SEAT TEST PROGRAM
OUTLINE

- OBJECTIVES
- TEST CONFIGURATIONS AND DATA ACQUIRED
- MATERIAL TEST RESULTS
- SEAT TEST RESULTS
- CONCLUSIONS
OBJECTIVES

- Evaluate severity of newspaper ignition source with contemporary seats
  - Determine weight loss and visual damage
  - Determine if ignition source is severe enough to show improvement with new material configurations

- Compare damage with Jet A-1 ignition source

- Determine if materials for seat tests pass FAR 25 and obtain LOI
TEST CONFIGURATIONS

- TESTS CONDUCTED IN STANDARD BODY FUSELAGE WITH IN FLIGHT VENTILATION

- TEST 1
  - NEWSPAPER TENTED ON CENTER SEAT OF THREE UNMODIFIED SEATS
  - NEWSPAPER IGNITED WITH MATCHES

- TEST 2
  - NEWSPAPER TENTED ON CENTER SEAT
  - ARMRESTS REMOVED
  - LEFT SEAT MOVED ADJACENT TO CENTER SEAT
  - NEWSPAPER IGNITED WITH HOT COIL

- TEST 3
  - ARMRESTS REMOVED
  - LEFT SEAT MOVED ADJACENT TO CENTER SEAT
  - 1 LITER OF JET A-1 IN 1 X 1 FOOT PAN UNDER CENTER SEAT
  - FUEL IGNITED WITH PROPANE BURNER
737 TEST SECTION

- Volume: 5920 ft³
- Ventilation Rate: 1500 CFM
DATA ACQUIRED

- Seats suspended from load cell for weight loss during test
- Seat weighed pre- and post-test
- Still photos before and after
- Three real time movie cameras
- One video monitor (taped)
- TC's and calorimeters in fuselage
- Six loss of visibility measurements
- Gas analysis (O₂, CO, CO₂, hydrocarbons, HCN, HCL, and HF)
SEAT MATERIAL TEST RESULTS

- **LOI**
  - CUSHION FOAM - 26
  - WOOL BLEND UPHOLSTERY - 32
  - TWO SEAT CUSHION BACKING MATERIALS - 21 AND 28

- **FAR 25**
  - UPHOLSTERY AND BACKING MATERIALS PASS
  - CUSHION FOAM COATED SPECIMENS FAIL
  - UNCOATED FOAM PASSES DUE TO MELTING AND RECEDING FROM FLAME
SEN TEST RESULTS

TEST 1

- IGNITION SOURCE SLOW TO DEVELOP (TOO TIGHTLY COMPRESSED)
- AT ~5 MINUTES ARMREST IGNITED
- ARMREST IGNITED ADJACENT SEAT
- CENTER SEAT MATERIALS ~90 PERCENT BURNED
- ADJACENT SEAT ~70 PERCENT BURNED
- TOTAL MATERIAL WT. LOSS 10.5 LBS.
- TEMPERATURES IN CABIN FROM AMBIENT TO 350°F
- NO SIGNIFICANT HEAT FLUXES
- MUCH SMOKE-LOSS OF VISIBILITY AFTER SEAT INVOLVEMENT
- HIGH CO, HCN AT 10 MIN.
SEAT TEST RESULTS

TEST 2

- MORE RAPID DEVELOPMENT OF NEWSPAPER IGNITION SOURCE
- CENTER SEAT BACK IGNITED AT ~4 MINUTES
- CENTER SEAT MATERIALS ~70 PERCENT DESTROYED
- ADJACENT SEATS NOT IGNITED
- TOTAL MATERIAL WT. LOSS ~7 IBS.
- CABIN TEMPERATURES 80°F TO 240°F
- NO SIGNIFICANT HEAT FLUXES
- CONSIDERABLE SMOKE-LOSS OF VISIBILITY AFTER SEAT INVOLVEMENT
- HIGH HCN, CO AT 12 AND 15 MIN.
SEAT TEST RESULTS

TEST 3

- More rapid involvement of seats than with newspaper
- Extensive propagation to adjacent seats (~90 percent of all 3 seats destroyed
- Weight loss ~31.4 lbs. (> 3 times that with newspapers)
- Cabin temperatures 200 to 950°F
- Burning and smoke over longer period (15 min.)
- High CO, HCN, and HCL levels
TEST 3
(1 LITER JET A-1)

TEST 2
(TENTED NEWSPAPER)

EIGHT FEET IN FRONT OF SLAT
# Gas Analysis Results

(5 Feet High Along Center Line)

<table>
<thead>
<tr>
<th>Test Nr and Ignition Source</th>
<th>8 Ft Fwd</th>
<th>16 Ft Aft</th>
<th>8 Ft Fwd</th>
<th>16 Ft Aft</th>
<th>8 Ft Fwd</th>
<th>16 Ft Aft</th>
</tr>
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<tbody>
<tr>
<td><strong>1</strong> Newspaper with Armrests</td>
<td>PPM 1340</td>
<td>2294</td>
<td>108</td>
<td>78</td>
<td>522</td>
<td>330</td>
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<td>9.5</td>
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<tr>
<td><strong>2</strong> Newspaper without Armrests</td>
<td>PPM 1126</td>
<td>712</td>
<td>102</td>
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<td>23</td>
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<td>15</td>
<td>13</td>
<td>12.5</td>
<td>11.5</td>
<td>11.5</td>
<td>15.5</td>
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<tr>
<td><strong>3</strong> Jet A-1 Fuel</td>
<td>PPM 2232</td>
<td>3596*</td>
<td>330</td>
<td>102</td>
<td>880</td>
<td>192</td>
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<td>6.5</td>
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<td>7.5</td>
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</tr>
</tbody>
</table>

*Eight Feet Aft — 20 Inches High at 5.5 Min
COMPARISON OF CONTEMPORARY AND PRE-68 MTLS

TEMP, °F

PRE 68 MTLS

CONTEMPORARY MTLS

TIME, SEC

0 120 240 360 480

1500
1000
500
CONCLUSIONS

- ARMRESTS OF THE SEATS TESTED HIGHLY FLAMMABLE

- NEWSPAPER IGNITION SOURCE WILL IGNITE SEAT IT IS ON (NO SIGNIFICANT PROPAGATION TO ADJACENT SEATS)

- FUEL PAN FIRE UNDER SEAT PROPAGATES TO AND DESTROYS ADJACENT SEATS

- SEATS TESTED NOT SIGNIFICANTLY BETTER THAN WITH PRE-68 MTLs (BASED ON FUEL PAN TESTS BY FAA, AIA, AND JSC)

- NEWSPAPER IGNITION SOURCE WILL BE MARGINAL IN SHOWING SIGNIFICANT DIFFERENCES WITH IMPROVED SEAT MATERIALS