



737NG Failsafe Strap STA 663 PZT Detection

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STA 663.75 Frame Fitting and Failsafe Strap - Inspection

Background

Operators have reported cracks in STA 663.75 fuselage [frame fittings and failsafe straps](#) on the left and right side. Cracks have also been reported at the aft fastener common the failsafe strap upper row. The cracks have been reported from the aft fastener hole to the aft edge of the STA 663.75 frame fitting. Several cracks in the STA 663.75 frame fitting have been found extending beyond the aft hole to the forward fastener hole. There has been one report of a visible crack in the failsafe strap without any visibly detectable crack in the frame fitting.

Operators have reported [crack findings on airplanes between 17,020 total flight cycles and 52,672 total flight cycles](#). One operator reported a crack in the left side STA 663.75 frame fitting that initiates at the aft, radiused edge of the fitting and propagated forward with an [approximate crack length of 0.26 inch](#). The crack is located above a fastener row, outside the original inspection area, and does not intersect the fastener hole.

Service bulletin 737-53A1414 gives instructions to [inspect the STA 663.75 frame fitting and failsafe strap](#) on the left and right side for any crack. The inspections make sure that any crack in the STA 663.75 frame fitting and failsafe strap is found before reaching a critical length. The [revised bulletin changed inspection area](#) for internal Detailed Inspection to include the radiused edge on the frame fitting and failsafe strap.

SB 737-53A1414 issued Oct 14, 2022, mandated by AD 2021-09-06 (superseded by AD 2025-07-03).
[SB 737-53A1414 Rev 1 issued Nov 20, 2023](#), mandated by [AD 2025-07-03](#) (effective May 13, 2025).

STA 663.75 Frame Fitting and Failsafe Strap - Inspection

Service Bulletin 737-53A1414 Inspections

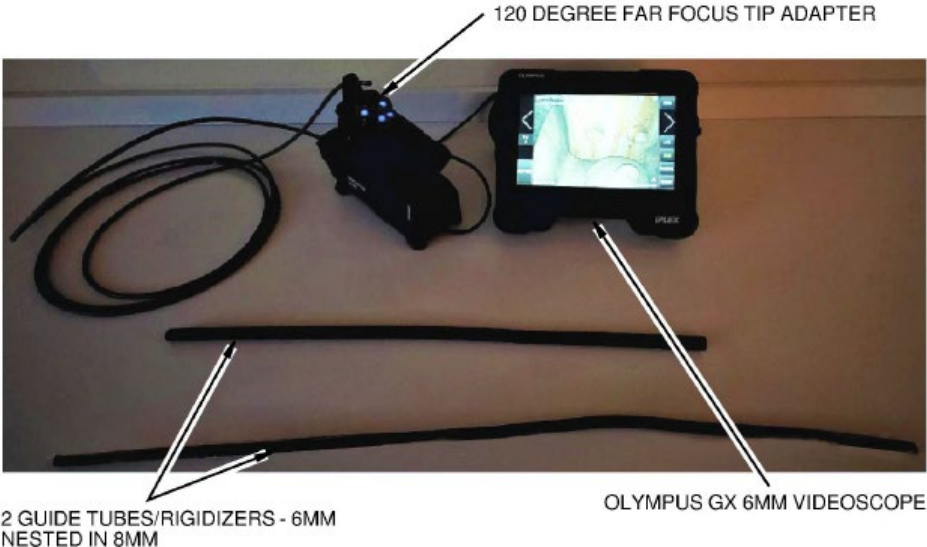
Do an internal Detailed Inspection of the frame fitting and the visible portion of the failsafe strap at STA 663.75 left and right side for any crack.
1500 cycle repeat

