

CROW HARNESS INSTALLATION FOR ZODIAC 601XL

DESCRIPTION OF MODIFICATION

This modification involves replacing the vendor-provided three point seat belt with a Crow Enterprises 3-point harness. These harnesses are commonly used in cart/car racing and by the ultralight community. Fred Crow of Crow Enterprises will custom make a harness to suit the installation requirements of the Zenith Zodiac design.

This modification is based on information from page 2 of the March/April 1997 Zenair News #99 for an attachment point at the rear of the baggage shelf. Both shoulders are restrained from a point centred directly behind and level with the shoulders which is the optimal position.



The red quick release tab is held in place by velcro and can be easily located and operated in an emergency.

The rear attachment strap interferes with baggage storage which may be a serious consideration for some. Another disadvantage is additional weight in that each harness weighs 1400g (49oz) compared to each supplied seat belt which weighs 750g (26.5oz) The rear attach point adds an additional 280g (10oz). The total extra weight for this modification is 1580g (55oz), about the weight of 2/3 US gallon of fuel.

DISCLAIMER

As with all amateur built aircraft, the aircraft builder has final responsibility for engineering soundness, installation practices, and compliance with national regulations. Since there can be a huge variation in builder skills and actual practices, no warranty of engineering soundness or applicability is made or implied. This document presents “the way I did it” and is presented for peer review and educational purposes only.

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You, the aircraft builder, understanding that the information contained in this and related documents is of an experimental nature and is not approved by any national authority and is not approved for aircraft use;

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- ◆ Whereas: You agree to hold the author harmless from, and the aircraft builder hereby assumes, the entire liability for any and all damage or injury of any nature whatsoever, including death.
- ◆ Whereas: You agree to indemnify and hold harmless the author from and against any and all loss, claim, expense, damage or injury that the aircraft builder may sustain.

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A NOTE ON WEIGHT

This modification is heavier than the supplied seat belts. Every effort should be made to keep the extra weight to a minimum. The authors choice of 0.125 extruded angle was simply due to availability. If 0.090 or 0.063 had been available, it would have been used.



Photo 1 Comparison of the Harness Attachments Crow on Left, Zenith on Right

The attachment hardware of the Crow harness is much heavier than the attachment for the supplied seat belt. This adds a considerable percentage of the weight. (Photo 1)



Photo 2 Quick Release Buckle

The quick release buckle is also a very heavy piece of hardware. (Photo 2)



Photo 3 Aft Attach Point after trimming Vertical Flange

By trimming the vertical flange of the extruded angle to 10mm, the weight of this piece is reduced from 520g to 325g. (Photo 3)



Photo 4 Lightening Holes in Aft Attach Point

Fourteen lightening holes further reduce the weight of the aft attach point to 280g. (Photo 4)

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DETAILS OF THE MODIFICATION

The harness is available from Crow Enterprises, 160 E. Freedom Avenue, Anaheim, CA 92801. Phone 714-879-5970 Fax 714-680-4776. The harness part number is 20113. Other colours are available under part numbers 20112/Red, 20114/Black, 20115/Purple, 20117/Gray. When ordering advise Fred that the rear attach point is 43 inches behind the seat back and that it is for an airplane.

Crow Enterprises can be found on the Internet at <http://www.crowenterprises.com> and the harnesses can be found at <http://www.crowenterprises.com/2x2-dune-buggy.html>

Harness Modifications

The harness requires only slight modification to be used in this application. The hole in the harness attachment plates is slightly under $\frac{1}{2}$ inch and must be drilled to $\frac{1}{2}$ inch to match the external diameter of the flanged bushing (Aircraft Spruce part #FF520-10). Photos 5 and 6 show the harness attachment plate with the flanged bush installed.

The FF520-10 bush needs to be trimmed lengthwise to just exceed the thickness of the harness attach plate. The harness attach plate is approximately 0.195 inches thick.

The internal diameter of the FF520-10 brass bush determines the size of the harness attach bolt as $\frac{3}{8}$ inch (AN-6 bolt). The length of the AN-6 bolt is determined by the required grip length. See the sections below and the bill of materials. See also photo 7

Hardware for Aft Attachment Point

See diagram P-P1 on page 8 for details of the harness attachment angle bracket. The bolt required is an AN6-10A which has sufficient grip length for the Flanged Bushing, AN960-616 washers, harness attachment, and baggage floor.

To reduce the weight of the P-P1-1 Harness Attachment, the vertical flange should be cut to a smaller size, say 10mm. The original design in the Zenair News letter used a strip of 0.063 so you could substitute a 70mm x 755mm strip of 0.090 or 0.063 if you have that size available. If using a thinner piece, set 20mm sandwiched between the 6B16-1 Baggage Floor and horizontal flange of Bulkhead BH4.



