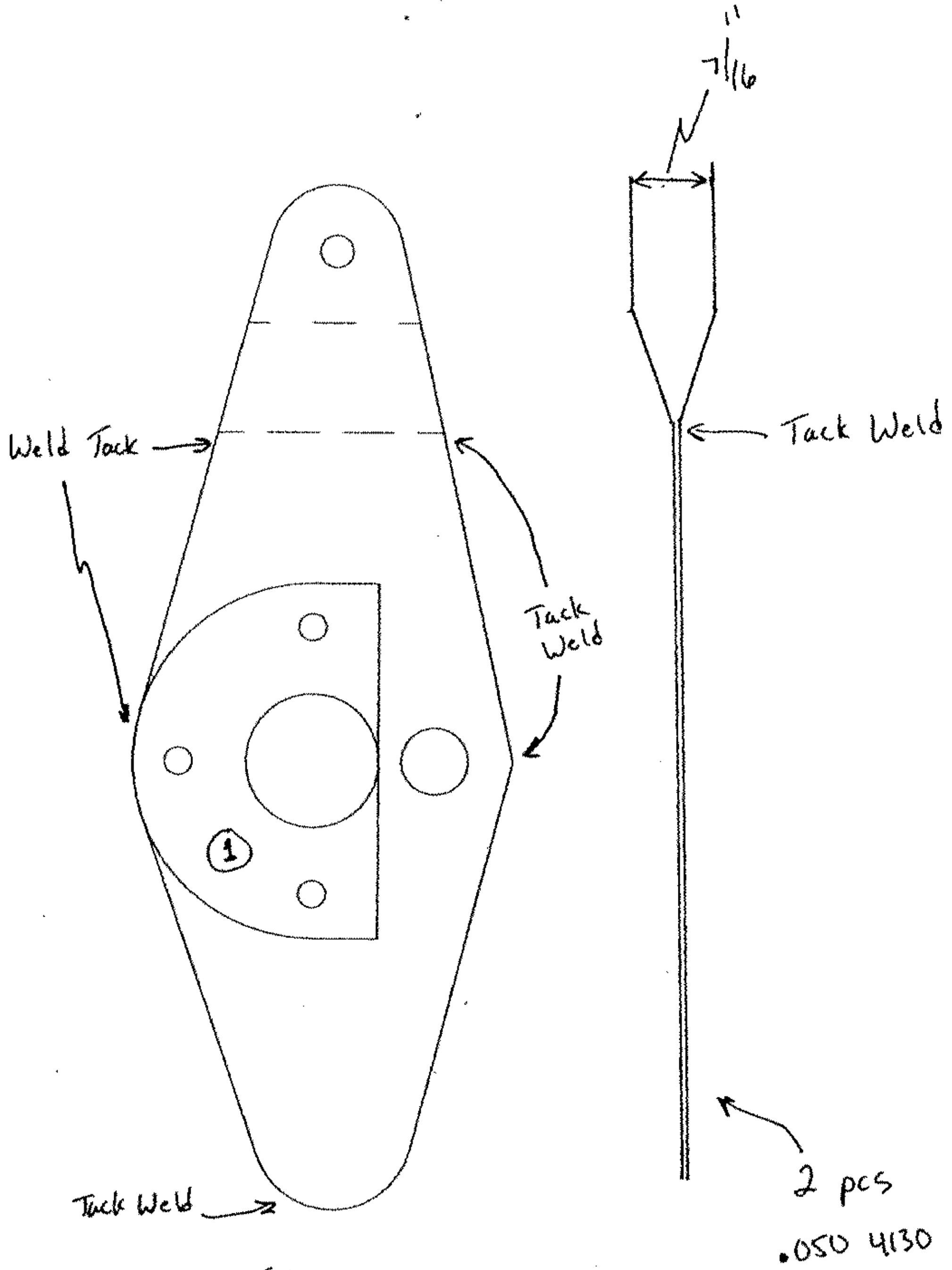
fitting is now tapped for MD36-14
rod end bearing.
(alternate bearing is Aurora
p/n GMM-3M-670)

Aft Elevator Control Tube

MIDGET ELEVATOR CONTROL HORN ASSEMBLY

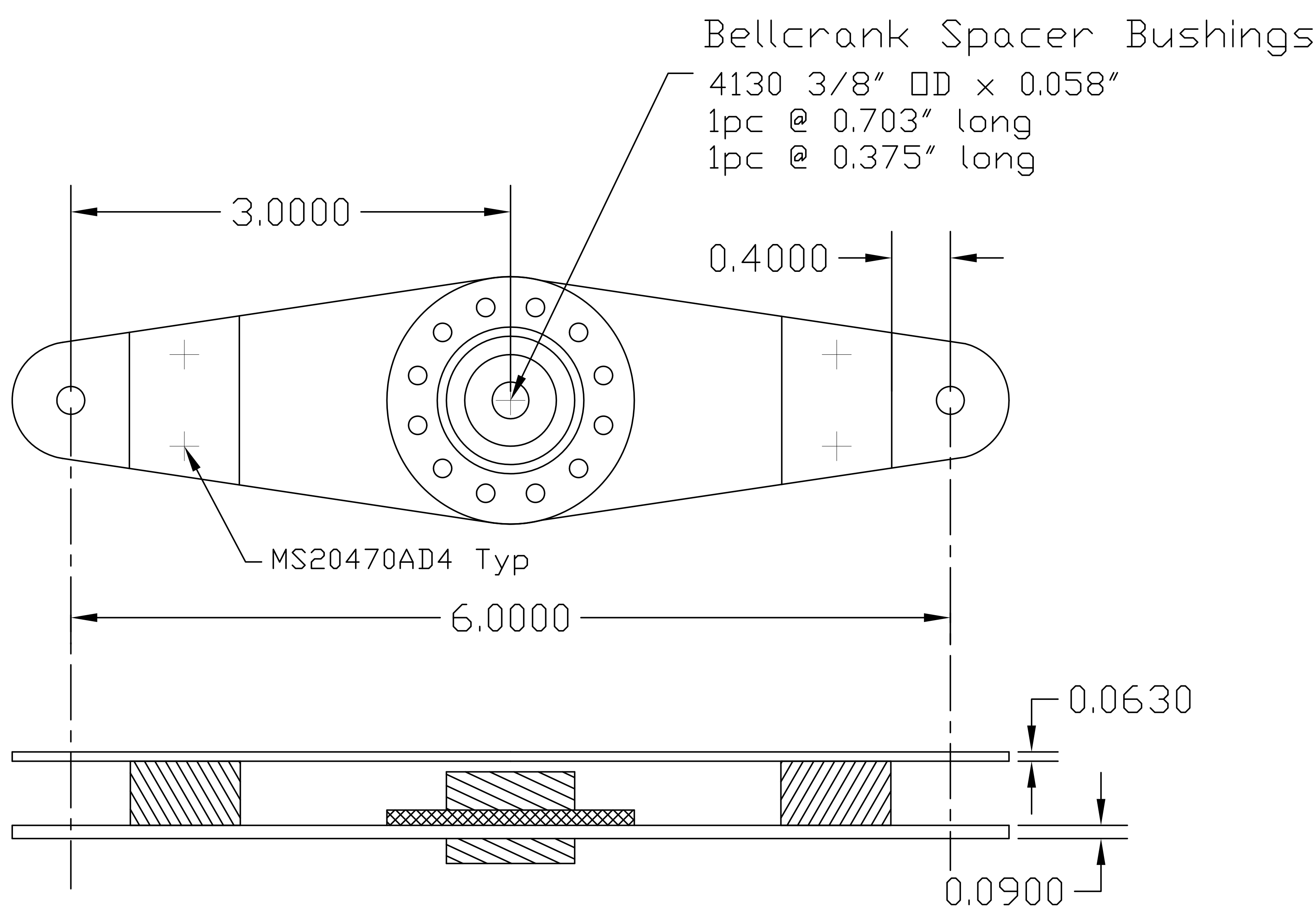


This end is the bottom of the horn
where the pushrod attaches.



Full Size

M-I Elevator Control Horn



160.121 Elevator Bellcrank

rev 11/29/2016

MUSTANG AERONAUTICS, INC.

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Troy, MI 48084

(248) 649-6818
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www.MustangAero.com

Mustang II & Midget Mustang Service Bulletin

Date: 5/22/00

Subject: Change to outboard horizontal stabilizer and elevator hinge brackets (p/n 250.308 & 250.321)

This change applies to both the Mustang II and Midget Mustang. The parts are interchangeable.

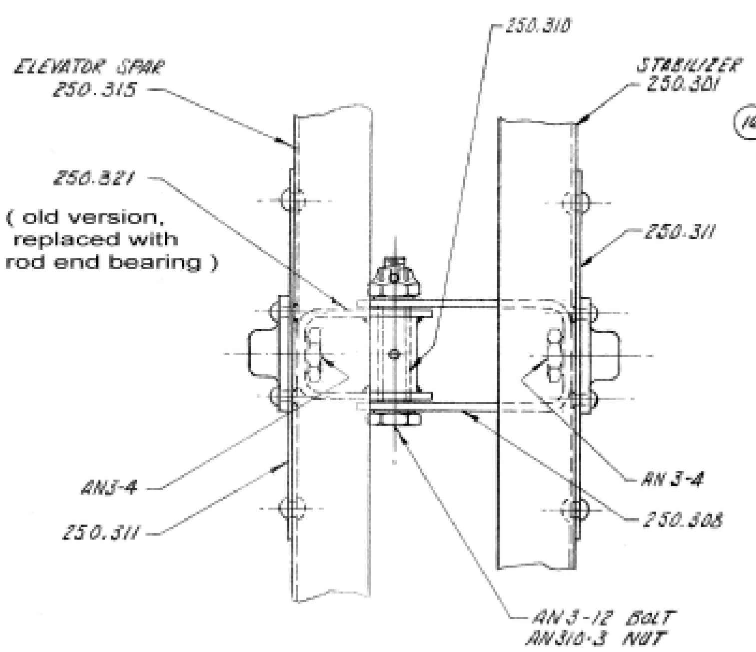
This change is not required for existing aircraft that do not have hinge alignment issues (binding) of the elevators. It was primarily made to simplify construction and manufacturing. It will also help to eliminate the possibility of cracks in the horizontal stabilizer spar around the doublers at the outer elevator hinge points due to misalignment of the hinge points.

The larger spar doublers, additional attach bolts for p/n 250.308, and the adjustment capability of the elevator attach points using rod end bearings make the new configuration superior in many ways.

It is possible to use the older steel elevator hinge bracket (p/n 250.321) with the new multiple bracket version of the stabilizer hinge brackets (p/n 250.308). The spacing between the 250.308 brackets just needs to be changed accordingly.

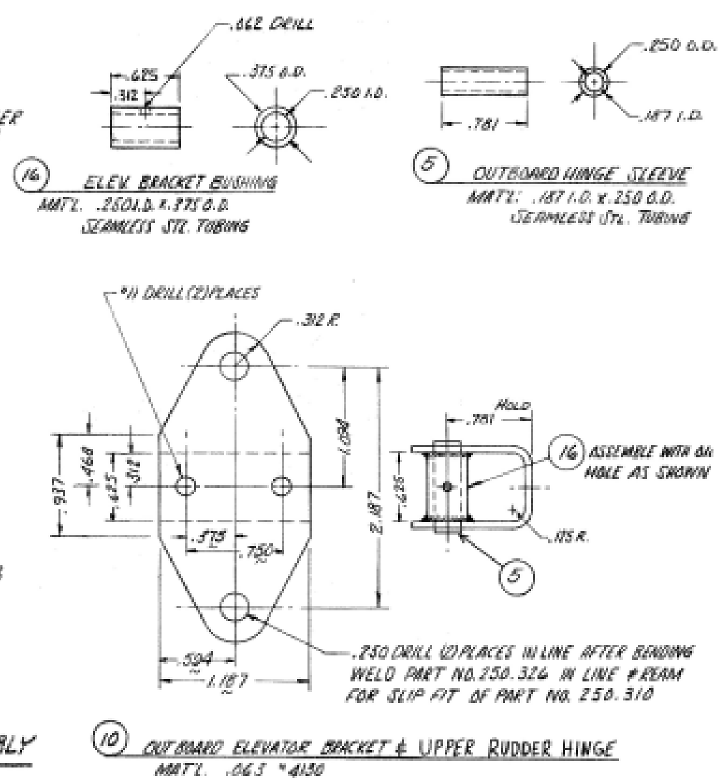
Original Configuration

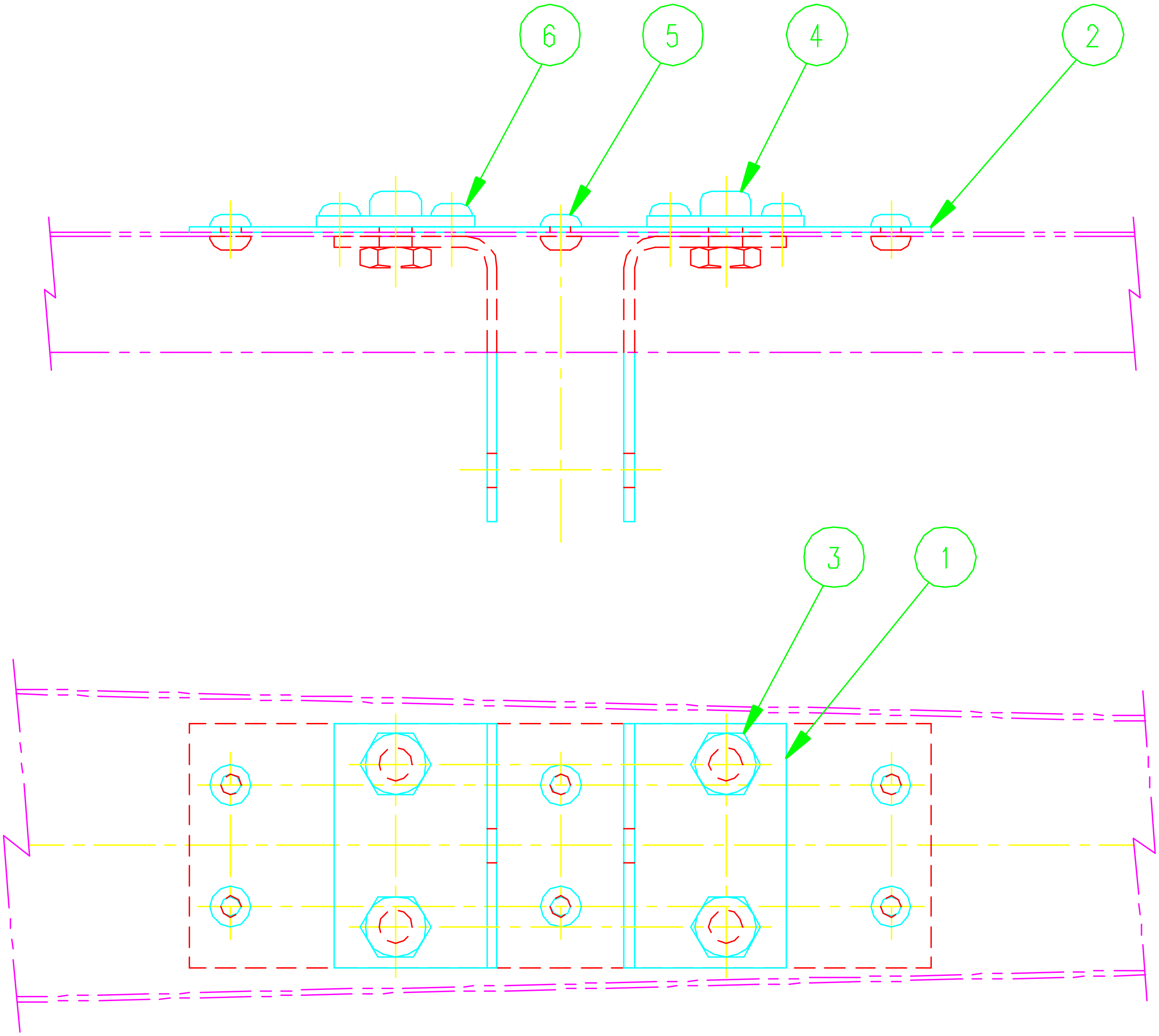
from dwg 250.003



Old Style OUTBOARD HINGE ASSEMBLY

from dwg 250.002





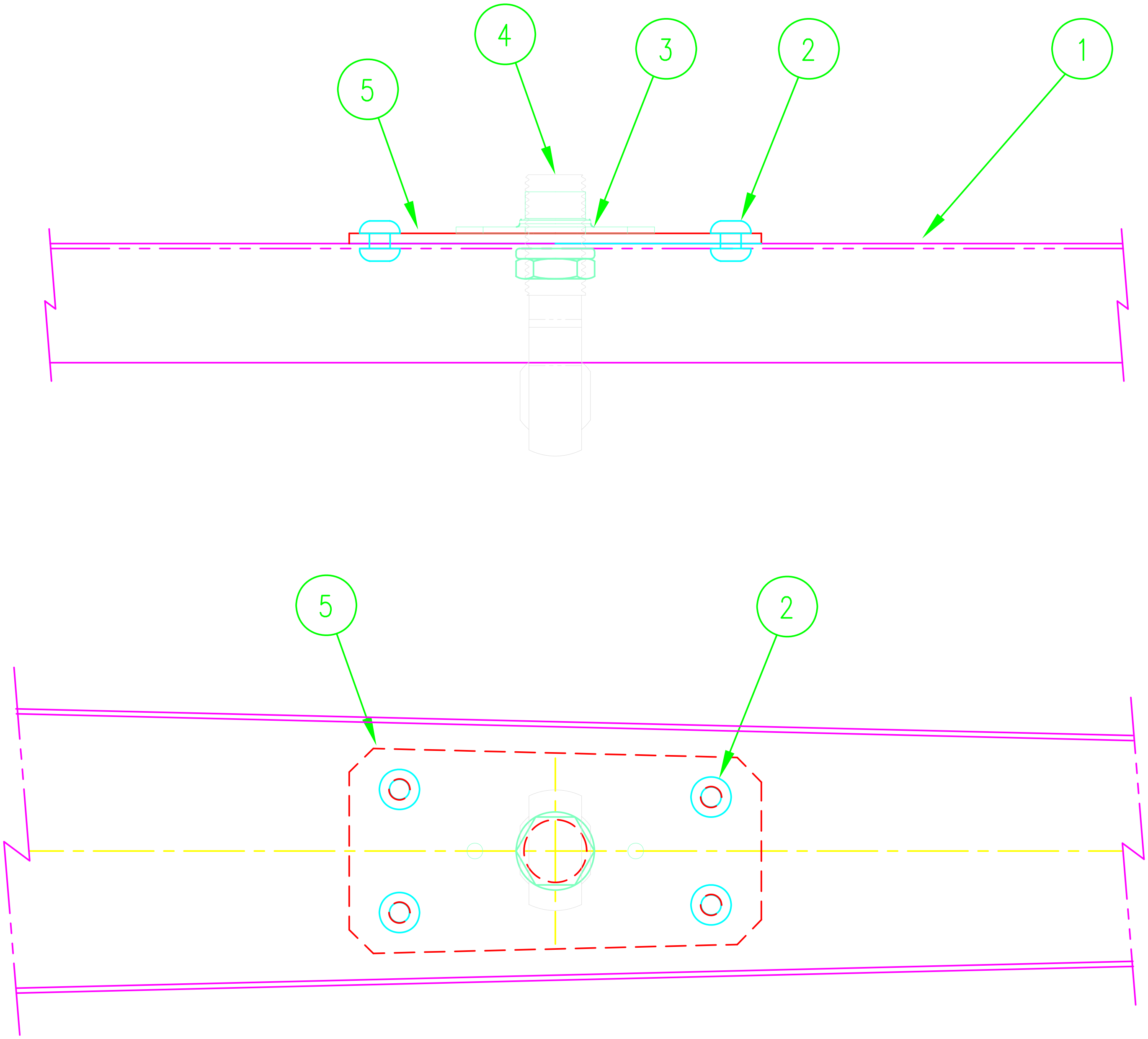
ITEM	PART No.	DESCRIPTION	No.	MAT'L
1	250–308	OUTBOARD STABILIZER HINGE .063 THK.	6	4130 STL.
2	250–386	HINGE BRACKET DOUBLER .032 THK.	5	2024 T3 AL.
3		AN3–3A BOLT	12	
4		AN366–F1032 NUT PLATE, SELF LOCK	12	
5		AN470–4–4 UNIVERSAL HEAD RIVET	18	
6		AN426–4–6 C'SUNK RIVET	24	