ALERT

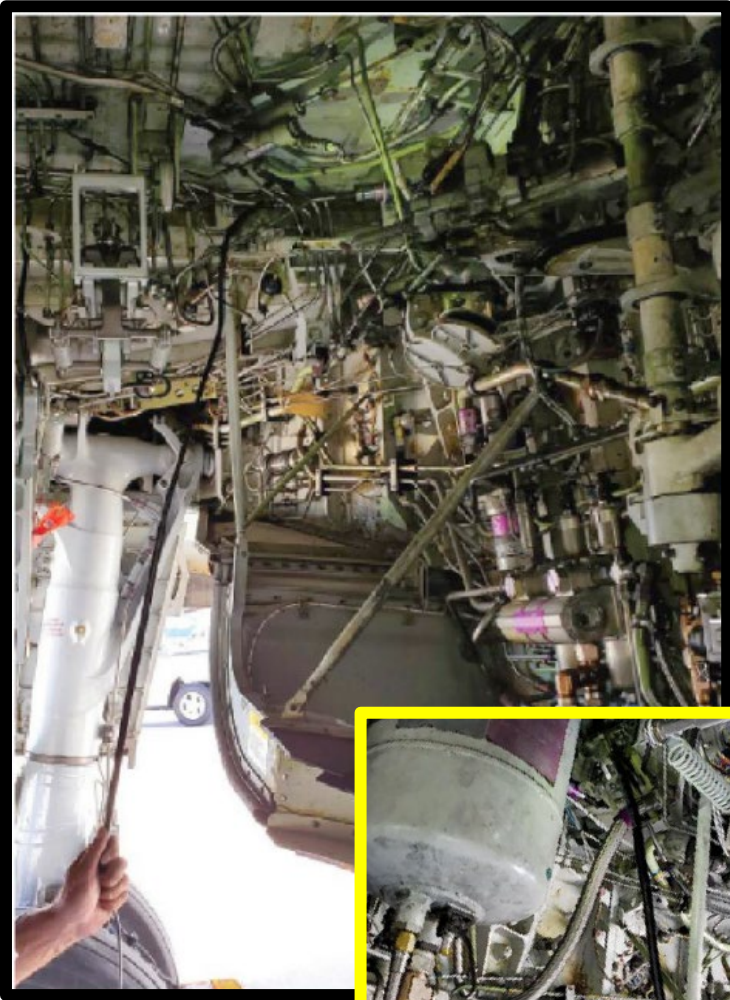
BOEING SERVICE BULLETIN 737-53A1414

This appendix is provided as an aid for the internal Detailed Inspection requirement. It shows the Olympus GX Borescope as an acceptable tool to do the Detailed Inspection in FIGURE 1 and FIGURE 2. A borescope inspection equipment that is an approved equivalent is acceptable to use to do the Detailed Inspection in FIGURE 1 and FIGURE 2.

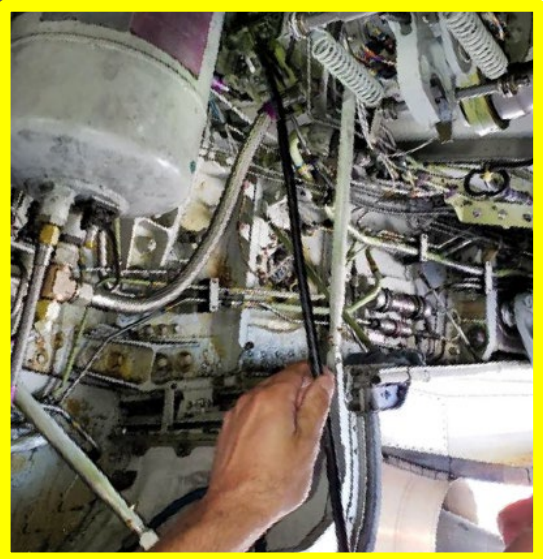
INSPECTION CAN BE PERFORMED WITH ANY BORESCOPE:



ALERT



LHS

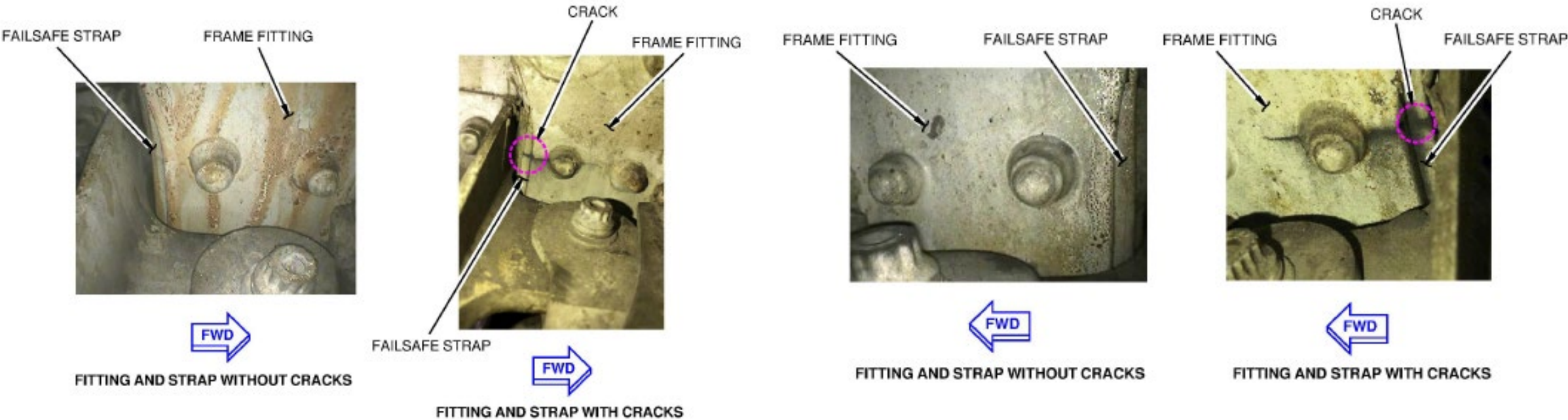


RHS

STA 663.75 Frame Fitting and Failsafe Strap - Inspection

Service Bulletin 737-53A1414 Inspections

Examples of internal Detailed Inspection of the frame fitting and the visible portion of the failsafe strap at STA 663.75 left and right side for any crack.

