



SAIB: CE-10-08

SUBJ: Wings: Zodiac CH601XL and CH650 Wing Structural Modifications **Date:** November 7, 2009

This is information only. Recommendations aren't mandatory.

Introduction

This Special Airworthiness Information Bulletin informs you of an airworthiness concern on all variants of Zodiac CH601XL and CH650 airplanes, all serial numbers, including special light-sport category aircraft (S-LSA), experimental light-sport aircraft (E-LSA), and experimental amateur-built aircraft.

Background

Since April 2009, the FAA has been conducting a special review of the Zodiac CH601XL and the nearly identical CH650 to evaluate design and operational details of these aircraft. This review was a continuation of efforts to investigate several in-flight structural failures of the CH601XL dating back to 2005. Five in-flight structural failure accidents have occurred in the United States and several abroad. The U.S. accidents involved two S-LSA, one E-LSA, and two experimental amateur-built kit aircraft. The design of all CH601XL & CH650 airplanes is essentially the same, but only the S-LSA aircraft are designed and produced to ASTM International LSA standards. We quickly launched the FAA special review because of the accidents exhibited signs of structural failures. After the review we made a determination that these accidents did not clearly indicate a single root cause. Instead, it implicated the potential coupling of design and operational aspects of the aircraft.

Our analysis did reveal several areas of concern regarding the CH601XL design that may impact the overall safety of the design. Those causing the greatest concern are as follows:

- **Wing structure:** FAA analysis shows bending loads used to design the wing structure were non-conservative and the basic static strength of the CH601XL/CH650 does not appear to meet the intent of the ASTM standards for a 600kg (1320 lb) airplane, given the current flight envelope in the Pilot Operating Handbook.
- **Structural Stability:** Other aviation authorities have noted the presence of buckling in the wing structure, including in the center section. Such structural instabilities can have a significant effect on static strength and flutter characteristics.
- **Flutter:** Our detailed review of available flutter analysis reports was inconclusive. However, accident photos clearly indicated flutter was present during the in-flight structural failures. The FAA believes flutter may either be a first order root cause of in-flight structural failure or a secondary cause after some initial wing structural deformation or twisting.
- **Airspeed calibration:** Calibration procedures do not appear to adequately account for basic static pressure source error due to the location of the static port. This could lead to potential airspeed indication anomalies, particularly since the CH601XL/650 derivatives can be delivered/built with several different airspeed indicators installed or without an indicator at all. The situation could lead to the potential of operating the airplane above the maneuver speed and/or the design cruise speed, potentially leading to structural failure.

- **Stick force characteristics:** Flight test data from foreign authorities indicates at aft center of gravity the stick forces become very light. The FAA believes this may be a contributing factor in structural failure accidents if coupled with operations over gross weight, at speeds higher than V_A , and/or for aircraft loaded improperly. In such conditions, it would be very easy to dynamically load the CH601XL/CH650 wing beyond its design structural load limit.

Recommendations

In order to prevent potential catastrophic structural failure, we strongly recommend that all owners and operators of Zodiac CH601XL/CH650 comply with actions outlined in a forthcoming Aircraft Manufacturing & Design, LLC (AMD) Safety Directive / Safety Alert to address the above-referenced concerns before further flight.

For SLSA owners and operators: We remind all owners and operators of their regulatory obligation to comply with Safety Directive / Safety Alert issued by AMD in accordance with the ASTM International consensus standards safety directive process and recommend the following:

- Reference 14 CFR §21.190(c)(5) – The manufacturer’s requirement to issue safety directives.
- Reference 14 CFR §91.327(b)(4) – Owner/operator compliance with each safety directive.
- Obtain and install AMD’s modification kit (i.e., major alteration) per drawings and instructions.
 - ✓ Contact AMD for any requests to correct the unsafe condition in a manner different from that specified in the safety directive.
 - ✓ Since the AMD safety directive adheres to the applicable consensus standard, the FAA will not likely issue any waivers from the provisions of the safety directive.
- Adhere to the manufacturer’s drawings and instructions. These drawings and instructions address the structural design changes that are required to meet the ASTM design and performance standard T they also address other operating limitations.
- If necessary, obtain a special flight permit to fly the aircraft to a location where the safety directive modifications can be made. The FAA may add special requirements for operating your aircraft to a place where the modifications can be done. The FAA may also decline to issue a special flight permit in particular cases if we determine you cannot move the aircraft safely. To apply for a special flight permit, follow the procedures in 14 CFR 21.199.

For amateur-built and E-LSA owners and operators: Due to shared design characteristics that amateur-built and E-LSA aircraft have with S-LSA, we strongly recommend compliance with the drawings and instructions contained in the AMD Safety Directive/Safety Alert and recommend the following:

- Reference 14 CFR §91.7: “(a) No person may operate a civil aircraft unless it is in an airworthy condition. (b) The pilot in command of a civil aircraft is responsible for determining whether that aircraft is in condition for safe flight. The pilot in command shall discontinue the flight when un-airworthy mechanical, electrical, or structural conditions occur.”

- Obtain and install the kit manufacturer's structural modification kit. The modification kit addresses the structural design changes and operating limitations required to meet a safe condition for operation.
- Contact the kit manufacturer with any modifications already incorporated to correct the identified unsafe condition to validate safety-of-flight issues.
- If necessary, obtain a special flight permit to fly the aircraft to a location where the safety directive modifications can be made. The FAA may add special requirements for operating your aircraft to a place where the modifications can be done. The FAA may also decline to issue a special flight permit in particular cases if we determine you cannot move the aircraft safely. To apply for a special flight permit, follow the procedures in 14 CFR 21.199.

For Further Information Contact

Wes Ryan, Manager ACE-114, Programs & Procedures, FAA Small Airplane Directorate, 901 Locust, Kansas City, MO 64106; Phone: (816) 329-4111; Fax: (816) 329-4090; e-mail: wes.ryan@faa.gov.

(Optional) For Related Service Information Contact

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Heart of Georgia Regional Airport
415 Airport Road,
Eastman, Georgia 31023 USA
Email: <http://www.newplane.com/>

Mailing address:
P O Box 4277 Eastman Georgia 31023 USA
TEL: 478-374-2759
FAX: 478-374-2793

Zenith Aircraft Company (Kit Manufacturer)
Mexico Memorial Airport, PO Box 650
Mexico, Missouri, 65265-0650 USA.

