Task Group Status

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Material & Process Technology

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Topics:

- Aging - Artificial Aging Test Results
- Contamination – CIC Flammability Testing
- In-service Sample Test Results
- Aging Wiring Information Summary (ATSRAC)
- Understanding Fleet Wide Issue - Proposal
  - Situation – Target – Proposal
  - Data gathering & testing approach proposal
## Artificial Aging Test Status

### Q-TIP Test Results on Aged PET Film (AN-36W)

<table>
<thead>
<tr>
<th>Aging Method</th>
<th>Exposure Time</th>
<th>Q-Tip Results</th>
<th>Flame Propagation Behavior in Crease</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>CONTROL</strong></td>
<td>Unaged</td>
<td>Passes</td>
<td>Film shrinks away vertically very quickly; 8&quot; Length and 1.5&quot; Width. Burn length &lt;1&quot;.</td>
</tr>
<tr>
<td>Oven; 200F</td>
<td>100 Days</td>
<td>Passes</td>
<td>Similar to Control</td>
</tr>
<tr>
<td></td>
<td>12 Months</td>
<td>Passes</td>
<td>Similar to Control</td>
</tr>
<tr>
<td></td>
<td><strong>16 Months</strong></td>
<td><strong>Passes</strong></td>
<td>Film shrinks away vertically slower than control; 7&quot; Length and 3.5&quot; Width. Edges of film catch fire causing slight propagation and a burn length of ~ 4 inches. Discoloration in scrim adhesive.</td>
</tr>
<tr>
<td>Humidity Chamber; 160F/100%RH</td>
<td>100 Days</td>
<td>Passes</td>
<td>Similar to Control</td>
</tr>
<tr>
<td></td>
<td>12 Months</td>
<td>Passes</td>
<td>Similar to Control</td>
</tr>
<tr>
<td></td>
<td><strong>16 Months</strong></td>
<td><strong>Passes</strong></td>
<td>Film shrinks away vertically slower than control; 5.5&quot; Length and 2.5&quot; Width. Edges of film catch fire causing slight propagation and a burn length of ~ 4 inches.</td>
</tr>
</tbody>
</table>

Red – New data since November 2003 Meeting
International Aircraft Materials and Fire Test Working Group

Aging/Contamination Task Group

Artificial Aging Test Status

CONTROL
Unaged
- Film Shrinkage - Fast
- Burn Length < 1"

16 Month at 200F
- Film Shrinkage - Moderate
- Burn Length ~ 3 - 4"
- Discolored Scrim Adhesive

16 Month 160F/100%RH
- Film Shrinkage - Moderate
- Burn Length ~ 3 - 4"
Flammability of Corrosion Inhibiting Compound on Insulation Blankets

- Evaluated radiant panel performance of Cor-ban 35 (heavy duty, similar to AV-15) on all types of insulation blanket films.

- Evaluated a single spray pass (0.7 g/ft$^2$) and a double spray pass (1.4 g/ft$^2$).
## Corrosion Inhibiting Compound