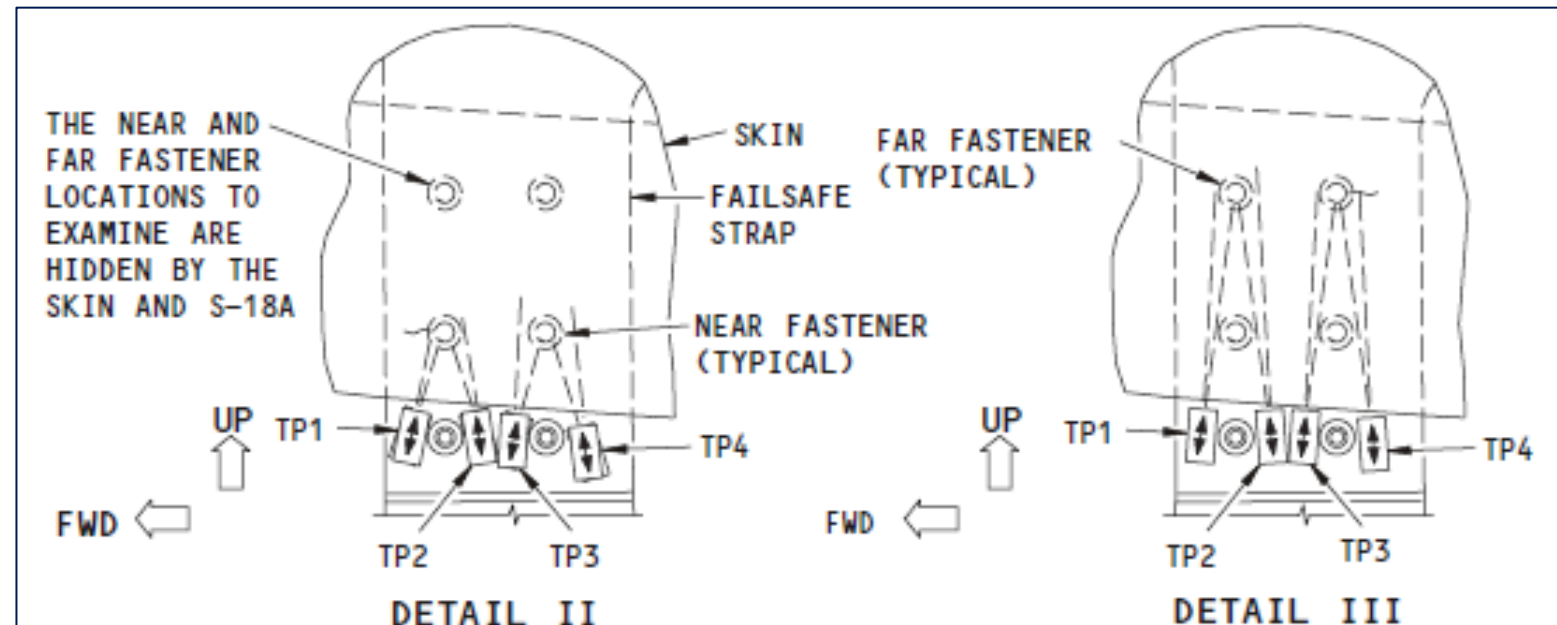
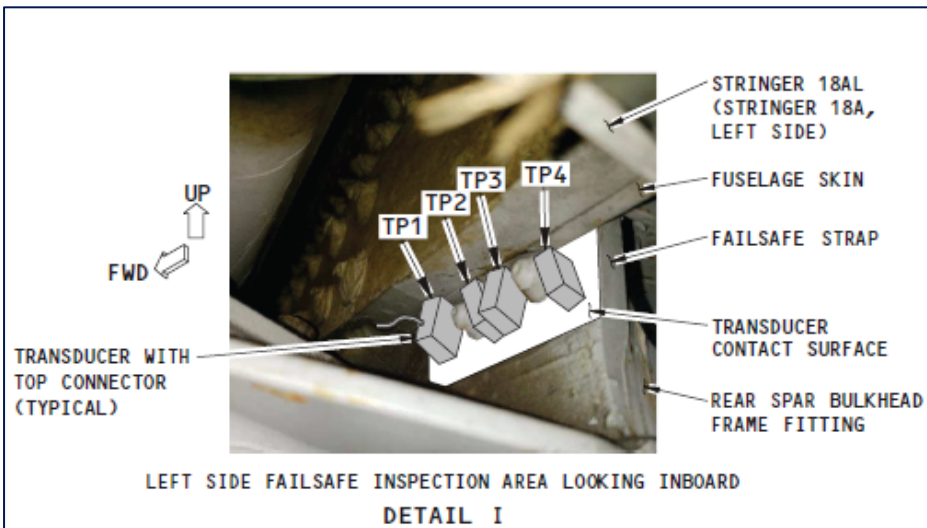


STA 663.75 Frame Fitting and Failsafe Strap - Inspection

Service Bulletin 737-53A1414 Inspections

Do an Ultrasonic (UT) inspection (737 NDT Manual Part 4, 53-10-16) of the failsafe strap at STA 663.75 left and right side for any crack.

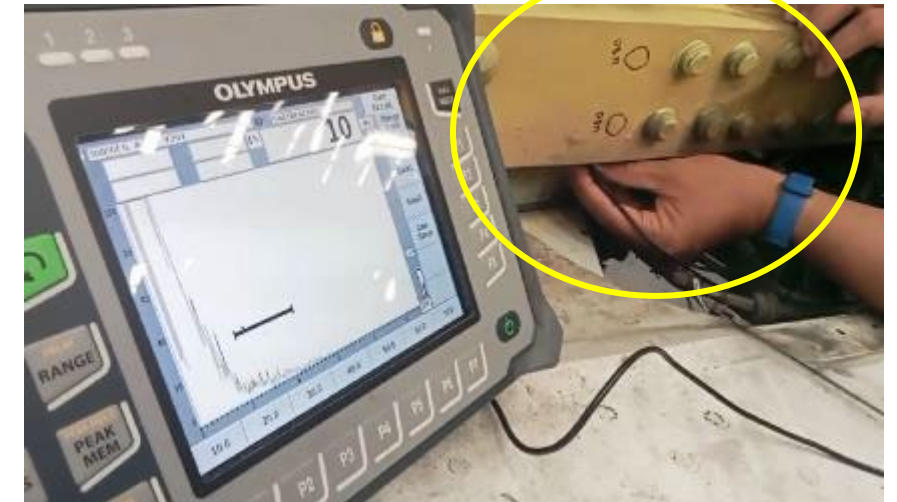
2000 cycle repeat, UT Lndi = 0.34 inches Thru Thickness at hole



