

# Federal Aviation Administration



## *Fluorescent Penetrant Inspection Workshop*

ATA NDT Forum  
October 3, 2002



# FAA Workshop in Fluorescent Penetrant Inspection

ATA NDT Forum - Thursday, October 3, 2002  
Houston, Texas

- |      |                                 |                     |
|------|---------------------------------|---------------------|
| 1:00 | Introduction and Purpose        | Al Broz, FAA        |
| 1:15 | FPI Process Issues              | Al Broz, FAA        |
| 1:45 | Human Factors Issues            | Rusty Jones, FAA    |
| 2:30 | An Aircarriers Experience       | Lee Clements, Delta |
| 3:00 | BREAK                           |                     |
| 3:15 | Reliable FPI                    | Ward Rummel, D&W    |
| 4:00 | R&D To Support FPI Improvements | Lisa Brasche, ISU   |
| 4:30 | Panel Discussion                |                     |

# CD Contents

- Viewgraphs from this meeting
- FAA Memo – Qualified Personnel
- Checklist for NDT Course
- FAA Memo – ANE on use of red dye
- Report – C. Drury on Human Factors in FPI
- Appendix 2 – C. Drury Report
- Technical Review of FPI Process
- FAA Report – FPI Review of Literature  
1970 – 1998 – B. Larson

# FPI Workshop

**Why:** This workshop is based on the documented missed opportunities for FPI to find critical cracks in components.

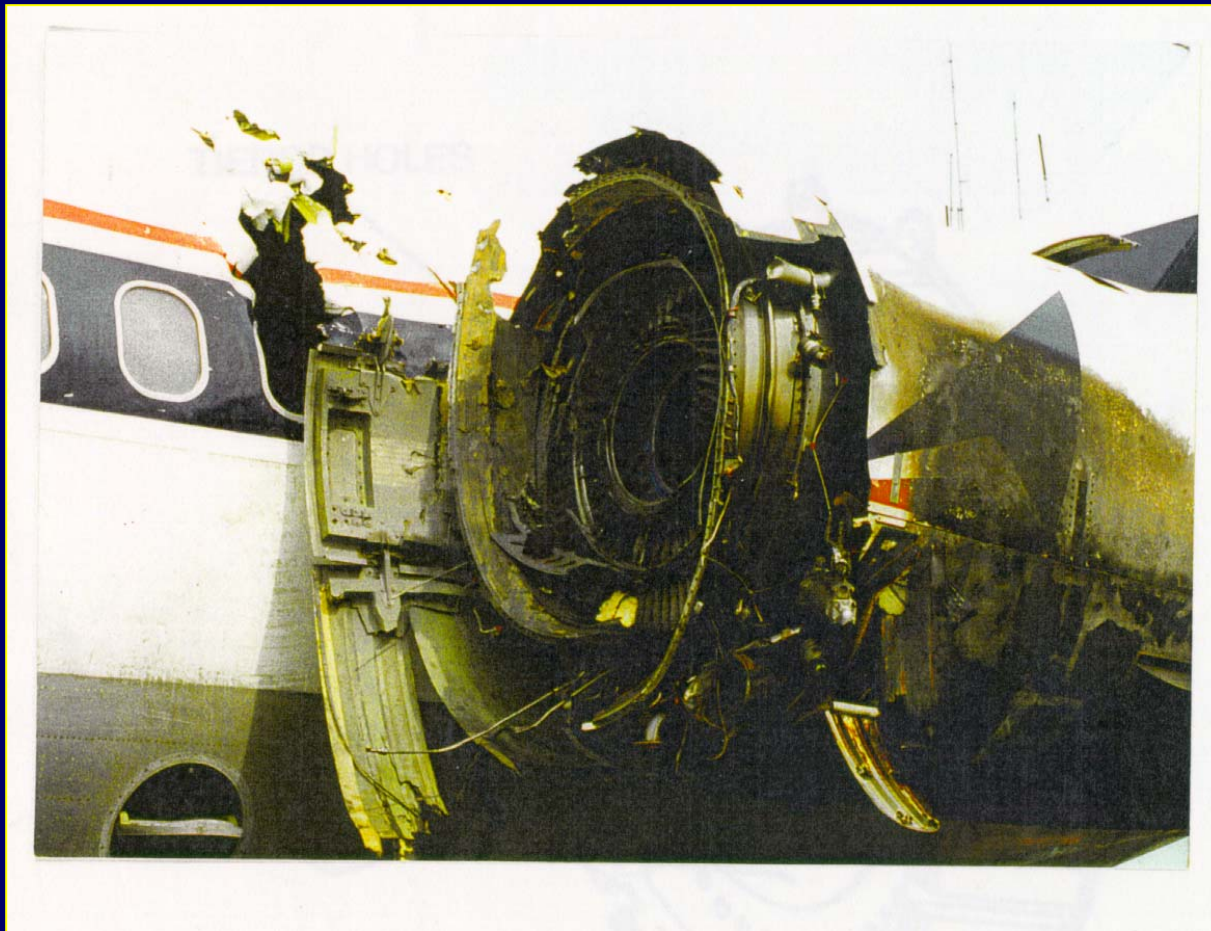
**Who:** Aimed at aviation industry personnel involved in the performance and quality assurance aspects of the application of FPI to rotating engine components.