### Radiant Panel Test Results; Cor-Ban 35

<table>
<thead>
<tr>
<th>FILM TYPE</th>
<th>Q-tip</th>
<th>Radiant Panel</th>
<th>Radiant Panel</th>
<th>Radiant Panel</th>
<th>Radiant Panel</th>
</tr>
</thead>
<tbody>
<tr>
<td>PET, 0.5 oz/sq yd</td>
<td>P</td>
<td>Marg. (P/F)</td>
<td>P</td>
<td>F</td>
<td></td>
</tr>
<tr>
<td>PET, 0.9 oz/sq yd</td>
<td>P</td>
<td>Marg. (P/F)</td>
<td>F</td>
<td>F</td>
<td></td>
</tr>
<tr>
<td>MPVF, 1.0 oz/sq yd</td>
<td>P</td>
<td>P</td>
<td>P</td>
<td>P</td>
<td></td>
</tr>
<tr>
<td>MPVF, 1.4 oz/sq yd</td>
<td>P</td>
<td>P</td>
<td>P</td>
<td>P</td>
<td></td>
</tr>
<tr>
<td>PVF, 1.0 oz/sq yd</td>
<td>P</td>
<td>P</td>
<td>P</td>
<td>P</td>
<td></td>
</tr>
<tr>
<td>Polyimide</td>
<td>P</td>
<td>P</td>
<td>P</td>
<td>F</td>
<td></td>
</tr>
<tr>
<td>Ceramic Paper</td>
<td>N/A</td>
<td>P</td>
<td>P</td>
<td>F</td>
<td></td>
</tr>
<tr>
<td>Experimental</td>
<td>P</td>
<td>Marg. (P/F)</td>
<td>P</td>
<td>P</td>
<td></td>
</tr>
</tbody>
</table>

### Q-Tip Test Requirement:
- No burn length shall exceed 8 inches
- (FAA Fire Test Handbook Chapter 22)

### Radiant Panel Requirement:
- FAR 25.856

### Aging Protocol:
- Thermal Cycle; -65F to 160F, 2000 Cycles

### Results Oct 04

- P = Pass
- F = Fail
- Marg. (P/F) = Marginal results
## CIC Radiant Panel Test Results

Cor-Ban 35 on Polyimide Film

<table>
<thead>
<tr>
<th>Polyimide Film</th>
<th>Single Coat</th>
<th>Double Coat</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Control</td>
<td>Sample S1</td>
</tr>
<tr>
<td>Afterburn (s)</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>Burn Length (in)</td>
<td>0.50</td>
<td>0.75</td>
</tr>
<tr>
<td>Pass/Fail</td>
<td>P</td>
<td>P</td>
</tr>
</tbody>
</table>

**Control - PASS**

**SINGLE COAT - PASS**

**DOUBLE COAT - FAIL**
CIC Flammability Test Results
Cor-Ban 35 on Ceramic Paper

<table>
<thead>
<tr>
<th>Dupont Ceramic Paper</th>
<th>Single Coat</th>
<th>Double Coat</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Control</td>
<td>Sample S1</td>
</tr>
<tr>
<td>Afterburn (s)</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>Burn Length (in)</td>
<td>0.75</td>
<td>1.00</td>
</tr>
<tr>
<td>Pass/Fail</td>
<td>P</td>
<td>P</td>
</tr>
</tbody>
</table>
CIC Flammability Test Results
Cor-Ban 35 on PET Films

<table>
<thead>
<tr>
<th>PET Film</th>
<th>0.5 oz/sq yd:</th>
<th>Single Coat</th>
<th>Double Coat</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Control</td>
<td>Sample S1</td>
<td>Sample S2</td>
</tr>
<tr>
<td>Afterburn (s)</td>
<td>0.00</td>
<td>0.00</td>
<td>4.30</td>
</tr>
<tr>
<td>Burn Length (in)</td>
<td>0.50</td>
<td>0.50</td>
<td>3.50</td>
</tr>
<tr>
<td>Pass/Fail</td>
<td>P</td>
<td>P</td>
<td>F</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>PET Film</th>
<th>0.9 oz/sq yd:</th>
<th>Single Coat</th>
<th>Double Coat</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Control</td>
<td>Sample S1</td>
<td>Sample S2</td>
</tr>
<tr>
<td>Afterburn (s)</td>
<td>15.30</td>
<td>20.40</td>
<td>70.70</td>
</tr>
<tr>
<td>Burn Length (in)</td>
<td>12.00</td>
<td>13.50</td>
<td>16.25</td>
</tr>
<tr>
<td>Pass/Fail</td>
<td>F</td>
<td>F</td>
<td>F</td>
</tr>
</tbody>
</table>

NOTE: Failures on PET are caused by reinforcing fibers and film residue sticking to the glass batting.
CIC Flammability Test Results

OBSERVATIONS

- CIC as a “contaminant” behaves as a fuel source on non-shrinkable materials such as polyimide film and ceramic paper.