STA 663.75 Frame Fitting and Failsafe Strap - Inspection

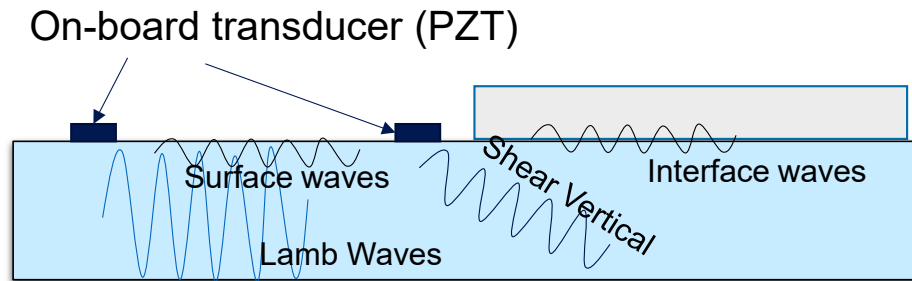
Service Bulletin 737-53A1414 Inspections

Examples of Ultrasonic (UT) inspection (737 NDT Manual Part 4, 53-10-16) of the failsafe strap inspection



Piezoelectric (PZT) Sensor Technology

- Based on ultrasound guided Lamb waves using Piezoelectric ceramic transceivers (PZT)
- A PZT can be used as both transmitter (actuation/pitcher) and receiver (sensor/catcher) and induces and measures waves in all directions

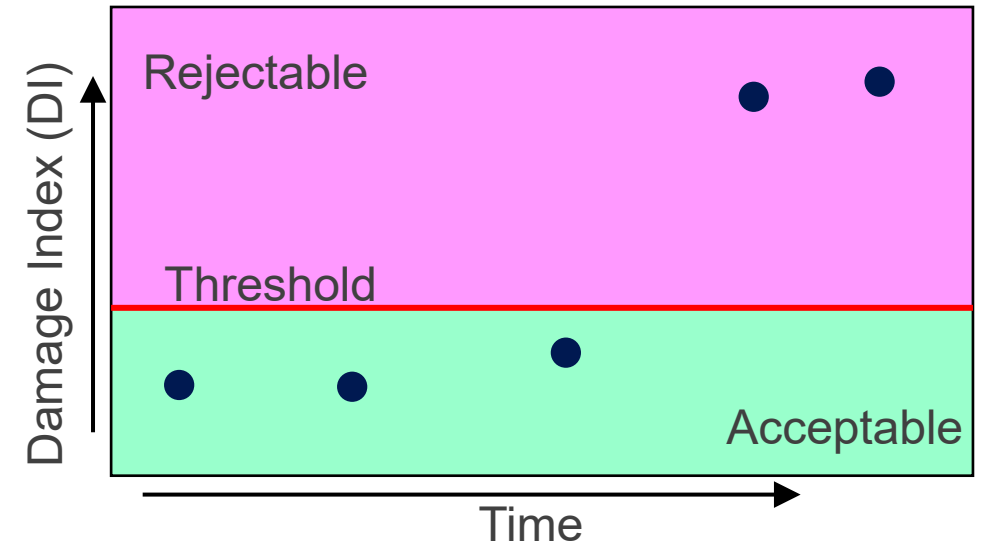


Pros:

- Damage detection including surface cracking and subsurface flaws (disbond, delaminations)
- Sensors can be placed in the vicinity of crack paths and not necessarily have to be in crack paths.

Cons:

- Custom design of the sensor required for each application
- Complex signal analysis requires verified software

