NATIONAL TRANSPORTATION SAFETY BOARD
OFFICE OF AVIATION SAFETY
WASHINGTON, D.C.

June 4, 2009

ADDENDUM A

SURVIVAL FACTORS GROUP CHAIRMAN'S FACTUAL REPORT

A.	**ACCIDENT**	**:**	**LAX08PA259**
	LOCATION	:	Weaverville, California
	DATE	:	August 5, 2008
	TIME	:	1941 Pacific Daylight Time (PDT)
	AIRCRAFT	:	Sikorsky, S-61N Helicopter, N612AZ, Operated by Carson Helicopter Services

B. SUMMARY

On December 5, 2008, the FAA issued Supplemental Type Certificate (STC) SR02327AK (Attachment 9) to Carson Helicopters, Inc. (Carson) for the installation of side-facing seat mounting structure and Martin Baker side-facing seats for the S-61N helicopter. The Martin Baker side-facing seat is an attenuating utility seat equipped with a 4-point rotary restraint. A Martin-Baker representative informed Safety Board staff that they offer a lift latch restraint in lieu of the rotary restraint (shown on page 16 of the Martin-Baker Utility Seat Data Sheet No. 003.)

This Addendum includes Attachment 9 for the Survival Factors Group Chairman's Factual Report and, the Carson STC SR02327AK, and Martin-Baker Seat Data Sheet for Attenuating Utility Seat.

Cynthia L. Keegan
Senior Survival Factors Engineer

Carson Helicopters**,** Inc.
Weaverville, CA
August 5, 2008
LAX08PA259

National Transportation Safety Board

Washington, D.C.

Attachment 9

Carson Helicopters, Inc.
Supplemental Type Certificate
SR02327AK
And
Martin-Baker Data Sheet No. 003
Attenuating Utility Seat
(Sidewall/Bulkhead Mounted)

Pages 17

United States of America
Department of Transportation -- Federal Aviation Administration

Supplemental Type Certificate

Number SR02327AK

This certificate issued to Carson Helicopters, Inc.
828 Brookside Blvd
Grants Pass, OR 97526

certifies that the change in the type design for the following product with the limitations and conditions therefore as specified hereon meets the airworthiness requirements of Part 29 of the Federal Aviation Regulations

Original Product - Type Certificate Number: 1H15
Make: Sikorsky Aircraft
Model: S-61N

Description of Type Design Change: Manufacture side-facing seat mounting structure in accordance with Carson Helicopters, Inc. Master Drawing List CHI-MB570-MDL, Revision A, dated 10/20/08, or later FAA approved revision. Install side-facing seat mounting structure and side-facing seats in accordance with Carson Helicopters, Inc. Installation Instructions CA07-MB-001, Revision A, dated 10/15/08, or later FAA approved revision. Maintain in accordance with Instructions for Continued Airworthiness CA07-MB-002, Revision IR, dated 5/5/08, or later FAA accepted revision.

Limitations and Conditions:
Approval of this change in type design applies to the rotorcraft models listed above only. This approval should not be extended to other rotorcraft of these models on which other previously approved modifications are incorporated unless it is determined that the relationship between this change and any of those other previously approved modifications, including changes in type design, will introduce no adverse effect upon the airworthiness of that rotorcraft. A copy of this Certificate and Instructions for Continued Airworthiness CA07-MB-002, Revision IR, dated 5/5/08, or later FAA accepted revision, must be maintained as part of the permanent record of the modified rotorcraft.

If the holder agrees to permit another person to use this certificate to alter the product, the holder shall give the other person written evidence of that permission.

This certificate and the supporting data which is the basis for approval shall remain in effect until surrendered, suspended, revoked or a termination date is otherwise established by the Administrator of the Federal Aviation Administration.

Date of application: November 5, 2007
Date of issuance: December 5, 2008

Date reissued:
Date amended:

By direction of the Administrator

[redacted]
FGH (Signature)
Gregory J. Holt
Manager, Anchorage Aircraft Certification Office
(Title)

Any alteration of this certificate is punishable by a fine of not exceeding $1,000, or imprisonment not exceeding 3 years, or both.

This certificate may be transferred in accordance with FAR 21.47.

