Panel Session: USAF NDI Reliability Improvements

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Inspection Philosophy

- Knowledge of process capability, reliability required before new inspection approved/implemented
  - Engineering, Inspection partnership
- Delta currently conducts internal POD studies on LFEC, MPI, and FPI
  - Future plans for more studies, additional technologies
  - Close cooperation with FAA's AANC (Airworthiness Assurance NDI Validation Center)
  - Initially just "base lining", but now "continuous improvement" tool
    - Roughly 3 year repeat interval, adjusted for significant changes in process & personnel
- Engineering Analyses
  - Inspection Threshold
  - Inspection Interval
- Increasingly important in Aging Aircraft, Multi-site damage, Damage Tolerance and widespread fatigue analyses
  - Rulemaking activities

Must have knowledge of processes for confidence in continued airworthiness

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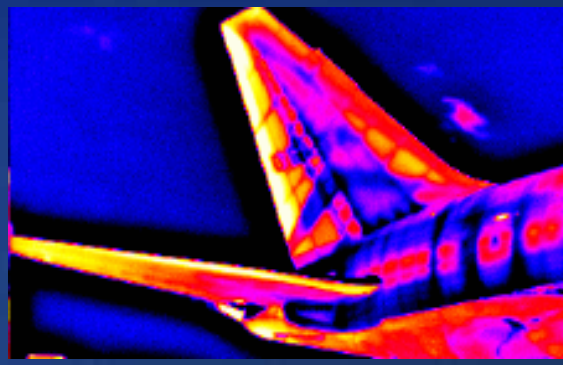
Training and Communication

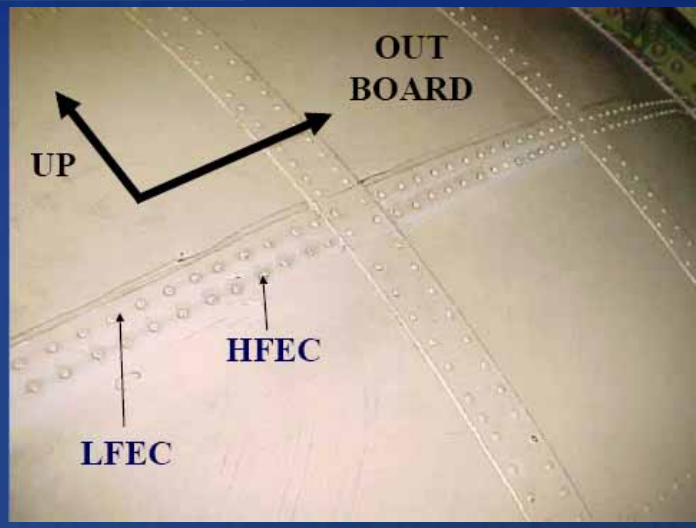
- Continuous improvement philosophy
- Training program designed for 3 year recertification
  - Classroom time, written exam & practical exam
- Annual assessment in each method
- Random assessments
- Open communication on all fronts
  - Close coordination between engineering, method Level III's
  - Engineering visits each shift, foremen; Seeks input; Often conducts OJT with Level III
  - Inspectors, foremen free to provide input (feel part of the process)