Mustang II

Mustang Aeronautics

Title: REVISED HINGE BRACKET AND DOUBLER

Scale: 1:1	Approved By:	Drawn By: TRM	Date: 05/22/00
Mat'l:	Revised:	Drawing Number.: XXX.XXX	

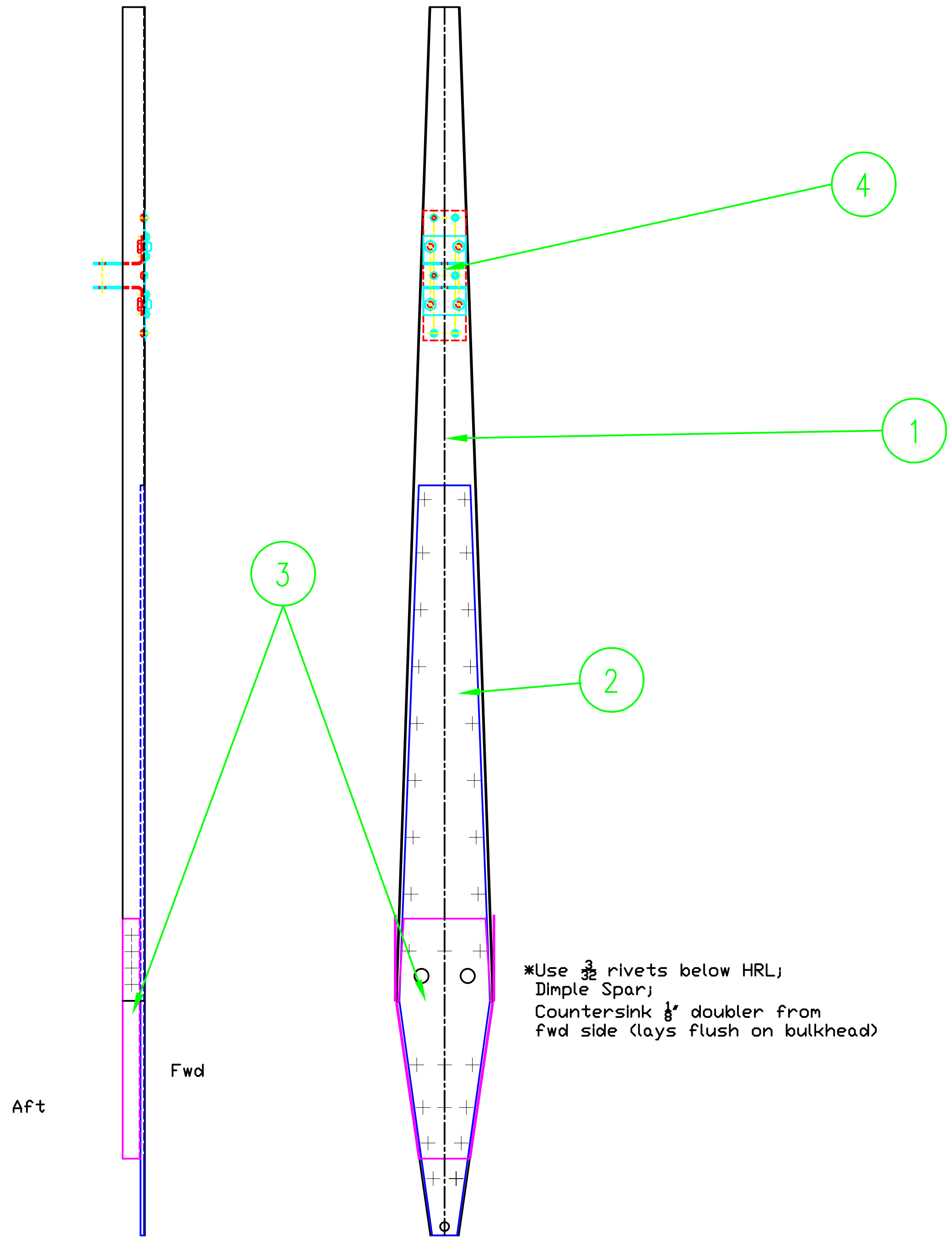


ITEM	PART No.	DESCRIPTION	Qty.	MAT'L
1	250.315	Elevator Spar	2	0.032 2024 AL
2		AN470AD4-5 Universal Head Rivet		
3		MS21047-L6 3/8" nutplate	3	
4		GMM-3M-670 RodEnd Bearing (MD36-14)	3	
5	250.329	Outboard Elev/Rudder Hinge Brkt Dblr	3	0.063 2024 AL

Mustang II
Mustang Aeronautics

Title: Revised Outboard Elevator Hinge

Scale: 1:1	Approved By:	Drawn By: CKT	Date: 08/20/11
Mat'l: ASSEMBLY	Revised:	Drawing Number.:	



ITEM	PART No.	DESCRIPTION	QUAN.	MAT'L	DWG No.
4	150.338	UPPER FIN HINGE	1	2024	13
3	150.335	LOWER FIN SPAR DOUBLER	1	.032 2024	13
2	150.332	SPAR REINFORCING PLATE	1	.125 2024	13
1	150.331	FIN REAR SPAR	1	.032 2024	13

Midget Mustang
Mustang Aeronautics

Title: FIN REAR SPAR

Scale: 1:6	Approved By: CKT	Drawn By: DSS	Date: 06/09/03
Mat'l:	Revised:	Drawing Number.: 13-R1	

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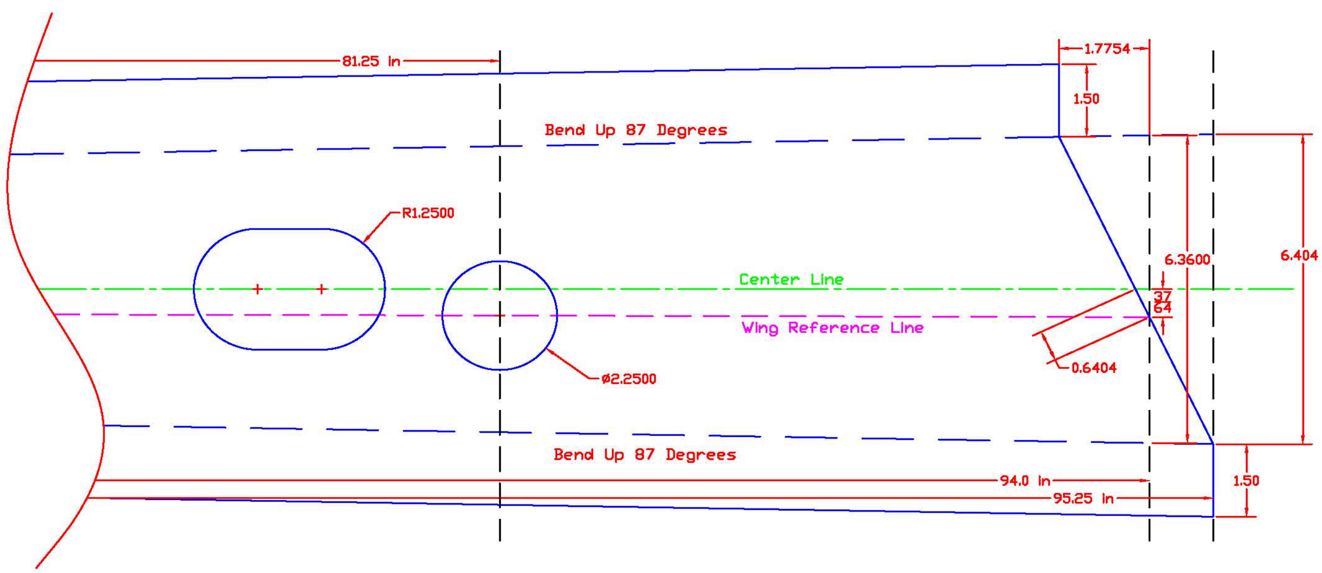
Mustang II Service Bulletin

Date: April 10 2012

Subject: Main Wing Spar, Wing Reference Line (WRL) at root end (p/n 130.301)

The following diagram shows the location of the WRL at the root end of the main wing spars. The center line of the wing spar should be measured and marked first. The WRL can then be marked at 37/64" below the center line at 94.0" from the tip of the wing spar. It is easiest to mark the center line before cutting the taper at the root end of the spar.

Note that all station locations are to be determined by measuring from the tip of the wing spar. Any variations in spar length will then be on the root end. If the spar web is a bit long or short at the root end it will not effect the assembly.



Note that this diagram also shows the clearance hole for the landing gear torque tube at 81.25" from the tip of the spar. This change was previously documented and is to give better clearance of the torque tube to the wing rib.

IMPORTANT INFORMATION MANUAL REVISIONS

AVOID CONTINUOUS OPERATION AT 2600 RPM.

This is to avoid a harmonic vibration condition.

Fuselage Transverse bulkhead between stations 117.5 % 182.0 should not have a access hole in it. With the elemination of the access hole it will be necessary to rivet in the bulkhead after all other components are installed. Also, a AN 366-1032 plate nut must be used for fin rear spar lower bolt attachment.

Hole Reaming Technique. Where a reamed hole fit is called out it should be recognised that all AN bolts will be slightly undersize. It is therefore necessary to use a adjustable reamer, or a solid reamer that has been ground undersize. Especialy on the wing attach bolt fitting it is necessary to fit the individual bolts as they may each vary in diameter.

Fuselage Forward top skin (sta. 52 to 73.75) is a structural item and must be attached securely. Proper dimpling and countersinking, and the use of AN 366 plate nuts is required.

Control Stick top 6 inches should angle forward 30°. This is best acomplished by cutting out a "V" section and welding. This is a "Crashworthiness" improvement, and is important.

Tail Wheel forward attach bolt at sta. 177.5 is in need or rienforcement as rough ground operation has caused cracks at the bolt bracket attaching rivets. A rienforcing "washer" type plate of either .032" steel or .063" aluminum should be riveted to the belly skin around the tail spring attach bolt. This rienforcement should be aproximately 2 in. diameter and is to be a ZERO clearance fit on eigher the bolt or fitting bushing, whichever protrudes through the skin. When the newer "rod" type tail wheel spring is used the above rienforcement is not required.

Forward Facing fuel tank vent as per fuel system schematic is required on all gravity fuel systems.

TECHNIQUE TO FILE EDGES OF ALUMINUM SHEET:

Using a mill or smooth file held square with the edge of the sheet, the aluminum is dressed down untile the cut edge is completely shinny. Experience will show the amount of pressure to exert on the file. Too mucy pressure will result in galling. Too little pressure will take too mucy time. This dressing down of the edge will leave a slight burr on the edge of the sheet. This burr is removed by running the file lightly down the edge, with the file held at a 45 degree angle. It is not intended to radius the edge of the sheet. If the aluminum is protected with a sheet of paper the paper must be removed prior to the deburring operation or a burr the thickness of the paper will remain.

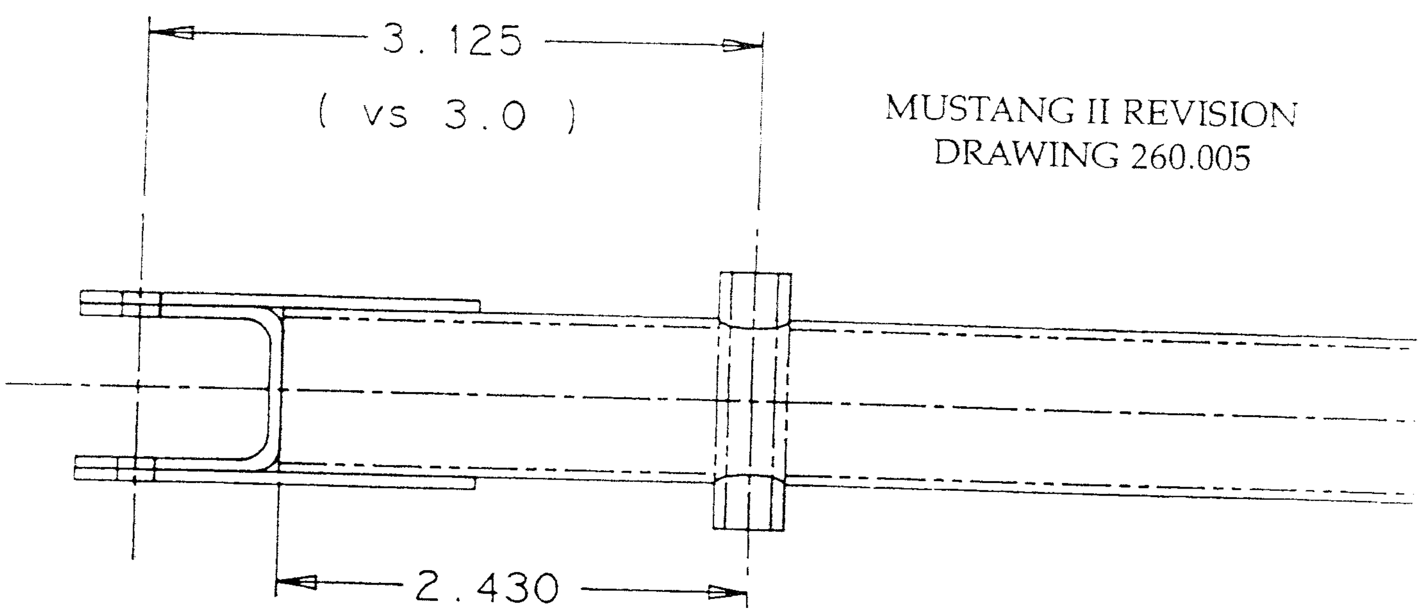
(continued from page 4)

Midget Mustang Aileron & Flap Attachment – In a previous newsletter a builder asked about Midget Mustang aileron and flap attachment sequence. We have found that it is easiest to install the flap first, and then the aileron.

Rudder & Elevator Attachment – The best way for removing and installing the tail group control surfaces is by using a ratchet with extensions long enough to reach the hinge bolts from the tip. First the elevator and rudder tips need to be removed. A slotted screwdriver is then used to hold the nut (or bolt if reversed) on the inboard side of the hinge. If the castle nut is used on the inboard side of the hinge it is easier to hold than the bolt.

Midget Mustang Gas Tank Hold Down – The turnbuckles should be adjusted so that the tank is close to where the top skin will be **before** attaching the skin. A welding rod or coat hanger with a bent end can then be used to tighten the turnbuckles after the skin is attached. The coat hanger or welding rod will determine how tight the tank will be wedged in automatically. It should be "snug" enough to prevent vibration and movement.

Riveting – A builder asked about cracks developing while dimpling for an AN509 screw. Cracks are **never** allowed. A properly deburred hole should not have this problem. If after proper cleaning of the hole it cracks while dimpling, try using a different #30 drill. Drill bits wear over time and become undersized. If this does not work, you can try a #29 drill bit.



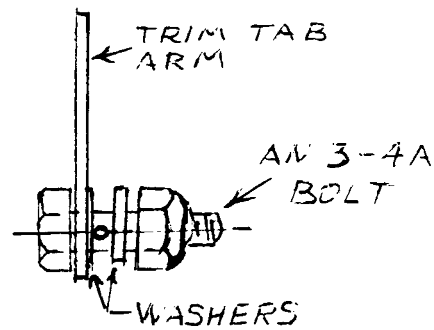
MUSTANG II REVISION
DRAWING 260.005

Control Stick Assembly

P/N 260.102

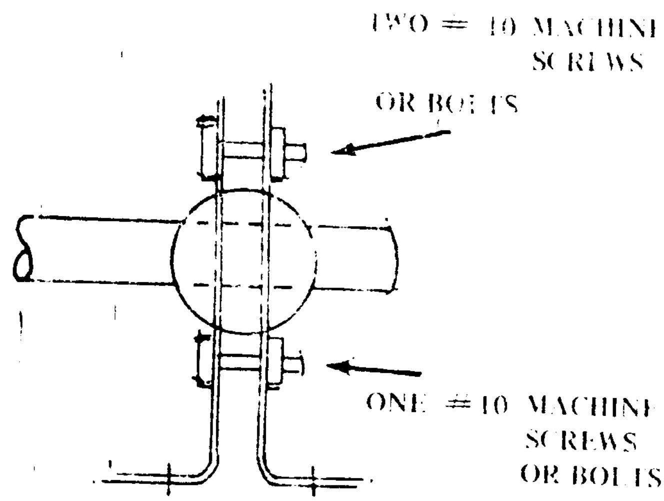
DWG. NO. 36 - TRIM RAB: CONTROL WIRE ATTACHMENT.

The .062 dia. hole drilled in the AN3-4A bolt for attaching the trim control wire is to be located .125" from the bolt head. The trim tab control arm is located between the bolt head and the wire. The control arm must be free to swivel without binding. A AN960-311 or 316L washer may be used to reduce excessive play of the arm. A AN960-316 washer and AN365-1032 nut are used to complete the installation. The nut is drawn tight to secure the control wire.

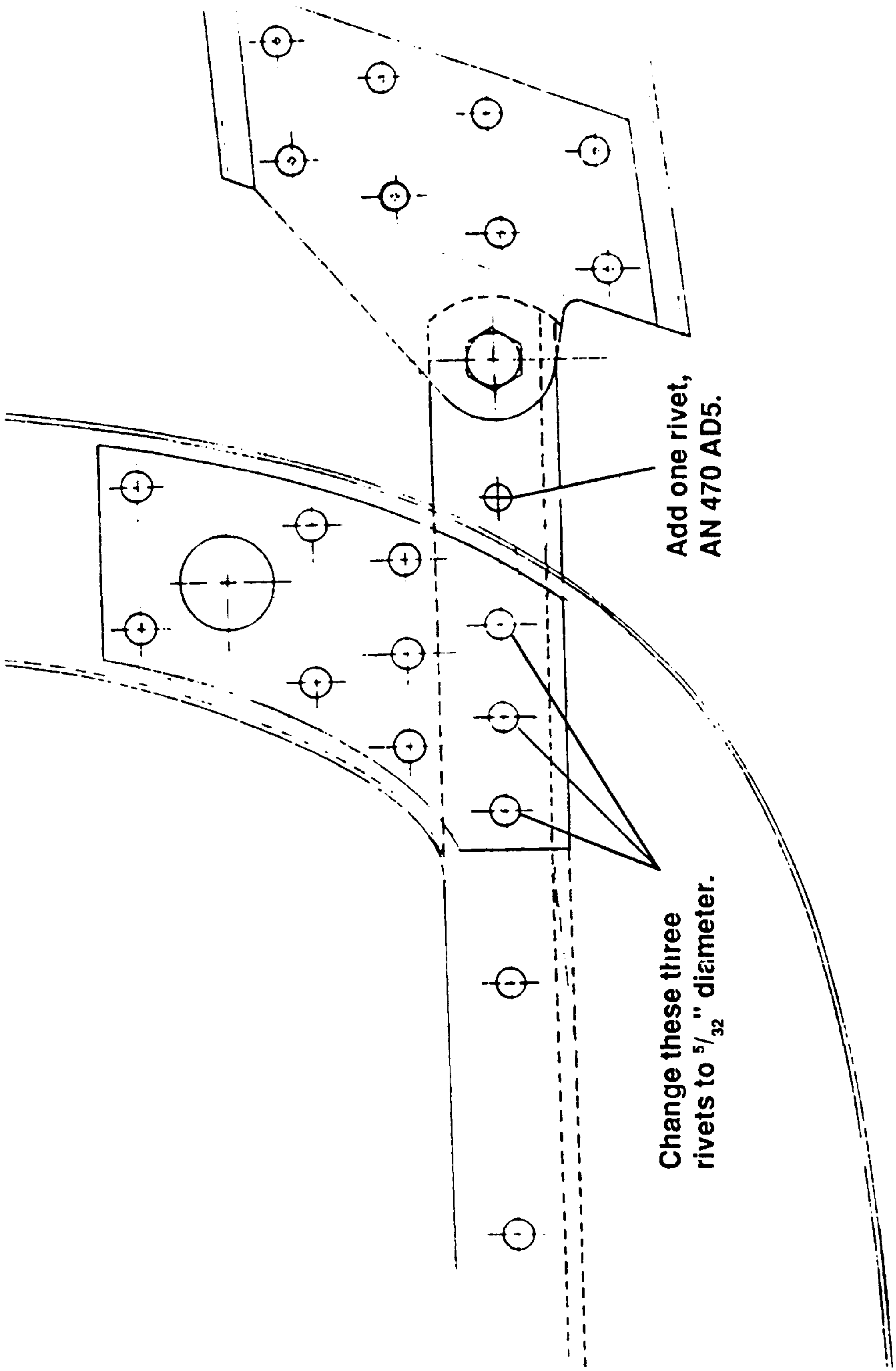


DWG. NO. 33 - AILERON TORQUE TUBE INBOARD MOUNT.

