The Basics of Maintenance Event Investigation

Dr. William B. Johnson
Chief Scientific & Technical Advisor for Human Factors in A/C Maintenance Systems

bill.johnson-dr@faa.gov
404.305.6118

Little Rock Repair Station Human Factors Seminar
Little Rock, AK
April 12, 2007

Agenda

- Why is Event Investigation Important
- How to Implement an Event Investigation Program
- How to know the Event Investigation program is working
- Key References
- Discussion as Time Permits
Agenda

Why is Event Investigation Important

How to Implement a Event Investigation Program

How to know the Event Investigation program is working

Key References

Discussion as Time Permits

1.0 Event Investigation

"Jackscrew assembly failure caused by excessive wear resulting from insufficient lubrication... contributing factors included extended lubrication and end play check intervals, lack of available parts, organizational norms, regulatory oversight issues, etc."

NTSB AAR-02/01 FINAL REPORT

EVENT INVESTIGATION

Chapter 1
Maintenance-Related Events
**Human Factors #1 Causal Factor**

- **FATAL AIRLINE CRashes BY ACCIDENT CATEGORY/MAIN CAUSAL FACTOR**

<table>
<thead>
<tr>
<th>Category</th>
<th>Number of Accidents</th>
</tr>
</thead>
<tbody>
<tr>
<td>Controlled flight into terrain</td>
<td>4</td>
</tr>
<tr>
<td>Human factors</td>
<td>5</td>
</tr>
<tr>
<td>Technical/maintenance</td>
<td>11</td>
</tr>
<tr>
<td>Unknown</td>
<td>6</td>
</tr>
</tbody>
</table>

**Human Factors Caused System Failures as a Contributing Factor to Accidents**

- **International Air Transport Association (IATA) Safety Report 2003**
- **Total of 92 accidents in 2003**
  - 42 Western-built jets
  - 32 Western-built turboprops
  - 7 Eastern-built jets
  - 11 Eastern-built turboprops
- **Found that in 24 accidents (26%) a maintenance-caused event started the accident chain.**
Iceberg Model

Traditional Error Investigation Process (a.k.a., Your system?)

- Event Occurs
- Event Caused by Maintenance Error
- Find Who Made Error
- Punish Mechanic
**The MEDA Process**

- **Event Occurs**
  - Interview Maintenance Staff
  - Find Contributing Factors
  - Get Ideas for Process Improvement

- **Investigation Finds Event Caused by Maintenance Error**
  - Follow-up to Obtain Additional Contributing Factors and Information

- **Find Who Made Error**
  - Add to Maintenance Error Data Base
  - Make Process Improvements Based on This Event Based on Analysis of Data for Multiple Events
  - Provide Information to All Employees Affected By Process Improvements

**Philosophy of Error Reporting (Boeing-MEDA)**

1. **Staff do not make errors on purpose**
2. **Maintenance errors are made because of a series of related contributing factors**
3. **Most of the contributing factors are part of maintenance organization processes and can be changed**

Slide provided by Boeing, Dr. Bill Rankin
More MEDA Philosophy

- Maintenance program must be viewed as a system, where the mechanic is one part of the system

- Addressing lower level events helps prevent more serious events

Contributing Factors: Anything that affects how a mechanic does his/her job.

- Access to equipment
- Lighting
- Temperature
- Hand tools
- Sound levels
- Hazardous materials
- Documentation
- Communication
- Airplane/part design
- Clean environment
Event Investigation – Why is it Important

- Event investigation helps manage the risks caused by mechanic or inspector actions.
- Event investigation helps identify and understand multiple contributing factors cause events.
- Knowing and addressing the contributing factors reduces the likelihood of future, similar events.
- Identification of lower level events helps prevent higher level events.

Agenda

Why is Event Investigation Important

How to Implement a Event Investigation Program

How to know the Event Investigation program is working

Key References

Discussion as Time Permits
Event Investigation - How to implement

- Select a manager/department to be responsible for the process.
- Determine whether the investigations will be carried out in the context of ASAP (Aviation Safety Action Program).
- Cooperative endeavor between labor and management and regulator.
- Select an investigation process.
- Write policies and procedures needed to implement process.
- If necessary, implement a “just” disciplinary policy.

Event Investigation - How to implement

- Select the events to be investigated.
- Select and train the event investigators.
- Establish a management team to review the investigation findings in order to decide what improvements to make.
- Follow up to insure the improvements are being made.
- Inform all personnel about the improvements that are being made on the basis of the event investigation findings.
- Analyze the findings using risk assessment techniques and trend analysis.
- Evolve the system so that personnel report “near events.”
Agenda

Why is Event Investigation Important

How to Implement a Event Investigation Program

How to know the Event Investigation program is working

Key References

Discussion as Time Permits

Event Investigation - How to know it is working

- Events are being investigated.
- Contributing factors to errors and to procedural deviations are being uncovered.
- These contributing factors are being corrected.
- The number of events caused by mechanic/inspector performance decreases over time.
- The operator saves time and money.
- Mechanics/inspectors begin to self report “near events.”
Simple Ways to Recall Human Factors in Maintenance
bill.johnson-dr@faa.gov
Little Rock, AK
April 12, 2007

Agenda

- Why is Event Investigation Important
- How to Implement a Event Investigation Program
- How to know the Event Investigation program is working
- Key References
- Discussion as Time Permits

Event Investigation - Key References

- Aviation Safety Action Plan (ASAP) AC 120-66B
- Maintenance Error Decision Aid (MEDA) User’s Guide and Results Form
- Ramp Error Decision Aid (REDA) User’s Guide and Results Form
- Human Factors Analysis and Classification System—Maintenance Extension (HFACS-ME)
Simple Ways to Recall Human Factors in Maintenance

Little Rock, AK
April 12, 2007

Agenda

Why is Event Investigation Important
How to Implement a Event Investigation Program
How to know the Event Investigation program is working
Key References
Discussion as Time Permits

Summary

- Event Investigations can be used to understand the causes (contributing factors) to these events and to make improvements to prevent future, similar events.

- M&E organization must implement process by
  - Selecting responsible manager/dept.
  - Writing policies and procedures
  - Implementing “just” discipline policy
  - Training staff
  - Carrying out investigations
  - Making improvements.

- Use the data!