Introduction

• **Insulation burnthrough test method**
  – Evaluate Sonic burner configuration update in Chapter 24 of the Fire Test Handbook

• **Focus on:**
  – Repeatability
    • Within lab consistency
  – Reproducibility
    • Lab to lab consistency
Phases of Study

• **Phase 1**
  – Old stator design with igniters and ignition wires in draft tube
  – PAN material and insulation blankets tested

• **Phase 2**
  – Igniterless stator, eliminates igniters and ignition wires in draft tube, increase burner air pressure from 60 psi to 65 psi
  – PAN material tested only

• **Phase 3**
  – Igniterless stator, Delevan 6.0 gal/hr fuel nozzle, air pressure remains at 65 psi
  – PAN material tested only
Phase 3 Current Status

• Test items provided to labs:
  – 5 PAN-8579 light felt material
  – 5 PAN-8611 heavy felt material
  – Delevan 6.0 gal/hr, type-B, 80-degree, solid spray pattern fuel nozzle
  – Detailed instructions

• 9 labs currently involved
  – 4 labs have returned data so far
Phase 3: Test Results

Across All Test Labs
Average BT: 284.8 s
Std Dev: 10.9 s
% Std Dev: 3.8%

Across All Test Labs
Average BT: 335.5 s
Std Dev: 10.3 s
% Std Dev: 3.0%
Phase 3: Test Results
Phase 2 and 3 Comparison

Across All Test Labs
Average BT: 256.2 s
Std Dev: 20.1 s
% Std Dev: 7.8%

Across All Test Labs
Average BT: 288.4 s
Std Dev: 41.5 s
% Std Dev: 14.4%
Phase 2 and 3 Comparison

Across All Test Labs
Average BT: 337.8 s
Std Dev: 18.8 s
% Std Dev: 5.6%

Across All Test Labs
Average BT: 336.0 s
Std Dev: 66.2 s
% Std Dev: 19.7%
Within Lab Repeatability for Phase 1, 2, and 3
Lab to Lab Reproducibility for Phase 1, 2, and 3
Phase 3: FAATC Test Results

• **Good repeatability within each lab**
  – ~3.8% Std Dev for PAN-8579 felt material
  – ~3.0% Std Dev for PAN-8611 felt material

• **Reproducibility among labs has improved as more data is returned**
  – ~14.4% Std Dev for PAN-8579 felt material
  – ~19.7% Std Dev for PAN-8611 felt material

• **Investigate reason for reproducibility issue**
  – Warped test frame?
  – Felt pulling out of frame?
  – Loose wires on test frame?
Sample Pulling Away from Frame
Loose Test Frame Wires
Questions?

Timothy Salter
timothy.salter@faa.gov
609-485-6952
International Aircraft Materials Fire Test Forum Meeting

Sonic Oil Burner Testing & Sonic Burner Video Update

Presented to: International Aircraft Materials Fire Test Forum

By: Tim Salter, FAA Technical Center

Date: June 18-19, 2019, Cologne, Germany
Sonic Burner Cargo Liner Test: Air Shroud Round Robin Update
Purpose of Round Robin Study

- Conduct cargo liner air shroud round robin to determine if it is an effective means of reducing the influence of airflow around the sample and improving test result repeatability and reproducibility.

- The air shroud may be incorporated into Chapter 8 of the Fire Test Handbook should the study results prove it is effective.
Shroud Design

• Design
  – 18-gage perforated aluminum
  – Mounted with threaded rod on top of sample frame
  – No frame modifications

• FAA TC Results
  – Reduced temperature fluctuations
  – Measured peak temperatures equivalent to unshrouded tests
Shroud Round Robin

• Test items provided to labs:
  – 10 liner samples
    • 5 samples to be tested with the shroud
    • 5 samples to be tested without the shroud
  – Two liner types being tested
    • Polyester infused woven fiberglass (4 labs)
    • Tedlar surfaced woven fiberglass/epoxy (5 labs)
  – Fire resistant board used in place of wall panel
    • Sample tested in ceiling panel position only
  – Detailed instructions

• 8 labs currently involved
  – 4 labs have produced data
    • Working to get test materials shipped to 2 labs
Test Results