- Scrim (reinforcement) and film residue can have a significant role in flame propagation results.
  - Different vendor materials may behave differently based on scrim material/configuration and CIC amount.
  - Film type and weight may also likely have an influence on results.
  - More investigation is necessary.

- The results clearly indicate the need to better understand contamination effects on flammability performance. Improved understanding will determine criteria for future design and maintenance philosophy to ultimately improve continued airworthiness.
  - Design; evaluating/selecting insulation blanket films, CICs, etc…
  - Maintenance; cleaning approaches, material selection/usage, etc…
Preventing Contamination

Updated Service Letters - 25 June 2004

PREVENTING CONTAMINATION THAT AFFECTS FLAMMABILITY OF INSULATION BLANKETS

707-SL-25-025-A  717-SL-25-105-A  DC9-SL-25-103-A

The updated Service Letter includes information regarding contaminants that can support fire propagation, identifies Boeing SRP 25-0237 to address AN-26, and recommends airlines increase attention to periodic inspection and cleaning during maintenance.
This Service Letter outlines the recommended approach for airlines to verify vendor materials. Boeing recommends vendor materials not listed in the maintenance manuals be evaluated to the requirements of D6-7127 (Interior) & D6-17487 (Exterior). These documents identify testing protocol to evaluate the materials.
### In-service Blanket Test Status

(Update to November 2003 Presentation)

<table>
<thead>
<tr>
<th>Film Cover</th>
<th>Film Weight (oz/sq yd)</th>
<th>Model</th>
<th>Delivery Date</th>
<th>Blanket Descriptions</th>
<th>Contamination Level</th>
<th>Q-Tip Results</th>
<th>Approx. Burn Area (sq. inches)</th>
<th>Propagation Behavior</th>
</tr>
</thead>
<tbody>
<tr>
<td>PET</td>
<td>0.5</td>
<td>737-300</td>
<td>Oct-86</td>
<td>Behind sidewall</td>
<td>Low to moderate contamination levels including local areas of contamination.</td>
<td>FAIL</td>
<td>20&quot; Burn Length</td>
<td>200</td>
</tr>
<tr>
<td>PET</td>
<td>0.5</td>
<td>757-300</td>
<td>May-86</td>
<td>Aft bulkhead above floor</td>
<td>Low to moderate contamination levels including local areas of contamination.</td>
<td>FAIL</td>
<td>10&quot; Burn Length</td>
<td>80</td>
</tr>
<tr>
<td>PET</td>
<td>0.5</td>
<td>767-200</td>
<td>Nov-85</td>
<td>Unknown</td>
<td>Low to moderate contamination levels including local areas of contamination.</td>
<td>FAIL</td>
<td>17&quot; Burn Length</td>
<td>150</td>
</tr>
<tr>
<td>MPVF</td>
<td>0.85</td>
<td>767-200</td>
<td>Nov-85</td>
<td>Unknown</td>
<td>Moderate contamination levels including local areas of contamination.</td>
<td>PASS</td>
<td>5.5&quot; Burn Length</td>
<td>40</td>
</tr>
<tr>
<td>MPET</td>
<td>0.95</td>
<td>DC-10</td>
<td>N310FE</td>
<td>Unknown</td>
<td>Moderate contamination levels including local areas of contamination.</td>
<td>FAIL</td>
<td>14&quot; Burn Length</td>
<td>285</td>
</tr>
<tr>
<td>MPVF</td>
<td>1.05</td>
<td>DC-10</td>
<td>N310FE</td>
<td>Unknown</td>
<td>Moderate contamination levels including local areas of contamination.</td>
<td>PASS</td>
<td>5.5&quot; Burn Length</td>
<td>40</td>
</tr>
<tr>
<td>MPVF</td>
<td>1.4</td>
<td>DC-10</td>
<td>N310FE</td>
<td>Unknown</td>
<td>Moderate contamination levels including local areas of contamination.</td>
<td>PASS</td>
<td>6.5&quot; Burn Length</td>
<td>25</td>
</tr>
</tbody>
</table>