ATTENUATING UTILITY SEAT (SIDEWALL / BULKHEAD MOUNTED)

This technical information has been exported under the authority of UK Government Export Licence No UKGL/05/02611/1P

DESCRIPTION

Folding attenuation utility seat designed for troop transport.

This seat is mounted to the wall or bulkhead of the airframe using attachment brackets.

The Lower Seat Attachment Brackets have a “hook” projection that locates over the Lower Attachment Bracket in the aircraft. The Upper Seat Mounting Bracket incorporates a seat release pull ring allowing quick removal of the seat by unlocking and lifting.

A more comprehensive description of the seat system, including details and views of the seat - aircraft attachments is given in Part B: Technical Details.

ATTENUATION

Roller and tube attenuation system absorbs sufficient energy to decelerate the 5th to 95th percentile occupant within human tolerance levels. This equates to a mass range for the occupant / equipment from 165lb to 261lb.

SEAT CHARACTERISTICS

SEAT WEIGHT 14.88lb (6.75kg)

ENVELOPE DIMENSIONS (Approx.)

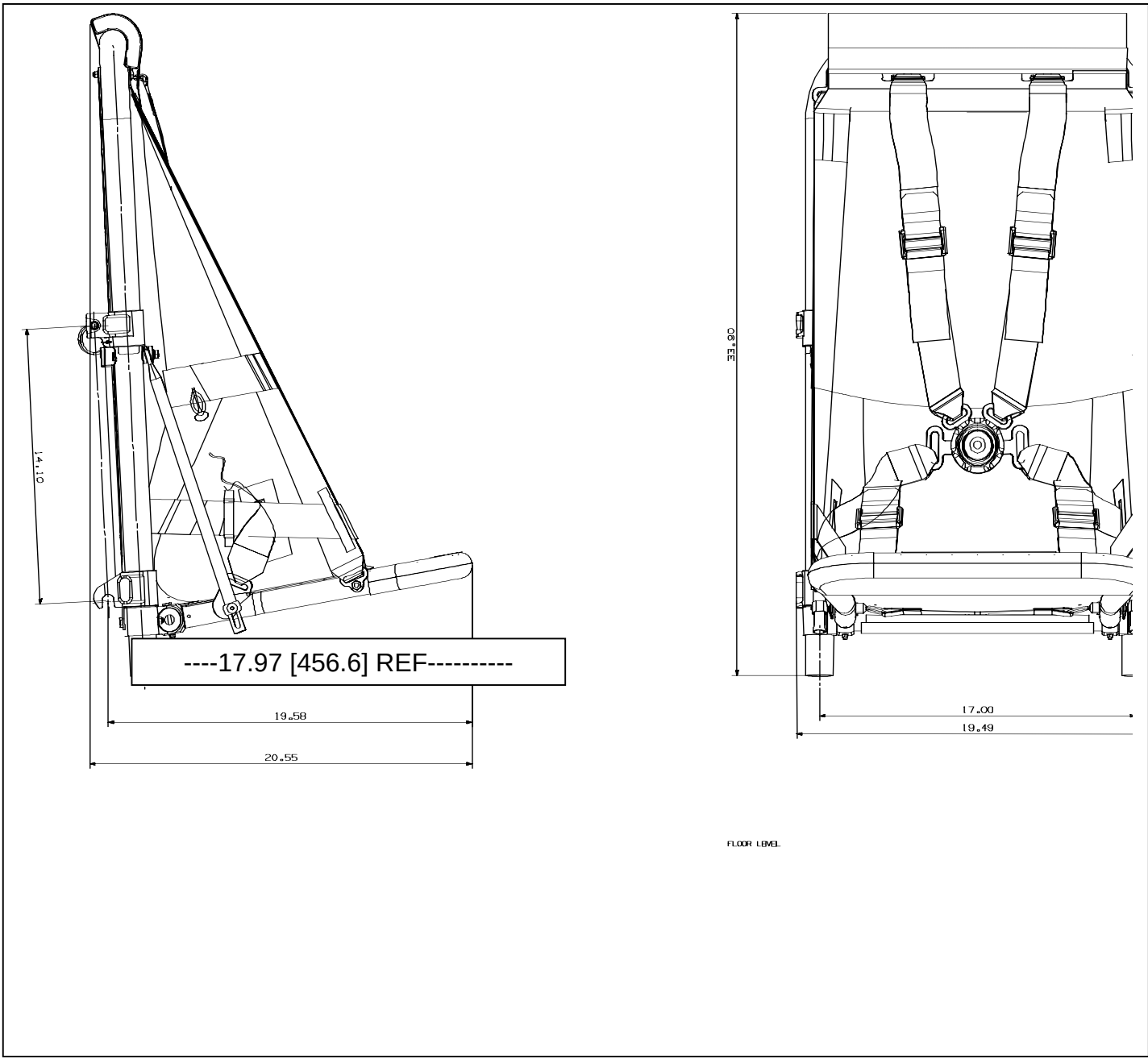
Vertical		33.9in
Width		19.5in
Depth	Deployed	20.6in
	Folded	7.5in