Lab A

Lab B

Lab D

Lab E
Test Results – Lab A
Test Results – Lab B

**Peak Temperatures Measured for each Cargo Liner Sample Test**

<table>
<thead>
<tr>
<th>Test</th>
<th>Temperature (°F)</th>
<th>No Shroud</th>
<th>With Shroud</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>164</td>
<td>179</td>
<td>166</td>
</tr>
<tr>
<td>2</td>
<td>167</td>
<td>183</td>
<td>167</td>
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<td>3</td>
<td>188</td>
<td>181</td>
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<tr>
<td>4</td>
<td>191</td>
<td>182</td>
<td>193</td>
</tr>
<tr>
<td>5</td>
<td>171</td>
<td>187</td>
<td></td>
</tr>
<tr>
<td>AVG</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Peak Temperature Data Results**

<table>
<thead>
<tr>
<th>STDEV</th>
<th>%STDEV</th>
<th>delta_T</th>
</tr>
</thead>
<tbody>
<tr>
<td>No Shroud</td>
<td>7.7</td>
<td>4.5</td>
</tr>
<tr>
<td>With Shroud</td>
<td>5.5</td>
<td>3.0</td>
</tr>
</tbody>
</table>

Federal Aviation Administration
Test Results – Lab D

- **Peak Temperatures Measured for each Cargo Liner Sample Test**

  - Test 1: 197°F
  - Test 2: 203°F
  - Test 3: 222°F
  - Test 4: 227°F
  - Test 5: 226°F
  - AVG: 226°F

- **Peak Temperature Data Results**

<table>
<thead>
<tr>
<th>STDEV</th>
<th>%STDEV</th>
<th>delta_T</th>
</tr>
</thead>
<tbody>
<tr>
<td>No Shroud</td>
<td>10.8</td>
<td>5.2</td>
</tr>
<tr>
<td>With Shroud</td>
<td>9.8</td>
<td>4.3</td>
</tr>
</tbody>
</table>

- **Legend**:
  - Blue: No Shroud
  - Red: With Shroud
Test Results – Lab E

Peak Temperatures Measured for each Cargo Liner Sample Test

- No Shroud
- With Shroud

Peak Temperature Data Results

<table>
<thead>
<tr>
<th>STDEV</th>
<th>%STDEV</th>
<th>delta_T</th>
</tr>
</thead>
<tbody>
<tr>
<td>No Shroud</td>
<td>10.5</td>
<td>4.2</td>
</tr>
<tr>
<td>With Shroud</td>
<td>24.5</td>
<td>7.9</td>
</tr>
</tbody>
</table>
Summary

• Lab A
  – Increased repeatability, less temperature fluctuation, and slightly lower peak temperatures with shroud

• Lab B
  – Increased repeatability, less temperature fluctuation, and slightly elevated peak temperatures with shroud

• Lab D
  – Slightly increased repeatability, equal temperature fluctuation, and slightly lower peak temperatures with shroud

• Lab E
  – Decreased repeatability, more temperature fluctuation, and significantly elevated peak temperatures with shroud

• Mixed data results
  – Need more data to support effectiveness of shroud
Sonic Burner Seat Cushion Test: Air Shroud Development and Round Robin Study
Seat Cushion Shroud

- **Same purpose as cargo shroud**
  - Reduce influence of airflow at sample
  - Can significantly effect sample burning

- **Modified cargo shroud design**
  - Perforated aluminum
  - Open on flame side
  - Does not interfere with sample mounting

- **Seat shroud round robin**
  - Awaiting shipment of test samples
  - Looking for labs to participate
Sonic Burner Assembly and Operation Instructional Video
Sonic Burner Instructional Video

• Focused on Sonic burner assembly and operation
  – Information not found in current documentation
  – Applies to any Sonic burner test method

• Viewing planned for seat task group
  – Other task groups if time allows

• Final video will be posted on Fire Safety website
  https://www.fire.tc.faa.gov
Insulation Burnthrough Video

• Currently working on instructional video for the insulation burnthrough test method

• Script is based on chapter 24 of the FTH

• Will focus on testing with the Sonic burner
Questions?

timothy.salter@faa.gov

(1)-609-485-6952