**Q-Tip Test Requirement:**
No burn length shall exceed 8 inches.  
*(FAA Fire Test Handbook Chapter 22)*

**Note:** 8” Radius = 200 sq. inches
In-service Q-tip Test Results

PET In-service Blanket
Weight = 0.5 oz/sq yd

Q-Tip Result: **PASS**
Burn Length = 6.5”
Burn Area = 80 sq in.

PET In-service Blanket
Weight = 0.5 oz/sq yd

Q-Tip Result: **FAIL**
Burn Length = 17”
Burn Area = 150 sq in.
PET In-service Blanket
Weight = 0.5 oz/sq yd

Q-Tip Result: **FAIL**
Burn Length = 10"
Burn Area = 80 sq in.
PET In-service Blanket
Weight = 0.5 oz/sq yd

Q-Tip Result: **FAIL**
Burn Length = 20"
Burn Area = 200 sq in.
In-service Q-tip Test Results

MPVF In-service Blanket
Weight = 0.85 oz/sq yd

Q-Tip Result: PASS
Burn Length = 5.5“
Burn Area = 40 sq in.
MPET In-service Blanket
Weight = 0.95 oz/sq yd

Q-Tip Result: **FAIL**
Burn Length = 14”
Burn Area = 285 sq in.
In-service Q-tip Test Results

MPVF In-service Blanket
Weight = 1.0 oz/sq yd

Q-Tip Result: PASS
Burn Length = 5.5"
Burn Area = 40 sq in.
In-service Q-tip Test Results

MPVF In-service Blanket
Weight = 1.4 oz/sq yd

Q-Tip Result: **PASS**
Burn Length = 6.5"
Burn Area = 25 sq in.
Aging Wiring Results Summary (ATSRAC)

http://www.mitrecaasd.org/atsrac/index.html

The Aging Transport Systems Rulemaking Advisory Committee (ATSRAC) is a Federal Advisory Committee and is tasked with providing public recommendations to the Federal Aviation Administration (FAA). The committee was chartered on January 19, 1999, by FAA Order 1100.127, which stated: “The committee’s primary task is to propose such revisions to the Federal Aviation Regulations and associated guidance material as may be appropriate to ensure that non-structural systems in transport airplanes are designed, maintained, and modified in a manner that ensures their continuing operational safety throughout the service life of the airplanes.”

ATSRAC has completed its initial five tasks, a second set of five tasks, and has again been re-chartered to accomplish an additional three tasks. Further information on ATSRAC activities is available through the links in the left-hand column of this page.
Aging Wiring Results Summary (ATSRAC)

I. The Approach for Gathering and Reviewing Data
FINAL REPORT Task 1 & 2


II. Intrusive Inspection Final report

REPORT: http://www.mitrecaasd.org/atsrac/intrusive_inspection.html
Understanding Overall Fleet Safety

Commercial Airplane Flammability Safety Risk Evaluation – An approach for evaluating flame propagation on aged/contaminated insulation blankets in the commercial airplane fleet.

I. Situation – Target - Proposal
Understanding Overall Fleet Safety

SITUATION

I. Flammability test results on some types of in-service insulation films indicate a degradation in flame propagation resistance.

- Flammability data exists only on a limited number of cover film products. Data consists primarily of single blanket tests, and “Intermediate Scale” installation configurations have not been performed for correlation.

- Flammability data does not exist on most cover film products that have been qualified/used in the fleet over the last 20 years.

- Unknown whether degradation is due to changes in material composition/morphology, contamination or a combination. Testing to-date has not been successful in determining quantifiable effects or understanding the interactions between aging and contamination.
II. Rules and requirements do not clearly define the aging/contamination issue.