A builder suggested alternate method of mounting the aileron control torque tube at the fuselage end. (Ref. dwg.33) This method uses a MOONEY aircraft part which is a micarta ball of aprox. 1½" O.D. with a 3/4 dia. center bore. The micarta ball is mounted by means of two simple angle brackets three in. long fabricated of .040 al. with a 1" dia. hole for mounting the ball. On in stallation the mircarta ball is self aligning on the tube. Tightening the 3 clamping bolts makes this a rid-gid installation.



The micarta balls are available from BUSHBY AIRCRAFT INC.



Midget Mustang Station 99.35 Revision
Left side shown. Modify both sides.
Detail from drawing No. 9

Add reinforcement of 0.063 2024-T3 aluminum, 1 inch wide by 24 inches long. Position the reinforcement between the bulkhead and the carry-through angle. Change the three outboard rivets to AN 470 AD5 rivets. Add an additional rivet as shown.

Midget Mustang Revision

Station 73.75 Bulkhead

There are reports from the field of cracks developing in the station 73.75 bulkhead. The crack starts at the top outboard corner of the angle carry-through member, emanating from the cut out for the wing fitting clearance. Examination of this area may also show a bulge in the bulkhead web. It is suspected that the crack and bulge is caused by high inertial loads created by high "G" landings.

Installation of the doublers shown in the illustration would be a satisfactory repair. Installation of the doublers is recommended for new manufactured Midget Mustangs to prevent future operational difficulties.

NOTE: The doublers MUST be mounted with lower edge in contact with the carry-through angles.

The doubler is made of 0.063" aluminum and is to be placed both fore and aft of the bulkhead (total requirement 4 pieces.) Use AN 470 AD 4 Rivets.

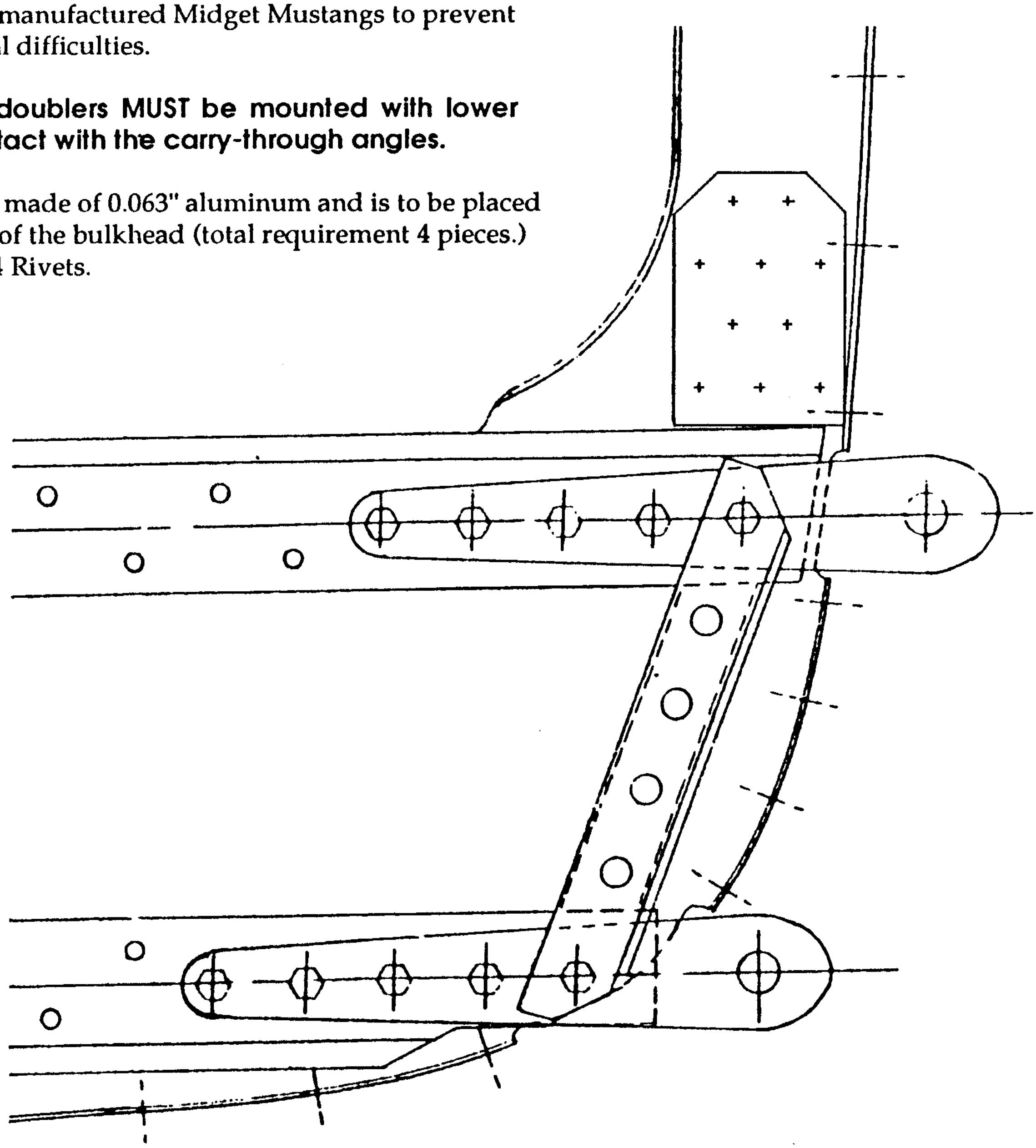
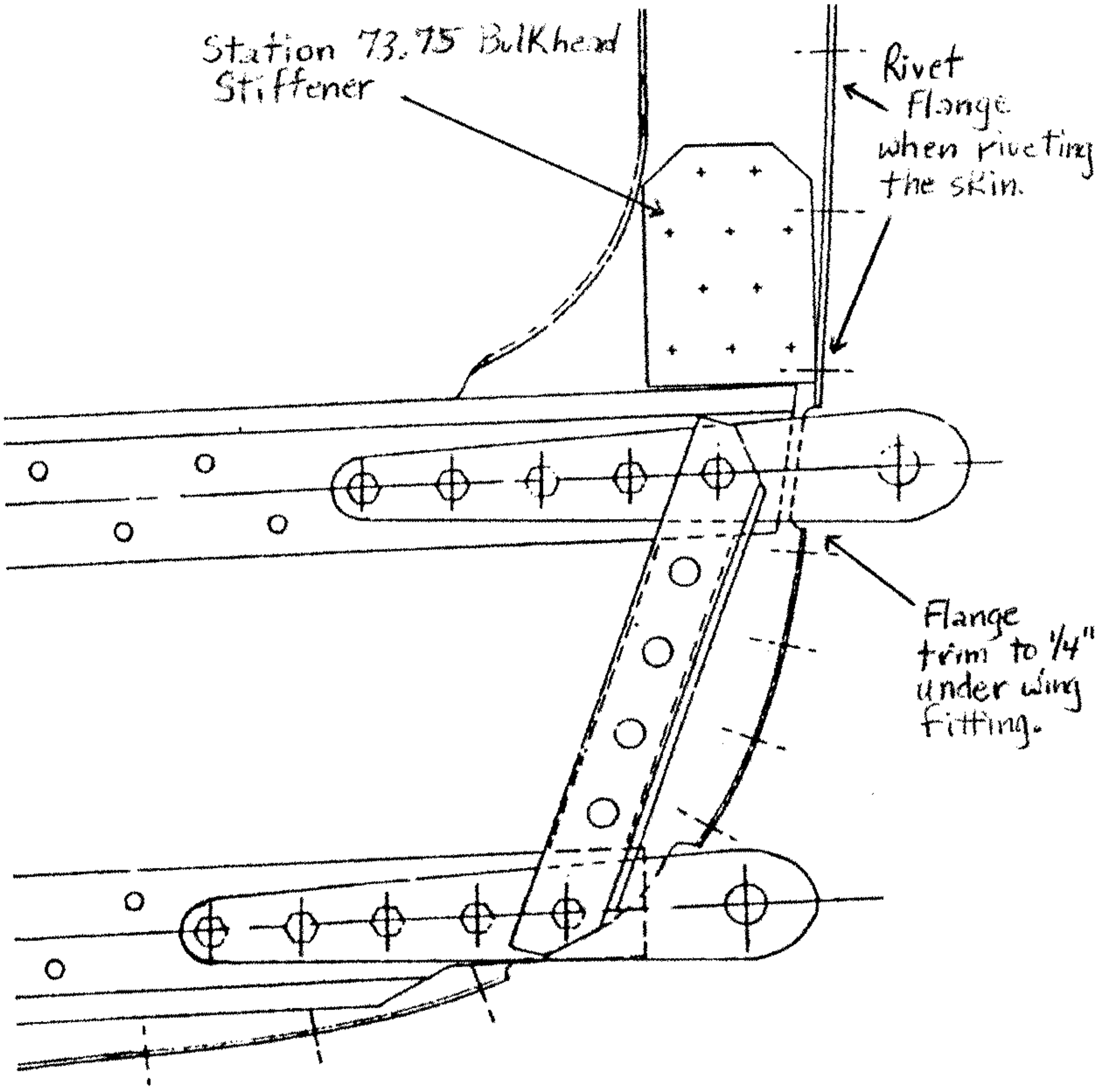


Figure #5



Station 73.75 Bulkhead Stiffener
Rivet Flange when riveting the skin.
Flange trim to 1/4" under wing fitting.

MIDGET MUSTANG MANDATORY CHANGE

Reports are still being received relating to failure of the fuselage transverse bulkhead. This is the small bulkhead positioned horizontally between bulkheads at stations 177.5 and 182.0.

Many years ago all drawing owners were notified that the lightening hole should be eliminated from this bulkhead so that this will be a solid piece. At that time, it was left to the discretion of the builder whether to change the bulkhead. It is now considered mandatory to replace the bulkhead with a solid bulkhead.

This bulkhead must be inspected carefully at annual inspections, and more often if the airplane is flown in aerobatics. It is believed that failures occur because of eccentric side loads during aerobatics, or by moving the airplane by pushing on the fin and rudder. If, during preflight inspection, motion is detected when the fin is pushed sideways, DO NOT FLY THE AIRCRAFT.

Failure of this bulkhead in flight can be catastrophic. It was reported that a plane was able to land and that the fin was held on only by the forward attach bolt and rudder cables. After the failure the fin was able to be flexed sideways 30 degrees. It is also possible the same condition would exist on the Mustang II as well.

Bob.

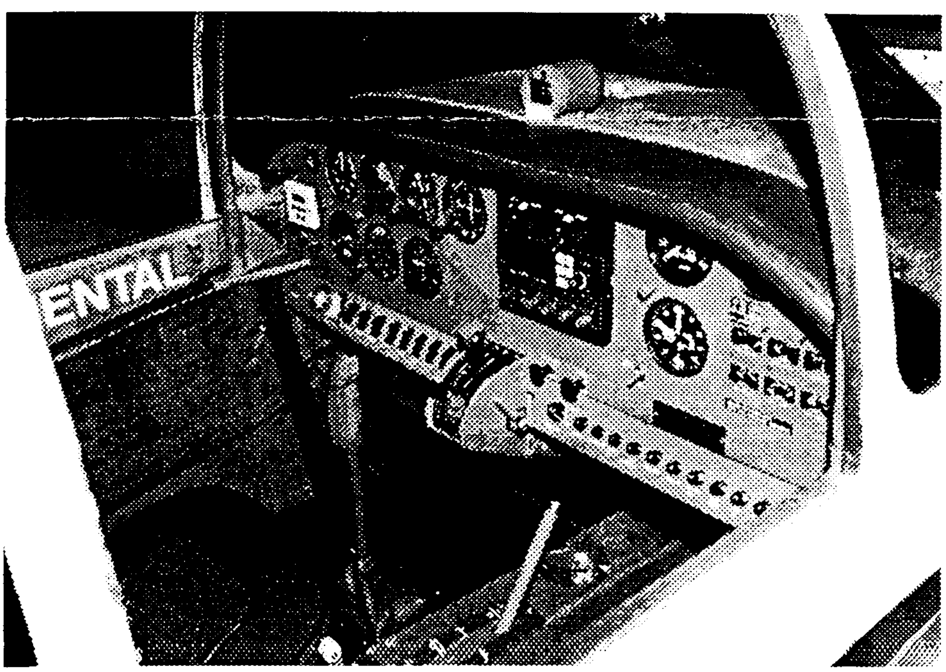
"THE MUSTANG BUILDERS TIPS, TRICKS, AND TRAPS"

Catchy title huh! In the Volume 8, No. 6 issue of the newsletter (November, 1992) we made mention of a publication that would include all of the newsletter construction ideas, techniques, performance specifications of other Mustangs, etc., for a target completion date of Oshkosh '93. We are calling it "The Mustang Builders Tips, Tricks, and Traps" book for builders.

Many builders have inquired on it's progress. We're sorry to tell you that we will not be meeting our Oshkosh '93 date, and at this time cannot project a new date. It's at a snails pace for right now because of all the "home improvements" and family matters to take care of.

Some builders asked if we can make this available in electronic form. The answer is yes, if you have access to a Macintosh or PC that is running DOS. The software we are using to publish this book is by Frame Technology called FrameMaker. A viewing package that can be purchased separately enables the user to view and assign "hiper links" within the document, and disabling the user from making changes. More information on price and capabilities will be published in a later newsletter.

Wes Bushby



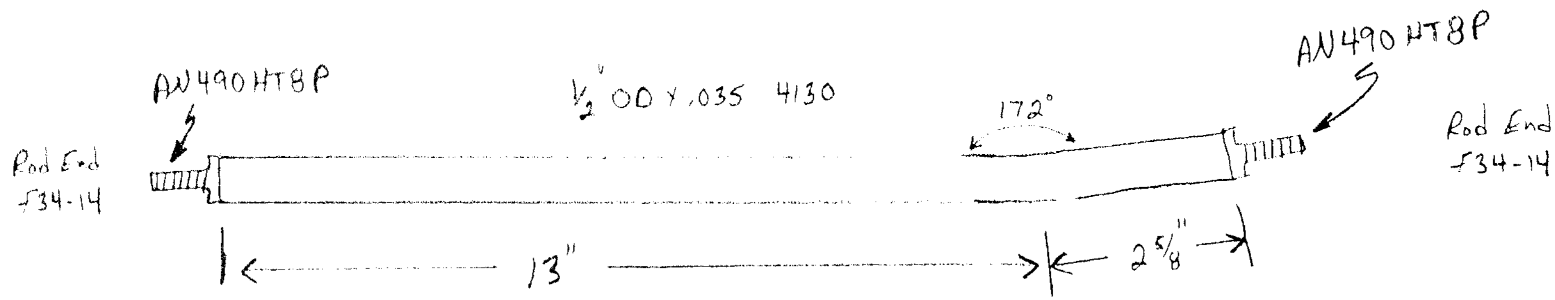
Ivan Slaybaugh's Mustang II

(continued from page 1)

article "Improving Stall Characteristics", published in Volume 7, No. 1, 1991 issue of the newsletter.

Per Ivan – "Many thanks to Bob Bushby for answers to my questions over the phone. Bob has designed a great airplane."

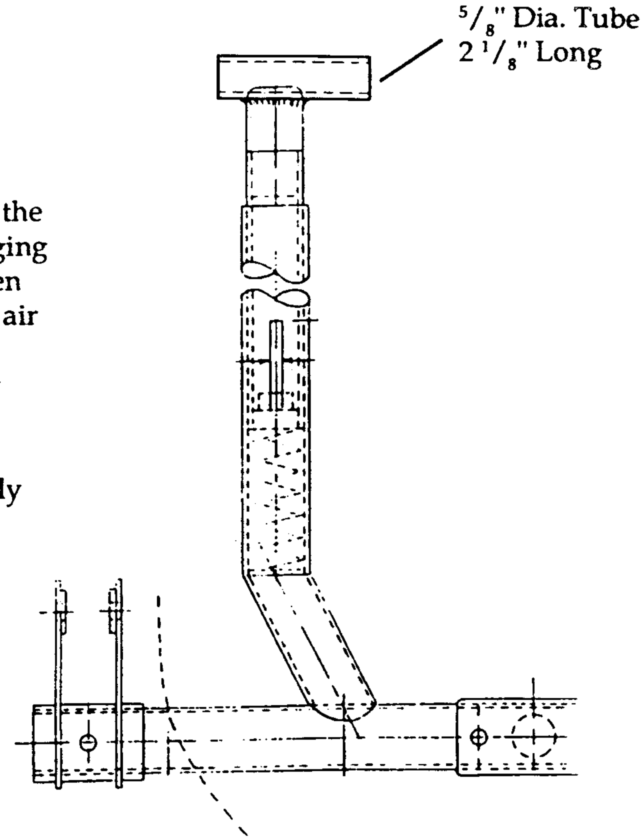
Flap Pushrod (2 reqd)



MIDGET MUSTANG FLAP HANDLE MODIFICATION

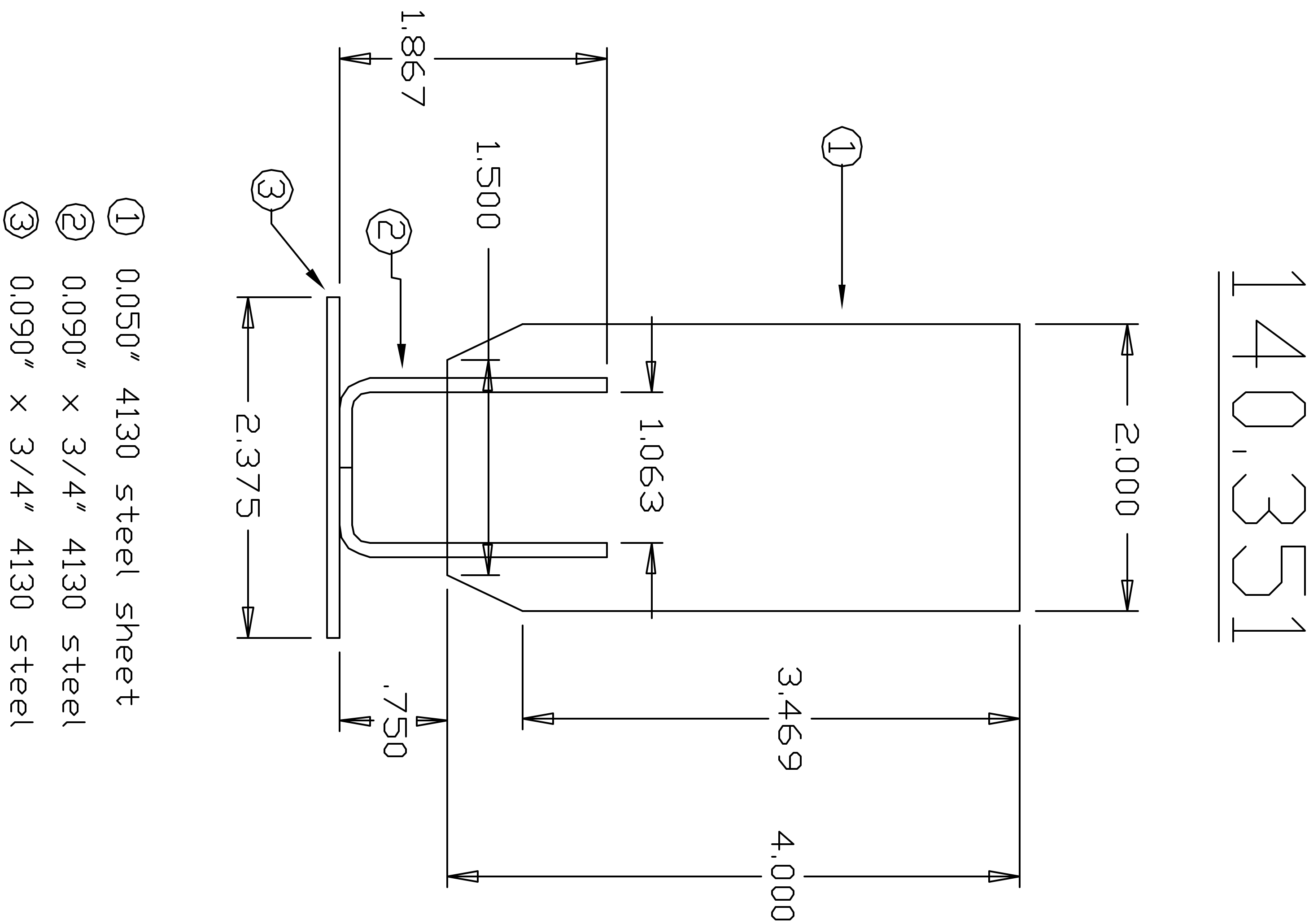
Field experience indicates persons flying the Midget Mustang are having difficulty engaging the flap into the last notch. (40°.) This is often caused by lowering the flaps at too great an air speed.