TEL: 573-581-9000
FAX: 573-581-0011
Email: <http://www.zenithair.com/>



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441 Airport Road, Eastman Georgia 31023 USA
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SAFETY ALERT / SAFETY DIRECTIVE

Release Date:

Saturday, November 07, 2009 (revision 1)

Effective Date:

Immediate

Subject/Purpose:

Mandatory Upgrade, before next flight.

Limitations:

None, once upgrade is complete.

Affected Models:

Aircraft Manufacturing & Development and Aircraft Manufacturing & Design (AMD) Zodiac CH 601 XL and CH 650 aircraft.

Owner/Operators of CH 601 XL and CH 650 aircraft in the Experimental Amateur Built category are encouraged to reference related information from Zenith Aircraft, Co. available at:
<http://www.zenithair.com/news/ntsb-astm-4-09a.html>

Serial numbers:

All

Notification Number:

Saturday, November 07, 2009

Does this Notice supersede another document?

Yes – Aircraft POH and all other aircraft documents that makes reference to flight limitations and Weight & Balance including pre-flight check list.

Discussion:

This Safety Alert is based on the "Chris Heintz" letter of July 7, 2009 and on the FAA's and other airworthiness authority's review of the design. Chris Heintz is the designer and owner of the Zodiac designs; AMD has a license agreement with Mr. Heintz for the manufacturing of the Zodiac 601XL and 650 in the USA under the SLSA category.

A number of accidents involving the CH 601 XL aircraft type have occurred in 2006-2009 causing different authorities to conduct full reviews of the design.

Two aircraft (a CH 601 XL as well as a CH 650) were delivered to a flutter specialist in Germany for the purpose of thorough Ground Vibration Testing. It is important to note that both aircraft used in these tests were professionally built and, therefore in compliance with design specifications. The result of these real-world tests (not just a computer simulation) can be viewed on the AMD web site (at [CH 650](#) and [ZODIAC XL](#)). The tests concluded that there are no flutter concerns for these planes. However, an on-going question that remains is: is flutter possible if a similar aircraft is not built or maintained as per the design specifications?

Chris Heintz agrees that one way to address this question is to follow the UK LAA's mandated upgrade to install aileron counter balance weights. AMD is now mandating this modification as part of the upgrades covered by this Safety Alert.

Additionally, the German laboratory in charge of the GVT also conducted non-linear test analysis of the design and concluded that the aileron bellcrank area of the CH 601 XL could be reinforced to minimize the possibility of non-linear-type vibrations in that area. This is why the reinforcement parts for this area are also part and parcel of the upgrade kit mandated by this Safety Alert.

Finally, Chris Heintz completed a series of static load tests this summer where the Zodiac design was load tested by as much as 6% beyond the SLSA requirements - without failure. This Safety Alert includes extra material which was not part of the tested airframes, further increasing the safety margins of the seat area, main spar bolt area, and rear spar area. The current upgrade kit therefore increases a number of safety margins on the aircraft even further than those on the tested airframes.

The purpose of this multi-part upgrade kit is to not only comply with the different interpretation of regulations by different authorities, but to also make sure that the aircraft is significantly tougher overall and less prone to vibrations, including everyday wear-and-tear.

Overloading of the airframes is still an important concern. In a number of cases, this overloading was probably due to exceeding V_c in turbulent conditions - which significantly increases the loads on the airframe. It is therefore imperative that all Zodiac 601XL and 650 aircraft be retrofitted with the upgrade kit covered in this Service Alert, and that pilots become and remain well aware of the aircraft limitations including V_c , and that the ASI of every aircraft be well calibrated and properly marked.

Corrective Action:

Complete the installation of the upgrade kit as per the following.

1. All work is to be performed by a certified mechanic as per maintenance manual “(a / b) Major Alterations / Major Repairs. Must be pre-approved by the Manufacturer or other identity and performed by an FAA certified A&P” or FAA certified repair station.
 - a) Complete the upgrade by using the following information:
 - i. Drawing 6-ZU-1, 6-ZU-2, 6-ZU-3, and 6-ZU-4.
 - ii. Photo guide with construction standards
 - iii. Use “FAA AC-43.13.-1B and 2A if additional information is required
 - iv. Use the UK LAA's modification MOD/162B/004 dated 18/08/09 for only the installation of the aileron counter balance weights. Drawings and assembly instructions are part of the modification.
 - b) Additionally:
 - i. When removing and reassembling the wings, ailerons and flaps, follow the procedure in the service manual section VII
 - ii. When removing and reinstalling the wing tanks follow the procedure in the service manual section VIII
 - iii. Inspect the aircraft using the Zodiac series checklist. This is a 41-page checklist to help owners thoroughly inspect their aircraft before flying again.
 - iv. Use the checklist with the Service Manual as you complete a 100 hour inspection as per table 1.
 - v. Ground and flight test procedures for the return to service after upgrade Follow Appendix 1 for “major repairs and alterations”
 - vi. For calibration of the ASI with a GPS, proper outside air temperature must be taken with a temperature gauge while doing the flight test as actual outside air temperature is required to allow proper correction.
 - vii. Complete a new weight & balance as per procedure in POH section 4. Update the “INSTALLED EQUIPMENT LIST”, “WEIGHT & BALANCE REPORT” and “WEIGHT & BALANCE UPATE” in the POH.

In addition to this and before each flight:

1. Check all control cable tensions by hand. If in doubt about the cables being properly tensioned, check them with a calibrated cable tension gauge. If necessary, adjust the cable tension to the proper values. If unsure, get a licensed mechanic to check or adjust the cables.

WARNING: Do not fly with control cables that are too loose or too tight.

2. Check for free play in the aileron control system. When holding the control stick stationary, beyond minor flexing, there should be no free play in the system when gently pushing up or down on the aileron trailing edges. Note that if the ailerons are not locked when the aircraft is parked outside, wind can damage the system.

WARNING: Do not fly with loose, sloppy or damaged controls.

3. Check the flaps for positive firm contact with the flap stops when in the “up” (retracted) position. Check for movement by gently pushing up and down on the flap trailing edges. **WARNING:** The flap system can get damaged if the flaps are stepped on. Do not fly with loose or damaged flaps.

4. When placing luggage/items in the wing lockers, baggage area behind seats, or in other places, check that it is well secured before take-off.

WARNING: Do not fly with loose luggage or other items in the aircraft.