- Industry requirements/criteria do not exist to evaluate aging/contamination effects on new materials.
  - Artificial aging on some materials have shown a change in flame propagation behavior.
  - Controlled testing of CICs as a contamination type indicates a change in flame propagation behavior on some materials.

- Standardized test methods do not exist to evaluate aging effects on new materials.
- Standardized test methods do not exist to evaluate effects of different types & quantities of contamination on new materials.
Understanding Overall Fleet Safety

SITUATION (Cont)

- Criteria are not defined on what constitutes an unsafe condition, in accordance with FAR 39. Need Industry consensus.
- No consensus that flame spread and arc-and-spark are the only criteria that determine fleet safety levels.
- AC guidance does not exist regarding aging/contamination.
- Existing maintenance information is not well defined.
- FAR 28.856 does not address aging/contamination of new materials.
III. Current focus is at an "AN-26 level", and as a result, an overall understanding of the fleet issue relative to contamination and aging is not moving forward very quickly.

- Based on Boeing fire incident data, there is no statistical difference of in-service insulation fire events except when moderate contamination was involved.
Understanding Overall Fleet Safety

TARGET

- Chartered harmonization working group (Like ATSRAC). Integrate with Structures Maintenance Conference?
- Industry defined and committed plan to work 'aging and contamination' across the commercial fleet for all insulation blanket materials to balanced approach and solutions.
- Industry criteria that defines aging/contamination "level of magnitude" that creates an airplane level safety threat.
- Industry adopted standardized test methods for evaluating aging and contamination effects on new insulation blanket material.
- Industry recommendations for appropriate cost effective safety improvements and mitigating solutions.
- Industry defined SOW for academia support of aging contamination research and secured funding (FAA-TC).
International Aircraft Materials and Fire Test Working Group

Aging/Contamination Task Group

Understanding Overall Fleet Safety

PROPOSAL

- Aging/Contamination Working Group chartered and supported.
- Define and implement a data collection plan to collect in-service blanket samples from across the fleet (all models and ages).
- Evaluate flammability performance on all types, thicknesses, and ages of in-service blanket samples. Samples should be selected from all fuselage locations and should include typical ranges of contamination.
- Support the FAATC to perform small/intermediate scale tests to further quantify fleet safety issue and correlate with single blanket test results.
PROPOSAL (Cont)

- Identify data to be used to determine “safety risk” criteria.
  - Heat release a criteria? Heat release must play a role to safety threat?
  - Medium scale test results? Need data to support understanding?
    - Pass/Fail criteria?
  - Location important?
  - Material classifications?

- Incorporate criteria, test methods, etc… into AC to provide guidance for new rule FAR 25.856.

- Develop mitigation options; remove and replace, cleaning, spray-on fire retardants, barriers, etc…

Understanding Overall Fleet Safety
Understanding Overall Fleet Safety Issue

II. Data Gathering and Evaluation Approach for Assessing the Flammability Safety Risk of In-service Insulation Blankets Across the Commercial Airplane Fleet
Understanding Overall Fleet Safety Issue

Proposed Plan

Material Definition & Usage:
- Qualified Material History
- Align with Airplane Delivery History
- Drawn Callouts for Fuselage Locations
- Align with In-service Fire Incident Data
- Target Specific Materials for Test
- Collect In-service Blanket Samples

Planning:
- Define Test Plan
- Perform Testing
- Evaluate Results

Testing:
- Define Industry Recommendations

Align with:
- OEMs
- Film Suppliers
- Blanket Fabricators
- Airlines

Task Group:
- OEMs
- FAA (TC and ACOs)
- Airlines (ATA)
- Suppliers

Task Group
- Task Group
- Task Group
Understanding Overall Fleet Safety Issue

Material Timeline for BMS 8-142 & BMS 8-360
### BMS 8-142 Material Types (1978 – Present)