Photo 5 Harness Attach Plate and Flanged Bushing (Flange Hidden)



Photo 6 Harness Attach Plate, Flanged Bush, and AN6 Bolt

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Photo 7 Harness Attachment Plate, Flanged Bush, and AN-6 Bolt

Photo 8 shows a view of the rear of the baggage shelf with the aft harness attach plate. The vertical flange of the 0.125 inch angle had not been trimmed when this photo was taken.



Photo 8 Aft Attach Point

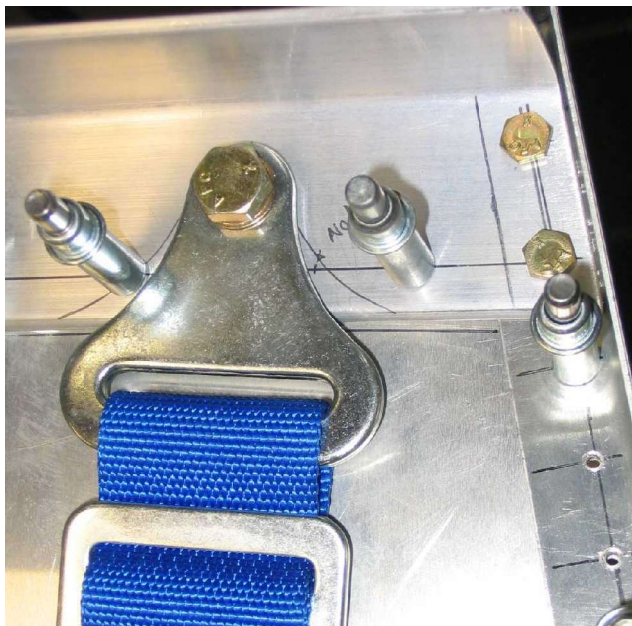


Photo 9 Attach Point showing L angle and Upper Longeron

Photo 9 shows the detail of the aft attach point. Set the rivet pitch on the L angle to the aft edge of the baggage shelf so as not to interfere with the movement of the harness attach plate. Note also the two AN3 bolts substituted for two of the A5 rivets in the upper longeron splice.

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Hardware for Outboard Seat Attachment Points

Due to the larger fittings on the Crow Harness, the 6B18-4 Seat Belt Attachment needs to be positioned so that the flange for the harness attachment bolt extends aft and not forward as indicated on diagram 6-B-18.

Photo 10 shows the orientation of the port side Seat Belt Attachment. Shown is a standard 6B18-4 that has been filed down at the top corner to provide clearance to the harness webbing. This technique can be used but it would be preferable to fabricate a modified attachment to ensure that the attachment will not chafe the harness webbing.

The material supplied for 6B18-4 can be used for a modified attachment if the attachments have not already been fabricated. The hole for the AN6 bolt needs to be located offset 10mm towards the top from centre of the attachment in order to clear the harness webbing. The centre of the hole is changed from 15mm to 16mm from the edge of the 6B18-4 attachment. Adjust the profile of the attachment to suit the new bolt hole location while respecting the original edge distances.

See diagram on page 9 for details of an alternate 6B18-4.

Photo 11 shows that there is a lot more clearance between the 6B18-4 Seat Belt Attachment and the seat back angle than appears in Photo 10. It is quite easy to install the nylon lock nut behind the attachment bracket. Note that the nut shown in this photo is a regular nut used to test the fit. An AN364-624A low profile nylon stop nut should be used in this position.



Photo 10 Port Side 6B18-4 Attachment



Photo 11 Outboard Attach Point Detail

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Hardware for Inboard Seat Attachment Points

There needs to be some clearance between the harness and the centre armrest side (6B18-1). This is achieved by using two AN960-616 flat washers between the flanged bushing and the seat belt attachment doubler plate (6B18-3). The original 5/16 inch hole is drilled to 3/8 inch.

To clean up the edges of the attachment doubler plate (6B18-3) and prevent damaging the harness material, the doubler can be installed with a 0.025 shim underneath (Photo 12 and Photo 13).

Use an AN6-10A bolt in this position with two AN960-616 flat washers between the FF520 bushing and the 6B18-3 Attachment Doubler Plate. Use an AN365-624 Elastic Stop Nut on the inside of the armrest.



Photo 12 Shim and 6B18-3 Attachment Doubler Plate



Photo 13 Shim for 6B18-3 Attachment Doubler Plate

Photo 14 shows the smooth edge that can be achieved on the doubler plate by using a shim. This also contributes slightly to the clearance required between the harness webbing and the armrest side.