AIRCRAFT IN USE IN: Sikorsky CH-53E Pre- and Post- Block, MH-53E

FEATURES			
ATTENUATION SYSTEM	Roller and Tube	SEAT ADJUSTMENT	Backrest Adjustment
HARNESS TYPE	4 point	FOLDING	Yes
HEADREST	Integral Full-Width Headpad		

GENERAL ARRANGEMENT			MBCS4100
MOUNTING	Horiz. Centres – 18.825”(478.2mm)		Vertical Centres – 14.078”(357.6mm)
	Seat Pitch – 20”(508mm)		
MASS	14.88lb (6.75kg)		
DESIGN STATUS	Proposal ŏ	Designed ŏ	Qualified ŏ
DOCUMENT DATE	July 2001		

OUTLINE AND MOUNTING DIMENSIONS (inches)



BASIC TEST REQUIREMENTS

STATIC AND DYNAMIC TEST REQUIREMENTS				
QUALIFICATION - CATSS (Crash Attenuating Troop Seat System) Specification				
STATIC TESTS	**Occupant / Equipment Mass (lb):** 261			
	Load Direction With Respect to Fuselage		**Load Direction with Respect to Seat**	**Load (g)**
STATIC TESTS - 1	Forward		Lateral	20
STATIC TESTS – 2 (also performed with fully stroked seat)	Lateral (inboard)		Forward	10
STATIC TESTS - 3	Lateral (outboard)		Aftward	10
STATIC TESTS – 4 (also performed with fully stroked seat)	Upward		Upward	10
STATIC TESTS - 5	Downward		Downward	20
STATIC TESTS – 6 COMBINED TEST	Forward		Lateral	20
	Upward		Upward	10
	Lateral (inboard)		Forward	10
STATIC TESTS – 7 COMBINED TEST	Forward		Lateral	20
	Downward		Downward	20
	Lateral (inboard)		Forward	10
STATIC TESTS – 8 COMBINED TEST	Forward		Lateral	20
	Lateral (inboard)		Forward	10
DYNAMIC TESTS	**G**	**Vel (ft/sec)**	**Simulated Crash Orientation**	**Occupant / Equipment Mass (lb)**
DYNAMIC TESTS – SINGLE SEAT - 1	30	37	Pure Vertical	165, 185 and 220
DYNAMIC TESTS SINGLE SEAT - 2	30	37	30° Pitch, 10° Roll	206, 226 and 261
DYNAMIC TESTS- SINGLE SEAT - 3	16	37	30° Yaw	261

PERFORMANCE AND LOADS DATA

Sign Convention: X: Aircraft Fore/Aft
+ve Y : Aircraft Lateral (Outboard), -ve Y : Aircraft Lateral (Inboard)
Z: Aircraft Downward/Upward

REACTION LOADS (approx.) – MAXIMUM LOADS MEASURED DURING TESTING (lbf)						
STATIC TESTS						
Attachment	Top Fore			Top Aft		
Direction	X	+Y (-Y)	Z	X	+Y (-Y)	Z
Max Load	1700	1130 (-1780)	1240	850	1250 (-1130)	1850
Attachment	Bottom Fore			Bottom Aft		
Direction	X	Y+Y (-Y)	Z	X	+Y (-Y)	Z
Max Load	2180	1950 (-970)	1450	1710	710 (-2540)	810
Total Reaction Loads in Specified Direction						
Direction	X	+Y (-Y)		Z		
Max Load	5720	2930 (-3540)		4040		