**What:** Identify issues that will enhance the application of FPI to critical rotating engine components.

# United Airlines Flight 232 Sioux City, Iowa



**Delta Air Lines  
Flight 1288  
Pensacola, Florida**







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# Process Issues

- **What is the Process?**
- **FPI Process Issues**
- **Qualified Personnel**



# Fluorescent Penetrant Inspection Process Technical Review Team

**Team formed** September 12, 1996

**Team Charter** Review and evaluate 6 facilities that perform FPI of high energy rotating engine components.

Determine whether systemic problem exists in available guidance or its implementation.

Recommend corrective action.

# Team Members

Chief Scientist & Technical Advisor,  
Nondestructive Evaluation

Engine Certification Office,  
Aerospace Engineer

Flight Standards Aircraft Evaluation Group,  
Aviation Safety Inspector

Flight Standards,  
Principal Aviation Safety Inspector

# **Team Focus Areas**

- 1. Qualification of Personnel**
- 2. Cleaning and Handling**
- 3. FPI Process**

# Qualification of Personnel

## 44 Observations

- Documentation/Manuals
- Certification/Recurrent Training
- Tracking Systems
- Other (miscellaneous)

# Qualification of Personnel (Cont.)

- Procedures or manuals not revised to latest standards
- Non-performance of required certifications or recurrent training
- Non-compliance to visual recurrent testing
- Need to revise or implement tracking systems for proper monitoring of inspector qualifications

# Cleaning and Handling

## 59 Observations

- Process/procedure
- Calibration
- Oils
- Media Blast
- Other

# Cleaning and Handling (Cont.)

- Non-compliance with requirements
- Need to update manuals and process to ensure that cleaning methods have been substantiated by approved data
- Need to review standard practices
- Inappropriate use of penetrating oils
- Need to review the use of media blast cleaning processes



# Fluorescent Penetrant Inspection Process

## 54 Observations

- Procedures
- Handling
- TAM Panels
- Other

# Fluorescent Penetrant Inspection Process (Cont.)

- Non-compliance with requirements
- Need to revise and update manuals and processes
- Revise and implement shop practices to preclude metal to metal contact between part and handling fixtures
- Improper use of TAM panels

# Conclusions

## Qualification of Personnel

- certification/documentation of personnel poorly structured or practically non-existent

## Cleaning & Handling

- Lack of concern as to whether items had been properly prepared for an inspection.
- use of unapproved oils - lack of sensitivity to the issue that parts had to be clean enough for inspection

# Conclusions (Cont.)

## FPI Process

- Facility guidance differs from OEM guidance
- Need to improve and clarify requirements
- Improper use of TAM panels in the areas of:
  - Interpretation of guidance material
  - Maintenance
  - Cleaning procedures
  - Overall utilization

# Conclusions (Cont.)

## General:

The observations documented in this report indicate poor quality assurance practices at most of the reviewed FPI facilities

# Recommendations

- Conduct Research and Development programs
  - Perform studies to evaluate the critical parameters in the pre-cleaning and drying steps before the FPI process
- Conduct an FPI workshop for FPI inspectors and FAA Aviation Safety Inspectors
- Communicate to Flight Standards Service the need to assure that only qualified personnel are engaged in the performance of FPI

# Recommendations (Cont.)

- Support the adoption of a single document for FPI process guidance and work with the engine manufacturers, end users and providers of FPI materials to disseminate guidance to all entities.
- Support the establishment of a guidance standard for cleaning and drying.