The modification shown here works very well. It is easier to depress the catch when moving the lever aft, and the handle can be pulled up to engage the catch rather than rely on just spring pressure.



Aft Tailwheel Attach Bracket

(for use with tapered rod vs leaf spring)



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<u>Mustang II & Midget Mustang Service Letter</u>

<u>Date:</u> 9/18/2019

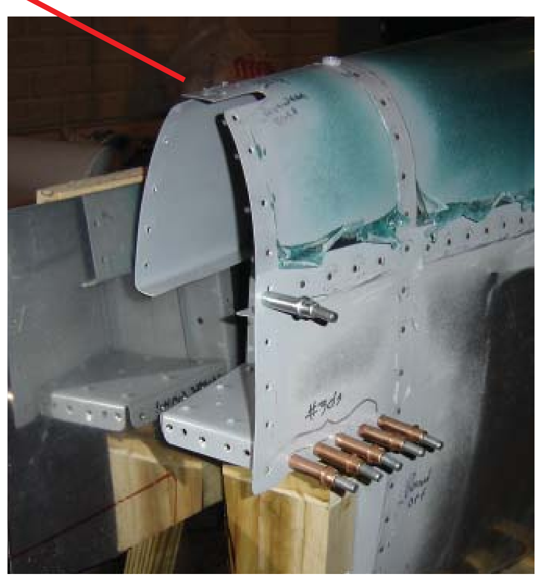
<u>Subject:</u> Installation of new style tailwheel mount bracket at sta. 182

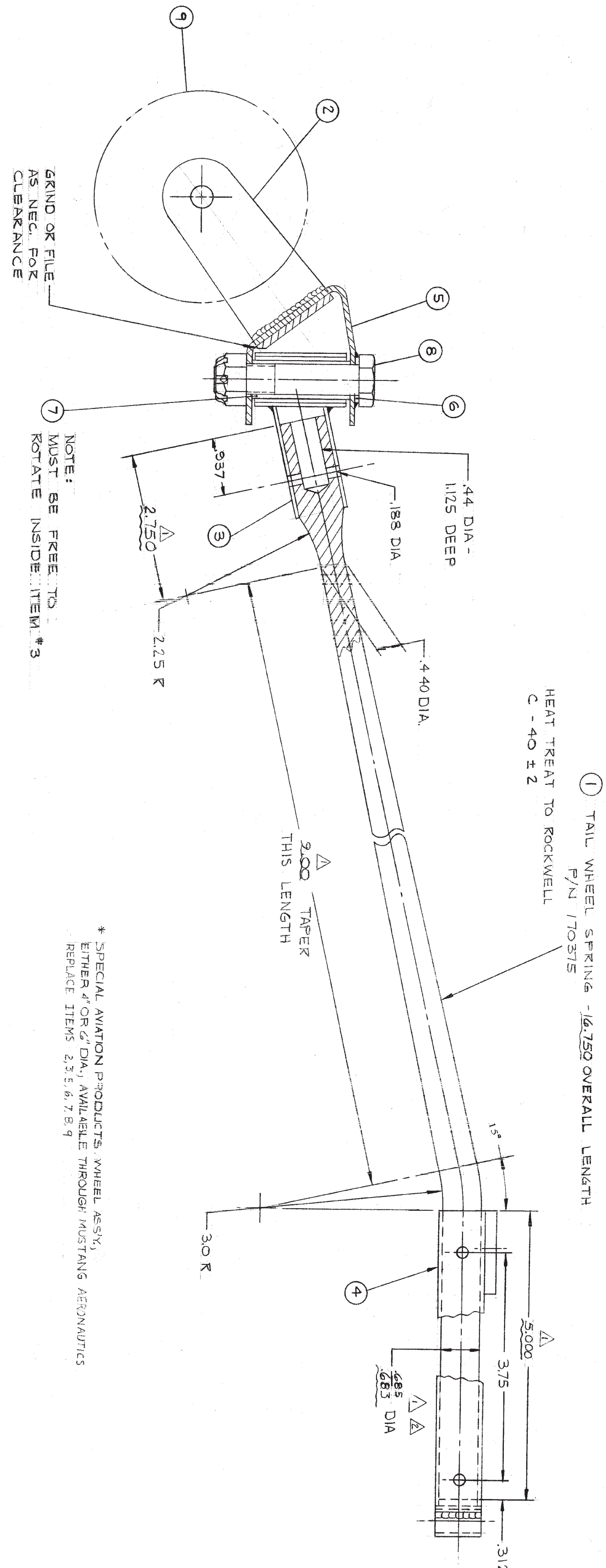
Tailwheel Mount Bracket 140.351

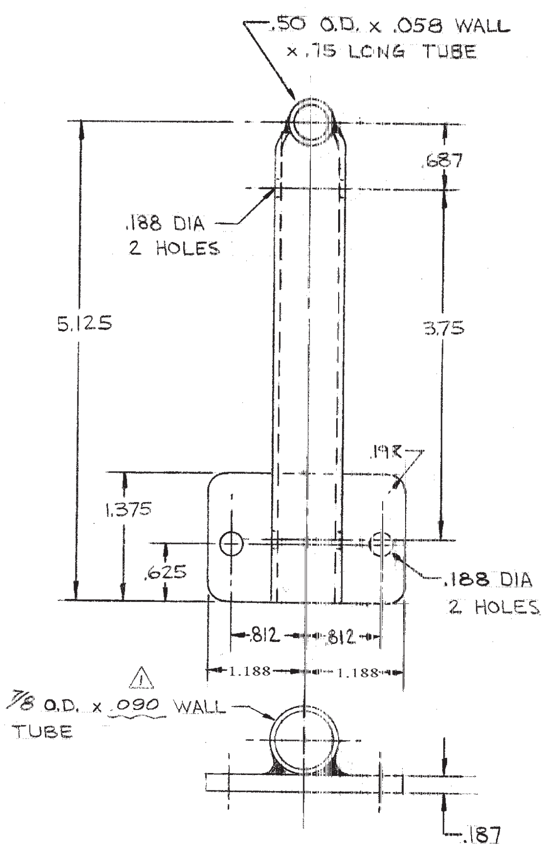
Tailcone in Jig
(upside-down)

sta. 182 sta. 177.5

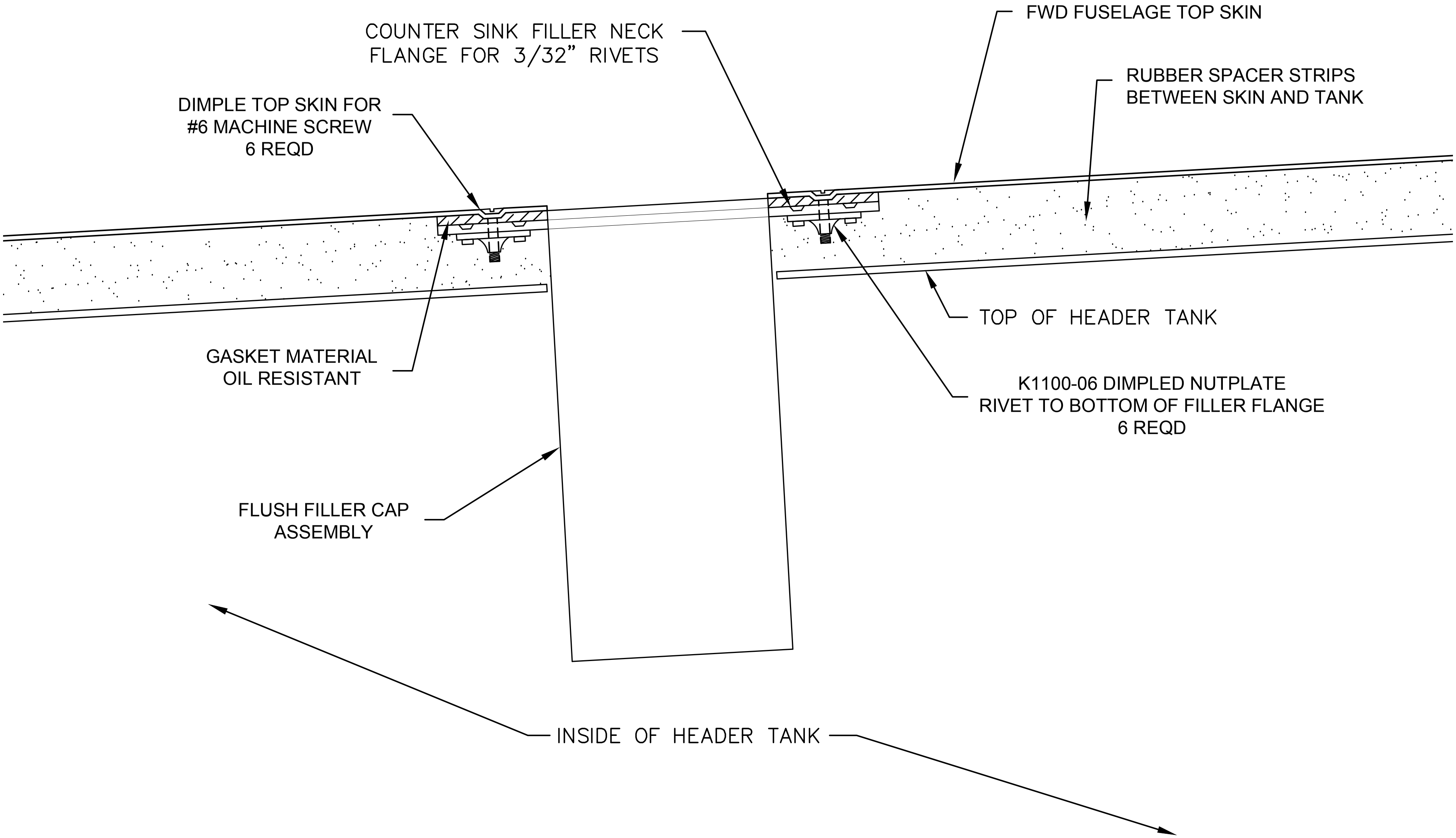
Slot in skin for mount bracket attached to fwd side of sta 182 bulkhead







MOUNTING BRACKET
P/N 170378



HEADER TANK FILLER CAP INSTALLATION DETAIL

10/3/2018

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Mustang II & Midget Mustang Service Bulletin

Date: 1/26/2019

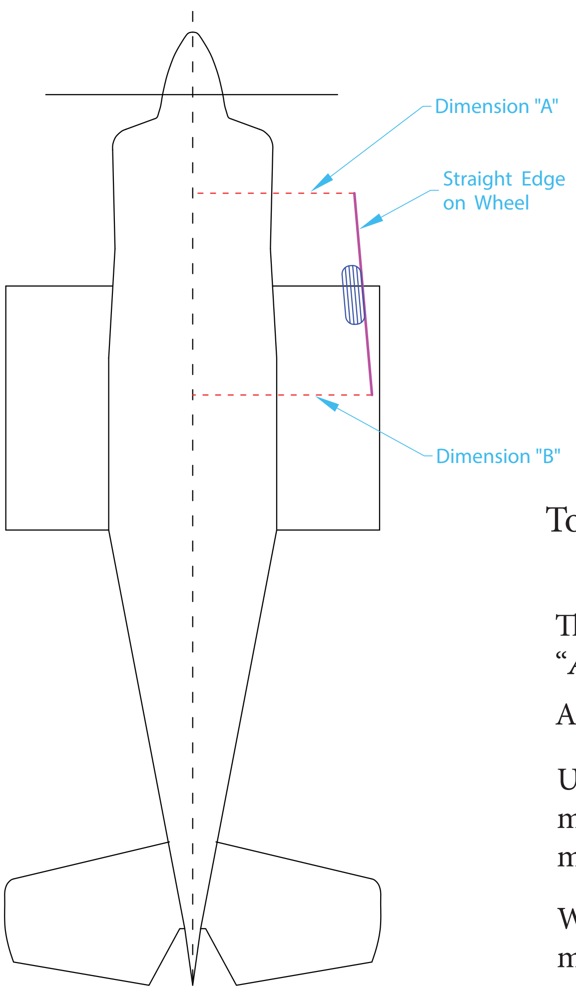
Subject: Checking for Correct Wheel Alignment

Good ground handling of the conventional landing gear (tail dragger) version of the Mustangs is dependent upon proper wheel alignment. There should absolutely be no wheel “toe out” with a desired angle of 0 to 2 degrees “toe in”.

To check the wheel alignment the following procedure can be used:

On the bottom of the aircraft, drop a plumb bob from the center (widthwise) of the firewall tunnel to the ground and make a mark on the pavement.

Drop a plumb bob from the center of the forward tailwheel attach bolt after verifying it is close to being on the centerline (widthwise) of the airplane. Put a mark on the pavement.



Using a chalk line, snap an aircraft centerline on the pavement between the two marks.

Using a long straight edge (4 feet or so, longer is better) hold it against the wheel close to its center on the outboard side as shown in the sketch.

Measure perpendicularly from the aircraft centerline to the end of the straight edge on both ends to get Dimensions “A” and “B” as shown in the sketch.

$$\text{Toe In} = \sin^{-1}\left(\frac{\text{Dimension “B”} - \text{Dimension “A”}}{\text{Length of Straight Edge}}\right)$$

This is also called the “ArcSin”.   A Google search such as: “***ArcSin .05 in degrees***” will give an answer.

A negative “Toe In” value will mean it is actually Toe Out

Up to 2 degrees of axle shims can be used. If there needs to be more than 2 degrees of correction, the gear leg will need to be modified.

Wheel Camber (vertical tilt) misalignment does not have much effect on ground handling, just tire wear.

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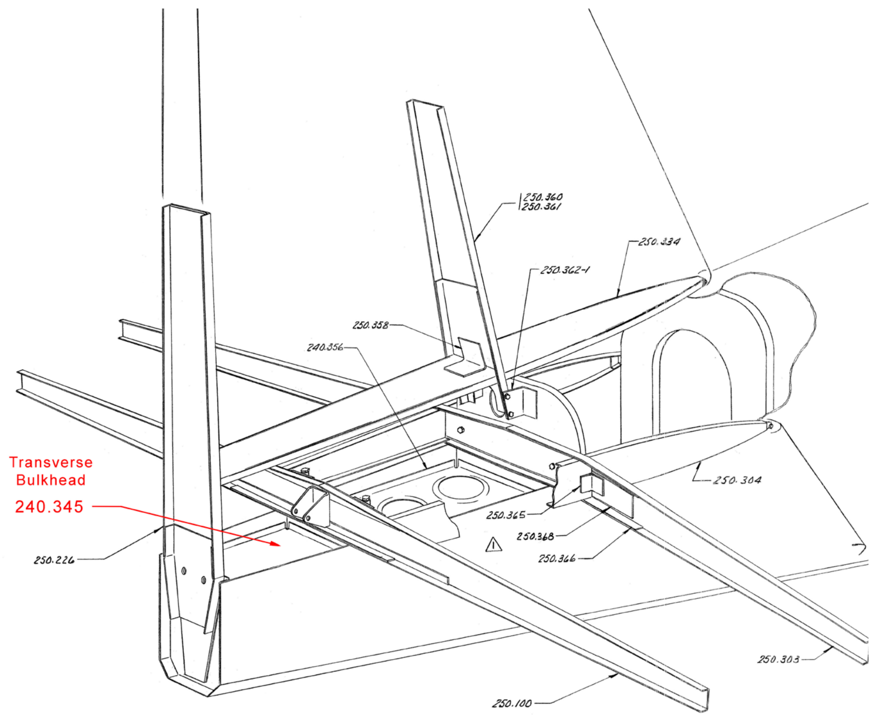
Mustang II & Midget Mustang Service Letter

Date: 7/30/2019

Subject: Inspection of the tailcone transverse bulkhead p/n 240.345 (M-II) or p/n 140.356 (M-I)

We have had another report of a failed Transverse Bulkhead (p/n 240.345) in an older Mustang II. No Mustangs with the design changes to the Transverse Bulkhead in May of 1993 have had cracking issues. The Midget Mustang has a similar design (p/n 140.356) and should follow the same inspection methods. A simple preflight check should reveal a crack in the transverse bulkhead before the aircraft is flown and should be done before every flight of all Mustangs. See page 4 for the preflight inspection procedure.

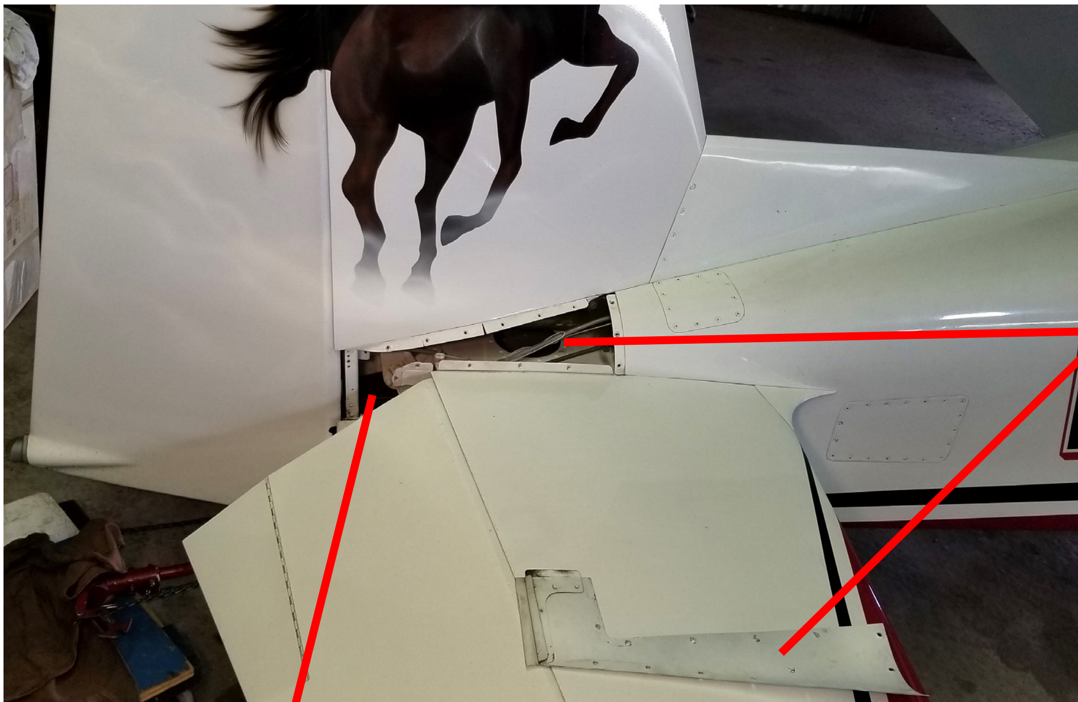
The small Transverse Bulkhead is a critical attach point for the vertical fin as it has 2 of the 3 lower fin rear spar attach points. Refer to construction drawing #29 for the Midget Mustang and drawings 240.021 and 240.023 for the Mustang II.