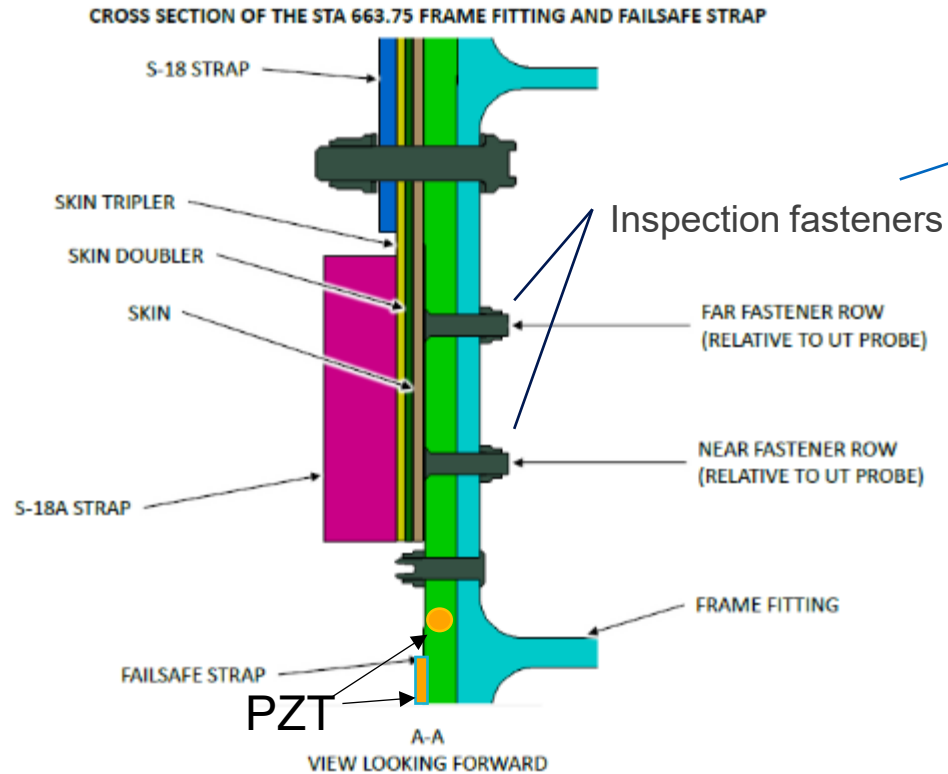


Representative Interface for Damage Index



737NG Fail Safe Strap – STA 663

PZT SMART Layer Sensor Design



- Sensors installed outside current UT inspection zone
- Pulse-echo guided waves propagated into far side fasteners and measured by PZT



Designed to detect any cracks from the four fasteners on Failsafe Strap

737NG Fail Safe Strap – STA 663: Overview

Description

- 737-600, 737-700, 737-700C, 737-800, 737-900, 737-900ER
- SB 737-53A1414, 21,600 Flight Cycles; Repeat 2,000 FC
- 6,687 Fleet Size
- DET + Ultrasonic Shear Wave inspection
- UT Lndi = 0.34 inches Thru Thickness at hole

Evaluation

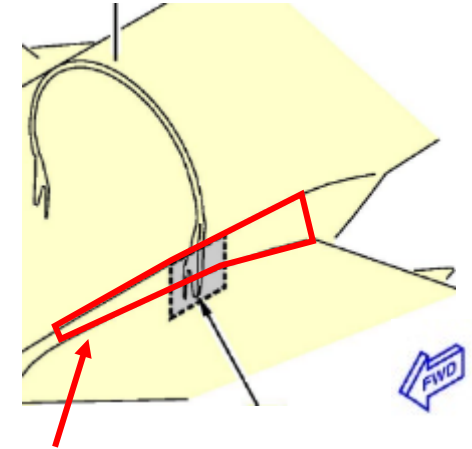
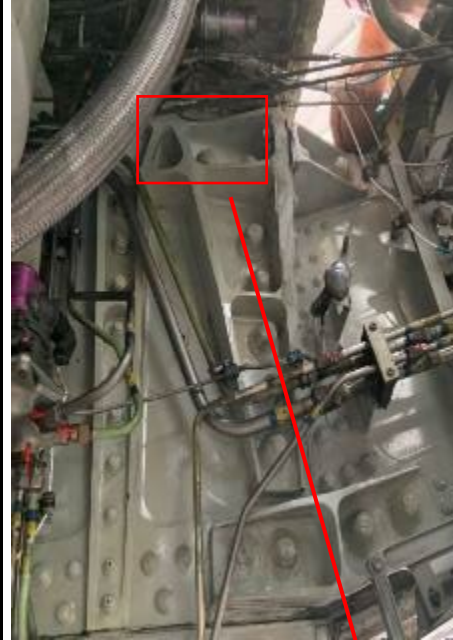
Pros:

- In-flight data collection on 2 aircraft since 2022.
- PZT sensors do not interfere with current inspections
- Validating post data review on detection

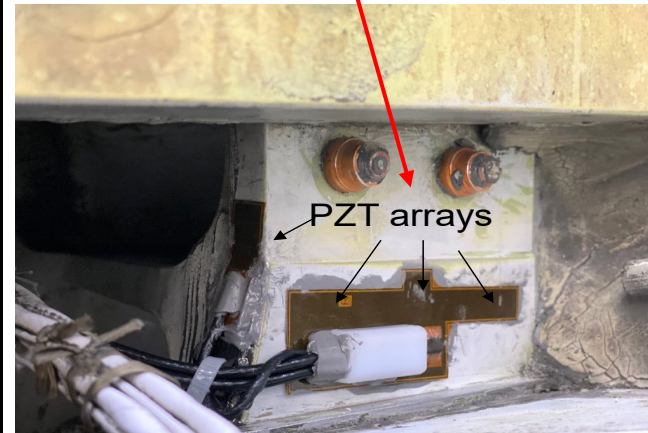
Challenges:

- May be difficult to grow a crack in the lab
- Agreed representative PoD test coupon
- Effects of sealant and boundary conditions