REACTION LOADS (approx.) – MAXIMUM LOADS MEASURED DURING TESTING (lbf)						
DYNAMIC TESTS						
Attachment	Top Fore			Top Aft		
Direction	X	+Y (-Y)	Z	X	+Y (-Y)	Z
Max Load	2490	1700 (-290)	1030	1240	1200 (-350)	1190
Attachment	Bottom Fore			Bottom Aft		
Direction	X	+Y (-Y)	Z	X	+Y (-Y)	Z
Max Load	1550	1060 (320)	2490	2910	860 (-690)	1090
Total Reaction Loads in Specified Direction						
Direction	X	+Y (-Y)		Z		
Max Load	2540	4020 (-400)		4060		

LUMBAR LOAD: Lumbar Compression Load <1500lbf for all occupant masses tested.

SEAT PAN ACCELERATION: No single excursion above 23g for > 8ms
Cumulative Time above 23g < 25ms

ENVIRONMENTAL TESTS

Environmental Factor	Tests in Accordance With:	Test Details
High Temperature (+71°C)	MIL-STD-810E	Method 501.3 Procedure I and II 7 Cycles, 24 Hours per Cycle
Low Temperature (-51°C)	MIL-STD-810E	Method 502.3 Procedure I and II 4 Hours Conditioning
Solar Radiation	MIL-STD-810E	Method 505.2 Procedure II 10 x 24 Hour Cycles
Humidity	MIL-STD-810E	Method 507.3 Procedure I, Cycle 2 10 Cycles, 95-100% Humidity, 24°C
Fungus	MIL-STD-810E	Method 508.4 Procedure II 28 Days Test
Salt Fog	MIL-STD-810E	Method 509.3 - 48 Hours Exposure, 48 Hours Ambient
Dust	MIL-STD-810E	Method 520.3 Procedure I Blowing Dust
Vibration	MIL-STD-810E	Method 514.4-IV Resonance Search / Random Vibrations
Pressure / Altitude	Sea Level to 20,000ft	
Weapons Firing	MIL-STD-810E	Method 519.4
Mechanical Shock	MIL-STD-810E	Method 516.4 Procedure I, IV &VI Functional / Transit Handling / Bench Handling
Contamination	CATSS / S92	Hydraulic Fluid / Jet Fuel / Lubrication Oil / Cleaning Agent
Energy Absorption Testing		

B. TECHNICAL DETAILS

The Martin-Baker Utility Seat is a simple yet robust design. The structure is manufactured from high strength, Aluminium alloy tubing & machined fittings. The sitting fabric is made from flame retardant nylon.

The main seat components are shown below:

Figure 1: General Front View of Seat

Figure 2: General Rear View of Seat

1. SEAT DESCRIPTION

1.1. Seat Pan Assembly.

The Seat Pan assembly (See Figure 3) is a riveted construction; the Back Tube & Sitting Tube are manufactured from high strength Aluminium Alloy tubing, which is bent to form the side and front members. An additional tube is joined to the back of the frame via machined end fittings, which also form the seat pan hinge. The top skin is dished for comfort & strength and is manufactured from high strength Aluminium Alloy sheet.

Figure 3: General View of Seat Structure

1.2. Crossbraces

The Crossbraces provide strengthening & stiffening to the Back Tube which helps to distribute the loads more evenly in the lateral crash case scenario. They also provide additional support to the occupant, in the event of a large rearward load on the occupant

1.3. Back Tube.

The Back Tube forms the main structure of the seat and provides a linear guide, this guides the seat along a defined path during a crash, and keeps the seat / occupant attached to the airframe.

1.4. Seat Pan Locking Strut.

The Seat Pan Locking Strut, manufactured from corrosion resistant steel has several functions. Firstly, it locks the Seat Pan assembly in the sitting position and prevents it folding up. Secondly, it restrains the occupant from falling through the back of the seat when any imposed upward, or aftward loads are applied to the occupant. Thirdly, it contains a lock recess to hold the seat pan in the stowed position.