5. Make sure the colored arcs on your ASI all properly indicate the correct speed limits (CAS). Incorrect markings could cause the pilot to unintentionally exceed aircraft limitations. Before flying your aircraft, know all the flight limitations including VA and Vc. Mark VA on your airspeed indicator (or panel). Remember that all aircraft limitations should be included in your flight manual (POH).

6. Check that your canopy closes and latches properly on both sides. If in doubt, add a secondary latching system as recommended by the Australian CAA. If your canopy does open in flight, keep your hands on the controls, lower your speed to approximately 60 knots, keep flying the aircraft and land as soon as practicable.

WARNING: Do not try to close the canopy in flight: Fly the aircraft!

7. “Self checkout” is not recommended. Before flying the aircraft, make sure that you have been properly checked out and that you are familiar with all flight limitations and the handling characteristics (feel and responsiveness) of the controls. Remember that, as with any light aircraft, if you encounter unexpected turbulence while cruising, ride it out rather than fight it – and slow down!

REMINDER TO PILOTS: Always get to know a new aircraft you plan to fly before taking the controls (this applies to any aircraft). A thorough condition inspection of the aircraft is essential; learn the operating limitations from the POH (and respect them); and get properly checked out to be familiar with the aircraft’s handling qualities.

OPERATING LIMITS AFTER UPGRADE IS COMPLETE:

1. The aircraft **MUST** comply with all Safety Directives issued by AMD except for operating limitations of July 08, 2009 .
2. The aircraft **MUST** have a current Weight and Balance, and should be within limits.
3. Aircraft VNE to be as per POH of November 2009
4. Gross weight, baggage and passenger limits to be as per POH of November 2009
5. Your POH and an instrument placard **MUST** reflect POH marking of November 2009.
6. Use applicable sections of Appendix 1 in the Service Manual of November 2009 to calibrate your ASI.
7. Use November 2009 POH only after the aircraft has been signed off by a certified mechanic, clearly stating that the aircraft complies with this Safety Alert.

Reminder

AMD reminds the Owner/Operator of AMD aircraft that compliance with all Safety Directives, Aircraft Operating Instructions, Maintenance Manuals as well as the reporting of any and all Safety of Flight or Service Difficulties by the Owner/Operator is *mandatory* for the operation of an SLSA aircraft.

- AMD Safety Alerts, Service Bulletins and Notices can be viewed and downloaded at:
http://www.newplane.com/amd/CH2000_Service.html
- UK LAA aileron balance can be downloaded from:
http://www.lightaircraftassociation.co.uk/engineering/engineering_updates.html



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SAFETY ALERT

Release Date:

Wednesday, October 29, 2008

Effective Date:

Immediately, before next flight.

Subject/Purpose:

Control cable tension and inspection of ailerons and rear wing root

Limitations:

None

Affected Models:

Zodiac CH 601 XL and CH 650

Serial numbers:

All CH 601 XL;

CH 650 model: Up to 650-104

Notification Number:

October 29, 2008

Does this Notice supersede another document?

Notification letter of August 11, 2008

Discussion:

This Safety Alert is in response to a September 2008 accident of a Zodiac CH 601 XL built by Czech Aircraft Works of the Czech Republic and the accident of another Zodiac built by the same company. Both aircraft had a wing destroyed in the air. It is likely that flutter may be the cause of this, based on a letter that Chris Heintz, designer of the Zodiac, received from a Zodiac kit builder who experienced wing flutter on the first flight. After safely landing, it was concluded that the flutter was due to loose aileron control cables.

There have not been any similar reports from an AMD SLSA built Zodiac.

Corrective Action:

To be completed by certified A&P. Log book entry to be made.

a) Inspect all of your control cables as per the following:

Rudder tension should be about 22 lbs +/- 5
Aileron tension should be about 30 lbs +/- 5
Elevator tension should be about 40 lbs +/- 5

b) Inspect both ailerons for any type of deformation of the skins at the piano hinge area and root rib area. Immediately contact AMD if anything unusual is found.

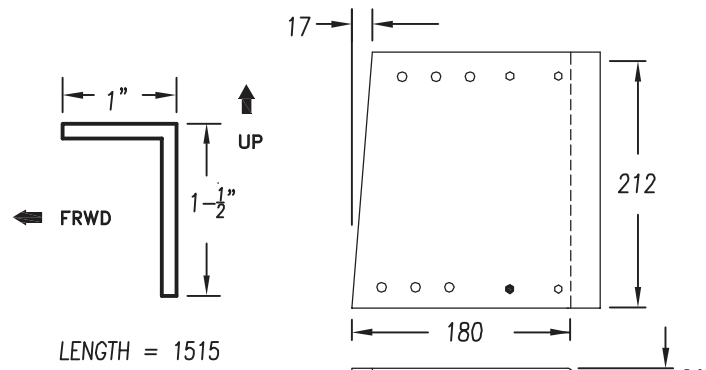
c) Inspect the rear spar attachment area at the wing root. Look for deformation, loose rivets, deformation around the rear spar attachment bolt etc. Immediately contact AMD if anything unusual is found.

Reminder

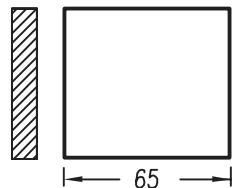
AMD reminds the Owner/Operator of AMD aircraft that compliance with all Safety Directives, Aircraft Operating Instructions, Maintenance Manuals as well as the reporting of any and all Safety of Flight or Service Difficulties by the Owner/Operator is *mandatory* for the operation of an SLSA aircraft.

Notice Of Corrective Actions can be viewed at:
http://www.newplane.com/amd/CH2000_Service.html

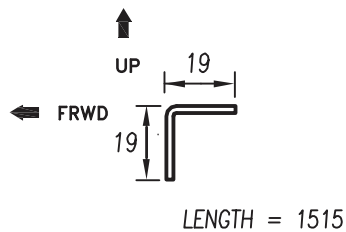
Also, see AMD Zodiac Notification letter of April 2008 regarding canopy opening in flight.