PZT Sensor Concept



Need to remove center wing-to-body fairing panels for access

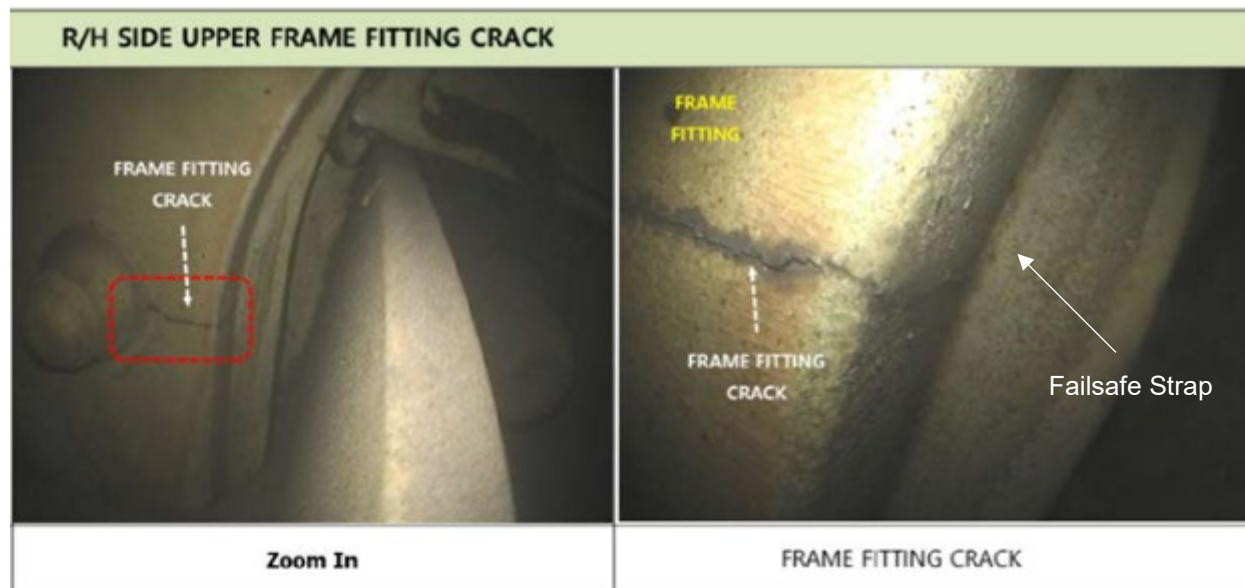


Data collection in wheel well.

737NG Fail Safe Strap – STA 663

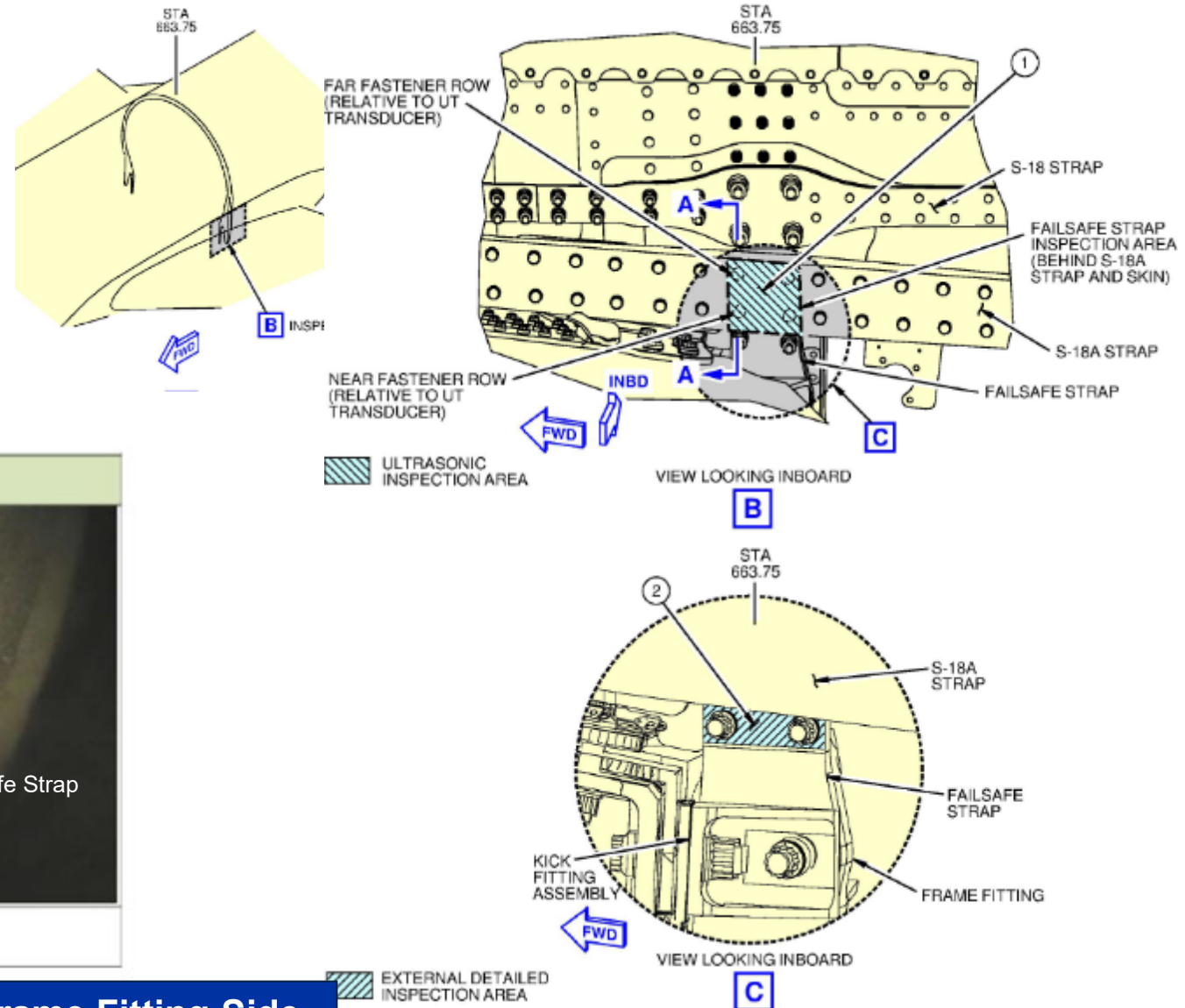
In-Service Crack Found on RH STA 663.75 Frame Fitting