1.5. Seat Upper Mounting Bracket

The Seat Upper Mounting Bracket (See Figure 4) houses a PTFE linear Bearing which provides a low friction surface for the Back Tube to slide through as the Seat attenuates. It also houses the Seat Release Plunger and Spring. When installed into the Aircraft, the Plunger locates inside the Tube of the Aircraft Attachment Bracket as shown. The Seat Upper Mounting Bracket is manufactured from High Strength Aluminium Alloy.

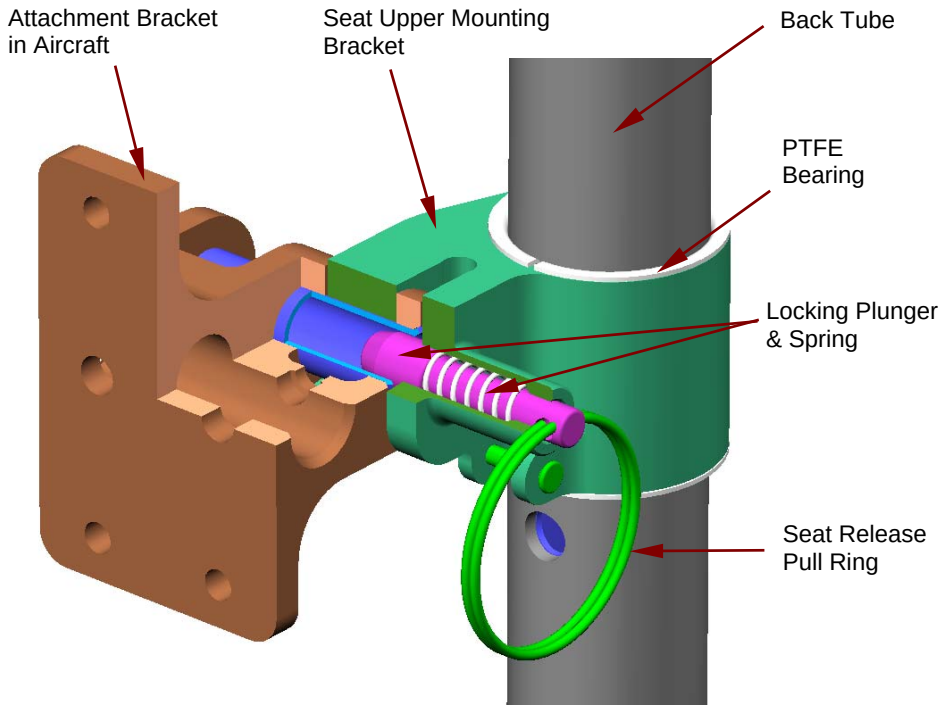


Figure 4: View showing Upper Attachment to Aircraft

1.6. Seat Release Plunger

The Seat Release Plunger is spring loaded and its function is to lock the seat to the aircraft. The Seat is installed & removed by pulling the rings attached to the plungers. The Seat Release Plunger is manufactured from corrosion resistant steel.

1.7. Seat Release Pull Ring

The Seat Release Pull Ring provides a simple means of attaching or removing the Seat from its attachment to the Aircraft.

1.8. Seat Pan Locking Plunger

The Seat Pan Locking Plunger (See Figure 5) which is spring loaded, is housed in the Lower Harness Attachment Trunnion and engages into the Seat Pan Locking Strut. The function of the Plunger is to lock the Seat in either the stowed or deployed state. It is operated by pulling the Seat Pan stowage handle located at the front edge of the Seat Pan. The Plunger is manufactured from corrosion resistant steel.