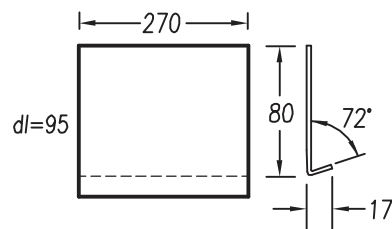
1 **WING UPPER EXTRUSION**
EXT. 6061-T6 1"x1-1/2"x1/8"
(2 REQ'D)
REPLACES PART OF 6W3-6 ANGLE



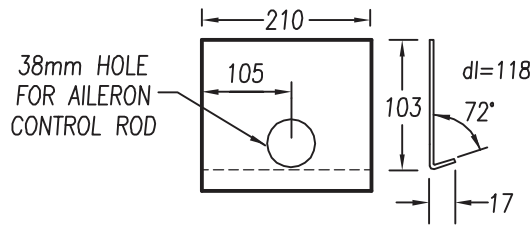
2 **ROOT PLATE**
t=.063" 6061-T6
(1L + 1R REQ'D)



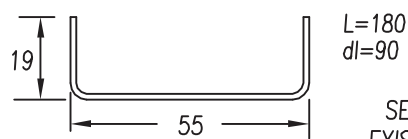
3 **CAP SPACER**
BAR 1-1/4"x1/4" 6061-T6
(2 REQ'D)



4 **UPPER ANGLE**
t=.040" 6061-T6 (4 REQ'D)



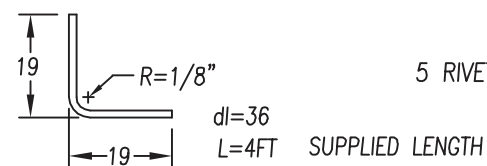
5 **REAR CHANNEL DOUBLER**
t=.040" 6061-T6 (2 REQ'D)
REPLACES HINGE DOUBLER 6W7-3