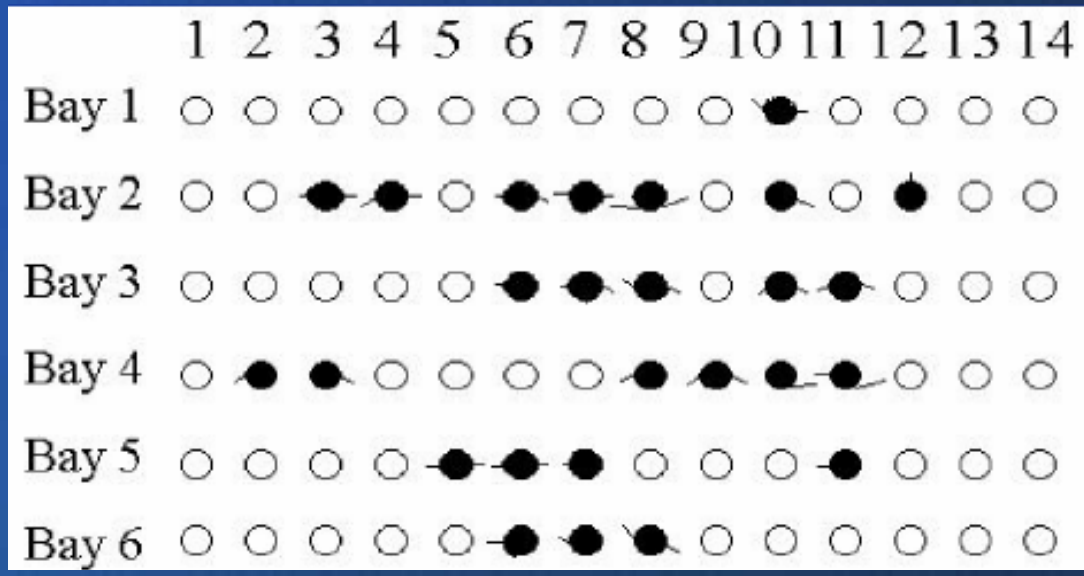


Vigilant, proactive inspectors from training program, effective communication

Example – B767 APB

- Skin lap splices extend radially from center
  - Boeing Service Bulletin
  - Visual for oil-canning
  - HFEC/LFEC for cracking from aft side of bulkhead
  - 25,000 cycle threshold, 6,000 cycle repeats
- Delta found MSD condition with HFEC:
  - 26 fasteners, 41 indications
  - Location of cracking, adjacency sparked concern from engineering, inspectors
  - Potential for link-up
  - Analysis revealed initiation on faying surface; Crack tunneling observed, similar to B727 lap joint experience
  - Growth thru-thickness from faying surface to aft surface
  - SEM striation counts
  - HFEC inspection called into question
  - ~ 31,500 cycles





Service Bulletin inspection worked – right?

Example – B767 APB

- MFEC used to inspect bulkhead again
  - Based on B727 MFEC inspection
  - Some holes also scanned with BHEC

Inspection Type	Number of fastener holes with indications
HFEC (SB 767-53-0026 R4)	*26 (all on stiffener 10R)*
BHEC	16 (all on stiffener 4R)
MFEC	20 (on stiffener 10R)
MFEC	4 (on stiffener 16R)
TOTAL	**66**

- SB inspection only found 39% of cracking!
  - Some origins not near hole – BHEC would miss
  - Boeing fatigue test had same cracking, but at 5X cycles
  - Records research indicated two previous HFEC inspections:
    - No HFEC indications at 24,914 and 26,945 cycles
    - Estimated max crack length of 0.180” and 0.200” at those inspections
  - Inspection interval had to be shortened

Delta inspectors initially questioned the inspection

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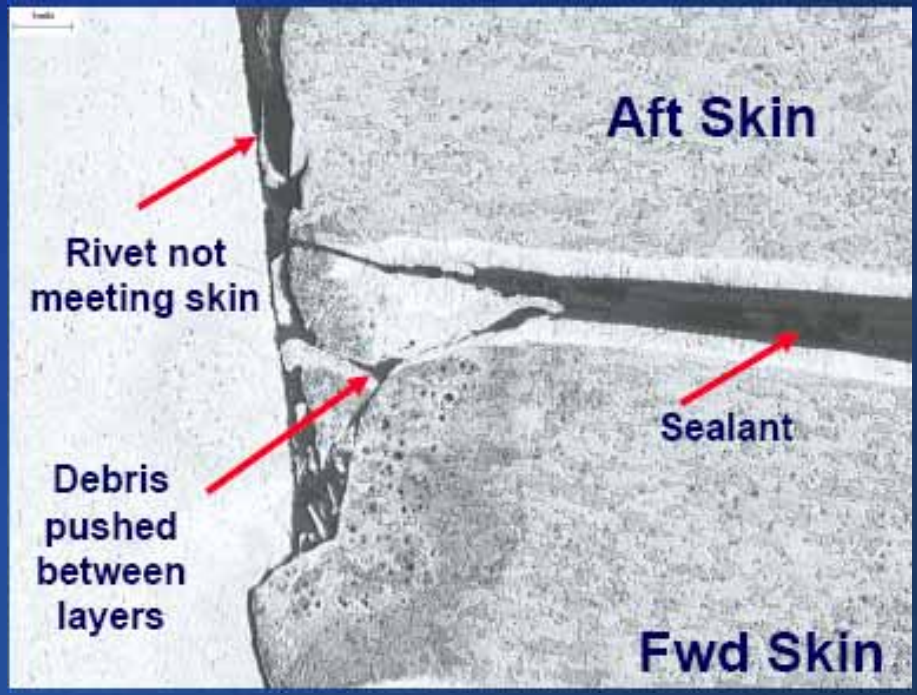
Example – B767 APB

- Delta then provided the how, why
  - Cracking from debris, gouges
  - Riveting squeezed sealant
  - Incomplete fit-up
- MFEC inspection incorporated at Delta with 1500 cycle repeats
  - 5 additional aircraft found with similar MSD damage shortly thereafter (not an isolated event)
  - Estimated link-up within 2,000 cycles
- Other operators contacted Delta



- Boeing eventually revised SB to include MFEC with 1800 cycle repeat
- Success for industry only due to our vigilant inspectors, experience

Delta improved inspection for industry; increased safety

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THANK YOU

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