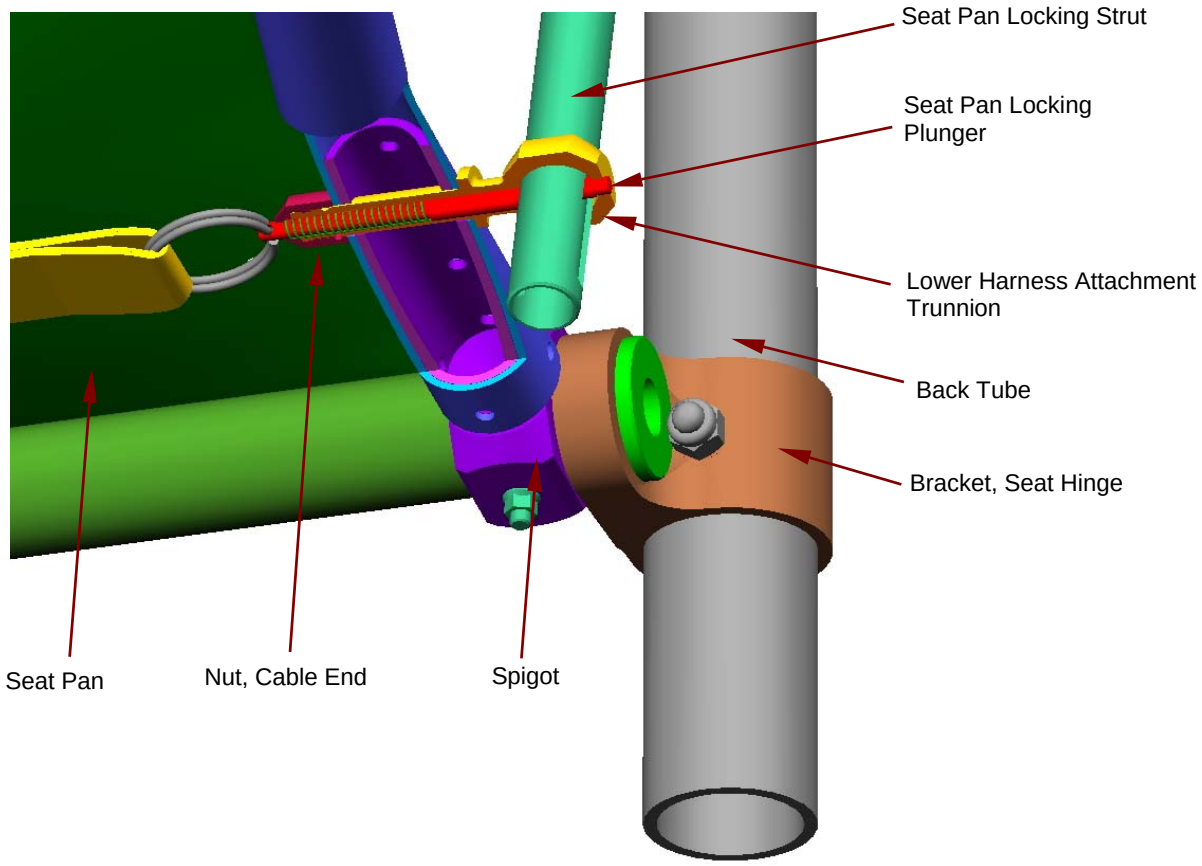


Figure 5: View showing Seat Pan locking arrangement

1.9. Lower Harness Attachment Trunnion

The Harness Attachment Trunnion provides attachment for the harness lap belt. It also forms the housing for the Seat Pan Locking Plunger and its spring.

1.10. Seat Lower Mounting Bracket

The Seat Lower Mounting Bracket (see Figure 6) is manufactured from high strength Aluminium Alloy. It houses a PTFE linear bearing, which provides a low friction surface for the Back Tube to slide through as the Seat attenuates. The 'hook' projection on the Bracket locates over the Lower Attachment Bracket in the Aircraft.