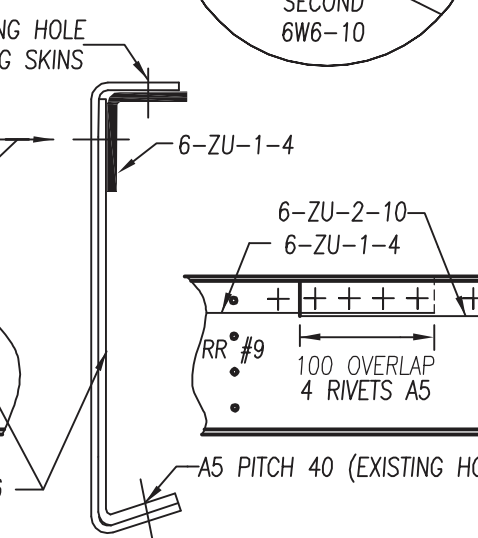
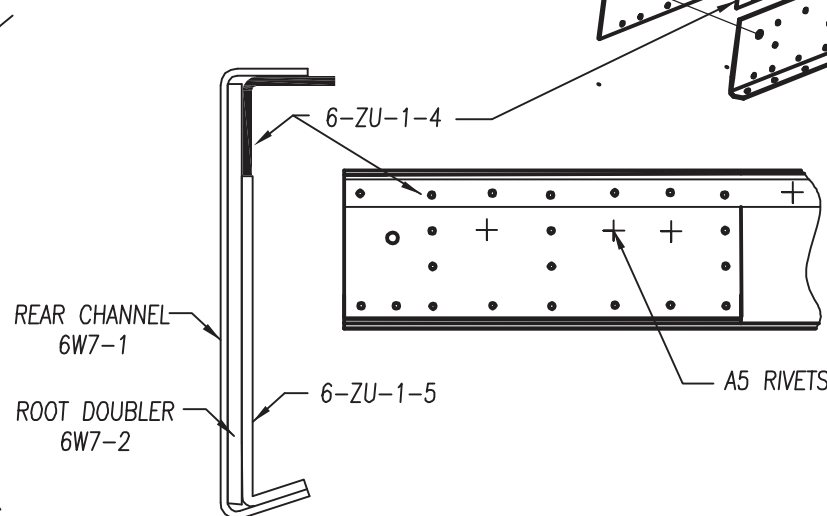
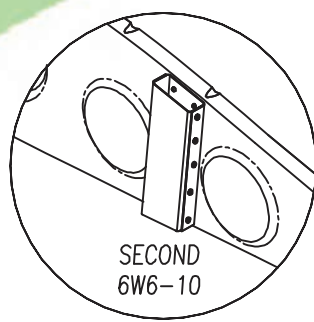
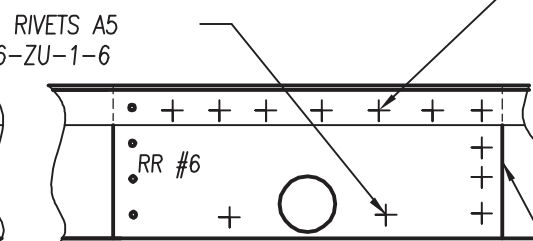
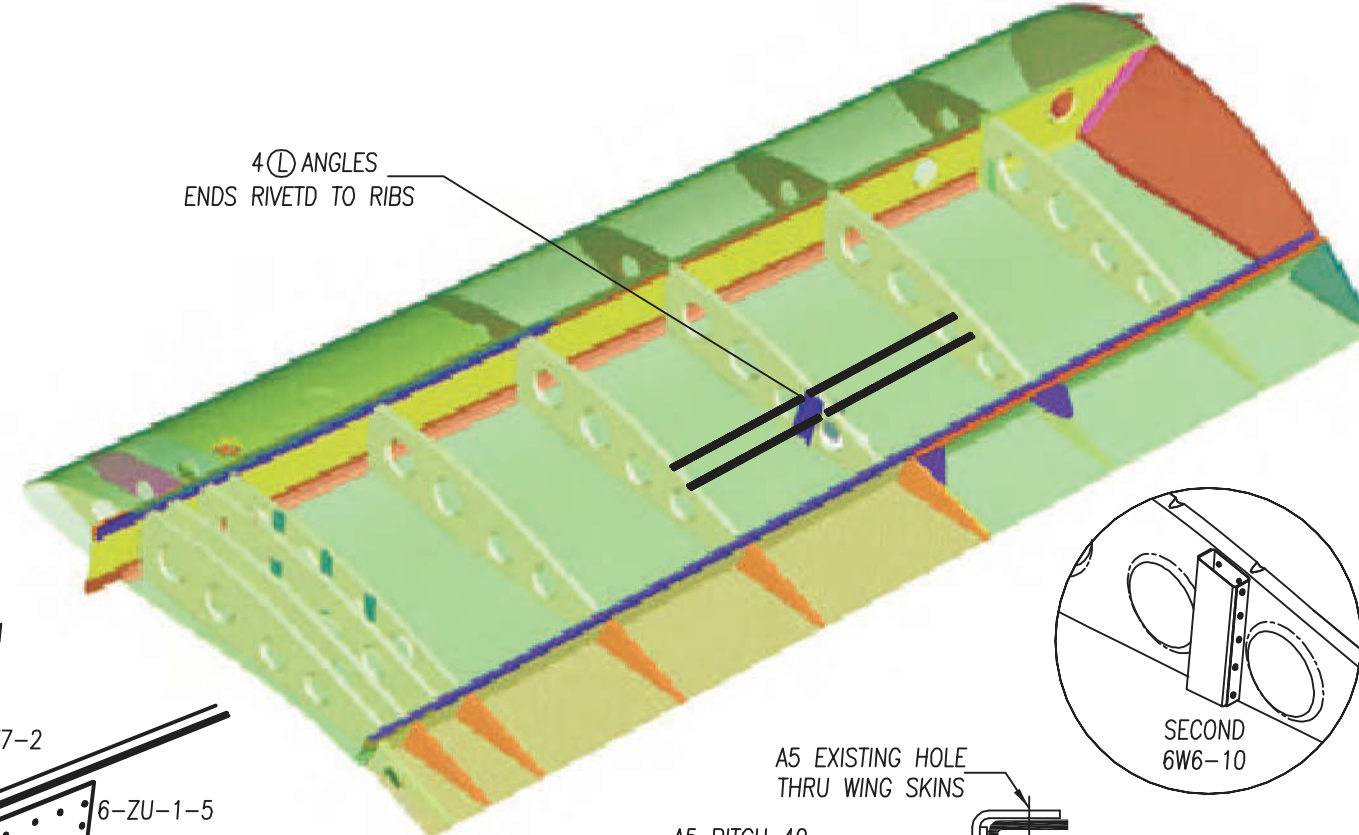
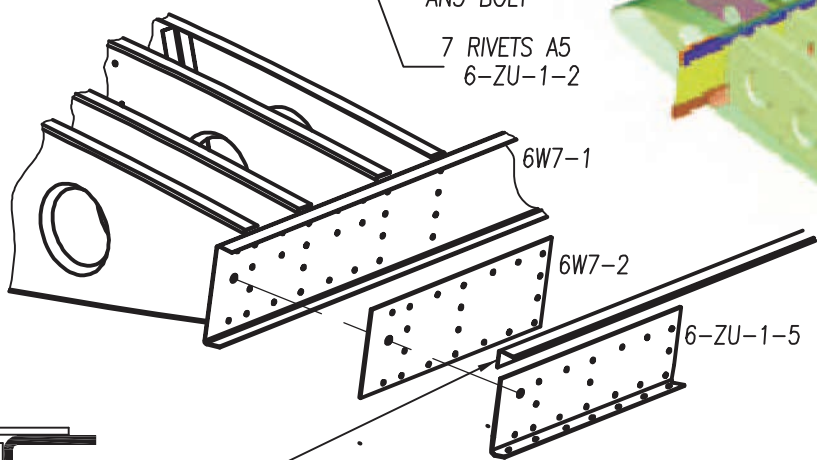
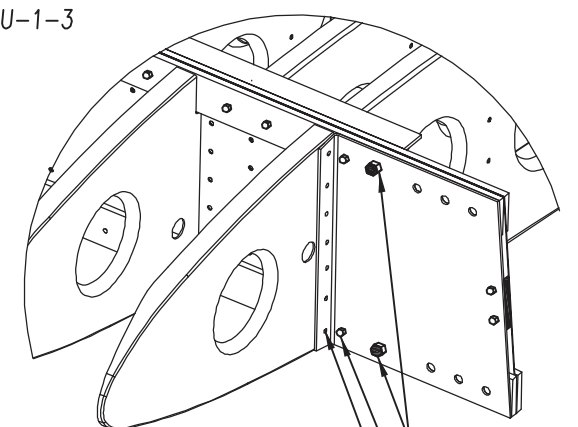
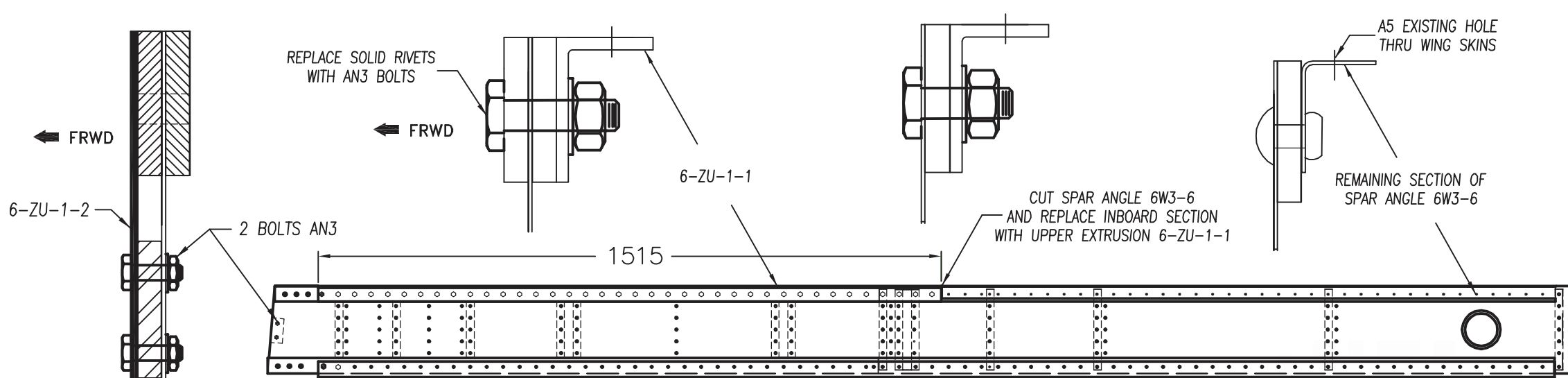
6 **HOLE DOUBLER**
t=.032" 6061-T6 (2 REQ'D)