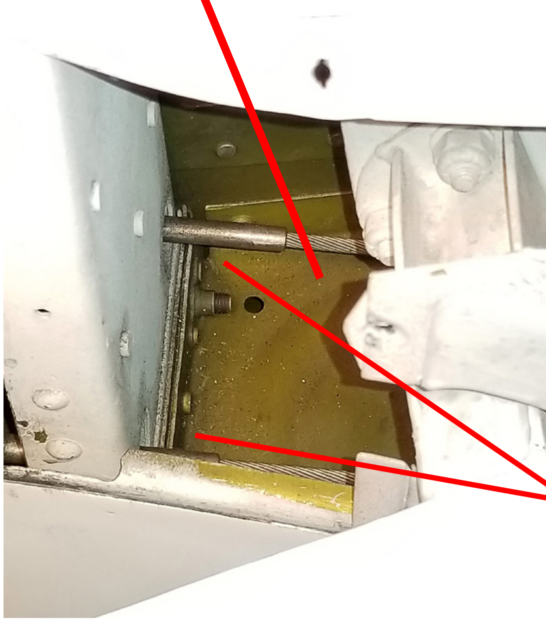


The affected aircraft suffered a fatigue crack in the transverse bulkhead emanating from the aft two corners whose flange is attached to the sta 209.5 bulkhead in the Mustang II. In the Midget Mustang the affected Transverse Bulkhead flange attaches to the sta. 182 bulkhead. Previously issued updates and repeated inspection recommendations have not always been adhered to. Improper manual ground handling has been the primary cause of the failures that we have seen. The original design is sound if the aircraft is not subjected to unapproved/nonstandard loads.

Repeatedly moving the aircraft on the ground by lifting the tail of the airplane by the horizontal stabilizer or applying a side load to the vertical fin can put excessive torsional loads on the Transverse Bulkhead. Mustangs should never be lifted or moved by applying force to the empennage. Instead steer the airplane manually on the ground by pushing on the side of the tailcone at a bulkhead, by lifting the tailwheel and pulling the airplane around by it, or by a tow bar connected to the tailwheel or nose wheel. Snap rolls can also put excessive loads on the transverse bulkhead. If aerobatics are performed in aircraft without the updates the aft tailcone inspection cover should be removed and the transverse bulkhead inspected more than once per year. Snap rolls are not approved in the Mustang II. Proper installation of the 3 AN3 bottom fin rear spar attach bolts is also critical.

A transverse bulkhead failure typically leaves only the vertical fin leading edge attach bolt, the single bottom lower fin rear spar attach bolt, and the rudder cables to hold the vertical fin on the aircraft. While a loss of the vertical fin has not occurred, serious structural damage has resulted from the failure of this bulkhead. In June 1987 the lightening hole was eliminated from the Transverse Bulkhead and inspections recommended. After another bulkhead failure this change was made mandatory and written up in the Mustang Newsletter Vol 9 No 3 (May 1993). The bulkhead was changed from .025” 2024-T3 to .032” in the Midget Mustang and changed from .032” to .040” in the Mustang II. In May 2006 a doubler was added to the bulkhead and the update was published in the Vol 16 No 5 issue of the Mustang Newsletter.





Midget and Mustang II Revisions

[From Mustang News & Views Vol 16 No 5 - May 2006]

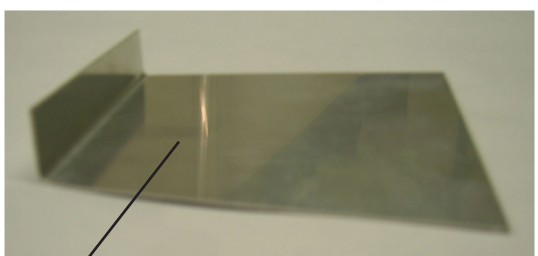
Transverse Bulkhead Doubler

We had a report that a Mustang II had a failure in the Transverse Bulkhead p/n 240.345 although this was probably the result of a missing bolt from the lower fin attach point. In a previous revision this bulkhead had been changed to thicker material and the lightening hole eliminated. This particular airplane has over 1200 hours and does not have this revision. For new airplanes we are adding an additional doubler just as an extra precaution. This is not a mandatory change. A good preflight should include checking the stiffness between the fin and horizontal stabilizer. Excessive movement is an indication that there is a problem.

For the Mustang II a lightening hole can be cut in the center of the new doubler to allow it to lay flat against the transverse bulkhead. The doubler is riveted to the bulkhead at the corners using 3/32” universal head rivets on 5/8” spacing, staggering rows 1/2” apart.

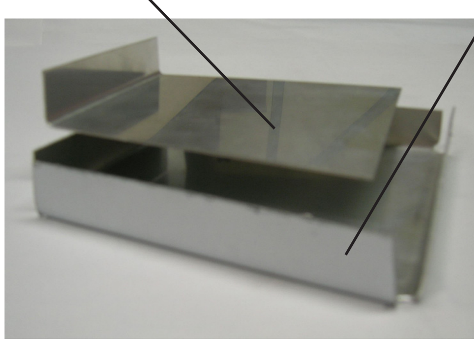
If you are building a Midget Mustang or do not have the stiffening bead in the bulkhead, the doubler can be attached to the bulkhead without the hole using 1/8” rivets on 7/8” spacing, staggering rows 5/8” apart.

Aft Side



.032 Doubler

Transverse Bulkhead



Preflight Inspection Procedures

As a part of **every** preflight inspection in a Midget Mustang or Mustang II the aft transverse bulkhead should be checked for cracks by preforming the following procedure:

Video published on YouTube: https://youtu.be/83DoBZV8WpQ

Holding onto the tip of the vertical fin rear spar (not the fiberglass tip) in one hand and tip of the horizontal stabilizer rear spar in the other (not the fiberglass tip) gently pull them towards each other with a small amount of force. The Midget Mustang will have a slight give as it does not have the front spar carry through in either the vertical fin or horizontal stabilizer. The Mustang II should not have any give between the tail surfaces. The important thing to notice is any change over time. If there is more give than normal remove the aft tailcone inspection cover and examine the aft transverse bulkhead and the fin attach points carefully for any cracks.

Annual Airworthiness Inspection Procedures

During the annual airworthiness inspection and more often as needed, the aft transverse bulkhead should be visually inspected by removing both of the aft tailcone covers between the vertical fin and horizontal stabilizer. A close examination of the transverse bulkhead (p/n 240.345 / 140.356) for any cracks and the steel elevator control arms (p/n 250.210 / 150.210) for cracks around the welds is an important part of every airworthiness inspection.

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Mustang II Service Bulletin

Date: 1/12/2016

Subject: Hardware Substitution

For availability and cost considerations the following equivalent hardware items have been substituted for the corresponding items originally called for in the Mustang drawings and manuals:

Original Manufacturer	Original Part #	Replacement Manufacturer	Replacement Part #
Heim	MD36-14M	Aurora	GMM-3M-670
Heim	F35-14M	Aurora	GMW-3M-570
Heim	F34-14M	Aurora	GMW-3M-470
nutplates	AN365-xxx		MS20365-xxx
nutplates	NAS680-xxx		MS21047-xxx

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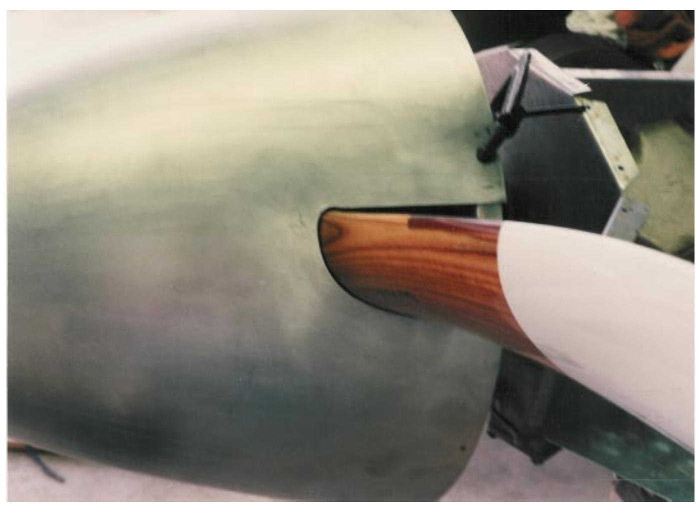
Mustang II Service Bulletin - MSB Spinner 1-24-96

Date: 1/24/96

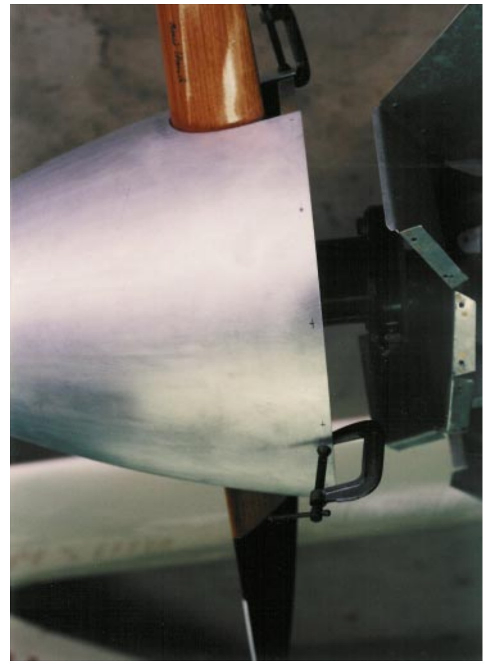
Subject: 16” Spinner Installation, fixed pitch propeller (p/n 010.010)

The first step for installing the spinner is to make the propeller cut outs. A tight fit to the propeller blade contour is desired. A gap of 3/16” should be used between the prop and spinner. Make a paper or cardboard template of the prop blade 8” out from the center. The template should fit over the propeller sitting in place on the spinner backplate flat on a table. The bottom edge of the template should be against the table to give the proper reference for the blade angle in relation to the back of the spinner. This template is then used to mark the spinner for removing the prop cut outs. Reference marks should be placed on the aft edge of the dome equal distances apart measured around in both directions. Using the template, align the trailing edge of the prop cut outs with the marks on the dome. In order to get the spinner dome in place the areas aft of the prop blades will need to be removed as well. Cut along the marks from the template and later file in the 3/16” clearance gap fitting the prop in place occasionally for comparison. Using another template make a filler piece to cover the gap aft of the prop. If care is taken the filler pieces can be made from material removed from the spinner for the cut out. The filler pieces are attached to the backplate in the same way as the dome using 2, #8 screws. Backup plates should be riveted to the sides of the filler pieces to fit under the dome. They need to be shimmed accordingly for a doubler around the prop cut out (see below). The filler pieces can now be attached to the dome and backplate in 4 spots.



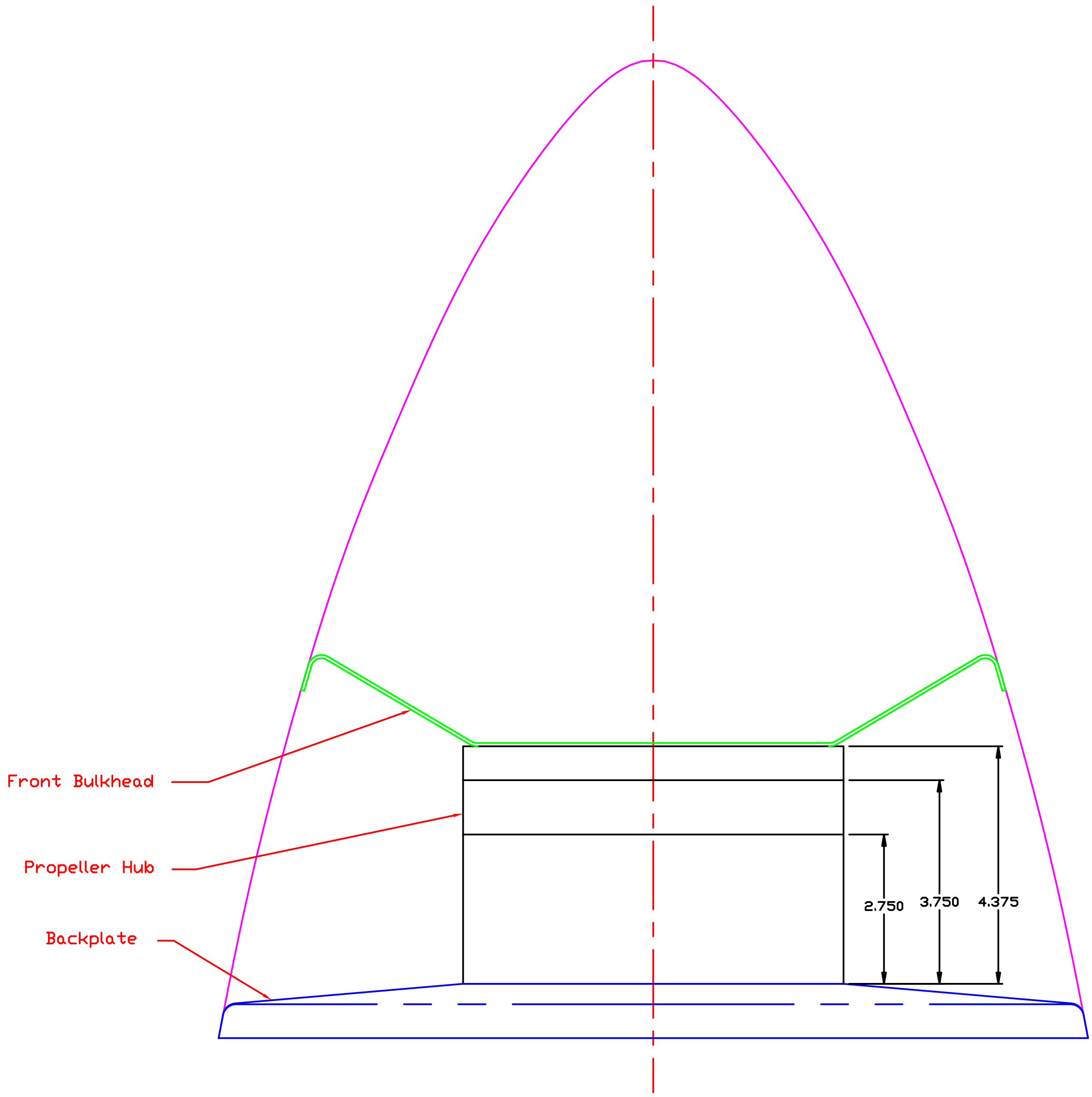
The prop cut outs in the spinner are where most cracking problems occur. This is why it should be reinforced with a doubler riveted to the inside. These spinners are much heavier than those supplied in the past and are therefore much less susceptible to cracking. However, we do still recommend installing an .040 doubler around the cut out. The doublers need to stop short of where the backplate fits on the inside edge of the dome. It is very important that the edges around the cut outs be polished to remove all nicks and other possible stress risers. We recommend using emery paper followed by Scotch Brite for a final finish.

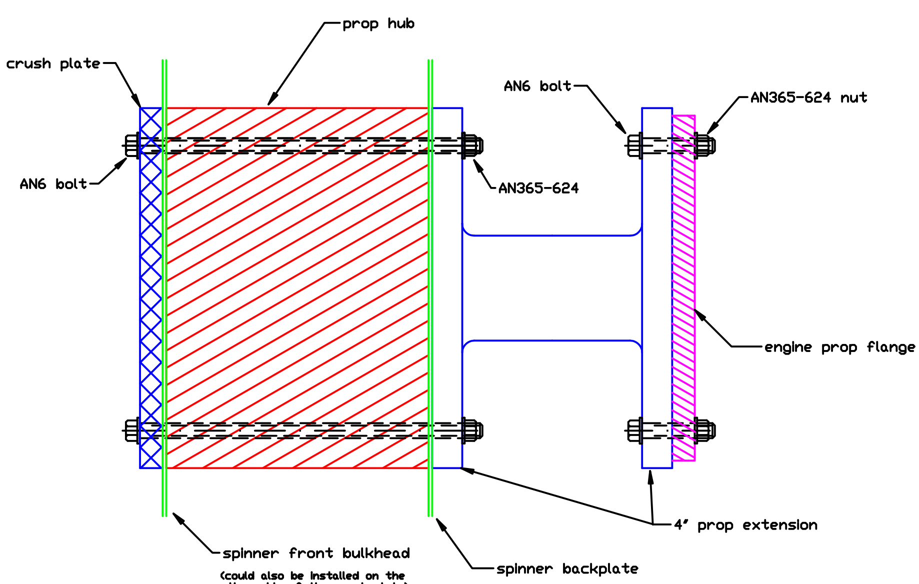
Our 16" diameter Mustang spinners are designed for installation with fixed pitch propellers. The front bulkheads will fit prop hubs of 2-3/4", 3-3/4", or 4-3/8" thickness. Shims are to be used to accommodate propellers with a different prop hub thickness. These are available from Mustang Aeronautics. The front bulkhead is a precision fit, so when installed properly it does not need to be attached to the dome with fasteners. The front bulkhead flange has a 3M Teflon fluorocarbon tape applied to it to prevent chaffing with the dome. It is **very important** that the dome fits tightly over the front bulkhead and spinner backplate. This requires proper spacing between the front bulkhead and backplate (2-3/4", 3-3/4", or 4-3/8"). Install the prop extension, then the backplate, and then the prop. To ensure that the front bulkhead rides on the dome properly, use washers as spacers between the front bulkhead and the prop when you install the front bulkhead. Now press the spinner dome in place. On the first trial fit of the dome it should not go all the way onto the aft edge backplate because of the spacers. At this point you know that the front bulkhead is hitting the dome. Now you can remove washers until the dome stops just short of flush with the aft flange on the backplate. At this point, you can remove the washers and make a permanent spacer based on the thickness of the remaining washers. After 10-15 hours of operation the spinner should be removed and inspected for excessive chaffing between the front bulkhead and the spinner dome. When the propeller cut outs are made the spinner will deform to a slightly oval shape due to the internal stresses. A little extra Teflon tape in the areas above the cut outs may be necessary to achieve a good fit. If the chaffing persists attach the front bulkhead to the spinner dome using 5 #8-32 screws into nutplates. The spinner backplate should be attached to the dome using #8-32 screws into nutplates on the backplate with 3 to 3.5” spacing.



It is also very important that the spinner be adjusted to run true so that there is no wobble. This procedure should be followed when drilling the holes for the backplate as well as every time the spinner is put on the airplane. We use a dial indicator on a horse close to the nose of the spinner. A dry marker could also be used. After removing a spark plug from each cylinder the prop is pulled through. The indicator near the spinner nose will show where the spinner is out of round to allow for adjustment before final tightening of the spinner screws. The marker placed very close to the spinner will also show where it is out of round by where it hits and where it does not. Use small c-clamps to hold the dome in place when drilling the backplate attach holes. This all needs to be done while the dome is pushed back into its proper position on the front and rear bulkheads. For a proper fit the dome should have to be pushed on and held in place to get the screws in. If the dome is not held tight to the front bulkhead, screws will need to be used to hold it in place.


B
B
B
B
B
B


Front Bulkhead
Propeller Hub
Backplate
2.750
3.750
4.375


prop hub
crush plate
AN6 bolt
AN365-624 nut
AN6 bolt
AN365-624
engine prop flange
4" prop extension
spinner front bulkhead
(could also be installed on the other side of the crush plate)
spinner backplate

YOUR SPINNER AND YOUR ANNUAL INSPECTION

by George Linkis

When you do your annual inspection, you probably remove your spinner to inspect your propeller. Even a fixed-pitch prop should be inspected for safety, time security and no "slip" between bolts and prop (wood prop). With a constant speed prop, removing the spinner is a necessity to grease the hub (Shell Oil Co. #5 grease).

Now you folks in the warm climes like Florida and California may do your inspection at any time, but us folks that live in the climes that blows snow between November and April -- well, this subject is written because the snow is here now and this subject comes to mind -- our annual inspection.

The point of this article is to cover the importance of getting the spinner on -- centered! And secondly, torqueing the screws.

After you have finished your airplane including getting the spinner in place, removing the spinner requires that centering is done each time it is removed. Just because you have located the spinner "true" when you completed the airplane does not mean it goes on "true" each time you put the screw back in place. Each screw hole has a few thousandths clearance. If not deliberate during construction, then with "time". (i.e., wear by removal and re-insertion of the screws of slippage due to inadequate torquing of the screws.)

You might think this is not possible with just a few thousandths in the holes and that tight-fitting front hub bulkhead. Wrong! It is a fact. Aluminum as you know by now has "give" and "spring back", so you can push the spinner on tight and off center. Figure 1 illustrates how a few thousandths can give an off center line condition. Mustangs have large spinners so the multiplication factor is also large.