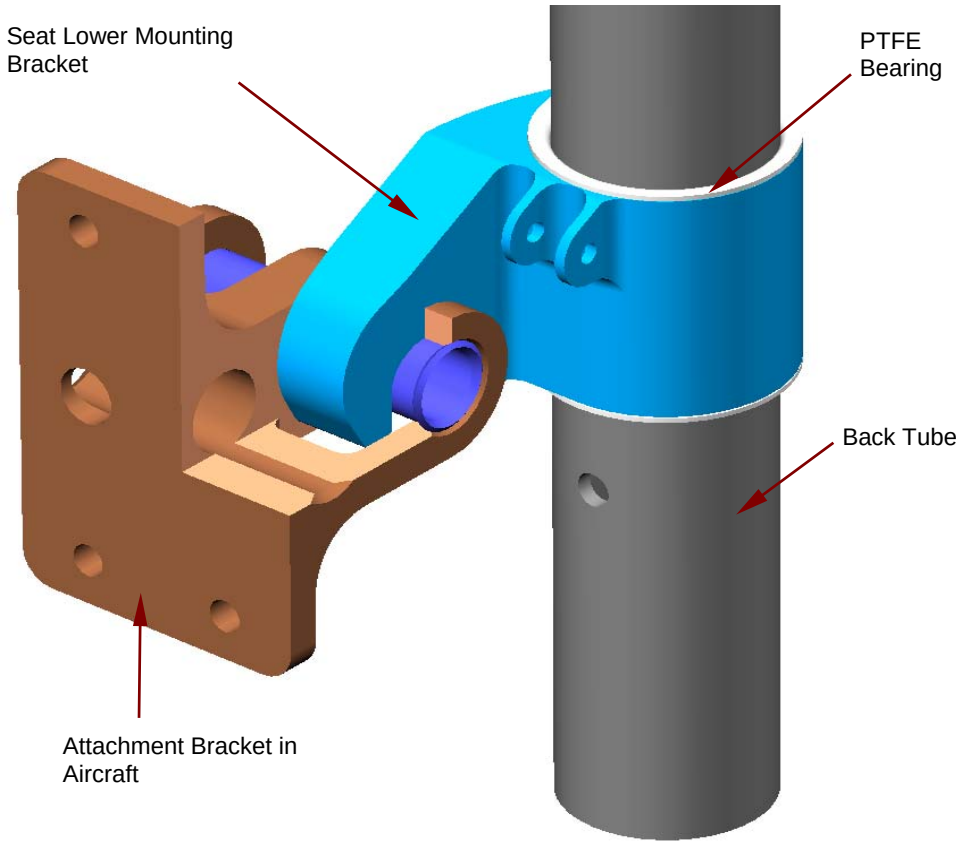


Figure 6: View showing Lower Attachment to Aircraft

1.11. Attenuation System

The Attenuation System (see Figure 7) is a new generation system employing a design derived from exhaustive dynamic testing of Helicopter Crashworthy Seats. The system is optimised to provide acceptable attenuation characteristics such as lumbar load & pelvic acceleration for a wide range of occupant sizes & masses.

The Attenuation System consists of a Stem. Assembled into the Stem are two Pins & Rollers which are located over an indented Attenuation Tube. The Upper part of the Attenuation Tube is secured to the Upper Bracket by means of an attachment Pin. The lower end of the Attenuation Tube is secured to the Lower Bracket. This provides a means of spacing the two brackets a set distance apart.

During a crash scenario, the moveable part of the Seat Structure moves downward. As it does so, the stem housing the rollers translates downward over the Attenuation Tube causing it to deform. The action of deforming the tube absorbs energy in a very predictable & controllable way. The seat is prevented from moving upward by the interference of the deformed tube with the Stem.