- During routine visual inspection (26 NOV 2024), a crack was found on the RH side frame fitting of the SHM-equipped 737-900 aircraft



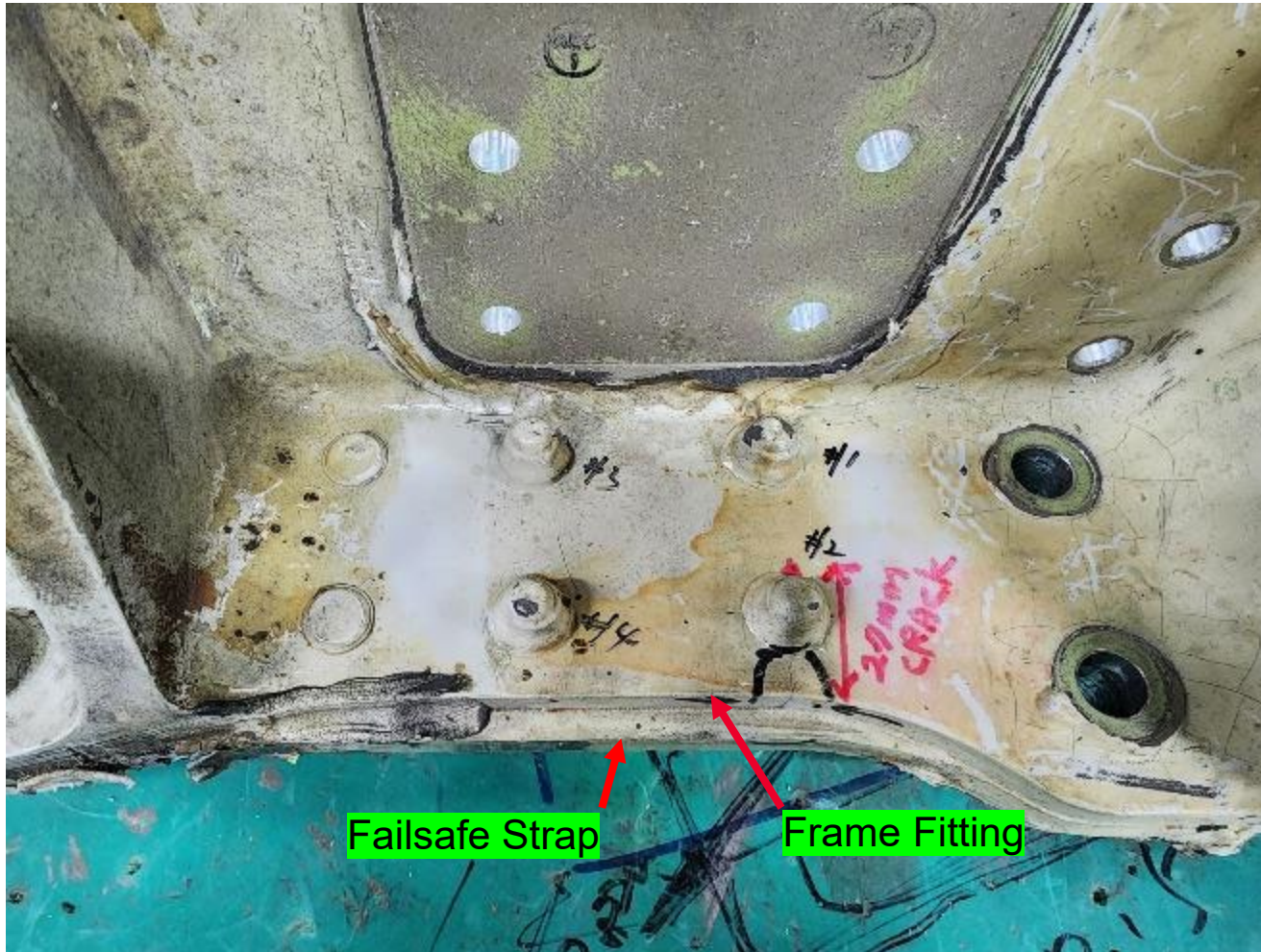
Visual crack confirmed only on Frame Fitting Side

SB 737-53A1414 External DVI and UT



737NG Fail Safe Strap – STA 663

Crack finding on aircraft with PZT installed

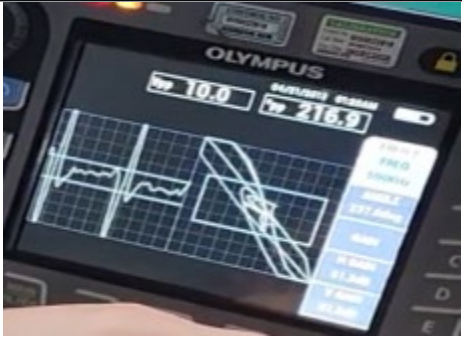
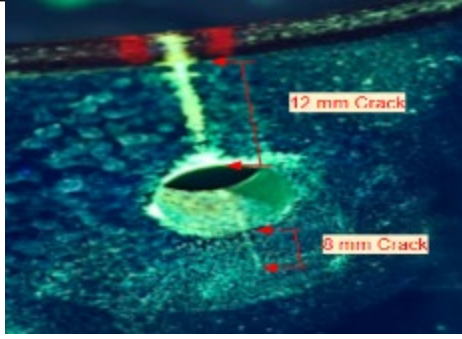


No.	Hole Location	Criteria
1	Hole 1	Acceptable
2	Hole 2	Rejectable
3	Hole 3	Acceptable
4	Hole 4	Acceptable

- Initial detection was a visual inspection.
- PZT showed an increased damage index.
- Lab results yielded cracks in both parts.