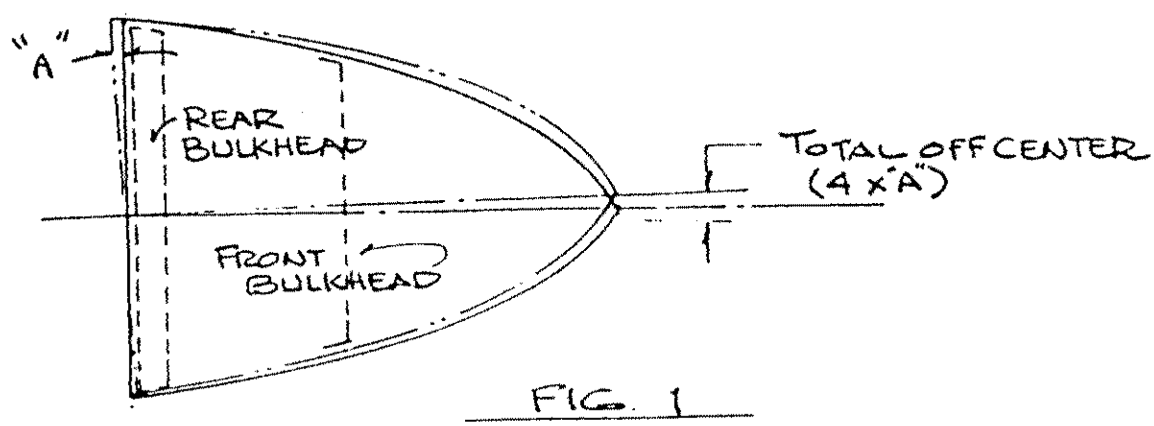


FIG. 1

Here is a tip on how to get the spinner on center:

1. Get the aircraft horizontal. Put the tail on a box . . . or a chair and box.
2. Get a broom, a tripod or some vertical device to which you can tape a felt tip marker horizontally.
3. Remove one plug from each cylinder. (After the compression test for your annual is the time to do a spinner alignment.) Refer to Figure 2.

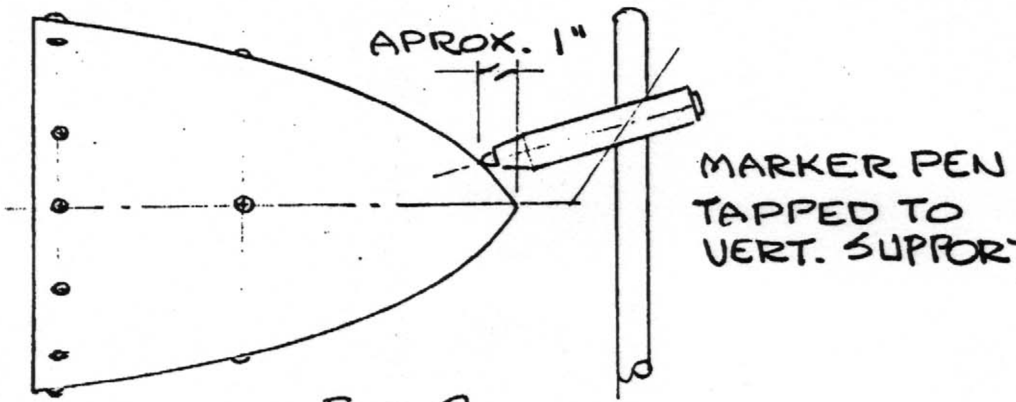


FIG. 2

Slowly, so that you do not apply incorrect pressures that permit the engine to move on the motor mounts, turn the prop. At least four of the screws at 90 degree intervals should be "slightly" snug. The marker will trace a path on the spinner. If you get an arc of 180 degrees or less, adjust the spinner by a slight "rap" of your palm in the appropriate direction. Do not wipe away the trace, but move the marker to say, 7/8" or 1-1/8" from the tip. Rotate the spinner again and note the trace. If unchanged, your screws are snugged too tight or your "rap" was too light.

Several tries will be required. When you get an arc of 270 degrees or more, your spinner is within a few thousandths of center. Refer to Figure 3.

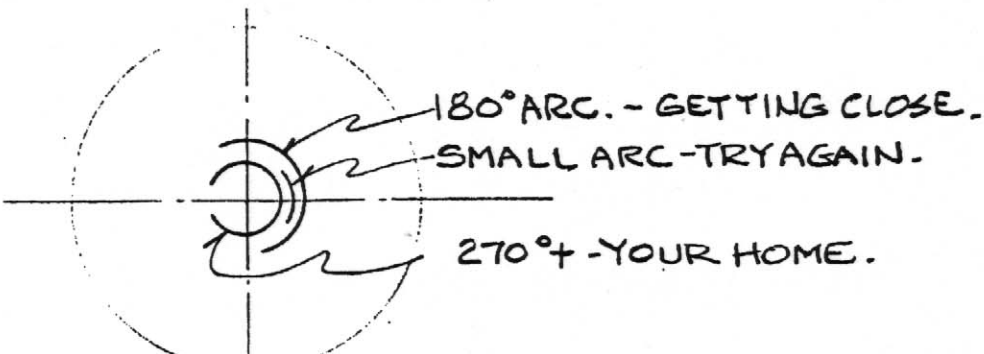


FIG. 3.

CAUTION! A trace of 360 degrees is no proof of being on center. The spinner may be pushing the felt tip pen away. A trace of 355 degrees is proof that the "pen" is free!

Satisfied you're centered? One more repeat wouldn't hurt. When completed, tighten the four screws, then insert and tighten the remaining screws.

To avoid cracks and "countersinking wear" be sure you use a nylon washer under each screw head. The nylon washer acts as a cushion against vibration wear and pressure compensator during temperature changes. If you have not been using these washers and find a black residue under the heads when your remove the screws -- your spinner is wearing away under the heads. Refer to Figure 4.

Your best insurance against wear is the nylon washer. Don't go flying without them. This works for new installations too. For you machinists out there, you can use a dial indicator in lieu of the felt pen (take care not to scratch the spinner).

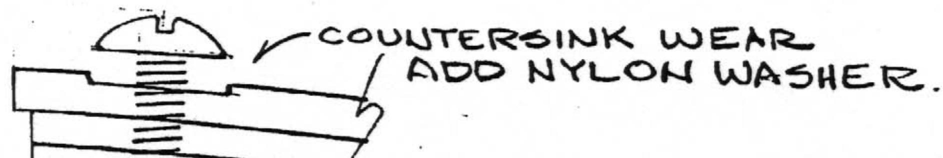


FIG. 4

MUSTANG AERONAUTICS, INC.

1990 Heide Dr
Troy, MI 48084

(248) 649-6818
fax (248) 688-9275
www.MustangAero.com

http://mustangaero.com/downloads/Mustang_Revisions

Mustang II & Midget Mustang Service Letter

Date: Jan 3, 2020

Subject: Torque Value for Main Wing Spar Attach Bolts

The Main Wing Spar Attach Bolts (p/n 220.0020 or 120.0002) are typically secured with either AN365-918 (MS20365-918) standard elastic stop nuts or AN364-918 (MS20364-918) thin or low profile elastic stop nuts. There has been repeated questions about the torque value for these bolts.

The Main Wing Spar Attach Bolts should only have the nuts tightened to a snug fit and NOT torqued.
This is indicated on drawing 230.001 for the Mustang II and drawing #24 for the Midget Mustang.

These bolts are strictly transferring a shear load from the main wing spar capstrips to the fuselage steel wing attach fittings. As such a snug fit of the nut to simply hold the bolt in place is good. Because of the 0.040" gap between the center capstrips created by the main wing spar web (p/n 230.301 or 130.301) the capstrips can potentially be damaged if the Main Wing Spar Attach Bolts are tightened too much. Excessive tightening without a filler piece (p/n 230.311 & 230.312) will squeeze and bend the capstrips together damaging them.

If there is slop in the wing attach bolt holes, tightening the nuts will not correct the situation and only potentially mask the problem during a preflight inspection. The tip of the main wing spar is allowed 0.25" of movement due to slop in the attach bolt holes. If the holes are oversized enough to allow more movement than this than oversize bolts will need to be installed. These bolts are available in .015" and .030" oversize from Mustang Aeronautics along with the appropriate hand reamers.

M U S T A N G   A E R O N A U T I C S ,   I N C .

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http://mustangaero.com/downloads/Mustang_Revisions

Mustang II & Midget Mustang Service Letter

Date: June 8, 2020   rev March 24,2021

Subject: Stall Speed and Wing Leading Edge Shape

The airfoil used on both the Midget Mustang and Mustang II is a fairly thin laminar flow airfoil. It is optimized to reduce drag. The maximum thickness at the root is about 6 inches and the maximum thickness at the tip is 3 inches. Fabricating the leading edge skins by hand can take some work to get the proper airfoil shape at the leading edge. This is critical for proper stall speeds and characteristics. In the kits now supplied by Mustang Aeronautics leading edge skins are supplied which have the proper leading edge radius formed into them. Many older Mustangs have wings that were fabricated entirely by the builder. On these scratch built Mustangs the leading edge skins were made by hand and the leading edge radius is sometimes too small (or sharp). This is because when the skins were folded over and flattened to get the desired airfoil thickness most of the bending occurs in a very small section at the leading edge. Some follow up work is required to achieve the proper airfoil shape and thus the proper flight characteristics. Robert Bushby published an article in the January 1991 issue of the Mustang Newsletter detailing the procedures to fine tune the wing leading edge shape to get the best stall characteristics. We have heard from builders in the field that they have reduced their stall speeds by 15 mph using this technique. A Mustang with a stall speed over 65mph at our recommended gross weights almost certainly has the wrong leading edge shape.

Wing leading edge radius templates can be made from the wing rib drawing or purchased from Mustang Aeronautics (p/n 230.0009). These can be used to check the wing at each rib location for the proper leading edge radius and to verify that both wings are the same. Keep in mind that the intermediate wing ribs do not have a full nose section and stop about 7/16" short of the leading edge so it is fairly easy to reshape the leading edge. The procedures detailed in the following article by Robert Bushby can be used to correct the wing leading edge shape and improve the stall characteristics.

Wing Leading Edge Radius Template Set
p/n 230.0009

MUSTANG NEWS & VIEWS

Volume 7, No. 1 January, 1991

IMPROVING STALL CHARACTERISTICS

by Bob Bushby

Although the majority of Mustang aircraft have a straight forward stall at modest airspeeds, there are still some that will stall one wing first, and sometimes at a higher than desired air speed. In most cases this undesirable stall is brought about because of a wing leading edge radius that is too sharp, or is caused by one wing leading edge having a radius different than the other. There have also been reports of poor stall characteristics because one wing had a different wash-out than the other. If your aircraft has a characteristic similar to the above, then this article will help to correct it. The procedure is based on the fact that a sharp leading edge radius will cause a higher stall speed.

The wing leading edge modification was prompted by a phone call from a Midget Mustang flyer in Michigan. He reported that the right wing was stalling at an unreasonably high speed of approximately 80 M.P.H. His correction was to reshape the wing leading edge radius to obtain a larger radius, and therefore, a lower stall speed. The leading edge modification was relatively simple, using a mallet to push the nose of the wing back thereby producing a larger radius.

The plastic mallet used should be less than one pound weight. A scrap of 0.032" aluminum approximately 4" wide is to be held on the leading edge as a buffer, and the mallet pounded on the aluminum piece. Numerous light blows are used as the work progresses down the leading edge. It is important to progress down the leading edge slowly, checking the newly formed radius frequently. The rate at which the work was performed by the builder was about 2' per hour, which did not cause marring of the paint.

For checking the leading edge contour, a tool may be purchased from Sears or any other hardware store called a "Copycat". This is a tool consisting of many small wires in a holder that are pushed in when pressed against the wing. Using this method the builder reworked the entire leading edge of the wing, and lowered the stall to where the other wing was stalling first, at about 60 M.P.H. At last report, the builder was going to rework the other wing, expecting an even stall at a lower speed.

To substantiate this rework, the same technique was performed by Bushby Aircraft on the prototype Mustang II, N1117M. This aircraft had a "right wing first" stall that was corrected by installation of a stall strip on the left wing during the early '70's. This resulted in a straight stall at 64 M.P.H. Examination of the wings showed the right wing having a sharper leading edge at the tip section. The stall strip was removed and flight tested again (solo), which showed a "right wing stall" still at 64 M.P.H. Using the rework method, the outer 6" of the wing leading edge was modified to obtain a nice looking radius. Another test flight showed some improvement so this treatment was extended inward, with more testing. After reworking the outer 18" of the wing, a nice even stall was obtained at 55 M.P.H. Thinking it desirable to have a slight left stall when solo, a little more rework was accomplished. This added work proved to be slightly undesirable because it placed the stall characteristic back to where it had been originally. The rework performed by Bushby Aircraft was also done quickly, without the aluminum buffer piece, and with a heavier mallet. The actual time that it took to work 18" of the leading edge was 15 minutes, which resulted in chipping the paint off. As is true with most things related to aircraft, the slow and easy way is best.

Increasing the radius of the entire leading edge will reduce the cruise speed somewhat. As only 18" was modified on the prototype N1117M, there was no noticeable change. It is reported that Mustang II builders obtain a stall about 55 to 60 M.P.H. with a nice pair of wings. If your Mustang cannot achieve this, try reworking the leading edge. Be aware that other factors such as a heavy empty weight also add to a higher stall speed, so be aware!

3/2021:
Before reworking the wing leading edge, the first step should be to verify the accuracy of the airspeed indicator. Errors in the static port can cause an erroneous airspeed reading and the airplane may not be stalling as fast as you think.
The next step would be to check the wing leading edges with profile radius templates.
If the problem is one wing stalling before the other and the leading edges are fairly close the next step would be to check the wing angles of attack at the root and tip with a full profile board. Verify the left wing and right wing angles match. Of course a heavy wing at cruise would be the main indicator of dissimilar wing angles. Is there a fixed trim tab on an aileron?

10.0 OPTIONAL FEATURES

INDEX:

10.1 Introduction

This section of the manual, "Optional Features", is intended to communicate information obtained from builders who have altered their aircraft from the original design which that may benefit other builders. The information may not necessarily be correct, but is an option to a way of construction. It is hoped that by supplying you this information part of the learning curve will be taken out of your project, thus saving you time and money.

The information in this section, "Optional Features", is not part of the original design. The use of the information is left up to the builder, placing all liabilities of design and manufacturing on the builder, not Bushby Aircraft or the supplier of the information.

The topic being presented first is titled "Increasing Fuel Capacity", and the design being the wet wing leading edge. As other topics and designs are adapted by builders and presented to Bushby Aircraft, they will be numbered and added.

10.2 Increasing Fuel Capacity

10.2.1 Design 1 (Wet Leading Edge)

The leading edge tanks will hold about 18 1/2 gallons per side. You can consider 17 1/2 gallons of this to be usable. The fuel C.G. will shift to approximately Sta. 67.5 vs Sta. 55.25 for the fuselage tank. Thus the fuel is 12.25 inches farther aft, at 10 gallons additional fuel. With a heavy Hartzel prop and aft battery location the airplane should have an empty C.G. at Sta. 65.7, 1/2 inch aft of the estimate in the manual and falling within the allowable CG range. Factors to consider when building this arrangement are structural strength, effects in flight, unporting, and the way you plumb and install gauges.

Structural strength - Engineering has not been performed in this area by Bushby Aircraft. The general consensus is that there should not be any adverse effects in flight, and a different landing technique or criteria will be needed. Remember, there is an extra 111 pounds in each wing!

Effects in flight - Aerobatics will not be allowed with fuel in the wings. Also, a three position selector is to be installed that has a "Both" position. If this is not done, the tanks will require switching every 10 to 15 minutes to maintain balance.

Unporting - There is the potential for fuel to slosh away from the pickup at lower fuel levels. In normal flight, unporting is unlikely because of dihedral and the fact that ribs act as baffles.

NOTES

WARNING !

The load imposed on the wing attach fitting by the inertia and moment arm of the added weight along with the addition of a hard landing may cause wing failure. No landings are to be made with full wing tanks, or extreme caution is to be taken if it necessary or serious injury may occur.

NOTES

Note 1: A fuel selector valve capable of selecting right, left, and both tanks is to be installed.

Note 2: Fuel inlet to the header tank is to be near the top of the tank. This will prevent the header tank from flowing back to the wing tanks.

The following precautions are to be taken (and not be limited to these):

1. No takeoff with less than 5 gallons per side (when a header tank is not used).
2. No turning takeoff run with low fuel (when a header tank is not used).
3. Select high wing tank for cross wind landing.
4. No slips.

Plumbing and gauges - a book titled "Technical Tips Manual" published by the International Aerobatics Club contains some articles on fuel systems. This should be referred to when deciding how to interconnect the fuel system.

A system should be set up to transfer wing fuel to a header tank (refer to Figure 10.1, preferably the fuselage tank called for in the original design) to reduce the concern of unporting. Most people will probably use an electric boost pump (the ultimate would be submerged pumps in each tank powered from their own bus) for back-up. **Refer to Note 1 and Note 2.**

Use hose from the wings through the center section to the fuselage side. Use tubing from the fuselage side to the components inside the cabin , to the firewall, and to the header tank. The lines from the wing tank to the header tank can be either 1/4 inch or 3/8 inch diameter. Use hose from the firewall to the engine. All lines should be 3/8 inch for O-320 engines and 1/2 inch for O-360 engines.

Fuel gauges and senders should be of a quality product. You must carefully position the sender and bend its arm so it will not interfere with the finger screen (which is required for pump life) or sump drain inside the tank. Due to dihedral and the shallow tank, the gauge will read "full"

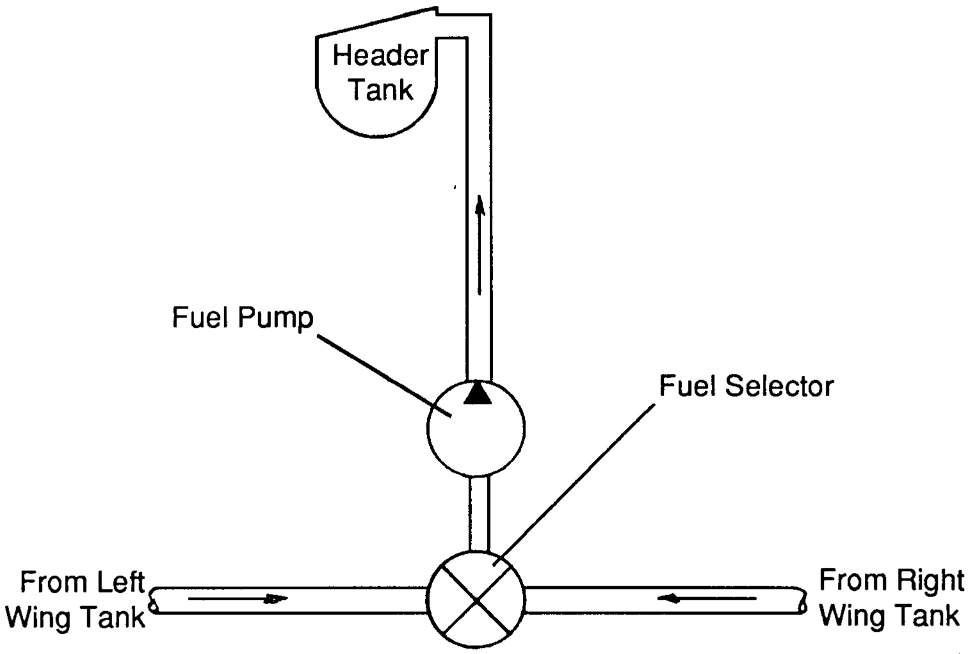

Figure 10.1, Fuel Flow Diagram

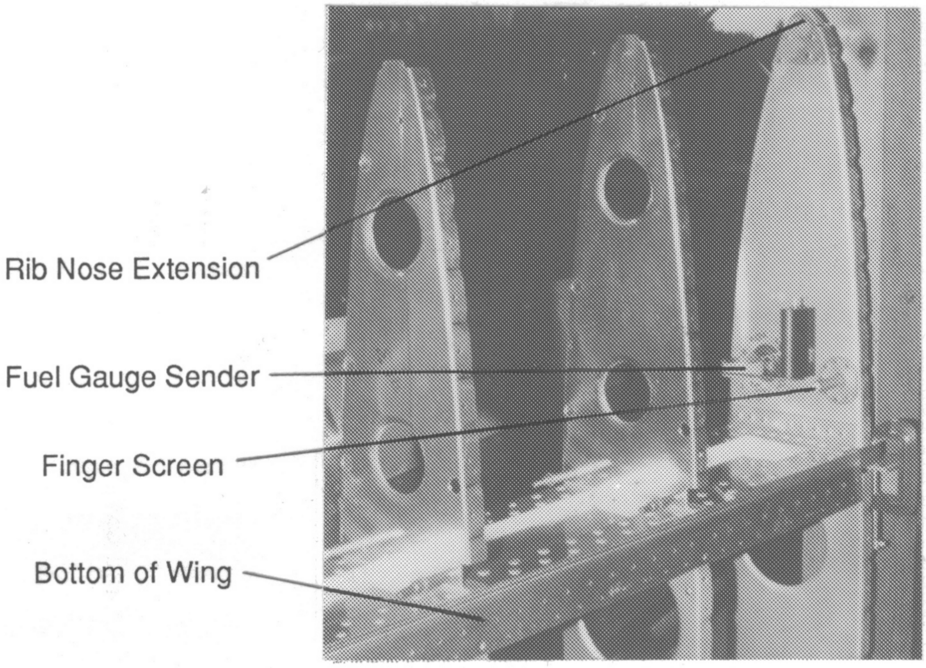

Figure 10.2, Fuel System Components

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down to about 8 gallons. This is somewhat of a liability. A calibration card should be near the gauge and a placard indicating this condition. Also, because of the dihedral and tank shape the fuel cannot be "dipsticked" or even seen when down a few gallons from full. This requires you to keep a careful chart of time and fuel burned.