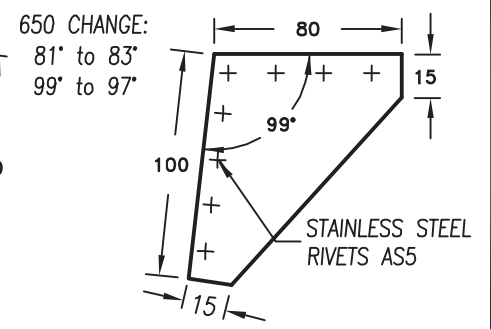
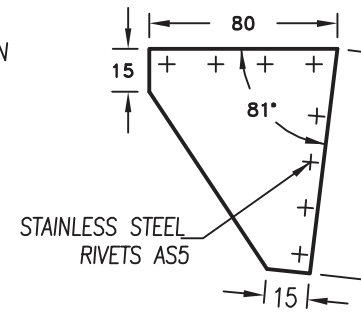
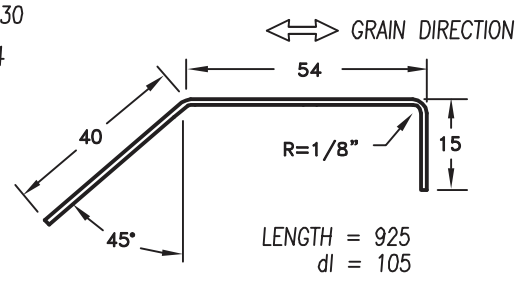
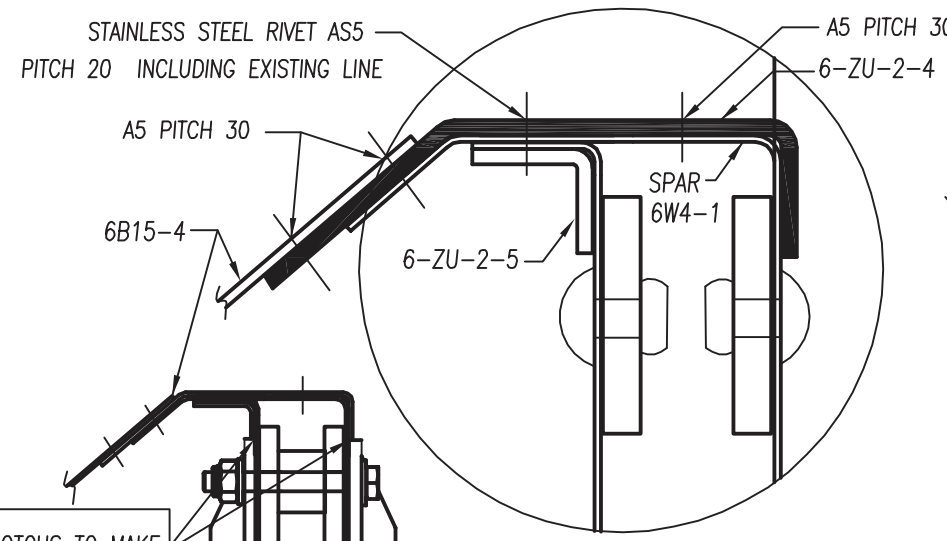
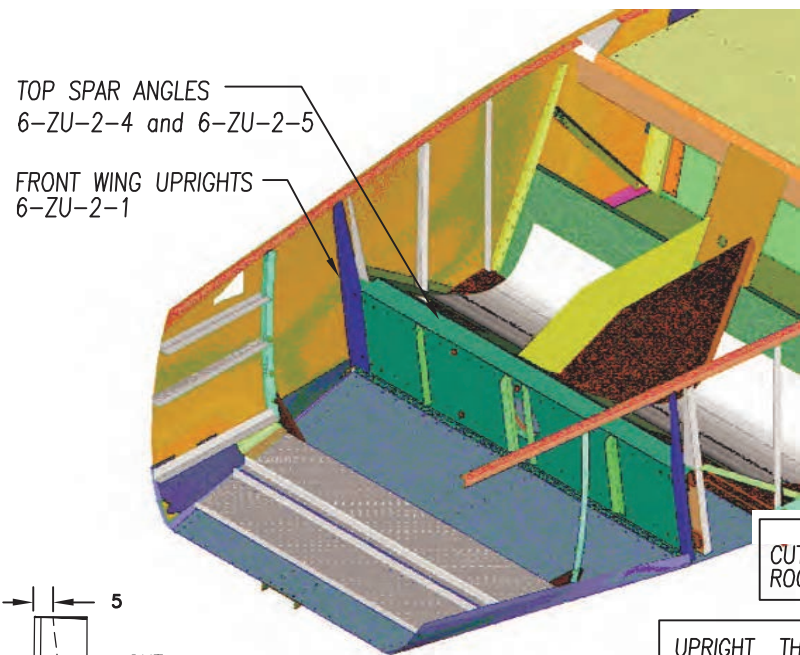
SECOND CHANNEL OVER
EXISTING CHANNEL 6W6-10

6W6-10 **BELLCRANK SUPPORT CHANNEL**
t=.025" 6061-T6 (2 REQ'D)
TO DOUBLE UP BELLCRANK CHANNEL



L **STANDARD L ANGLE**
t=.025" 6061-T6 (8 REQ'D)
TRIM TO FIT

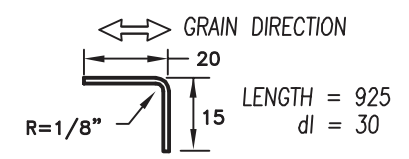




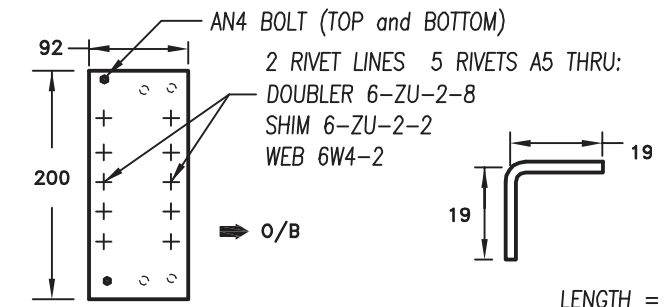
4 TOP SPAR ANGLE
t=.063" 6061-T6 (1 REQ'D)

6 REAR GUSSET
t=.040" 6061-T6 (2 REQ'D)

9 FRONT GUSSET
t=.040" 6061-T6 (2 REQ'D)

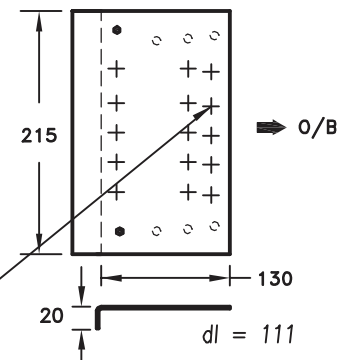
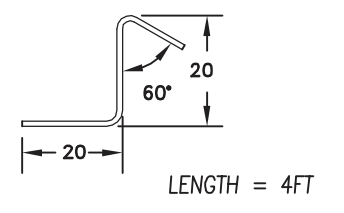


