Development of an Improved Fire Test Method and Criteria for Aircraft Electrical Wiring

Presented to: The International Aircraft Material Fire Testing Working Group

By: John Reinhardt, Project Manager, PMP
Date: March 4-5, 2008
Outline

- Project Initiating Process
  - Project Charter
  - Preliminary Scope Statement
- Planning Process
  - Develop Project Mgt Plan
Initiating Process

PROJECT CHARTER

• Date of Request: 24 October 2007
• Sponsor: Jeff Gardlin, FAA Transport Airplane Directorate
• Program Manager: Gus Sarkos, FAA Fire Safety
• Project Manager: John Reinhardt, PMP, FAA Fire Safety
  ✓ Achieve the lowest possible commercial air carrier fatal accident rate:
    - Currently (2007): 8.8828 fatalities per 100 million persons onboard
    - FY 2012: 7.65 fatalities per 100 million persons onboard
    - FY 2025: 4.44 fatalities per 100 million persons onboard
PROJECT CHARTER (CONT.)

- Project Justification:
  - The FAA initiated efforts to improve the fireworthiness of hidden areas in the aircraft (T/A Insulation, ducting and wires)
  - The Sixty Degree Test, Title 14 Code of Federal Regulations Part 25, Appendix F Part I (b)(7)) and Chapter 4 in the Aircraft Material Fire Test Handbook, must be replaced.
Initiating Process

PROJECT CHARTER (CONT.)

- **Objectives:**
  - Develop a fire test method for aircraft electrical wiring that could adequately discriminate between poorly performing wire insulation materials and fire worthy ones when exposed to a realistic fire scenario.

- **Requirements:**
  - Submit a final report documenting the developmental project and the new test method.

- **Due Date (milestone):**
  - 30 June 2009: Draft Final Report
Preliminary Scope Statement

• This project will focus on the flammability characteristics of aircraft wiring insulation only.

• It will consider the Radiant Heat Panel test apparatus as a candidate replacement.

• Excluded: wire arcing, design issues, installation issues, maintenance issues, FAA policies, etc.
Outline

• Project Initiating Process
  ✔ Project Charter
  ✔ Preliminary Scope Statement

• Planning Process
  ✔ Develop Project Mgt Plan
Planning Process

- PROJECT MANAGEMENT PLAN
  - Scope
  - Time
  - Cost
  - Quality
  - Human Resource
  - Communications
  - Risk
  - Procurement
Planning Process

- SCOPE
  - Planning
  - Definition
  - Create Work Breakdown Structure (see next slide)
Federal Aviation Administration Development of an Improved Fire Test Method and Criteria for Aircraft Electrical Wiring

Planning Process: Scope

Work Breakdown Structure

1. NEW FLAMMABILITY TEST FOR AIRCRAFT WIRING

1.1 Review Historical Information
1.2 Meet with Stakeholders
1.3 Define Fire Threat
1.4 Test Methods Selection
1.5 Material Selection
1.6 Material Testing
1.7 Evaluate Test Methods
1.8 Select/Modify Selected Test Method
1.9 Verify Test Method
1.10 Publish Test Method
WBS 1.1 Reviewed Historical Information

- Title 14 Code of Federal Regulations Part 25, Appendix F Part I(b)(7) – “Sixty Degree Test”
WBS 1.1 Reviewed Historical Information

WBS 1.1 Reviewed Historical Information

- “Assessing the Fire Performance of Electric Cables (FIPEC)” by P. Van Hees, and J. Axelsson, SP Sweden, S.J. Grayson and A.M. Green, Interscience Communications UK, H Breulet, ISSeP Belgium and U Vercellotti, CESI Italy
- Federal Test Method Standard No. 228, “Cable and Wire, Insulated; Method of Testing,” 1951
WBS 1.2 Meet with Stakeholders

- FAA Sponsor
- FAA Program Manager
- FAA Fire Safety Researchers
- International Aircraft Materials Fire Test Working Group
- OEMs
- Other
WBS 1.3 Define Fire Threat

- **Fire Threat**: 101.6 by 101.6 by 228.6-mm Urethane Foam Block (Density: 16.02 kg/m³)
- Environment:
  - Sea Level
  - Narrow-body attic
  - Insulation blankets in attic
  - Insulated duct in attic
  - Quasi-Std Ambient Temperature
### WBS 1.4 Test Methods Selection

<table>
<thead>
<tr>
<th>MEASUREMENT</th>
<th>60-Degree Bunsen Burner Test</th>
<th>Intermediate-Scale</th>
<th>Microscale Combustion Calorimeter</th>
<th>Radiant Heat Panel</th>
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<tbody>
<tr>
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<td>Heat Release Rate</td>
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<td>-</td>
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## Planning Process: Scope: WBS 1.5 Material Selection

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<tr>
<th>Item No.</th>
<th>Wire Specification</th>
<th>AWG</th>
<th>Insulation Material</th>
<th>Jacket Material</th>
<th>Temp Rating (degC)</th>
<th>Comments</th>
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</table>
WBS 1.6 Material Testing

• Tests to be conducted:
  • 60-Degree Bunsen Burner Test
  • Micro-scale Combustion Calorimeter
  • Intermediate-scale Fire Test
  • Radiant Heat Panel Test (Aircraft Ducting Version)
  • Other (as needed)

• Results will help rank materials based on their flammability characteristics.
WBS 1.7 Evaluate Test Methods

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</tr>
<tr>
<td>% Char</td>
<td></td>
<td></td>
<td></td>
<td>●</td>
</tr>
</tbody>
</table>

**Current small-scale test measures:**
- Fire Propagation (Burn Length)
- After flame time
- Drip flame time

**Radiant heat panel test measures:**
- Fire Propagation
- After Flame Time
WBS 1.8 Select/Modify Selected Test Method

- The Radiant Heat Panel (RHP) test machine is the platform currently used to test the flammability of aircraft thermo acoustic insulation materials and possibly, in the future, aircraft ducting.
- The RHP test machine will be evaluated to determine if it could be used as a testing platform for aircraft electrical wire bundles.
- If the RHP platform doesn’t work out, another platform will be identified, evaluated, and selected.
WBS 1.9 Verify Test Method (Scope Verification)

- The results of the data obtained from the developed fire test method will be compared against the results obtained during the intermediate-scale fire test. Of interest, will be information about fire propagation and burning time.
Planning Process: Scope

**WBS 1.10 Publish Test Method**

- Major Milestone
- Draft Final Report must be submitted by 30 June 2009
Planning Process

- **TIME**
  - Project Activity Definition
  - Project Activity Sequencing
  - Project Activity Resource Estimate
  - Project Activity Duration Estimate
  - Schedule
    - Gantt Chart

- **COST**
  - Estimating & Budgeting (TBD)

- **QUALITY**
  - Material Inspection & Conditioning
  - Systems/instrumentation calibrations
  - Measurements Accuracy
Planning Process

-HUMAN RESOURCE

- Input from IAMFTWG task group members will be requested
- Work will be conducted by FAA Fire Safety Team & SRA technical staff
- Responsibility Assignment Matrix will be provided

-COMMUNICATIONS

- Informal Oral Presentations: FAA internal
- Formal Oral Presentations: IAMFTWG
- Informal Written (E-mails): FAA & IAMFTWG
- Final Formal Written Report
Planning

RISK PLAN

- FAA Safety Office
- OSHA
- Risk Mitigation/Response Plan
- Etc.

- PROCUREMENT PLAN

- Create list of required materials, equipment, and other resources
- Request sellers response
- Select vendors
- Purchase required resources
Questions?

Anyone interested in joining this task group?

Contact:
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