Assembly

There are several methods to assemble the tank area. Three methods are as follows:

Method 1 is preferred.

Method 1 - Use solid rivets and attach the ribs to the spar. Rivet all of the bottom skin with solid rivets by lifting up the skin aft edge and reaching through with the bucking bar. It should only be necessary to use blind rivets for the three locations ahead of the spar on each rib. When completed, close the top skin with solid rivets on the spar and end ribs, and use blind rivets on the intermediate ribs.

Method 2 - Attach the intermediate ribs to the spar with structural screws from behind with plate nuts on the ribs. After fitting the skin, remove the ribs and rivet each to the skin with solid rivets. Assemble the skin and ribs as a unit to the spar and end ribs, using all solid rivets, then replace the screws.

Method 3 - Include access panels that can be solid riveted by bucking through the holes. If the intermediate ribs are flanged towards each other, only 4 access panels are needed per wing.

Component Construction

Main Spar - The lightening holes are to be omitted from the spar web.

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NOTE: If the butt and tip ribs have already been formed, an extension can be made and riveted to the rib web.

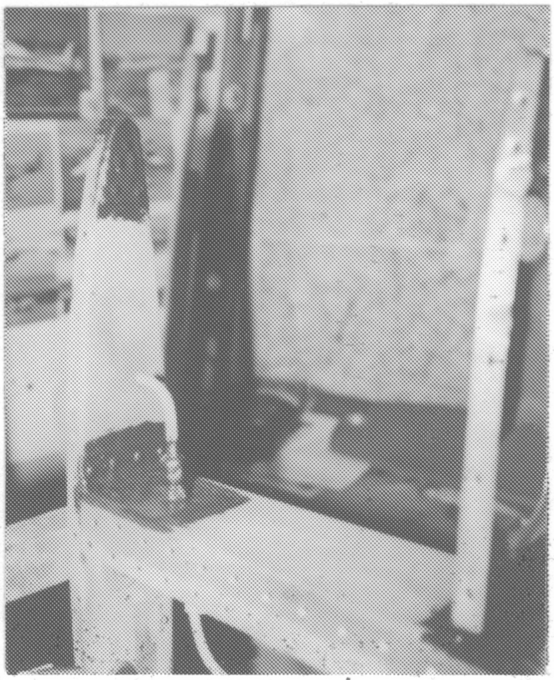

Figure 10.3, Tip Rib Extension

But and Tip Ribs - Use 0.032 aluminum. The rib nose is to be extended to the leading edge, including the flange. Be sure to make the proper preparations when cutting the rib blanks. The flange will require welding onto the web (nose) since it would be impossible to form in one piece. Make provisions for the fuel pick-up and gauge sender at the butt rib, and a vent fitting for the tip rib. For the vent fitting a block of aluminum tapped for the fitting can be fabricated and riveted on.

Intermediate Ribs - Use 0.025 aluminum. The lightening holes are to be made 2 inches in diameter which is smaller than called for by the construction drawings. This is so the ribs will act as baffles. For fuel flow, make a generous notch at the lower aft corner of each rib. The lower aft corner is obviously the low point in flight and on the ground. To aid the fuel flow in a nose low attitude drill 1/2 inch holes forward of the lower aft corner at 2 inch or 3 inch intervals. For venting during fueling drill 3 evenly spaced 1/2 inch holes along the top of the ribs.

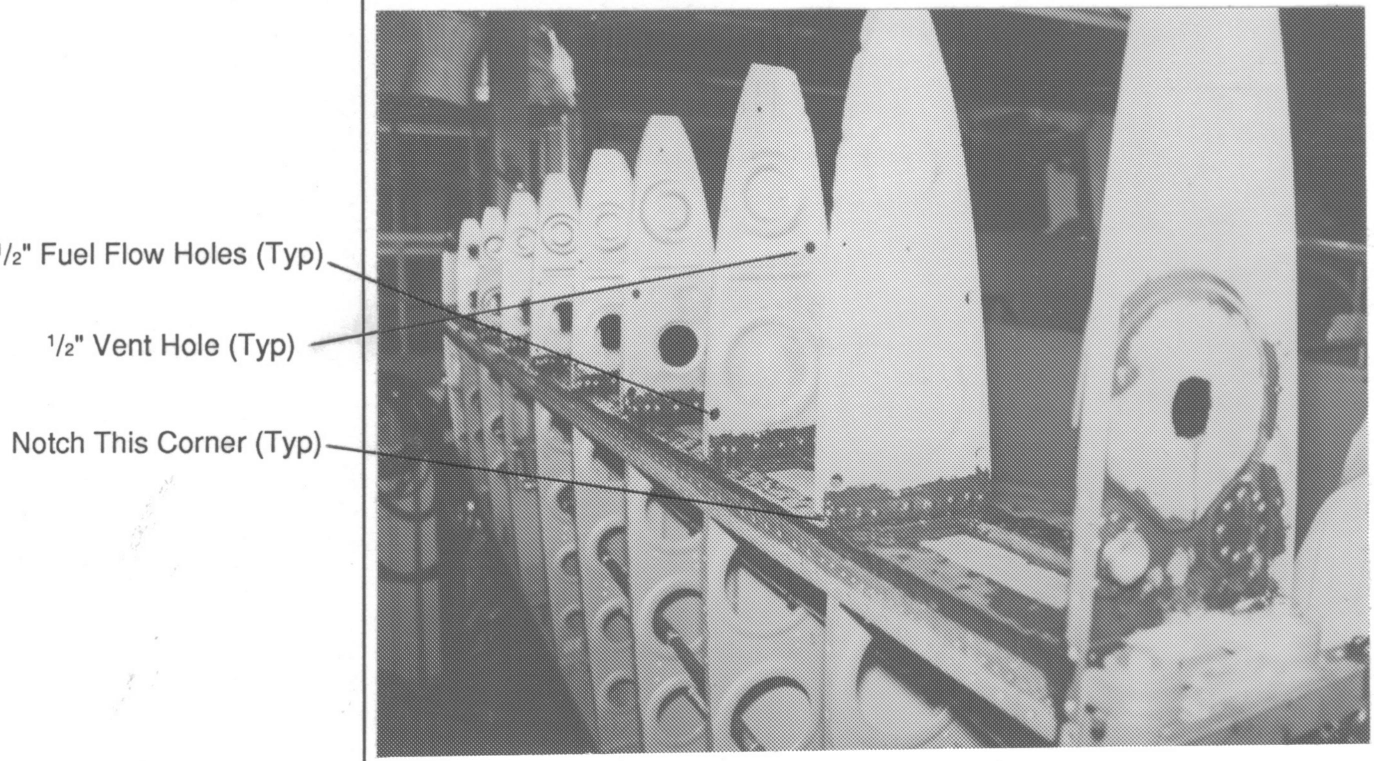

Figure 10.4, Fill and Vent Holes Through Ribs

Skins - Use 0.032 aluminum. This is to make the tank area stiffer and to reduce the chance of a rivet loosening. A sump fitting is to be installed in the lower skin, near the fuel pick-up area. As recommended by a builder, a Shaw Aero drain valve Part No. 72/478 can be used. The address presently available is:

Shaw Aero Devices, Inc.
Industrial Road
East Hampton, NY 11937
(516) 537-1404

To complete the skin construction install a flush filler cap at the top skin, just inboard of the tip rib.

Rivets - Spacing will be per print, except for the butt and tip rib which will require 1 inch spacing. When selecting blind rivets remember: Cherry Lock and Cherry Max are "aircraft quality", and only "aircraft quality" are to be used. Cherry Lock requires a special puller, where as Cherry Max can be pulled with a hand pop rivet tool. Both have their pros and cons depending upon application. Technical information can be obtained from:

Cherry Fasteners
Townsend Division of Textron
1224 E. Warner Ave.
Box 2157
Santa Ana, CA 92707
(714) 545-5511

Sealant - PRC and Pro Seal are two types of sealant available, and more can be found. PRC will provide a brochure titled "Coatings and Sealants for Aerospace Manufacturing, Maintenance, and Repair". Their address is:

Products Research & Chemical Co.
5454 San Fernando Road
Box 1800
Glendale, CA 91209

Technical data sheets are available from PRC for each of their products. Three that can be recommended (but don't stop here, look into others). They are:

- PR-1422-A-4, brushable sealant with 4 hour application time at 75 degrees Fahrenheit.
- PR-1321-B, low adhesion access panel sealant.
- PR-1005L, sloshing sealer.

PRC is available in what is called "Simkits", which is a cartridge for mixing and applying the two part material. These kits reduce the mess and allow you to mix a small pre-measured batch. When PRC is manufactured it has an expiration date. So order close to when you require it, do not store it. When writing to PRC or other manufacturers for information remember

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to ask for the closest dealer or representative where the product can be purchased, and from whom you can ask for help if needed. As an additional reference there is a book available entitled "Sealing Your Integral Fuel Tank". It is available through:

Aviation Products
Santa Paula Airport
Box 857
Santa Paula, CA 93060

This is an old address given by a builder. If a new one or another source is found, please update us.

Sealant Application

Step 1 - Etch and alodine all parts. Take special care not to get fingerprints on them.

Step 2 - Brush the sealant on the spar cap joints, rivets, and rib-to-spar joints. Extrude the sealant into a large drugstore type syringe, apply a bead, then finish by brushing it on.

Step 3 - Apply the sealant to the bottom side of spar and rib surfaces, then cleco the skin on leaving the top open.

Step 4 - Rivet the bottom together. As you remove the clecos put them in a jar of MEK or recommended solvent. This is the only time that you

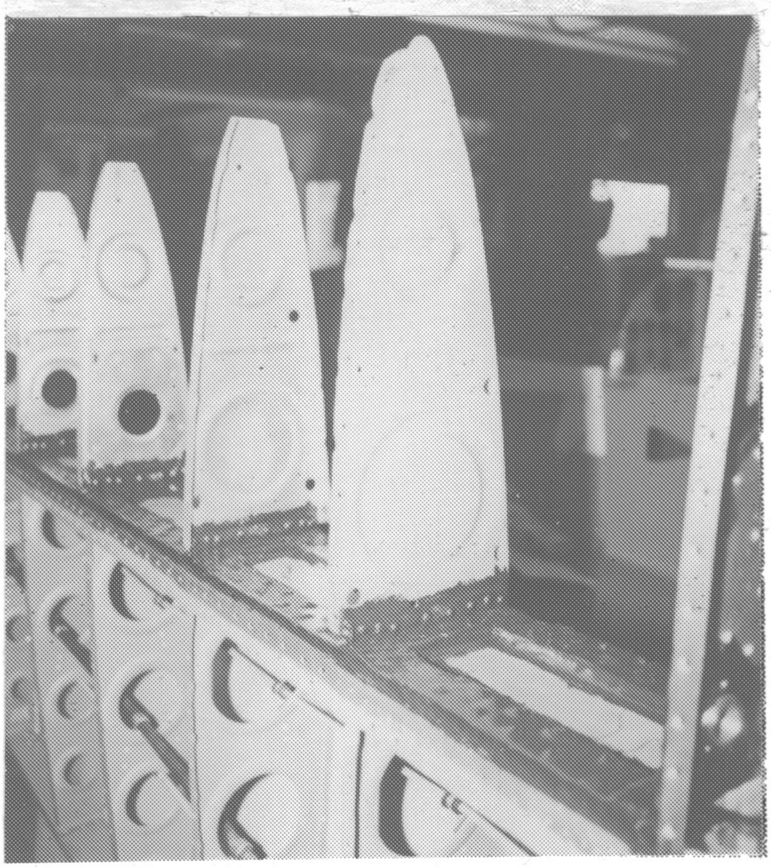


Figure 10.5, PRC On Spar

may have to "cut" the sealant. It may not work 100%, so plan to scrap a few clecos.

Step 5 - With the top skin open, brush another coat over all the joints.

Step 6 - Apply a generous amount of sealant to the top surfaces, especially around the butt and tip rib's nose and upper corners. Cleco the skin down and complete the riveting. Dip the blind rivets, if used, in the sealant before riveting.

Step 7 - Clean the wing and tools immediately. Use the recommended solvent.

Leak Testing

Pressure testing is explained in the book from Aviation Products mentioned earlier. Other sources are also available. The Aviation Products book recommends 2 1/2 PSI. If leaks are detected, use a sloshing compound to re-seal.

Venting

For simplicity you can do what is shown in Figure 10.6 and 10.7. This type of vent will lose a little fuel when making a sharp taxi turn with full fuel or if parked with one wing low. A check valve from Shaw Aero, mentioned earlier, would prevent this. It is important that the vents be connected to each other; the line running aft in Figure 10.7 goes to the other vent.

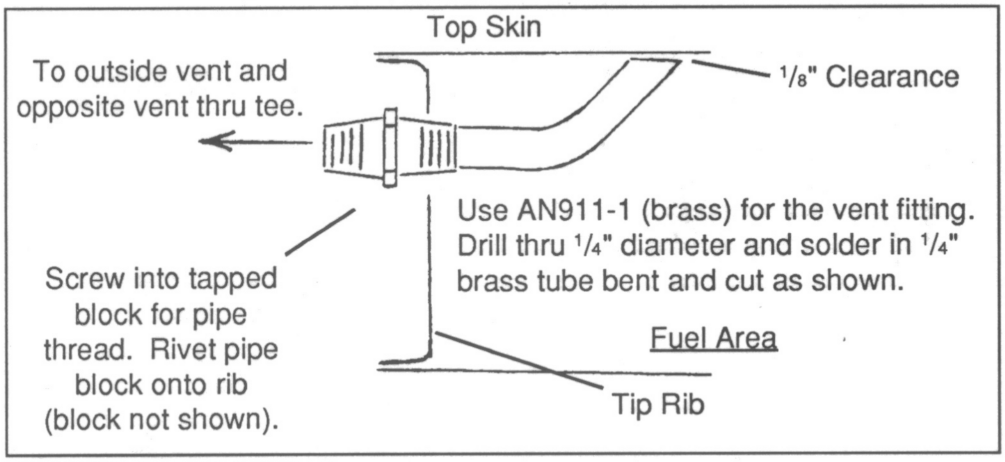


Figure 10.6, Fuel Tank Vent

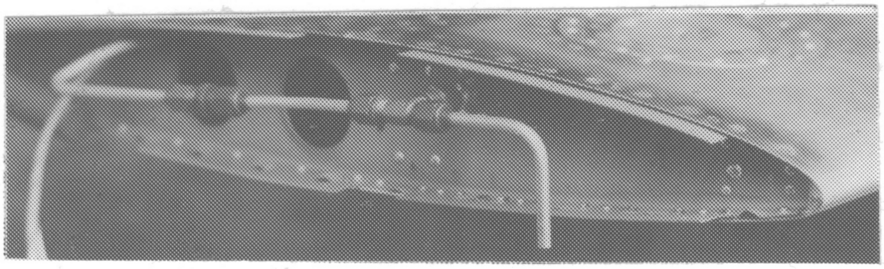


Figure 10.6, Outside Vent and Tank Connection At Tee

NOTES

WARNING !

Use proper protection such as a respirator and industrial gloves when working with solvents. Always provide proper ventilation.

CAUTION !

Make sure of the compatibility between different manufactured products before use!

NOTE: Using this information is up to the builder, hence, placing all liabilities of design and manufacturing on the builder, not Bushby Aircraft or the supplier of information.

2.3 Center Section and Wing Fittings

2.3.1 Center Section Spar

So that the wing will have the correct dihedral angle to the center section, the wing fitting holes need to be drilled as an assembly. The first step is to complete the center section spar as per drawing 220.002.

2.3.2 Wing Spar

The wing spar may be constructed by first bending the spar and cutting out the lightning holes. Make sure not to scratch any of the spar during construction. Especially near the bends.

Cut the capstrips and debur the edges so that they can be assembled. Clamp the staggered lengths together as per drawing 230.002. After clamped, locate and drill the attachment hole at the large end. It would be wise at this time to place a pin through the hole and mark the capstrips as shown in Figure 2.1. This will help keep from mixing the left and right wing capstrips.

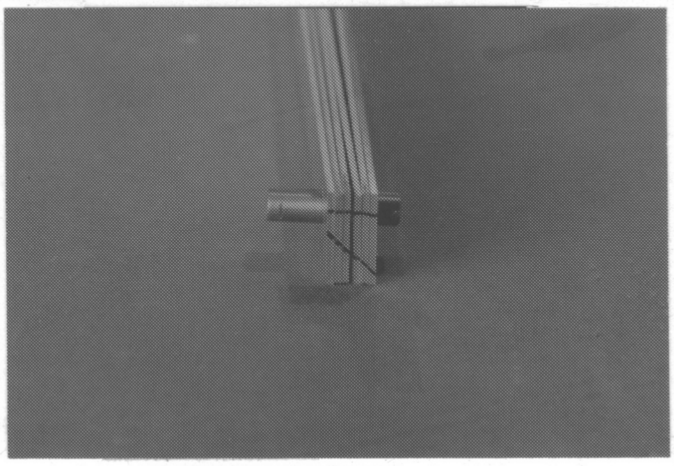


Figure 2.1, Capstrip Marking

When you are ready, mark the radius at the large end and pre-cut to the radius using a bandsaw or equivalent. Finish the radius with a file and sandpaper, and again mark the capstrips. Stack the capstrips in their proper order (both forward and aft sets) and clamp them together. Layout and pre-drill the rivet holes. Place rivets in every third or fourth hole as you proceed to help hold the alignment.

THE PROCEDURE IN THIS TOPIC, 2.3, IS WRITTEN FOR THE MMII. IT CAN ALSO BE USED FOR THE MMI IF THE WING SPAR IS FABRICATED FIRST, AND ALIGNING THE LOWER WING FITTING OF THE MAIN SPAR ASSEMBLY LAST.

NOTE: DRILL THIS HOLE UNDERSIZE, 35/64", AND REAM TO THE PROPER SIZE DURING FINAL ASSEMBLY OF THE PLANE.

NOTE: MARK THE CAPSTRIPS FOR FOR LEFT WING DIFFERENT FROM THE RIGHT. THIS ELIMINATES THE CHANCE OF MIXING SETS.

Radius the cap strip that fits into the radius of the spar with a file or sander until it fits without interference.

2.3.3 Center Section and Wing Spar Alignment

Using just the capstrips that fit into the radius, clamp the upper and lower capstrip to the spar. Position the spar and the capstrips so that the spar will make the proper dihedral with the center section spar. Once the capstrips are positioned, leave only the top capstrip clamped and remove the lower capstrip. Using the capstrip as a template, drill the rivet holes through the spar web and insert clecos about every fourth hole as you go. Figure 2.2 shows the rough positioning of the wing spar and capstrips with the center section spar, along with the drilled and clecoed top capstrip.

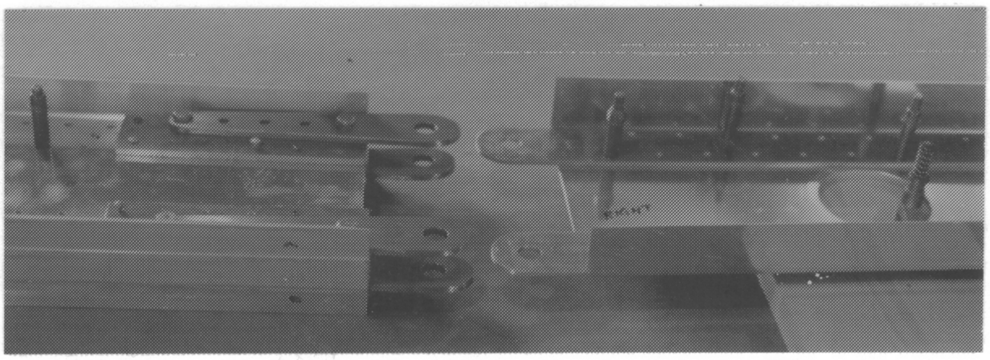


Figure 2.2

Pin the upper and lower capstrips to the center section spar and place a straight edge along the center section spar as shown in Figure 2.3.