5 REAR SPAR ANGLE
t=.063" 6061-T6 (1 REQ'D)



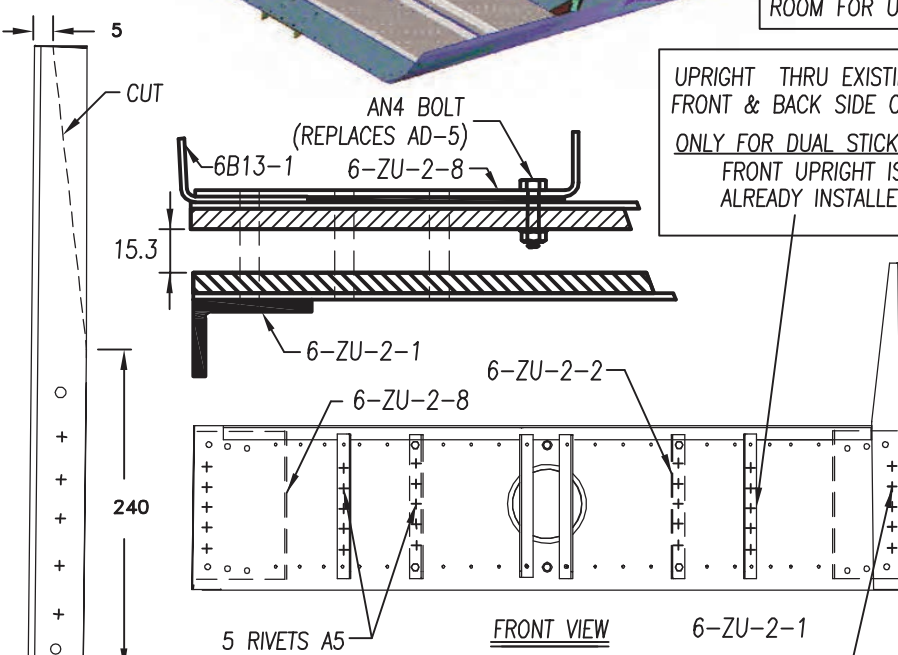
7 UPRIGHT SHIM
t=.063" 6061-T6 (2 REQ'D)

10 SEAT ANGLES
t=.040" 6061-T6 (3 REQ'D)
TRIM TO FIT



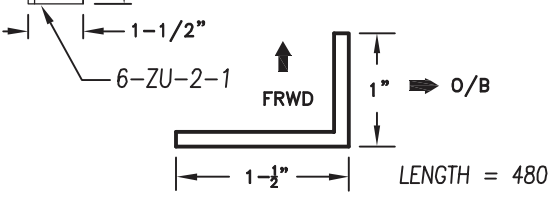
8 WEB DOUBLER
t=.063" 6061-T6 (2 REQ'D)

Z STANDARD Z ANGLE
t=.025" 6061-T6 (1 REQ'D)
TRIM TO FIT



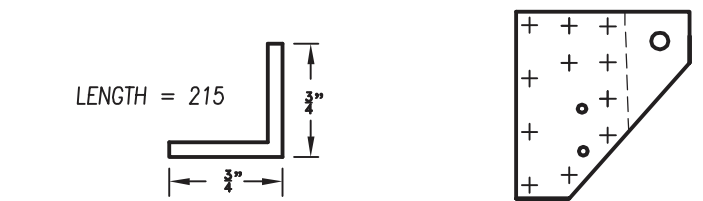
CUT NOTCHES TO MAKE ROOM FOR UPRIGHTS

UPRIGHT THRU EXISTING BOLTS FRONT & BACK SIDE OF SPAR.
ONLY FOR DUAL STICK OPTION: FRONT UPRIGHT IS ALREADY INSTALLED.



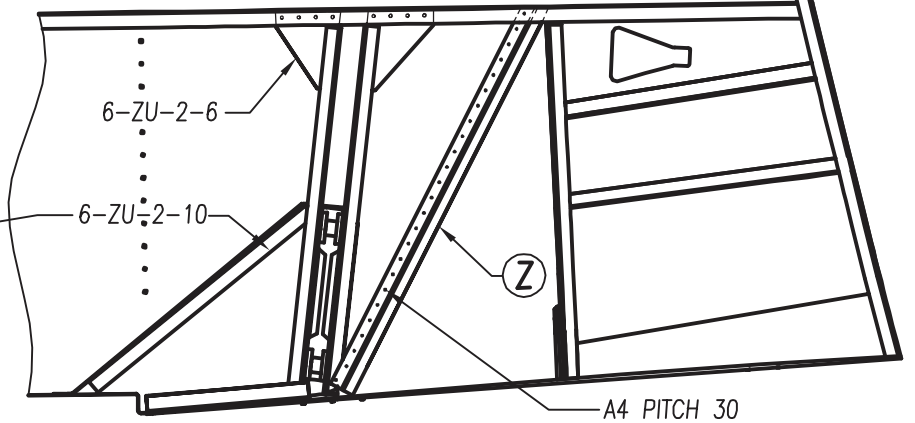
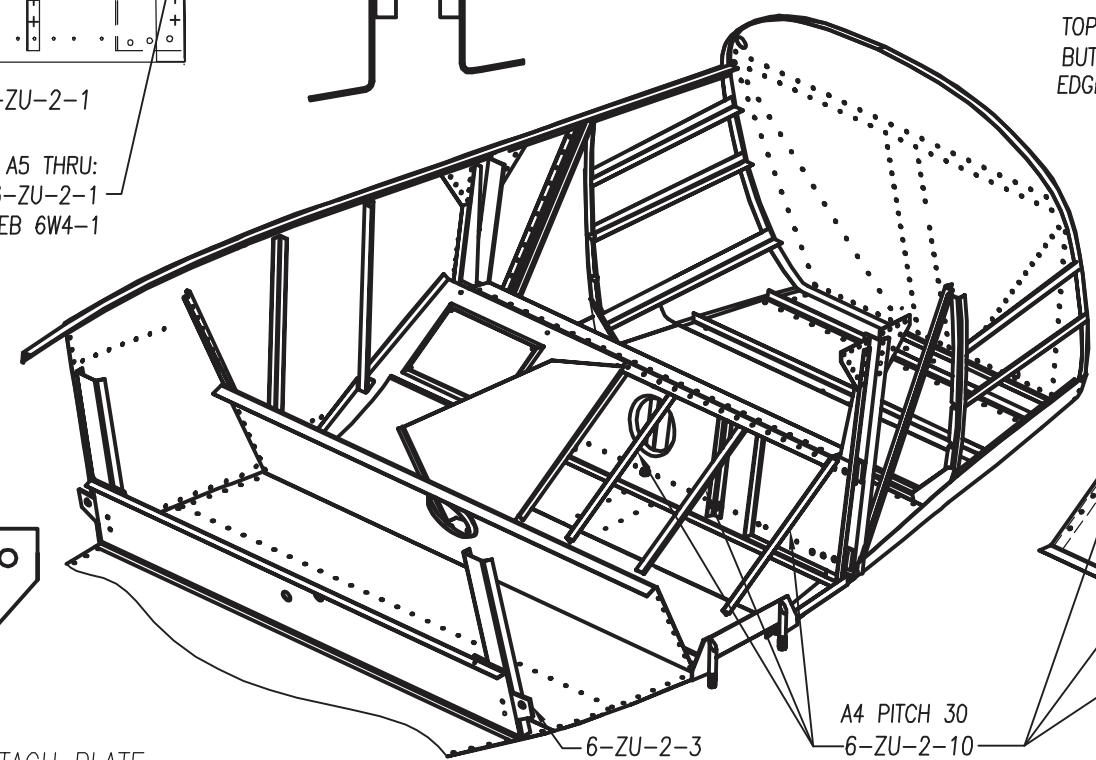
1 FRONT WING UPRIGHTS
EXT. 6061-T6 1"x1-1/2"x1/8"
(1L + 1R REQ'D)
REPLACES 6B13-1 FRONT UPRIGHT and 65-B-13-1