Photo 15 on the next page shows the inboard harness attachment with the harness installed. The harness webbing is well clear of the 6B18-3 doubler plate when in use but will pivot down and may catch on the edge of the doubler when not in use.



Photo 14 Installed Doubler and Shim for the inboard harness attachment

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Important Assembly Note

In all cases the AN6 bolt should be tightened down on the FF520 Flanged Bushing so that it cannot move. The harness attachment should be free to swing on the bushing but the bushing should not move.



Photo 15 Detail of Inboard Attachment



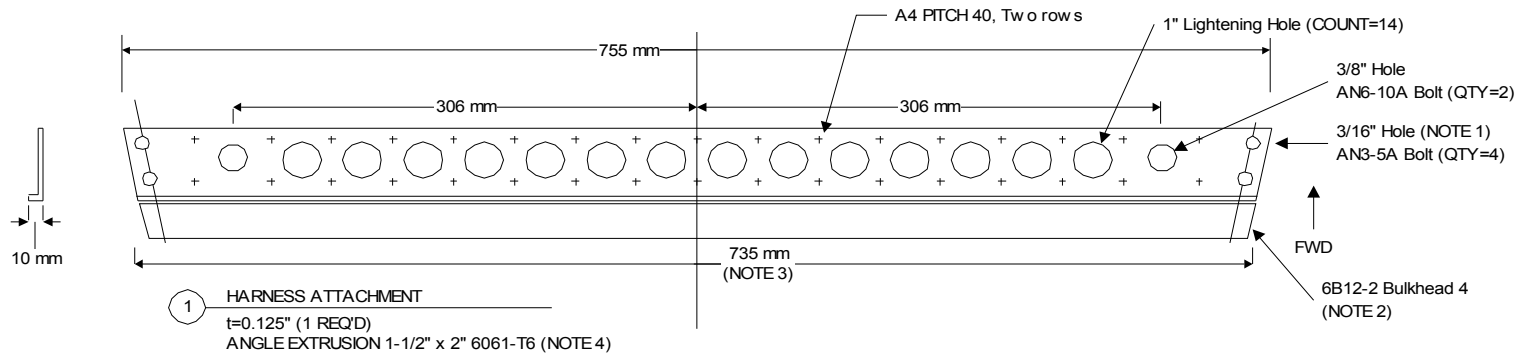
Photo 16 Detail of Outboard Attachment

Optional Baggage Tie Down Point (Not Shown)
Diagram P-P1-2 depicts an optional baggage tie down point fabricated from 3/4" 0.125 6061-T6 aluminum angle. If this option is installed the AN3-5A bolts must be replaced with AN3-6A bolts which have the correct grip length.

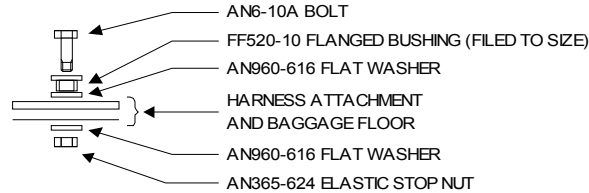
BILL OF MATERIALS

QTY	PART NO.	DESCRIPTION
2	CROW ENTERPRIZES #20113	2x2 RESTRAINT
3 ft	AIRCRAFT SPRUCE 03-48300	1-1/2" x 2" x 0.125" 6061-T6 EXTRUDED ANGLE
1 ft	AIRCRAFT SPRUCE 03-47900	3/4" x 3/4" x 0.125" 6061-T6 EXTRUDED ANGLE
4	AN3-5A (or AN3-6A)	3/16" BOLT
6	AN6-10A	3/8" BOLT
4	AN365-1032A	3/16" ELASTIC STOP NUT
4	AN365-624A	3/8" ELASTIC STOP NUT
2	AN364-624A	3/8" LOW PROFLE ELASTIC STOP NUT
6	AIRCRAFT SPRUCE FF520-10	FLANGED BUSHING - OD=1/2 ID=3/8
14	AN960-616	3/8" FLAT WASHER
4	AN960-10	3/16" FLAT WASHER

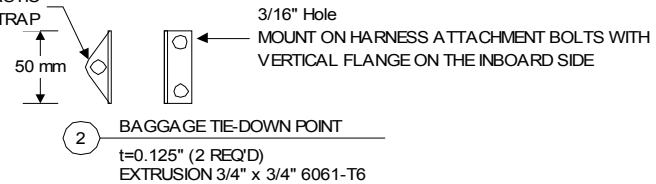
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DETAIL OF HARNESS FITTING BUSH AND BOLT