<table>
<thead>
<tr>
<th>Material</th>
<th>Specification</th>
<th>Weight; oz/sq.yd</th>
<th>Suppliers</th>
<th>Number of Formulations</th>
<th>Active Dates</th>
</tr>
</thead>
<tbody>
<tr>
<td>PET</td>
<td>BMS 8-142 Class 00</td>
<td>0.5 - 0.65</td>
<td>3</td>
<td>16</td>
<td>1981 - Present</td>
</tr>
<tr>
<td></td>
<td>BMS 8-142 Class 1</td>
<td>0.9 Max</td>
<td>3</td>
<td>11</td>
<td>1992 - Present</td>
</tr>
<tr>
<td></td>
<td>BMS 8-142 Class 2</td>
<td>1.3 Max</td>
<td>3</td>
<td>6</td>
<td>1992 - Present</td>
</tr>
<tr>
<td></td>
<td>BMS 8-142 Class 3</td>
<td>1.8 Max</td>
<td>3</td>
<td>5</td>
<td>1993 - Present</td>
</tr>
<tr>
<td>MPVF</td>
<td>BMS 8-142 Class 0</td>
<td>0.9 Max</td>
<td>2</td>
<td>3</td>
<td>1978 - 1988</td>
</tr>
<tr>
<td></td>
<td>BMS 8-142 Class 1</td>
<td>0.9 Max</td>
<td>2</td>
<td>3</td>
<td>1978 - 1998</td>
</tr>
<tr>
<td></td>
<td>BMS 8-142 Class 2</td>
<td>1.3 Max</td>
<td>2</td>
<td>2</td>
<td>1978 - 1988</td>
</tr>
<tr>
<td></td>
<td>BMS 8-142 Class 3</td>
<td>1.8 Max</td>
<td>1</td>
<td>1</td>
<td>1978 - 1998</td>
</tr>
</tbody>
</table>
Understanding Overall Fleet Safety Issue

Fuselage Locations

Notional Example Data Collection
(Specific Time Frame for Model X)

<table>
<thead>
<tr>
<th>Fuselage Location</th>
<th>Percentage Area</th>
<th>Engineering Definition</th>
<th>Purchased Material</th>
</tr>
</thead>
<tbody>
<tr>
<td>Above Floor</td>
<td>60%</td>
<td>Class 00</td>
<td>Product X</td>
</tr>
<tr>
<td>Crown</td>
<td>15%</td>
<td>Class 00</td>
<td>Product X</td>
</tr>
<tr>
<td>Main Cabin</td>
<td>40%</td>
<td>Class 00</td>
<td>Product X</td>
</tr>
<tr>
<td>Flight Deck</td>
<td>5%</td>
<td>Class 1</td>
<td>Product Y</td>
</tr>
<tr>
<td>Below Floor</td>
<td>40%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cheek Area</td>
<td>20%</td>
<td>Class 00</td>
<td>Product X</td>
</tr>
<tr>
<td>Below Lavs/Galleys</td>
<td>10%</td>
<td>Class 1</td>
<td>Product Y</td>
</tr>
<tr>
<td>Below Cargo (Bilge)</td>
<td>10%</td>
<td>Class 3</td>
<td>Product Z</td>
</tr>
</tbody>
</table>

Usage; % of Fuselage Area:
Product X; 75%
Product Y; 15%
Product Z; 10%
Airplane Deliveries (timeline and active status)

Boeing:  

Airbus:  
http://www.airbus.com/media/orders_n_deliveries.asp

Incident Data Review – Statistically Significant Factors
International Aircraft Materials and Fire Test Working Group

Aging/Contamination Task Group

Understanding Overall Fleet Safety Issue

Testing

- Small Scale Fuselage Section
  - 40” x 60”
  - 3 Frames/2 Bays
  - Cotton Swab Ignition Source
We are all here to evaluate and improve safety.

Are you ready for action?

ACTION: Provide formal response & comments to the STP and Data Gathering Plan