5 RIVETS A5 THRU:
UPRIGHT 6-ZU-2-1
FRONT SPAR WEB 6W4-1

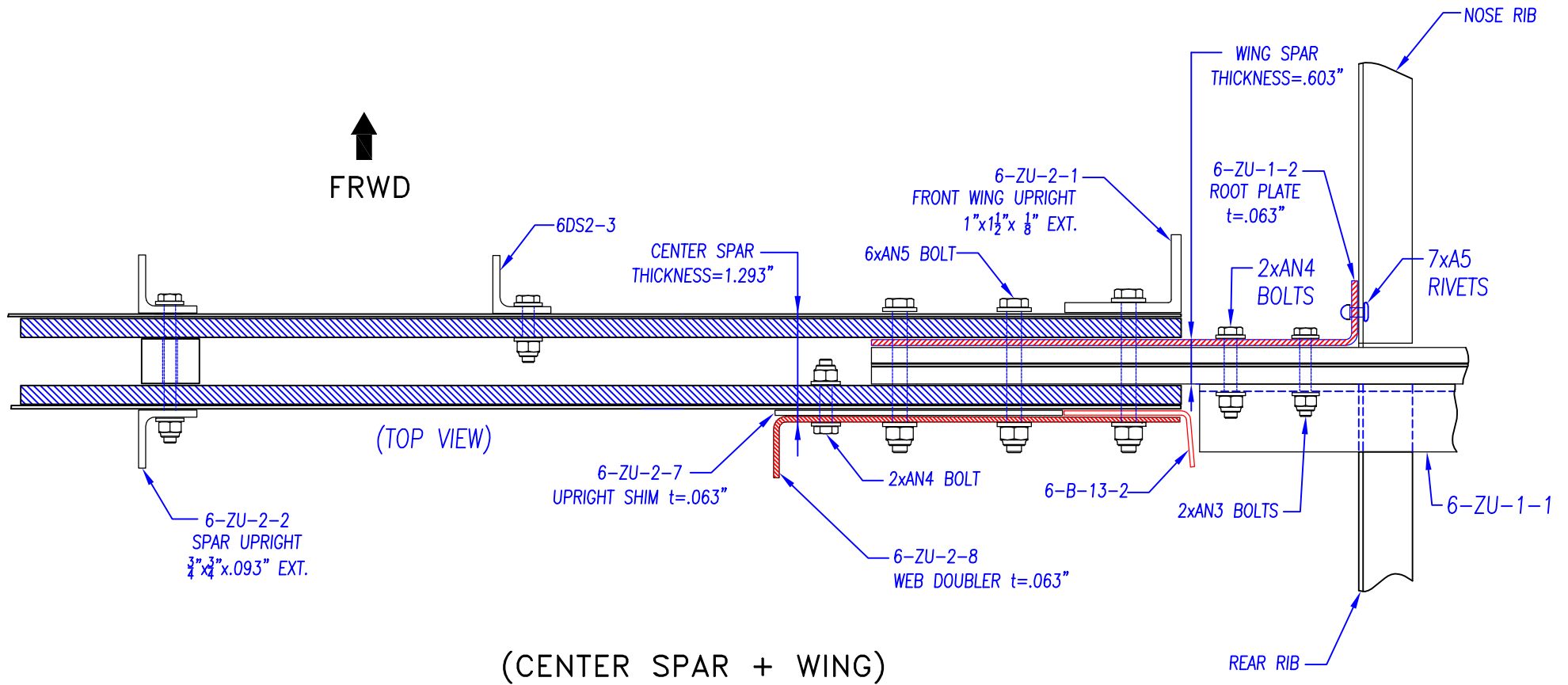


2 SPAR UPRIGHTD
EXT. 6061-T6 (4 REQ'D)
3/4"x3/4"x.093" LENGTH = 215

3 ATTACH PLATE
t=.125" 6061-T6 (1 REQ'D)
REPLACES 6B5-4 (NO CHANCES TO 65-B-5-4)



| | | |
|-------------------------------------|---|--------------------------|
| <p>ZODIAC CH 601 XL / 650</p> | <p>ZENAIR UPGRADE CENTER SPAR SECTION</p> | <p>6-ZU-2</p> |
| <p>Copyright© 2009 CHRIS HEINTZ</p> | | <p>DATE: 16 OCT 2009</p> |



ZODIAC
CH 601 XL / 650

ZENAIR UPGRADE
CENTER SPAR SECTION

6-ZU-3

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DATE: 10/2009