

MODEL ASSISTED POD CRACKS UNDER FASTENER DATA

PAUL SWINDELL

FAA

MIKE BODE

AANC

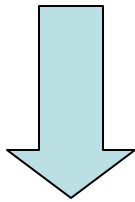
4 FEB 2005

CRACKS UNDER FASTENER DATA

- DEVELOPED A SET OF QUESTIONS AND SENT THEM TO AANC TO REVIEW THEIR DATA SETS
 1. EXPERIMENT NAME
 2. OBJECTIVE
 3. REFERENCES
 4. SPLICE GEOMETRY
 5. CRACK CHARACTERISTICS
 6. NDI METHODS TESTED
 7. INSPECTOR INFORMATION
 8. RESULTS
 9. PROBE CHARACTERIZATION

AANC Lap Joint POD Data Sets

**ECIRE Surface Crack
Panels**



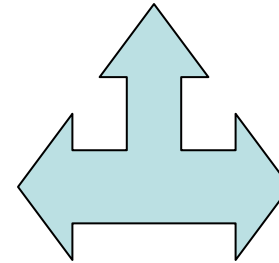
Sliding Probe Data

Rivet Check Data

Pencil Probe Data

Inner Layer Crack Panels

**Sliding
Probe
Data**



**Emerging
Technologies
Data**

CRACKS UNDER FASTENER DATA

Experiment Name: Reliability Assessment at Airline Inspection Facilities, Volumes I, II, & III: An Eddy Current Inspection Reliability Experiment (ECIRE)

Objective: Assess the reliability of field inspections for detecting a crack originating within fastener holes in lap splices using high frequency eddy current inspection methods.

References:

DOT/FAA/CT-92/12, I

DOT/FAA/CT-92/12, II

DOT/FAA/CT-92/12, III

CRACKS UNDER FASTENER DATA

Splice Geometry: Volume II – Figure 2-1,

Specimen Types: 20X20 inch panels & large aircraft panels

Aircraft Type: Boeing 737

Skin Thickness: 0.040” on 0.040”

Material: new, 2024-T3 alclad aluminum

Fastener: 5/32” aluminum, anodized coating (measured high resistance)

Tear Straps: None

Surface Condition: painted and unpainted

Crack Characteristics:

Types of Cracks: essentially through-cracks (front vs. back lengths slightly vary)

How Cracks Grown: tension/tension uniaxial loads with EDM starter notches

Crack Size Range: 0.020” to 0.250” length (one at 1.0”)

Crack Size Distributions: See Vol. II, Table 2-2 & 2-3 (161 total cracks)

Crack Growth Orientations: horizontal to loads & off-angles (11 & 22 degrees)

Crack Density (#/panel): none, low (1-3), and high (7-9)

Cracks per site: 0, 1, & 2

CRACKS UNDER FASTENER DATA

NDI Methods Tested: IAW AD88-22-11

Methods: Eddy Current – Rotating Probe, Sliding Probe, Pencil Probe

Data Type: hit/miss

Probe Characterizations: Probes generally no longer available

Equipment Used: Vol. III Table 4.2

Inspector Information:

Number of Inspectors: 45 at 9 different facilities (5 at each facility)

Demographic Data Collected: Yes

CRACKS UNDER FASTENER DATA

Results: POD curves in DOT/FAA/CT-92-12, III – several types of analysis performed

Lab 0.9 POD: approximately 0.060” to 0.070”

Field 0.9 POD: approximately 0.090”

Miss Rate: approximately 0.024 (2.4%)

False Call Rates: generally low (<1%, with exceptions)

Variation: substantial between inspectors and facilities

Significant Performance Factors: procedure implementation & instrument-specific training, surface condition, crack orientation, surface accessibility.

Non-Significant Performance Factors: Specimen type, inspection time, shift work, crack density

CRACKS UNDER FASTENER DATA

IS THIS DATA SUFFICIENT TO SUPPORT THIS EFFORT?

IF NOT, WHAT OTHER DATA IS NEEDED?