Summary - NDI Results to Confirm Crack Finding

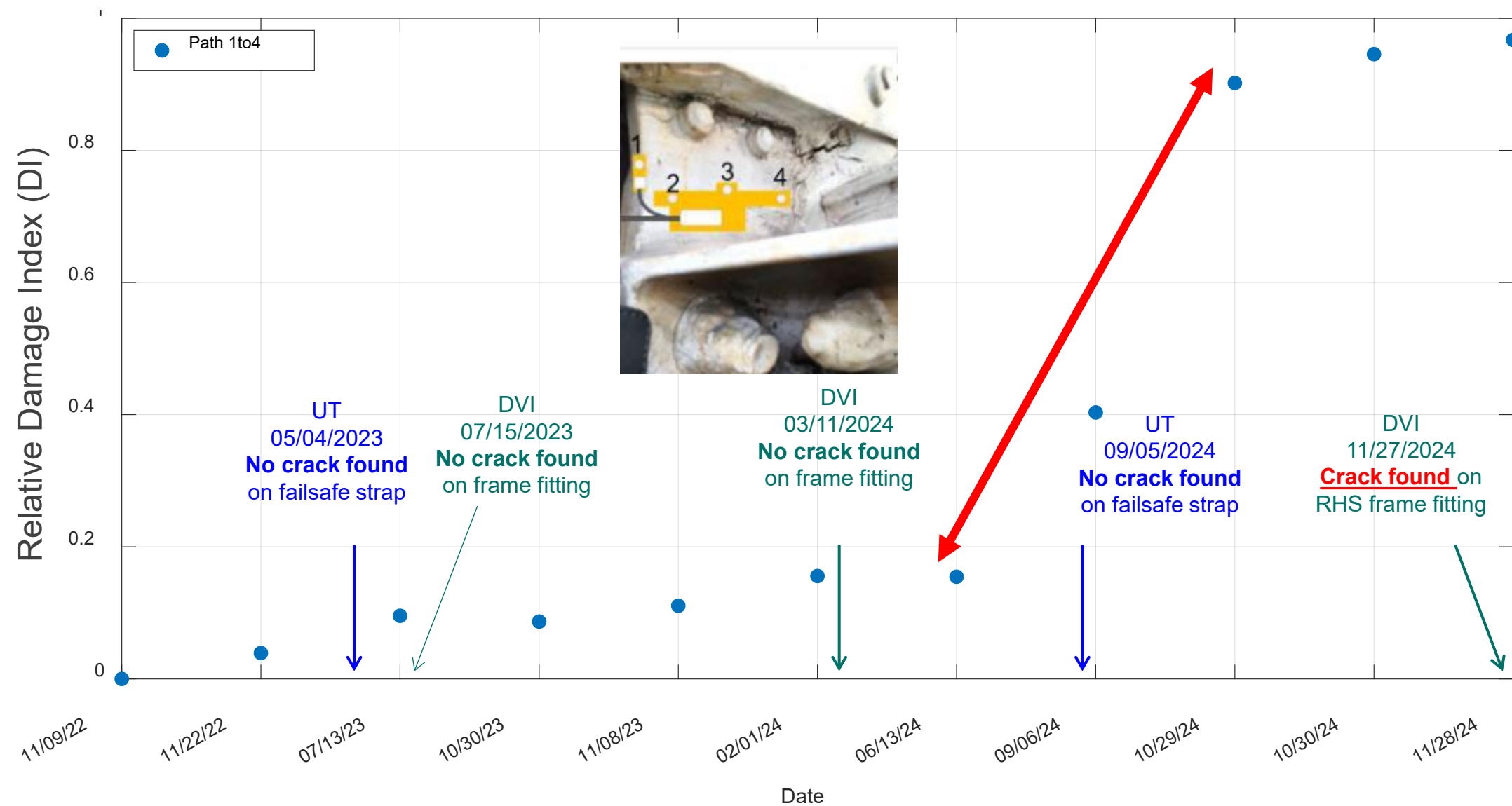
RHS Frame Fitting

USI	ECI (Hole)	ECI (Countersink)	ECI (Surface)	FPI
		No Countersink		
Crack	12 & 6 O'clock Crack	N/A	Crack	Crack

RHS Failsafe Strap

USI	ECI (Hole)	ECI (Countersink)	ECI (Surface)	FPI
				
No Crack	12 O'clock Crack	12 O'clock Crack	No Crack	Crack

PZT Damage Index & NDI vs Date (RH STA 663.75 Frame Fitting)



737NG Fail Safe Strap – STA 663

Proposed Next Steps

Phase 1

- Coupon design development
- Install on a 3rd aircraft

Phase 2

- Establish the team, end-to-end solution, test planning
- Review Issue Paper requirements, hold TDR
- Perform engineering tests – finalize test specimen
- Issue Paper Approval
- Open Project, Submit Cert Plan, draft Test Plan

Phase 3

- Cert Plan approval
- Test Plan approval
- Perform Cert Tests
- Development of Service Bulletin & Deliverables

Phase 4

- Test Report & Project Deliverables
- Finalize Service Bulletin
- Submit Cert Package to FAA

Questions?