7/16" HOLE FOR ELASTIC TIE DOWN STRAP

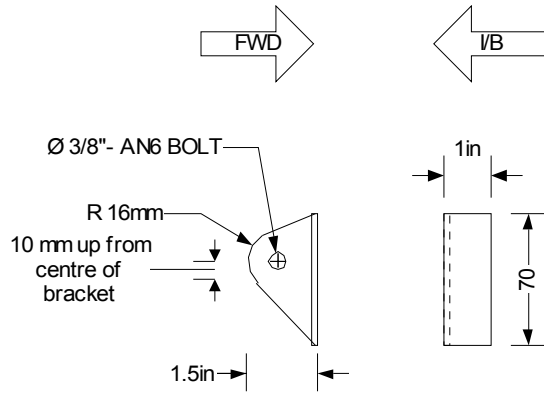


- NOTE 1** The two AN3 bolts on upper longeron splice rivet line replace two of the eight A5 rivets. Adjust the rivet pitch accordingly to accommodate the AN3 bolts and the width of the harness attachment. Substitute AN3-6A if installing P-P1-2
- NOTE 2** The harness attachment is installed immediately forward of bulkhead 4 (6B12-2). The slope of the baggage floor (6B16-1) can be adjusted to be slightly higher where the baggage floor meets the front edge of the harness attachment. This will allow a row of A4 rivets to be used along the forward edge of the harness attachment resulting in a pleasant transition.
- NOTE 3** The harness attachment is slightly narrower than Bulkhead 4 (6B12-2) in order to fit inside the upper rear longeron (6B2-1). The ends of the horizontal flange of the harness attachment need to be chamfered to fit the radius of the longeron.
- NOTE 4** Weight saving can be realized by trimming the vertical flange of P-P1-1 to 10mm. Alternatively, substitute a 70mm x 755mm strip of 0.090 or 0.063. Set 20mm sandwiched between the 6B16-1 Baggage Floor and BH4 bulkhead. Add an extra flat washer between the flanged bush and the baggage shelf to restore clearance for the harness

ITEM	QTY	PART NO.	DESCRIPTION
P-P1-1	1	AIRCRAFT SPRUCE 03-48300	1.5x2x0.125" 6061-T6 EXTRUSION
P-P1-2	2	AIRCRAFT SPRUCE 03-47900	3/4x3/4x0.125" 6061-T6 EXTRUSION
	4	AN3-5A or AN3-6A (NOTE 1)	BOLT
	4	AN6-10A	BOLT
	4	AN365-1032A	ELASTIC STOP NUT
	2	AN365-624A	ELASTIC STOP NUT
	2	AIRCRAFT SPRUCE FF520-10	FLANGED BUSHING OD=1/2 ID=3/8
	4	AN960-10	3/16" FLAT WASHER
	14	AN960-616	3/8" FLAT WASHER

MATERIAL PRESENTED IN THIS DIAGRAM AND ANY ASSOCIATED INFORMATION IS OF AN EXPERIMENTAL NATURE AND FINAL SUITABILITY FOR ANY PURPOSE IS THE RESPONSIBILITY OF THE INDIVIDUAL AIRCRAFT BUILDER		CROW HARNESS ATTACHMENT BRACKET AND OPTIONAL BAGGAGE TIE-DOWN POINTS			
		CROW HARNESS INSTALLATION FOR ZENITH ZODIAC 601XL			
SIZE	FSCM NO	DWG NO		REV	
		P-P1 JANUARY 2005		1.2	
SCALE	NTS	SHEET		1 OF 2	

CROW HARNESS INSTALLATION FOR ZODIAC 601XL



1 ALTERNATE 6B18-4 DIMMENSIONS
 t=0.125" (2 REQ'D - One Left, One Right)
 EXTRUSION 1" x 1-1/2" x 1/8" 6061-T6

MATERIAL PRESENTED IN THIS DIAGRAM AND ANY ASSOCIATED INFORMATION IS OF AN EXPERIMENTAL NATURE AND FINAL SUITABILITY FOR ANY PURPOSE IS THE RESPONSIBILITY OF THE INDIVIDUAL AIRCRAFT BUILDER	ALTERNATE DIMMENSIONS FOR 6B18-4 SEAT BELT ATTACHMENT			
	CROW HARNESS INSTALLATION FOR ZENITH ZODIAC 601XL			
	SIZE	FSCM NO	DWG NO P-P2 DECEMBER 2004	REV 1.0
	SCALE	NTS	SHEET	1 OF 1