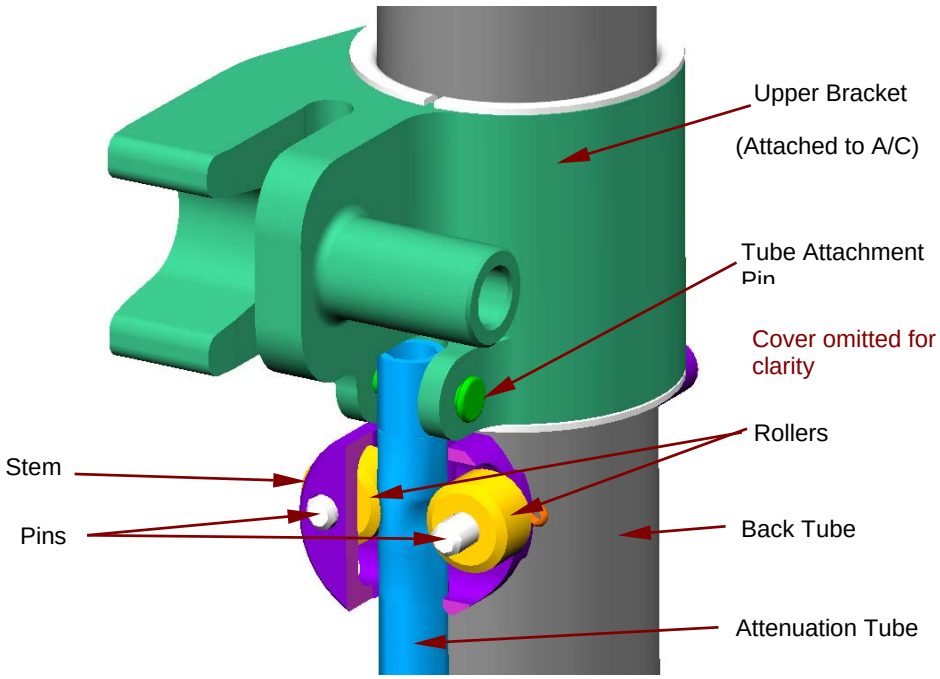


Figure 7: View showing Attenuation System

1.12. Seat Fabric System

The Fabric Seat Assembly (See Figure 8) is manufactured from flame retardant Nylon. It provides a comfortable sitting enclosure and gives lateral restraint to the occupant. The integral Back strap provides lumbar support.

The Headpad which contains a flame retardant foam insert, extends across the top of the seat to provide a large cushioned area for occupant protection from the hard surfaces of the seat structure.

Backrest adjustment is provided by means of adjustable side straps. This provides the additional space needed for the occupant when a Butt Pack is worn.

The Webbing sling provides support to the Seat Pan and carries the occupant loads into the main frame on the Seat. It also provides the occupant with lateral restraint.

A clearly marked warning label at the front edge of the sitting platform warns the prospective occupant “DO NOT STOW ARTICLES OR EQUIPMENT UNDER THE SEAT"

Figure 8: View showing Seat Fabric System

1.13. Four Point Harness

The four point Harness Assembly (See Figure 9) holds a civil certification TSO to C114. It comprises a Quick Release Fitting, four adjusters and four quick release end lugs. The Harness has three separate lugs which plug into the Quick release Fitting individually without activating the box.

The Quick Release Fitting is permanently attached to the left-hand lap strap. It provides a simple means for the occupant to secure or release themselves from the Seat.

The harness straps are secured into the Quick Release Fitting by inserting them into their respective recesses in the Box.

The Harness is released by rotating the faceplate fully on the Quick Release Fitting in either direction. 'Lost motion' is a design feature of the box. This prevents the harness from decoupling by inadvertent partial operation of the faceplate.

Should the need for replacement of the Quick Release Fitting occur, it may be quickly removed & replaced using a suitable tool.

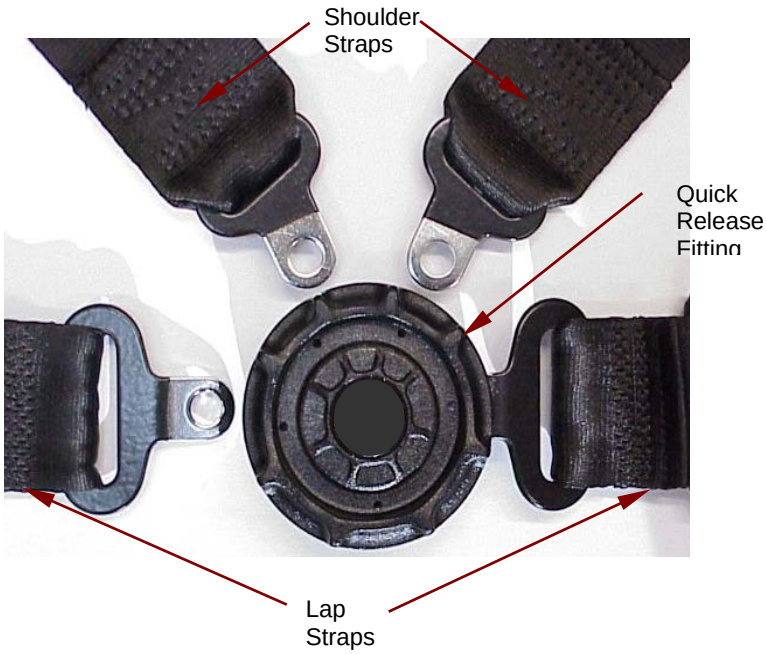


Figure 9: Quick Release Fitting and Harness Attachments

Quick Release End Lugs attached to the harness straps are used to secure the Harness to the Seat Structure. These provide a simple and quick method for both securing and removing the Harness when necessary for replacement.