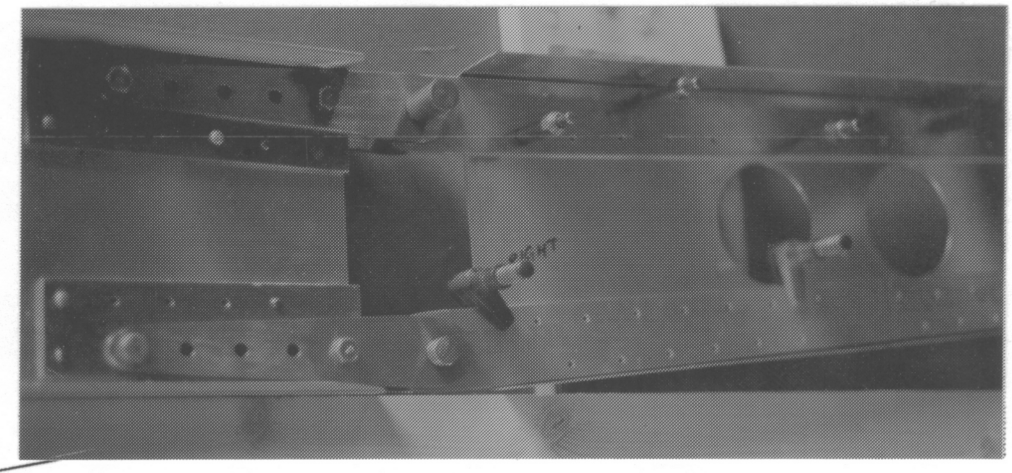


Figure 2.3

Using the straight edge as a reference, position the tip of the wing spar 9 3/4" above as shown in Figure 2.4. Clamp the lower capstrip to the spar, making sure that it fits into the radius of the spar.

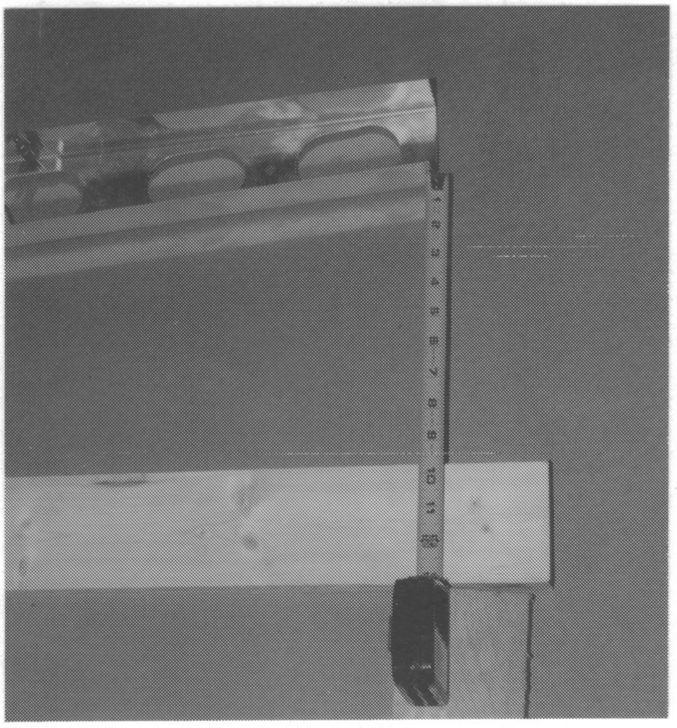


Figure 2.4

Separate the center section and wing spars, and drill the lower rivet holes into the spar web using the capstrip as the template. After the rivet holes have been drilled, remove the capstrips and debur the holes. Place the capstrips in their proper order around the spar web and place the correct length rivets into every fourth hole to help hold alignment. Rivet the capstrips to the spar.

WEIGHT AND BALANCE COMPUTATION

The aircraft must be weighed to determine its weight and center of gravity location. The aircraft is weighed in level flight attitude by use of a scale under each wheel. This must be done in a closed hanger, as a slight wind over the aircraft will effect the scale readings.

After placing a scale under each wheel the aircraft is blocked up on the scales into level flight attitude. The weight of blocking, or "tare" is subtracted from the gross scale reading to obtain the net aircraft weight. A level is placed on the top fuselage side stringer aft of sta. 73.75 for longitudinal leveling, and on the sta. 73.75 top angle assembly for latteral or span-wise leveling.

After leveling the fuselage it is necessary to determine the location of the wheel axle centers, or weighing points, in terms of fuselage stations. As the aircraft will be completely assembled for weighing the most convenient point from which to measure is the forward face of the firewall, which is station 52.0. To determine the station location of the main wheel weighing points drop a plumb bob from the firewall to the floor. From the plumb bob point on the floor measure back to a line connecting the centers of the two main wheel axles. Add this measurement to 52.0 to determine station location of main wheel weighing points. In a similar manner determine the weighing point location of tail wheel. This method of measurement will put all distances and moment arms relative to Station Zero.

The aircraft EMPTY WEIGHT is the sum of the three scale NET readings.

Determine empty weight CENTER OF GRAVITY as follows:

1. Multiply the total net weight on the two main wheels times the main wheel weight point station location.
2. Multiply the net weight of the tail wheel times it's weigh point station location.
3. Add together the products of steps 1 & 2, and divide this sum by the aircraft empty weight. The resulting figure is the station location of the EMPTY WEIGHT CENTER OF GRAVITY.

After determining the aircraft empty weight center of gravity the most forward and most rearward flight C.G. locations must be determined. The acompanying Weight & Balance Report form should be used for this purpose. This form should be made a part of the aircraft records.

THE AIRCRAFT MUST BE OPERATED AT ALL TIMES
WITH THE CENTER OF GRAVITY WITHIN THE
PRESCRIBED LIMITS.

Weight & balance computation (continued).

The basis of center of gravity computations are weights, distances or moment arms, and moments. The following values and terms will be used in the center of gravity computations.

Fuel - 15 gal. @ 6.0 lb/gal. - located at station 61.0.

Oil - 7.5 lb/gal. - Use engine capacity and location applicable to engine installed.

Pilot - 170 lb. (Or use actual weight). located at sta. 91.5.

Baggage - 20 lb. max. - located @ sta. 105.0.

Minimum fuel - 45 lb. - used for rearward C.G. computation.

DATUM is an imaginary vertical line from which all measurements are taken. Datum used for MUSTANG I is STATION ZERO.

MOMENT ARM is horizontal distance from datum to center of gravity of the item.

MOMENT is product of the weight of a item and its moment arm.

EMPTY WEIGHT CENTER OF GRAVITY IS THE CENTER OF GRAVITY OF THE EMPTY AIRPLANE AS DETERMINED BY WEIGHING.

CENTER OF GRAVITY LIMITS are the most forward and rearward permissable center of gravity locations. These limits are Station 69.25 to Station 72.25.

CENTER OF GRAVITY RANGE is the distance between the C.G. limits in which the operating C.G. must fall.

TARE is weight of blocking on scales used to level aircraft. Tare weight is to be subtracted from gross scale weight.

Although other methods and formulas can be used for C.G. computation I find the above method most desireable as the C.G. is obtained directly in relation to fuselage stations, and it is applicable to both nose wheel and tail wheel type aircraft. Complete information relative to weight and balance is printed in FAA publication AC 43.13-i, and is available from Government printing office.

WEIGH AIRCRAFT in level attitude, in CLOSED hangar, and with brakes released.

Weight and Balance Report

Midget Mustang M-I

Registration No.________________ Serial No. M-I-______________ Date_________________

Datum used is Fuselage Station Zero. Station Zero is located 52.0" forward of the firewall.
Location of Main Wheel weighing point is Sta.______________
Location of Tail Wheel weighing point is Sta.______________

AIRCRAFT WEIGHTS AS FOLLOWS

	Scale Reading	Tare	Net	Station	Moment
Left Wheel					
Right Wheel					
Tail Wheel					
TOTALS	Aircraft Empty Weight				

EMPTY WEIGHT C.G. = Total Moment / Total Weight = Station ______________. {typ. ~sta 67.0}

Most FORWARD C.G. Determination

ITEM	WEIGHT	STATION	MOMENT
Aircraft Empty Weight			
Oil (max. qts.)			
Fuel Main (max. capacity)			
Pilot			
TOTALS			

FORWARD C.G. = Total Moment / Total Weight = Station ________________.

Most REARWARD C.G. Determination

ITEM	WEIGHT	STATION	MOMENT
Aircraft Empty Weight			
Oil (min. qts.)			
Fuel Main (min.)			
Pilot			
Baggage			
TOTALS			

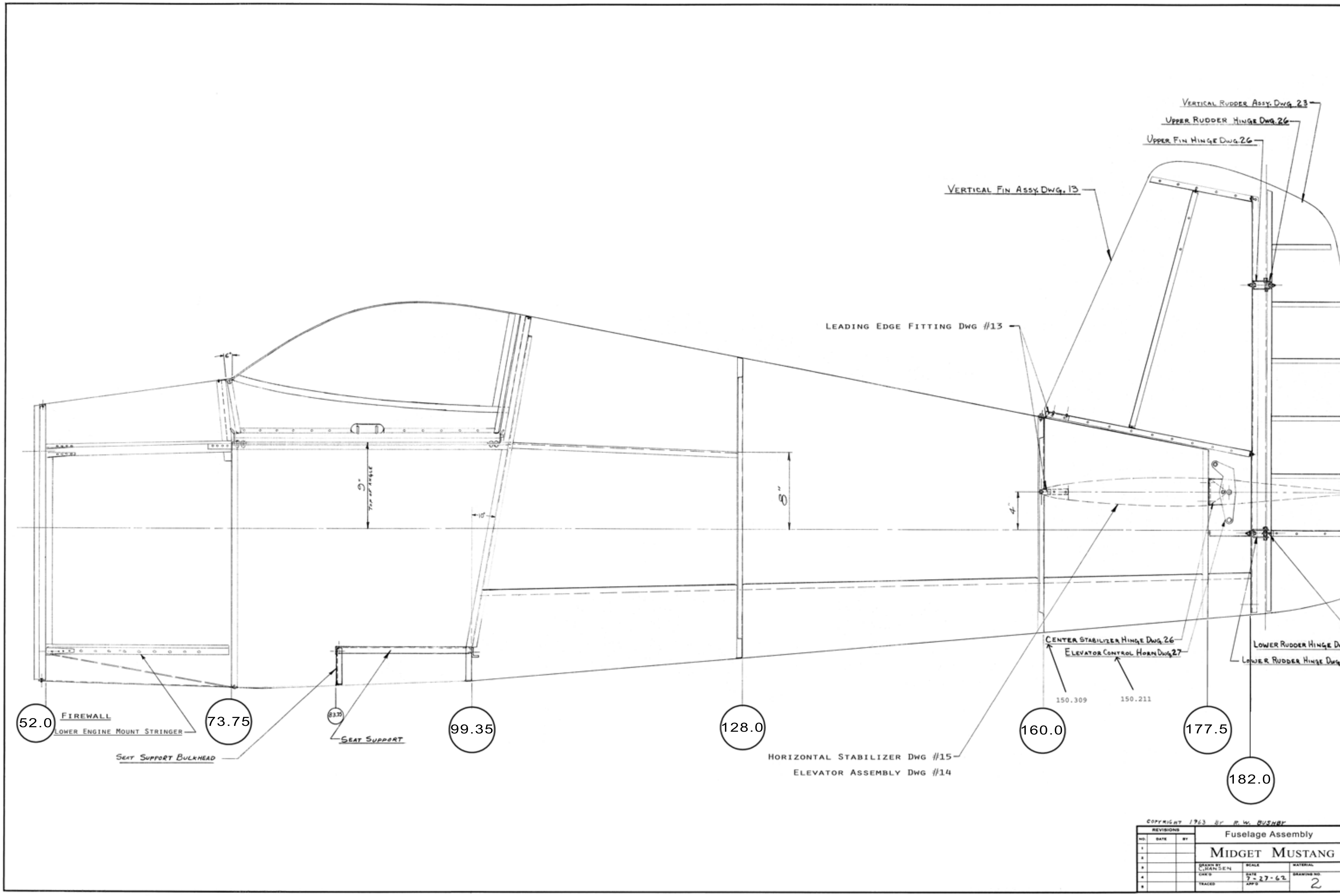
REARWARD C.G. = Total Moment / Total Weight = Station ___________

CENTER OF GRAVITY LIMITS are **STA. 69.25 TO STA. 72.25 (20% to 26.5% MAC)**

Useful Load = __________lb. - __________lb. = __________lb
(Gross wt.) (Empty wt.)

A listing of all equipment items included in the empty weight should be attached to this form.

1/12/00 CKT



Vertical Rudder Assy. Dwg 23
Upper Rudder Hinge Dwg.26
Upper Fin Hinge Dwg.26
Vertical Fin Assy. Dwg. 13
Leading Edge Fitting Dwg #13
9"
Top of Angle
8"
4"
10°
6°
Center Stabilizer Hinge Dwg.26
Elevator Control Horn Dwg.27
Lower Rudder Hinge Dwg.23
Lower Rudder Hinge Dwg.26
150.309
150.211
52.0
Firewall
Lower Engine Mount Stringer
73.75
Seat Support Bulkhead
83.35
Seat Support
99.35
128.0
Horizontal Stabilizer Dwg #15
Elevator Assembly Dwg #14
160.0
177.5
182.0
Copyright 1963 by R. W. Bushby
Revisions
No. Date By
Fuselage Assembly
Midget Mustang
Drawn by C. Hansen
Scale
Material
Chk'd
Date 7-27-62
Drawing No. 2
Traced
App'd

Midget Mustang / M-I

Aircraft Design Specifications

Suggested Gross Weight (Aerobatic Category)	900 pounds
Suggested Gross Weight (Normal Category)	1,000 pounds
Baggage Capacity	30 pounds
Power Recommendations	85 to 160 hp
Wing Loading @ 1,000 pounds	14.7 lb/ft^2
Wing Aspect Ratio	5.0
Power Loading (100 / 160hp)	10.0 / 6.3 lb/hp

Wing Span	18' 6"	Height	4' 6"
Fuselage Length	16' 5"	Max. Fuselage Width	21”
Max. Prop Diameter	64”	Wheel Tread	5' 1"

Wing Area	68.0 ft^2	Fin Area	3.6 ft^2
Flap Area	7.7 ft^2	Elevator Area	5.1 ft^2
Aileron Area	4.8 ft^2	Rudder Area	3.3 ft^2
Stabilizer Area	8.8 ft^2	Trim Tab Area (elevator)	0.3 ft^2

Flap Travel	40 deg maximum Down
Aileron Travel	20 deg Up, 15 deg Down
Elevator Travel	20 deg Up, 20 deg Down
Elevator Trim Tab Travel	20 deg Up, 40 deg Down
Rudder Travel	20 deg Right, 20 deg Left
Wing Angle of Incidence	+1.0 deg
Stabilizer Angle of Incidence	-1.5 deg
Wing Wash Out (geometric twist)	+2.5 deg
Wing Dihedral (outer panels)	+5.0 deg
Airfoil (modified)	64A212 (root), 64A210 (tip)
Thrust Line Above Fuselage Horiz. Reference Line	0.0 in

Center of Gravity Limits	20% to 26.5% MAC

Never Exceed Speed (V_{ne}, smooth air)	230 mph
Max. Structural Cruise Speed (V_{no})	195 mph
Max. Maneuvering Speed (V_A)	150 mph
Maximum Flap Extension Speed (V_{fe})	100 mph
Stall Speed Clean at 1,000 lbs (V_s)	62 mph
Stall Speed Full Flap at 1,000 lbs (V_{so})	57 mph

Maximum Structural Loading - Aerobatic Cat.	+ 6/-4 g's yield

FLIGHT TESTING THE MUSTANG

Persons intending to fly the tail wheel equipped MUSTANG should have prior tail wheel flying experience. The two characteristics of the MUSTANG that would tend to cause difficulty are common to all small aircraft - this is directional sensativity on the ground, and also sensitivity of the elevator control. This sensitivity is completely forgotten by MUSTANG flyers after a few hours flying, but it does require attention on initial flights.

A smooth sod runway is prefered over a hard surface for two reasons. First, the directionl sensitivity is practically eleminated. Secondly, the landing roll distance is reduced to about half that required on a hard surface runway.

A few taxi runs at high speed are recomended. During these taxi runs the tail should be raised two or three inches. Slow initial acceleration is desirable. On a hard surface urnway 1400 to 1600 RPM will be sufficient as air speed should not exceed 50 MPH. Slightly more power will be required on sod. One caution - Due to slow acceleration the right rudder used to counteract torque effect is fed in gradualy, and in most cases is un-noticed by the flyer. The effect of this is that if the throttle is cut abruptly the flyer finds he is holding right rudder which is not needed., and imediately overcontrols with left rudder - thereby making " S " turns down the runway. The throttle should be reduced slowly to prevent this.

I definitely recomend that you lift off and land straight ahead on the runway several times prior to full flight. I believe the best method of performing these lift offs, as it eleminates the need for attitude and control changes is as follows:

Accelerate down the runway using a intermediate amount of power (about 1800 RPM) with tail raised slightly off the ground. Your taxi runs will have given an idea of how much runway is required to accelerate and decelerate. Allow PLENTY of reserve runway. If at this RPM the aircraft does not become airborne, try again using slightly more power. When the plane is felt to be airborne slowly retard the throttle. As the plane is in the landing attitude it will settle back to the runway and roll out will be similar to a normal landing. As this type operation is entirely in ground effect you will find the air speed to be lower than anticipated. These lift offs will familiarise you with control responses, and also detect any misalighment of the landing gear.

Perhaps the one major differance in landing the MUSTANG as compared to most factory made planes is that the landing FLARE must me made much LOWER than you are used to doing. This is due to the fact that when you are sitting on the ground in the MUSTANG your eye level is much lower than in most standard type aircraft.

As a safety precaution in case of a unplanned go-around it is suggested that the plane be fully ready for flight, with sufficient fuel, during these taxi tests.

CAUTION - DO NOT blast down the runway with lots of power and with the stick full back during these tests.

Unless you are an experienced flyer I do not recomend that you simply take off on the first flight without the lift-off experience. In the event of engine operating difficulty you may need to make a quick return to the field, and would have no real idea as to approach speed, float characteristics, or runway required.

On the first flight feel out an APPROACH to a stall. This will give you a indication of the stall speed. Use about 20 MPH additional for final approach speed, slowing to 10 MPH more for a over the fence speed. I believe the main aspect of the landing, as with any landing, is to break the glide or "flare" as low as possible. (Remember you are sitting closer to the ground than you are generaly accustomed to.) I suggest using a little power for the initial landings, 1100 to 1200 RPM. This will flatten the glide and give more positive control of the approach.

After the taxiing and lift-offs you will be familiar with the three point attitude of the airplane. This will make three point landings simple. The method recommended is to use full flaps and a little power. Flare out the landing glide as normal, and after the flare set up the three point attitude. A slightly nose high attitude is satisfactory. After attaining the three point attitude just hold it there and let the plane settle in. If your flare is high and you feel the plane is settling too fast an additional 100 RPM will reduce the rate of decent. If you feel the plane is floating too far, or wants to "balloon", slack off the power. I have watched a person make a good landing in a MUSTANG although he flared 12 ft. high, by just maintaining the attitude and regulating the rate of decent with power. He did use a lot of runway however.

As the above described approach using partial throttle (although only a small amount of power) results in a flat approach a clear runway approach is necessary. A completely power off aproach is fine, but things happen a little quicker.

A go-around with full flaps down is satisfactory, and acceleration is quick. It is not necessary to raise the flaps.

One more comment on the above described three point landing proceedure. The ground attitude is approximately 5° less than the stall attitude. That is why this method works well. However, if you were to become too engrosed in easing the plane down from a too high level off position it is easy to raise the nose high enough to get a stall. Caution should be used in this respect.